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March 5, 2007
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06-AFC-4	
DATE	MAR 05 2007
RECD.	MAR 05 2007

Dr. James Reede
Energy Facility Siting Project Manager
California Energy Commission
1516 Ninth Street, MS-15
Sacramento, CA 95814-5512

RE: Data Response, Set 2A
Vernon Power Project (06-AFC-4)

On behalf of the City of Vernon, please find attached 12 copies and one original of the Data Responses, Set 2A, in response to Staff's Second Round of Data Requests dated February 2, 2007. We are also filing copies of this Data Response electronically.

Please call me if you have any questions.

Sincerely,

CH2M HILL

John L. Carrier, J.D.
Program Manager

c: Project File
Proof of Service List

VERNON POWER PLANT
(06-AFC-4)

DATA RESPONSE, SET 2A

(Responses to Data Requests: Public Health and Transmission System Engineering)

Submitted by

City of Vernon

March 5, 2007

CH2MHILL

2485 Natomas Park Drive, Suite 600
Sacramento, California 95833-2937

VERNON POWER PLANT
(06-AFC-4)
DATA RESPONSES, SET 2A

Technical Area: Public Health
Author: Obed Odoemelam

BACKGROUND

Various epidemiological, clinical and SCAQMD studies show the background health risks from elevated levels of environmental pollution to be relatively high for the area around the proposed project which includes several densely populated communities (e.g., Maywood, Huntington Park, Southgate, and Commerce). The applicant noted in this regard (on pages 8.8-5 and 8.8-6 of the Application for Certification) that no additional housing is planned for the City of Vernon to reflect its pollution-related unsuitability for such purposes.

DATA REQUEST

49. Given the high incidence of pollution-related exposures in the cities (e.g., Maywood, Huntington Park, Southgate, and Commerce) in the project's immediate area, please provide a detailed assessment of the City of Vernon stationary source contributors to the high levels of the area's environmental pollutants.

    a) Discuss whether the residential communities surrounding Vernon have a disproportionate level of health problems such as respiratory impairment/diseases when compared with the greater Los Angeles region.

Response: Residential communities surrounding the proposed project site include Maywood, Huntington Park, South Gate and Commerce. Estimated populations for these communities, obtained from the 2000 Census, and the approximate locations relative to the project site are:

- Maywood: population of 28,000; the city's center is located approximately 1.7 miles east of the proposed project site.
- Huntington Park: population of 61,300; the city's center is located approximately 1 mile south of the proposed project site.
- South Gate: population of 96,400; the city's center is located approximately 2.7 miles south of the proposed project site.
- Commerce: population of 12,600; the city's center is located approximately 3 miles east of the proposed project site.

An analysis was conducted to evaluate the possible disproportionate mortality and morbidity within the geographical area that includes the residential communities surrounding Vernon. This analysis is based on statistics collected by the Los Angeles County Department of Public Health (LADPH). These statistics do not show a disproportionately increased level of disease burden from cancer or respiratory disease (such as asthma) in the residential communities surrounding Vernon compared with Los Angeles County at large.

According to data compiled by the Los Angeles County Depart of Public Health (LADPH) (http://lapublichealth.org/), these communities fall within the San Antonio Health District (Maywood, Huntington Park and South Gate) or the East Los Angeles Health District (Commerce). Both are within the LADPH Service Planning Area (SPA) 7 (http://www.lapublichealth.org/spa7/), shown in Figure PH49-1. According to the SPA 7 health profile (LADPH, 2000), the San Antonio Health District is approximately 80 percent Latino. The East Los Angeles Health District is approximately 88 percent Latino.

Data provided by the LADPH were examined to identify morbidity and mortality trends in these communities and in different ethnicities in Los Angeles County. The disease burden in SPA 7 for health problems that might be affected by air pollutant emissions from the proposed facility, such as cancer and chronic lower respiratory disease, closely resembles the burden for all of Los Angeles County, and in some cases, the burden is lower in SPA7 than it is for the County as a whole. Trends in cancer mortality in Los Angeles County and SPA 7 from 1991 to 1999 (LADPH, 2002) are shown in Figure PH49-2.

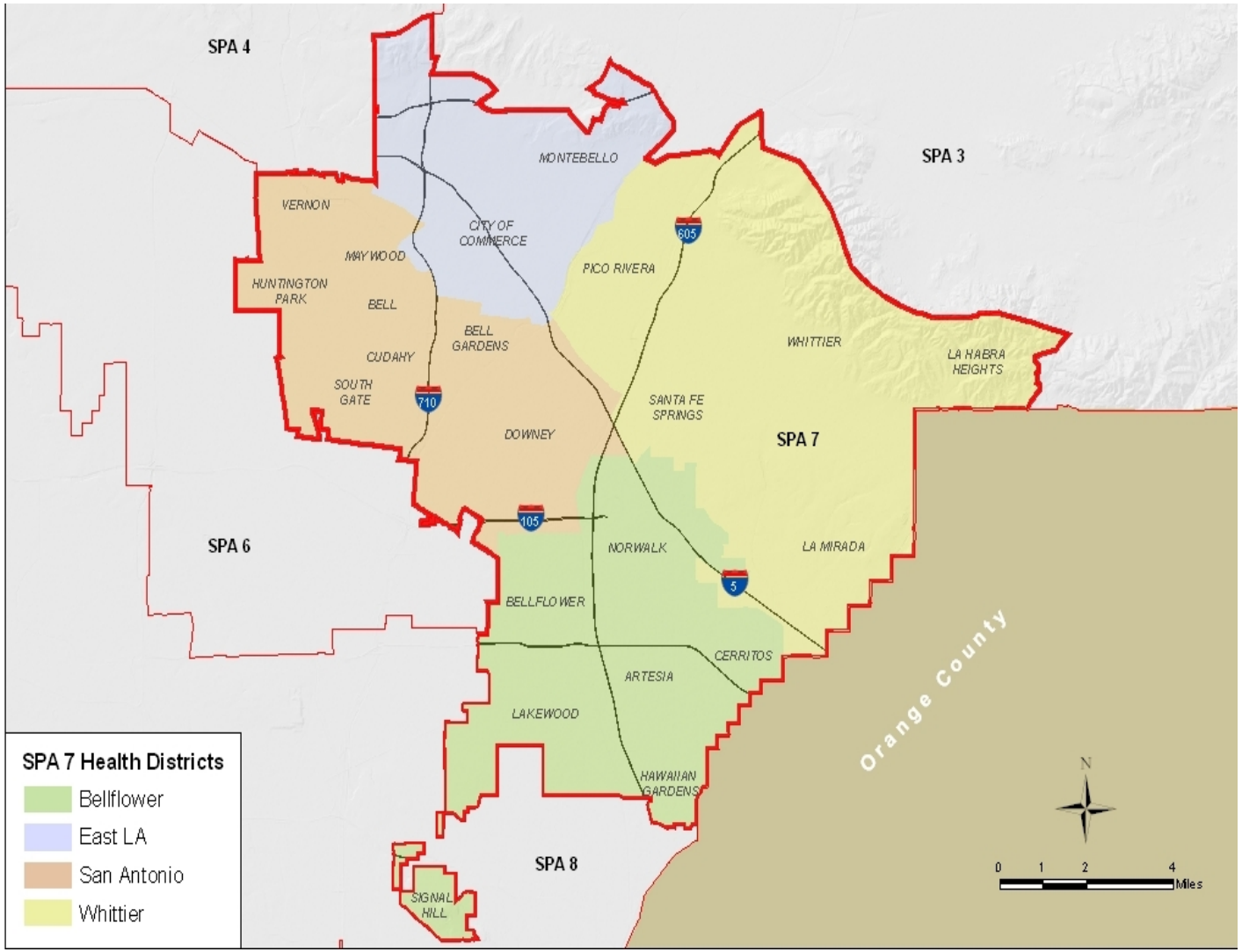

Figure PH49-1. Service Planning Area (SPA) 7, Los Angeles County Department of Public Health

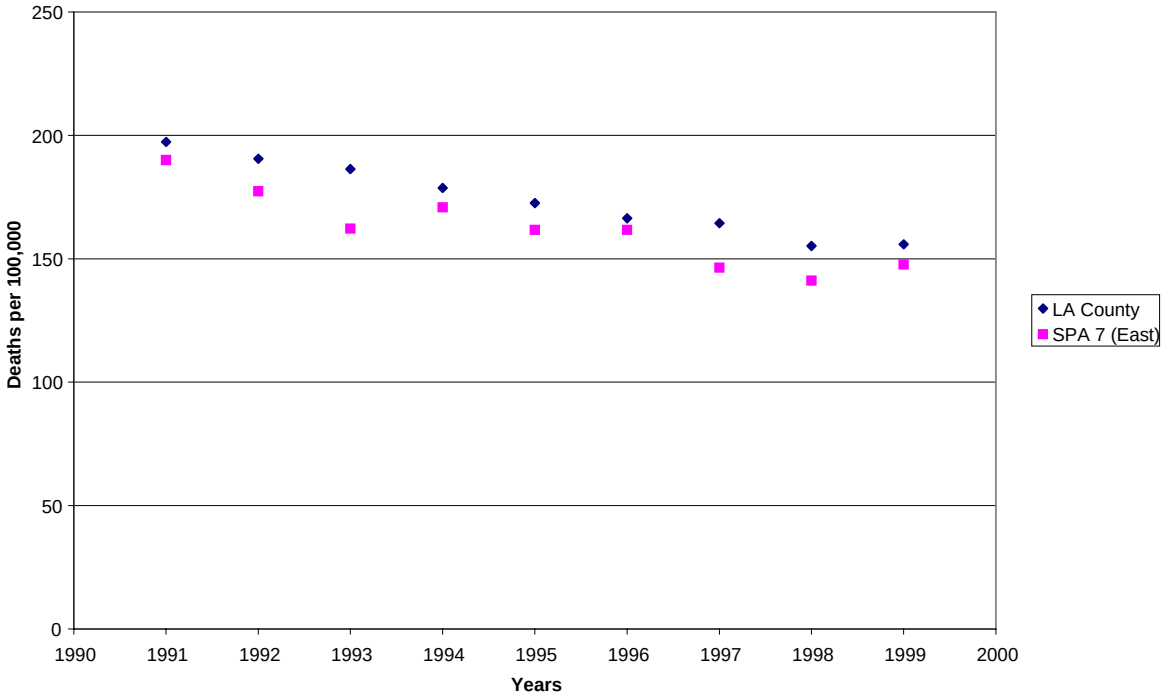

Figure PH49-2. Cancer Mortality in LA County and SPA 7, 1991 to 1999

As presented in Figure PH49-2, trends in cancer mortality in SPA 7 are lower than the trends for Los Angeles County. Statistics for mortality from specific cancers in health districts in Los Angeles County and SPA 7 for 1999 (LADPH, 2000) are presented in Figure PH49-3.

As can be seen from Figure PH49-3, mortality for these selected cancers in the SPA 7 health districts, which contain the communities of Huntington Park, South Gate, Maywood and Commerce, is similar to Los Angeles County, with the possible exception of prostate cancer mortality in the East LA Health District, which includes the City of Commerce. The prostate cancer mortality in the East LA Health District is slightly higher compared with Los Angeles County.

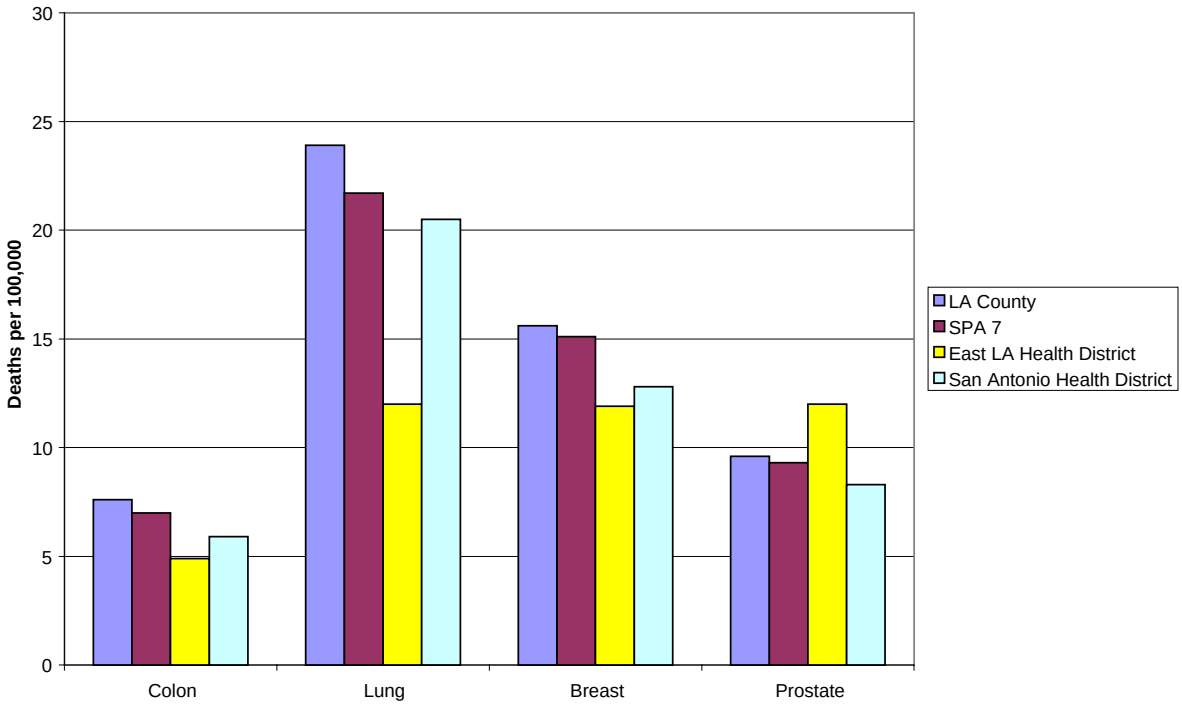

Figure PH49-3. Mortality from Selected Cancers, LA County and SPA 7 (1999)

Trends in chronic lower respiratory disease (CLRD) in Los Angeles County and SPA 7 from 1991 – 1999 are shown in Figure PH49-4. As shown in Figure PH49-4, the mortality from CLRD in SPA 7 in the early 1990s was slightly higher than Los Angeles County. However, after 1994, the trends in SPA 7 were either similar to, or lower than, the trends for Los Angeles County. In addition, mortality in Los Angeles County from CLRD increased 2.8 percent from 1991 to 1999. During the same time period, mortality from CLRD in SPA 7 decreased 10.8 percent.

