# SAN ONOFRE NUCLEAR GENERATING STATION

## Annual Radioactive Effluent Release Report

## 2019

## January - December

# PREFACE

San Onofre Nuclear Generating Station is located next to San Onofre State Beach, adjoining Camp Pendleton Marine Corps Base, in San Diego County, 64 miles south of Los Angeles, California. There were three operating pressurized water reactors.

Southern California Edison notified the Nuclear Regulatory Commission (NRC) on June 12, 2013, that it had permanently ceased operation of Units 2 and 3 on June 7, 2013. The notification, called a Certification of Permanent Cessation of Power Operations, sets the stage for SCE to begin preparations for decommissioning.

Unit 1 was supplied by Westinghouse Electric Company and began commercial operation on January 1, 1968. The unit was permanently shutdown on November 30, 1992. By August 31, 2004, all fuel was transferred to the Independent Spent Fuel Storage Installation (ISFSI). By November 29, 2006, remaining monitored effluent pathways were permanently removed from service. Currently, Unit 1 effluent pathway is routed to Unit 2 . Unit 1 is owned by Southern California Edison (80%) and San Diego Gas and Electric (20%).

Unit 2 and Unit 3 were supplied by Combustion Engineering, Inc., with turbine generators supplied by G.E.C. Turbine Generators, Ltd., of England. The units began commercial operation on August 29, 1983, and April 1, 1984, respectively. The twin units are owned by Southern California (78.21%), San Diego Gas and Electric (20%), and the City of Riverside (1.79%).

Effective December 29, 2006, the City of Anaheim had transferred its ownership interests in San Onofre Units 2 and 3 and the entitlement to the Units 2 and 3 output, to Southern California Edison Company, except that it retains its ownership interests in its spent nuclear fuel and Units 2 and 3's independent spent fuel storage installation located on the facility's site. In addition, the City of Anaheim retains financial responsibility for its spent fuel and for a portion of the Units 2 and 3 decommissioning costs. The City of Anaheim remains a licensee for purposes of its retained interests and liabilities.

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## SECTION A. INTRODUCTION

This Annual Radioactive Effluent Release Report summarizes the gaseous and liquid radioactive effluent releases and radwaste shipments made from the San Onofre Nuclear Generating Station, Units 1, 2 and 3. This report is prepared in the general format of USNRC Regulatory Guide 1.21, Revision 1, and includes:

1. Quarterly Summaries of Gaseous for Continuous Mode of Release
2. Quarterly Summaries of Liquid Effluents for Continuous and Batch Modes of Release
3. Percent of Applicable Limits
4. Estimated Total Percent Error
5. Lower Limit of Detection Concentrations
6. Batch Summary Releases
7. Previous Radioactive Effluent Release Report Addendum
8. Radwaste Shipments
9. 10 CFR 50 Appendix I Requirements
10. Changes to Offsite Dose Calculation Manual

These are acronyms used throughout the Annual Radioactive Effluent Release Report.

| | |
|---|---|
| AL | Applicable Limit |
| ALARA | As Low As Reasonably Achievable |
| AR | Action Request |
| ARERR | Annual Radioactive Effluent Release Report |
| Ci | Curies |
| CR | Condition Report |
| DAS | Data Acquisition System |
| DEC | Decommissioning |
| ECL | Effluent Concentration Limit |
| GI-LLI | Gastrointestinal Tract-Lower Large Intestine |
| GPI | Groundwater Protection Initiative |
| ISFSI | Independent Spent Fuel Storage Installation |
| LLD | Lower Limit of Detection |
| $m^3$ | Meter cubed |
| MPC | Maximum Permissible Concentrations |
| mRAD | One thousandth Radiation Absorbed Dose |
| mREM | One thousandth of a Roentgen Equivalent Man |
| N/A | Not Applicable |
| GW-NIA | North Industrial Area formally know as Unit 1 |
| NN | Nuclear Notification used in site's corrective action program |
| ODCM | Offsite Dose Calculation Manual |
| PCS | Plant Computer System |
| TLD | Thermoluminescent Dosimeter |
| uCi/sec | Micro Curies per second |
| X/Q | Chi over q |
| SYF | South Yard Facility |

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## SECTION B. GASEOUS EFFLUENTS

Table 1A, "Gaseous Effluents Summation of All Releases," provides a detailed listing of gaseous effluents released quarterly in four categories: fission and activation gases, iodine 131, particulates with half-lives greater than eight days, and tritium. Listed for each of the four categories are:

(1) the total curies released
(2) the average release rate
(3) the percent of applicable limit
(4) the estimated total error

In addition, the particulate category lists the gross alpha radioactivity released for each quarter.

The methodology used to calculate the percent of Applicable Limit is presented in Section F of this report. The methodology used in Table 1A to calculate the estimated total error is presented in Section G of this report.

Table 1B, "Gaseous Effluents Elevated Release," has not been included in this report since San Onofre Nuclear Generating Station Units 2 and 3 do not conduct elevated releases.

Table 1C, "Gaseous Effluents Ground Level Releases," provides the systematic listing by radionuclide for the quantity of radioactivity released in three categories: fission gases, iodines, and particulates. The total radioactivity for each radionuclide is listed for each quarterly period for continuous mode of release. Containment purges and plant stack releases are considered to be continuous releases.

Table 1D, "Gaseous Effluents Lower Limit of Detection," provides a listing of lower limit of detection concentrations for radionuclides not detected in Tables 1A and 1C.

Table 1E, "Gaseous Effluents Radiation Doses at the Site Boundary," provides a quarterly summary of doses at the site boundary for this report period.

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TABLE 1A
GASEOUS EFFLUENTS SUMMATION OF ALL RELEASES

| | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter | Estimated Total Error, % |
|---|---|---|---|---|---|---|
| A. Fission and activation gases | | | | | | |
| 1. Total release | Ci | < LLD | < LLD | < LLD | < LLD | 3.00E+01 |
| 2. Average release rate for period | µCi/sec | N/A | N/A | N/A | N/A | |
| 3. Percent of applicable limit | % MPC | N/A | N/A | N/A | N/A | |
| 4. Percent Effluent Concentration Limit | % ECL | N/A | N/A | N/A | N/A | |
| B. Iodines | | | | | | |
| 1. Total I-131 | Ci | < LLD | < LLD | < LLD | < LLD | 1.90E+01 |
| 2. Average release rate for period | µCi/sec | N/A | N/A | N/A | N/A | |
| 3. Percent of applicable limit | % MPC | N/A | N/A | N/A | N/A | |
| 4. Percent Effluent Concentration Limit | % ECL | N/A | N/A | N/A | N/A | |
| C. Particulates | | | | | | |
| 1. Particulates with half-lives >8 days | Ci | < LLD | < LLD | 3.01E-06 | < LLD | 1.60E+01 |
| 2. Average release rate for period | µCi/sec | N/A | N/A | 3.79E-07 | N/A | |
| 3. Percent of applicable limit | % MPC | N/A | N/A | 3.64E-07 | N/A | |
| 4. Percent Effluent Concentration Limit | % ECL | N/A | N/A | 9.09E-07 | N/A | |
| 5. Gross alpha activity | Ci | < LLD | < LLD | < LLD | < LLD | 5.00E+01 |
| D. Tritium | | | | | | |
| 1. Total release | Ci | 1.30E+00 | 2.35E-01 | 2.14E+00 | 6.61E+00 | 2.50E+01 |
| 2. Average release rate for period | µCi/sec | 1.67E-01 | 2.99E-02 | 2.69E-01 | 8.32E-01 | |
| 3. Percent of applicable limit | % MPC | 4.01E-04 | 7.17E-05 | 6.46E-04 | 2.00E-03 | |
| 4. Percent Effluent Concentration Limit | % ECL | 8.02E-04 | 1.43E-04 | 1.29E-03 | 3.99E-03 | |

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TABLE 1C

GASEOUS EFFLUENTS GROUND LEVEL RELEASES
BATCH MODE

Batch gaseous releases were not performed at SONGS

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TABLE 1C (Continued)

GASEOUS EFFLUENTS GROUND LEVEL RELEASES
CONTINUOUS MODE

| Radionuclides Released | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|---|
| 1. Fission and activation gases | | | | | |
| krypton-85 | Ci | <LLD | <LLD | <LLD | <LLD |
| krypton-85m | Ci | <LLD | <LLD | <LLD | <LLD |
| krypton-87 | Ci | <LLD | <LLD | <LLD | <LLD |
| krypton-88 | Ci | <LLD | <LLD | <LLD | <LLD |
| xenon-133 | Ci | <LLD | <LLD | <LLD | <LLD |
| xenon-133m | Ci | <LLD | <LLD | <LLD | <LLD |
| xenon-135 | Ci | <LLD | <LLD | <LLD | <LLD |
| xenon-135m | Ci | <LLD | <LLD | <LLD | <LLD |
| xenon-138 | Ci | <LLD | <LLD | <LLD | <LLD |
| Total for period | Ci | <LLD | <LLD | <LLD | <LLD |
| 2. Iodines | | | | | |
| iodine-131 | Ci | <LLD | <LLD | <LLD | <LLD |
| iodine-133 | Ci | <LLD | <LLD | <LLD | <LLD |
| iodine-135 | Ci | <LLD | <LLD | <LLD | <LLD |
| Total for period | Ci | <LLD | <LLD | <LLD | <LLD |
| 3. Particulates | | | | | |
| barium-140 | Ci | <LLD | <LLD | <LLD | <LLD |
| cerium-141 | Ci | <LLD | <LLD | <LLD | <LLD |
| cerium-144 | Ci | <LLD | <LLD | <LLD | <LLD |
| cesium-134 | Ci | <LLD | <LLD | <LLD | <LLD |
| cesium-137 | Ci | <LLD | <LLD | 3.01E-06 | <LLD |
| cobalt-58 | Ci | <LLD | <LLD | <LLD | <LLD |
| cobalt-60 | Ci | <LLD | <LLD | <LLD | <LLD |
| iron-59 | Ci | <LLD | <LLD | <LLD | <LLD |
| lanthanum-140 | Ci | <LLD | <LLD | <LLD | <LLD |
| manganese-54 | Ci | <LLD | <LLD | <LLD | <LLD |
| molybdenum-99 | Ci | <LLD | <LLD | <LLD | <LLD |
| strontium-89 | Ci | <LLD | <LLD | <LLD | <LLD |
| strontium-90 | Ci | <LLD | <LLD | <LLD | <LLD |
| zinc-65 | Ci | <LLD | <LLD | <LLD | <LLD |

LLD Lower Limit of Detection; see Table 1D.

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TABLE 1D

GASEOUS EFFLUENTS LOWER LIMIT OF DETECTION

| Radionuclides | Continuous Mode LLD (µCi/cc) | Batch Mode LLD (µCi/cc) |
|---|---|---|
| 1. Fission and activation gases | | |
| krypton-85 | 2.20E-05 | N/A |
| krypton-85m | 5.50E-08 | N/A |
| krypton-87 | 2.70E-07 | N/A |
| krypton-88 | 1.90E-07 | N/A |
| xenon-133 | 1.40E-07 | N/A |
| xenon-133m | 4.40E-07 | N/A |
| xenon-135 | 5.70E-08 | N/A |
| xenon-135m | 2.10E-06 | N/A |
| xenon-138 | 3.70E-06 | N/A |
| 2. Iodines | | |
| iodine-131 | 2.30E-13 | N/A |
| iodine-133 | 2.20E-12 | N/A |
| iodine-135 | 1.50E-10 | N/A |
| 3. Particulates | | |
| barium-140 | 4.80E-13 | N/A |
| cerium-141 | 5.80E-14 | N/A |
| cerium-144 | 2.30E-13 | N/A |
| cesium-134 | 1.30E-13 | N/A |
| cesium-137 | 1.10E-13 | N/A |
| cobalt-58 | 1.20E-13 | N/A |
| cobalt-60 | 1.90E-13 | N/A |
| iron-59 | 3.00E-13 | N/A |
| lanthanum-140 | 9.70E-13 | N/A |
| manganese-54 | 1.20E-13 | N/A |
| molybdenum-99 | 7.00E-14 | N/A |
| strontium-89 | 1.00E-11 | N/A |
| strontium-90 | 1.00E-11 | N/A |
| zinc-65 | 3.20E-13 | N/A |
| 4. Tritium | N/A | N/A |
| 5. Alpha | 1.00E-11 | N/A |

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TABLE 1E

GASEOUS EFFLUENTS RADIATION DOSES AT THE SITE BOUNDARY

| Radionuclides Released | | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|---|---|
| A. | Noble Gas | | | | | |
| 1. | Gamma Air Dose | Mrad | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 2. | Percent of Applicable Limit | % | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 3. | Beta Air Dose | Mrad | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 4. | Percent Applicable Limit | % | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| B. | Tritium, Iodine, Particulates (at the nearest receptor) | | | | | |
| 1. | Organ Dose | Mrem | 3.71E-05 | 6.69E-06 | 6.41E-05 | 1.88E-04 |
| 2. | Percent of Applicable Limit | % | 2.47E-04 | 4.46E-05 | 4.27E-04 | 1.25E-03 |

NOTE: Calculations performed in accordance with the ODCM utilizing the historical X/Q.

