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REBUTTAL TESTIMONY OF BILL POWERS
IN OPPOSITION TO THE APPLICATON FOR CERTIFICATION FOR THE
PALOMAR ENERGY PROJECT (01-AFC-24)

Water Resources – Rebuttal to Testimony of Joe Rowley

Pg. 4, 3rd paragraph: ACC estimated to be 300 feet wide, 300 feet long, and 100 feet high . . . .

Air-cooled condenser (ACC) vendors typically provide standard ACC heights of 100 to 120 feet. These ACC heights are completely acceptable in areas with no people where visual impacts are not an issue, as is the case with Sempra's El Dorado Plant in Nevada. However, ACC height can be optimized to 70 feet or potentially less if minimum height is a critical design criterion. For example, the ACC at Crockett Cogen is only 70 feet high, although it is sitting atop a 50-foot high building. The overall height of the ACC designed for the 540 MW Otay Mesa Project, located on the outskirts of San Diego, is just under 76 feet in height. The ACC at Otay Mesa is split into two sections. The ACC would also be split into two sections at Palomar Energy, separated by approximately 200 feet of open space, to minimize height. There is sufficient space on the Palomar site in the vicinity of the proposed location for the wet cooling tower to construct a height-optimized ACC.

Pg 5: Dry cooling is not the universal environmental and economic solution claimed by some proponents. If it was, then all new projects would be dry cooled, and obviously this is not the case.

CEC staff would apparently prefer that all new projects be dry cooled. On February 8, 2001 the Siting and Environmental Protection Committee of the CEC conducted a workshop on water issues that may constrain the licensing of future power plants in California and to discuss strategies to address these issues. The three topics discussed at the workshop included: 1) water supply and water regulations, 2) technological solutions, and 3) water policy issues.

CEC staff Recommendation D in the June 5, 2001 Water Workshop Summary (pg. 17) based on workshop discussions is:

> *Staff recommends that the Energy Commission develop and implement a policy that requires new generation to maximize water conservation measures for power plant cooling. . . Staff believes this policy (SWRCB Resolution 75-58) does not adequately address the true costs of using fresh or even potable water for power plant cooling in California. . . . For example, due to the greater capital cost and efficiency penalty associated with dry cooling , the reliance on economic criteria will almost always favor wet cooling and ignores long term reliability concerns as well as issues of protection of a limited resource.*
>
> *The greatest emphasis in such a policy should be given to the use of dry cooling because, although more expensive, dry cooling significantly reduces facilities' water demand,*

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removes a major siting constraint and ensures facility reliability during emergencies and droughts.

Pg. 5: Palomar has a 229 MW steam turbine and a 110 °F (ambient) design temperature . . .

It is unclear why the cooling system of the Palomar Energy Project would be designed assuming a 110 °F ambient temperature. Escondido typically experiences an average of one hour per year at or above 100 °F, based on 1999 – 2001 temperature data from the District's Escondido ambient monitoring station. The only power project currently permitted for construction in San Diego County is the 540 MW dry-cooled Otay Mesa Power Project. The Otay Mesa ACC is designed for a 180 MW steam turbine rating, equal to a steam flow of 1,500,000 pounds per hour. The backpressure vs. ambient temperature profile for the 28-cell Otay Mesa ACC is compared to the Escondido monitoring station temperature data below:

28-Cell ACC Performance	Escondido Temperatures		Escondido Annual Temp. Dist.	
2.0 inches Hg @ 50 °F	Annual ave.	= 61.6 °F	No. of hours ≥ 100 °F:	1
2.5 inches Hg @ 60 °F	January ave.	= 53.7 °F	No. of hours ≥ 95 °F:	10
3.0 inches Hg @ 68 °F	July ave.	= 73 °F	No. of hours ≥ 90 °F:	56
3.5 inches Hg @ 74 °F	Peak	= 101 °F	No. of hours ≥ 85 °F:	224
6.7 inches Hg @ 100 °F			No. of hours ≥ 80 °F:	634
			No. of hours ≥ 75 °F:	1,193
			No. of hours ≥ 70 °F:	1,895
			No. of hours ≥ 65 °F:	2,894
			No. of hours ≥ 60 °F:	4,451

Assuming the Palomar steam turbine is designed to maintain rated output up to a backpressure of ~ 7.0 inches Hg, which is typical for a state-of-the-art combined-cycle ACC design, the ACC would be able to maintain rated load at ambient temperatures up to slightly over 100 °F. The overall efficiency of the plant would decrease several percent at temperatures in the 100 °F range, though the MW output of the plant would be maintained. This is an important point, as during periods of peak demand the issue is generally capacity, not maximum efficiency.

