HAZARD ASSESSMENT

Selective Catalytic Reduction (SCR) System

California Renewable Carbon, LLC (CRC)

6229 Myers Road
Williams, California 95987

Revision	Date	Description
0.0	June 21, 2021	Initial Issue

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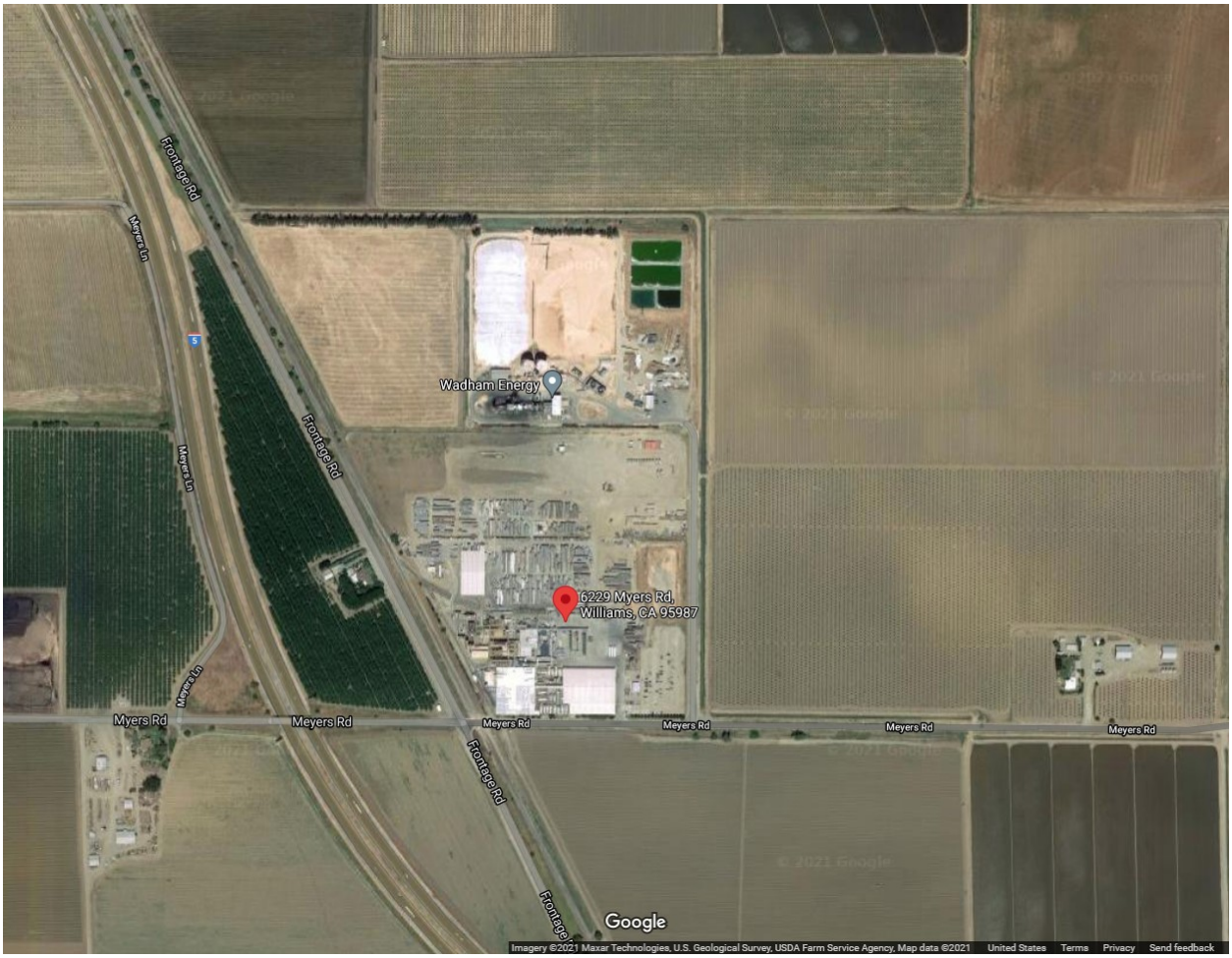
1.0 FACILITY OVERVIEW

This technical assessment was conducted to fulfill the off-site consequence analysis (Hazard Assessment) requirements of the California Accidental Release Prevention (CalARP) Program for ***California Renewable Carbon, LLC's (CRCs)*** Selective Catalytic Reduction (SCR) Ammonia System in accordance with California Code of Regulations (CCR), Title 19, Sections 2750.1 to 2750.8. The facility's address is listed as 6229 Myers Road, Williams, California and the location is depicted in Figure 1.