TABLE 1F

GASEOUS EFFLUENTS BATCH RELEASE SUMMARY

Batch gaseous releases were not performed at SONGS.

## SECTION C. LIQUID EFFLUENTS

Table 2A, "Liquid Effluents Summation of All Releases," provides a detailed summary of liquid effluents released quarterly in three categories: fission and activation products, tritium, and dissolved and entrained gases. Listed for each of the three categories are:

(1) the total curies released
(2) the average diluted concentration
(3) the percent of applicable limit
(4) the estimated total error

In addition, Table 2A lists:

(1) the gross alpha radioactivity
(2) the volume of waste released (prior to dilution)
(3) the volume of dilution water

The methodology used to calculate the percent of applicable limit is presented in Section F of this report. The methodology used to calculate the estimated total error in Table 2A is presented in Section G of this report.

Table 2B, "Liquid Effluents," provides the systematic listing by radionuclide for the quantity of radioactivity released in each category. The total radioactivity of each radionuclide released is listed for each quarterly period by both "continuous" and "batch" modes of release.

Table 2C, "Liquid Effluents Lower Limit of Detection," provides a listing of lower limit of detection concentrations for radionuclides not detected in Table 2B.

Table 2D, "Liquid Effluents Radiation Doses at the Liquid Site Boundary," presents a quarterly summary of doses at the Liquid Site Boundary for this report period.

Table 2E, "Liquid Effluents Batch Release Summary," provides summary information regarding batch releases conducted during this report period from San Onofre Nuclear Generating Station.

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TABLE 2A
LIQUID EFFLUENTS SUMMATION OF ALL RELEASES

| | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter | Estimated Total Error, % |
|---|---|---|---|---|---|---|
| A. Fission and activation products | | | | | | |
| 1. Total release (not including tritium, gases, alpha) | Ci | 1.12E-05 | 2.39E-05 | <LLD | 1.68E-05 | 1.90E+01 |
| 2. Average diluted concentration during period | µCi/ml | 1.55E-12 | 2.99E-12 | N/A | 2.07E-12 | |
| 3. Percent of applicable limit | % MPC | 7.74E-06 | 1.50E-05 | N/A | 9.10E-6 | |
| 4. Percent Effluent Concentration Limit | % ECL | 1.55E-04 | 2.99E-04 | N/A | 1.57E-4 | |
| B. Tritium | | | | | | |
| 1. Total release | Ci | <LLD | 8.69E-03 | <LLD | 2.47E-03 | 1.90E+01 |
| 2. Average diluted concentration during period | µCi/ml | N/A | 1.09E-09 | N/A | 3.04E-10 | |
| 3. Percent of applicable limit | % MPC | N/A | 3.63E-05 | N/A | 1.01E-05 | |
| 4. Percent Effluent Concentration Limit | % ECL | N/A | 1.09E-04 | N/A | 3.04E-05 | |
| C. Dissolved and entrained gases | | | | | | |
| 1. Total release | Ci | <LLD | <LLD | <LLD | <LLD | 1.90E+01 |
| 2. Average diluted concentration during period | µCi/ml | N/A | N/A | N/A | N/A | |
| 3. Percent of applicable limit | % MPC | N/A | N/A | N/A | N/A | |
| 4. Percent Effluent Concentration Limit | % ECL | N/A | N/A | N/A | N/A | |
| D. Gross alpha activity | | | | | | |
| 1. Total release | Ci | <LLD | <LLD | <LLD | <LLD | 5.00E+01 |
| E. Volume of waste released (batch & continuous, prior to dilution) | liters | 1.18E+07 | 2.80E+06 | 1.26E+06 | 8.33E+06 | 5.00E+00 |
| F. Volume of dilution water used during period | liters | 7.23E+09 | 7.98E+09 | 8.15E+09 | 8.11E+09 | 5.00E+00 |

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TABLE 2B

LIQUID EFFLUENTS
CONTINUOUS MODE

| Radionuclides Released | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|---|
| 1. Fission and activation products | | | | | |
| barium-140 | Ci | <LLD | <LLD | <LLD | <LLD |
| cerium-141 | Ci | <LLD | <LLD | <LLD | <LLD |
| cerium-144 | Ci | <LLD | <LLD | <LLD | <LLD |
| cesium-134 | Ci | <LLD | <LLD | <LLD | <LLD |
| cesium-137 | Ci | 1.12E-05 | 2.39E-05 | <LLD | 9.43E-06 |
| chromium-51 | Ci | <LLD | <LLD | <LLD | <LLD |
| cobalt-58 | Ci | <LLD | <LLD | <LLD | <LLD |
| cobalt-60 | Ci | <LLD | <LLD | <LLD | <LLD |
| iodine-131 | Ci | <LLD | <LLD | <LLD | <LLD |
| iron-55 | Ci | <LLD | <LLD | <LLD | <LLD |
| iron-59 | Ci | <LLD | <LLD | <LLD | <LLD |
| lanthanum-140 | Ci | <LLD | <LLD | <LLD | <LLD |
| manganese-54 | Ci | <LLD | <LLD | <LLD | <LLD |
| molybdenum-99 | Ci | <LLD | <LLD | <LLD | <LLD |
| niobium-95 | Ci | <LLD | <LLD | <LLD | <LLD |
| strontium-89 | Ci | <LLD | <LLD | <LLD | <LLD |
| strontium-90 | Ci | <LLD | <LLD | <LLD | <LLD |
| technetium-99m | Ci | <LLD | <LLD | <LLD | <LLD |
| zinc-65 | Ci | <LLD | <LLD | <LLD | <LLD |
| zirconium-95 | Ci | <LLD | <LLD | <LLD | <LLD |
| Total for period | Ci | 1.12E-05 | 2.39E-05 | <LLD | 9.43E-06 |
| 2. Dissolved and entrained gases | | | | | |
| xenon-133 | Ci | <LLD | <LLD | <LLD | <LLD |
| xenon-135 | Ci | <LLD | <LLD | <LLD | <LLD |
| Total for period | Ci | <LLD | <LLD | <LLD | <LLD |

LLD Lower Limit of Detection; see Table 2C.

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TABLE 2B (Continued)

LIQUID EFFLUENTS
BATCH MODE

| Radionuclides Released | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|---|
| 1. Fission and activation products | | | | | |
| barium-140 | Ci | N/A | N/A | N/A | <LLD |
| cerium-141 | Ci | N/A | N/A | N/A | <LLD |
| cerium-144 | Ci | N/A | N/A | N/A | <LLD |
| cesium-134 | Ci | N/A | N/A | N/A | <LLD |
| cesium-137 | Ci | N/A | N/A | N/A | 1.26E-06 |
| chromium-51 | Ci | N/A | N/A | N/A | <LLD |
| cobalt-58 | Ci | N/A | N/A | N/A | <LLD |
| cobalt-60 | Ci | N/A | N/A | N/A | 6.09E-06 |
| iodine-131 | Ci | N/A | N/A | N/A | <LLD |
| iron-55 | Ci | N/A | N/A | N/A | <LLD |
| iron-59 | Ci | N/A | N/A | N/A | <LLD |
| lanthanum-140 | Ci | N/A | N/A | N/A | <LLD |
| manganese-54 | Ci | N/A | N/A | N/A | <LLD |
| molybdenum-99 | Ci | N/A | N/A | N/A | <LLD |
| niobium-95 | Ci | N/A | N/A | N/A | <LLD |
| strontium-89 | Ci | N/A | N/A | N/A | <LLD |
| strontium-90 | Ci | N/A | N/A | N/A | <LLD |
| technetium-99m | Ci | N/A | N/A | N/A | <LLD |
| zinc-65 | Ci | N/A | N/A | N/A | <LLD |
| zirconium-95 | Ci | N/A | N/A | N/A | <LLD |
| Total for period | Ci | N/A | N/A | N/A | 7.35E-06 |
| 2. Dissolved and entrained gases | | | | | |
| xenon-133 | Ci | N/A | N/A | N/A | <LLD |
| xenon-135 | Ci | N/A | N/A | N/A | <LLD |
| Total for period | Ci | N/A | N/A | N/A | <LLD |

LLD Lower Limit of Detection; see Table 2C.

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TABLE 2C

LIQUID EFFLUENTS LOWER LIMIT OF DETECTION

| Radionuclides | Continuous Mode LLD (µCi/cc) | Batch Mode LLD (µCi/cc) |
|---|---|---|
| 1. Fission and activation products | | |
| barium-140 | 3.30E-07 | 2.70E-07 |
| cerium-141 | 4.50E-08 | 4.40E-08 |
| cerium-144 | 1.90E-07 | 1.90E-07 |
| cesium-134 | 8.50E-08 | 8.50E-08 |
| cesium-137 | 7.30E-08 | 7.30E-08 |
| chromium-51 | 3.60E-07 | 3.30E-07 |
| cobalt-58 | 7.70E-08 | 7.50E-08 |
| cobalt-60 | 1.10E-07 | 1.10E-07 |
| iodine-131 | 6.40E-08 | 4.80E-08 |
| iron-55 | 1.00E-06 | 1.00E-06 |
| iron-59 | 1.80E-07 | 1.70E-07 |
| lanthanum-140 | 6.40E-07 | 2.10E-07 |
| manganese-54 | 7.60E-08 | 7.60E-08 |
| molybdenum-99 | 6.00E-08 | 2.90E-08 |
| niobium-95 | 7.70E-08 | 7.20E-08 |
| strontium-89 | 5.00E-08 | 5.00E-08 |
| strontium-90 | 5.00E-08 | 5.00E-08 |
| technetium-99m | 6.10E-08 | 3.00E-08 |
| zinc-65 | 1.90E-07 | 1.90E-07 |
| zirconium-95 | 1.30E-07 | 1.30E-07 |
| 2. Dissolved and entrained gases | | |
| xenon-133 | 2.50E-07 | 2.50E-07 |
| xenon-135 | 9.60E-08 | 9.60E-08 |
| 3. Tritium | 1.00E-05 | 1.00E-05 |
| 4. Gross Alpha | 1.00E-07 | 1.00E-07 |

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TABLE 2D

LIQUID EFFLUENTS RADIATION DOSES AT THE LIQUID SITE BOUNDARY

| | | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|---|---|
| A. | | | | | | |
| 1. | Total body dose | mrem | 2.55E-05 | 5.33E-05 | 0.00E+00 | 2.83E-05 |
| 2. | Percent of Applicable Limit | % | 8.50E-04 | 1.78E-03 | 0.00E+00 | 9.43E-04 |
| B. | | | | | | |
| 1. | Limiting organ dose | mrem | 3.90E-05 | 8.12E-05 | 0.00E+00 | 5.29E-05 |
| 2. | Limiting organ for period | | Liver | Liver | N/A | GI-LLI |
| 3. | Percent of Applicable Limit | % | 3.90E-04 | 8.12E-04 | 0.00E+00 | 5.29E-04 |

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TABLE 2E

LIQUID EFFLUENTS BATCH RELEASE SUMMARY

| | | 12 month period | |
|---|---|---|---|
| 1. | Number of batch releases: | 1 | release |
| 2. | Total time period for batch releases: | 47 | minutes |
| 3. | Maximum time period for a batch release: | 47 | minutes |
| 4. | Average time period for a batch release: | 47 | minutes |
| 5. | Minimum time period for a batch release: | 47 | minutes |
| 6. | Average saltwater flow during batch releases: | 16741 | gpm |

## SECTION D. PREVIOUS RADIOACTIVE EFFLUENT RELEASE REPORT ADDENDUM

- The following corrections are to 2018 ARERR Table 2B "Liquid Effluents Continuous Mode" where <LLD values were reported.

| Radionuclides Released | Unit | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|---|
| 1. Fission and activation products | | | | | |
| Total for period | Ci | <LLD | 5.37E-04 | 3.87E-04 | 3.71E-05 |

- The following correction is to 2018 ARERR Section L "SONGS Conclusions" where incorrect radiation dose at the highest receptor was reported.

  The radiation doses from gaseous releases were: (a) gamma air dose: 0.00E+00 mrad at the site boundary, (b) beta air dose: 0.00E+00 mrad at the site boundary, (c) organ dose (Child - Liver, Thyroid, Kidney, Lung, and GI-LLI): 2.83E-03 mrem at the highest receptor.

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## SECTION E. RADWASTE SHIPMENTS

TABLE 3 (Units 2 & 3)

SOLID WASTE AND IRRADIATED FUEL SHIPMENT

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

| 1. Type of waste | Unit | 12 month period | Estimated total error (%) |
|---|---|---|---|
| a. Spent resins, filter sludge, evaporator bottoms | $m^3$ | N/A | N/A |
| | Ci | N/A | |
| b. Dry active waste (DAW), compactable and non-compactable | $m^3$ | 6.56E+01 | 30% |
| | Ci | 2.19E-02 | |
| c. Irradiated components | $m^3$ | N/A | N/A |
| | Ci | N/A | |
| d. Other: Filters | $m^3$ | N/A | N/A |
| | Ci | N/A | |

N/A: No shipments containing these items made in 2019.