Pg. 5: See Tables 1 and 2 for a summary of cooling methods employed by projects reviewed at the California Energy Commission.

Table 2 lists ten applications currently being processed, six of which are at the stage of Final Staff Assessment (FSA). These projects are Palomar, East Altamont, Morro Bay, Potrero, El Segundo, and San Joaquin. Of these six, wet cooling is the preferred alternative identified by the CEC staff in only two cases, Palomar and San Joaquin. CEC staff have recommended dry cooling at Morro Bay. CEC staff recommended dry cooling at East Altamont due to concerns over reclaimed water availability. Parallel dry/wet cooling is recommended at Potrero. A novel once-through cooling system is recommended for use at El Segundo. Sufficient reclaimed water is available from the nearby Hyperion Treatment Plant to permit circulation of up to 300,000,000 gallons/day of reclaimed water through the heat exchangers at the proposed El Segundo Power Plant. No water is lost to evaporation in this configuration, and the reclaimed water will be available for reuse. Use of reclaimed water in a once-through configuration at El Segundo is an excellent site-specific cooling approach. The use of reclaimed water at Palomar is currently in

dispute. Table 2 in no way reinforces Palomar Energy's assertion that wet cooling is the norm in current CEC siting decisions.

Pg. 8, Output and Efficiency: Dry cooling is function of ambient dry bulb temperature, which at the Palomar site can reach 110 °F on hot days. This causes steam turbine exhaust pressure to rise to relatively high levels (6.0 inches Hg absolute) which results in substantial reductions in steam turbine generator output.

As noted earlier, the typical peak annual hour temperature at the Escondido monitoring station from 1999 to 2001 was 101 °F. Steam turbines used with ACCs are typically designed to withstand a backpressure of 7 to 8 inches Hg at rated load. Assuming the ACC is properly designed, meaning backpressure will not exceed approximately 7 inches Hg at the peak site temperature, the ACC will not cause a reduction in steam turbine generator output at any time. A steam turbine designed for use with ACC is also significantly less expensive than a turbine designed for use with a conventional wet system. The reason for this is that there are fewer stages in the steam turbine designed for use with ACC. GE Power Systems estimates the cost of a steam turbine is approximately $2 million less on a hypothetical dry-cooled plant.

Pg. 11, Visual Impacts and Noise, . . . an air-cooled condenser would be about 300 feet wide, 300 feet long, and 100 feet high . . .

This is an incorrect statement and implies that dry-cooled plants such as Sempra's El Dorado Plant built in isolated areas would be built in the exact same way in the middle of an urban area. The only power plant currently permitted for construction in San Diego County is the 540 MW dry-cooled Otay Mesa Project. The overall height of the ACC at Otay Mesa is 76 feet. The plant is located on the outskirts of San Diego. An elevation view of the Otay Mesa Plant is attached. A height-optimized ACC will fit on the Palomar site based on a review of the plot plan provided in the November 2001 Application For Certification.

The 240 MW Crockett Cogeneration Plant is the only dry-cooled combined-cycle plant in California located in an urban area. The Crockett ACC uses ultra-low noise fans. The February 2002 CEC/EPRI report on cooling alternatives comments on the ACC noise level at Crockett Cogen and states:

> *In the case of the Crockett Co-Generation Plant (see Appendix C), the plant is located on the outskirts of the town of Crockett in a mixed commercial/residential area with private homes located across the street to the south. On the northern boundary are the Carquinez Straits of the San Francisco Bay, a recreational and commercial boating area. Site-specific noise limits of 50 dB at the nearest residence and at a distance of 300 ft into the Bay were imposed and met with no difficulty through the use of Alpina low-noise fans.*

Water Resources – Rebuttal to Testimony of John Hoagland

Pg. 3, . . . the second phase (9 million gallons per day) would expand tertiary treated water production capacity to 18 million gallons per day in the event of increased future demands for recycled water . . . .

Where will the City of Escondido get the grants and zero interest loans to do this? California is facing a $35 billion dollar deficit and is cutting all but essential services. The U.S. government is facing historic deficits as well. It is highly unlikely that funding that was relatively easy to obtain from the Bureau of Reclamation and the SWRCB in the late 1990s will be available in the foreseeable future for reclaimed water plant expansions. Selling reclaimed water to Palomar will stall any other significant reclaimed water project in the HARRF service area for many years to come.

