DOCKETED	
Docket Number:	93-AFC-03C
Project Title:	Compliance - Application for Certification for SMUD's Campbell Soup Cogeneration Project
TN #:	237173
Document Title:	SPA Petition to Amend
Description:	N/A
Filer:	Jerry Salamy
Organization:	Jacobs
Submitter Role:	Applicant Consultant
Submission Date:	3/15/2021 2:22:59 PM
Docketed Date:	3/15/2021

Jacobs

Cooling Tower Air Emission VOC Rate Increase for the Sacramento Power Authority's Campbell Cogeneration Project (93-AFC-3C)

Petition for Modification

March 2021

Sacramento Municipal Utility District

Contents

Tables

Figure

Acronyms and Abbreviations

AFC	Application for Certification
BMP	Best Management Practice
CARB	California Air Resources Board
CEC	California Energy Resources Conservation and Development Commission
City	City of Sacramento
COCs	Conditions of Certification
Condition	Condition of Certification
CPM	Compliance Project Manager
CSSC	Campbell Soup Supply Company LLC
DAHS	Data Acquisition and Handling System
gpm	gallons per minute
HRA	health risk assessment
lb	pounds
LORS	laws, ordinances, regulations, and standards
PM2.5	particulate matter less than 2.5 microns in diameter
PM10	particulate matter less than 10 microns in diameter
ppmw	parts per million by weight
PTA	Petition to Amend
PTE	maximum potential to emit
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMUD	Sacramento Municipal Utility District
SPA	Sacramento Power Authority
SPAC	Sacramento Power Authority at Campbell Cogeneration Project
TDS	Total Dissolved Solids
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

1. Introduction

On November 30, 1994, the California Energy Commission (CEC) issued a license to the Sacramento Power Authority (SPA), a Joint Powers Agency of the Sacramento Municipal Utility District (SMUD) and SMUD Financing Authority (SFA), for the construction and operation of the Sacramento Power Authority at Campbell Cogeneration Project (SPAC). SPAC is a nominal 158-megawatt cogeneration facility consisting of a Siemens V84.2 natural-gas-fired combustion turbine generator, a steam turbine generator, and associated equipment. The facility is located in Sacramento County, California, on approximately 5.8 acres adjacent to the former Campbell Soup Supply Company LLC (CSSC) facility (now known as the Capital Commerce Center), which was the project's steam host. SPAC is located at 3215 47th Avenue. It is east of the corner of 47th Avenue and Franklin Boulevard, approximately 1 mile west of Highway 99. (Figure 1; figures are located at the end of each section).

On September 27, 2012, CSSC made a public announcement that it would close its South Sacramento facility in 2013. This would result in 700 CSSC employees being laid off. On October 30, 2012, the CSSC provided official written notice to SPA of its intent to close the CSSC's Sacramento facility and terminate the Steam Sales Agreement between SPA and CSSC effective October 30, 2013. The termination of the SSA in turn left SPAC without a viable steam host. On May 9, 2013, CSSC shut down all steam systems and ceased receipt of steam from SPAC. On May 16, 2013, SPA filed a Petition to Amend (PTA or Petition) for modification of Condition of Certification (Condition) EFF-1, which would allow SPAC to provide steam when there is a suitable steam host. That PTA was approved by the Commission on November 4, 2013.

SPA submitted a second PTA on November 20, 2015 to use recycled water as makeup water for the cooling tower, which PTA the Commission approved on July 13, 2016.

On November 2, 2018, SPA submitted a third PTA to replace the existing combustion system with an in-kind system that included a wet compression system to increase electrical production during warm ambient conditions. The proposed combustion system replaced existing components with new, upgraded components. The PTA was approved by the Commission on January 11, 2019.

On April 30, 2020, SPA submitted a fourth PTA to repurpose an existing water storage tank to be used for fire suppression; and installing a new fire water pump, housing, and piping to connect them to each other and to the water supply system to eliminate the potential for backflow into the potable water system. The post certification petition was approved by the Commission on May 27, 2020.

SPA's construction of the recycled water infrastructure was completed in 2020. The City of Sacramento Department of Utilities' final approval for SPA to receive recycled water was issued on July 21, 2020 following additional modification to separate SPA's firewater pumping system from the potable water system. Sacramento Regional Sanitation District Wastewater Treatment Plant (Regional San) first delivered recycled water to the site on July 28, 2020. SPA verified compliance with the cooling tower's VOC emissions by performing an air quality source test via the direct sampling of recycled water on August 25, 2020. Recycled water delivery was terminated on October 15, 2020 due to changes in overall water quality of the Regional San's provided water expected upon evaluating the results of a pilot test by Regional San. The changes are in VOC and non-VOC constituents and related to different components of the EchoWater Project (Regional San's major new water treatment upgrade) coming online.

During a recent recycled water pilot plant test, intended to simulate the recycled water that will be provided following the completion of their EchoWater Project, Regional Sans determined that the recycled water's volatile organic compound (VOC) concentration could be ten times higher than is currently permitted for use by the SPA cooling tower. None of the pilot plant's recycled water has been delivered to

SPA at any time. Rather, these testing results prompted SPA to start the process of requesting modifications to the air permit and CEC license prior to delivery of the higher VOC water.

The environmental impact assessment, addressing potential impacts from the use of recycled water in the cooling tower, is presented in Section 3.0 and concludes that there will be no significant adverse environmental impacts associated with the implementation of the actions specified in this PTA. The associated impacts to the environment would be less than significant, and in most cases would provide a community benefit. Therefore, not only will no adverse effects on the environment occur because of the changes to the project as proposed in this PTA, but some minor environmental benefits will occur, especially during drought years.

The project, as modified, will comply with all applicable laws, ordinances, regulations, and standards (LORS).

1.1 Overview of Proposed Amendment

The proposed amendment reflects a request to increase the cooling tower VOC emission rate contained in COC AQ-7 and the corresponding air quality permit condition from the Sacramento Metropolitan Air Quality Management District (SMAQMD) to allow the SPAC to resume operations using recycled water, in compliance with all applicable LORS. No construction is required, and no ground disturbance is necessary. The Project vicinity is presented in Figure 1.

1.2 Necessity of Proposed Changes

The CEC Siting Regulations require a discussion of the necessity for the proposed revisions to certification and whether the amendment is based on information known by the petitioner during the certification proceeding (Title 20, CCR, Sections 1769 (a)(1)(B) and (C)).

The proposed changes will not impact the function or operation of the SPAC, alter the basis of the Commission Decision (CEC, 1994), nor will they impact the health and safety of environmental resources. The changes are required for the project to operate in compliance with applicable LORS with the beneficial use of recycled water.

1.3 Need for Modification was Not Known at the Time of Certification

The proposed change was not known when the Project was licensed in 1994. SPA identified the potential exceedance of the cooling tower VOC emission rate contained in Condition of Certification (COC) AQ-7 in 2020 following Regional San's final EchoWater Project recycled water pilot plant testing results.

1.4 Why the Change should be Permitted

The proposed Project revision would allow recycled water to be used in the cooling tower in compliance with appliable LORS.

1.5 Consistency of Proposed Changes with Applicable Laws, Ordinances, Regulations, and Standards

The CEC Siting Regulations also require a discussion of the consistency of the proposed project revision with the applicable laws, ordinances, regulations, and standards (LORS) and whether the modifications are

based on new information that changes or undermines the assumptions, rationale, findings, or other basis of the final decision (Title 20, CCR, Section 1769 (a)(1)(D)). If the project would no longer be consistent with the decision as the result of requested project modifications, the PTA must provide an explanation as to why the modification(s) should be permitted.

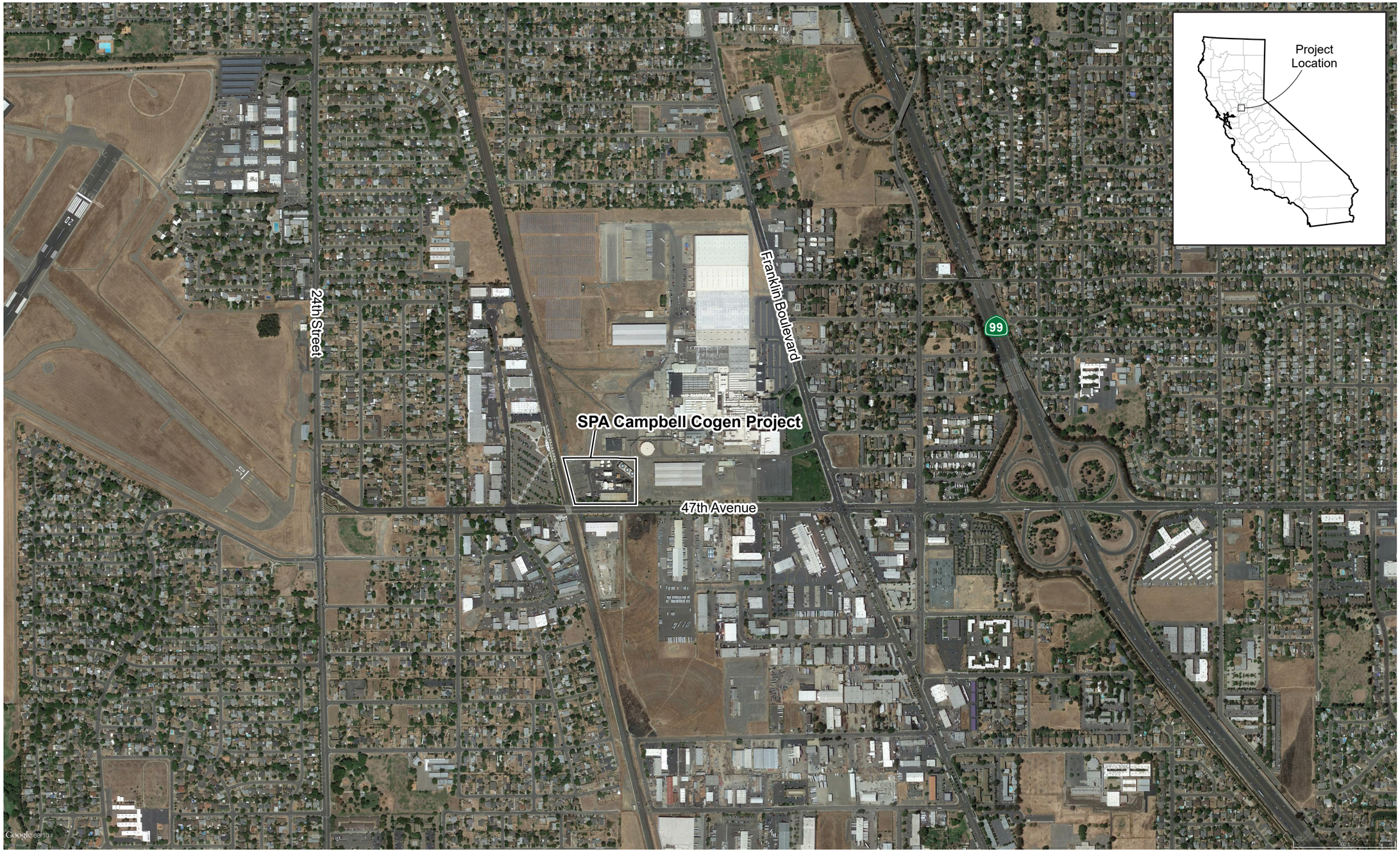
The proposed request to increase the cooling tower VOC emission rate is required to ensure the project operates in compliance with applicable LORS. As discussed in Section 3.0 of this PTA, approval of the proposed change does not undermine any basis for the Commission Decision (CEC, 1994). SPA would continue to operate in compliance with all applicable LORS. Therefore, the findings and conclusions contained in the Commission Decision (CEC, 1994) would remain applicable to the Project, as modified.

1.6 Summary of Environmental Impacts

The CEC Siting Regulations require that an analysis be conducted to address the potential impacts the proposed modifications may have on the environment and to propose measures to mitigate any potentially significant adverse impacts (Title 20, CCR, Section 1769 (a)(1)(E)). The regulations also require a discussion of the modifications' impact on the Project's ability to comply with applicable LORS (Section 1769 (1)(a)(F)). Section 3.0 of this PTA includes a discussion of the potential environmental impacts associated with the modification(s) as well as a discussion of the consistency of the modification(s) with the LORS. Section 3.0 concludes that there would be no significant environmental impacts associated with implementing the actions specified in this PTA and that the Project, as modified, will comply with all applicable LORS and will reduce the use of potable water, providing an environmental/economic benefit to the region.

1.7 Conditions of Certification

This PTA proposes changes to the air quality COC are required to accommodate the proposed modification.