According to the Los Angeles County Health Survey in 2002 – 2003, the overall occurrence of asthma in children under the age of 17 was 8 percent (LADPH, 2004). The prevalence of childhood asthma in the East LA and San Antonio Health Districts was 6 percent and 8.4 percent, respectively.

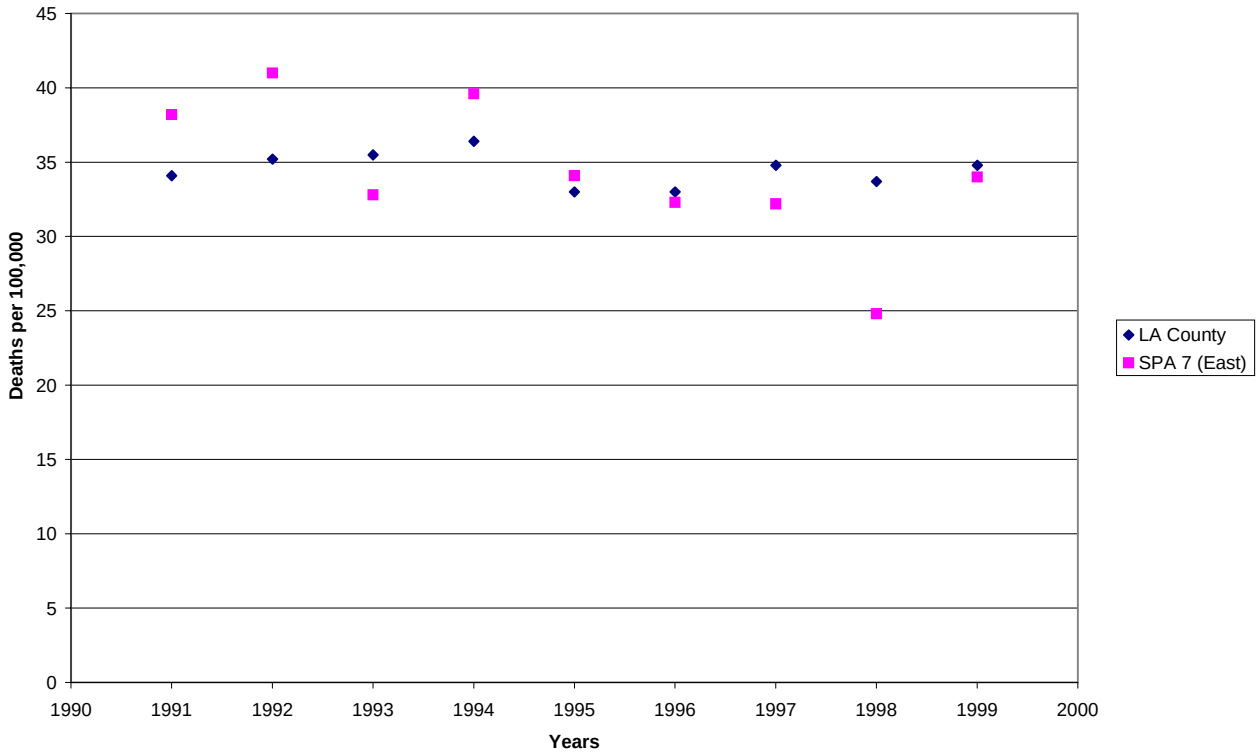

Figure PH49-4. Trends in Chronic Lower Respiratory Disease in LA County and SPA 7, 1991 - 1999

Sources:

Los Angeles County Department of Public Health (LADPH). 2000. SPA 7 Health Profile Report. http://www.lapublichealth.org/spa7/docs/spa7report31.pdf

Los Angeles County Department of Public Health (LADPH). 2002. Vital Statistics: Mortality Trends in LA County, 1991 – 1999. http://lapublichealth.org/dca/reports/aadr/addrtoc.htm. Cancer: http://lapublichealth.org/dca/reports/aadr/aadrxls/aar-cancerweb.htm. Chronic Lower Respiratory Disease: http://lapublichealth.org/dca/reports/aadr/aadrxls/aar-CLRDweb.htm.

Los Angeles County Department of Public Health (LADPH). 2004. Health Survey: Childhood Asthma. October 2004. http://lapublichealth.org/wwwfiles/ph/hae/ha/childasthmabrief_1004.pdf. Survey data presented at: http://www.lapublichealth.org/ha/survey/ha03ch_topics_asthma.htm

b) Please identify studies of the public health problems in the surrounding communities of Maywood, Huntington Park, Southgate, and Commerce and identify those problems which could be exacerbated by the project's air emissions.

Response: Public health studies that are relevant to potential impacts from the project emissions on the communities are discussed below. In each case, the potential impacts identified in these studies were evaluated in light of the maximum projected impacts associated with emissions from the proposed project. Furthermore, it should be noted that the Applicant prepared the toxic air contaminant emissions estimates in a way that overstates the potential health impacts of the project. For instance, the combustion turbines were assumed to operate at the highest heat input rate for every hour of every day of the year, with the duct burners operating for a total of 5,000 hours per year as well, reflecting an operating profile that cannot occur. Furthermore, the cooling tower was assumed to operate at the maximum rate for every hour of every day of the year, which would not be practicable or reasonable during cooler weather conditions. These assumptions also do not reflect the need for scheduled outages of the plant for preventative maintenance or unscheduled outages due to equipment failures, which typically reduce plant availability from 8 to 14 percent of the year. As such, the toxic air contaminant emissions estimates used in the VPP project's public health analysis significantly over predict public heath impacts.

The conclusion from this public health study review is that health problems identified for these communities would not be exacerbated by the project's air emissions. These studies are as follows:

Children's Health Study. A primary study of public health problems that could be exacerbated by emissions from the proposed project is the Children's Health Study (CHS) (Peters, 2004). The CHS examined 6,000 children from 12 communities across the South Coast Air Basin, over a period of several years. Pollutants measured in each community were criteria pollutants, including particulate matter (measured as PM_{10} and $PM_{2.5}$, elemental and organic carbon, metals, and ions), ozone, and nitrogen dioxide. Acid vapor also was monitored. Toxic air pollutants were not addressed as part of the CHS. The CHS concluded that ambient levels of criteria pollutants in the South Coast Air Basin may be associated with respiratory health effects on children, including reductions in lung function and increased occurrence of asthma symptoms. The CHS provides substantial discussion of how the proximity to roadways and how mobile source emissions contribute to criteria pollutant exposure and the observed respiratory health effects. As shown below in Data Response 51, emissions from the proposed facility are not likely to produce a significant cumulative effect on respiratory health. The chronic hazard indices predicted in each of the communities are less than 2 percent of the threshold for noncancer health effects, including respiratory effects. This is a conservative analysis of the potential respiratory health risks associated with emissions from the proposed facility.

Asthma Symptoms in Hispanic Children and Daily Ambient Exposures to Toxic and Criteria Air Pollutants (Delfino et al., 2003). This was a study of 22 Hispanic children with asthma who were 10 to16 years old and living in a Los Angeles community with high traffic density. Subjects were recruited within a 2.6-mile radius study area in the Huntington Park region (Huntington Park, Maywood, Bell, South Gate, and Florence-Graham). Pollutants evaluated in this study included ambient hourly values of ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide; and 24-hour values of volatile organic compounds (VOCs) , particulate matter with aerodynamic diameter < 10 µm (PM_{10}) , and elemental carbon (EC) and organic carbon (OC) PM_{10} fractions. Positive associations with asthma symptoms were observed with criteria pollutant concentrations. Positive associations with asthma symptoms also were observed for VOCs associated with petroleum combustion, such as mobile source emissions (such as benzene, toluene, ethylbenzene and xylenes, and formaldehyde), and one VOC associated with stationary source emissions (tetrachloroethylene, associated with dry cleaners).

With the exception of tetrachloroethylene, emissions of VOCs associated with stationary sources were not associated with the occurrence of asthma symptoms. Personal exposures to the VOCs are thought to be strongly associated with motor vehicle emissions. In addition there is a correlation between VOCs from motor vehicle emissions exposures and criteria pollutants, such that it is not clear that VOCs emitted from motor vehicles are independently associated with the occurrence of asthma symptoms. In addition, with the exception of formaldehyde, there are no clearly identified mechanisms of respiratory effects for the other VOCs. Potential respiratory health risks from formaldehyde emissions from the proposed facility were predicted at each of the communities, as shown in Data Response 51. Based on that analysis, there is little likelihood that emissions from the VPP will produce cumulative adverse respiratory health effects, because the highest estimated exposures from the VPP emissions to the surrounding communities are 2 percent or less of a level that might pose respiratory health risks to the most sensitive individuals (young children and the elderly).

Childhood Cancer Incidence Rates and Hazardous Air Pollutants in California: An Exploratory Analysis (Reynolds et al., 2003). This study was an exploratory analysis of whether childhood cancer rates are elevated in census tracts estimated to have high exposure to potentially carcinogenic toxic air pollutants. Toxic air pollutant exposures were based on modeled concentrations developed by the U.S. Environmental Protection Agency (USEPA), as part of its National Air Toxics Assessment (NATA). The results from this study indicated that elevated risks of some childhood cancers might be associated with elevated exposures to toxic air pollutants. These results, which were developed on a census-tract level basis, cannot be extrapolated to individual communities. In addition, the study design was for an ecological study; these kinds of studies may be useful for identifying associations between risk factors and disease that should be investigated further, but they rarely provide specific answers regarding the causes of disease. As discussed below, the estimated cancer risks associated with toxic air pollutants in the South Coast Air

Basin have been characterized in the Multiple Air Toxics Exposure Study (MATES-II) (SCAQMD, 2000). Cancer risks from project emissions, which were estimated in the individual communities, are compared with the results from the MATES-II study as discussed below.

Risk-based maps have been developed by the South Coast Air Quality Management District (SCAQMD), Cumulative Impacts Working Group (SCAQMD, 2004). While these maps, which are based on the results of the MATES-II study, do not represent actual health outcomes associated with potential exposure to toxic air pollutants, they provide an indication of the differences in estimated risks at different locations within the South Coast Air Basin. These maps indicate that the census tracts containing these communities are associated with estimated lifetime cancer risks of greater than 1,500 in one million from all sources (mobile and stationary sources) of toxic air pollutants. The results of the MATES-II study indicated that motor vehicles and other mobile sources of air pollution are the predominant source of cancer-causing toxic air pollutants in the Basin, and that the largest contributor to total cancer risk was from diesel particulate emissions. The highest cancer risk estimated from VPP emissions in all of the communities is 0.4 in one million (see Data Response 51). Therefore, it is unlikely that emissions from the proposed project would result in a cumulative increase in cancer risks in the surrounding residential communities. Furthermore, the VPP project is not expected to emit significant quantities of diesel particulate matter, since the combustion turbines are exclusively natural gas fired and the only diesel fuel being used at the project site is for the emergency diesel fire pump.

Local Variations in CO and Particulate Air Pollution and Adverse Birth Outcomes in Los Angeles County, California, USA (Wilhelm, M and B. Ritz, 2005). This study evaluated the possible association between adverse pregnancy outcomes (low birth weight and preterm birth) in the South Coast Air Basin and exposure to elevated concentrations of carbon monoxide and PM_{10}. It represented a continuation of previous studies that evaluated the association between mobile source emissions and adverse pregnancy outcomes. Adverse effects potentially associated with particulate matter exposure were thought to be related to the sorption of toxic substances, such as polycyclic aromatic hydrocarbons (PAHs), onto the particles. According to Cal-EPA, PAHs can cross the placental barrier, and prenatal exposure to PAHs may be associated with adverse reproductive outcomes in humans (OEHHA, 2001). Wilhelm and Ritz, 2005 do not show ambient concentration data for PAHs. However, a different study of PAH exposures and pregnancy outcomes in women in New York City did measure PAH concentrations in air. In that study, elevated PAH exposures were associated with low birth weight; the total PAH concentrations measured in air averaged 3.7 nanograms per cubic meter[1] (ng/m^3), and ranged from 0.36 to 36 ng/m^3 (Perera et al., 2003). The California Air Resources Board (ARB, 2007) publishes ambient air monitoring data for toxic air pollutants in

[1] One nanogram weighs a billion times less than one gram.

the South Coast Air Basin, including PAHs. Total PAH concentration[2] in downtown Los Angeles in 2004 averaged 0.72 ng/m^3. The maximum total PAH concentrations modeled in air (annual average) at the individual communities are 2 to 3 orders of magnitude smaller than typical PAH concentrations measured in air in downtown Los Angeles:

- Huntington Park – 0.00019 ng/m^3
- Maywood – 0.00021 ng/m^3
- Commerce – 0.0013 ng/m^3
- South Gate – 0.00009 ng/m^3

The existing concentrations of PAHs in air (resulting largely from motor vehicle emissions) would not be noticeably affected by the PAHs emitted from the VPP. Therefore, PAH emissions from the facility would not have an influence on pregnancy outcomes potentially associated with particle-bound PAHs in air.