Pg. 4, Palomar Energy will receive recycled water under a long-term (30-year) contract. . . . Recycled water not used by the power plant likely would flow to the ocean through the City's outfall system for the foreseeable future.

Palomar has indicated it will be paying ~$375/acre-ft for the reclaimed waster and $0/acre-ft to discharge ~0.9 Mgd of brine to the HARRF. Other users of reclaimed water in Escondido pay approximately $550/acre-ft for the reclaimed water, and generate no high volume, concentrated wastewater. Why the discrepancy in reclaimed water price? A combined $350/acre-ft in subsidies are provided by MWD and CWA for reclaimed water use that displaces potable water imports. No potable water imports will be displaced by Palomar, and clearly reclaimed water sold to Palomar would not be eligible for the displacement subsidies. However, the water could be provided essentially for free to growers that currently use potable water and provide Escondido with essentially the same revenue via the subsidies that they will receive from Palomar for the water.

The point is made that Ramona avocado growers get their reclaimed water virtually free of charge, which Escondido can not afford to do. Why not, if the net revenue realized by giving the water to growers is essentially the same as the revenue received from Palomar for the same water? Giving the water to the growers also relieves Escondido of the burden of dealing with nearly 1 Mgd of brine from Palomar.

It is my understanding that Escondido offered reclaimed water to the growers at about 80 percent of the cost of potable water. Given the uncertainties, it is not surprising that the relatively small discount did not generate much enthusiasm. Has the City polled the growers about their potential interest if the price is dropped to $375/acre-ft? 200/acre-ft? At some cost point there will be considerable interest.

The avocado groves within the city limits of Escondido can not be more than 4 to 5 miles from the HARRF. How close does the existing 25-mile network of HARRF reclaimed water pipeline get to the groves? Adding a modest pipeline construction surcharge to the reclaimed water rate

charged the growers is a straightforward way to pay for any pipeline extension necessary without burdening the city budget.

The California avocado industry is currently experiencing unprecedented profitability and growth, yet the City of Escondido dismisses it as dying industry that will soon be replaced with subdivisions. This viewpoint apparently justifies making no effort to utilize reclaimed water in the groves.

Pg. 5, I would respectfully suggest that the City of Escondido is in the best position to judge the viability and utility of various potential alternatives uses, after having studied the issue for years.

Mr. Hoagland goes on to state there is no certainty if or when the City of San Diego will move forward with the San Pasqual Valley (SPV) aquifer recharge project, based on a recent communication with the City of San Diego. Earlier Mr. Hoagland gave the following assessment of the SPV aquifer recharge project (Sempra November 12, 2002 response letter in Docket):

> *"The City of San Diego is not interested in using recycled water from any other entity for a potential recharge project in the San Pasqual area due to their need to find usage sites for the huge quantities of treated and desalted recycled water that they have available from their North City Water Reclamation Plant."*

The North City Water Reclamation Plant (NCWRP) is approximately 20 miles from the San Pasqual Valley (SPV). The HARRF reclaimed water pipeline reaches the SPV now. The City of San Diego is a part owner of the HARRF. It is highly unlikely that the City of San Diego has any plans to extend a pipeline from NCWRP to the SPV, given one of the justifications for the HARRF reclaimed water project was/is recharge of the SPV aquifer. The current Bureau of Reclamation Southern California Area Office webpage (www.lc.usbr.gov/scao/escondi2.htm) describing the Escondido regional water reclamation program states that HARRF reclaimed water will be used to recharge the SPV aquifer. The Bureau of Reclamation has contributed $17,000,000 to date to the HARRF reclaimed water project, which represents 25 percent of the total cost. The Bureau of Reclamation has also contributed more than $360,000 for planning studies to develop the SJV aquifer project.

The stated goal of Bureau of Reclamation grant funding support of the HARRF reclaimed water program is to provide reclaimed water for local water uses that would displace Colorado River water imports. Using HARRF reclaimed water as the cooling medium in a new power plant will not achieve this goal, as no new power plant can be permitted in Escondido using potable water as per existing state water policy. In addition, use of HARRF reclaimed water in the power plant will restrict the amount of reclaimed water available for legitimate potable water displacement projects, such as the SPV aquifer recharge project.