North

0 500 1,000

Approximate scale in feet

Figure 1. Project Vicinity Map

SPA Campbell Cogeneration Project

Jacobs

2. Description of Proposed Amendment

At the time the PTA was submitted in April 2020, it was expected that using recycled water from the Sacramento Regional Sanitation District Wastewater Treatment Plant (Regional San) would not increase the amount of TDS in the Cooling Tower basin but would increase VOC emissions from the Cooling Tower by 0.5 pounds per day. The results of the most recent Regional San pilot test of the recycled water system concluded that VOC emissions could increase from the previously expected 0.5 lb/day to 6.5 lb/day.

The SPAC cooling tower VOC emissions are currently limited to 0.5 pounds/day as outlined in Table 1 below. This equates to approximately 46 parts per billion by weight (ppbw) VOC in potable water based on a 900 gallons per minute (gpm) cooling tower make-up water rate. The proposed VOC emission rate is based on a maximum VOC concentration of 600 ppbw in recycled water and a 900 gpm make-up water rate, which increases VOC mass emissions to 6.5 lb/day.

Table 1. VOC Emission Rates in the Cooling Tower

VOCs	Maximum Emissions					
	Daily (lb)	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual (tons)
Existing Cooling Tower	0.5	44	45	45	45	0.1
Modified Cooling Tower	6.5	584	590	597	597	1.2

The maximum quarterly and annual emissions for the modified SPAC are summarized in Table 2 below.

Table 2. SPAC Maximum Quarterly and Annual Emissions

Pollutant	Maximum Emissions[a]				
	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual lb/year
VOC	9,376	9,488	13,861	9,565	42,290
NOx	24,209	24,545	26,321	24,725	99,800
SOx	1,814	1,836	1,944	1,853	7,447
PM_{10}	11,015	10,160	12,294	11,619	45,088
$PM_{2.5}$	10,995	10,141	12,271	11,597	45,004
CO	47,599	47,599	47,599	47,599	190,396

Note:

[a] All emissions except VOC are consistent with SMAQMD Permit to Operate No. 25725.

PA is proposing to modify its air permit cooling tower emission limits. Appendix 1 presents a copy of the air permit modification request to the SMAQMD.

The potential environmental impacts associated with the proposed project are evaluated in Section 3.0.

3. Environmental Analysis of Proposed Project Amendment

The following subsections present a discussion of the potential impacts that the proposed project modification(s) may have on the environmental analysis, as presented in the Application for Certification (AFC). More detail is provided for those areas where the potential for a significant impact exists.

3.1 Air Quality

The permit modification request presented in Appendix 1 demonstrates that the SPAC project will not cause or contribute to the violation of an applicable ambient air quality standard. Furthermore, after receipt of the modified air permit and approval of this PTA, SPAC will comply with applicable LORS.

The 1994 Commission Decision approving the construction and operation of the SPAC found the project to be in compliance with all applicable LORS. The proposed Project is consistent with all applicable LORS and is not expected to alter the assumptions or conclusions made in the Commission Decision.

3.2 Biological Resources

The proposed project occurs entirely within the existing SPAC site and does not include any physical changes to the project site. Therefore, the proposed project is not expected to impact biological resources and does not change the biological resources impact analysis conclusions as presented in the 1994 Commission Decision or subsequent amendments for the Project.

The Project modification(s) would comply with applicable LORS and would not require any changes to the Biological Resources Conditions of Certification.

3.3 Cultural and Tribal Resources

The proposed project does not include any additional construction or groundbreaking activities at the SPAC site and therefore there will be no expected impacts to native soils. As such, Cultural and Tribal resource impacts are not expected.

No operational cultural or Tribal resource impacts beyond those analyzed in the original license and subsequent amendments are expected.

The Project modification(s) would comply with applicable LORS and would not require any changes to the Cultural Resources Conditions of Certification.

3.4 Geologic Hazards and Resources

The PTA does not involve any construction or groundbreaking activities at the project site. Therefore, project implementation will not be susceptible to any geologic hazards greater than those previously analyzed by the CEC during licensing of the Project, and the conditions imposed in the 1994 Commission Decision are adequate to protect the environment with respect to geological resources.

The Project modification(s) would comply with applicable LORS and would not require any changes to the Geologic Hazards and Resources Conditions of Certification.

Hence, the Project modification(s) will comply with applicable LORS and will not require a change to any of the Geologic Hazards Conditions of Certification.

3.5 Hazardous Materials Management

No additional hazardous materials are expected to be required as a result of the proposed changes to the project. If additional cooling tower water treatment chemicals are required, these water treatment chemicals will be reported to the CEC's compliance project manager consistent with Condition HAZ-1. The proposed project will not result in hazardous materials management impacts beyond those analyzed in the 1994 Commission Decision or subsequent license amendments. Therefore, the project is expected to comply with applicable hazardous materials management LORS.

3.6 Land Use

The Project vicinity is zoned heavy industrial (M-2) by Sacramento County. The proposed project does not include any additional construction or groundbreaking activities at the SPAC site. The proposed project will not result in any land use impacts beyond those analyzed in the 1994 Commission Decision or subsequent license amendments. In addition, the Project will comply with applicable LORS, and will not require a change to any of the Land Use Conditions of Certification.

3.7 Noise

There are no additional construction or groundbreaking activities at the SPAC site beyond what are described herein that would be required as part of this PTA. The modification(s) to the Project will comply with applicable LORS during construction and will not require any changes to the Noise Conditions of Certification.

3.8 Paleontological Resources

There are no additional construction or groundbreaking activities at the SPAC site and therefore there will be no expected impact to native soils. As such, paleontological resource impacts are not expected.

The Project modification(s) would comply with applicable LORS and would not require any changes to the Paleontological Resources Conditions of Certification.

3.9 Public Health

The proposed increase in the cooling tower VOC emissions could result in an increase in toxic air contaminants (TAC). As a result, SPA performed a health risk assessment (HRA) consistent with the SMAQMD's Rule 402 which regulates TAC emissions. As included in Appendix 1, the results of the HRA show that the project's increase in cooling tower VOC emissions results in residential or workplace cancer risk of less than 1 in a million and an acute or chronic hazard index of less than 1. The assessment is presented in Appendix 1, including the air dispersion modeling results. Therefore, the increase in cooling tower VOC emissions is not expected to result in a significant impact. The project is expected to comply with applicable LORS.

3.10 Socioeconomics

The proposed project does not include any construction or groundbreaking activities at the SPAC site and will not result in any impacts to population, housing, employment patterns, community services (law enforcement, fire services, and parks and recreation. Additionally, no impact to environmental justice

areas are expected and will not require a change to any of the Socioeconomics Conditions of Certification. Therefore, no significant negative socioeconomic impacts are expected due to the proposed change.

3.11 Soils

The proposed project does not include any construction or groundbreaking activities at the SPAC site and will not result in soils impacts beyond those analyzed in the 1994 Commission Decision and subsequent amendments. The proposed project will comply with all applicable LORS. There will be no impacts to soils from the operation of the proposed project. No changes to the Soils Conditions of Certification are required to address soils.

3.12 Transportation

There are no additional construction or groundbreaking activities at the SPAC site beyond what are described herein that would be required as part of this PTA. Therefore, there will be no impacts to transportation.

3.13 Visual Resources

There are no additional construction or groundbreaking activities at the SPAC site and the proposed modifications will not result in any visual impacts from construction or operation. Consequently, the proposed project will not cause any visual resources impacts greater than those previously analyzed by the CEC during licensing (CEC, 1994).

3.14 Waste Management

There are no additional construction or groundbreaking activities at the SPAC site beyond what are described herein that would be required as part of this PTA. Therefore, the Project will comply with applicable LORS and will not require any changes to the Waste Management Conditions of Certification.

3.15 Water Resources

There are no additional construction or groundbreaking activities at the SPAC site beyond what are described herein that would be required as part of this PTA. No increase in potable or recycled water is proposed. Therefore, impacts to water resources are not expected and will not require any changes to the Water Resources Conditions of Certification. During operation, the use of recycled water to offset potable water use, is an overall benefit to the region.

3.16 Worker Safety and Health

The proposed project does not include any construction or groundbreaking related activities and will not create any worker safety and health impacts beyond those analyzed in the 1994 Commission Decision.

3.17 Energy

The proposed project will not consume additional energy. Therefore, energy impacts due to construction of the Project modification(s) are expected to be less than significant.

3.18 Wildfires

The SPAC is located in highly urbanized areas with a low potential for wildfires. The SPAC site is supported by the City of Sacramento fire water system and the nearest fire station is located less than one-half of a mile away (City of Sacramento Fire Station 56 located on 47th Avenue). Therefore, the potential impacts due to wildfires is less than significant.

4. Potential Effects on the Public

In accordance with CEC Siting Regulations (Title 20, CCR, Section 1769(a)(1)(G)), this section discusses the potential effects on the public that may result from the modifications proposed in this PTA.

The proposed increase in cooling tower VOC emissions would have no adverse effect on the public, as shown in Section 3 and Appendix 1. Furthermore, the increase in VOC emissions will be fully offset by SPA, consistent with the SMAQMD's rules and regulations.

5. List of Property Owners

Consistent with the CEC Siting Regulations Section 1769(a)(1)(H), a list of property owners adjacent or near the proposed project is provided under a separate cover.

6. Potential Effects on Property Owners, the Public, and Parties in the Proceeding

This section addresses potential effects of the Project modifications proposed in this PTA on nearby property owners, the public, and parties in the application proceeding, in accordance with CEC Siting Regulations (Title 20, CCR, Section 1769 (a)(1)(I)).

The proposed modifications' effects on adjacent landowners would not differ significantly compared with the Project as previously certified and amended. The increase in the cooling tower VOC emissions is minimal and the associated impacts to the environment would be less than significant as analyzed in Section 3 and Appendix 1.

7. References

California Energy Commission (CEC). 1994. Commission Decision, Application for Certification of the Sacramento Power Authority Campbell Soup Cogeneration Project (93-AFC-03C). November 30.

Trinity Consultants (Trinity). 2021. Permit Modification Application to the Sacramento Metropolitan Air Quality Management District to Increase VOC Emissions from the SPA Cooling Tower Recycled Water Project. January 2021.

Appendix A
Permit Modification Application to the Sacramento Metropolitan Air Quality Management District to Increase VOC Emissions from the SPA Cooling Tower Recycled Water Project

PROJECT REPORT

Sacramento Power Authority (SPA) > Sacramento, CA

Permit Modification Application to the Sacramento Metropolitan Air Quality Management District to Increase VOC Emissions from the SPA Cooling Tower Recycled Water Project

Prepared By:

Jeffrey Adkins, Principal Consultant

TRINITY CONSULTANTS
3301 C Street, Suite 400
Sacramento, CA 95816
(916) 444-6666

February 2021

Project 210506.00XX

Trinity Consultants

Environmental solutions delivered uncommonly well

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The Sacramento Power Authority (SPA) is a Joint Powers Authority of the Sacramento Municipal Utility District (SMUD). SPA produces electric power for sale to SMUD. SPA owns a Siemens Model V84.2 combined-cycle gas turbine rated 1,410 MMBtu/hour with a 200 MMBtu/hour duct burner located at 3215 47th Avenue in Sacramento, California (Facility). The turbine is operated by EthosEnergy Group under contract to SPA. The Combined Cycle Gas Turbine operates under Permit to Operate (PTO) No. 25725 issued by the Sacramento Metropolitan Air Quality Management District (SMAQMD or District).

On July 22, 2016, the SMAQMD issued SPA an Authority to Construct (ATC) No. 24808 for the modification of the Cooling Tower PTO No. 13316 to allow the supply water to include a recycled water source. The PTO for this project was issued on January 11, 2021 but dated October 26, 2020. At the time the application was submitted, it was expected that the use of recycled water from the County of Sacramento's Regional Waste Water Treatment Plant (Regional San WWTP) would not increase the amount of total dissolved solids (TDS) in the Cooling Tower basin and would increase volatile organic compound (VOC) emissions from the Cooling Tower by 0.5 pounds per day.

Currently, Regional San is undergoing construction of the EchoWater Project, a large WWTP upgrade project that is necessary to comply with California wastewater discharge regulations. Preliminary testing of the recycled water from the pilot scale EchoWater test plant has shown that VOC emissions will be over ten times higher than originally anticipated in the 2016 permit application for PTO No. 24808. As such, SPA is proposing to modify PTO No. 24808 to account for these increased VOC emissions (the Project).

SPA is also proposing to add clarifying changes to the PTO No. 24808 permit condition language.

The use of EchoWater Project recycled water in the Cooling Tower will trigger Best Available Control Technology (BACT) requirements because VOC emissions will increase above currently permitted levels and changes will be required to the existing permit conditions and permit emission limits. Emission offsets are also triggered under SMAQMD regulations because the project results in an increase in VOC emissions above the offset threshold.

