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Sonoran Energy Project

(02-AFC-01C)

Data Responses, Set 1A

(Revised Response to Data Request 29)

Submitted to

California Energy Commission

Prepared by

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Contents

SECTION 1

Introduction

Attached is AltaGas Sonoran Energy Inc.'s (AltaGas or the Project Owner) revised response to the California Energy Commission (CEC) Data Request #29 regarding the Sonoran Energy Project (SEP) (02-AFC-01C) Petition to Amend (PTA).

SECTION 2

Hazardous Materials Management (29)

BACKGROUND

Section 3.5.1 of the Petition to Amend (PTA) states that the new Sonoran Energy Project (SEP) will have a total of 24,000 gallons of aqueous ammonia. However, Table 3.5.1 lists two aqueous ammonia solutions at 19 and 29 percent by weight. The table does not specify the precise quantities for each percentage of aqueous ammonia and the PTA does not explain why SEP needs both concentrations, or how each will be used. Staff needs more information in order to complete its analysis.

29. Please provide an updated Offsite Consequence Analysis (OCA) due to the increase in the amount of aqueous ammonia on site. If both concentrations of aqueous ammonia are to be kept on site, please provide a separate OCA for each tank.

    Response: At the request of the Commission Staff to revise the OCA using a different dispersion model, the Project Owner provides Attachment DR29-1R hereto. This Attachment presents a revised Offsite Consequence Analysis for the use and storage of aqueous ammonia on the SEP site. The results of the revised OCA indicate that the use and storage of aqueous ammonia will not result in a significant public health or hazardous materials impacts.

Attachment DR29-1R:
SEP Ammonia Offsite Consequence Analysis

SEP Ammonia Offsite Consequence Analysis

An offsite consequence analysis (OCA) for ammonia was conducted for the proposed Sonoran Energy Project (SEP). SEP is required by both the Clean Air Act and the Mojave Desert Air Quality Management District to install Best Available Control Technology to control emissions of criteria air pollutants from the proposed natural-gas-fired combustion turbine. Oxides of nitrogen (NO_x) emissions from the combustion turbine will be reduced through the use of selective catalytic reduction (SCR). The SCR control system utilizes ammonia as the reduction reagent in the presence of a catalyst. The SEP will use a 29 percent aqueous ammonia solution, stored in an aboveground storage tank located near the power block with a capacity of 24,000 gallons. A second 19 percent aqueous ammonia tank (a 500 gallon tote) is located at the water treatment skid. This ammonia solution is used to control boiler feed water pH. Due to the smaller size storage container and the lower ammonia concentration, the off-site consequence analysis is focused on the larger, more concentrated SCR ammonia storage tank.

The storage area for the ammonia storage tank will include a secondary containment basin, measuring 62 feet by 35 feet, with depth sufficient to hold the full contents of the tank plus rainwater from a 25-year, 24-hour storm event. The ammonia storage tank will be equipped with a pressure relief valve, a vapor equalization system, and a vacuum breaker system. The ammonia storage tank will be maintained at ambient temperature and atmospheric pressure.

Aqueous ammonia will be delivered to the plant by truck transport. The ammonia delivery truck unloading area will include a bermed and sloped pad surface. The bermed truck drainage pad will slope to a collection trough that will drain into the same secondary containment basin used for the ammonia storage tank.

Analysis

An assessment of worst-case and alternative scenarios of an accidental ammonia release were considered pursuant to the guidance given in *RMP Offsite Consequence Analysis Guidance, USEPA, April 1999*. The purpose of the worst-case analysis is to assist emergency planners by providing a maximum possible distance downwind, and is not representative of a probable release event. The worst-case analysis uses a number of conservative assumptions including the following:

- Worst-case of a constant mass flow, at the highest possible initial evaporation rate for the modeled wind speed and temperature is used, whereas in reality the evaporation rate would decrease with time as the concentration in the solution decreases.
- Worst-case stability class is used with the maximum ambient temperature of 120°F.