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

| | | |
|---|---|---|
| 2a. Estimate of major nuclide composition (U2 and U3 Resin) There were no resin shipments in 2019 | | |
| 2b. Estimate of major nuclide composition [U2 and 3 Dry Active Waste (DAW)] | | |
| Carbon-14 | % | 1.41E+00 |
| Iron-55 | % | 5.24E+00 |
| Cobalt-60 | % | 6.83E+00 |
| Nickel-63 | % | 6.82E+01 |
| Antimony-125 | % | 5.00E-01 |
| Cesium-134 | % | 1.50E-01 |
| Cesium-137 | % | 1.76E+01 |
| Cerium-144 | % | 3.00E-02 |
| Plutonium-238 | % | 2.00E-02 |
| Americium-241 | % | 2.00E-02 |
| 2c. Estimate of major nuclide composition (U2 and U3 Irradiated Components) There were no irradiated components shipments in 2019 | | |
| 2d. Estimate of major nuclide composition (U2 and U3 Filters) There were no filter shipments in 2019 | | |

| 3. Solid Waste Disposition | | |
|---|---|---|
| Number of Shipments | Mode of Transportation | Destination |
| 2* | Tractor Trailer | EnergySolutions LLC, Clive Utah Disposal Site |

Notes:

* Two shipments were made in 2019 from San Onofre (SONGS SDS) to Energy*Solutions* Clive Utah Disposal Site.

SONGS SDS maintains a contract with a vendor Bear Creek Operations (BCO) that provides volume reduction services. No shipments were made from SONGS SDS to BCO for volume reduction in 2019. No shipment were made from BCO to direct burial on SONGS SDS behalf in 2019.

B. IRRADIATED FUEL SHIPMENTS (Disposition)

| Number of Shipments | Mode of Transportation | Destination |
|---|---|---|
| None | No shipments were made in 2019 | N/A |

C. DEWATERING

| Number of Containers | Solidification Agent |
|---|---|
| None | N/A |

CHANGES TO THE PROCESS CONTROL PROGRAM AT SAN ONOFRE UNITS 1, 2 & 3

1) Changes made to the Process Control Program: There were no changes made that impacted the Process Control Program in 2019.
2) References:
    a. Procedure SO123-VII-20, Radiation Protection Program
    b. Procedure SDS-WM1-PCD-0018, Radwaste Process Control Program
    c. Procedure SDS-CH2-PCD-1005, Annual Radioactive Effluent Release Report
    d. Regulatory Guide 1.21, Rev. 1-June 1974

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## SECTION F. APPLICABLE LIMITS

### Gaseous Effluents Applicable Limits

The percent of Applicable Limits, tabulated in Sections A, B, C, and D of Table 1A, were calculated using the following equation:

- % Applicable Limit (%MPC) = $\frac{\text{(Rel Rate) (X/Q) (100)}}{MPC_{eff} * (1E+6)}$

  where: Rel Rate = total microcuries released in each category and each quarter, divided by the seconds in a quarter; the value in Sections A.2, B.2, C.2 and D.2 of Table 1A, µCi/sec.

  X/Q = 4.80E-6 sec/$m^3$; the annual average atmospheric dispersion defined in the ODCM.

  1E+6 = conversion from $m^3$ to cc

- $MPC_{eff} = \frac{1}{\sum_{i=1}^{n} \frac{F_i}{MPC_i}}$

  where: $F_i$ = fractional concentration of the $i^{th}$ radionuclide obtained by dividing the activity (curies) for each radionuclide, $C_i$, by the sum of all the isotopic activity, $C_T$.

  n = total number of radionuclides identified

  $MPC_i$ = Maximum Permissible Concentration (MPC) of the $i^{th}$ radionuclide from 10 CFR 20 (20.1-20.602), Appendix B, Table II, Column 1.

- % Applicable Limit (% ECL) = $\frac{\text{(Rel Rate) (X/Q) (100)}}{ECL_{eff} * (1E+6)}$

  where: Rel Rate = total microcuries released in each category and each quarter, divided by the seconds in a quarter; the value in Sections A.2, B.2, C.2 and D.2 of Table 1A, µCi/sec.

  X/Q = 4.80E-06 sec/$m^3$; the annual average atmospheric dispersion defined in the ODCM.

  1E+6 = conversion from $m^3$ to cc

- $ECL_{eff} = \frac{1}{\sum_{i=1}^{n} \frac{F_i}{ECL_i}}$

  where: $F_i$ = fractional concentration of the $i^{th}$ radionuclide obtained by dividing the activity (curies) for each radionuclide, $C_i$, by the sum of all the isotopic activity, $C_T$.

  n = total number of radionuclides identified

  $ECL_i$ = Effluent Concentration Limit (ECL) of the $i^{th}$ radionuclide from 10 CFR 20 (20.1001-20.2402), Appendix B, Table 2, Column 1.

SECTION F. APPLICABLE LIMITS (Continued)

Liquid Effluents Applicable Limits

The percent of Applicable Limits, tabulated in Sections A, B, and C of Table 2A, were calculated using the following equations:

- % Applicable Limit (%MPC) = $\frac{\text{(Dil Conc) (100)}}{MPC_{eff}}$

  where: Dil Conc = total microcuries released in each category and each quarter divided by the total volume released (sum of Sections E and F in Table 2A); the value in Sections A.2, B.2, and C.2 of Table 2A, µCi/ml.

- $MPC_{eff} = \frac{1}{\sum_{i=1}^{n} \frac{F_i}{MPC_i}}$

  where: $F_i$ = fractional concentration of the $i^{th}$ radionuclide obtained by dividing the activity (curies) for each radionuclide, $C_i$, by the sum of all the isotopic activity, $C_T$.

  n = total number of radionuclides identified

  $MPC_i$ = Maximum Permissible Concentration (MPC) of the $i^{th}$ radionuclide from 10 CFR 20 (20.1-20.602), Appendix B, Table II, Column 2.

- % Applicable Limit (% ECL) = $\frac{\text{(Dil Conc) (100)}}{ECL_{eff}}$

  where: Dil Conc = total microcuries released in each category and each quarter divided by the total volume released (sum of Sections E and F in Table 2A); the value in Sections A.2, B.2, and C.2 of Table 2A, µCi/ml.

- $ECL_{eff} = \frac{1}{\sum_{i=1}^{n} \frac{F_i}{ECL_i}}$

  where: $F_i$ = fractional concentration of the $i^{th}$ radionuclide obtained by dividing the activity (curies) for each radionuclide, $C_i$, by the sum of all the isotopic activity, $C_T$.

  n = total number of radionuclides identified

  $ECL_i$ = Effluent Concentration Limit (ECL) of the $i^{th}$ radionuclide from 10 CFR 20 (20.1001-20.2402), Appendix B, Table 2, Column 2.

SECTION F. APPLICABLE LIMITS (Continued)

APPENDIX A

GASEOUS EFFLUENTS – APPLICABLE LIMITS

A. Table 1A lists the total curies released and the release rate. The percent of applicable limit compares the release concentration limits of 10 CFR 20 Appendix B, Table II, Column 1.

B. Table 1E lists the air doses as calculated using the historical X/Q. The air dose due to noble gases released in gaseous effluents from SONGS (per unit) to areas at and beyond the site boundary shall be limited to the following values:

1. During any calendar quarter: ≤ 5 mrad for gamma radiation and
   ≤ 10 mrad for beta radiation.
2. During any calendar year: ≤ 10 mrad for gamma radiation and
   ≤ 20 mrad for beta radiation.

C. The dose to a Member of the Public from iodines, tritium, and radionuclides in particulate form with half-lives greater than eight days in gaseous effluents released from SONGS (per unit) to areas at and beyond the site boundary shall be limited to the following values:

1. During any calendar quarter: ≤ 7.5 mrem to any organ.
2. During any calendar year: ≤ 15 mrem to any organ.

SECTION F. APPLICABLE LIMITS (Continued)

APPENDIX A (Continued)

LIQUID EFFLUENTS – APPLICABLE LIMITS

A. Table 2A lists the total curies released, the diluted concentration, and percent of applicable limit. The percent of applicable limit compares the diluted concentration of radioactive material released to the concentrations specified in 10 CFR 20 Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained gases. For dissolved or entrained noble gases, the concentration is limited to 2.00E-04 μCi/ml.

B. Table 2D lists the doses due to liquid releases. The dose commitment to a Member of the Public from radioactive materials in liquid effluents released from SONGS (per unit) to unrestricted areas shall be limited to the following values:

| | | |
|---|---|---|
| 1. | During any calendar quarter: | ≤ 1.5 mrem to the total body and<br>≤ 5 mrem to any organ. |
| 2. | During any calendar year: | ≤ 3 mrem to the total body and<br>≤ 10 mrem to any organ. |

## SECTION G. ESTIMATION OF ERROR

Estimations of the error in reported values of gaseous and liquid effluents releases have been made.

Sources of error for gaseous effluents batch releases are:

(1) Tank volumes
(2) Sampling
(3) Counting
(4) Calibration

Sources of error for gaseous effluents - continuous releases are:

(1) Fan flow rate
(2) Sampling
(3) Counting
(4) Calibration
(5) Differential pressure drop

Sources of error for liquid effluents - batch releases are:

(1) Tank volumes
(2) Sampling
(3) Counting
(4) Calibration

Sources of error for liquid effluents - continuous releases are:

(1) Dilution flow rate
(2) Sampling
(3) Counting
(4) Calibration

These sources of error are independent, and thus, the total error is calculated according to the following formula:

$$\text{Total Error} = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 \cdots \sigma_i^2}$$

where: $\sigma_i$ = Error associated with each component.

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## SECTION H. 10 CFR 50 APPENDIX I REQUIREMENTS

Table 1 in Section H presents the quarterly and annual maximum dose to an individual. Six different categories are presented:

(1) Liquid Effluents - Whole Body

(2) Liquid Effluents - Organ

(3) Airborne Effluents - Tritium, Iodines and Particulates

(4) Noble Gases - Gamma

(5) Noble Gases - Beta

(6) Direct Radiation

Each portion of each category is footnoted to briefly describe each maximum individual dose presented.

The doses for each category are derived as follows:

A. Categories 1 and 2 are calculated using the ODCM methodology. In addition, this data is presented in Table 2D.

B. Categories 3, 4, and 5 are calculated utilizing RETDAS, Regulatory Guide 1.109 methodology, and concurrent meteorology. However, Table IE of (Gaseous Effluents, Section B) lists data similar to categories 3, 4, and 5 using methods described in the ODCM and the historical meteorology (X/Q).

C. Category 6 presents direct dose data measured by TLD dosimeters.

For individuals who may, at times, be within the Site boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the Site boundary[1]. For members of the public who traverse the Site boundary (e.g., via highway I-5), the residency time is considered negligible and hence the dose is "0."

Table 2 in Section H presents the percent of Applicable Limits for each dose presented in Table 1.

[1] ODCM Figures 1-2 and 2-2

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TABLE 1

| SOURCE | Dose * (millirems) First Quarter | Second Quarter | Third Quarter | Fourth Quarter | Year |
|---|---|---|---|---|---|
| LIQUID EFFLUENTS | 1) | 2) | 3) | 4) | 5) |
| Whole Body | 2.55E-05 | 5.33E-05 | 0.00E+00 | 2.83E-05 | 1.07E-04 |
| | 6) | 7) | 8) | 9) | 10) |
| Organ | 3.90E-05 | 8.12E-05 | 0.00E+00 | 5.29E-05 | 1.57E-04 |
| AIRBORNE EFFLUENTS | 11) | 12) | 13) | 14) | 15) |
| Tritium, Iodines, and Particulates | 3.97E-04 | 4.39E-05 | 6.66E-04 | 1.62E-03 | 2.73E-03 |
| NOBLE GASES ** | 16) | 17) | 18) | 19) | 20) |
| Gamma | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | 21) | 22) | 23) | 24) | 25) |
| Beta | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| | 26) | 27) | 28) | 29) | 30) |
| DIRECT RADIATION | 6.57E-02 | 9.07E-02 | 6.45E-02 | 8.38E-02 | 3.05E-01 |

* The numbered footnotes below briefly explain how each maximum dose was calculated, including the organ and the predominant pathway(s).

** Noble gas doses due to airborne effluent are in units of mrad, reflecting the air dose

1. This value was calculated using the methodology of the ODCM.
2. This value was calculated using the methodology of the ODCM.
3. No liquid radioactive effluent releases occurred during this quarter.
4. This value was calculated using the methodology of the ODCM.
5. This value was calculated using the methodology of the ODCM.
6. This value was calculated using the methodology of the ODCM; the Liver received the maximum dose.
7. This value was calculated using the methodology of the ODCM; the Liver received the maximum dose.
8. No liquid radioactive effluent releases occurred during this quarter.
9. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose.
10. This value was calculated using the methodology of the ODCM; the Liver received the maximum dose.
11. The maximum organ dose was to a child's Liver, Thyroid, Kidney, Lung, and GI-LLI and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
12. The maximum organ dose was to a child's Liver, Thyroid, Kidney, Lung, and GI-LLI and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
13. The maximum organ dose was to a child's Liver and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.