This Application is organized as outlined below.

- Section 1: Executive Summary
- Section 2: Facility and Project Overview
- Section 3: Emission Calculations
- Section 4: Regulatory Analysis

2.1. FACILITY DESCRIPTION

SPA operates a combined cycle power plant in Sacramento, California that produces up to 159 MW (nominal) of electrical power. The Facility currently contains the permitted equipment listed below.

- PTO No. 21738: Gas Turbine, Siemens, Model V84.2, combined cycle, 1,410 MMBTU/hour, natural gas fueled
- PTO No. 14071: Duct Burner, 200 MMBTU/hour, natural gas fueled
- PTO No. 11458: Selective Catalytic Reduction System
- PTO No. 11459: Oxidation Catalyst System
- PTO No. 24808: Cooling Tower, 3 cell, 45,000 gpm circulation rate

2.2. PROJECT DESCRIPTION

SPA operates its Cooling Tower under PTO No. 24808 issued by the SMAQMD. SMAQMD previously issued ATC No. 24808 to SPA for the modification of the PTO No. 13316 to allow the use of recycled water in the cooling tower.

SPA's construction of the recycled water infrastructure was completed on July 30, 2020 when the fire pump was commissioned. Sacramento City Utility's final approval to receive water was issued on July 21, 2020 following additional modifications of SPA's potable water system. Regional San WWTP delivered recycled water to the site on July 30, 2020 with an air quality source test being performed on August 25, 2020. The recycled water delivery was discontinued on October 15, 2020.

During a recent test performed by Regional San of recycled water from a pilot plant intended to simulate the recycled water that will be provided by Regional San following the completion of their EchoWater Project, it was determined that VOC emissions will be over ten times higher than outlined in the application associated with PTO No. 24808. Please note that the recycled water from the pilot plant was not delivered to SPA at any time. Due to the expected increase in VOC emissions, this report summarizes the requested modifications to PTO No. 24808 for the VOC (from 0.5 lb/day to 6.5 lb/day).

Additionally, SPA requests the following changes to the permit conditions in PTO No. 24808 to account for the current configuration of the data acquisition and handling system (DAHS) software for calculating 3-hour averages, and to address testing during extended periods when recycled water is not being used in the cooling tower:

10. *The total dissolved solids content of the circulating cooling water must not exceed 3,000 ppmw, averaged over any consecutive three hour period. The 3-hour average TDS limit is on a clock* ***rolling 3****-hour basis.* ***[Basis: SMAQMD Rule 201, Section 405]***

13. *Testing for VOC and Hexavalent Chrome (measured as compounds of chrome) of the recycled water inlet to the cooling tower (not the cooling tower basin) must be performed once every second calendar year to verify compliance with Condition Nos. 7 and 11. The first test occurred 8-25-2020.* ***Testing is not required when recycled water is not being used in the cooling tower. If a test is postponed because recycled water is not being used in the cooling tower, testing must be completed within 60 days of returning to recycled water service.***

3.1. EMISSION ESTIMATES

3.1.1. Regulated Pollutants

While actual operation will vary, the SPA combined-cycle turbine and Cooling Tower have the potential to operate on a full-time basis (24-hours/day, 365 days/year). Consequently, in the following sections regarding emissions and regulatory applicability, full-time Cooling Tower operation is assumed.

The Cooling Tower currently emits particulate matter less than 10 microns and less than 2.5 microns in diameter (PM_{10} and $PM_{2.5}$). The modified Cooling Tower Project with recycled water will continue to emit PM_{10} and $PM_{2.5}$ at levels less than or equal to the current Cooling Tower and will emit quantities of VOC above de minimis thresholds. As compared to the permit application for PTO No. 24808, ammonia emissions are remaining the same. This section presents future potential emissions from the modified Cooling Tower and future potential emissions from the modified facility.

The modified Cooling Tower Project will also emit trace levels of toxic air contaminants (TACs). For the purposes of this permit application, it is conservatively assumed that TACs will increase proportional to the increase in VOC. Thus, the increase from 0.5 to 6.5 lb/day VOC results in a corresponding increase in TAC emissions by a factor of 6.5/0.5 = 13. Appendix B includes detailed TAC emissions calculations.

Future Potential Emissions from the Modified Cooling Tower – The following emissions for the modified Cooling Tower Project are summarized in Table 3-1:

- Maximum daily emission increase;
- Maximum quarterly emissions increase; and
- Maximum annual emissions increase.

Maximum PM_{10} and $PM_{2.5}$ emissions from the modified Cooling Tower operating 24 hours per day were calculated based on the permitted total dissolved solid (TDS) limit of 3,000 ppmw, a circulation rate of 45,000 gpm, and a drift loss of 0.0006% as per Condition #8 of SMAQMD Permit to Operate No. 13316. These reported emission rates in Table 3-1 are the same as the pre-project emission rates for these pollutants.

We note that SPA measures the conductivity of the water in the cooling tower basin as a surrogate for TDS. Conductivity measures the ability of a solution to conduct an electric current between two electrodes. In solution, the current flows by ion transport. Therefore, with an increasing number of ions present in the liquid, the liquid will have a higher conductivity. Conductivity is measured in units of "mho" (referred to as "Siemen"). This is equivalent to the inverse of resistivity which is measured ohms.

The DAHS software converts the measured conductivity (in units of micromho or µmho to TDS in ppm using a conversion factor based on test data. The current factor is 0.826 µmho/ppm. However, recent water analyses indicate that the actual factor for recycled water is much lower than the current input value, and is consistently below 0.70 µmho/ppm (see Appendix A for recent water analyses). Therefore, SPA is going to change its conductivity to TDS conversion factor to 0.70 µmho/ppm. TDS will remain below the current permit limit of 3000 ppm on a 3-hour average basis.

VOCs emissions from the SPA Cooling Tower are currently limited to 0.5 lb/day in the recycled water PTO No. 24808. This equates to about 46 ppmw VOC at a 900 gpm make-up water rate to the Cooling Tower. The new

proposed VOC emission rate is based on a maximum VOC concentration of 600 ppmw in the recycled water and a 900 gpm make-up water rate, which thereby increases VOC mass emissions to 6.5 lb/day (see Appendix B for detailed emission calculations).

Table 3-1. Future Potential Emissions from the Modified Cooling Tower

Pollutant	Maximum Emissions					
	Daily (lb)	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual (tons)
$PM_{10}/PM_{2.5}$[1]	9.7	875	885	895	895	1.8
VOC[2]	6.5	584	590	597	597	1.2

Notes:

1. $PM_{10}/PM_{2.5}$ based on 3,000 ppmw TDS, 45,000 gpm circulation rate, and 0.0006% drift loss.
2. VOC emissions based on a 900 gpm make-up water rate and a VOC concentration of 600 ppmw after completion of the EchoWater Project.

Table 3-2 shows the current permitted emissions for the Cooling Tower from PTO No. 24808:

Table 3-2. Current Permitted Emissions from the Existing Cooling Tower

Pollutant	Maximum Emissions[1]					
	Daily (lb)	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual (tons)
$PM_{10}/PM_{2.5}$	9.7	875	885	895	895	1.8
VOC	0.5	44	45	45	45	0.1

Note:

1. Emission rates from SMAQMD PTO No. 24808, Condition 7.

Table 3-3 shows the VOC emissions increase from the SPA Cooling Tower associated with the use of recycled water from the EchoWater Project:

Table 3-3. Maximum Emission Increases from the Modified Cooling Tower

Pollutant	Maximum Emissions Increase					
	Daily (lb)	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual (tons)
$PM_{10}/PM_{2.5}$	0	0	0	0	0	0
VOC	6.0	540	545	552	552	1.1

Future Potential Emissions from the Modified Facility – The maximum quarterly and annual emissions for the modified SPA facility are summarized in Table 3-4. Total facility PM_{10}/ $PM_{2.5}$ emissions will not increase as a result of using EchoWater Project recycled water because the TDS content of the recycled water will be less than or equal to the current permitted level of 3,000 ppmw. The original permit application for PTO No. 24808 requested a VOC increase of 179 pounds per year, so SPA is requesting an additional increase of 2,189 pounds,

for a total VOC increase of 2,368 pounds for the Cooling Tower. Table 3-4 below shows the modified SPA facility-wide maximum potential emissions.

Table 3-4. Maximum Emissions from the Modified SPA Facility

Pollutant	Maximum Emissions[1]				
	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual lb/year
VOC	9,376	9,488	13,861	9,565	42,290
NOx	24,209	24,545	26,321	24,725	99,800
SOx	1,814	1,836	1,944	1,853	7,447
PM_{10}	11,015	10,160	12,294	11,619	45,088
$PM_{2.5}$	10,995	10,141	12,271	11,597	45,004
CO	47,599	47,599	47,599	47,599	190,396

Note:

1. Emission rates from SMAQMD PTO No. 25725, Condition 9, except for VOC which is Condition 9 plus the VOC in Table 3-1.

The Facility is subject to federal and local air regulations. This section summarizes the air permitting requirements and the key air quality regulations that apply to the proposed Cooling Tower VOC increase Project at the SPA facility. Specifically, the applicability of New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and SMAQMD regulations are addressed. The applicability of certain general provisions is not detailed in this narrative summary.

4.1. SMAQMD REQUIREMENTS

4.1.1. Regulation 2 – Permits

4.1.1.1. Rule 201 – General Permit Requirements

Rule 201 specifies that any owner/operator constructing, altering, replacing or operating any source that emits or controls air pollutants must first obtain an ATC from the District. This ATC application satisfies this requirement for the Project.

4.1.1.2. Rule 202 – New Source Review (NSR) Rule

The SMAQMD adopted Rule 202 to provide for preconstruction review of new or modified facilities, to ensure that affected sources do not interfere with the attainment of ambient air quality standards. In general, Rule 202 contains three separate elements as part of a New Source Review (NSR) analysis:

- Best Available Control Technology (BACT);
- Emission Offsets; and
- Air Quality Impact Analysis.

In order to determine which of these NSR elements is applicable to the Project, first it must be determined if SPA is a "major stationary source" and whether the Project is a "modification" or a "major modification."

SPA is a "major stationary source" per Rule 202, Section 228 for NOx, per the information presented in **Error! Reference source not found.**.

Table 4-1. SMAQMD Major Stationary Source Applicability Determination (tpy)

Pollutant	Major Source Threshold	SPA Permit Limit	Major Source?
VOC	25	20.0	**NO**
NOx	25 (or 100 tpy as $PM_{2.5}$ precursor)	49.9	**YES**
SO_2	100	3.7	**NO**
PM_{10}	100	22.5	**NO**
$PM_{2.5}$	100	22.5	**NO**
CO	100	43.7	**NO**

For all pollutants except NOx, which do not result in a "major stationary source" determination, emission increases from a "modification" are calculated pursuant to Rule 202, Sections 225, 229, and 411 based on a comparison of "historic potential emissions" to future potential to emit (PTE). Since SPA is proposing to change its permitted emission limits only for VOC, this will be the only increase in emissions for the non-major source pollutants under Rule 202.

Per Rule 202, Section 229, a "modification" includes the following:

> *229* ***MODIFICATION:*** *Any physical change, change in method of operation (including change in fuel), or addition, which:*
>
> *229.1 For an emissions unit would necessitate a change in a permit condition or result in the potential to emit being higher than the historic potential emissions as defined in Section 225.*

Since SPA is proposing a change in permit conditions to increase the daily and quarterly maximum PTE for VOC, the proposed change will be classified as a modification for VOC. Specific NSR requirements are discussed in more detail in the subsequent sections.

Additionally, Rule 202, Section 227 defines a "major modification" as follows:

> *227* ***MAJOR MODIFICATION:*** *Any physical change, change in method of operation (including change in fuel), or addition, to a stationary source classified as a major source for:*
>
> *227.1 VOC or NOx emissions, which result in an emission increase for the project as determined by Section 411.5, which when aggregated with all other creditable increases and decreases in emissions from the source is equal to or exceeding any of the following thresholds:*
>
> *a. 25 tons per year of volatile organic compounds; or*
> *b. 25 tons per year of nitrogen oxides.*

Section 225 states that the "historic potential emissions" for existing emissions units that are not part of a "major modification" are equal to the unit's potential to emit prior to the modification. The recycled water Cooling Tower Project is not a "major modification" as defined in Section 227 because the potential to emit of the project does not result in an increase in VOC emissions of 25 tons per year.