Summary - The City of Escondido indicates it can foresee no other applications for reclaimed water over the next 20 years, meaning Palomar is the only potential customer. This is despite use of reclaimed water in Ramona avocado groves and a proposed (long range) plan by the City of San Diego Water Department to inject HARRF reclaimed water into the SPV aquifer to produce potable well water. The City of San Diego Water Department indicated in July 2002 that the SPV aquifer injection project is slated for funding in 5 to 7 years. This project was deleted from

the high priority list when the Water Department did not receive a requested fee increase a few years ago that would have (in part) funded the project. Where will the reclaimed water for this project come from if PEP is under contract for 3.6 Mgd and no subsidies are available to add capacity to the HARRF reclaimed water facility? Selling reclaimed water to Palomar will essentially derail indefinitely more beneficial uses of reclaimed water.

Pg. 6, It is noteworthy that the San Diego County Water Authority, the area's water wholesaler, also is on record stating that it considers the Palomar Energy Project, an "excellent candidate" to use recycled water.

It is not clear whether the County Water Authority (CWA) was made aware by the City of Escondido that the Palomar Project would not be permitted to use potable water, and as a result use of reclaimed water will not displace potable water at this site. The CWA will provide a $100/acre-foot subsidy for each acre-ft of delivered reclaimed water that displaces an acre-ft of imported water. The purpose of this subsidy is to relieve pressure on imported water supply pipelines. It is highly unlikely that the CWA will authorize the $100/acre-ft subsidy on water sold to Palomar Energy once the CWA becomes familiar with the cooling water limitations imposed on Palomar Energy by SWRCB Resolution 75-58. It is unclear at this time if the City of Escondido has communicated with the Metropolitan Water District, which provides a $250/acre-ft subsidy for delivered reclaimed water in addition to the $100/acre-ft subsidy provided by the CWA, regarding the specifics of the Palomar case.

Air Quality – Rebuttal to Testimony of Sara Head

Pg. 8, Although ammonia is a precursor to PM_{10}, only a small portion of the Palomar Energy ammonia emissions are expected to be converted to PM_{10} in the atmosphere in the vicinity of the project.

This statement contradicts the FSA, which states that (pg. 4.1-11):

> *Data from the Escondido station does not identify the composition of local PM_{10}, but data from other stations in the San Diego Air Basin indicates that on most days with high PM_{10} concentrations, there is a greater presence of nitrate (NO^{3-}) than ammonium (NH^{4+}). Because the reactions leading to ammonium nitrate depend on the joint availability of nitrate ions and ammonium ions, the relative importance of ammonia as a precursor is not known with certainty, but if additional ammonia is available then ammonium nitrate particles would be more likely to form.*

The molecular weigh of ammonium nitrate is nearly five times that of ammonia. The applicant's current estimate of PTE ammonia emissions from the cooling tower is approximately 40 tpy. Ammonia emissions from the cooling could be considerably greater than 40 tpy, depending primarily on the pH of the circulating water (see discussion below under Public Health). Forty (40) tpy of ammonia from the cooling towers has the potential to form close to 200 tpy of ammonium nitrate in an ammonia-limited atmosphere, if all of the ammonia forms ammonium nitrate. The relative humidity needs to be above approximately 60 to 65 percent for the reaction to take place readily. Data on seasonal average relative humidity is not readily available for

Escondido. Higher humidity is generally associated with cooler months in Escondido, though high humidity conditions can occur at any time of the year.

The projected annual PM_{10} PTE emissions for Palomar are 105 tpy. Cooling tower ammonia emissions could in fact form an amount of secondary PM_{10} that is on the same scale as the current annual PM_{10} PTE emissions for Palomar. It is also important to point out that cooling tower ammonia emissions are "real" emissions, as the PTE ammonia emissions estimate is based on expected operating conditions, not a manufacturer's guarantee. This is in contrast to the ammonia slip emissions from the gas turbine NO_x control system, where actual ammonia slip levels are generally a small fraction of the manufacturer's guarantee.

Pg. 9, The cooling tower will be equipped with high efficiency drift eliminators with a guaranteed efficiency of 0.0005 percent. This means that most (99.9995%) of the drift will be eliminated and only a tiny fraction of it will be released from the cooling tower.