Figure 1: Site Location Map



The facility is currently under design and construction. This report serves as documentation to pre-determine the CalARP Program Level for the facility based on design assumptions.

2.0 COVERED PROCESS

The focus of this report is 19.5% aqueous ammonia (20% is used in this report due to modeling defaults), which is the regulated substance at the facility. The covered process is the equipment and piping associated with the SCR, subject to CalARP Program Level 1.

As part of this analysis, CalARP[1] have assigned the toxic endpoint to be used to quantify off-site impacts for aqueous ammonia. A Table of Toxic Endpoints is found in "Appendix A: Table of Toxic Endpoints," 19 CCR Division 2, Chapter 4.5[2]. The toxic endpoint is used to provide an estimate of concentration within which reasonably healthy individuals could remove themselves from exposure without suffering adverse health effects. The toxic endpoints ensure that calculated results over-predict the consequences of a release, to the benefit of the public.

Table 1 lists the coordinates for the covered processes. The appendixes of this report contain the scenario modeling and calculations. This hazard assessment focuses on the regulated substances at the facility, and does not account for other, non-regulated substances per 19 CCR §2750.1 – 2750.8.

Table 1: Coordinates for the Covered Process

Chemical Process	Format	Latitude	Longitude
19.5% Aqueous Ammonia	Decimal Degrees	39.102739°	-122.110174°

3.0 FIVE-YEAR ACCIDENT HISTORY

There have been no CalARP-applicable releases of ammonia at ***CRC*** in the past five (5) years.

4.0 LEVEL OF CONCERN

Toxic endpoints for regulated chemicals are defined in the California Code of Regulations, Title 19, Division 2, Chapter 4.5, Article 11, Section 2785.1 as "Appendix A to Title 19, Division 2, Chapter 4.5, Subchapter 1, Table of Toxic Endpoints" (19 CCR §2785.1)[2]. The toxic endpoints are listed to assist with evacuation decision-making and is intended to guide emergency response. Toxic endpoint concentration values are based on ERPG-2 values, are 0.1 times the

IDLH value, or for a few chemicals, are estimated at some fraction of LD50 values for some animals. For reference, the following are the definitions of the other toxicity threshold concentrations identified above:

- ERPG-1 is “the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.” [3]
- ERPG-2 is “the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.” [3]
- IDLH (Immediate Danger to Life and Health) is “an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.” [4]
- LD_{50} (Medan Lethal Dose; interchangeable with LC_{50}) is “the amount of a toxic agent (as a poison, virus, or radiation) that is sufficient to kill 50 percent of a population of animals usually within a certain time.” [5]

The toxic endpoint concentration (Endpt) is used to quantify off-site impacts of an ammonia release. In many cases these concentrations are provided in units of parts per million (ppm) or milligrams per liter (mg/L). The toxicity concentrations are listed in Table 2.

Table 2: Ammonia Toxicity Threshold Concentrations

Exposure Level	Ammonia Concentration (ppm)
ERPG-1	25
ERPG-2	150
Toxic Endpoint	**200**
IDLH	300

5.0 WORST-CASE RELEASE SCENARIO

The off-site consequence modeling (OCA) consists of a worst-case release scenario and alternative release scenario for the SCR process at the facility. The CalARP regulations define the worst-case release scenario for toxic gas releases as follows [19 CCR §2750.3(c)]:

> *(1) For regulated toxic substances that are normally gases at ambient temperature and handled as a gas or as a liquid under pressure, the owner or operator shall assume that the quantity in the vessel or pipe…is released as a gas over 10 minutes. The release rate shall be assumed to be the total quantity divided by 10 unless passive mitigation systems are in place…*

To develop the worst-case scenario, the largest storage vessel was selected. As stated in 19 CCR §2750.3, the worst-case release quantity is the greatest amount held in a single vessel, taking into account administrative controls that limit the maximum quantity.