4.1.1.2.1 Best Available Control Technology (BACT)

Rule 202, Section 301 requires that an applicant apply BACT on a pollutant-by-pollutant basis to new or modified emissions units for each emissions change of a regulated air pollutant, if the change would result in an emission increase calculated pursuant to Section 411.1 of more than 550 lb/day for CO and any increase of VOCs, NOx, SOx, and $PM_{10}/PM_{2.5}$. In accordance with Section 411.1, historic daily potential emissions must be compared to future daily potential emissions. VOC is the only pollutant for which changes are proposed to the daily emissions limits, and the proposed change exceeds 0 lb/day. Therefore, the Project triggers BACT for VOC.

BACT guidelines for VOC emissions from a Cooling Tower in the Bay Area AQMD, San Joaquin Valley APCD, South Coast AQMD, and SMAQMD were searched, and it was not found that any VOC control technology had been achieved in practice for a cooling tower. Due to the potential for technology transfer, the cost effectiveness of a water-phase carbon adsorption system was considered for compliance with VOC BACT for the cooling tower emissions increase.

Utilizing the EPA Air Pollution Control Cost Manual for Carbon Adsorbers estimates a total cost of $98,545, assuming vapor phase adsorption of toluene at a similar flow rate (120 acfm) and emission rate (6.5 lb/day). Although there is no liquid phase adsorption calculator, the vapor-phase adsorption control technology is

similar enough to use in a rough cost estimate. The cost effectiveness for this control option is greater than $84,000 per ton of VOC reduced, which is far greater than the SMAQMD maximum cost effectiveness threshold of $17,500 per ton for VOC, indicating that liquid phase carbon adsorption of VOC would need to be substantially cheaper than a similar vapor phase adsorption system, which is unlikely. Any other control options (stripper plus carbon, stripper plus thermal oxidation, etc.) would be substantially more expensive and would not result in greater emission reductions (this hypothetical carbon system assumes 98% control). A copy of the EPA Control Cost Manual calculator is included in Appendix C.

4.1.1.2.2 Emission Offsets

Rule 201, Section 302 requires that emission offsets be provided on a per-pollutant basis for increases in quarterly emissions from any new or modified emissions unit, if the stationary source's post-project potential to emit exceeds the levels specified in Rule 202, Section 302.1. VOC is the only pollutant with an additional increase above the emissions outlined in the permit for PTO No. 24808. The SPA facility exceeds the offset trigger level in Section 302.1 for VOC.

Table 4-2. Offsets Applicability

Pollutant	Maximum Emissions (lb/quarter)[1]	Offsets Threshold (lb/quarter)	Above Offsets Threshold?
VOC	13,861	5,000	Yes

Note:
1. Presented previously in Table 3-4.

Because the original Cooling Tower modification was previously offset under PTO No. 24808, SPA will only have to offset the difference between this previous PTO and this modification application. As such, Table 4-3 below outlines the quantity of offsets required for each quarter due to this modification.

Table 4-3. Additional Offsets Required

Description	Maximum Emissions					
	Daily (lb)	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)	Annual (lb)
PTO No. 24808 Project PTE	0.5	44	45	45	45	179
Modification PTE	6.5	584	590	597	597	2368
Offsets Required (not including distance ratio)	N/A	540	545	552	552	2189

SPA is proposing to use VOC emission offsets from one or more of the following SMUD owned Emission Reduction Credit (ERC) certificates: ERC 04-00917 and ERC 04-00920, generated from the shutdown of compound application processes at Campbell Soup Company, previously located at 6200 Franklin Boulevard, Sacramento; and ERC 99001-F-S2, generated from the phase down of rice straw burning in Southern Sutter County. Table 4-4 summarizes the amounts of VOCs available for use from these ERC certificates.

Table 4-4. ERC Certificates Available

Pollutant	Certificate Number	1st Quarter (lb)	2nd Quarter (lb)	3rd Quarter (lb)	4th Quarter (lb)
VOC	04-00917	2,349	1,287	2,747	3,651
VOC	04-00920	458	354	1,603	59
VOC	99001-F-S2	7,483	4,132	1,112	9,452

Pursuant to Rule 202, Section 303.1, an offset distance ratio of 1.2 to 1.0 will be applied to SMAQMD ERC Certificates 04-00917 and 04-00920, and an offset distance ratio of 2.0 to 1.0 will be applied to Feather River Air Quality Management District ERC Certificate 99001-F-S2. The aforementioned ERC Certificates provide enough VOC reduction credits to fully offset the amount needed for each calendar quarter.

4.1.1.2.3 Ambient Air Quality Standards (AAQS)

Rule 202, Section 305 prohibits a new or modified stationary source from interfering with the attainment or maintenance of an applicable ambient air quality standard. An ambient air quality impact analysis is required only for a new major source or major modification, and the proposed SPA Cooling Tower recycled water project is neither a new major source nor a major modification. Therefore, an ambient air quality impacts analysis is not required.

4.1.1.3. Rule 203 – Prevention of Significant Deterioration

Rule 203 incorporates the Federal Prevention of Significant Deterioration (PSD) Program by reference (40 CFR 52.21). The PSD program requires pre-construction review and permitting of new or modified major stationary sources of air pollution to prevent significant deterioration of ambient air quality. PSD applies to pollutants for which ambient concentrations do not exceed the corresponding National Ambient Air Quality Standards (i.e., attainment pollutants). For the proposed EchoWater Cooling Tower project, the emitted pollutants are VOC and PM_{10}. While the SMAQMD is classified as an attainment area for NOx, SOx, CO, and PM_{10}, the SMAQMD is a nonattainment area with respect to the $PM_{2.5}$ and ozone National Ambient Air Quality Standards.

The federal PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing major stationary source (these terms are defined in the PSD regulations at 40 CFR 52.21). SPA is not an existing major source because its emissions are limited to less than 100 tons per year for all pollutants (see Table 3-4), and the modified Cooling Tower will not cause the SPA facility to become a new major stationary source. Therefore, PSD does not apply to the project.

4.1.1.4. Rule 207 – Title V Federal Operating Permit Program

SPA is an existing Title V facility with Permit No. TV2007-14-02B. The proposed SPA Cooling Tower VOC Increase Project will require a significant modification to SPA's Title V permit because of the revisions to the VOC emission limits and the new BACT determination.

In order to expedite the Title V permit modification process, SPA requests that the SMAQMD process this application and Title V permit modification under the Enhanced New Source Review process allowed pursuant to Rule 202 (Sections 101 and 404). This permit application package includes the SMAQMD application forms necessary for this modification to the SPA Title V permit (see Appendix D).

4.1.1.5. Rule 217 – Public Notification Requirements for Permits

Rule 217, Section 110 notes that notification requirements shall not apply if the application is for any new or modified emissions unit where the combined potential to emit from the Project would have an increase in potential to emit less than the amounts listed below (and provided that offsets are not triggered).

Volatile organic compounds	5,000 pounds per quarter
Nitrogen oxides	5,000 pounds per quarter
Sulfur oxides	9,200 pounds per quarter
PM_{10}	7,300 pounds per quarter
$PM_{2.5}$	10 tons per year
Carbon monoxide	49,500 pounds per quarter

There will not be an increase in potential to emit from the Project exceeding the levels listed in Section 110, but offsets are triggered by the Project. Therefore, the Project is subject to Rule 217 public notice requirements.

4.1.2. Regulation 3 – Fees

4.1.2.1. Rule 301 – Stationary Source Permit Fees

The SPA permit application is subject to the permit fees established by Rule 301. The initial permit fee was determined in accordance with SMAQMD Rule 301 based on Sections 301 and 306.1 as follows:

> ***306 ALTERATIONS, ADDITIONS, REVISIONS OR CHANGE IN CONDITIONS:***
> *306.1 When an application is filed for a permit involving alterations or additions resulting in a change to any existing equipment for which a permit to operate was granted for such equipment and has not been canceled under Section 401 of this rule, the applicant shall pay a permit fee based on the incremental increase in rating, capacity or increase in the number of nozzles resulting from such change in accordance with the fee schedule in Section 308 of this rule.*

The permit fee is $3,977, corresponding to the 200 or greater horsepower electric motor horsepower schedule in Section 308.2. Additionally, Section 313 requires $4,024 for each significant Title V permit modification, and $1,517 for a filing fee for each Title V application. Therefore, a check in the amount of $9,518 for one cooling tower source payable to the SMAQMD is included as part of this permit application package. The applicant understands that the SMAQMD may charge additional fees based on the actual review hours spent by District staff.

4.1.3. Regulation 4 – Prohibitions

4.1.3.1. Rule 401 – Ringelmann Chart/Opacity

Rule 401 prohibits the emission of air contaminants that are darker than Ringelmann No. 1 or 20% opacity for more than three minutes in a 1-hour period. Water vapor is not included in an opacity determination. The Cooling Tower will not create visible emissions in excess of the limits of this rule.

4.1.3.2. Rule 402 – Nuisance

This rule prohibits the discharge of air contaminants in quantities that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public. The SMAQMD regulates new and modified

sources of toxic air contaminants (TACs) under this rule by implementing its "Risk Assessment Guidelines for New and Modified Stationary Sources," dated December 2000. These guidelines implement what is commonly known as "Toxics New Source Review." For the SPA Cooling Tower, there are TAC emissions associated with the use of recycled water. The original analyses of the recycled water and associated TACs were outlined in the permit application for PTO No. 24808.

Under the SMAQMD's toxics policy, modified projects with TAC emission increases are required to perform a health risk assessment. To determine whether the proposed Cooling Tower VOC Project will result in a significant increase in either the carcinogenic or non-cancer health impacts for the SPA facility, the health risk assessment (HRA) TAC concentrations from the permit application for PTO No. 24808 were conservatively scaled up by the increase in daily VOC emissions (6.5/0.5 = 13), except for chloroform, which was conservatively set at 300 ppb, and bromodichloromethane, which was set at 100 ppb, based on recommendations from Regional San. A new AERMOD modeling analysis was performed and a new HRA was performed using CARB's Hotspots Analysis and Reporting Program (HARP) computer model. Table 4-5 below shows the revised HRA results from the modified Cooling Tower.

Table 4-5. Revised HRA Impacts for the SPA Cooling Tower VOC Project

Risk Component	PTO No. 24808 Cooling Tower Risk	Revised Impacts
Cancer Risk - Residential	7.63×10^{-8}	1.10×10^{-7}
Cancer Risk - Workplace	3.50×10^{-9}	1.39×10^{-8}
Cancer Risk – PMI	--	2.24×10^{-7}
Acute Hazard Index	0.154	0.250
Chronic Hazard Index	0.0149	0.00886
8-Hour Chronic	--	3.29×10^{-5}

Table 4-5 shows that the HRA results for the SPA Cooling Tower VOC Increase Project are below the significance thresholds for cancer, acute, and chronic impacts. Appendix E includes the HARP files associated with this HRA. Therefore, the TAC emission impacts for the proposed Cooling Tower VOC Increase Project will not be significant, and the project is not expected to create a nuisance due to health risk.

In addition to project TAC emissions, bacterial growth in the proposed cooling water system could include the Legionella bacterium which could present a public health risk. This risk is present for both recycled water cooling systems as well as potable water cooling systems. Legionella is a bacterium that is ubiquitous in natural aquatic environments and is also widely distributed in man-made water systems. It is the principal cause of legionellosis, otherwise known as Legionnaires' disease, which is similar to pneumonia. Transmission to people results mainly from inhalation or aspiration of aerosolized contaminated water. Untreated or inadequately treated cooling systems, such as industrial cooling towers and building heating, ventilating, and air conditioning systems, have been correlated with outbreaks of legionellosis.

The State of California regulates recycled water for use in cooling towers in Title 22, section 60303, California Code of Regulations. This section requires that, in order to protect workers and the public who may come into contact with cooling tower mists, chlorine or another biocide must be used to treat the cooling system water to minimize the growth of Legionella and other micro-organisms. SPA will use tertiary-treated recycled water provided by the Regional San WWTP which has been pre-treated with chlorine. SPA will also add additional

chlorine bleach at the cooling tower basin to minimize the growth of microorganisms. Therefore, it is not expected that bacterial growth in the modified SPA Cooling Tower will present a public health risk.

4.1.3.3. Rule 404 – Particulate Matter

Rule 404 prohibits emissions of particulate matter (PM) in excess of 0.1 gr/dscf. The PM drift loss from the Cooling Tower will be much less than this emission limit. Therefore, the Cooling Tower will comply with the Rule 404 PM emission limit.

4.1.4. California Environmental Quality Act (CEQA)

Under Rule 202 (Section 307), the Air Pollution Control Officer shall deny an Authority to Construct or Permit to Operate if the Air Pollution Control Officer finds that the project which is the subject of an application would not comply with CEQA. Because the SPA Project underwent review/approval by the CEC in its Application for Certification (AFC) process, the CEC is responsible for the CEQA equivalent review of the Cooling Tower Project. As a CEC-approved project, all subsequent SPA modifications go through the CEC AFC amendment process.