Sources:

Air Resources Board (ARB). 2007. Annual Toxics Summary by Monitoring Site. http://www.arb.ca.gov/adam/toxics/sitesubstance.html. Accessed March 5, 2007

Delfino, R.J. et al. 2003. Asthma Symptoms in Hispanic Children and Daily Ambient Exposures to Toxic and Criteria Air Pollutants. *Environmental Health Perspectives*. 111: 647-656. http://www.ehponline.org/members/2003/5992/5992.html

Office of Environmental Health Hazard Assessment (OEHHA). 2001. *Prioritization of Toxic Air Contaminants – Children's Environmental Health Protection Act, Final Report. Appendix C-1: Polycyclic Organic Matter.* California Environmental Protection Agency. http://www.oehha.ca.gov/air/toxic_contaminants/SB25finalreport.html.

Perera, F.P. et al. 2003. Effects of Transplacental Exposure to Environmental Pollutants on Birth Outcomes in a Multiethninc Population. *Environmental Health Perspectives.* 111: 201-205. http://www.ehponline.org/members/2003/5742/5742.html

Peters, J.M. et al. 2004. *Epidemiologic Investigation to Identify Chronic Effects of Ambient Air Pollutants in Southern California.* Prepared for the California Air Resources Board and the California Environmental Protection Agency, Contract No. 94-331. http://www.arb.ca.gov/research/chs/chs.htm

Reynolds, P. et al. 2003. Childhood Cancer Incidence Rates and Hazardous Air Pollutants in California: An Exploratory Analysis. *Environmental Health Perspectives*. 111: 663-668. http://www.ehponline.org/members/2003/5986/5986.html

[2] Summed from the concentrations of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzi(g,h,i)perylene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene detected from the Los Angeles air monitoring station, located on 1630 North Main Street http://www.arb.ca.gov/adam/toxics/sitesubstance.html.

South Coast Air Quality Management District (SCAQMD). 2000. Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES-II). http://www.aqmd.gov/matesiidf/matestoc.htm

South Coast Air Quality Management District (SCAQMD). 2004. Cumulative Impacts Working Group Maps. http://www.aqmd.gov/rules/CIWG/maps.html

Wilhelm, M. and B. Ritz. 2005. Local Variations in CO and Particulate Air Pollution and Adverse Birth Outcomes in Los Angeles County, California, USA. *Environmental Health Perspectives.* 113: 1212-1221. http://www.ehponline.org/members/2005/7751/7751.html

50. Please explain what mitigation would be undertaken to prevent further introduction of project-related pollutants at levels that could exacerbate the surrounding communities' health situation and cumulative impacts.

Response: As set forth in previous responses, project related emissions are not expected to exacerbate negative health impacts in the surrounding communities. Nevertheless, the Applicant will mitigate any potential impacts associated with air emissions by employing the best available air pollution control technologies on project equipment, and providing emission offsets to reduce the overall air pollution burden in the air basin.

BACKGROUND

The South Coast Air Quality Management District's MATES-II report, dated March 2000, identified Huntington Park and adjacent communities as having the highest Cancer and Non-Cancer Risks in the air basin from toxic air contaminants from all sources (i.e., both stationary and mobile). The Hotspots Analysis and Reporting Program (HARP) health risk assessment in the AFC does not reflect information regarding the surrounding communities (e.g., Maywood, Huntington Park, Southgate, and Commerce).

DATA REQUEST

51. Please revise the HARP health risk assessment to reflect the potential impacts to the surrounding communities of Maywood, Huntington Park, Southgate, and Commerce.

Response: Concentrations in ambient air in the surrounding communities associated with potential emissions from the proposed project were estimated using the SCAQMD-approved HARP software package. Selection of the receptors that reflect the locations of these communities, and the results from the revised human health risk assessment, are presented in Table PH50-1. Also included in Table PH50-1 is VPP's maximum residential risk as presented in Section 8.6 of the AFC.

TABLE PH50-1
Vernon Health Risk Analysis Impacts on the Surrounding Communities

Community	Location (lat/long)	HARP Receptor Number	Cancer (per million increase risk)	Chronic Health Hazard Index	Acute Health Hazard Index
VPP3 AFC (MEIR)	See AFC Appendix 8.6C	---	0.568	0.0222	0.0544
Huntington Park	33.982N 118.224W	38053	0.0805	0.00308	0.0206
Maywood	33.987N 118.186W	24758	0.0854	0.00328	0.0251
Bell	33.978N 118.186W	41587	0.0166	0.000727	0.0255
Commerce[1]	34.001N 118.159W	24522	0.402	0.0192	0.0273
East LA[2]	34.024N 118.174W	7035	0.0462	0.00229	0.0370
South Gate[3]	339.955N 118.211W	46736	0.0297	0.00131	0.0260

1. The Commerce Community HRA receptor is the receptor nearest the community centroid in the existing AFC modeling grid.
2. The East LA Community HRA receptor is the receptor nearest the community centroid in the existing AFC modeling grid..
3. The South Gate Community HRA receptor is the receptor nearest the community centroid in the existing AFC modeling grid.

As shown in Table PH50-1, the highest estimated cancer risk in the surrounding communities associated with the project (0.4 in one million) was predicted by the HARP model to occur in the City of Commerce. The highest chronic hazard index associated with the project (less than 0.02) also was assumed to occur in the City of Commerce. These values are lower than the risks projected for maximum exposed individual for the proposed project. The acute hazard indices in the surrounding communities are slightly higher than the VPP project's maximum exposed individual, but are still well below a level of significance. As discussed in the Public Health section of the AFC (Section 8.6). Lifetime cancer risks less than 10 in a million are unlikely to represent public health impacts that require additional air pollution control applied to facility emissions. Noncancer hazard indices less than one also are unlikely to represent public health impacts that require additional air pollution control applied to facility emissions. Further discussion of the potential cumulative impact of these results is presented in Data Response 49.

VERNON POWER PLANT
(06-AFC-4)
DATA RESPONSES, SET 2A

Technical Area: Transmission System Engineering
Author: Ajoy Guha, P.E.; Mark Hesters

BACKGROUND

Staff needs to determine the system reliability impacts of the project interconnection and to identify the related support facilities needed. The interconnection must comply with the Utility Reliability and Planning Criteria, North American Electric Reliability Council (NERC) Planning Standards, NERC/Western Electricity Coordinating Council (WECC) Planning Standards, and California Independent System Operator (CAISO) Planning Standards. In addition the California Environmental Quality Act (CEQA) requires the identification and description of the "direct and indirect significant effects of the project on the environment."

For compliance with planning and reliability standards and identification of indirect or downstream transmission impacts, staff relies on the System Impact and Facilities Studies as well as review of these studies by the agencies responsible for insuring the interconnecting grid meets reliability standards; in this case, Southern California Edison (SCE) and CAISO. The studies analyze the effect of the proposed project on the ability of the transmission network to meet reliability standards. When the studies determine that the project will cause the transmission system to violate reliability requirements, the applicant and SCE identify, and CAISO approves, the potential mitigation options, or upgrades required to bring the system into compliance are identified.

After reviewing the System Impact Study (SIS) and its addendum dated November 15, 2006 performed by SCE and the Data Adequacy (DA) Response Supplements A & B dated August & September, 2006, staff observes the following:

SCE's November 15, 2006 SIS, identified contingency (N-1) overloads on each circuit of the proposed new double circuit 230 kV interconnecting line between the VPP switchyard and the SCE Laguna Bell 230 kV substation for 914 megawatts (MW) full generation output from the VPP. A new interconnection in which the system could lose over 900 MW of the VPP generation when a single circuit is lost may compromise system reliability.

The short circuit study results indicate that thirteen circuit breakers in the SCE system would exceed fault duties due to the addition of the VPP, but there is no mention of the substations where the circuit breakers would need replacement or upgrades. Staff needs this information to assess the complete effects of the project, including system reliability impacts.

DATA REQUEST

52. Please identify the location of SCE substations where the circuit breakers would need replacement or upgrades required for the operation of the VPP and their expected installation date.

Response: The thirteen breakers identified in the draft 304 MW Increase System Impact Study are located at the Lighthipe substation. This is reported on page 23 of the draft study under the heading "scope of work." The Applicant has asked SCE to identify the specific breakers that need to be upgraded. These 13 breakers will be in addition to the two breakers that were identified at Laguna Bell in the 610 MW study. These were identified as breakers 6S012 and 4N102 at Laguna Bell.

Applicant is not convinced that it is responsible for the upgrade or replacement of these breakers. Applicant has commented on this to SCE and CAISO and is working to confirm the draft results or correct them.

Any of these changes are to terminal equipment in existing substations and therefore would have negligible impact on the environment. To the extent that there is an impact, it is likely to be positive since old equipment will be upgraded or replaced by new equipment. For example one would expect significantly fewer oil or SF6 leaks from a new or upgraded breaker than with older equipment.

Installation of upgraded breakers would occur prior to the operation of the plant. The draft SIS states that:

> "The transmission schedule would be the controlling element of the Project. All other elements would be well within the 30-Month time frame…"

Thus, upgrade and replacement of any necessary breaker would occur prior to operation of the Vernon Power Plant.

BACKGROUND

The SIS performed by SCE with 914 MW net generation output from the proposed VPP for 2009 summer peak and light spring system conditions identified the following new overloaded facilities under single contingency conditions:

a. Vernon Power Plant-Laguna Bell 230 kV Line/Circuit #1.

b. Vernon Power Plant-Laguna Bell 230 kV Line/Circuit #2.

These facilities are the interconnection of the proposed VPP to the existing transmission network and have been proposed in the AFC (Section 5.2.2.2, Figure 5.2-2) as a new double circuit interconnection line with 2-1033 kcml 'Curlew' ACSR conductor.

DATA REQUEST

53. Please verify the thermal rating of each circuit of the proposed line under normal and emergency contingency conditions for full 914 MW generation output from the VPP.

Response: The draft System Impact Study is using the wrong rating for the proposed 2-1033 kcmil "Curlew" ACSR conductor. According to SCE's documentation, the rating for this conductor for each circuit would be 2,480 amps under normal conditions and 2,850 amps under emergency conditions, so each circuit is capable of carrying the entire

plant output. The draft study presumes 1,973 amps for the ratings and incorrectly lists the tie as overloaded during contingencies. The confusion is the result of a previous study for a plant with only 610 MW of output. Applicant has no intention of building an undersized direct connection and is working with SCE and CAISO to correct the final report. For reference, a table of SCE's "Transmission Line Conductor Thermal Ratings" that was provided to Applicant in a study review meeting is provided as Attachment TSE-53.

BACKGROUND

The SIS performed by SCE with 914 MW net generation output from the proposed VPP for 2009 summer peak and light spring conditions identified the following SCE facilities where pre-project overloads under various contingencies are exacerbated by the addition of the VPP:

a. Lighthipe-Mesa 230 kV line (for N-1 & N-2 contingencies).

b. Hinson-Lighthipe 230 kV line (for N-2 contingencies).

c. Hinson-Del Amo 230 kV line (for N-2 contingencies).

d. Mesa-Redondo 230 kV line (for N-2 contingencies).

e. Lighthipe-Long Beach 230 kV line (for N-2 contingencies).

DATA REQUEST

54. Please identify and describe the mitigation measures that would eliminate the overloads on each of the above lines and provide a report or letter from SCE documenting these mitigation measures. The description should include the SCE planned transmission project number, the expected date of operation, and whether or not the project has the CAISO approval.

Response: None of these impacts are attributable to the Vernon Power Plant. The revision of the draft study dated January 31, 2007 and released to the City of Vernon for comment states:

> "Most of the overloads identified in this study had been identified in the VPP 610 MW SIS, VPP 610 MW Sensitivity Study and all were triggered by changes in system condition and configuration. SCE will evaluate the risk in the Annual Transmission Expansion Plan and proposed upgrade projects as needed. The VPP Expansion Project will not be responsible for the upgrade of these facilities."

The System Impact Study and the subsequent Facilities Study will be the basis for an Interconnection Agreement, which is a contract including all the facilities that will be required for the applicant to interconnect to the grid. The CAISO/SCE System Impact Study is the "report or letter" documenting the grid facilities needed to describe the facilities required to interconnect the Vernon Power Plant.