The vessel with the largest quantity of regulated substance at any one period is the aqueous ammonia storage tank. The facility implements administrative controls that limit the maximum filling of the tank to 85%. The operating procedures provide detailed procedures for ensuring an acceptable level of ammonia in the tank prior to truck unloading. Once the vessel with the largest inventory of ammonia was identified, the EPA's RMP*Comp modeling software was used to determine the distance to the endpoints for the worst-case release scenario analysis. The vulnerability zones resulting from this analysis were then reviewed. A vulnerability zone is defined as a circle whose center is the point of release and its radius is the length of the endpoint, which is predicted by the dispersion model (e.g., RMP*Comp).

4.1 WORST-CASE RELEASE SCENARIO SELECTION PROCESS

The process of worst-case release scenario identification is summarized as follows. Figure 2 on the following page depicts the steps in this process.

Inventory Calculation: The first step was to review the inventory calculations of the vessels in the covered units and systems. This was completed using the inventory information provided by the facility.

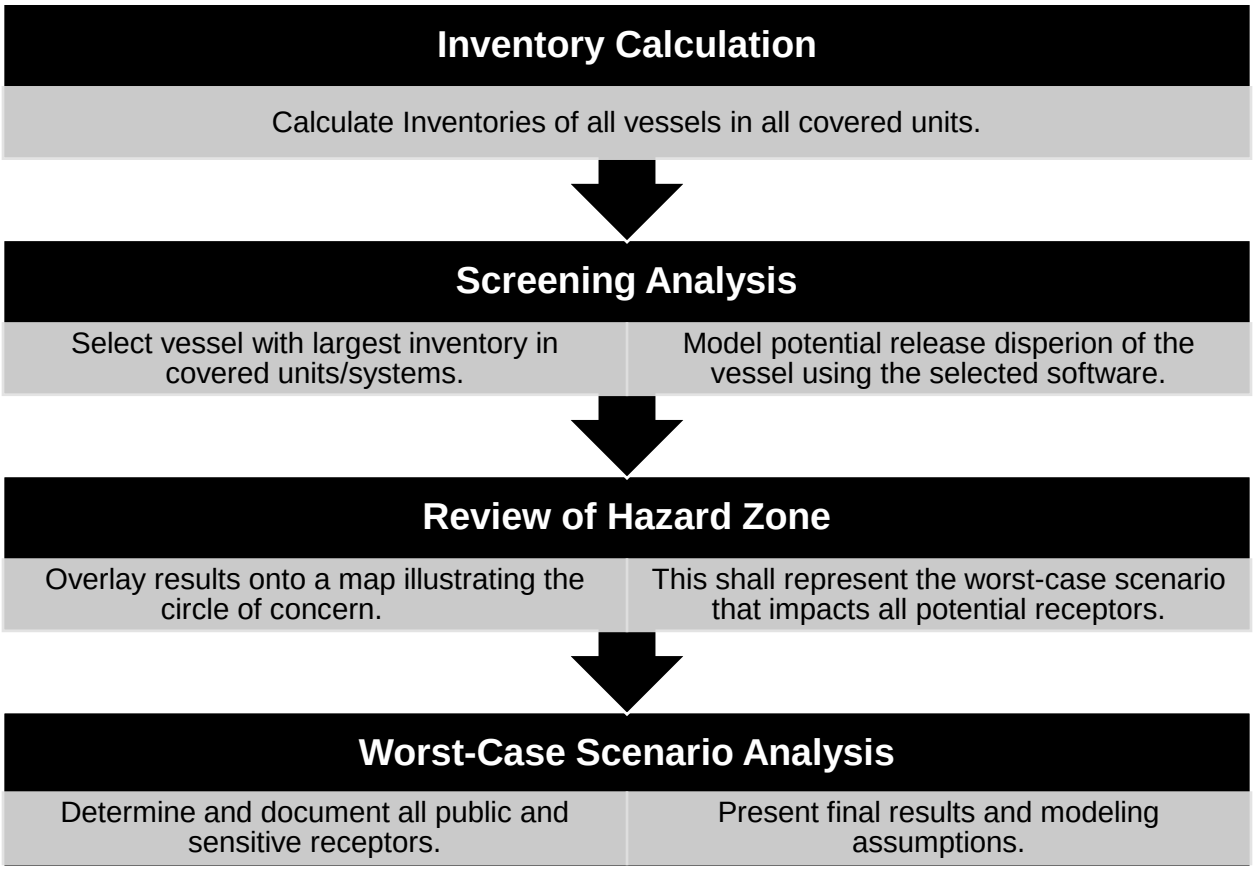
Screening Analysis: The vessels with the largest inventory of regulated toxic materials were selected for the analysis. Once the vessels were identified, the selected modeling software was