This AFC amendment process includes a review to confirm that a proposed project modification complies with applicable CEQA requirements. The applicant is in the process of preparing the petition to the CEC to amend the AFC for the SPA Project to allow the proposed changes discussed in this permit application package. Therefore, the CEQA review of the proposed Cooling Tower Recycled Water Project will be covered by the CEC amendment process.

APPENDIX A: RECYCLED WATER ANALYSES

Ethos Energy Group
5000 83rd Street
Sacramento, CA 95826

Reported: 07/27/2020 16:23
Project: Tertiary Water
Project Number: [none]
Project Manager: Pedro Juarez

Laboratory / Client Sample Cross Reference

Laboratory	Client Sample Information			
2021270-01	**COC Number:**	---	**Receive Date:**	07/24/2020 08:10
	Project Number:	---	**Sampling Date:**	07/23/2020 13:15
	Sampling Location:	---	**Sample Depth:**	---
	Sampling Point:	Spa Cogen - Tertiary Water	**Lab Matrix:**	Water
	Sampled By:	Karl Wolff	**Sample Type:**	Wastewater

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

Ethos Energy Group
5000 83rd Street
Sacramento, CA 95826

Reported: 07/27/2020 16:23
Project: Tertiary Water
Project Number: [none]
Project Manager: Pedro Juarez

Volatile Organic Analysis (EPA Method 624.1)

BCL Sample ID: 2021270-01 | **Client Sample Name:** Spa Cogen - Tertiary Water, 7/23/2020 1:15:00PM, Karl Wolff

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Benzene	ND	ug/L	0.50	0.062	EPA-624.1	ND		1
Bromodichloromethane	**2.0**	**ug/L**	**0.50**	**0.050**	**EPA-624.1**	ND		1
Bromoform	**0.13**	**ug/L**	**0.50**	**0.067**	**EPA-624.1**	ND	**J**	1
Bromomethane	ND	ug/L	1.0	0.077	EPA-624.1	ND		1
Carbon tetrachloride	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Chlorobenzene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Chloroethane	**0.16**	**ug/L**	**0.50**	**0.057**	**EPA-624.1**	ND	**J**	1
Chloroform	**11**	**ug/L**	**0.50**	**0.050**	**EPA-624.1**	ND		1
Chloromethane	ND	ug/L	0.50	0.055	EPA-624.1	ND		1
Dibromochloromethane	**0.43**	**ug/L**	**0.50**	**0.050**	**EPA-624.1**	ND	**J**	1
1,2-Dichlorobenzene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
1,3-Dichlorobenzene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
1,4-Dichlorobenzene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
1,1-Dichloroethane	ND	ug/L	0.50	0.051	EPA-624.1	ND		1
1,2-Dichloroethane	ND	ug/L	0.50	0.068	EPA-624.1	ND		1
1,1-Dichloroethene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
cis-1,2-Dichloroethene	ND	ug/L	0.50	0.060	EPA-624.1	ND		1
trans-1,2-Dichloroethene	ND	ug/L	0.50	0.056	EPA-624.1	ND		1
1,2-Dichloropropane	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
cis-1,3-Dichloropropene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
trans-1,3-Dichloropropene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Ethylbenzene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Methylene chloride	**0.25**	**ug/L**	**1.0**	**0.055**	**EPA-624.1**	ND	**J**	1
Methyl t-butyl ether	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
1,1,2,2-Tetrachloroethane	ND	ug/L	0.50	0.066	EPA-624.1	ND		1
Tetrachloroethene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Toluene	**3.1**	**ug/L**	**0.50**	**0.051**	**EPA-624.1**	ND		1
1,1,1-Trichloroethane	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
1,1,2-Trichloroethane	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Trichloroethene	ND	ug/L	0.50	0.081	EPA-624.1	ND		1
Trichlorofluoromethane	ND	ug/L	0.50	0.080	EPA-624.1	ND		1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
Vinyl chloride	ND	ug/L	0.50	0.059	EPA-624.1	ND		1

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

Ethos Energy Group
5000 83rd Street
Sacramento, CA 95826

Reported: 07/27/2020 16:23
Project: Tertiary Water
Project Number: [none]
Project Manager: Pedro Juarez

Volatile Organic Analysis (EPA Method 624.1)

BCL Sample ID: 2021270-01 | **Client Sample Name:** Spa Cogen - Tertiary Water, 7/23/2020 1:15:00PM, Karl Wolff

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Total Xylenes	ND	ug/L	0.50	0.15	EPA-624.1	ND		1
p- & m-Xylenes	ND	ug/L	0.50	0.10	EPA-624.1	ND		1
o-Xylene	ND	ug/L	0.50	0.050	EPA-624.1	ND		1
1,2-Dichloroethane-d4 (Surrogate)	99.5	%	75 - 125 (LCL - UCL)		EPA-624.1			1
Toluene-d8 (Surrogate)	90.7	%	80 - 120 (LCL - UCL)		EPA-624.1			1
4-Bromofluorobenzene (Surrogate)	91.6	%	80 - 120 (LCL - UCL)		EPA-624.1			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID	Prep Method
1	EPA-624.1	07/27/20 05:00	07/27/20 06:42	MGC	MS-V7	1	B083286	EPA 624.1

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

SMUD
6201 S Street/P.O. Box 15830
Sacramento, CA 95852-0830

Reported: 09/24/2015 15:09
Project: Waste Water
Project Number: SPA Reclaim Water Supply
Project Manager: Brad Gacke

Laboratory / Client Sample Cross Reference

Laboratory	Client Sample Information			
1524304-01	**COC Number:**	---	**Receive Date:**	09/24/2015 08:45
	Project Number:	---	**Sampling Date:**	09/23/2015 12:10
	Sampling Location:	---	**Sample Depth:**	---
	Sampling Point:	SRCSD Storage tank Eff (3032)	**Lab Matrix:**	Water
	Sampled By:	Brad Gacke	**Sample Type:**	Wastewater

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

SMUD
6201 S Street/P.O. Box 15830
Sacramento, CA 95852-0830

Reported: 09/24/2015 15:09
Project: Waste Water
Project Number: SPA Reclaim Water Supply
Project Manager: Brad Gacke

Volatile Organic Analysis (EPA Method 8260B)

BCL Sample ID: 1524304-01 | **Client Sample Name:** SRCSD Storage tank Eff (3032), 9/23/2015 12:10:00PM, Brad Gacke

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Benzene	ND	ug/L	0.50	0.083	EPA-8260B	ND		1
Bromobenzene	ND	ug/L	0.50	0.13	EPA-8260B	ND		1
Bromochloromethane	ND	ug/L	0.50	0.24	EPA-8260B	ND		1
Bromodichloromethane	**0.62**	**ug/L**	**0.50**	**0.14**	**EPA-8260B**	ND		1
Bromoform	ND	ug/L	0.50	0.27	EPA-8260B	ND		1
Bromomethane	ND	ug/L	1.0	0.25	EPA-8260B	ND		1
n-Butylbenzene	ND	ug/L	0.50	0.11	EPA-8260B	ND		1
sec-Butylbenzene	ND	ug/L	0.50	0.15	EPA-8260B	ND		1
tert-Butylbenzene	ND	ug/L	0.50	0.13	EPA-8260B	ND		1
Carbon tetrachloride	ND	ug/L	0.50	0.18	EPA-8260B	ND		1
Chlorobenzene	ND	ug/L	0.50	0.093	EPA-8260B	ND		1
Chloroethane	**0.77**	**ug/L**	**0.50**	**0.14**	**EPA-8260B**	ND		1
Chloroform	**12**	**ug/L**	**0.50**	**0.12**	**EPA-8260B**	ND		1
Chloromethane	**1.2**	**ug/L**	**0.50**	**0.14**	**EPA-8260B**	ND		1
2-Chlorotoluene	ND	ug/L	0.50	0.20	EPA-8260B	ND		1
4-Chlorotoluene	ND	ug/L	0.50	0.15	EPA-8260B	ND		1
Dibromochloromethane	ND	ug/L	0.50	0.13	EPA-8260B	ND		1
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0	0.44	EPA-8260B	ND		1
1,2-Dibromoethane	ND	ug/L	0.50	0.16	EPA-8260B	ND		1
Dibromomethane	ND	ug/L	0.50	0.24	EPA-8260B	ND		1
1,2-Dichlorobenzene	ND	ug/L	0.50	0.072	EPA-8260B	ND		1
1,3-Dichlorobenzene	ND	ug/L	0.50	0.15	EPA-8260B	ND		1
1,4-Dichlorobenzene	ND	ug/L	0.50	0.062	EPA-8260B	ND		1
Dichlorodifluoromethane	ND	ug/L	0.50	0.099	EPA-8260B	ND		1
1,1-Dichloroethane	ND	ug/L	0.50	0.11	EPA-8260B	ND		1
1,2-Dichloroethane	ND	ug/L	0.50	0.17	EPA-8260B	ND		1
1,1-Dichloroethene	ND	ug/L	0.50	0.18	EPA-8260B	ND		1
cis-1,2-Dichloroethene	ND	ug/L	0.50	0.085	EPA-8260B	ND		1
trans-1,2-Dichloroethene	ND	ug/L	0.50	0.15	EPA-8260B	ND		1
Total 1,2-Dichloroethene	ND	ug/L	1.0	0.23	EPA-8260B	ND		1
1,2-Dichloropropane	ND	ug/L	0.50	0.13	EPA-8260B	ND		1
1,3-Dichloropropane	ND	ug/L	0.50	0.086	EPA-8260B	ND		1
2,2-Dichloropropane	ND	ug/L	0.50	0.13	EPA-8260B	ND		1

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

SMUD
6201 S Street/P.O. Box 15830
Sacramento, CA 95852-0830

Reported: 09/24/2015 15:09
Project: Waste Water
Project Number: SPA Reclaim Water Supply
Project Manager: Brad Gacke

Volatile Organic Analysis (EPA Method 8260B)

BCL Sample ID: 1524304-01 | **Client Sample Name:** SRCSD Storage tank Eff (3032), 9/23/2015 12:10:00PM, Brad Gacke

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
1,1-Dichloropropene	ND	ug/L	0.50	0.085	EPA-8260B	ND		1
cis-1,3-Dichloropropene	ND	ug/L	0.50	0.14	EPA-8260B	ND		1
trans-1,3-Dichloropropene	ND	ug/L	0.50	0.079	EPA-8260B	ND		1
Total 1,3-Dichloropropene	ND	ug/L	1.0	0.21	EPA-8260B	ND		1
Ethylbenzene	**0.13**	**ug/L**	**0.50**	**0.098**	**EPA-8260B**	ND	**J**	1
Hexachlorobutadiene	ND	ug/L	0.50	0.17	EPA-8260B	ND		1
Isopropylbenzene	ND	ug/L	0.50	0.14	EPA-8260B	ND		1
p-Isopropyltoluene	ND	ug/L	0.50	0.12	EPA-8260B	ND		1
Methylene chloride	ND	ug/L	1.0	0.48	EPA-8260B	ND		1
Methyl t-butyl ether	ND	ug/L	0.50	0.11	EPA-8260B	ND		1
Naphthalene	ND	ug/L	0.50	0.36	EPA-8260B	ND		1
n-Propylbenzene	ND	ug/L	0.50	0.11	EPA-8260B	ND		1
Styrene	ND	ug/L	0.50	0.068	EPA-8260B	ND		1
1,1,1,2-Tetrachloroethane	ND	ug/L	0.50	0.18	EPA-8260B	ND		1
1,1,2,2-Tetrachloroethane	ND	ug/L	0.50	0.17	EPA-8260B	ND		1
Tetrachloroethene	ND	ug/L	0.50	0.13	EPA-8260B	ND		1
Toluene	**0.11**	**ug/L**	**0.50**	**0.093**	**EPA-8260B**	ND	**J**	1
1,2,3-Trichlorobenzene	ND	ug/L	0.50	0.16	EPA-8260B	ND		1
1,2,4-Trichlorobenzene	ND	ug/L	0.50	0.19	EPA-8260B	ND		1
1,1,1-Trichloroethane	ND	ug/L	0.50	0.11	EPA-8260B	ND		1
1,1,2-Trichloroethane	ND	ug/L	0.50	0.16	EPA-8260B	ND		1
Trichloroethene	ND	ug/L	0.50	0.085	EPA-8260B	ND		1
Trichlorofluoromethane	ND	ug/L	0.50	0.13	EPA-8260B	ND		1
1,2,3-Trichloropropane	ND	ug/L	1.0	0.24	EPA-8260B	ND		1
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ug/L	0.50	0.15	EPA-8260B	ND		1
1,2,4-Trimethylbenzene	ND	ug/L	0.50	0.12	EPA-8260B	ND		1
1,3,5-Trimethylbenzene	ND	ug/L	0.50	0.12	EPA-8260B	ND		1
Vinyl chloride	ND	ug/L	0.50	0.12	EPA-8260B	ND		1
Total Xylenes	**0.53**	**ug/L**	**1.0**	**0.36**	**EPA-8260B**	ND	**J**	1
p- & m-Xylenes	**0.42**	**ug/L**	**0.50**	**0.28**	**EPA-8260B**	ND	**J**	1
o-Xylene	**0.11**	**ug/L**	**0.50**	**0.082**	**EPA-8260B**	ND	**J**	1
Total Purgeable Petroleum Hydrocarbons	**23**	**ug/L**	**50**	**7.2**	**Luft-GC/MS**	ND	**J**	1
1,2-Dichloroethane-d4 (Surrogate)	88.6	%	75 - 125 (LCL - UCL)		EPA-8260B			1