The worst-case meteorology stability class corresponds to nighttime hours, whereas the maximum ambient temperature most likely occur during daytime hours.

Additionally, the worst-case modeling does not take into account the low risk probability associated with such a catastrophic release, which is discussed separately.

The purpose of an alternative release scenario is to assess the risk associated with a more probable, non-catastrophic, release scenario using less conservative assumptions. The SEP alternative scenario assumed an uncoupling of the ammonia transfer hose during tank filling. The hose is assumed to have an inside diameter of 4 inches, and a length of 20 feet, resulting in a release of 13.1 gallons of aqueous ammonia into the secondary containment area.

The assessment of the worst-case and alternative release scenarios were prepared using the USEPA's Area Locations of Hazardous Atmospheres (ALOHA) model[1], and assuming a dense gas release. Each analysis

[1] http://www2.epa.gov/cameo/aloha-software.

assumed the immediate release of ammonia, and the formation of an evaporating pool of aqueous ammonia within the secondary containment basin. Evaporative emissions of ammonia would be subsequently released into the atmosphere. Meteorological conditions at the time of the release would control the evaporation rate, dispersion, and transport of ammonia released to the atmosphere. Meteorological data for the worst-case and alternative scenarios were pursuant to USEPA guidance and supplemented by the requirements of 19 California Code of Regulations (CCR) 2750.2.

Worst-Case Release Scenario

For purposes of worst-case release scenario, the maximum temperature recorded at the Blythe Airport station, which is near the SEP, in the past three years was 120 degrees Fahrenheit (°F) or 322.04 Kelvin[2]. Maximum temperatures combined with worst-case meteorological conditions result in the highest ammonia concentrations at the farthest distance downwind of the release site. Table 1 displays the meteorological data values used in the worst-case modeling analysis.

TABLE 1
Worst-Case Release Scenario Meteorological Input Parameters

Parameter	Worst-Case Meteorological Data
Wind Speed, meters/second	1.5
Stability Class	F
Relative Humidity, Percent	50
Ambient Temperature, Kelvin (°F)	322.04 (120)
Surface Roughness Length, meters (based on open country land cover)	0.03

Release rates for ammonia vapor from an evaporating 29-percent aqueous ammonia solution were calculated assuming mass transfer of ammonia across the liquid surface occurs according to principles of heat transfer by natural convection. The ammonia release rates for the worst-case scenario were calculated using ALOHA, meteorological data displayed in Table 1, and the dimensions of the secondary containment (35 feet by 62 feet) basin assuming that the full contents of the 24,000-gallon storage tank would be released instantaneously into the secondary containment basin. No passive controls were assumed for the worst-case scenario.

An initial ammonia evaporation rate was calculated and assumed to occur for 1 hour after the initial release. For concentrated solutions, the initial evaporation rate is substantially higher than the rate averaged over time periods of a few minutes or more since the concentration of the solution immediately begins to decrease as evaporation begins.

Alternative Release Scenario

For purposes of the alternative release scenario, average daily high temperature at the Blythe Airport station, which is near the SEP, is 87.7 °F or 304.1 Kelvin. An average wind speed of 3.35 meters per second and was assumed based on meteorological data collected at Blythe Airport for the years 2010 through 2013. Atmospheric stability class C was based on ALOHA default. Table 2 displays the meteorological data values used in the alternative modeling analysis.

[2] http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca0927

TABLE 1
Worst-Case Release Scenario Meteorological Input Parameters

Parameter	Worst-Case Meteorological Data
Wind Speed, meters/second	3.35
Stability Class	C
Relative Humidity, Percent	50
Ambient Temperature, Kelvin (°F)	304.1 (87.7)
Surface Roughness Length, meters (based on open country land cover)	0.03

Release rates for ammonia vapor from an evaporating 29-percent aqueous ammonia solution were calculated assuming mass transfer of ammonia across the liquid surface occurs according to principles of heat transfer by natural convection. The ammonia release rates for the worst-case scenario were calculated using ALOHA and meteorological data displayed in Table 2. For the alternative release scenario, it is assumed that 13.1 gallons of ammonia escapes from the transfer hose forming a 0.39 inch deep pool measuring 53.7 square feet within the secondary containment area.