used to model the scenarios and determine the dispersion endpoints for the worst-case release scenarios. The screening analysis helps to determine the vulnerability zones associated with the worst-case release scenarios.

Review of the Vulnerability Zone: The vulnerability zones resulting from the previous step were reviewed and are representative for the facility's worst-case scenario.

Worst-Case Analysis: To document the worst-case release scenario, the potential public receptors within the vulnerability zone were identified. All modeling inputs, calculations and assumptions are documented.

Figure 2: Worst-Case Scenario Selection Process



4.2 WORST-CASE RELEASE SCENARIO MODELING ASSUMPTIONS

The CalARP regulations impose several assumptions that were adhered to when performing the OCA of the worst-case release scenario. These are conservative assumptions for weather and release conditions and are listed in 19 CCR §2750.2. The distance to the endpoint estimated under worst-case conditions provides an estimate for the maximum possible area that might be affected by these unlikely conditions. It should be noted that the CalARP Program's intention for the vulnerability zone representing a worst-case release scenario is to provide a basis for discussion among the regulated industry, emergency responders, and the public, rather than a basis for any specific actions.

Once a release has occurred, mitigation systems are means (structures, equipment, or activities) that help minimize the transport of material to the atmosphere. Mitigation systems can be characterized as passive or active systems. Passive mitigation systems do not require activation, an energy source, or movement of components to perform their intended function. Active mitigation systems do require activation, an energy source, and/or movement of components to perform their intended function.

It should be emphasized that the effectiveness of mitigation systems was taken into account when these systems were considered in the OCA. The effectiveness is determined based on how well the systems are designed and their abilities to respond reliably upon demand. The rule permits consideration of only passive mitigation systems for the worst-case release analysis provided that the systems are capable of withstanding the event triggering the release scenario and would still function as intended. All dispersion modeling parameters utilized in the worst-case release scenarios modeling are listed in Table 3.

Table 3: Worst-Case Release Scenario Dispersion Modeling Parameters

Parameter	Input Value	Notes
Ammonia Input Parameters		
Mass Released	15,300 gallons	Largest, single vessel on-site filled to 85% total capacity (total capacity is 18,000 gallons; design basis inventory confirmed June 15, 2021)
Meteorological Parameters		
Atmospheric Stability	F stability	As per 19 CCR §2750.2(b) and 40 CFR §68.22(b), "For the worst-case release analysis, the owner or operator shall use a wind speed of 1.5 meters per second and F atmospheric stability class"
Wind Speed	1.5 m/s	
Ambient Temperature	77ºF	As per 19 CCR §2750.2(c) and 40 CFR §68.22(c), "An owner or operator using the RMP Offsite Consequence Analysis Guidance may use 25 °C and 50 percent humidity as values for these variables"
Relative Humidity	50%	
Dispersion and Impact Modeling Parameters		
Height of Release	Ground level	As per 19 CCR §2750.2(d) and 40 CFR §68.22(d), "The worst-case release of a regulated toxic substance shall be analyzed assuming a ground level (0 feet) release"
Topography	Urban	As per 19 CCR §2750.2(d) and 40 CFR §68.22(d), "Urban means that there are many obstacles in the immediate area; obstacles include buildings or trees."