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

SMUD
6201 S Street/P.O. Box 15830
Sacramento, CA 95852-0830

Reported: 09/24/2015 15:09
Project: Waste Water
Project Number: SPA Reclaim Water Supply
Project Manager: Brad Gacke

Volatile Organic Analysis (EPA Method 8260B)

BCL Sample ID: 1524304-01 | **Client Sample Name:** SRCSD Storage tank Eff (3032), 9/23/2015 12:10:00PM, Brad Gacke

Constituent	Result	Units	PQL	MDL	Method	MB Bias	Lab Quals	Run #
Toluene-d8 (Surrogate)	98.3	%	80 - 120 (LCL - UCL)		EPA-8260B			1
4-Bromofluorobenzene (Surrogate)	99.1	%	80 - 120 (LCL - UCL)		EPA-8260B			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-8260B	09/24/15	09/24/15 12:04	MGC	MS-V5	1	BYI2315

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.
All results listed in this report are for the exclusive use of the submitting party. BC Laboratories, Inc. assumes no responsibility for report alteration, separation, detachment or third party interpretation.

APPENDIX B: EMISSION CALCULATIONS

SPA Cooling Tower VOC Emissions

	Inlet Flow (GPM)	Water lb/gal	PPB (wt)	lb/hr	lb/day	tons/yr
VOC	900	8.34	600	0.27	6.49	1.18

SPA Cooling Tower Toxic Emissions

Operation Schedule = 8760 hours/year

Pollutant ID	Compound		GPM	lb/gal	PPB[2]	PPB x 13	PPM	lb/hr	g/sec	lb/Yr
7664417	NH3		900	8.34			40	18.01	2.27E+00	157,806
75274	Bromodichloromethane		900	8.34	2.00	100		4.50E-02	5.67E-03	394.5
75252	Bromoform		900	8.34	0.13	1.69		7.61E-04	9.59E-05	6.7
79345	Chloroethane		900	8.34	0.77	10.01		4.51E-03	5.68E-04	39.5
67663	Chloroform		900	8.34	12	300		1.35E-01	1.70E-02	1,184
74873	Chloromethane		900	8.34	1.2	15.6		7.03E-03	8.85E-04	61.5
124481	Dibromochloromethane		900	8.34	0.43	5.59		2.52E-03	3.17E-04	22.1
100414	Ethylbenzene		900	8.34	0.13	1.69		7.61E-04	9.59E-05	6.7
75092	Methylene chloride		900	8.34	0.25	3.25		1.46E-03	1.84E-04	12.8
108883	Toluene		900	8.34	3.1	40.3		1.81E-02	2.29E-03	159.0
1330207	Total Xylenes		900	8.34	0.53	6.89		3.10E-03	3.91E-04	27.2
					Total =	485.02				
			Circ Rate			**% Drift**				
Ignored[1]	Iron	Fe,	45000	8.34		0.0006	0.04	5.40E-06	6.81E-07	0.05
7440508	Copper	Cu,	45000	8.34		0.0006	0.01	1.35E-06	1.70E-07	0.01
7440666	Zinc	Zn,	45000	8.34		0.0006	0.03	4.05E-06	5.11E-07	0.04
Ignored[1]	Sodium	Na,	45000	8.34		0.0006	102	1.38E-02	1.74E-03	120.72
Ignored[1]	Potassium	K,	45000	8.34		0.0006	16	2.16E-03	2.72E-04	18.94
Ignored[1]	Chloride	Cl,	45000	8.34		0.0006	132	1.78E-02	2.25E-03	156.23
Ignored[1]	Sulfate	SO4,	45000	8.34		0.0006	52	7.03E-03	8.85E-04	61.54
Ignored[1]	Nitrate	NO3,	45000	8.34		0.0006	4	5.40E-04	6.81E-05	4.73
Ignored[1]	Ortho−Phosphate	PO4,	45000	8.34		0.0006	8.7	1.18E-03	1.48E-04	10.30
1175	Silica	SiO2,	45000	8.34		0.0006	48	6.49E-03	8.17E-04	56.81
7429905	Aluminum	Al,	45000	8.34		0.0006	0.05	6.76E-06	8.51E-07	0.06
Ignored[1]	Boron	B,	45000	8.34		0.0006	0.32	4.32E-05	5.45E-06	0.38
7440393	Barium	Ba,	45000	8.34		0.0006	0.02	2.70E-06	3.40E-07	0.02
7440439	Cadmium	Cd,	45000	8.34		0.0006	0.005	6.76E-07	8.51E-08	0.01
7440484	Cobalt	Co,	45000	8.34		0.0006	0.005	6.76E-07	8.51E-08	0.01
7440473	Chromium	Cr,	45000	8.34		0.0006	0.005	6.76E-07	8.51E-08	0.01
Ignored[1]	Lithium	Li,	45000	8.34		0.0006	0.005	6.76E-07	8.51E-08	0.01
7439965	Manganese	Mn,	45000	8.34		0.0006	0.05	6.76E-06	8.51E-07	0.06
Ignored[1]	Molybdenum	Mo,	45000	8.34		0.0006	4.1	5.54E-04	6.98E-05	4.85
7440020	Nickel	Ni,	45000	8.34		0.0006	0.005	6.76E-07	8.51E-08	0.01
7439921	Lead	Pb,	45000	8.34		0.0006	0.005	6.76E-07	8.51E-08	0.01
Ignored[1]	Strontium	Sr,	45000	8.34		0.0006	0.24	3.24E-05	4.09E-06	0.28
7440622	Vanadium	V,	45000	8.34		0.0006	0.025	3.38E-06	4.26E-07	0.03
7440382	Arsenic	As,	45000	8.34		0.0006	0.05	6.76E-06	8.51E-07	0.06
7550450	Titanium	Ti,	45000	8.34		0.0006	0.025	3.38E-06	4.26E-07	0.03
7440224	Silver	Ag,	45000	8.34		0.0006	0.05	6.76E-06	8.51E-07	0.06
1101	Fluoride	F,	45000	8.34		0.0006	0.82	1.11E-04	1.40E-05	0.97

Notes:

1. These chemicals were not included in HARP analysis because they are not listed in the pollutant list in HARP.
2. Toxics PPB values represent the higher of the 9/24/15 VOC water test used in the orginal Recycled Water application and a more recent 7/27/20 VOC water test, except for Bromodichloromethane set at a maximum of 100 ppb and Chloroform set at a maximum of 300 ppb per 2/8/21 conference call with Regional San.

APPENDIX C: CARBON ADSORBER CALCULATION SPREADSHEET

Cost Estimate

Capital Costs

Estimated capital costs for a Carbon Canister Adsorber with Carbon Replacement with the following characteristics:

VOC Controlled/Recovered = Chloroform
Adsorber Vessel Orientation = Not Applicable
Operating Schedule = Continuous Operation

Total Capital Investment (TCI) (in 2019 dollars)

Parameter	Equation	Cost	
Total Cost for All Carbon Adsorber Canisters (EC_{Adsorb}) =	Canister Cost x Number of Canisters Required =	$27,800	
Auxiliary Equipment (EC_{aux}) =	(Based on design costs or estimated using methods provided in Section 2)	$2,000	
Total Purchased Equipment Costs for Carbon Adsorber (A) =	= EC_{Adsorb} + EC_{aux} =	$29,800	
Instrumentation =	0.10 × A =	$2,980	
Sales taxes =	0.03 × A =	$894	
Freight =	0.05 × A =	$1,490	
	Total Purchased Equipment Costs (B) =	$35,164	

Installation Costs (in 2019 dollars)

Parameter	Equation	Cost	
Direct and Indirect Installation =	0.20 × B =	$2,813	
Site Preparation (SP) =		$0	
Buildings (Bldg) =		$0	
	Total Direct and Indirect Installation Costs =	$2,813	
Contingency Cost (C) =	CF(Purchase Equipment Cost + Installation costs)=	$3,798	
Total Capital Investment (TCI) =	**Purchace Equipment Costs + Installation Costs + Contingency Costs =**	**$41,775**	**in 2019 dollars**

Annual Costs

Direct Annual Costs

Parameter	Equation	Cost
Operating Labor Costs:	Operator = 0.5 hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$15,045
	Supervisor = 15% of Operator	$2,257
Maintenance Costs:	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$16,551
	Materials = 100% of maintenance labor	$16,551
Carbon Replacement Costs:	Labor = CFR_{carbon} [Labor Rate × T_C/CRR] =	$234
	Carbon = CRF_{carbon}[CC x T_c x 1.08] =	$14,637
Direct Annual Costs (DAC) =		**$65,275**	**in 2019 dollars**

Indirect Annual Costs

Parameter	Equation	Cost
Overhead	= 60% of sum of operator, supervisor, maintenance labor Plus maintenance materials	$30,242
Administrative Charges	= 2% of TCI	$835
Property Taxes	= 1% of TCI	$418
Insurance	= 1% of TCI	$418
Capital Recovery	= $CRF_{Adsorber}$ × [TCI - [(1.08 *CC *Tc) + (LR*Tc/CRR)] =	$1,357
Indirect Annual Costs (IAC) =		**$33,270**	**in 2019 dollars**
Total Annual Cost (TAC) =	**DAC + IAC =**	**$98,545**	**in 2019 dollars**

Cost Effectiveness

Cost Effectiveness

Parameter	Equation	Cost	
Total Annual Cost =	TAC =	$98,545	per year in 2019 dollars
Annual Quantity of VOC Removed =	$W_{voc} = m_{voc} \times \Theta_s \times E$ =	1.16	tons/year
Cost Effectiveness =	Total Annual Cost (TAC) / Annual Quantity of VOC Removed/Recovered =	$84,768	per ton of pollutants removed in 2019 dollars

Data Inputs

Select the type of carbon adsorber system: Carbon Canister Adsorber with Carbon Replacement

For fixed-bed carbon adsorbers, provide the following information:

Select the type of operation: Continuous Operation

Select the type of material used to fabricate the carbon adsorber vessels: Not Applicable

Select the orientation for the adsorber vessels: Not Applicable

Enter the design data for the proposed Carbon Canister Adsorber with Carbon Replacement

Number of operating hours per year (Θ_s)	8,760	hours/year	
Waste Gas Flow Rate (Q)	120	acfm (at atmospheric pressure and 77°F)	Assumed 900 gallons of water per minute
VOC Emission Rate (m_{voc})	0.271	lbs/hour	Assumed 6.5 lbs/day
Required VOC removal efficiency (E)	98	percent*	* 98 percent is a default control efficiency. User should enter actual value, if known.
Estimated equipment life of adsorber vessels and auxiliary Equipment (n)	15	Years*	* 15 years is a default equipment life. User should enter actual value, if known.
Estimated Carbon life (n)	2	Years	
Estimated Carbon Replacement Rate (CRR)	379	lbs/hour*	* 379 lbs./hour is a default value. User should enter actual value, if known.
Carbon Canister Size	3000	lbs carbon per canister*	* 3000 lbs of carbon per canister is a default value. User should enter prefered canister size, if known.

Enter the Characteristics of the VOC/HAP:

Name of VOC/HAP	Chloroform		
Partial Pressure of Chloroform in waste gas stream	0.0104	psia	Left these as default from Toluene, even those this is not consistent with liquid phase adsorption
Parameter "k" for Chloroform	0.551	**Note:**	
Parameter "m" for Chloroform	0.110	Typical values of "k" and "m" for some common VOCs are shown in Table A.	