The percentage of drift being referred to is the percentage of the circulation water flow. Approximately 0.02 percent of total circulating water flow is emitted as drift in a cooling tower that is not equipped with drift eliminators, according to Marley Cooling Technologies, Inc. The actual guaranteed efficiency of the drift eliminators proposed by Palomar, equal to (0.020 - 0.0005)/0.020, is in the 97 to 98 percent range if the drift eliminator meets the performance guarantee in the field. No field testing of drift performance is proposed in the FSA to validate the claimed guarantee performance of 0.0005 percent or less drift.

Public Health – Rebuttal to Testimony of Donald Shilling

Pg. 5, However, because the nitrifying bacteria will reduce the amount of total ammonia/ammonium in the circulating water, the amount of ammonia available for stripping will be decreased proportionately.

Ammonia consuming nitrifying bacteria in circulating water – Isn't the point of adding copious amounts of biocide to eliminate biological activity in the circulating water? Is it reasonable to assume that a significant portion of the ammonia is being consumed by nitrifying bacteria if the biocide program is effective? Or by assuming that bacteria are quite active, aren't we implying the biocide treatment program is not particularly effective and that other bacteria, specifically Legionella bacteria, are also thriving in the circulating water? The final line of Mr. Schilling states:

> *In summary, Palomar Energy cooling system design as well as the planned rigorous operation and maintenance approach to control bacteria and biofilm buildup, will reduce to insignificance the risks associated with Legionella or other bacteria.*

If this statement is correct, how will the nitrifying bacteria significantly reducing the ammonia/ammonium concentration in the cooling water?

Pg. 5, To account for losses of ammonia/ammonium from the circulating water system due to processes other than air stripping and cooling tower blowdown, effective stripping rates ranging

from 1.5 to 5 percent can be used in estimating the ammonia emission rates, with an average of 3 percent. The average rate was used for this analysis.

This statement is confusing. What does ". . *processes other than air stripping . . .*" mean? The paragraph is exclusively discussing ammonia stripping in the cooling tower, yet this sentence states that processes other than air stripping are being addressed. No supporting documentation is provided to justify the estimated 1.5 to 5 percent ammonia stripping rate in the cooling tower. A 5 percent ammonia stripping rate is accurate for Case 6 in Table PH-B2 – full load, maximum duct fire with circulating water temperature of 90 °F. Five (5) percent is the appropriate ammonia stripping rate to use to calculate potential to emit (PTE) ammonia emissions during 2,000 hours/year of full load, maximum duct fire option. Three (3) percent may not be an accurate assumption for the stripping rate during the 6,760 hours/year at the full load, unfired operating condition (Case 5). Three (3) percent represents a simple average of the ammonia stripping rate range of 1.5 to 5 percent range. Again, no supporting documentation is provided for the three percent stripping rate estimate. Use of 3 percent may result in an underestimation of PTE ammonia emissions from the cooling tower.

PTE ammonia emissions from the cooling tower are 42 tpy if an ammonia stripping rate of 5 percent is assumed for 2,000 hours/year of Case 6 operation and 6,760 hours/year of Case 5 operation. Ammonia emissions are sensitive to the pH concentration in the tower. An increase in pH from 8.0 to 8.3 results in an approximate doubling of ammonia availability, increasing PTE ammonia emissions from 42 tpy to approximately 84 tpy.

Cooling water pH is typically in the range of 7.8 to 8.4. Is the 8.0 maximum pH that Palomar anticipates in the circulating water, or simply an expected average pH? Given the direct relationship between pH and ammonia emissions, it is important that adequate supporting documentation be provided to validate that the pH value used in the ammonia stripping calculation is conservative. Is Palomar prepared to accept a pH permit limit of 8.0?

The Health Risk Assessment (HRA) prepared by the San Diego Air Pollution Control District assumes essentially no ammonia emissions from the cooling tower. The Final Determination of Compliance prepared by the District is based on the assumption that the HRA is accurate.

It is my professional opinion that the foregoing prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