While Applicant is not responsible for any of these upgrades, as a matter of prudence it is sensitive to grid operational issues, if only to ensure and promote the value the proposed plant will have once connected to the grid. Of the impacts listed

above, the limitation on the Lighthipe-Mesa 230 kV and the Hinson-Del Amo 230 kV lines are due to "wave traps," which are terminal equipment and can easily be removed. While not yet confirmed, Applicant believes that the Mesa-Redondo 230 kV line is also a wave trap or another piece of terminal equipment. The remaining two overloads are attributed to another project in the CAISO queue. If this project(s) is not built then there is no adverse impact on these lines. If it is built, then those projects will be responsible and these impacts will be reviewed by the appropriate agency, perhaps the CEC, as a part of the application process for the responsible projects.

Finally, Applicant notes that these impacts are virtually all N-2 or Category C impacts. The mitigation for these impacts has traditionally allowed for load and generation dropping as long as cascading outages do not result. While Applicant does not object to more stringent criteria, if more stringent criteria are applied it should be demonstrated that there are no existing violations before the criteria is applied to new applicants.

BACKGROUND

The SIS provided by Commonwealth Associates includes a power flow analysis for system impacts in the LADWP area under 2009 normal and contingency conditions in the SCE system. It identifies several facilities in the LADWP area where the pre-project overloads are exacerbated by the addition of the VPP. For example, the SIS results indicate the following overloaded facilities:

a. St. John-Atwater 230 kV line (under normal conditions).

b. Olympic-Tarzana 230 kV line (under normal conditions).

c. Victorville 500/287 kV transformer (under N-2 contingencies).

The SIS results include the contingencies in the SCE system only but does not identify mitigation measures for the overloaded facilities.

DATA REQUEST

55. Please submit a complete power flow analysis report under normal and probable N-1 & N-2 contingencies in both the LADWP & SCE areas.

Response: The CAISO supervised System Impact Study (SIS) provides the complete power flow analysis under normal (Category A) and probable Category B (N-1) and Category C (N-2) conditions for the California grid. The CAISO/SCE SIS includes all power flow conditions normally studied by CAISO and SCE engineers. A draft version of this study has been provided to the CEC. Review of this study will reveal that it includes relevant contingencies from the entire grid including Victorville to Lugo 230 kV. Regional 500 kV was studied as a part of the "post transient" study. Regional interties selected by CAISO/SCE for this study included:

N-1 Contingencies

1. BEP2500 - Devers 500-kV line
2. BEP2500 – Midpoint 500-kV line

3. BEP2500B – BEP2500 500-kV line
4. Calpine – Valley 500-kV line
5. Devers – Midpoint #1 500-kV line
6. Devers – Midpoint #2 500-kV line
7. Devers – Valley 500-kV line
8. El Dorado–Lugo 500-kV line
9. El Dorado – Mohave 500-kV line
10. Lee Lake – Serrano 500-kV line
11. Lee Lake – Valley 500-kV line
12. Lugo – Mira Loma #2 500-kV line
13. Lugo – Mira Loma #3 500-kV line
14. Lugo – Mohave 500-kV line
15. Lugo – Rancho Vista 500-kV line
16. Lugo – Victorville 500-kV line
17. Lugo – Vincent #1 500-kV line
18. Lugo – Vincent #2 500-kV line
19. Midway – Vincent #1 500-kV line
20. Midway – Vincent #2 500-kV line
21. Midway – Vincent #3 500-kV line
22. Mira Loma – Serrano 500-kV line.
23. Rancho Vista – Serrano 500-kV line
24. Rancho Vista – TOT128 #1 500-kV line
25. Rancho Vista – TOT128 #2 500-kV line

N-2 Contingencies
26. Lugo – Mira Loma #2 & #3 500-kV lines
27. Lugo – Vincent #1 & #2 500-kV lines
28. Lugo – Rancho Vista 500-kV line & Lugo – Mira Loma #2 500-kV line
29. Rancho Vista – Serrano 500-kV line & Mira Loma – Serrano 500-kV line
30. Midway – Vincent #1 & #2 500-kV lines
31. Devers – Midpoint #1 500-kV line & Devers – Valley 500-kV line
32. Lugo – Mohave 500-kV line & Lugo – Mira Loma #2 500-kV line
33. Lugo – Mohave 500-kV line & Lugo – Mira Loma #3 500-kV line
34. Lugo – Vincent #2 500-kV line & Lugo – Victorville 500-kV line
35. Lugo – Vincent #2 500-kV line & Midway – Vincent #3 500-kV line

The latest draft of the SIS provided by CAISO and SCE to Applicant for its comments is provided for reference as Attachment TSE-55.

The CAI study used the contingency list provided by SCE. The impacts listed above under background are included in the automatically generated listing from the Appendix C of the CAI Study. These were not discussed in the body of the report because they were dismissed as no impacts by the analyst. These were dismissed because they were found to be caused by dispatch and other changes, not the addition of the Vernon Power Plant. The CAISO/SCE SIS study accounts for the

generation added at Vernon by reducing the output of a queue plant at Devers. The CAI study reduced generation throughout California in the PG&E, SCE, San Diego, and LADWP areas. The impacts noted above were most likely caused by the reduction in LADWP generation and were thus dismissed by CAI when the impacts from the addition of the Vernon Power Plant were enumerated.

One potential source for confusion is the normally open intertie that connects SCE's Laguna Bell to LADWP's Velasco substation. If this tie were closed, the addition of the Vernon Power Plant would certainly change the flow on this tie. Even without the addition of Vernon Power Plant (or any other proposed plant), closing this tie would significantly change the flows in the area for both LADWP and SCE. However, because this tie is normally open, neither LADWP nor SCE plan their systems assuming that the tie will be closed under normal conditions. Closing this tie occurs under unusual or emergency conditions and would be the subject of appropriate operational studies and the addition of the Vernon Power Plant would not change this. However, no capital changes would be triggered. We presume that CAISO and SCE are well aware of this connection and presume that they would have addressed it further if they felt the addition of the Vernon Power Plant would impact the operating mode for this tie.

56. In consultation with LADWP, pleases provide a Short Circuit Duty study report for the LADWP area. The analysis is required to identify the system impacts in the LADWP area under 2009 summer peak and light spring system conditions due to interconnection of the 914 MW VPP at the existing Laguna Bell substation.

Response: As with the power flow portion of the SIS, Applicant presumes that the CAISO/SCE SIS includes all short circuit conditions normally studied by CAISO and SCE engineers. As a consequence, Applicant believe it should contain all the fault impacts consistent with normal CAISO/SCE practice. As noted above, the Laguna Bell to Velasco 230 kV tie is a normally open connection that is only used under special circumstances.

Except for the Laguna Bell to Velasco 230 kV tie, LADWP is electrically remote from Laguna Bell. The closest interconnection point is four buses distant (Laguna Bell, to Goodrich to Gould to Sylmar SCE to Sylmar LADWP, for example). If an additional short circuit study is required for Vernon's Application, an additional study will be necessary for virtually every project in the SCE queue.

57. In the power flow analysis requested in Data Request #63, please verify the overloads on the facilities mentioned above and also verify the system impacts, if any, on the SCE system for probable contingencies in the LADWP system. For any identified reliability criteria violations in the LADWP area, provide respective mitigation measures with a report or approval letter from the LADWP and their expected on-line date.

Response: Per the discussion in Data Response #55, there are no reliability criteria violations in the LADWP area caused by the addition of the Vernon Power Plant. Based on the same discussion, the addition of the Vernon Power Plant does not cause probable contingencies in the LADWP system to have new impacts on the SCE system.

58. Please provide power flow one-line diagrams for the LADWP area for base cases and detected overloads under N-1 & N-2 contingencies.

Response: Per the discussion in Data Response #55, there are no overloads in the LADWP area caused by the addition of the Vernon Power Plant.

BACKGROUND

The SIS results for 2009 system conditions do not include the system impacts of the operation of 914 MW VPP on the 66 kV network of the City of Vernon. The AFC proposes the VPP interconnection to the Laguna Bell 230/66 kV substation which could impact the 66 kV network.

DATA REQUEST

59. Please provide a complete power flow analysis for the 66 kV system under 2009 summer peak and spring system conditions for normal base cases and probable N-1 & N-2 contingencies in the 66 kV and SCE systems. Provide power flow diagrams for the 66 kV system for base cases and for identified overloads under N-1 & N-2 contingencies. Also provide a Short Circuit Duty study report for the 66 kV network. For any identified reliability criteria violations in the 66 kV system, identify and describe mitigation measures with their expected on-line date.

Response: The Applicant is not proposing to interconnect the existing 66 kV system with the new 230 kV double-circuit radial tie to the Vernon Power Plant. The 66 kV system will continue to operate as a radial system. As a consequence, there are no power flow impacts.

As Applicant points out in AFC subsection 5.2.2, there will be minor modifications to the 66 kV system that will not change its radial character. The impact will also be virtually undetectable because these modifications take advantage of existing circuits that are not in use. SCE was commissioned to do a study of these circuits and concluded:

> "The load flow analysis results indicate that both the idle lines are adequate to service the City of Vernon for either option #1 or option #2. Both options are feasible…"

A copy of this "Idle Circuit Study" is provided as Attachment TSE-59.

The proposed Vernon Power Plant will contribute fault currents that will have some impact on the 66 kV system. Because these locations are electrically closest to the proposed plant, this impact will be primarily on the low-side of the 230/66 kV transformers at Laguna Bell. These impacts should have been included in the

304 MW Expansion SIS. SCE and CAISO committed to include these results in the Facilities Study. The Applicant is continuing to pursue this study aggressively.

However, because of the impedance of the 230/66 kV transformers, Applicant expects a minimal impact. If there is an impact it will be limited to changes to terminal equipment, most likely in the Laguna Bell substation. No environmental or regional grid reliability impact is foreseen.

VERNON POWER PLANT
(06-AFC-4)
DATA RESPONSES, SET 2A

ATTACHMENT TSE-53
Transmission Line Conductor Thermal Rating

NEED 915 MW NOW on N-1

TABLE 2-2

TRANSMISSION LINE CONDUCTOR THERMAL RATINGS

ASSUMED 5% SAG

Conductor Thermal Ratings in Amperes

Conductor Size (kcmil)		CODE WORD	Normal (N-C)		Likely Contingency 115% (N-1)		Unlikely Contingency 135% (N-2)	
336	A.C.S.R. 18/1	MERLIN	605		695		810	
336	A.C.S.R. 26/7	LINNET	610		700		825	
336	A.C.S.R. 30/7	ORIOLE	615		705		830	
4-336*	A.C.S.R. 18/1	MERLIN	2,420		2,780		3,240	
397	A.C.S.R. 26/7	IBIS	680		780		915	
477	Alum. Str./37	SYRINGA	710		815		960	
605	A.C.S.R. 24/7	PEACOCK	885		1,020		1,195	
605	A.C.S.R. 30/19	Teal	895		1,030		1,210	
605	A.C.S.R. 54/7	DUCK	885		1,020		1,195	
636	Alum. Str./37	ORCHID	850		975		1,150	
650	Calson Bronze		1,185		1,365		1,600	
653	A.C.S.R. 18/3	EDISON'S BIRD	920		1,060		1,240	
666	A.C.S.R. 24/7	FLAMINGO	940		1,080		1,270	
666	A.C.S.R. 54/7	GULL	940		1,080		1,270	
795	Alum. Str./37	ARBUTUS	975		1,120		1,315	
795	A.C.S.R. 26/7	DRAKE	1,055		1,215		1,425	
954	Alum. Str./37	MAGNOLIA	1,090	434	1,255		1,472	
1033	A.C.S.R. 54/7	CURLEW	1,240	494 MVA	1,425	568 MVA	1,675	667 MVA
2-1033*	A.C.S.R. 54/7	31.9°	2,480	988 MVA	2,850	1135 MVA	3,350	1335 MVA
3-1033*	A.C.S.R. 54/7		3,720	1482 "	4,275	1703 "	5,025	2002 "
4-1033*	A.C.S.R. 54/7		4,960		5,700		6,700	
1590	A.C.S.R. 45/7	LAPWING	1,615	643 MVA	1,855	739 MVA	2,180	868 MVA
2-1590*	A.C.S.R. 45/7	29.23	3,230	1287 MVA	3,710	1478 MVA	4,360	1737 MVA
3-1590*	A.C.S.R. 45/7		4,845	1930 "	5,565	2217 "	6,540	2605 "
4-1590*	A.C.S.R. 45/7		6,460		7,420		8,720	
2156	A.C.S.R. 84/19	BLUEBIRD	1,975	787 MVA	2,270	904 MVA	2,665	1062 MVA
2-2156*	A.C.S.R. 84/19	25.1°	3,950	1574 "	4,540	1808 "	5,330	2123 "

150' SPAN SWING

4.66' OK

32 → 70' R/W

4.19' OK

3.51' OK

* Bundled

10 SHORT

NOTE: Refer to Section 2.1.1 for rating evaluation details.