14. The maximum organ dose was to a child's Liver, Thyroid, Kidney, Lung, and GI-LLI and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
15. The maximum organ dose was to a child's Liver and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
16. No noble gas radioactive effluent releases occurred during this quarter.
17. No noble gas radioactive effluent releases occurred during this quarter.
18. No noble gas radioactive effluent releases occurred during this quarter.
19. No noble gas radioactive effluent releases occurred during this quarter.
20. No noble gas radioactive effluent releases occurred during this year.
21. No noble gas radioactive effluent releases occurred during this quarter.
22. No noble gas radioactive effluent releases occurred during this quarter.
23. No noble gas radioactive effluent releases occurred during this quarter.
24. No noble gas radioactive effluent releases occurred during this quarter.
25. No noble gas radioactive effluent releases occurred during this year.
26. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WNW sector.
27. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WNW sector.
28. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WNW sector.
29. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WNW sector.
30. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WNW sector.

NOTES:

1) TLD 11, (former Visitor Center) was removed from its station by an unknown external action sometime during the 2nd Q 2019. (CR SDS-000593)
2) The South Yard Facitliy weekly particulate filter collected on 4/10/19 was not centered in filter holder. Since the filter was only slightly off-set, sample flow bypassing the filter was minimal and a sufficient amount of sample was collected for analysis. The gamma scan identified only natural isotopes and the activities were very similar to previous sample results. There has been no licensed material detected in these samples for many years. (CR SDS-000522, AR 0419-43754)
3) The Unit 2 Containment Purge required weekly noble gas and tritium samples were not collected on 6/25/19. Containment ventilation was in service for a maximum of 45 minutes. Noble gas and tritium samples from U2 Containment were obtained and analyzed on 7/9/19. Noble gas activity was < MDA and tritium activity was >MDA and were consistent with prior containment samples. The tritium activity was used to determine curies released and dose to the public per the SO123-ODCM (CR SDS-000585, AR 0719-52997)

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TABLE 2

| SOURCE | Percent Applicable Limit | | | | |
|---|---|---|---|---|---|
| | First Quarter | Second Quarter | Third Quarter | Fourth Quarter | Year |
| LIQUID EFFLUENTS | | | | | |
| Whole Body | 8.50E-04 | 1.78E-03 | 0.00E+00 | 9.43E-04 | 1.79E-03 |
| Organ | 3.90E-04 | 8.12E-04 | 0.00E+00 | 5.29E-04 | 7.84E-04 |
| AIRBORNE EFFLUENTS | | | | | |
| Tritium, Iodines, and Particulates | 2.65E-03 | 2.92E-04 | 4.44E-03 | 1.08E-02 | 9.10E-03 |
| NOBLE GASES | | | | | |
| Gamma | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Beta | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

NOTE: Direct Radiation is not specifically addressed in the Applicable Limits.

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## SECTION I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

There were no changes to the SONGS Offsite Dose Calculation Manual in 2019.

The Land Use Census (LUC) for 2019 identified a new location with a higher calculated or committed dose than those calculated for the locations evaluated in the previous revision to the ODCM due to change in occupancy factor from 0.2466 to 1.0. Therefore, this new location is reported per ODCM 5.2.1 and will be incorporated in the next feasible revision to the ODCM.

TABLE 2-6
UNITS 2&3 CONTROLLING LOCATION FACTORS[1]

| Radionuclide | $\sum_k R_{ik} W_k$ mrem/yr per µCi/sec | Use: |
|---|---|---|
| H-3 | 1.29E-03 | Q: Sorb Rec Beach |
| Cr-51 | 4.43E-02 | Q: Sorb Rec Beach |
| Mn-54 | 8.98E+00 | Q: Sorb Rec Beach |
| Co-57 | 1.73E+00 | Q: Sorb Rec Beach |
| Co-58 | 3.19E+00 | Q: Sorb Rec Beach |
| Co-60 | 1.19E+02 | Q: Sorb Rec Beach |
| Sr-89 | 1.75E+01 | Q: SC Res with Garden |
| Sr-90 | 6.88E+02 | Q: SC Res with Garden |
| Zr-95 | 3.92E+00 | Q: Sorb Rec Beach |
| Nb-95 | 9.03E+00 | E: Deer Consumer/Hunter |
| Ru-103 | 1.43E+01 | E: Deer Consumer/Hunter |
| Te-129M | 6.49E+00 | E: Deer Consumer/Hunter |
| Cs-134 | 3.41E+01 | Q: Sorb Rec Beach |
| Cs-136 | 7.68E-01 | Q: Sorb Rec Beach |
| Cs-137 | 5.01E+01 | Q: Sorb Rec Beach |
| Ba-140 | 2.09E+00 | Q: Sorb Rec Beach |
| Ce-141 | 6.74E-01 | Q: Sorb Rec Beach |
| Ce-144 | 1.32E+01 | Q: Sorb Rec Beach |
| I-131 | 2.58E+01 | Q: SC Res with Garden |
| I-132 | 1.94E-01 | Q: Sorb Rec Beach |
| I-133 | 3.77E+00 | Q: Sorb Rec Beach |
| I-134 | 5.27E-02 | Q: Sorb Rec Beach |
| I-135 | 7.95E-01 | Q: Sorb Rec Beach |
| UN-ID | 4.94E+00 | Q: Sorb Rec Beach |

[1] These values to be used in manual calculations are the maximum $\sum_k R_{ik} W_k$ for all locations based on the most restrictive age group.

## SECTION J. CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

There were no changes to the Liquid Radioactive Waste Treatment System in 2019.

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## SECTION K. MISCELLANEOUS

### ABNORMAL RELEASES

There were no abnormal releases from SONGS in 2019.

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EFFLUENT MONITORING INSTRUMENTS OUT OF SERVICE GREATER THAN 30 DAYS

January 1, 2019 - December 31, 2019

| Instrument | Inoperability Period | Inoperability Cause | Explanation |
|---|---|---|---|
| Meteorological Tower Temperature Probes | 05/20/19 – 10/24/2019 | 10 Meter Air Temperature Channel 2 reading low | Due to troubleshooting and parts lead time. (AR 0519–80240, 1019-22236) |
| 2/3RE-7813 Liquid Radwaste Radiation Monitor FE7643 Process Flow | 06/20/2018 – 04/09/19 | Implementing Engineering Design Plan | Due to modifications to the radwaste treatment system. Note that no radwaste releases were performed in this timeframe. (SDS-EN1-EDP-0005 * |
| 3RE-7828 Unit 3 Containment Purge Radiation Monitor | 10/20/2019 – Present | Heat Trace over-temperature condition | Requires assessment and long preparation time due to location of failed equipment (MWP SDS-1019-58129-1, ARs 1019-60997, 1119-25832) |
| NIA Yard Drain Sump Effluent Flow Instrument 2/3FQI-6095 | 09/23/19 -10/30/19 | Instrument failure during performance of Channel Functional Test | NIA process flow element and control panel required replacement with new equipment (Order SDS-9019-92182-2 with attached ECP, AR 1019-58101, 0919-92182) |

Note:

* Design change reported in 2018 ARERR

## SECTION K. MISCELLANEOUS (Continued)

### ONSITE GROUND WATER SAMPLES

In 2007, the Nuclear Energy Institute (NEI) established a standard for monitoring and reporting radioactive isotopes in groundwater titled NEI Groundwater Protection Initiative, NEI 07-07. It has been established that there is no drinking water pathway for groundwater underneath SONGS. However, the site implemented the groundwater protection industry standard. This section provides results of on-site samples of ground water that were obtained as part of SCE's implementation of the voluntary industry Ground Water Protection Initiative. The sample locations and the frequency of sampling may change over time. The Groundwater Monitoring Wells that are in the Groundwater Protection Initiative are NIA-1, NIA-2, NIA-12, NIA-13, PA-1, PA-2, PA-3, PA-4, OCA-1, OCA-2, and OCA-3. These wells are sampled on a quarterly basis.

Groundwater sample data indicated the presence of low, but detectable levels of tritium in shallow ground water in the area formerly occupied by Unit 1 known as the North Industrial Area (NIA). The concentrations of tritium are well below regulatory limits.

Low tritium concentrations are present in the shallow ground water situated between the former Unit 1 Containment and Fuel Handling Building, and extend towards the seawall. Although these samples indicate the presence of tritium, the sample results were at concentrations below the Environmental Protection Agency drinking water limit of 20,000 pCi/l.

The site continues to sample and analyze the groundwater monitoring wells in accordance to the site's Groundwater Monitoring Program. In addition, the site samples, analyzes and documents other groundwater wells that are identified as investigatory wells. The groundwater investigatory wells analysis results are documented in this report. The groundwater investigatory wells are identified as NIA-3 through NIA-15.

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SECTION K. MISCELLANEOUS (Continued)

ONSITE GROUND WATER SAMPLES

January 1, 2019 – December 31, 2019

| Location | Sample Date | Tritium Activity pCi/L | Gamma Activity pCi/L | Gross Beta, pCi/L | Gross Alpha, pCi/L |
|---|---|---|---|---|---|
| GW-NIA-1 | 02/07/19 | <MDC | <MDC | 9.11E+00 | 7.49E+00 |
| GW-NIA-1 | 06/03/19 | <MDC | <MDC | 1.12E+01 | 6.08E+00 |
| GW-NIA-1 | 08/15/19 | <MDC | <MDC | 7.87E+00 | <MDC |
| GW-NIA-1 | 11/07/19 | <MDC | <MDC | 1.36E+01 | 8.03E+00 |
| GW-NIA-2 | 02/06/19 | 6.48E+02 | <MDC | 1.02E+01 | 8.49E+00 |
| GW-NIA-2 | 06/03/19 | <MDC | <MDC | 8.22E+00 | 5.83E+00 |
| GW-NIA-2 | 08/20/19 | <MDC | <MDC | 8.21E+00 | 3.41E+00 |
| GW-NIA-2 | 11/06/19 | <MDC | <MDC | 9.95E+00 | 7.72E+00 |
| GW-NIA-12 | 02/06/19 | <MDC | <MDC | 5.52E+00 | <MDC |
| GW-NIA-12 | 05/29/19 | <MDC | <MDC | 7.20E+00 | 6.67E+00 |
| GW-NIA-12 | 08/19/19 | <MDC | <MDC | 5.25E+00 | <MDC |
| GW-NIA-12 | 11/06/19 | <MDC | <MDC | 3.97E+00 | <MDC |
| GW-NIA-13 | 02/07/19 | <MDC | <MDC | 7.92E+00 | 6.05E+00 |
| GW-NIA-13 | 05/29/19 | 4.72E+02 | <MDC | 1.63E+01 | <MDC |
| GW-NIA-13 | 08/19/19 | <MDC | <MDC | 5.71E+00 | 3.81E+00 |
| GW-NIA-13 | 11/06/19 | <MDC | <MDC | 8.71E+00 | <MDC |
| GW-OCA-1 | 01/24/19 | <MDC | <MDC | <MDC | 1.49E+01 |
| GW-OCA-1 | 04/17/19 | <MDC | <MDC | <MDC | 6.52E+00 |
| GW-OCA-1 | 08/14/19 | <MDC | <MDC | 5.14E+00 | 1.12E+01 |
| GW-OCA-1 | 10/31/19 | <MDC | <MDC | 8.31E+00 | 1.06E+01 |
| GW-OCA-2 | 01/23/19 | <MDC | <MDC | <MDC | 8.57E+00 |
| GW-OCA-2 | 04/10/19 | <MDC | <MDC | 2.86E+00 | 7.85E+00 |
| GW-OCA-2 | 08/12/19 | <MDC | <MDC | <MDC | 4.28E+00 |
| GW-OCA-2 | 10/30/19 | <MDC | <MDC | 9.15E+00 | 5.91E+00 |
| GW-OCA-3 | 01/30/19 | <MDC | <MDC | 3.37E+00 | 3.95E+00 |
| GW-OCA-3 | 05/29/19 | <MDC | <MDC | 2.85E+00 | <MDC |
| GW-OCA-3 | 08/14/19 | <MDC | <MDC | <MDC | 3.86E+00 |
| GW-OCA-3 | 10/28/19 | <MDC | <MDC | 7.74E+00 | 6.10E+00 |
| GW-PA-1 | 02/11/19 | <MDC | <MDC | 8.53E+00 | 1.09E+01 |
| GW-PA-1 | 06/05/19 | <MDC | <MDC | 6.28E+00 | 1.16E+01 |
| GW-PA-1 | 08/22/19 | <MDC | <MDC | 4.60E+00 | 1.41E+01 |
| GW-PA-1 | 11/14/19 | <MDC | <MDC | 7.11E+00 | 8.46E+00 |
| GW-PA-2 | 02/27/19 | <MDC | <MDC | 1.91E+01 | 5.02E+01 |