Enter the cost data for the carbon adsorber:

Desired dollar-year	2019			
CEPCI* for 2019	567.5	CEPCI value for 2019	567.5	2018
Annual Interest Rate (i)	5	percent*	* 5 percent is a default value. User should enter current prime bank rate.	

* CEPCI is the Chemical Engineering Plant Cost Index. The use of CEPCI in this spreadsheet is not an endorsement of the index for purpose of cost escalation or de-escalation, but is there merely to allow for availability of a well-known cost index to spreadsheet users. Use of other well-known cost indexes (e.g., M&S) is acceptable.

Carbon Canister Cost	$13,900	per canister (in 2019 dollars)	Note: Typical costs for carbon canisters are shown in Table B.
Operator Labor Rate	$27.48	per hour*	* $27.48/hour is a default value. User should enter actual value, if known.
Maintenance Labor Rate	$30.23	per hour*	* $30.23/hour is a default value. User should enter actual value, if known. If the rate is not known, use 1.10 x operator labor rate.
Carbon Cost (CC)	$4.20	per lb	* $4.20/lb is a default value based on 2018 market price. User should enter actual value, if known.

If known, enter any additional costs for site preparation and building construction/modification:

Site Preparation (SP) =	$0	* Default value. User should enter actual value, if known.
Buildings (Bldg) =	$0	* Default value. User should enter actual value, if known.
Equipment Costs for auxiliary equipment (e.g., ductwork, dampers, and stack) (EC_{aux}) =	$2,000	* Default value. User should enter actual value, if known.
Contingency Factor (CF)	10.0	percent* * 10 percent is a default value. The contingency factor should be between 5 and 15 percent.

Data Sources for Default Values Used in Calculations:

Data Element	Default Value	Sources for Default Value	If you used your own site-specific values, please reference the source from which the site-specific value was derived.	Recommended data sources for site-specific information
Carbon Cost ($/lb)	$1.90	January 2018 market price for virgin carbon.		Check with activated carbon vendors for current prices.
Operator Labor Rate ($/hour)	$27.48	Bureau of Labor Statistics, May 2017 National Occupational Employment and Wage Estimates – United States, May 2017 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for operators based on data for plant and System Operators – other (51-8099).		Use payroll data, if available, or check current edition of the Bureau of Labor Statistics, National Occupational Employment and Wage Estimates – United States (https://www.bls.gov/oes/current/oes_nat.htm).
Maintenance Labor Rate ($/hour)	$30.23	Estimated as 110 percent of operator labor rate.		Use payroll data, if available, or check current edition of the Bureau of Labor Statistics, National Occupational Employment and Wage Estimates – United States (https://www.bls.gov/oes/current/oes_nat.htm).

Design Parameters

The following design parameters for the carbon adsorber were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Type of Carbon Adsorber:	**Carbon Canister Adsorber with Carbon Replacement**
Name of VOC Controlled:	**Chloroform**

Parameter	Equation	Calculated Value	Units
Quantity of Chloroform Removed:			
Quantity of Chloroform Removed (Wvoc) =	$W_{voc} = m_{voc} \times \Theta_s \times E =$	1.163	tons/year
Estimated Carbon Consumption (M_c) for a continuously operated system =	$(m_{voc}/w_c) \times \Theta_A (1 + N_D/N_A) =$	29	lbs.
Number of times canister(s) replaced per year =	$\Theta_s / \Theta_A =$	2	
Adsorber Parameters for Carbon Canisters:			
Time for Adsorption (Θ_A) =	*Number of operating hours before carbon canister replacement* =	4,380	hours
Equilibrium Capacity at the Inlet ($W_{e(max)}$) =	$k \times P^m =$	0.333	lb. VOC/lb. Carbon
Working Capacity (w_c) =	$0.5 \times w_{e(max)} =$	0.167	lb. VOC/lb. Carbon
Estimated Total Carbon Required (M_c) =	$(m_{voc}/w_c) \times \Theta_A =$	3,558	lbs.
Number of Carbon Canisters Required =	M_c/Carbon Canister Capacity	2	canisters
Total Quantity of Carbon Required for 2 Canisters =	Number of Carbon Canisters * Carbon Capacity per Canister =	6,000	lbs.
Capital Recovery Factor:			
Capital Recovery Factor for adsorber vessels and auxiliary equipment (CFRabsorber)=	$[i \times (1 + i)^n] / [(1 + i)^n - 1] =$ Where n = Equipment Life and i = Interest Rate	0.0963	
Capital Recovery Factor for carbon (CRF_{Carbon}) =	$[i \times (1 + i)^n] / [(1 + i)^n - 1] =$ Where n = Carbon Life and i = Interest Rate	0.5378	

Table A: Typical Parameters for Selected Adsorption Isotherms[a]

Compound	Adsorption Temperature (°F)	Isotherm Parameters		Range of Isotherm[b] (psia)
		k	m	
Acetone	100	0.412	0.389	0.0001 - 0.05
Acrylonitrile	100	0.935	0.424	0.0001 - 0.015
Benzene	77	0.597	0.176	0.0001 - 0.05
Chlorobenzene	77	1.05	0.188	0.0001 - 0.01
Cyclohexane	100	0.505	0.210	0.0001 - 0.05
Dichloroethane	77	0.976	0.281	0.0001 - 0.04
m - Xylene	77	0.708	0.113	0.0001 - 0.001
Phenol	104	0.855	0.153	0.0001 - 0.03
Toluene	77	0.551	0.110	0.001 - 0.05
Trichloroethane	77	1.06	0.161	0.0001 - 0.04
Vinyl Chloride	100	0.2	0.477	0.0001 - 0.05

[a] Each isotherm is of the form w = kPm, where w is the equilibrium adsorptivity (lb adsorbated/lb adsorbant), P is the partial pressure of VOC in the gas stream (psia), and k and m are empirical parameters based on Calgon BPL carbon.

[b] Adsorptivity equation should not be extrapolated outside these ranges.

Table B: Typical Equipment Costs for Carbon Adsorber Canisters[a]

Canister Size (in pounds of activated carbon)	Maximum Flow Rate (cfm)	Canister Type	Cost with Virgin Carbon (in 2019 dollars)	Cost with Reactivated Carbon (in 2019 dollars)
140	500	Polyethylene	$720	-
140	500	Epoxy-Lined Steel	$1,105	-
170	300	Epoxy-Lined Steel	$1,090	-
180	100	Epoxy-Lined Steel	$1,600	$980
200	100	Epoxy-Lined Steel	$785	-
1,000	600	Epoxy-Lined Steel	$6,600	-
1,000	1,000	Epoxy-Lined Steel	$11,500	$7,000
2,000	2,000	Epoxy-Lined Steel	$19,000	$10,000
2,000	750	Carbon Steel	$22,000	$13,200
3,000	2,000	Epoxy-Lined Steel	$13,900	-
4,100	8,000	Polypropylene	$45,000	-
5,000	2,500	Carbon Steel	$42,600	$20,100
8,000	4,500	Carbon Steel	$66,000	$30,000
10,000	18,000	Polypropylene	$94,500	-

(a) Equipment costs based on 2018 data provided by Calgon Carbon Corporation and Carbtrol Corporation.

APPENDIX D: SMAQMD FORMS

777 12th Street, 3rd Floor
Sacramento, CA 95814-1908

Sacramento Metropolitan
Air Quality Management District

(916) 874-4800
Fax (916) 874-4899

FORM G100
APPLICATION FOR AUTHORITY TO CONSTRUCT AND/OR PERMIT TO OPERATE

A SEPARATE APPLICATION AND FORM(S) SPECIFIC TO THE PROCESS
OR EQUIPMENT MUST BE COMPLETED FOR **EACH** PROCESS OR PIECE OF EQUIPMENT

A. Both pages of this application must be completed; an original signature (not a facsimile or copy) is required.
B. The appropriate permit fee must be submitted with the application (refer to SMAQMD Rule 301 or 310 for fee schedule).

1. Name of business or organization that is to receive the permit: _____

Business type: ☐ Sole Proprietorship ☐ Limited Liability Company ☐ Partnership ☐ Corporation ☐ Wholly-owned Subsidiary ☐ Government ☑ Other

2. Employer Identification Number (E.I.N.): 38-3683152

3. Number of Employees: 17 4. NAICS Classification No.: 221112

5. Does this business (including its affiliates) have annual receipts in excess of $750,000? ☑ Yes ☐ No

6. Mailing address: PO Box 15380, Mail Stop EA405 (NUMBER STREET) Sacramento (CITY) CA (STATE) 95852-0830 (ZIP CODE) 916-732-5303 (PHONE NO.)

7. Location Address (where the equipment will be operated, if different than above)

3215 47th Avenue (NUMBER STREET) Sacramento (CITY) CA (STATE) 95824 (ZIP CODE) 916-391-2993 (PHONE NO.)

8. Name of Facility that will Operate the Equipment (if different than above):

DBA: _____

9. Description of equipment/process to be permitted: Increase in cooling tower recycled water VOC content to 600 ppbw (from 42 ppbw).

☐ Constructing/installing new equipment
Estimated startup date for new equipment: _____

☐ Initial permit for existing equipment
Date Operation First Commenced: _____

☑ Modification of existing permitted equipment or permit conditions
Estimated completion date for modification: Upon Approval Previous Permit No.: 24808

☐ Change of Ownership
Change of ownership date: _____ Previous Permit No.: _____

10. Is this permit application being submitted in response to a Notice of Violation (NOV) or Notice to Comply (NTC) issued by the SMAQMD? ☐ Yes ☑ No If Yes, NOV or NTC #: _____

DO NOT WRITE BELOW (SMAQMD USE ONLY)

DATE STAMP	PERMIT NUMBER	A/C FEE	A/C RECEIPT
	PREVIOUS P/O	P/O FEE	P/O RECEIPT

777 12th Street, 3rd Floor
Sacramento, CA 95814-1908

Sacramento Metropolitan
Air Quality Management District

(916) 874-4800
Fax (916) 874-4899

APPLICATION FOR AUTHORITY TO CONSTRUCT AND/OR PERMIT TO OPERATE

A SEPARATE APPLICATION AND FORM(S) SPECIFIC TO THE PROCESS
OR EQUIPMENT MUST BE COMPLETED FOR **EACH** PROCESS OR PIECE OF EQUIPMENT

A. Both pages of this application must be completed; an original signature (not a facsimile or copy) is required.
B. The appropriate permit fee must be submitted with the application (refer to the SMAQMD Rules or fee schedule).

11. All information submitted to obtain an Authority to Construct/Permit to Operate is considered public information as defined by section 6254.7 of the California Government Code unless specifically marked as trade secret by the applicant. Each document containing trade secrets must be separated from all non-privileged documents. Each document which is claimed to contain trade secrets must indicate each section or paragraph that contains trade secret information and must have attached a declaration stating with specificity the reason this document contains trade secret information. All emission data is subject to disclosure regardless of any claim of trade secret.

Are trade secret documents are included with this application? ☐ Yes ☑ No

12. Pursuant to Section 42301.6(f) of the Health and Safety Code, I hereby certify that emission sources in this permit application:

(*Check appropriate box)* ☐ **ARE** OR ☑ **ARE NOT** within 1,000 feet of the outer boundary of a school

Pursuant to section 42301.9(a) of the Health and Safety Code, "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.

13. Required information, analyses, plans and/or specifications needed to complete this application are being collected under authority granted by California Health & Safety Code (CH&SC) section 42303. In addition, CH&SC section 42303.5 states that *No person shall knowingly make any false statements in any application for a permit, or in any information, plans, or specifications submitted in conjunction with the application or at the request of the Air Pollution Control Officer.* Violations of the CH&SC may result in criminal or civil penalties, as specified in CH&SC sections 42400 through 42402.3. By signing below, I certify that all information is true and accurate and complete, to the best of my knowledge and ability.

Please be advised that constructing, installing, or operating air pollutant emitting equipment prior to receiving an Authority to Construct from the Air District is a violation of air pollution regulations and is subject to civil or criminal penalties prescribed in the California Health and Safety Code.

Signature of responsible officer, partner or proprietor of firm _____

Printed Name: Frankie McDermott Title: Chief Energy Delivery Officer Date: 3/1/21

Phone number: 916-732-5303 Fax number: N/A E-mail address: Frankie.McDermott@smud.org

14. Contact person for information submitted with this application (if different from above):

Name: René Toledo Title: Environmental Compliance Supervisor

Phone number: 530-220-9595 Fax number: N/A E-mail address: Rene.Toledo@smud.org

15. Receipt of future rules and planning notices affecting your permit and facility; check one box:

☐ Please send e-mail notices to _____

☐ I will sign up myself at www.airquality.org/listserve/ to receive e-mailed notices.

☐ I want the District to mail notices to the address on this application.

☑ I am already subscribed.