An initial ammonia evaporation rate was calculated and assumed to occur for a maximum of 10 minutes after the initial release as the any remaining ammonia in the solution after that time would be more dilute than it was initially and will evaporate much less rapidly.

Although the edge of the secondary containment basin is raised above ground level, the release height used in the modeling was set at 0 meters above ground level (AGL) to maintain the conservative nature of the analysis.

Toxic Effects of Ammonia

With respect to the assessment of potential impacts associated with an accidental release of ammonia, four offsite “bench mark” exposure levels were evaluated, as follows: (1) the lowest concentration posing a risk of lethality, 2,000 part(s) per million (ppm); (2) the Occupational Safety and Health Administration’s (OSHA) Immediately Dangerous to Life and Health (IDLH) level of 300 ppm; (3) the Emergency Response Planning Guideline (ERPG) level of 150 ppm, which is the American Industrial Hygiene Association’s (AIHA) updated ERPG-2 for ammonia; and (4) the level considered by the California Energy Commission (CEC) staff to be without serious adverse effects on the public for a one-time exposure of 75 ppm (*Preliminary Staff Assessment-Otay Mesa Generating Project, 99-AFC-5, May 2000)*.

The odor threshold of ammonia is approximately 5 ppm, and minor irritation of the nose and throat will occur at 30 to 50 ppm. Concentrations greater than 140 ppm will cause detectable effects on lung function, even for short-term exposures (0.5 to 2 hours). At higher concentrations of 700 to 1,700 ppm, ammonia gas will cause severe effects; death occurs at concentrations of 2,500 to 7,000 ppm.

The ERPG-2 value of 150 ppm is based on a 1-hour exposure or averaging time. The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual’s ability to take protective action.

Modeling Results

Table 3 shows the modeled distance for the worst-case and alternative release scenarios to the four benchmark criteria concentrations: lowest concentration posing a risk of lethality (2,000 ppm), OSHA’s IDLH (300 ppm), AIHA’s ERPG-2 (150 ppm), and the CEC significance value (75 ppm). Please note that the distances shown represent the distance to the instantaneous concentration from the edge of the ammonia tank secondary containment basin, and do not take into account the exposure or averaging time associated with the toxic endpoints. Attachment 1 presents the modeling output files for the OCA.

TABLE 3
Distance to USEPA and CEC Toxic Endpoints (Ammonia) for the Worst-Case Release Scenario

Scenario	Distance to 2,000 ppm	Distance to IDLH (300 ppm)	Distance to AIHA's ERPG-2 (150 ppm)	Distance to CEC Significance Value (75 ppm)
Worst-Case Release	657 feet	2,238 feet	3,414 feet	5,808 feet
Alternative Release	90 feet	252 feet	375 feet	543 feet

Note:

The model input and output files are available upon request.

The closest point on the SEP boundary to the ammonia tank secondary containment basin extends approximately 287 feet to the east and the closest residence is approximately 0.95 miles (4,990 feet) to the southwest. The results of the offsite consequence analysis for the worst-case release scenario of ammonia at the SEP indicate that concentrations exceeding the benchmarks above would extend beyond the project boundary, but only the CEC significance value of 75 ppm would extend beyond the distance of the nearest resident.

The results for the alternative release scenario show that the concentrations exceeding the ERPG-2 and CEC significance value would extend beyond the project fenceline, but not far enough to impact any residential receptors.