| Location | Sample Date | Tritium Activity pCi/L | Gamma Activity pCi/L | Gross Beta, pCi/L | Gross Alpha, pCi/L |
|---|---|---|---|---|---|
| GW-PA-2 | 06/05/19 | <MDC | <MDC | 2.03E+01 | 5.79E+01 |
| GW-PA-2 | 08/22/19 | <MDC | <MDC | 2.03E+01 | 6.23E+01 |
| GW-PA-2 | 11/18/19 | <MDC | <MDC | 1.69E+01 | 7.23E+01 |
| GW-PA-3 | 02/28/19 | <MDC | <MDC | 8.00E+01 | 5.30E+01 |
| GW-PA-3 | 06/06/19 | <MDC | <MDC | 2.38E+01 | 2.35E+01 |
| GW-PA-3 | 08/26/19 | <MDC | <MDC | 2.52E+01 | <MDC |
| GW-PA-3 | 12/11/19 | <MDC | <MDC | 2.51E+01 | 2.15E+01 |
| GW-PA-4 | 03/04/19 | <MDC | <MDC | 6.55E+00 | 3.06E+00 |
| GW-PA-4 | 06/06/19 | <MDC | <MDC | 1.55E+01 | 9.38E+00 |
| GW-PA-4 | 08/26/19 | <MDC | <MDC | 1.38E+01 | <MDC |
| GW-PA-4 | 12/09/19 | <MDC | <MDC | 1.16E+01 | 6.02E+00 |
| NIA-3 | 08/28/19 | <MDC | N/A | N/A | N/A |
| NIA-4 | 08/28/19 | <MDC | N/A | N/A | N/A |
| NIA-5 | 09/18/19 | <MDC | N/A | N/A | N/A |
| NIA-6 | 03/25/19 | <MDC | N/A | N/A | N/A |
| NIA-6 | 08/28/19 | <MDC | N/A | N/A | N/A |
| NIA-7 | 09/18/19 | <MDC | N/A | N/A | N/A |
| NIA-10 | 09/16/19 | <MDC | N/A | N/A | N/A |
| NIA-11 | 03/25/19 | 2.54E+02 | N/A | N/A | N/A |
| NIA-11 | 09/16/19 | <MDC | N/A | N/A | N/A |
| NIA-14 | 09/18/19 | <MDC | N/A | N/A | N/A |
| NIA-15 | 09/18/19 | <MDC | N/A | N/A | N/A |

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW- NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

NIA = Temporary investigation wells installed in the North Industrial Area.

*a priori* LLD = H-3: 3000 pCi/l
= Gross Beta: 4.0 pCi/l
= Gross Alpha: 3.0 pCi/l

Values above MDC are reported as calculated

The Beta and Alpha reported are of natural origin and not from plant operation based on the laboratory analyses.

SAN ONOFRE NUCLEAR GENERATING STATION

ONSITE GROUND WATER SAMPLES (Continued)

| Location | Sample Date | Hard to detect, pCi/L (Ni-63, Fe-55, Sr-89 and or Sr-90) |
|---|---|---|
| GW-NIA-1 | 02/07/19 | <MDC |
| GW-NIA-2 | 02/06/19 | <MDC |
| GW-NIA-12 | 02/06/19 | <MDC |
| GW-NIA-13 | 02/07/19 | <MDC |
| GW-OCA-1 | 01/24/19 | <MDC |
| GW-OCA-2 | 01/23/19 | <MDC |
| GW-OCA-3 | 01/30/19 | <MDC |
| GW-PA-1 | 02/11/19 | <MDC |
| GW-PA-2 | 02/27/19 | <MDC |
| GW-PA-3 | 02/28/19 | <MDC |
| GW-PA-4 | 03/04/19 | <MDC |

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

*a priori* LLD = Ni-63: 50 pCi/L
= Fe-55: 200 pCi/L
= SR-89/SR-90: 2 pCi/L

SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUS (Continued)

40 CFR 190 REQUIREMENTS

The Table below presents the annual site-wide doses and percent of ODCM Specification limits to members of the public. These values were calculated utilizing doses resulting from all effluent pathways and direct radiation. The different categories presented are: (1) Total Body, (2) Limiting Organ, and (3) Thyroid.

| | Dose Category | Units | Year |
|---|---|---|---|
| 1. | Total Body | | |
| | a. Total Body Dose | mrem | 7.99E-01 |
| | b. Percent ODCM Specification Limit | % | 3.20E+00 |
| 2. | Limiting Organ | | |
| | a. Organ Dose (All except thyroid) (Liver) | mrem | 4.53E-04 |
| | b. Percent ODCM Specification Limit | % | 1.81E-03 |
| 3. | Thyroid | | |
| | a. Thyroid Dose | mrem | 2.97E-04 |
| | b. Percent ODCM Specification Limit | % | 3.96E-04 |

SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUS (Continued)

CARBON-14

In June, 2009, the NRC revised its guidance in Regulatory Guide (RG) 1.21, Measuring, Evaluating and Reporting Radioactivity In Solid Wastes And Releases Of Radioactive Materials In Liquid And Gaseous Effluents From Light-Water-Cooled Nuclear Power Plants, Revision 2. RG 1.21 explains, that in part, the quantity of carbon-14 (C-14) discharged can be estimated by sample measurements or by use of a normalized C-14 source term and scaling factors based on power generation or estimated by use of the GALE Code from NUREG-0017. The dose contribution of C-14 from liquid radioactive waste is much less than that contributed by gaseous radioactive waste, evaluation of C-14 in liquid radioactive waste is not required. Revision 2 to RG 1.21 guidance includes:

- If sampling is performed, the sampling frequency may be adjusted to that interval that allows adequate measurement and reporting of effluents.

- If estimating C-14 based on scaling factors and fission rates, a precise and detailed evaluation of C-14 is not necessary. It is not necessary to calculate uncertainties for C-14 or to include C-14 uncertainty in any subsequent calculation of overall uncertainty.

Electric Power Research Institute (EPRI) Technical Report 1021106, "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents," was used to estimate the production and release quantities of C-14.

C-14 calculated production, discharge parameters and resulting dose are reported here, separately from tables 1, 1A, 1C, 1E, 2 and 40 CFR 190 Table 1.

| | |
|---|---|
| Calculated C-14 production , Ci/EFPY(1) | U2 = 0<br>U3 = 0 |
| 2019 Unit capacity factors | U2 = 0<br>U3 = 0 |
| Fraction release of produced C-14 to atmosphere | 0.98 |
| C-14 chemical form fraction assumed | Organic = 0.80<br>Inorganic = 0.20 |
| C-14 curies released to atmosphere | U2 = 0<br>U3 = 0 |
| Critical receptor dose(2) [Child (bone)], mrem | 0 |

(1) Effective Full Power Year

NOTE: Units have been shutdown since January 9, 2012 for Unit 2 and January 31, 2012 for Unit 3.

SAN ONOFRE NUCLEAR GENERATING STATION

## SECTION L. SONGS CONCLUSIONS

1) Gaseous releases (excluding carbon-14) totaled 1.03E+01 curies of which noble gases were 0.00E+00 curies, particulates were 3.01E-06 curies, iodines were 0.00E+00 curies, and tritium was 1.03E+01 curies.

2) The radiation doses from gaseous releases were: (a) gamma air dose: 0.00E+00 mrad at the site boundary, (b) beta air dose: 0.00E+00 mrad at the site boundary, (c) organ dose (Child - Liver): 2.73E-03 mrem at the highest receptor.

3) Airborne carbon-14 release was projected at 0.00E+00 curies due to the fact that both units have been permanently shut down since January 2012.

4) Liquid releases totaled 1.13E-02 curies of which particulates were 5.19E-05 curies, iodines were 0.00E+00 curies, tritium was 1.12E-02 curies, and noble gases were 0.00E+00 curies.

5) The radiation doses from liquid releases were: (a) total body: 1.07E-04 mrem, (b) limiting organ (LIVER): 1.57E-04 mrem.

6) The radioactive releases and resulting doses generated from Units 2 and 3 were below the Applicable Limits for both gaseous and liquid effluents.

7) Two shipments were made from San Onofre (SONGS SDS) to EnergySolutions Clive Utah Disposal Site These shipments included 65.6 cubic meters of Dry Active Waste containing 2.19E-02 curies of radioactivity.

8) Meteorological conditions during the year were typical for SONGS. Meteorological dispersion was good 35% of the time, fair 35% of the time and poor 30% of the time.

9) The results of samples taken from on-site ground water wells in support of the Industry Ground Water Protection Initiative are reported in Section K. There are low but detectable concentrations of tritium identified in the shallow ground water area formerly occupied by Unit 1 that is currently identified as the North Industrial Area. The ground water beneath SONGS is not a source of drinking water. On April 28, 2015, the extraction pumps were secured to evaluate the impact of groundwater extraction. There was no groundwater or dewatering well effluent discharges from the site during 2019. The site continues to sample, analyze and document the results of the groundwater monitoring wells in accordance to the site's Groundwater Monitoring Program.

10) The net result from the analysis of these effluent releases indicates that the operation of SONGS has met all the requirements of the applicable regulations that ensure adequate protection of the health of members of the public.

SAN ONOFRE NUCLEAR GENERATING STATION

## METEOROLOGY

The meteorology of the San Onofre Nuclear Generating Station for each of the four quarters, 2019 is described in this section. Meteorological measurements have been made according to the guidance provided in USNRC Regulatory Guide 1.23, "Onsite Meteorological Programs." A summary report of the meteorological measurements taken during each calendar quarter are presented in Table 4A as joint frequency distribution (JFD) of wind direction and wind speed by atmospheric stability class.

The hourly data for the Annual Report is available, but have not been included in this report because of the bulk of data records.

Table 4A lists the joint frequency distribution for each quarter, 2019. Each page of Table 4A represents the data for the individual stability classes: A, B, C, D, E, F, and G. The last page of each section shows the JFD for all the stability classes. The wind speeds have been measured at the 10 meter level, and the stability classes are defined by the temperature differential between the 10 meter and 40 meter levels.

## METEOROLOGY

### January - March
### Table 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19010100-19033123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
EXTREMELY UNSTABLE (DT/DZ ≤ - 1.9 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NNE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ENE | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| E | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 0 | 0 | 4 | 2 | 7 | 8 | 2 | 0 | 0 | 0 | 23 |
| SSE | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 7 | 2 | 0 | 3 | 0 | 23 |
| S | 0 | 0 | 0 | 2 | 2 | 11 | 10 | 3 | 3 | 0 | 0 | 0 | 31 |
| SSW | 0 | 0 | 0 | 1 | 9 | 6 | 7 | 1 | 1 | 0 | 0 | 0 | 25 |
| SW | 0 | 0 | 0 | 3 | 10 | 20 | 11 | 2 | 0 | 0 | 0 | 0 | 46 |
| WSW | 0 | 0 | 1 | 4 | 12 | 29 | 33 | 0 | 0 | 0 | 0 | 0 | 79 |
| W | 0 | 0 | 0 | 3 | 5 | 47 | 57 | 2 | 1 | 1 | 0 | 0 | 116 |
| WNW | 0 | 0 | 0 | 3 | 4 | 35 | 58 | 16 | 5 | 0 | 0 | 0 | 121 |
| NW | 0 | 0 | 0 | 0 | 1 | 6 | 10 | 4 | 1 | 0 | 0 | 0 | 22 |
| NNW | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| TOTALS | 0 | 0 | 1 | 18 | 52 | 161 | 204 | 43 | 15 | 1 | 3 | 0 | 498 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 498 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 498 |

PASQUILL B
MODERATELY UNSTABLE ( - 1.9 < DT/DZ ≤ - 1.7 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| NNE | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 1 | 1 | 2 | 13 | 3 | 0 | 0 | 0 | 0 | 20 |
| SSE | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 3 | 1 | 0 | 2 | 0 | 12 |
| S | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 2 | 2 | 0 | 1 | 0 | 9 |
| SSW | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| SW | 0 | 0 | 0 | 1 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| WSW | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| W | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 9 |
| WNW | 0 | 0 | 0 | 2 | 2 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 11 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTALS | 0 | 0 | 0 | 8 | 10 | 14 | 38 | 14 | 3 | 0 | 3 | 0 | 90 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 90 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 90 |

## METEOROLOGY

### January - March
### Table 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19010100-19033123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE ( -1.7 < DT/DZ ≤ - 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| NNE | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| SE | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 2 | 3 | 0 | 0 | 0 | 13 |
| SSE | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 3 | 0 | 0 | 0 | 9 |
| S | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 1 | 0 | 1 | 0 | 0 | 10 |
| SSW | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| SW | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 4 |
| WSW | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 4 |
| WNW | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 7 |
| NW | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 4 |
| NNW | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| TOTALS | 0 | 0 | 0 | 2 | 12 | 13 | 26 | 4 | 9 | 1 | 0 | 0 | 67 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 67 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 67 |