Parameter	Input Value	Notes
Mitigation Systems		
Passive Mitigation	Secondary Containment	The facility estimated a secondary containment measuring 1,323 square feet (ft^2) with a berm / wall measuring two (2) feet (ft) tall. A second model was completed to establish the largest containment area possible while maintaining the radius of concern at 0.1 miles. See Attachment A for the modeling for both scenarios.
Active Mitigation	None	

Definitions:

m/s = meters per second

ºF = degrees Fahrenheit

4.3 WORST-CASE RELEASE SCENARIO RESULTS

One (1) worst-case release scenario has been developed for the process**.** A summary of the scenario is presented in Table 4. Attachment A of this report provides a detailed description of the worst-case release scenario, modeling outputs including 2010 census population estimate, and a map with the circle representing the vulnerability zone superimposed on a map.

Table 4: Worst-Case Scenario Results Summary

Release Scenario Description	Endpoint	Endpoint Distance
19.5% Aqueous Ammonia: Release of all contents of the single storage vessel.	200 ppm (0.14 mg/L)	0.1 miles

4.4 WORST-CASE ANALYSIS CONSIDERATION

The worst-case release scenario distances to the toxic endpoints are based on a number of very conservative assumptions. This applies to the likelihood of a vessel rupture being extremely low and as a result, the release of entire inventory of a vessel is an unrealistic assumption.

6.0 ALTERNATIVE RELEASE SCENARIO

An alternative release scenario is not required because the facility has determined that it is a CalARP Program Level 1 facility.

7.0 OFFSITE IMPACTS

A summary of the off-site impacts from an accidental release, including population and sensitive receptors, is discussed in the following sub-sections.

6.1 IMPACTED POPULATION

In order to determine the impacted population around the facility, the potential for exposure to concentrations exceeding the toxic endpoint was calculated. The furthest endpoint distance reached by the worst-case scenario and by the alternative release scenario along with the estimated impacted population are summarized in Table 5.

Table 5: Impacted Population for OCA Scenarios

Scenario	Endpoint Distance	Estimated Impacted Population
Worst Case Scenario: Instantaneous Release of Aqueous Ammonia Storage Tank	0.1 miles	0

The impacted population was estimated using 2010 census tract data with the MARPLOT 5.1.1 software. When calculating population densities for large areas that encompass many tracts, the accuracy is rated as good; however, for small areas that encompass only two or three partial tracts, the population data may be skewed due to the unequal distribution within the tract. The use of MARPLOT 5.1.1 is pursuant to guidance endorsed by the United States Environmental Protection Agency (US EPA). MARPLOT 5.1.1 requires the latitude and longitude of the facility to calculate the population. The latitude and longitude were estimated using Google Maps because MARPLOT uses mapping data from Google Earth. The tank location was provided on a site map by the design contractor for the purposes of this report.

6.2 OFFSITE SENSITIVE RECEPTOR DATA SOURCES

Sensitive receptors were located utilizing Google Maps and/or Google Earth, depending on information availability. A combination of distance searches to determine receptors eligibility and map interpolation to determine whether the receptor falls within the circle of concern were used. In all cases the receptor must be mapped to verify its location in relation to the chemical location due to the discrepancies between the legal address and actual latitude and longitude of the chemical.

6.3 OFFSITE SENSITIVE RECEPTORS

CalARP requirements state that sensitive populations such as schools, hospitals, day-care centers, long-term health care facilities, prisons, residential areas, public use parks/recreational areas, and major commercial facilities, located within the “at risk” area must be identified. These sensitive populations include individuals who could not remove themselves from the exposure area without assistance. The sensitive populations also include industrial installations which may have a hazardous process that cannot be immediately left unattended. The sensitive populations also include industrial installations which may have a hazardous process that cannot be immediately left unattended. Table 6 shows a summary of offsite population receptors and offsite environmental receptors within the circle of concern as determined by the worst-case and alternative release scenarios.