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VERNON POWER PLANT
(06-AFC-4)
DATA RESPONSES, SET 2A

ATTACHMENT TSE-55
System Impact Study (304 MW Increase)

ATTACHMENT TSE-55

CITY OF VERNON
VERNON POWER PLANT EXPANSION PROJECT
(304 MW INCREASE)

SYSTEM IMPACT STUDY

January 31, 2007

SOUTHERN CALIFORNIA
EDISON

Prepared by
Jeffery L. Ellis, P.E.
(Consultant)

Southern California Edison Company

Approved by: Patricia L. Arons
for

EXECUTIVE SUMMARY

Southern California Edison Company ("SCE") performed under direction of the California Independent System Operator ("CAISO"), an Interconnection System Impact Study ("SIS") as requested by the City of Vernon for a proposed Vernon Power Plant ("VPP") pursuant to the Interconnection System Impact Study Agreement entered into by SCE and Vernon on October 13, 2005. The initial VPP request for 610 MW (net) was for a 2x1 Combined Cycle unit with particular technical parameters. The expansion by 304 MW (net) is realized by converting to a 3x1 with associated technical parameter changes. For all studies outlined below (power flow, transient stability, and short circuit) the increment due to the expansion will be determined by studying the full 914 MW (net) at the 304 MW queue position with the original 610 MW 2x1 model removed. The incremental impacts due solely to the expansion will be determined by comparing the impacts from the 610 MW study and the impacts from the 304 MW Expansion study completed as outlined above. The project is scheduled to be on line by March of 2009.

Results of the System Impact Study will be used as the basis to determine project cost allocation for facility upgrades in the Facilities Study. ***The study accuracy and the results for the assessment of the system adequacy are contingent on the accuracy of the technical data provided by the City of Vernon***. Any changes from the attached data could void the study results.

The study was performed for four system conditions: a 2009 and 2011 Heavy Summer one-in-ten load forecast and a 2009 and 2011 Light Spring load forecast (65% of the heavy summer load).

The report provides detailed study assumptions and conditions of the system in which the study was conducted. Furthermore power flow contingencies for the SCE 230-kV system, post-transient governor power flow for 500-kV line contingencies, transient stability for significant 230 and 500-kV contingencies, and short-circuit duty assessments were completed for this study and are summarized below.

The objective of the System Impact Study is to determine whether SCE's transmission system can accommodate the proposed project. The study results indicated that the SCE system could not accommodate the proposed VPP Expansion Project without system modifications.

Power Flow Analysis
Studies identified that the VPP Expansion Project aggregated overload on several SCE owned transmission facilities under N-1 and N-2 conditions. However, VPP Expansion Project did not trigger these overloads. These overloads were triggered by changes in system condition, assumptions, and projects ahead in the generation queue.

Post-Transient Power Flow Analysis
There were no post-transient power flow impacts identified with addition of the VPP Expansion Project.

Transient Stability Analysis
The transmission system remained in operating equilibrium throughout all transmission contingencies with inclusion of the Project.

The VPP Expansion Project met the Low Voltage Ride-Through criterion. None of the VPP generators tripped due to adverse contingencies that were simulated. Phase-to-ground faults were not simulated in this SIS since previously studied projects that had a larger output did not reveal any problems.

Short-Circuit Analysis
Single-line-to-ground and three-phase-to-ground results indicate that thirteen (13) circuit breakers have fault duties that increased by 0.1 kA from the pre-project case and exceeded their breaker fault duty of 60%. Prior projects ahead in the queue triggered upgrade and replacement of 83 SCE owned circuit breakers.

Cost Responsibility
The ***Nonbinding*** Cost Estimate for the transmission facilities triggered by the VPP 304 MW Expansion Project is $30 million which has already been identified in the VPP 610 MW SIS.

The ***Nonbinding*** Cost Estimate for circuit breaker upgrades triggered by VPP 304 MW Expansion Project is $1.584 million.

The ***Nonbinding*** Cost Estimate for the VPP 304 MW Expansion Project's maximum exposure for circuit breaker replacement and upgrades is $42.651 million.

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5 - 2011 HS Pre-VPP 304 MW Expansion Project
6 - 2011 HS Post-VPP 304 MW Expansion Project
7 - 2011 LSpr Pre-VPP 304 MW Expansion Project
8 - 2011 LSpr Post-VPP 304 MW Expansion Project

Appendix B – Complete list of Power Flow Results

Appendix C – List of Power Flow Contingencies

Appendix D – 2009 Heavy Summer Stability Plots
Appendix D – 2009 Light Spring Stability Plots

Appendix D – 2011 Heavy Summer Stability Plots

Appendix D – 2011 Light Spring Stability Plots

Appendix E – Transient Stability Modeling

Appendix F – Transient Stability Switching Sequences

Appendix G – SCE Project Queue

CITY OF VERNON
VERNON POWER PLANT EXPANSION PROJECT
(304 MW INCREASE)

SYSTEM IMPACT STUDY
January 31, 2007

INTRODUCTION

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The report provides detailed study assumptions and conditions of the system in which the study was conducted. Furthermore, power flow contingencies for the SCE 230-kV system, post-transient governor power flow for 500-kV line contingencies, transient stability for significant 230 and 500-kV contingencies, and short-circuit duty assessments were completed for this study.

STUDY CONDITIONS AND ASSUMPTIONS

A. Planning Criteria

The study was conducted by applying the CAISO Reliability Criteria. More specifically, the main criteria applicable to this study are as follows:

Power Flow Assessment

The following contingencies are considered for transmission and sub-transmission lines and 500/230-kV transformer banks ("AA-Banks"):

- Single Contingencies (loss of one line or one AA-Bank)
- Credible Double Contingencies (loss of two lines or one line and one AA-Bank) (Outages of two AA-Banks are beyond the Planning Criteria)

The following reliability criteria are used:

Transmission Lines	Base Case	Limiting Component Normal Rating
	N-1	Limiting Component Emergency-Rating
	N-2	Limiting Component Emergency-Rating
AA-Banks	Base Case	Normal Loading Rating
	Long Term & Short Term	Bank Emergency-Rating

System upgrades for transmission lines are generally recommended for all reliability criteria violations. Special Protection Schemes (SPS) may be allowed for single contingency and credible double contingencies reliability criteria violation in place of system upgrade.

Congestion Assessment

The following principles were used in determining whether congestion management, special protection schemes, or facility upgrades are required to mitigate base case, single contingency, or double contingency overloads:

- Congestion management, as a means to mitigate base case overloads, can be used if it is determined to be manageable and the CAISO concurs with the implementation.

- Facility upgrades will be required if it is determined that the use of congestion management is unmanageable as defined in the congestion management section that follows.

- SPS, in lieu of facility upgrades, will be recommended if the scheme is effective, does not jeopardize system integrity, does not exceed the current CAISO single and double contingency tripping limitations, does not adversely effect existing or proposed special protection schemes in the area, and can be readily implemented.

- Facility upgrades will be required if use of protection schemes is determined to be ineffective, the amount of tripping exceeds the current CAISO single and double contingency tripping limitations, adverse impacts are identified on existing or currently proposed special protection schemes, or the scheme cannot be readily implemented.

- Congestion management in preparation for the next contingency will be required, with CAISO concurrence, if no facility upgrades or special protection schemes are implemented.

The following study method was implemented to assess the extent of possible congestion:

a) Under Base Case with all transmission facilities in service, the system was evaluated with all existing interconnected generation and all generation requests in the area that have a queue position ahead of this request (pre-project).

b) Under Base Case with all transmission facilities in service, the system was reevaluated with the inclusion of the Vernon Expansion Project (post-project).

If the normal loading limits of facilities are exceeded in (a), the overload is identified as an existing overload that was triggered by a project in queue ahead of the Vernon Expansion Project. If the normal loading limits of facilities are exceeded in (b) and were not exceeded in (a), the overload is identified as triggered by the addition of the Vernon Expansion Project. The Vernon Expansion Project, assuming it is a market participant, and other market participants in the area may be subjected to congestion management, potential upgrade cost and/or participation of any proposed special protection systems if the project addition aggravates or triggers the overload. Additionally, the Vernon Expansion Project may have to participate in mitigation of overloads triggered by subsequent projects in queue, subject to FERC protocols and policies.

In order for congestion management to be a feasible alternative to system facilities, all of the following factors need to be satisfied:

- Time requirements for necessary coordination and communication between the CAISO operators, scheduling operators and SCE operators.

- Distinct Path/Corridor rating should be well defined so monitoring and detecting congestion and implementing congestion of the contributing generation resources can be performed when limits are exceeded.

- Sufficient amount of market generation in either side of the congested path/corridor should be available to eliminate market power.

- Manageable generation in the affected area is necessary so that operators can implement congestion management if required (i.e. the dispatch schedule is known and controllable).

Results of these studies should identify:

a. if capacity is available to accommodate the proposed Vernon Expansion Project and all projects ahead in queue without the need for congestion management, special protection schemes, or facility upgrades

b. if overloads exist in the area after the addition of all projects in queue ahead of the Vernon Expansion Project and all facilities in service

c. if congestion exists in the area with the addition of the Vernon Expansion Project and all projects ahead in queue under single and double element outage conditions assuming no new special protection schemes are in place

d. if sufficient capacity is maintained to accommodate all Must-Run and Regulatory Must-Take generation resources with all facilities in service

e. if sufficient capacity is maintained to accommodate the total output of any one generation resource which is not classified as Must-Run.

Post-Transient Governor Power Flow Analysis

The following assumptions were modeled in the studies:

a) All loads will be modeled as constant power during the first few minutes following an outage or disturbance.

b) All voltages at distribution substations will be restored to normal values by the transformer tap changers and other voltage control devices.

c) Generator VAR limits will be modeled as a single value for each generator since the reactive power capability curve will not be modeled in the power flow program.

d) There will be no manual operator intervention to increase the generator VAR output.

e) Remedial actions such as generator dropping, load shedding and blocking of automatic generation control (AGC) will not be considered.

f) Alpha min and Gamma min of the PDCI and IPPDC will be adjusted to 5 degrees and 13 degrees, respectively.

g) Shunt capacitors (132 MVAR) at Adelanto and Marketplace will be used if the post-transient voltage deviation exceeds 5% at those buses.

h) Other Assumptions
- Area Interchange: Disabled;
- Governor Blocking: Per WECC Modeling & Validation Work Group recommendations - Diablo, Palo Verde, and San Onofre;
- DC Line Transformer Tap Automatic Adjustment: Enabled;
- Generator Voltage Control set to local except for San Onofre, Palo Verde, and selected Northwest generation;
- Phase Shifter Control: Disabled;
- Switched Shunt Devices: Disabled - except in Sierra Pacific Power's system.

Voltage dips should meet the following combined SCE and WECC Reliability Criteria:

Performance Level	Disturbance	Post Transient Voltage Deviations
B	N-1	Not to exceed 7% at any bus.
C	N-2	Not to exceed 10% at any bus.
D	N-3	Cascading Not Permitted

The following system contingencies were simulated and compared between the pre and post project base cases:

N-1 Contingencies

1. BEP2500 - Devers 500-kV line
2. BEP2500 – Midpoint 500-kV line
3. BEP2500B – BEP2500 500-kV line
4. Calpine – Valley 500-kV line
5. Devers – Midpoint #1 500-kV line
6. Devers – Midpoint #2 500-kV line
7. Devers – Valley 500-kV line
8. El Dorado–Lugo 500-kV line
9. El Dorado – Mohave 500-kV line
10. Lee Lake – Serrano 500-kV line
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14. Lugo – Mohave 500-kV line
15. Lugo – Rancho Vista 500-kV line
16. Lugo – Victorville 500-kV line
17. Lugo – Vincent #1 500-kV line

18. Lugo – Vincent #2 500-kV line
19. Midway – Vincent #1 500-kV line
20. Midway – Vincent #2 500-kV line
21. Midway – Vincent #3 500-kV line
22. Mira Loma – Serrano 500-kV line.
23. Rancho Vista – Serrano 500-kV line
24. Rancho Vista – TOT128 #1 500-kV line
25. Rancho Vista – TOT128 #2 500-kV line

N-2 Contingencies

26. Lugo – Mira Loma #2 & #3 500-kV lines
27. Lugo – Vincent #1 & #2 500-kV lines
28. Lugo – Rancho Vista 500-kV line & Lugo – Mira Loma #2 500-kV line
29. Rancho Vista – Serrano 500-kV line & Mira Loma – Serrano 500-kV line
30. Midway – Vincent #1 & #2 500-kV lines
31. Devers – Midpoint #1 500-kV line & Devers – Valley 500-kV line
32. Lugo – Mohave 500-kV line & Lugo – Mira Loma #2 500-kV line
33. Lugo – Mohave 500-kV line & Lugo – Mira Loma #3 500-kV line
34. Lugo – Vincent #2 500-kV line & Lugo – Victorville 500-kV line
35. Lugo – Vincent #2 500-kV line & Midway – Vincent #3 500-kV line

Transient Stability Analysis

WECC currently is in the process of adopting The Generator Electrical Grid Fault Ride-Through Capability Criteria. SCE currently supports a Low Voltage Ride-Through Criteria to ensure continued reliable service. A proposed Criteria that SCE supports, is as follows:

1. Generator is to remain in-service during system faults (three phase faults with normal clearing and single-line-to-ground with delayed clearing) unless clearing the fault effectively disconnects the generator from the system.

2. During the transient period, generator is required to remain in-service for the low voltage and frequency excursions specified in WECC Table W-1 (provided below) as applied to load bus constraint. These performance criteria are applied to the generator interconnection point, not the generator terminals.

3. Generators may be tripped after the fault period if this action is intended as part of a special protection scheme.

4. This Standard will not apply to individual units or to a site where the sum of the installed capabilities of all machines is less than 10MVA, unless it can be proven that reliability concerns exist.

5. The performance criteria of this Standard may be satisfied with performance of the generators or by installing equipment to satisfy the performance criteria.