PASQUILL D
NEUTRAL ( - 1.5 < DT/DZ ≤ - 0.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 7 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 14 |
| NNE | 0 | 0 | 1 | 2 | 5 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 20 |
| NE | 0 | 0 | 2 | 0 | 0 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 9 |
| ENE | 0 | 0 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 5 |
| E | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| ESE | 0 | 0 | 1 | 0 | 2 | 3 | 14 | 8 | 2 | 0 | 0 | 0 | 30 |
| SE | 0 | 0 | 0 | 1 | 0 | 4 | 28 | 31 | 7 | 2 | 0 | 0 | 73 |
| SSE | 0 | 0 | 0 | 0 | 2 | 7 | 8 | 8 | 3 | 1 | 2 | 1 | 32 |
| S | 0 | 0 | 0 | 1 | 4 | 1 | 4 | 3 | 0 | 1 | 0 | 0 | 14 |
| SSW | 0 | 0 | 0 | 2 | 6 | 5 | 3 | 2 | 4 | 0 | 0 | 0 | 22 |
| SW | 0 | 0 | 2 | 3 | 1 | 6 | 5 | 5 | 3 | 0 | 0 | 0 | 25 |
| WSW | 0 | 0 | 0 | 4 | 2 | 3 | 6 | 9 | 2 | 0 | 0 | 0 | 26 |
| W | 0 | 0 | 0 | 3 | 3 | 7 | 6 | 7 | 6 | 2 | 0 | 0 | 34 |
| WNW | 0 | 0 | 0 | 4 | 2 | 5 | 7 | 6 | 1 | 0 | 0 | 0 | 25 |
| NW | 0 | 0 | 0 | 1 | 3 | 10 | 5 | 2 | 1 | 0 | 0 | 0 | 22 |
| NNW | 0 | 0 | 0 | 2 | 3 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 16 |
| TOTALS | 0 | 0 | 7 | 24 | 41 | 78 | 99 | 83 | 31 | 6 | 2 | 1 | 372 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 372 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 372 |

## METEOROLOGY

### January - March
### Table 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19010100-19033123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
SLIGHTLY STABLE ( - 0.5 < DT/DZ ≤1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 4 | 11 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 34 |
| NNE | 0 | 0 | 0 | 14 | 20 | 29 | 16 | 0 | 0 | 0 | 0 | 0 | 79 |
| NE | 0 | 0 | 0 | 3 | 5 | 5 | 2 | 3 | 2 | 0 | 0 | 0 | 20 |
| ENE | 0 | 0 | 0 | 2 | 4 | 7 | 1 | 1 | 1 | 0 | 0 | 0 | 16 |
| E | 0 | 0 | 0 | 1 | 6 | 8 | 5 | 7 | 5 | 0 | 0 | 0 | 32 |
| ESE | 0 | 0 | 0 | 2 | 1 | 5 | 2 | 1 | 4 | 0 | 0 | 0 | 15 |
| SE | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 3 | 3 | 0 | 0 | 0 | 12 |
| SSE | 0 | 0 | 0 | 2 | 1 | 4 | 4 | 2 | 3 | 0 | 0 | 0 | 16 |
| S | 0 | 0 | 1 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| SSW | 0 | 0 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| SW | 0 | 0 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| WSW | 0 | 0 | 1 | 2 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 9 |
| W | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 9 | 0 | 0 | 0 | 15 |
| WNW | 0 | 1 | 1 | 5 | 4 | 5 | 9 | 6 | 8 | 1 | 0 | 0 | 40 |
| NW | 0 | 0 | 2 | 3 | 6 | 5 | 5 | 5 | 3 | 0 | 0 | 0 | 29 |
| NNW | 0 | 0 | 0 | 5 | 5 | 6 | 8 | 3 | 0 | 0 | 0 | 0 | 27 |
| TOTALS | 0 | 1 | 7 | 54 | 74 | 95 | 61 | 34 | 38 | 1 | 0 | 0 | 365 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 365 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 365 |

PASQUILL F
MODERATELY STABLE (1.5 < DT/DZ ≤ 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 6 | 7 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 23 |
| NNE | 0 | 0 | 0 | 5 | 26 | 62 | 25 | 0 | 0 | 0 | 0 | 0 | 118 |
| NE | 0 | 0 | 1 | 8 | 14 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 36 |
| ENE | 0 | 0 | 0 | 5 | 4 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 15 |
| E | 0 | 0 | 0 | 3 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| ESE | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| SE | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| SSE | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| S | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| SSW | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| SW | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| WSW | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| W | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| WNW | 0 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| NW | 0 | 0 | 0 | 4 | 2 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 11 |
| NNW | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| TOTALS | 0 | 0 | 3 | 47 | 62 | 97 | 41 | 0 | 1 | 0 | 0 | 0 | 251 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 251 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 251 |

## METEOROLOGY

### January - March
### Table 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19010100-19033123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 2 | 3 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 15 |
| NNE | 0 | 0 | 0 | 2 | 5 | 114 | 285 | 14 | 0 | 0 | 0 | 0 | 420 |
| NE | 0 | 0 | 0 | 4 | 11 | 12 | 15 | 1 | 0 | 0 | 0 | 0 | 43 |
| ENE | 0 | 0 | 0 | 1 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 9 |
| E | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| ESE | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| SSE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| S | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 5 |
| SSW | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| W | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| WNW | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| TOTALS | 0 | 0 | 0 | 12 | 28 | 141 | 320 | 16 | 0 | 0 | 0 | 0 | 517 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 517 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 517 |

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 13 | 31 | 31 | 15 | 2 | 0 | 0 | 0 | 0 | 92 |
| NNE | 0 | 0 | 1 | 24 | 58 | 214 | 330 | 14 | 1 | 0 | 0 | 0 | 642 |
| NE | 0 | 0 | 3 | 15 | 31 | 30 | 22 | 6 | 3 | 0 | 0 | 0 | 110 |
| ENE | 0 | 0 | 1 | 9 | 13 | 16 | 6 | 1 | 1 | 0 | 0 | 0 | 47 |
| E | 0 | 0 | 0 | 5 | 10 | 12 | 9 | 7 | 6 | 0 | 0 | 0 | 49 |
| ESE | 0 | 0 | 1 | 6 | 7 | 10 | 21 | 10 | 6 | 0 | 0 | 0 | 61 |
| SE | 0 | 0 | 1 | 4 | 6 | 11 | 59 | 47 | 15 | 2 | 0 | 0 | 145 |
| SSE | 0 | 0 | 0 | 3 | 4 | 21 | 26 | 21 | 12 | 1 | 7 | 1 | 96 |
| S | 0 | 0 | 1 | 7 | 14 | 18 | 22 | 9 | 5 | 2 | 1 | 0 | 79 |
| SSW | 0 | 0 | 1 | 8 | 19 | 18 | 14 | 3 | 5 | 0 | 0 | 0 | 68 |
| SW | 0 | 0 | 3 | 14 | 15 | 31 | 22 | 7 | 3 | 0 | 0 | 0 | 95 |
| WSW | 0 | 0 | 2 | 12 | 19 | 36 | 44 | 12 | 2 | 0 | 0 | 0 | 127 |
| W | 0 | 0 | 0 | 11 | 11 | 58 | 72 | 12 | 18 | 3 | 0 | 0 | 185 |
| WNW | 0 | 1 | 1 | 16 | 15 | 52 | 84 | 29 | 14 | 1 | 0 | 0 | 213 |
| NW | 0 | 0 | 2 | 8 | 13 | 25 | 28 | 11 | 6 | 0 | 0 | 0 | 93 |
| NNW | 0 | 0 | 1 | 10 | 13 | 16 | 15 | 3 | 0 | 0 | 0 | 0 | 58 |
| TOTALS | 0 | 1 | 18 | 165 | 279 | 599 | 789 | 194 | 97 | 9 | 8 | 1 | 2160 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 2160 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 2160 |

## METEOROLOGY

### April - June
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19040100-19063023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
EXTREMELY UNSTABLE (DT/DZ ≤ - 1.9 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NNE | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| NE | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| ENE | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 2 | 3 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 14 |
| SSE | 0 | 0 | 0 | 0 | 0 | 8 | 8 | 2 | 0 | 0 | 0 | 0 | 18 |
| S | 0 | 0 | 0 | 3 | 3 | 12 | 19 | 1 | 0 | 0 | 0 | 0 | 38 |
| SSW | 0 | 0 | 0 | 1 | 7 | 12 | 16 | 0 | 0 | 0 | 0 | 0 | 36 |
| SW | 0 | 0 | 0 | 2 | 7 | 25 | 30 | 0 | 0 | 0 | 0 | 0 | 64 |
| WSW | 0 | 0 | 0 | 0 | 10 | 77 | 94 | 1 | 0 | 0 | 0 | 0 | 182 |
| W | 0 | 0 | 0 | 4 | 4 | 40 | 113 | 2 | 0 | 0 | 0 | 0 | 163 |
| WNW | 0 | 0 | 0 | 4 | 0 | 20 | 66 | 10 | 1 | 0 | 0 | 0 | 101 |
| NW | 0 | 0 | 0 | 1 | 3 | 4 | 7 | 3 | 3 | 0 | 0 | 0 | 21 |
| NNW | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| TOTALS | 0 | 1 | 2 | 22 | 43 | 209 | 356 | 19 | 4 | 0 | 0 | 0 | 656 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 656 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 656 |

PASQUILL B
MODERATELY UNSTABLE ( - 1.9 < DT/DZ ≤ - 1.7 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 0 | 0 | 4 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 12 |
| SSE | 0 | 0 | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 7 |
| S | 0 | 0 | 0 | 0 | 2 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 14 |
| SSW | 0 | 0 | 0 | 1 | 2 | 3 | 7 | 1 | 0 | 0 | 0 | 0 | 14 |
| SW | 0 | 0 | 0 | 0 | 2 | 5 | 12 | 0 | 0 | 0 | 0 | 0 | 19 |
| WSW | 0 | 0 | 0 | 2 | 0 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 10 |
| W | 0 | 0 | 0 | 2 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 10 |
| WNW | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 4 |
| NNW | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTALS | 0 | 0 | 1 | 6 | 15 | 42 | 38 | 5 | 0 | 0 | 0 | 0 | 107 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 107 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 107 |

## METEOROLOGY

### April - June
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19040100-19063023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE ( -1.7 < DT/DZ ≤ - 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NNE | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| NE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| ESE | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| SE | 0 | 0 | 0 | 0 | 2 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 12 |
| SSE | 0 | 0 | 0 | 2 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 9 |
| S | 0 | 0 | 1 | 2 | 2 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 12 |
| SSW | 0 | 0 | 0 | 0 | 2 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 11 |
| SW | 0 | 0 | 0 | 3 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 19 |
| WSW | 0 | 0 | 0 | 1 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 10 |
| W | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| WNW | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 7 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| NNW | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTALS | 0 | 0 | 1 | 13 | 17 | 38 | 28 | 3 | 0 | 0 | 0 | 0 | 100 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 100 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 100 |

PASQUILL D
NEUTRAL ( - 1.5 < DT/DZ ≤ - 0.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 3 | 7 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| NNE | 0 | 0 | 1 | 8 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| NE | 0 | 0 | 0 | 3 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| ENE | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 8 |
| E | 0 | 0 | 0 | 4 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 8 |
| ESE | 0 | 0 | 2 | 2 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 12 |
| SE | 0 | 0 | 0 | 4 | 5 | 18 | 10 | 0 | 0 | 0 | 0 | 0 | 37 |
| SSE | 0 | 0 | 0 | 3 | 9 | 13 | 16 | 1 | 1 | 0 | 0 | 0 | 43 |
| S | 0 | 0 | 0 | 6 | 3 | 7 | 18 | 2 | 0 | 0 | 0 | 0 | 36 |
| SSW | 0 | 0 | 1 | 3 | 12 | 20 | 13 | 0 | 0 | 0 | 0 | 0 | 49 |
| SW | 0 | 0 | 1 | 9 | 13 | 21 | 29 | 0 | 0 | 0 | 0 | 0 | 73 |
| WSW | 0 | 0 | 2 | 5 | 7 | 20 | 13 | 2 | 0 | 0 | 0 | 0 | 49 |
| W | 0 | 0 | 1 | 5 | 5 | 5 | 7 | 4 | 0 | 0 | 0 | 0 | 27 |
| WNW | 0 | 0 | 2 | 4 | 9 | 5 | 6 | 4 | 0 | 0 | 0 | 0 | 30 |
| NW | 0 | 0 | 2 | 5 | 5 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 20 |
| NNW | 0 | 0 | 1 | 4 | 6 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 19 |
| TOTALS | 0 | 0 | 16 | 75 | 93 | 139 | 121 | 15 | 2 | 0 | 0 | 0 | 461 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 461 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 461 |