Risk Probability

Accidental releases of aqueous ammonia in industrial use situations are rare. Statistics compiled on the normalized accident rates for RMP chemicals for the years 1994-1999 from *Chemical Accident Risks in U.S. Industry-A Preliminary Analysis of Accident Risk Data from U.S. Hazardous Chemical Facilities*, J.C. Belke, September 2000, indicates that ammonia (all forms) averages 0.017 accidental releases per process per year, and 0.018 accidental releases per million pounds stored per year. Data derived from *The Center for Chemical Process Safety, 1989* indicates the accidental release scenarios and probabilities for ammonia in general, as shown in Table 3.

TABLE 3
General Accidental Release Scenarios and Probabilities for Ammonia

Accident Scenario	Failure Probability
Onsite Truck Release	0.0000022
Loading Line Failure	0.005
Storage Tank Failure	0. 000095
Process Line Failure	0.00053
Evaporator Failure	0.00015

As shown in Table 3, the probability of a catastrophic failure of the ammonia storage tank is very remote. Given the consequences of a release due to the catastrophic failure of the ammonia storage tank, it should be evaluated to determine if a significant public health impact could occur. In the case of SEP, although the catastrophic tank failure would result in offsite ammonia concentrations exceeding all of the benchmark concentrations, the area impacted by a SEP catastrophic ammonia storage tank failure is sparsely populated with few residences potentially impacted. Furthermore, the probability of a catastrophic ammonia tank failure is further mitigated by the fact that SEP is required to comply with the state and federal Risk Management Programs (RMP). These programs require SEP to preparation and submittal of Risk Management Plans, including measures/procedures to prevention accidental releases and to conduct periodic inspections of covered components. Compliance with RMP, coupled with the low probability of the SEP ammonia tank catastrophic failure reduces the potential impact of an accidental ammonia release to insignificant levels.

The alternative release scenario also results in offsite impacts exceeding both the ERPG-2 and CEC significance values. As noted above, compliance with the RMP will require the preparation of measures to reduce the potential for accidental ammonia releases. These measure will include procedures for unloading ammonia to ensure that releases associated with the alternative scenario are minimized. As such, the sparsely populated nature of the SEP area, combined with the mitigation measures inherent with the RMP compliance results in the alternative ammonia release scenario having a less than significant impact on the public.

Conclusions

Several factors need to be considered when determining the potential risk from the use and storage of hazardous materials. These factors include the probability of equipment failure, population densities near the project site, meteorological conditions, and the process design. Considering the results of the above analysis, and accounting for the probability of a tank failure resulting in the modeled ammonia concentrations at the conditions modeled, the risk posed to the local community from the storage of aqueous ammonia at the SEP is not significant.

The results of the catastrophic scenario analysis indicate that the probability of a complete storage tank failure in combination with the conservatively modeled meteorological conditions would not pose a significant threat to the public.

The results of the alternative release scenarios show instantaneous concentrations exceeding the ERPG-2 and CEC benchmarks extending off the property site. However, these high concentrations would decrease quickly and would not pose a threat to nearby residences.

As described above, numerous conservative assumptions have been made at each step in this analysis. The conservative nature of these assumptions has resulted in a significant overestimation of the probability of an ammonia release at the SEP site, and the predicted distances and elevations to toxic endpoints do not pose a threat to the public. Therefore, it is concluded that risk from exposure to aqueous ammonia due to the SEP is less than significant.