6. The performance criterion of this Standard applies to any generation independent of the interconnected voltage level.

7. No exemption from this Standard will be given because of minor impact to the interconnected system.

8. Existing generators that go through any refurbishments or any replacements are then required to meet this Standard.

In addition to the Low Voltage Ride-Through Criteria, the following criterion was applied for the transient stability analysis:

a.) All machines in the system shall remain in synchronism as demonstrated by their relative rotor angles.

b.) All stability simulation cases will be run for a minimum of 10 seconds.

c.) Generators with a base load flag of zero will not respond to contingencies.

d.) System stability is evaluated based on the damping of the relative rotor angles and the damping of the voltage magnitude swings.

Other transient voltage dips must meet the following CAISO Reliability Criteria:

Performance Level	Disturbance	Transient Voltage Dip Criteria
B	N-1	Transient Voltage Dip: Not to exceed 25% at load buses or 30% at non-load buses. Also, not to exceed 20% for more than 20 cycles at load buses. Minimum Transient Frequency: Not below 59.6 Hz for 6 cycles or more at a load bus.
C	N-2	Transient Voltage Dip: Not to exceed 30% at any bus. Also, not to exceed 20% for more than 40 cycles at load buses. Minimum Transient Frequency: Not below 59.0 Hz for 6 cycles or more at a load bus.
D	N-3	Not Specified

The following system contingencies were simulated for all Heavy Summer and Light Spring conditions:

Category "B" Contingencies

1. Full load rejection of the VPP
2. Three-phase fault at the VPP 230-kV bus followed by loss of the VPP STG.
3. Three-phase fault at the VPP 230-kV bus followed by loss of the VPP – Laguna Bell 230-kV #1 circuit.
4. Three-phase fault at the Laguna Bell 230-kV bus followed by loss of the Laguna Bell – Rio Hondo 230-kV #1 circuit.
5. Three-phase fault at the Laguna Bell 230-kV bus followed by loss of the Laguna Bell – Goodrich 230-kV #1 circuit.
6. Three-phase fault at the Laguna Bell 230-kV bus followed by loss of the Laguna Bell – Del Amo 230-kV #1 circuit.
7. Three-phase fault at the Laguna Bell 230-kV bus followed by loss of the Laguna Bell – La Fresa 230-kV circuit.
8. Three-phase fault at the Harbor Gen 230-kV bus followed by loss of the Long Beach – Harbor Gen 230-kV circuit.
9. Three-phase fault at the Lighthipe 230-kV bus followed by loss of the Long Beach – Lighthipe 230-kV circuit.
10. Three-phase fault at the Rio Hondo 230-kV bus followed by loss of the Vincent – Rio Hondo 230-kV circuit.
11. Three-phase fault at the Devers 500-kV bus followed by loss of the Midpoint – Devers 500-kV #1 circuit.
12. Three-phase fault at the Midpoint 500-kV bus followed by loss of the Midpoint – Harquahala 500-kV circuit.
13. Three-phase fault at the Midpoint 500-kV bus followed by loss of the Midpoint – Palo Verde 500-kV circuit.
14. Three-phase fault at the Valley 500-kV bus followed by loss of the Lee Lake – Serrano 500-kV circuit.
15. Three-phase fault at the Valley 500-kV bus followed by loss of the Lee Lake – Valley 500-kV circuit.

Category "C" Contingencies

16. Pre-fault outage of the Laguna Bell – Goodrich 230-kV circuit, then a three-phase fault at the Laguna Bell 230-kV bus followed by loss of the Laguna Bell – Rio Hondo 230-kV circuit.
17. Pre-fault outage of the Laguna Bell – Del Amo 230-kV #1 circuit, then a three-phase fault at the Laguna Bell 230-kV bus followed by loss of the Laguna Bell – La Fresa 230-kV #2 circuit.
18. Three-phase fault at the Long Beach 230-kV bus followed by loss of the Long Beach – Lighthipe 230-kV and Harbor Gen – Hinson 230-kV transmission lines.
19. Three-phase fault at the Rancho Vista 500-kV bus followed by loss of the Rancho Vista – Vincent 500-kV and Mira Loma – Walnut 230-kV transmission lines.
20. Three-phase fault at the Serrano 500-kV bus followed by loss of the Rancho Vista – Vincent 500-kV and Mira Loma – Serrano 500-kV transmission lines.

Category "D" Contingency

21. A pre-fault outage of the Laguna Bell – Rio Hondo 230-kV circuit, then a three-phase fault at the VPP 230-kV bus followed by loss of a double circuit tower removing both the Laguna Bell – Del Amo 230-kV and the Laguna Bell – La Fresa 230-kV circuits.

Short-Circuit Analysis

The following study assumptions were used for conducting the short-circuit analysis:

a) Shunt capacitor banks will be omitted at all stations. Normally, shunt capacitors produce a minimal effect on fault currents. When they are large enough to be significant, their effect is to reduce total fault current. Results are more conservative to neglect them altogether.

b) Shunt reactors will also be neglected since their contribution is minimal.

c) Reactors connected to autotransformer delta tertiary windings will be neglected since they cannot contribute fault current to the system.

d) Phase shifting transformers will be by-passed as this would be the worst case from the fault current standpoint.

e) If zero sequence data is not available, the assumption will be made that Xo=3X1 and Ro=0 or R1.

Circuit breakers exposed to fault currents in excess of 100 percent of their interrupting capacities will be replaced or upgraded, whichever is appropriate.

Sub-synchronous Resonance Analysis (SSR)

It is not anticipated that there will be any SSR impacts. Hence, the SSR studies are not required.

B. City of Vernon – Vernon Power Plant Expansion Project

The expansion project is scheduled to be on-line by March 2009.

Proposed Vernon Power Plant Expansion Project ("VPP")

The initial VPP request for 610 MW (net) was for a 2x1 Combined Cycle unit with particular technical parameters. The expansion by 304 MW (net) is realized by converting to a 3x1 with associated technical parameter changes with the full 914 MW (net) project and the original 610 MW 2x1 model removed.

Following is a summary of 2009/2011 project additions modeled in the Project base cases:

1. Three 230/16.5 kV, 225 MVA transformers were modeled at the VPP 230-kV Substation to be used for the combustion turbines.
2. One 230/19 kV, 450 MVA transformer was modeled at the VPP 230-kV Substation to be used for the steam turbine.
3. Three 220 MVA combustion turbine generators were modeled at the VPP 230-kV Substation.
4. Three 9.67 MW, 5.99 MVAR plant auxiliary loads were modeled at the combustion turbine buses for a total plant auxiliary load of 29 MW.
5. One 405 MVA steam turbine generator was modeled at the VPP 230-kV Substation.

Figure 1 illustrates the one-line schematic of the proposed VPP Expansion Project and **Figure 2** illustrates the one line diagram of transmission lines emanating from the Laguna Bell 230-kV bus.

Figure 1. One-line Vernon Power Plant Expansion ("VPP") Project bus Configuration.

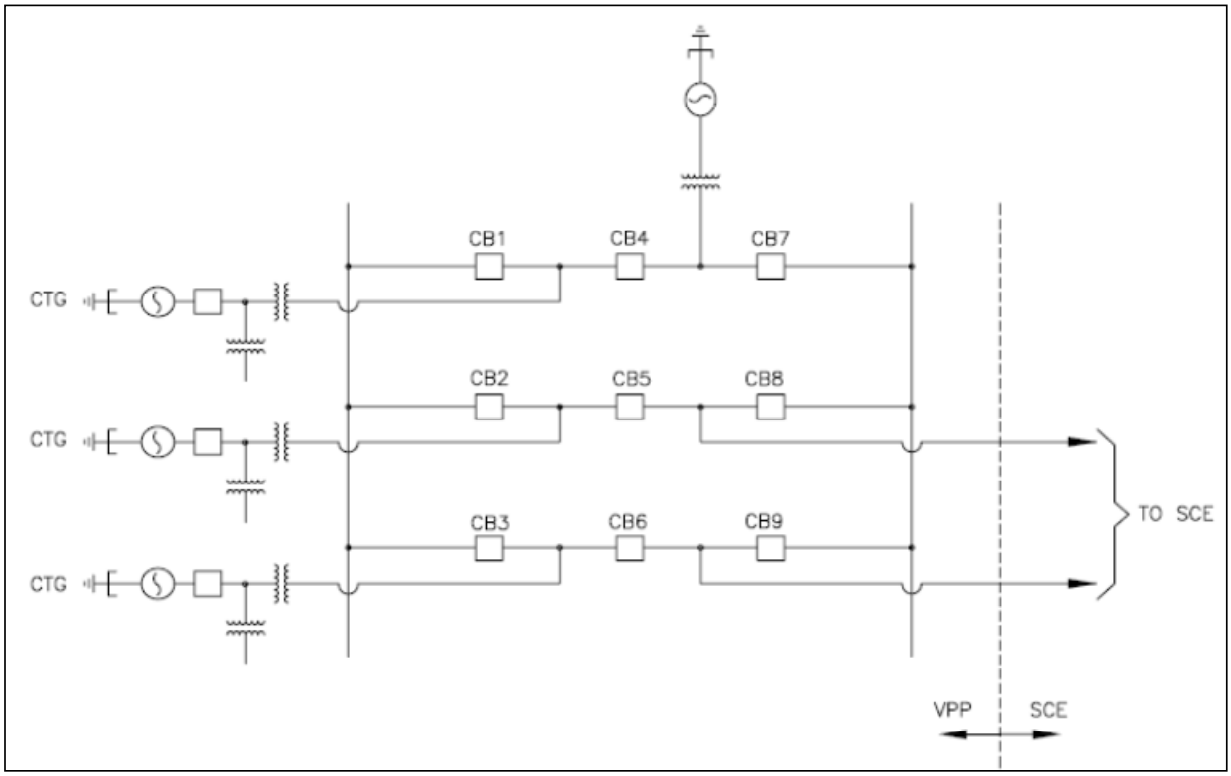
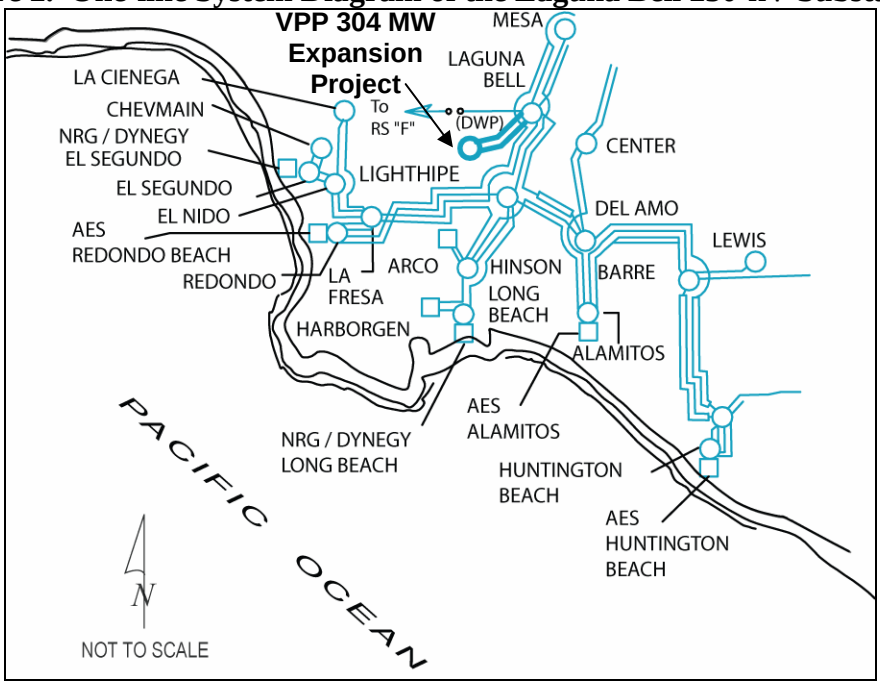


Figure 2. One-line System Diagram of the Laguna Bell 230-kV Substation.



C. System Conditions

To simulate the SCE transmission system for analysis, the study used a SCE internal planning case that modeled 2009 and 2011 Heavy Summer conditions. In addition, additional SCE internal planning cases modeled 2009 and 2011 Light Spring conditions. Starting base cases were updated to represent system conditions in 2009 and 2011. Most significantly, SCE's 2009 and 2011 Heavy Summer load levels were escalated to a one-in-ten load forecast. System generation is based upon the application queue. That is, all projects ahead in SCE's queue regardless of the in-service date of such prior projects are modeled.

The Light Spring scenarios assume 65% of the heavy summer load.

D. Load Flow Study

Load flow studies were conducted under the 2009 and 2011 Heavy Summer and Light Spring conditions. Refer to **Appendix G** for a list of SCE Queue projects modeled in all base cases. Further descriptions of each base case follow:

1) 2009 Heavy Summer Pre-VPP 304 MW Expansion Project, Case 1.

   Case 1 modified to include the VPP 610 MW Project and all projects ahead in the queue in the same vicinity. Generation connected at the TOT032 bus was reduced to accommodate

the Project.

2) 2009 Heavy Summer Post-VPP 304 MW Expansion Project with a total of 914 MW plant output, Case 2.

   Case included a 2009 Heavy Summer load level. Generation patterns were maximized in the LA Basin to fully stress the SCE 230-kV system.