777 12th Street, 3rd Floor
Sacramento, CA 95814-1908

Sacramento Metropolitan
Air Quality Management District

(916) 874-4800
Fax: (916) 874-4899

APPLICATION TO MODIFY TITLE V PERMIT

I. FACILITY IDENTIFICATION

1. Facility Name: Sacramento Power Authority

2. Parent Company: _____
(if different from Facility name)

3. Mailing Address: PO Box 15830 , Sacramento, CA 95852-0830

4. Facility Location: 3215 47th Street; Sacramento, 95824

5. Type of Organization:

[ ] Corporation [ ] Sole Ownership [ ] Government [ ] Partnership [✓] Utility Company

6. Responsible Official: Frankie McDermott Phone No.: 916-732-5303

Title: Chief Energy Delivery Officer

7. Plant Site Contact: Jeremy Johnson Phone No.: 916-391-2993 ext. 4

Title: Plant Manager

II. TYPE OF PERMIT ACTION

	Current Permit Number	Permit Expiration Date
☑ Significant Permit Modification	TV2007-14-02B	03/01/2014
☐ Minor Permit Modification		
☐ Administrative Amendment		

777 12th Street, 3rd Floor
Sacramento, CA 95814-1908

Sacramento Metropolitan
Air Quality Management District

(916) 874-4800
Fax: (916) 874-4899

APPLICATION TO MODIFY TITLE V PERMIT

III. DESCRIPTION OF PERMIT ACTION

1. Does the permit action involve?: [ ] Temporary Source [ ] Voluntary Emissions Caps
   [✓] Acid Rain Source [ ] Alternative Operating Scenarios
   [ ] MACT Requirements

2. Provide a general description of the proposed permit modification. Reference any Authority to Construct that is requested to be incorporated. Attach any additional information that is relevant to the request.

This application requests the modification of the facility's Title V permit to incorporate the proposed increase in volatile organic compound (VOC) emissions from the cooling towers. The VOC increase is the result of an expected increase in VOC concentrations from the Regional Sans' provided recylced water once their ECHO Water Project comes fully online.

Under penalty of perjury, I certify that based on information and belief formed after reasonable inquiry, the answers, statements and information contained in this application (and supplemental attachments thereto) are true, accurate and complete. This application consists of the application forms provided by the SMAQMD, information required pursuant to the List and Criteria and any supplemental information and/or attachments submitted with the application. I also certify that I am the responsible official as defined in SMAQMD Rule 207.

Signature of Responsible Official

3/1/21
Date

Frankie McDermott, Chief Energy Delivery Officer
Print Name of Responsible Official

APPENDIX E: HARP HRA MODELING DATA

1.1.1 Spatial Averaging

Spatial averaging was not used to determine risk values for receptors. Instead, the most conservative, representative value for each receptor was chosen. This methodology results in higher risk values than spatial averaging and is therefore a more conservative approach.

1.1.2 Meteorological and Elevation Data

Five years of pre-processed meteorological data supplied by ARB for 2014 through 2018 were used for this model. The surface station and upper air data are from the Sacramento Executive Airport (WBAN 23232). Terrain data were obtained from the Multi-Resolution Land Characteristics Consortium (MRLC) in the form of National Elevation Dataset (NED) files at 1/3 arc second resolution.

1.1.3 Model Options

Air dispersion modeling is performed with US-EPA AERMOD through the EPA-approved BREEZE user interface. All modeling exercises were conducted using the latest version of EPA AERMOD (v19191). Modeling was performed utilizing all regulatory defaults as defined by EPA. Selected outputs were for the 1st high 1-hr and 1st high annual average period values.

The emission sources considered in this analysis were evaluated in terms of their proximity to nearby structures. The purpose of this evaluation was to determine if stack discharge might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the building was absent. Plumes entrained in the zones of turbulence experience enhanced plume growth and restricted plume rise. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) algorithms using dimensions from the U.S. EPA's Building Profile Input Program (BPIP) for estimating for plumes affected by building wakes. The site layout was used to digitize buildings and structures to be included in the downwash analysis.

Direction-specific building dimensions and the dominant downwash structure parameters were determined using the *BREEZE®* BPIPP software, developed by Trinity Consultants, Inc. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 04274.[1]

1.1.4 Receptor Placement

The following receptor placements were used for this HRA.

- Fence-line – Fence-line receptors were defined at 20-meter spacing along the property border. The fence-line boundary receptors are identified as Receptors 1267-1307.
- Nearby Residences and Workers (Discrete Grid) - The modeling discrete receptor grid uses a 5 tiered-density grid with 50 m spacing out to 500 m from the facility center point, 100 m spacing to 1,000 m from the facility center point, 250 m spacing to 2,500 m from the facility center point, 500 m spacing to 5,000 from the facility center point, and 1,000 m spacing to 10,000 m from the facility center point. This multi-density grid approach allows for precise identification of maximum impacts near the facility

[1] U S. Environmental Protection Agency, User's Guide to the Building Profile Input Program, Research Triangle Park, NC, EPA-454/R-93-038.

boundary (where impacts are greatest) while reducing the computational load for excess receptors far away from the facility (where impacts are lowest).

- Census Block Receptors – In accordance with SMAQMD Guidance, no cancer burden calculation is needed in this HRA because no receptors have a cancer risk of 10 in 1 million or greater. Therefore, no census block receptors were included.
- Onsite Receptors – No onsite receptors were identified.

1.1.5 Receptors Evaluated for Multipathway Analysis

A summary of receptor pathways is shown in Table A-1.

Table A-1. Multipathway Analysis Receptor Summary

Pathway	Residential Receptors	Worker Receptors	Sensitive Receptors
Soil	X	X	X
Dermal	X	X	X
Mother's Milk	X		X
Drinking Water			
Fish			
Homegrown Produce	X		X
Beef			
Dairy Cows			
Pigs			
Chicken	X		X
Eggs	X		X

1.1.6 Multipathway and Exposure Parameters

In accordance with SMAQMD Guidance, default HARP2 values were used for the pathways identified in Section 1.1.6 of this report. Specific justifications for certain default selections are outlined below:

Home Grown Produce

"Households that farm" fractions were used because they are more conservative than "Households that garden".

Chickens/Eggs

- "Households that raise/hunt" fractions were used because there are no obvious animal farms in the area surrounding the facility.
- The fraction of drinking water from contaminated sources is zero for both chickens and eggs because there are no obvious surface water sources in the area surrounding the facility for the animals to consume, therefore the chickens are likely to drink from municipal water sources.

1.1.7 Health Values and HARP Version Used in Risk Analysis

For this HRA, Trinity used the last version of HARP – Air Dispersion and Risk Tool (v19121). This version of HARP utilized a health.mdb file updated on September 9, 2019.

1.1.8 Summary of Results

Table A-2 below presents a summary of the results including the following:

- Summary of Maximum Cancer Health Risk Impacts (Worker and Resident)
- Summary of the Maximally Exposed Individual Resident and Worker (MEIR and MEIW)
- Summary of Maximum Chronic Non-cancer Health Risk Impacts (Resident)
- Summary of Maximum Acute Non-cancer Health Risk Impacts (Resident)
- Summary of Maximum 8-hour Chronic Non-cancer Health Risk Impacts (Worker)

Table A-2. HRA Results Summary

HRA results for (HARP2)	**5-Year Combined Run**	
Receptor Description	**Receptor No.**	**Risk Value**
Cancer Risk - PMI	228	2.24E-07
Chronic HHI - PMI	228	8.86E-03
Cancer Risk – Resident (MEIR)	481	1.10E-07
Cancer Risk – Worker (MEIW)	246	1.39E-08
Acute - PMI	101	2.50E-01
8 Hour Chronic - PMI	228	3.29E-05

The following HARP input and output files are included electronically.

- Input file with risk scenario and site specific information (*HRAInput.hra)
- Supplemental input file with GLCs (*GLCList.csv)
- AERMOD Plotfiles (*.plt and *txt)
- Output log file (*output.txt)
- Output file with cancer risk details (*CancerRisk.csv)
- Output file with chronic non-cancer risk details (*NCCHronicRisk.csv)
- Output file with acute non-cancer risk details (*NCAcuteRisk.csv)
- Output file with 8-hour chronic non-cancer risk details (*NCAcuteRisk.csv) (worker only)

SPA Cooling Tower Stack Parameters

	Velocity		Height		Diameter		Exhaust Temp	
	ft/sec	m/sec	feet	meters	feet	meters	F	K
Per Cell (3 cells)	27.9	8.50	43.5	13.3	40	12.2	85	302.6

		Source
Overall Dimensions		
Length (ft) =	162	1996 Manual, Pg. 40
Width (ft) =	48	
Fan Shroud Dimensions		1996 Manual, Pg. 44
Diameter (ft) =	40	
Height (ft) =	10	

*HARP - HRACalc v19044 2/11/2021 11:16:20 AM - Cancer Risk - Input File: C:\Users\skeane\Desktop\v0.4\ETHOS HRA V0.4\hra\Resident_HRAInput.hra

REC	GRP	NETID	X	Y	RISK_SUM	SCENARIO	INH_RISK	SOIL_RISK	DERMAL_R	MMILK_RI	WATER_RI	FISH_RISK	CROP_RISK	BEEF_RISK	DAIRY_RISI	PIG_RISK	CHICKEN_F	EGG_RISK
228	ALL		633219.6	4263923	2.24E-07	30YrCance	1.91E-07	1.96E-08	7.98E-10	2.01E-13	0.00E+00	0.00E+00	1.26E-08	0.00E+00	0.00E+00	0.00E+00	1.16E-13	2.80E-13
481	ALL		633519.6	4264123	1.10E-07	30YrCance	9.38E-08	9.62E-09	3.92E-10	9.87E-14	0.00E+00	0.00E+00	6.19E-09	0.00E+00	0.00E+00	0.00E+00	5.69E-14	1.38E-13

*HARP - HRACalc v19044 2/11/2021 11:16:20 AM - Chronic Risk - Input File: C:\Users\skeane\Desktop\v0.4\ETHOS HRA V0.4\hra\Resident_HRAInput.hra

REC	GRP	NETID	X	Y	SCENARIO	CV	CNS	IMMUN	KIDNEY	GILV	REPRO/DE\	RESP	SKIN	EYE	BONE/TEET	ENDO	BLOOD	ODOR	GENERAL	MAXHI
228	ALL		633219.6	4263923	NonCancer	2.65E-03	2.66E-03	0.00E+00	3.47E-05	3.03E-05	2.69E-03	8.86E-03	2.65E-03	2.98E-07	3.26E-06	2.56E-08	3.24E-06	0.00E+00	0.00E+00	8.86E-03

*HARP - HRACalc v19044 2/11/2021 11:14:49 AM - Cancer Risk - Input File: C:\Users\skeane\Desktop\v0.4\ETHOS HRA V0.4\hra\Worker_HRAInput.hra

REC	GRP	NETID	X	Y	RISK_SUM	SCENARIO	INH_RISK	SOIL_RISK	DERMAL_R	MMILK_RI	WATER_RI	FISH_RISK	CROP_RISK	BEEF_RISK	DAIRY_RISI	PIG_RISK	CHICKEN_F	EGG_RISK
246	ALL		633269.6	4263923	1.39E-08	25YrCance	1.28E-08	7.91E-10	3.16E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*HARP - HRACalc v19044 2/11/2021 11:16:20 AM - Acute Risk - Input File: C:\Users\skeane\Desktop\v0.4\ETHOS HRA V0.4\hra\Resident_HRAInput.hra

REC	GRP	NETID	X	Y	SCENARIO	CV	CNS	IMMUN	KIDNEY	GILV	REPRO/DE\	RESP	SKIN	EYE	BONE/TEE\	ENDO	BLOOD	ODOR	GENERAL	MAXHI
101	ALL		632869.6	4263823	NonCancer	1.30E-03	3.58E-02	1.29E-04	0.00E+00	0.00E+00	3.58E-02	2.50E-01	0.00E+00	2.15E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-01

*HARP - HRACalc v19044 2/11/2021 11:19:06 AM - Chronic 8Hr Risk - Input File: C:\Users\skeane\Desktop\v0.4\ETHOS HRA V0.4\hra\Worker8hr_HRAInput.hra

REC	GRP	NETID	X	Y	SCENARIO	CV	CNS	IMMUN	KIDNEY	GILV	REPRO/DEVEL	RESP	SKIN	EYE	BONE/TEETH	ENDO	BLOOD	ODOR	GENERAL	MAXHI
228	ALL		633219.6	4263923.1	NonCancer8HrChronic	3.02E-05	3.29E-05	7.56E-07	0.00E+00	0.00E+00	3.02E-05	3.10E-05	3.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-05