Table 6: Sensitive and Environmental Receptors

RECEPTOR	WCS (0.8 MI)
Population Receptors	
Schools	No
Residences	No
Hospitals	No
Prisons/Correction Facilities	No

RECEPTOR	WCS (0.8 MI)
Recreation Areas	No
Major Commercial, Office, or Industrial Areas	No
Child Daycare	No
Long-term Health Care (e.g., convalescent homes)	No
Other (Government Buildings)	No
Environmental Receptors	
National or State Parks, Forests, or Monuments	No
Officially Designated Wildlife Sanctuaries, Preserves, or Refuges	No
Federal Wilderness Areas	No
Other (Landmark & Indian Reservations)	No

8.0 REFRENCES

1. California Code of Regulations (CCR), Title 19, Division 2, Chapter 4.5, Article 4, Sections 2750.1 to 2750.9, “Hazard Assessment”; 2015, January 1.

2. CCR, Title 19, Division 2, Chapter 4.5, Article 11, Section 2785.1; “Appendix A to Title 19, Division 2, Chapter 4.5, Subchapter 1 Table of Toxic Endpoints”; 2015, January 1.

3. Occupational Safety and Health Administration (OSHA); CFR, Title 29, Subtitle B, Chapter XVII, Part 1910, Subpart H, Section 1910.120, “Hazardous Waste Operations and Emergency Response”; 2014, July 1.

4. Merriam-Webster Dictionary; http://www.merriam-webster.com/.

5. Weather Underground; www.wunderground.com.

6. MARPLOT® 5.1.1 Mapping Software (internet download), National Oceanic and Atmospheric Administration and U.S. Environmental Protection Agency. http://www.epa.gov/osweroe1/content/cameo/MARPLOT.htm.

7. RMP*Comp™ Version 2.01, U.S. Environmental Protection Agency, February 2012. https://cdxnodengn.epa.gov/cdx-rmp-maintain/action/rmp-comp.

ATTACHMENT A
WORST-CASE RELEASE SCENARIO INFORMATION

WORST-CASE RELEASE SCENARIO (WCS)

To develop the worst-case scenarios (WCS), the largest storage vessels for each process were selected. As stated in 19 CCR §2750.3 and 40 CFR §68.25 (b), the worst-case release quantity is the greatest amount held in a single vessel, considering administrative controls that limit the maximum quantity.

The planned storage tank is capable of storing 18,000 gallons (gal) of 19.5% aqueous ammonia in the tank at 100% full. Taking into account administrative controls that limit the quantity stored in the tank (maximum of 85% full), this would make the amount of ammonium hydroxide approximately 15,300 gal. The proposed coordinate location of the ammonia storage tank is 39.102739°, -122.110174°.

The secondary containment area surrounding the aqueous ammonia storage tank is estimated to be 1,323 square feet (ft^2) with a two-foot (2-ft) berm or wall, which also serves as a secondary containment area for storm water.

Additional modeling (Figure A-3) shows that the area of secondary containment may be increased to up to 2,600 ft^2 and maintain a 0.1-mile radius of concern. This is as large as a surface area as possible without increasing radius of concern to more than 0.1 miles. Over 0.1 miles, the circle of concern is too large to be contained on-site.

The worst-case release scenario analyzed the hypothetical rupture and release of the entire contents of the vessel within 10 minutes, per regulatory requirement. Passive mitigation was credited in the form of the secondary containment planned for construction.

The RMP*Comp[7] Model calculation predicts that the area impacted by the endpoint (200 ppm) is a circle with a radius of approximately 0.1 miles for the worst-case release scenario. Per MARPLOT 5.1.1 using 2010 census data, there is a population of 0 and 0 housing units within the totality of the vulnerability zone. The figures on the following pages illustrate the RMP*Comp modeling outputs, the MARPLOT 5.1.1 population estimates, and the vulnerability zone map.

Figure A-1: WCS RMP*Comp Modeling Results

Estimated Distance Calculation

Estimated distance to toxic endpoint: 0.1 miles (0.2 kilometers)

This is the downwind distance to the toxic endpoint specified for this regulated substance under the RMP Rule. Report all distances shorter than 0.1 mile as 0.1 mile, and all distances longer than 25 miles as 25 miles.