3) 2009 Light Spring Pre-VPP 304 MW Expansion Project, Case 3.

   Case 3 modified to include the VPP 610 MW Project and all projects ahead in the queue in the same vicinity. Generation connected at the TOT032 bus was reduced to accommodate the Project.

4) 2009 Light Spring Post-VPP 304 MW Expansion Project with a total of 914 MW plant output, Case 4.

   Case included a 2009 Light Spring load level. Generation patterns were maximized in the LA Basin to fully stress the SCE 230-kV system.

5) 2011 Heavy Summer Pre-VPP 304 MW Expansion Project, Case 5.

   Case 5 modified to include the VPP 610 MW Project and all projects ahead in the queue in the same vicinity. Generation connected at the TOT032 bus was reduced to accommodate the Project.

6) 2011 Heavy Summer Post-VPP 304 MW Expansion Project with a total of 914 MW plant output, Case 6.

   Case included a 2011 Heavy Summer load level. Generation patterns were maximized in the LA Basin to fully stress the SCE 230-kV system.

7) 2011 Light Spring Pre-VPP 304 MW Expansion Project, Case 7.

   Case 7 modified to include the VPP 610 MW Project and all projects ahead in the queue in the same vicinity. Generation connected at the TOT032 bus was reduced to accommodate the Project.

8) 2011 Light Spring Post-VPP 304 MW Expansion Project with a total of 914 MW plant output, Case 8.

   Case included a 2011 Light Spring load level. Generation patterns were maximized in the LA Basin to fully stress the SCE 230-kV system.

Table 1 summarizes SCE area system demand and resources for the 2009 and 2011 Heavy Summer and Light Spring cases.

Table 1. Summary of case attributes.

SOUTHERN CALIFORNIA IMPORT TRANSMISSION ("SCIT"), EAST-OF-RIVER ("EOR") AND WEST-OF-RIVER ("WOR") FLOWS SCE AREA TOTAL GENERATION, IMPORT, LOAD AND LOSSES (MW)								
	2009 Heavy Summer		2009 Light Spring		2011 Heavy Summer		2011 Light Spring	
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
	Pre-project	Post-Project	Pre-Project	Post-Project	Pre-project	Post-Project	Pre-Project	Post-Project
SCIT	9,687	9,686	1,345	1,344	9,828	9,825	1,271	1,272
EOR	3,673	3,682	3,531	3,541	3,862	3,871	3,527	3,538
WOR	5,356	5,362	4,445	4,450	5,538	5,541	4,409	4,416
Generation*	22,267	22,259	18,493	18,495	23,135	23,136	19,250	19,253
Import	-3,339	-3,339	1,787	1,787	-3,539	-3,538	1,787	1,787
Load	25,186	25,178	16,414	16,414	26,244	26,244	17,152	17,152
Losses	420	420	293	294	430	431	312	315

*Changes in generation can be attributed to swing bus adjustments compensating for loss increases.

E. Post-Transient Governor Power Flow Study

All 500-kV contingencies were simulated with the post-transient governor power flow methodology. The governor power flow methodology utilizes Special Protection Systems ("SPS") for loss of bulk system contingencies. In addition, loss of a significant amount of generation would be spread throughout the system instead of at the system swing bus.

F. Transient Stability Study

Transient stability studies were performed for the 2009 and 2011 summer peak and light spring base cases to ensure that the transmission system remains in operating equilibrium through abnormal operating conditions after the new facility begins operation.

The "critical clearing" time for the Project will be determined based on the fault clearing time increasing for loss of the VPP – Laguna Bell 230-kV #1 circuit. The "critical clearing" time is the time during which a fault can persist without causing system instability.

G. Short Circuit Duty Study

Short circuit studies were conducted to determine fault duties on existing SCE facilities before and after proposed project additions. Fault duty results were used to identify overstressed equipment, if any, that results solely from addition of the proposed facility.

STUDY RESULTS

A. Load Flow Study

1. Base Case

2009 and 2011 Heavy Summer
Studies identified that with the 304 MW addition to the VPP Project, there were no base case thermal overloaded elements for the 2009 or 2011 heavy summer conditions. In addition, no bus voltages in the LA Basin violated the CAISO voltage criteria.

2009 and 2011 Light Spring
Studies identified that with the 304 MW addition to the VPP Project, there were no base case thermal overloaded elements for the 2009 or 2011 light spring system conditions. In addition, no bus voltages in the LA Basin violated the CAISO voltage criteria.

Refer to **Appendix A** for pre and post-project power flow plots for the 2009 and 2011 heavy summer and light spring cases.

2. Power Flow Contingency Results.

2009 and 2011 Heavy Summer
Studies identified that with the 304 MW addition to the VPP Project, there were two NERC/WECC Category "B" and none in Category "C" contingency affected elements for the 2009 heavy summer condition, three NERC/WECC Category "B" and three Category "C" contingency affected elements for the 2011 heavy summer condition.

Overload on Laguna Bell – Vernon Power Plant 230-kV lines was based on the 786 MVA conductor rating.

Table 2. Power Flow Contingency Analysis – 2009 and 2011 Heavy Summer – Percent Loading.

AFFECTED ELEMENT	CONTINGENCY	Normal/Emergency Rating (Amps)	2009 Pre-Project (%)†	2009 Post-Project (%)†	2011 Pre-Project (%)†	2011 Post-Project (%)†
Laguna Bell - Vernon PP No.1 230-kV	Laguna Bell - Vernon PP No.2 230-kV	1973/1973	78	118	78	118
Laguna Bell - Vernon PP No.2 230-kV	Laguna Bell - Vernon PP No.1 230-kV	1973/1973	78	118	78	118

2009 and 2011 Light Spring
Studies identified that with the 304 MW addition to the VPP Project, there were two NERC/WECC Category "B" and five NERC/WECC Category "C" contingency affected elements for the 2009 light spring condition, three NERC/WECC Category "B" and six

NERC/WECC Category "C" contingency affected elements for the 2011 light spring conditions.

Overload on Laguna Bell – Vernon Power Plant 230-kV lines was based on the 786 MVA conductor rating.

Table 3. Power Flow Contingency Analysis – 2009 and 2011 Light Spring – Percent Loading.

AFFECTED ELEMENT	CONTINGENCY	Normal/Emergency Rating (Amps)	2009 Pre-Project (%)†	2009 Post-Project (%)†	2011 Pre-Project (%)†	2011 Post-Project (%)†
Laguna Bell - Vernon PP No.1 230-kV	Laguna Bell - Vernon PP No.2 230-kV	1973/1973	78	118	79	119
Laguna Bell - Vernon PP No.2 230-kV	Laguna Bell - Vernon PP No.1 230-kV	1973/1973	78	118	79	119

†Percent loading based on the normal rating.

All identified overloaded elements in 2009 and 2011 Heavy Summer and Light Spring were triggered by changes in system condition and configuration and aggravated by projects ahead in the generation queue with exception of the Laguna Bell – Vernon PP 230-kV contingency. There were no voltage violations observed with addition of the VPP Expansion Project.

Appendix B tabulates all power flow contingency results.

The study focused on identifying system thermal overloads within the SCE service territory. Reported thermal overloads were limited to the condition where a modeled transmission component was loaded over 98% of its appropriate normal rating (as entered in the power flow database). In addition, only element loadings greater than 1% between the pre and post-project cases were reported.

B. Post-Transient Governor Power Flow Study

Results from the post-transient governor power flow analysis did not reveal any thermally overloaded elements. In addition, there were no voltage deviation violations.

C. Transient Stability Study

The transmission system remained in operating equilibrium throughout all transmission contingencies with inclusion of the Project. Refer to **Appendix D** for all simulated contingency plots.

The VPP Expansion Project met the Low Voltage Ride-Through criterion; since, none of the VPP Expansion Project generators tripped due to the adverse contingencies that were

simulated. Phase-to-ground faults were not simulated in this SIS since previously studied projects that had a larger output did not reveal any problems.
In an effort to determine a "critical clearing" time for the Project during 2009 and 2011 heavy summer conditions, the clearing time for loss of the VPP-Laguna Bell 230-kV was increased from 4 cycles (typical clearing time for 230-kV transmission lines) until system instability was observed at 10 cycles. Note, the "critical clearing" time is the time during which a fault can persist without causing instability.

D. Short Circuit Duty Study

The starting short-circuit analysis case includes all projects based on their application date [Project Queue].

Single-line-to-ground and three-phase-to-ground results indicate that thirteen (13) circuit breakers have fault duties that increased by 0.1 kA from the pre-project case and exceeded their breaker fault duty of 60%. Prior projects in the queue triggered upgrade and replacement of 83 SCE owned circuit breakers.

Table 4. Summary of Short-Circuit Duties, 3-Phase-to-Ground.

		Min	PRE CASE		POST CASE		
Bus Name	Bus KV	Rating	X/R	KA	X/R	KA	DELTA KA
MESA500	500	0	24.8	26.1	24.8	26.2	0.1
SERRANO	500	40	25.6	31.8	25.6	31.9	0.1
VINCENT	500	38	18.4	40.7	18.4	40.8	0.1
ALMITOSE	230	50.2	17	30.7	16.9	30.8	0.1
CENTER S	230	45.6	16	43.3	16	43.5	0.2
CHEVMAIN	230	63	20.4	37.8	20.3	38	0.2
CHINO	230	50	17	49.9	17	50	0.1
CTYVERH	230	0	18.1	31.8	18.3	35.7	3.9
DELAMO	230	50	16	45.3	16	45.8	0.5
EL NIDO	230	45.6	20.5	43.2	20.5	43.4	0.2
ELLIS	230	45.6	18	41.5	18	41.6	0.1
ELSEGNDO	230	34	21.7	38.5	21.7	38.6	0.1
HARBOR	230	45.6	15.4	36.5	15.3	36.6	0.1
HINSON	230	50	21.2	53.4	21.1	53.6	0.2
LA FRESA	230	45.6	26.2	50.4	26.2	50.7	0.3
LAGUBELL	230	34	18.8	40.2	19.4	42.5	2.3
LBEACH	230	40	15.2	34.6	15.1	34.7	0.1
LEWIS	230	45.6	21.5	44.8	21.5	44.9	0.1
LITEHIPE	230	40	17.2	49.9	17.2	50.1	0.2
MESA CAL	230	50	19.7	66.6	19.6	67	0.4
MRLOMA E	230	63	23.3	64.5	23.3	64.6	0.1
REDONDO	230	50.2	25.9	49	25.9	49.2	0.2
RIOHONDO	230	34	14.7	29.4	14.7	29.7	0.3
SERRANO	230	63	26	53.9	25.9	54	0.1
WALNUT	230	37.7	16.7	36.5	16.7	36.6	0.1

Table 5. Summary of Short-Circuit Duties, Single-Line-to-Ground.

		Min	PRE CASE		POST CASE		
Bus Name	Bus KV	Rating	X/R	KA	X/R	KA	DELTA KA
Mira Loma	525	38.4	13.9	32.6	13.9	32.7	0.1
Arcogen	230	0	16.3	38.1	16.3	38.2	0.1
Del Amo	230	50	9.4	39.3	9.4	39.6	0.3
El Nido	230	45.6	17.8	40.4	17.7	40.6	0.2
El Segundo	230	34	21.1	36.7	21.1	36.8	0.1
Ellis	230	45.6	17.7	35.4	17.7	35.5	0.1
Hinson	230	50	20.9	51.5	20.8	51.6	0.1
La Fresa	230	45.6	20.6	45.8	20.6	46	0.2
Laguna Bell	230	34	13.6	38.8	13.9	40.4	1.6
Lighthipe	230	40	11.2	43.9	11.2	44	0.1
Mesa	230	50	18	64.2	18	64.4	0.2
Mira Loma A	230	63	13.1	54.3	13.1	54.4	0.1
Redondo	230	50.2	31.2	42.7	31.2	42.8	0.1
Rio Hondo	230	34	14.4	25.4	14.4	25.6	0.2
Santiago	230	34	18.4	25.2	18.4	25.3	0.1
Serrano	230	63	18.6	55.5	18.6	55.6	0.1
Walnut	230	37.7	15.2	28.1	15.2	28.2	0.1

CONCLUSIONS

A. Power Flow Analysis

2009 and 2011 Light Spring

Existing SCE facilities are not adequate to accommodate the City of Vernon's, Vernon Power Plant Expansion Project of 304 MW interconnecting to the SCE owned Laguna Bell 230-kV Substation for 2009 and 2011 operation. The identified NERC/WECC Category "C" affected elements will require system upgrades.

2009 and 2011 Heavy Summer

Existing SCE facilities are not adequate to accommodate the City of Vernon's, Vernon Power Plant Expansion Project of 304 MW interconnecting to the SCE owned Laguna Bell 230-kV Substation only for 2011 operation. The identified NERC/WECC Category "C" affected elements will require system upgrades.

Most of the overloads identified in this study had been identified in the VPP 610 MW SIS, VPP 610 MW Sensitivity Study and all were triggered by changes in system condition and configuration. SCE will evaluate the risk in the Annual Transmission Expansion Plan and proposed upgrade projects as needed. The VPP Expansion Project will not be responsible for the upgrade of these facilities. Following is a list of overloaded transmission facilities.