Attachment 1
ALOHA Model Output

```
SITE DATA:
  Location: BLYTHE, CALIFORNIA
  Building Air Exchanges Per Hour: 0.58 (unsheltered single storied)
  Time: July 1, 2016  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AQUEOUS AMMONIA
  Solution Strength: 29% (by weight)
  Ambient Boiling Point: 81.5° F
  Partial Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%
  Hazardous Component: AMMONIA           Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.5 meters/second from W at 10 meters
  Ground Roughness: 3.0 centimeters      Cloud Cover: 5 tenths
  Air Temperature: 120° F
  Stability Class: F (user override)
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Evaporating Puddle (Note: chemical is flammable)
  Puddle Area: 2170 square feet          Puddle Volume: 24000 gallons
  Ground Type: Concrete                  Ground Temperature: 120° F
  Initial Puddle Temperature: 81.5° F
  Release Duration: ALOHA limited the duration to 1 hour
  Max Average Sustained Release Rate: 278 pounds/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 5,927 pounds

THREAT ZONE: (HEAVY GAS SELECTED)
  Model Run: Heavy Gas
  Red   : 219 yards --- (2000 ppm)
  Orange: 746 yards --- (300 ppm = IDLH)
  Yellow: 1138 yards --- (150 ppm = ERPG-2)
```

```
SITE DATA:
  Location: BLYTHE, CALIFORNIA
  Building Air Exchanges Per Hour: 0.58 (unsheltered single storied)
  Time: July 1, 2016  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AQUEOUS AMMONIA
  Solution Strength: 29% (by weight)
  Ambient Boiling Point: 81.5° F
  Partial Pressure at Ambient Temperature: greater than 1 atm
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     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 5,927 pounds

THREAT ZONE: (HEAVY GAS SELECTED)
  Model Run: Heavy Gas
  Red   : 746 yards --- (300 ppm = IDLH)
  Orange: 1138 yards --- (150 ppm = ERPG-2)
  Yellow: 1.1 miles --- (75 ppm)
```

```
SITE DATA:
  Location: BLYTHE, CALIFORNIA
  Building Air Exchanges Per Hour: 0.67 (unsheltered single storied)
  Time: July 1, 2016  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AQUEOUS AMMONIA
  Solution Strength: 29% (by weight)
  Ambient Boiling Point: 81.5° F
  Partial Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%
  Hazardous Component: AMMONIA           Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3.35 meters/second from W at 10 meters
  Ground Roughness: 3.0 centimeters      Cloud Cover: 5 tenths
  Air Temperature: 87.7° F               Stability Class: C
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Evaporating Puddle (Note: chemical is flammable)
  Puddle Area: 53.7 square feet          Puddle Volume: 13.1 gallons
  Ground Type: Concrete                  Ground Temperature: 87.7° F
  Initial Puddle Temperature: 81.5° F
  Release Duration: 44 minutes
  Max Average Sustained Release Rate: 5.39 pounds/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 28.2 pounds

THREAT ZONE: (HEAVY GAS SELECTED)
  Model Run: Heavy Gas
  Red   : 30 yards --- (2000 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
    make dispersion predictions less reliable for short distances.
  Orange: 84 yards --- (300 ppm = IDLH)
  Yellow: 125 yards --- (150 ppm = ERPG-2)
```

```
SITE DATA:
  Location: BLYTHE, CALIFORNIA
  Building Air Exchanges Per Hour: 0.67 (unsheltered single storied)
  Time: July 1, 2016  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AQUEOUS AMMONIA
  Solution Strength: 29% (by weight)
  Ambient Boiling Point: 81.5° F
  Partial Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%
  Hazardous Component: AMMONIA           Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3.35 meters/second from W at 10 meters
  Ground Roughness: 3.0 centimeters      Cloud Cover: 5 tenths
  Air Temperature: 87.7° F               Stability Class: C
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Evaporating Puddle (Note: chemical is flammable)
  Puddle Area: 53.7 square feet          Puddle Volume: 13.1 gallons
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  Release Duration: 44 minutes
  Max Average Sustained Release Rate: 5.39 pounds/min
     (averaged over a minute or more)
  Total Amount Hazardous Component Released: 28.2 pounds

THREAT ZONE: (HEAVY GAS SELECTED)
  Model Run: Heavy Gas
  Red   : 84 yards --- (300 ppm = IDLH)
  Orange: 125 yards --- (150 ppm = ERPG-2)
  Yellow: 181 yards --- (75 ppm)
```