Scenario Summary

Chemical:	Ammonia (water solution)
Initial concentration:	20 %
CAS number:	7664-41-7
Threat type:	Toxic Liquid
Scenario type:	Worst-case
Liquid temperature:	77 F
Quantity released:	15300 gallons
Mitigation measures:	
Diked area:	1323 square feet
Dike height:	2 feet
Release rate to outside air:	27.8 pounds per minute
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.14 mg/L; basis: ERPG-2

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)

Figure A-2: WCS Population Estimate using MARPLOT 5.1.1

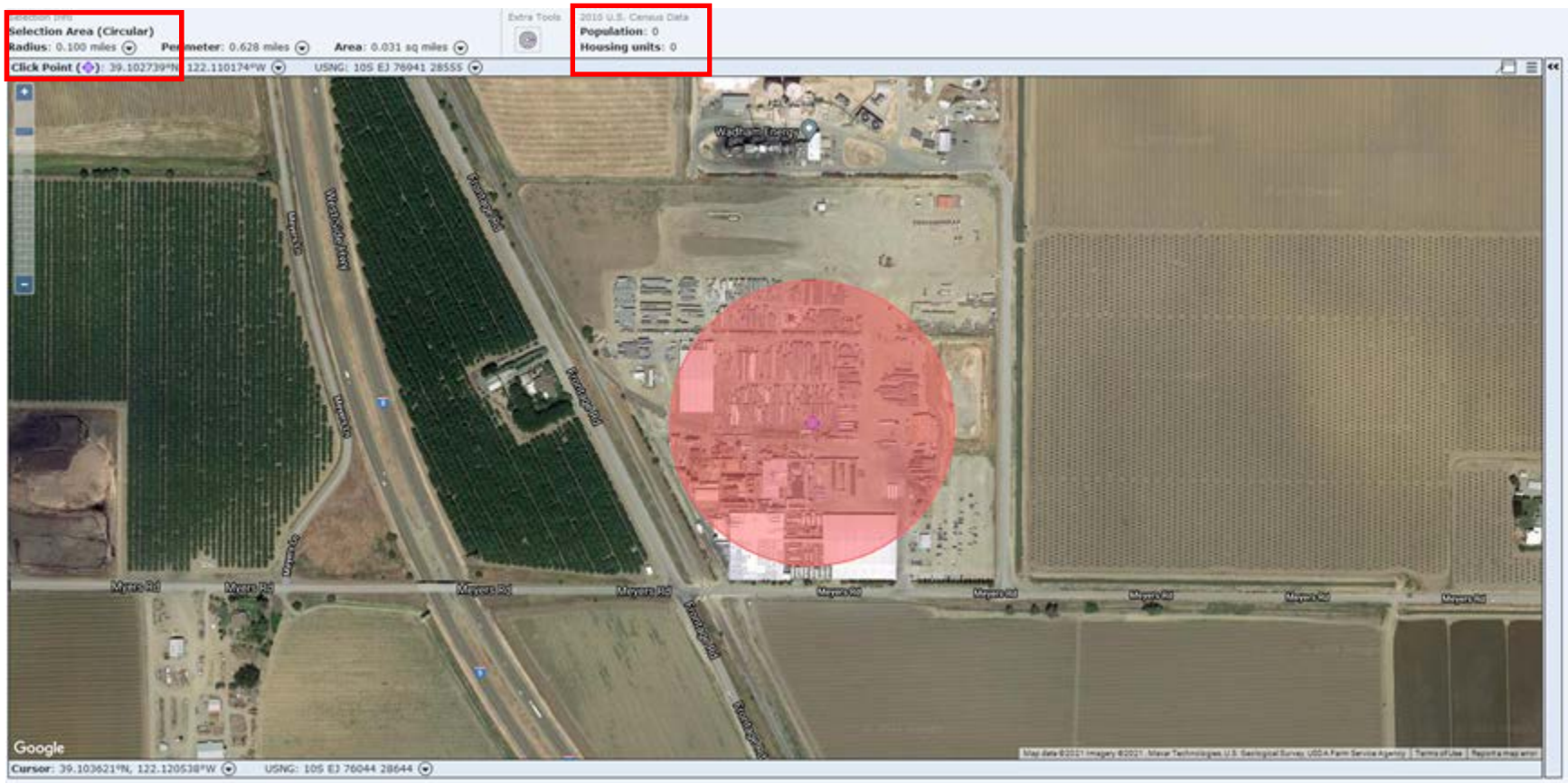
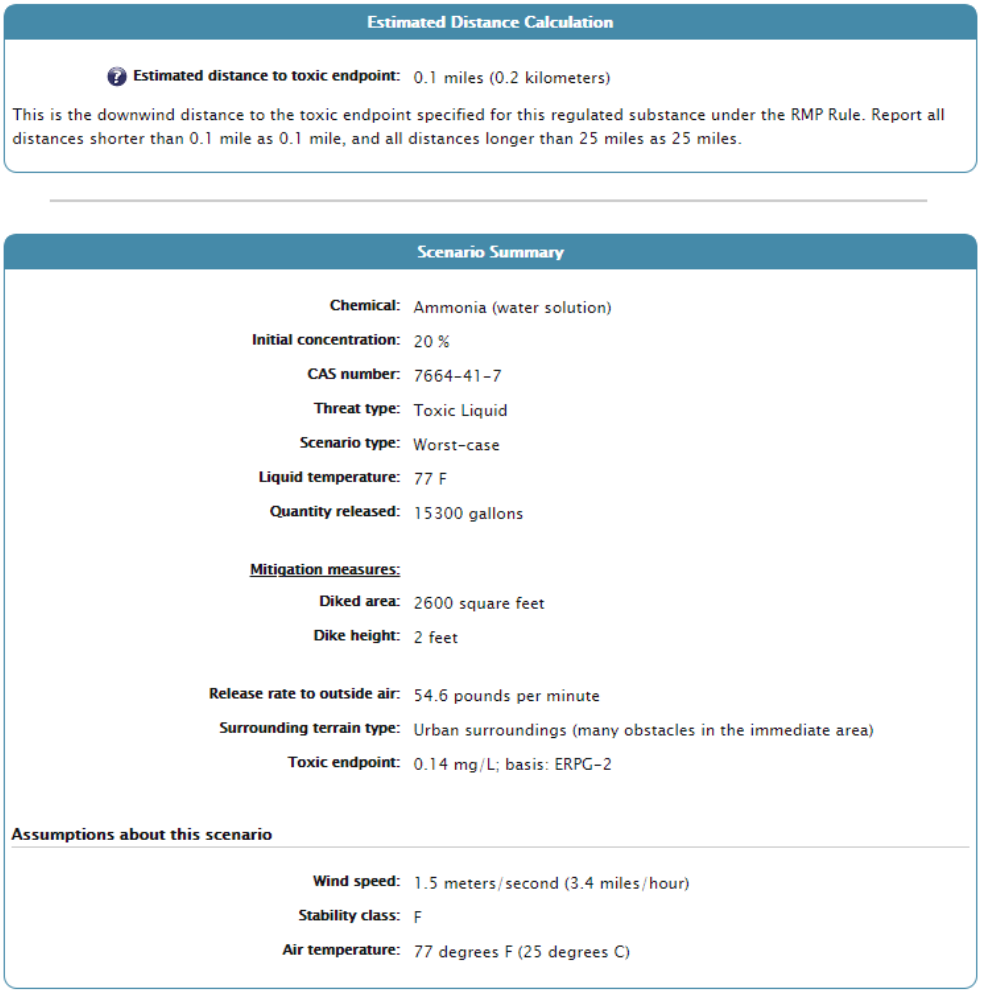


Figure A-3: WCS Population Estimate using MARPLOT 5.1.1



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Scenario Summary

Chemical:	Ammonia (water solution)
Initial concentration:	20 %
CAS number:	7664-41-7
Threat type:	Toxic Liquid
Scenario type:	Worst-case
Liquid temperature:	77 F
Quantity released:	15300 gallons
Mitigation measures:	
Diked area:	2600 square feet
Dike height:	2 feet
Release rate to outside air:	54.6 pounds per minute
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.14 mg/L; basis: ERPG-2

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)

In the above figure, the secondary containment area surrounding the aqueous ammonia storage tank is estimated to be 2,600 square feet (ft^2) with a two-foot (2-ft) berm or wall, which also serves as a secondary containment area for storm water.