- Del Amo-Hinson 230kV line
- Hinson-Lighthipe 230kV line
- Lighthipe-Long Beach 230kV line
- Lighthipe-Mesa 230kV line
- Mesa-Redondo 230kV line
- Alamitos West-Barre 230kV No. 2 line

B. Short-Circuit Analysis

Single-line-to-ground and three-phase-to-ground results indicate that thirteen (13) circuit breakers have fault duties that increased by 0.1 kA from the pre-project case and exceeded their breaker fault duty of 60%. Several SCE replacement/upgrade circuit breakers were identified by generation projects ahead in the queue. Studies indicated that 58 SCE owned circuit breakers require replacement and 25 SCE owned circuit breakers require upgrade. It is estimated that the maximum exposure of circuit breaker replacement/upgrades will yield a total cost of $42.651 million, with the Vernon Power Plant Expansion only triggering $1.584 million in circuit breaker replacement/upgrades.

Facilities Study

1. Develop a detail cost estimate for SCE system and direct assignment facilities that are required to interconnect the VPP Expansion project.

SCOPE OF WORK

The scope of upgrades required to accommodate the City of Vernon Power Expansion Project interconnection on the SCE network is listed below.

Substation Components

- Install equipment at vacant 230 kV Pos. 2 (East end of the 230 kV Switchrack) to terminate Vernon No.2 230 kV Gen. Tie Line
- Extend North 7 South Operating Buses to the East and create a new 230 kV Pos.1 to terminate Vernon No.1 230 kV generator tie line
- The bus extensions require the relocation of the 230 kV conductors presently connecting the No.6 230 kV capacitor bank to the South Bus
- The relocation of the capacitor bank leads would require (at least) two new 230 kV Tubular Steel Poles
- The bus extensions also require the relocation of the existing access road within this area of the station
- The bus extensions also require the relocation of the test shop building
- Install I.T. termination equipment at Laguna Bell and the generating station.

ORDER of MAGNITUDE" SUBSTATION COST: $10,000,000

Transmission Components

- Underground Fourteen (14) 66 kV circuits on the north/northwest side of the station (includes ductwork for two available positions) to the 66 kV rack.
- Underground One (1) 66-16 kV transformer leads to the 66 kV rack.
- Relocate water tank and salt house from north side of substation.
- Raise one double-circuit 230 kV tower for undercrossing.

ORDER of MAGNITUDE" TRANSMISSION COST: $20,000,000

Short Circuit Duty Components

- Upgrade 13 circuit breaker at Lighthipe sub

ORDER of MAGNITUDE" SUBSTATION COST: $1.584 million

<u>Pre-project upgrades aggravated by VPP and Projects Ahead in the Queue:</u>

- Upgrade and Replace 83 circuit breakers

ORDER of MAGNITUDE" TRANSMISSION COST: $41.067 million

Circuit Breaker Upgrade/Replacement for three-phase-to-ground SCD results

TRANSMISSION SYSTEM
CASE A - Triggered by VPP Additional 304MW Project

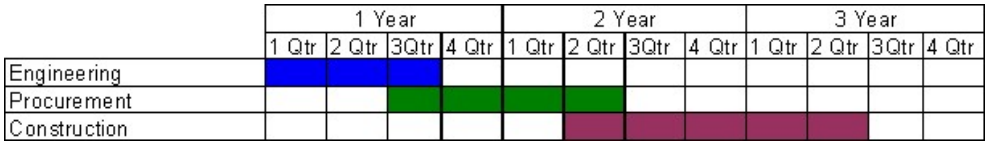
STATION	Replace	Upgrade	Sets of TRV's required	Cost of CB	Cost of TRV set of 3	Sub-Total CB	Sub-Total TRV	GRAND TOTAL
Lighthipe		13	11		$ 144,000		$ 1,584,000	**$ 1,584,000**

CASE B - Triggered by earlier Projects ahead of VPP Additional 304MW in Application Queue

STATION	Replace	Upgrade	Sets of TRV's required	Cost of CB	Cost of TRV set of 3	Sub-Total CB	Sub-Total TRV	GRAND TOTAL
Center	6			$ 476,000		$ 2,856,000		**$ 2,856,000**
El Nido	5			$ 476,000		$ 2,380,000		**$ 2,380,000**
Hinson	4	6	8	$ 476,000	$ 144,000	$ 1,904,000	$ 1,152,000	**$ 3,056,000**
La Fresa		5	5		$ 144,000		$ 720,000	**$ 720,000**
Lag. Bell	2	14	9		$ 144,000		$ 1,296,000	**$ 1,296,000**
Lewis	2			$ 476,000		$ 952,000		**$ 952,000**
Mesa	23			$ 629,000		$ 14,467,000		**$ 14,467,000**
Mira Loma	12			$ 629,000		$ 7,548,000		**$ 7,548,000**
Vincent (500kV)	4			$ 1,948,000		$ 7,792,000		**$ 7,792,000**
	58	**25**	**22**			**$ 37,899,000**	**$ 3,168,000**	**$ 41,067,000**

NOTES:
All Circuit Breakers are 220kV except where noted
All costs in 2008 Dollars
ITCC Tax not included
Costs of upgrading the Mesa 220kV Switchyard (Not shown above) is estimated at $30,000,000
Costs of upgrading the Mira Loma 220kV Switchyard (Not shown above) is estimated at $15,000,000
The cost of upgrading the Mesa and Mira Loma Substation 220kV Switchyards to 80kA Rating is only an approximate value based on an existing estimate prepared for a similar facility

The transmission schedule would be the controlling element of the Project. All other elements would be well within the 30-Month time frame shown below.



VERNON POWER PLANT
(06-AFC-4)
DATA RESPONSES, SET 2A

ATTACHMENT TSE-59
Idle Circuit Study Results

SOUTHERN CALIFORNIA
EDISON®
An EDISON INTERNATIONAL® Company

ATTACHMENT TSE-59

Robert J. Lugo
Mgr., Grid Interconnection
& Contract Development

August 3, 2006

Mr. Donal O'Callaghan
Acting Director of Light & Power
City of Vernon
4305 Santa Fe Avenue
Vernon, California 90058

Re: Idle Circuit Study Results for the Vernon Power Plant

Dear Mr. O'Callaghan:

Enclosed is the Idle Circuit Study ("Study") report requested by the City of Vernon ("Vernon") associated with the proposed Vernon Power Plant. Vernon has proposed two alternative routes, the LA River Option and the Randolph Street Option, for the gen-tie line to be interconnected from the Vernon Power Plant to Southern California Edison Company's ("SCE") Laguna Bell Substation. In order to accommodate the construction of the gen-tie line for either route, Vernon proposes to re-route some of the existing 66 kV lines out of Laguna Bell using the following two 66 kV idle lines: the former Laguna Bell – Pole Switch 20 – Pole Switch 38 circuit and the former Laguna Bell – Pole Switch 33 circuit. The purpose of the Study was to perform load flow analyses in order to determine the feasibility of re-instating the idle lines into service.

The Study results indicate that both idle lines are adequate to accommodate either of the proposed gen-tie routes. SCE is performing further evaluation to determine which gen-tie route is the more suitable option for the idle lines. Such evaluation is expected to be completed the week of August 7, 2006. After the completion of such evaluation, SCE will proceed with seeking management's approval for the utilization of the idle circuits to accommodate the proposed gen-tie routes.

If you have any questions regarding the Study, please contact Ms. Teri T. Kondo at (626) 302-8703.

Sincerely,

Robert J. Lugo

Enclosure
c: David Le (ISO) via email
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To: Teri Kondo

Date: July 27, 2006

Subject: Field Engineering 66 kV Idle Circuit Study for New Vernon Power Plant Project

Purpose of Study:

The City of Vernon is planning to build a 914 MW generation facility (Estimated O.D. is 3/31/09) in the central part of Vernon. The Vernon Power Plant project proposes to interconnect to Southern California Edison Company's ("SCE") Laguna Bell Substation 230 kV bus via a double-circuit 230 kV generation tie line. The city of Vernon has proposed two alternate routes for such gen-tie line (i.e., the LA River Option and the Randolph St. Option as described below). To free up space to build the new double-circuit 220 kV line for either route, some existing 66kV lines out of the Laguna Bell 'A' system will need to be re-routed using the following two 66 kV idle lines that lie within the Laguna Bell system area of responsibility.

1) The former Laguna Bell – Pole Switch 20 – Pole Switch 38 66 kV circuit (**"Vernon Reserve Circuit"**).
   - Line runs parallel to the Laguna Bell – Federalgen - Fruitland 66 kV line.
2) The former Laguna Bell – Pole Switch 33 66 kV circuit (**"SCE Idle Circuit"**).
   - Line is currently open at Fruitland Avenue and Loma Vista Avenue in Vernon, California.

To determine if the idle lines in question are adequate to be re-instated for service, Field Engineering conducted a study on the two idle lines by means of load flow analysis.

Study: Load Flow Analysis

The load flow analysis consisted of simulating the two idle circuits in question as if they were in service in the following ways (options recommended by the city of Vernon):

<u>Option #1: The LA River Option</u>

The two idle lines replace the existing:
1. Laguna Bell – Leonis No. 2 66 kV line
2. Laguna Bell – Ybarra 66 kV line

<u>Option #2: The Randolph St. Option</u>

The two idle lines replace the existing:
1. Laguna Bell – Container – ~~Pulpgen~~ – Vernon 66 kV line
2. Laguna Bell – Leonis – Vernon 66 kV line

Two different scenarios were applied for both options as part of the load flow analysis. The first scenario consisted of performing a load flow assessment with all the generation within the Laguna Bell 'A' system on. Whereas in the second scenario all the generation was turned off.

The load flow analysis results of both options with the two scenarios applied, indicated that putting the idle lines in question back into service as stated in either option would not cause any detrimental impact to the exiting Laguna Bell system; thus making the idle lines adequate to be reinstated.

Study Assumptions:

1. The 2015 SCE ten year non-coincident (normal weather) load forecast was used for existing SCE distribution subs and dedicated subs. There was no additional load growth considered beyond 2015.

2. Laguna Bell transmission substation is assumed to operate as a split system, in which two A-banks in parallel feed section "AB", and another two A-banks in parallel feed section "DE" of the system.

3. New overhead circuit sections will utilize 653 ACSR conductor.

4. New underground circuit sections will utilize 2000 KCMIL conductor with open shields.

Study Requirements:

The study required the following load flow modeling changes on the Laguna Bell System.

1. New Line Configurations:

   Option #1: The LA River Option

   A. Laguna Bell-Leonis #2 66kV Line *(Approximate Total Circuit Length: 4.98 mi.)*

      a. Utilize the Vernon Reserve line.
      b. Change approximately 0.3 miles of 66 kV line from overhead to underground, using 2000 KCMIL conductor, between the closest tower outside of the Laguna Bell substation and the 66 kV switch rack at the Laguna Bell substation.

   B. Laguna Bell –Ybarra 66 kV Line *(Approximate Total Circuit Length: 5.2 mi.)*

      a. Utilize SCE idle line.
      b. Add on approximately 0.3 miles of underground 66 kVline section to the SCE idle circuit, using 2000 KCMIL conductor, between the termination of the line located south of Slauson Avenue and into the 66 kV switch rack at the Laguna Bell 66 kV substation.
      c. Add on approximately 0.6 miles of new 66 kV line section, using 653 ACSR cable, to the SCE idle line between Fruitland Ave and 44th Street.

   Option #2: The Randolph St. Option

   A. Laguna Bell–Container-~~Pulpgen~~–Vernon 66 kV Line *(Approximate Total Circuit Length: 5.7 mi.)*

      a. Utilize the Vernon Reserve Circuit
      b. Add on approximately 0.3 miles of new 66 kV line section, using 653 ACSR cable, to Vernon Reserve circuit between Alcoa Avenue and Boyle Avenue.

   B. Laguna Bell–Leonis–Vernon 66 kVLine *(Approximate Total Circuit Length: 6.2 mi.)*

      a. Utilize SCE idle line.
      b. Add on approximately 0.3 miles of new 66 kV line section to SCE idle line t, using 653 ACSR cable, between the termination of line south of Slauson Avenue and into the switch rack at the Laguna Bell 66 kV substation.

2. New Impedance Calculations:

   Due to the fact that several 66 kV lines would need to be undergrounded at the 66 kV Laguna Bell Switch rack to have space available to bring in the two new 220 kV lines into the station, new line impedances had to be calculated for the following lines:

   - Laguna Bell-Ybarra 66kV Line
   - Laguna Bell-Leonis #2 66kV Line
   - Laguna Bell-Federalgen-Fruitland-Laguna Bell 66kV Line
   - Laguna Bell-Leonis #1 66kV Line
   - Laguna Bell Fruitland-Laguna Bell-Randolph 66kV Line
   - Laguna Bell-Randolph #1 66kV Line
   - Laguna Bell-Newmark-Vail 66kV Line
   - Mesa-Laguna Bell-Mesa-Narrows 66kV Line
   - Laguna Bell-Vail 66kV Line
   - Laguna Bell-Bandini- Refuse-Vail 66kV Line

***Conclusion*:**

The load flow analysis results indicate that both idle lines are adequate to service the City of Vernon for either option #1 or option #2. Both of the options are feasible, however the determination of which option is most suitable to build will be based on the recommendation submitted by transmission planning.

If you have any questions or concerns regarding this study feel free to contact me.

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Vernon Power Plant Project
APPLICATION FOR CERTIFICATION,
DOCKET NO. 06-AFC-4

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