## METEOROLOGY

### April - June
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19040100-19063023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
SLIGHTLY STABLE ( - 0.5 < DT/DZ ≤ 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 3 | 9 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| NNE | 0 | 0 | 3 | 11 | 21 | 26 | 7 | 0 | 0 | 0 | 0 | 0 | 68 |
| NE | 0 | 0 | 1 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| ENE | 0 | 0 | 0 | 2 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| E | 0 | 0 | 0 | 3 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| ESE | 0 | 0 | 0 | 1 | 4 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 12 |
| SE | 0 | 0 | 0 | 3 | 5 | 14 | 14 | 3 | 0 | 0 | 0 | 0 | 39 |
| SSE | 1 | 1 | 1 | 8 | 9 | 29 | 6 | 1 | 1 | 0 | 0 | 0 | 57 |
| S | 0 | 0 | 1 | 7 | 11 | 25 | 5 | 1 | 0 | 0 | 0 | 0 | 50 |
| SSW | 0 | 0 | 1 | 11 | 7 | 26 | 12 | 5 | 1 | 0 | 0 | 0 | 63 |
| SW | 0 | 0 | 2 | 7 | 11 | 10 | 8 | 2 | 0 | 0 | 0 | 0 | 40 |
| WSW | 0 | 1 | 3 | 7 | 7 | 10 | 7 | 2 | 0 | 0 | 0 | 0 | 37 |
| W | 0 | 1 | 1 | 10 | 2 | 7 | 1 | 4 | 0 | 0 | 0 | 0 | 26 |
| WNW | 0 | 1 | 2 | 6 | 9 | 7 | 3 | 5 | 0 | 0 | 0 | 0 | 33 |
| NW | 0 | 0 | 4 | 8 | 2 | 5 | 7 | 2 | 0 | 0 | 0 | 0 | 28 |
| NNW | 0 | 0 | 0 | 2 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 9 |
| TOTALS | 1 | 4 | 22 | 98 | 113 | 184 | 74 | 25 | 2 | 0 | 0 | 0 | 523 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 523 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 523 |

PASQUILL F
MODERATELY STABLE (1.5 < DT/DZ ≤ 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 1 | 0 | 3 | 4 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 14 |
| NNE | 0 | 0 | 0 | 8 | 25 | 35 | 9 | 1 | 0 | 0 | 0 | 0 | 78 |
| NE | 0 | 0 | 0 | 7 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 17 |
| ENE | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| E | 0 | 0 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| ESE | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| SE | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| SSE | 0 | 0 | 0 | 2 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| S | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| SSW | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| SW | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| WSW | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| W | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| WNW | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 10 |
| NW | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| NNW | 0 | 1 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| TOTALS | 1 | 2 | 2 | 39 | 55 | 57 | 20 | 3 | 0 | 0 | 0 | 0 | 179 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 179 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 179 |

## METEOROLOGY

### April - June
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19040100-19063023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| NNE | 0 | 0 | 0 | 0 | 9 | 64 | 51 | 2 | 0 | 0 | 0 | 0 | 126 |
| NE | 0 | 0 | 0 | 1 | 5 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 12 |
| ENE | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| E | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| ESE | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| WSW | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| W | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| WNW | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTALS | 0 | 0 | 0 | 3 | 24 | 73 | 56 | 2 | 0 | 0 | 0 | 0 | 158 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 158 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 158 |

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 1 | 7 | 20 | 15 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 62 |
| NNE | 0 | 0 | 5 | 29 | 67 | 138 | 68 | 3 | 0 | 0 | 0 | 0 | 310 |
| NE | 0 | 0 | 2 | 16 | 20 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 54 |
| ENE | 0 | 0 | 0 | 9 | 13 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 28 |
| E | 0 | 0 | 0 | 9 | 12 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 34 |
| ESE | 0 | 0 | 2 | 5 | 11 | 12 | 6 | 0 | 0 | 0 | 0 | 0 | 36 |
| SE | 0 | 0 | 1 | 10 | 20 | 48 | 36 | 4 | 0 | 0 | 0 | 0 | 119 |
| SSE | 1 | 1 | 1 | 15 | 25 | 61 | 34 | 4 | 2 | 0 | 0 | 0 | 144 |
| S | 1 | 0 | 2 | 20 | 22 | 61 | 44 | 4 | 0 | 0 | 0 | 0 | 154 |
| SSW | 0 | 0 | 3 | 18 | 31 | 66 | 54 | 6 | 1 | 0 | 0 | 0 | 179 |
| SW | 0 | 0 | 3 | 21 | 36 | 66 | 90 | 2 | 0 | 0 | 0 | 0 | 218 |
| WSW | 0 | 1 | 5 | 18 | 29 | 114 | 121 | 7 | 0 | 0 | 0 | 0 | 295 |
| W | 0 | 1 | 2 | 22 | 17 | 61 | 125 | 10 | 0 | 0 | 0 | 0 | 238 |
| WNW | 0 | 1 | 4 | 18 | 20 | 44 | 79 | 23 | 1 | 0 | 0 | 0 | 190 |
| NW | 0 | 0 | 6 | 16 | 11 | 14 | 21 | 9 | 3 | 0 | 0 | 0 | 80 |
| NNW | 0 | 2 | 1 | 10 | 11 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 43 |
| TOTALS | 2 | 7 | 44 | 256 | 360 | 742 | 693 | 72 | 8 | 0 | 0 | 0 | 2184 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 2184 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 2184 |

## METEOROLOGY

### July - September
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19070100-19093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
EXTREMELY UNSTABLE (DT/DZ ≤ - 1.9 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| NNE | 0 | 0 | 0 | 5 | 4 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| NE | 0 | 0 | 0 | 1 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| ENE | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| E | 0 | 0 | 0 | 4 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 10 |
| ESE | 0 | 0 | 0 | 0 | 2 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 18 |
| SE | 0 | 0 | 1 | 1 | 4 | 21 | 23 | 2 | 0 | 0 | 0 | 0 | 52 |
| SSE | 0 | 0 | 0 | 3 | 4 | 7 | 13 | 7 | 2 | 0 | 0 | 0 | 36 |
| S | 0 | 0 | 0 | 5 | 4 | 19 | 15 | 8 | 0 | 0 | 0 | 0 | 51 |
| SSW | 0 | 0 | 1 | 4 | 7 | 12 | 26 | 2 | 0 | 0 | 0 | 0 | 52 |
| SW | 0 | 0 | 0 | 5 | 13 | 21 | 33 | 1 | 0 | 0 | 0 | 0 | 73 |
| WSW | 0 | 0 | 0 | 3 | 13 | 85 | 59 | 3 | 0 | 0 | 0 | 0 | 163 |
| W | 0 | 0 | 0 | 2 | 8 | 78 | 125 | 0 | 0 | 0 | 0 | 0 | 213 |
| WNW | 0 | 0 | 1 | 3 | 6 | 32 | 72 | 4 | 0 | 0 | 0 | 0 | 118 |
| NW | 0 | 0 | 0 | 3 | 2 | 6 | 8 | 0 | 0 | 0 | 0 | 0 | 19 |
| NNW | 0 | 0 | 1 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| TOTALS | 0 | 0 | 5 | 44 | 76 | 308 | 380 | 27 | 2 | 0 | 0 | 0 | 842 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 842 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 842 |

PASQUILL B
MODERATELY UNSTABLE ( - 1.9 < DT/DZ ≤ - 1.7 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NNE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| SSE | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 4 |
| SSW | 0 | 0 | 0 | 0 | 1 | 3 | 4 | 1 | 0 | 0 | 0 | 0 | 9 |
| SW | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 6 |
| WSW | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| W | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| WNW | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| NW | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 0 | 0 | 0 | 0 | 8 | 20 | 13 | 4 | 0 | 0 | 0 | 0 | 45 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 45 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 45 |

## METEOROLOGY

## July - September
## TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19070100-19093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE (- 1.7 < DT/DZ ≤ - 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| S | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 6 |
| SSW | 0 | 0 | 0 | 1 | 1 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 13 |
| SW | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 11 |
| WSW | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| W | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| WNW | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 5 |
| NW | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 0 | 0 | 0 | 2 | 9 | 20 | 21 | 9 | 0 | 0 | 0 | 0 | 61 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 61 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 61 |

PASQUILL D
NEUTRAL ( - 1.5 < DT/DZ ≤ - 0.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| NNE | 0 | 0 | 0 | 6 | 9 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| NE | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| ENE | 0 | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| E | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| ESE | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| SE | 0 | 0 | 1 | 0 | 3 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 16 |
| SSE | 0 | 0 | 0 | 1 | 10 | 16 | 10 | 5 | 0 | 0 | 0 | 0 | 42 |
| S | 0 | 0 | 1 | 3 | 1 | 8 | 20 | 4 | 0 | 0 | 0 | 0 | 37 |
| SSW | 0 | 0 | 0 | 1 | 4 | 10 | 9 | 1 | 0 | 0 | 0 | 0 | 25 |
| SW | 0 | 0 | 1 | 1 | 4 | 15 | 4 | 1 | 0 | 0 | 0 | 0 | 26 |
| WSW | 0 | 0 | 0 | 3 | 9 | 13 | 5 | 0 | 0 | 0 | 0 | 0 | 30 |
| W | 0 | 0 | 0 | 2 | 7 | 9 | 5 | 0 | 0 | 0 | 0 | 0 | 23 |
| WNW | 0 | 0 | 1 | 3 | 3 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| NW | 0 | 0 | 0 | 1 | 1 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 8 |
| NNW | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| TOTALS | 0 | 0 | 4 | 30 | 65 | 114 | 56 | 12 | 0 | 0 | 0 | 0 | 281 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 281 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 281 |

## METEOROLOGY

### July - September
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19070100-19093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
SLIGHTLY STABLE ( - 0.5 < DT/DZ ≤ 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 12 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| NNE | 0 | 0 | 0 | 7 | 15 | 25 | 4 | 0 | 0 | 0 | 0 | 0 | 51 |
| NE | 0 | 0 | 2 | 2 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| ENE | 0 | 0 | 0 | 3 | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 9 |
| E | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| ESE | 0 | 0 | 0 | 2 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| SE | 0 | 0 | 0 | 3 | 6 | 16 | 8 | 0 | 0 | 0 | 0 | 0 | 33 |
| SSE | 0 | 0 | 1 | 7 | 11 | 18 | 14 | 1 | 0 | 0 | 0 | 0 | 52 |
| S | 0 | 0 | 0 | 7 | 5 | 14 | 21 | 2 | 0 | 0 | 0 | 0 | 49 |
| SSW | 0 | 0 | 0 | 5 | 5 | 15 | 17 | 2 | 0 | 0 | 0 | 0 | 44 |
| SW | 0 | 0 | 0 | 2 | 10 | 12 | 18 | 0 | 0 | 0 | 0 | 0 | 42 |
| WSW | 0 | 0 | 1 | 3 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| W | 0 | 0 | 0 | 6 | 4 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 18 |
| WNW | 0 | 0 | 1 | 3 | 7 | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 27 |
| NW | 0 | 0 | 0 | 4 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 16 |
| NNW | 0 | 0 | 1 | 9 | 5 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 21 |
| TOTALS | 0 | 0 | 6 | 77 | 110 | 143 | 91 | 6 | 0 | 0 | 0 | 0 | 433 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 433 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 433 |

PASQUILL F
MODERATELY STABLE (1.5 < DT/DZ ≤ 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 6 | 7 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| NNE | 0 | 0 | 0 | 10 | 33 | 45 | 9 | 0 | 0 | 0 | 0 | 0 | 97 |
| NE | 0 | 0 | 1 | 6 | 12 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| ENE | 0 | 0 | 0 | 6 | 8 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 17 |
| E | 0 | 0 | 0 | 3 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| ESE | 0 | 0 | 0 | 5 | 1 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 17 |
| SE | 0 | 0 | 1 | 2 | 4 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 26 |
| SSE | 0 | 0 | 1 | 7 | 13 | 13 | 12 | 3 | 0 | 0 | 0 | 0 | 49 |
| S | 0 | 0 | 0 | 2 | 11 | 6 | 5 | 4 | 0 | 0 | 0 | 0 | 28 |
| SSW | 0 | 0 | 0 | 4 | 3 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 19 |
| SW | 0 | 0 | 0 | 5 | 3 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 15 |
| WSW | 0 | 0 | 0 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| W | 0 | 0 | 0 | 3 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| WNW | 0 | 0 | 0 | 10 | 10 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 24 |
| NW | 0 | 0 | 3 | 9 | 6 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 22 |
| NNW | 0 | 0 | 0 | 5 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| TOTALS | 0 | 0 | 6 | 86 | 130 | 134 | 40 | 7 | 0 | 0 | 0 | 0 | 403 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 403 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 403 |

## METEOROLOGY

## July - September
## TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19070100-19093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| NNE | 0 | 0 | 0 | 5 | 11 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 71 |
| NE | 0 | 0 | 0 | 3 | 2 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 20 |
| ENE | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| E | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| ESE | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SSE | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| S | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| SSW | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| SW | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| WSW | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| W | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| WNW | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| NW | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| NNW | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| TOTALS | 0 | 0 | 1 | 23 | 32 | 57 | 30 | 0 | 0 | 0 | 0 | 0 | 143 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 143 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 143 |