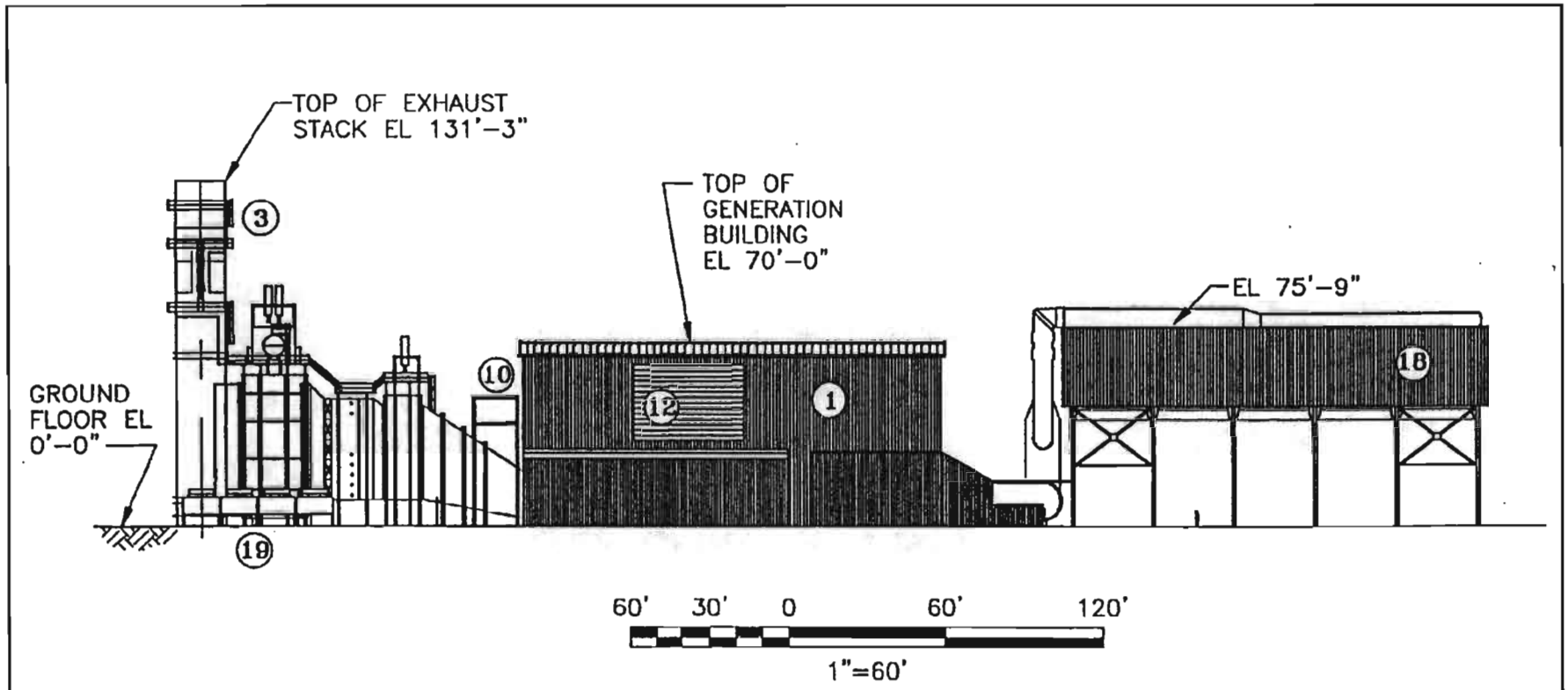
I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: March 31, 2003 Signed: Bill Powers

At: San Diego, CA

PROJECT DESCRIPTION - Figure 2
Otay Mesa Generating Project - Site Cross Section



LEGEND

1. GENERATION BUILDING
3. STACK
10. PIPE RACK
12. CT INLET AIR
18. AIR COOLED CONDENSER
19. AUXILIARY COOLING WATER HEAT EXCHANGES

SOURCE: Otay Mesa Generating Project Application for Certification Supplement (99-AFC-5), March 2000

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA

IN THE MATTER OF:	**DOCKET NO. 01-AFC-24**
APPLICATION FOR CERTIFICATION FOR THE PALOMAR ENERGY PROJECT	**PROOF OF SERVICE** *(REVISED 3/18/03)*

I, Sunita Nagin, declare that on **April 4, 2003**, I deposited copies of **BILL POWERS', REBUTTAL TESTIMONY IN OPPOSITION TO THE AFC** in the United States mail at *Sacramento, CA* with first class postage thereon fully prepaid and addressed to the following:

DOCKET UNIT

Send the original signed document plus the required 12 copies to the address below:

CALIFORNIA ENERGY COMMISSION
DOCKET UNIT, MS-4
Attn: Docket No. 01-AFC-24
1516 Ninth Street
Sacramento, CA 95814-5512

* * * *

Also send copies of all documents to:

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**Revisions to POS List, i.e. updates, additions and/or deletions.*

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I declare under penalty of perjury that the foregoing is true and correct

[signature]

**Revisions to POS List, i.e. updates, additions and/or deletions.*