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 1 | 23 | 17 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| NNE | 0 | 0 | 0 | 33 | 74 | 116 | 37 | 0 | 0 | 0 | 0 | 0 | 260 |
| NE | 0 | 0 | 3 | 12 | 35 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 79 |
| ENE | 0 | 0 | 0 | 13 | 14 | 8 | 2 | 1 | 0 | 0 | 0 | 0 | 38 |
| E | 0 | 0 | 0 | 10 | 12 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 34 |
| ESE | 0 | 0 | 0 | 9 | 12 | 28 | 6 | 0 | 0 | 0 | 0 | 0 | 55 |
| SE | 0 | 0 | 3 | 6 | 18 | 65 | 39 | 2 | 0 | 0 | 0 | 0 | 133 |
| SSE | 0 | 0 | 2 | 20 | 40 | 56 | 55 | 16 | 2 | 0 | 0 | 0 | 191 |
| S | 0 | 0 | 1 | 19 | 25 | 48 | 65 | 23 | 0 | 0 | 0 | 0 | 181 |
| SSW | 0 | 0 | 1 | 18 | 21 | 54 | 62 | 9 | 0 | 0 | 0 | 0 | 165 |
| SW | 0 | 0 | 1 | 14 | 30 | 59 | 65 | 6 | 0 | 0 | 0 | 0 | 175 |
| WSW | 0 | 0 | 2 | 13 | 43 | 114 | 64 | 3 | 0 | 0 | 0 | 0 | 239 |
| W | 0 | 0 | 0 | 14 | 27 | 110 | 134 | 0 | 0 | 0 | 0 | 0 | 285 |
| WNW | 0 | 0 | 3 | 22 | 29 | 59 | 83 | 4 | 0 | 0 | 0 | 0 | 200 |
| NW | 0 | 0 | 3 | 19 | 19 | 19 | 13 | 1 | 0 | 0 | 0 | 0 | 74 |
| NNW | 0 | 0 | 2 | 17 | 14 | 12 | 3 | 0 | 0 | 0 | 0 | 0 | 48 |
| TOTALS | 0 | 0 | 22 | 262 | 430 | 796 | 631 | 65 | 2 | 0 | 0 | 0 | 2208 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 2208 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 2208 |

## METEOROLOGY

### October - December
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19100100-19123123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
EXTREMELY UNSTABLE (DT/DZ ≤ - 1.9 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| NE | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 3 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 5 |
| SSE | 0 | 0 | 0 | 1 | 2 | 2 | 6 | 4 | 0 | 0 | 0 | 0 | 15 |
| S | 0 | 0 | 0 | 3 | 1 | 6 | 15 | 2 | 1 | 0 | 0 | 0 | 28 |
| SSW | 0 | 0 | 0 | 4 | 6 | 13 | 7 | 3 | 3 | 0 | 0 | 0 | 36 |
| SW | 0 | 0 | 1 | 2 | 7 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 27 |
| WSW | 0 | 0 | 0 | 1 | 17 | 19 | 14 | 0 | 0 | 0 | 0 | 0 | 51 |
| W | 0 | 0 | 0 | 2 | 15 | 57 | 22 | 1 | 0 | 0 | 0 | 0 | 97 |
| WNW | 0 | 0 | 1 | 3 | 8 | 62 | 77 | 2 | 0 | 0 | 0 | 0 | 153 |
| NW | 0 | 0 | 0 | 1 | 1 | 7 | 9 | 1 | 0 | 0 | 0 | 0 | 19 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 0 | 0 | 2 | 19 | 57 | 183 | 162 | 14 | 5 | 0 | 0 | 0 | 442 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 442 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 442 |

PASQUILL B
MODERATELY UNSTABLE (- 1.9 < DT/DZ ≤ - 1.7 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NNE | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 4 |
| SSE | 0 | 0 | 0 | 0 | 1 | 4 | 7 | 3 | 0 | 0 | 0 | 0 | 15 |
| S | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 2 | 0 | 0 | 0 | 0 | 8 |
| SSW | 0 | 0 | 0 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| SW | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 6 |
| WSW | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| W | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| WNW | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| NW | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 5 |
| NNW | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTALS | 0 | 0 | 0 | 5 | 5 | 20 | 21 | 13 | 0 | 0 | 0 | 0 | 64 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 64 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 64 |

## METEOROLOGY

### October - December
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19100100-19123123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE ( - 1.7 < DT/DZ ≤ - 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 4 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 6 |
| SSE | 0 | 0 | 1 | 0 | 0 | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 12 |
| S | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 7 |
| SSW | 0 | 0 | 1 | 1 | 0 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 9 |
| SW | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 7 |
| WSW | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| W | 0 | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 8 |
| WNW | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| NW | 0 | 0 | 0 | 1 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 6 |
| NNW | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTALS | 0 | 0 | 3 | 4 | 12 | 23 | 16 | 14 | 4 | 0 | 0 | 0 | 76 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 76 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 76 |

PASQUILL D
NEUTRAL ( - 1.5 < DT/DZ ≤ - 0.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 4 | 5 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 16 |
| NNE | 0 | 0 | 0 | 1 | 4 | 8 | 9 | 0 | 0 | 0 | 0 | 0 | 22 |
| NE | 0 | 0 | 1 | 2 | 1 | 0 | 4 | 1 | 1 | 2 | 0 | 0 | 12 |
| ENE | 0 | 0 | 1 | 1 | 0 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 10 |
| E | 0 | 0 | 0 | 1 | 4 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 11 |
| ESE | 0 | 0 | 0 | 0 | 4 | 6 | 8 | 2 | 3 | 1 | 0 | 0 | 24 |
| SE | 0 | 0 | 0 | 2 | 4 | 17 | 18 | 8 | 9 | 0 | 0 | 0 | 58 |
| SSE | 0 | 0 | 0 | 0 | 2 | 13 | 9 | 3 | 1 | 0 | 0 | 0 | 28 |
| S | 0 | 1 | 0 | 3 | 1 | 3 | 8 | 2 | 2 | 0 | 0 | 0 | 20 |
| SSW | 0 | 0 | 1 | 2 | 4 | 3 | 2 | 0 | 3 | 1 | 0 | 0 | 16 |
| SW | 0 | 0 | 0 | 2 | 5 | 4 | 2 | 0 | 1 | 0 | 0 | 0 | 14 |
| WSW | 0 | 0 | 2 | 1 | 0 | 1 | 1 | 0 | 7 | 1 | 0 | 0 | 13 |
| W | 0 | 1 | 0 | 5 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 9 |
| WNW | 0 | 0 | 1 | 2 | 2 | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 25 |
| NW | 0 | 0 | 0 | 3 | 5 | 8 | 6 | 2 | 0 | 0 | 0 | 0 | 24 |
| NNW | 0 | 0 | 0 | 2 | 2 | 12 | 6 | 0 | 0 | 0 | 0 | 0 | 22 |
| TOTALS | 0 | 2 | 6 | 31 | 44 | 92 | 94 | 23 | 27 | 5 | 0 | 0 | 324 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 324 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 324 |

## METEOROLOGY

### October - December
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19100100-19123123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
SLIGHTLY STABLE ( - 0.5 < DT/DZ ≤ 1.5 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 1 | 0 | 1 | 8 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 29 |
| NNE | 0 | 0 | 0 | 7 | 14 | 17 | 11 | 0 | 0 | 0 | 0 | 0 | 49 |
| NE | 0 | 0 | 1 | 3 | 8 | 15 | 9 | 3 | 1 | 0 | 0 | 0 | 40 |
| ENE | 0 | 0 | 1 | 1 | 1 | 6 | 3 | 2 | 3 | 0 | 0 | 0 | 17 |
| E | 0 | 0 | 0 | 3 | 7 | 7 | 4 | 2 | 1 | 2 | 0 | 0 | 26 |
| ESE | 0 | 0 | 0 | 2 | 4 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | 15 |
| SE | 0 | 0 | 1 | 0 | 2 | 4 | 12 | 4 | 0 | 0 | 0 | 0 | 23 |
| SSE | 0 | 0 | 1 | 3 | 2 | 2 | 7 | 5 | 1 | 0 | 0 | 0 | 21 |
| S | 0 | 0 | 0 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 7 |
| SSW | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 |
| SW | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| WSW | 0 | 0 | 0 | 2 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| W | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| WNW | 0 | 1 | 0 | 1 | 2 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 12 |
| NW | 0 | 0 | 1 | 1 | 2 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 16 |
| NNW | 0 | 0 | 0 | 3 | 1 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 14 |
| TOTALS | 0 | 2 | 6 | 36 | 62 | 94 | 67 | 19 | 6 | 2 | 0 | 0 | 294 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 294 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 294 |

PASQUILL F
MODERATELY STABLE (1.5 < DT/DZ ≤ 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 2 | 2 | 8 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 19 |
| NNE | 0 | 0 | 1 | 9 | 26 | 51 | 21 | 0 | 0 | 0 | 0 | 0 | 108 |
| NE | 0 | 0 | 3 | 13 | 17 | 22 | 13 | 4 | 0 | 0 | 0 | 0 | 72 |
| ENE | 0 | 0 | 0 | 8 | 8 | 6 | 1 | 0 | 1 | 0 | 0 | 0 | 24 |
| E | 0 | 0 | 1 | 3 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 12 |
| ESE | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| SE | 0 | 0 | 0 | 3 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 10 |
| SSE | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 7 |
| S | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| SSW | 0 | 1 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| SW | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| WSW | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| W | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| WNW | 0 | 0 | 1 | 2 | 6 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| NW | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 4 |
| NNW | 0 | 0 | 0 | 2 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 10 |
| TOTALS | 0 | 1 | 11 | 51 | 87 | 109 | 49 | 4 | 1 | 0 | 0 | 0 | 313 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 313 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 313 |

## METEOROLOGY

### October - December
### TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 19100100-19123123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 1 | 5 | 8 | 0 | 0 | 0 | 0 | 0 | 15 |
| NNE | 0 | 0 | 0 | 4 | 8 | 106 | 251 | 8 | 0 | 0 | 0 | 0 | 377 |
| NE | 0 | 0 | 3 | 6 | 17 | 80 | 72 | 1 | 0 | 0 | 0 | 0 | 179 |
| ENE | 0 | 0 | 0 | 8 | 9 | 8 | 7 | 0 | 0 | 0 | 0 | 0 | 32 |
| E | 0 | 0 | 0 | 2 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 11 |
| ESE | 0 | 0 | 0 | 2 | 6 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 14 |
| SE | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| SSE | 0 | 0 | 0 | 2 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 10 |
| S | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| SSW | 0 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| SW | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| WSW | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| W | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| WNW | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 1 | 0 | 0 | 0 | 0 | 9 |
| NW | 0 | 1 | 0 | 1 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 11 |
| NNW | 0 | 0 | 0 | 2 | 2 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 11 |
| TOTALS | 0 | 1 | 5 | 34 | 59 | 234 | 351 | 11 | 0 | 0 | 0 | 0 | 695 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 695 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 695 |

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

| Wind Dir | 0.22 0.5 | 0.51 0.75 | 0.76 1 | 1.1 1.5 | 1.6 2 | 2.1 3 | 3.1 5 | 5.1 7 | 7.1 10 | 10.1 13 | 13.1 18 | >18 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 0 | 1 | 2 | 10 | 22 | 30 | 18 | 0 | 0 | 0 | 0 | 0 | 83 |
| NNE | 0 | 0 | 1 | 21 | 53 | 184 | 295 | 8 | 0 | 0 | 0 | 0 | 562 |
| NE | 0 | 0 | 8 | 24 | 43 | 118 | 100 | 12 | 4 | 2 | 0 | 0 | 311 |
| ENE | 0 | 0 | 2 | 18 | 18 | 23 | 13 | 8 | 4 | 0 | 0 | 0 | 86 |
| E | 0 | 0 | 1 | 9 | 21 | 18 | 8 | 2 | 1 | 2 | 0 | 0 | 62 |
| ESE | 0 | 0 | 1 | 5 | 14 | 20 | 13 | 6 | 3 | 1 | 0 | 0 | 63 |
| SE | 0 | 0 | 2 | 7 | 9 | 30 | 33 | 19 | 9 | 0 | 0 | 0 | 109 |
| SSE | 0 | 0 | 2 | 6 | 10 | 34 | 36 | 18 | 2 | 0 | 0 | 0 | 108 |
| S | 0 | 1 | 1 | 10 | 8 | 17 | 33 | 7 | 3 | 0 | 0 | 0 | 80 |
| SSW | 0 | 1 | 4 | 14 | 18 | 20 | 15 | 5 | 7 | 1 | 0 | 0 | 85 |
| SW | 0 | 0 | 2 | 7 | 18 | 22 | 15 | 1 | 1 | 0 | 0 | 0 | 66 |
| WSW | 0 | 0 | 2 | 11 | 28 | 25 | 15 | 0 | 8 | 1 | 0 | 0 | 90 |
| W | 0 | 1 | 1 | 10 | 22 | 67 | 26 | 2 | 1 | 0 | 0 | 0 | 130 |
| WNW | 0 | 1 | 3 | 10 | 20 | 89 | 101 | 4 | 0 | 0 | 0 | 0 | 228 |
| NW | 0 | 1 | 1 | 8 | 13 | 31 | 26 | 5 | 0 | 0 | 0 | 0 | 85 |
| NNW | 0 | 0 | 0 | 10 | 9 | 27 | 13 | 1 | 0 | 0 | 0 | 0 | 60 |
| TOTALS | 0 | 6 | 33 | 180 | 326 | 755 | 760 | 98 | 43 | 7 | 0 | 0 | 2208 |

| | | | |
|---|---|---|---|
| NUMBER OF VALID HOURS | 2208 | NUMBER OF CALMS | 0 |
| NUMBER OF INVALID HOURS | 0 | TOTAL HOURS FOR THE PERIOD | 2208 |