

ENGINEERING ASSESSMENT

FACILITY DESIGN

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SUMMARY OF CONCLUSIONS

Staff concludes that the design, construction and eventual closure of the project and its linear facilities would likely comply with applicable engineering laws, ordinances, regulations and standards. The proposed Conditions of Certification, below, would ensure compliance with these laws, ordinances, regulations and standards.

INTRODUCTION

Facility Design encompasses the civil, structural, mechanical and electrical engineering design of the project. The purpose of the Facility Design analysis is to:

- verify that the laws, ordinances, regulations and standards (LORS) applicable to the engineering design and construction of the project have been identified;
- verify that the project and ancillary facilities have been described in sufficient detail, including proposed design criteria and analysis methods, to provide reasonable assurance that the project can be designed and constructed in accordance with all applicable engineering LORS, and in a manner that assures public health and safety;
- determine whether special design features should be considered during final design to deal with conditions unique to the site which could influence public health and safety; and
- describe the design review and construction inspection process and establish Conditions of Certification that will be used to monitor and ensure compliance with the engineering LORS and any special design requirements.

Subjects discussed in this analysis include:

- Identification of the engineering LORS applicable to facility design;
- Evaluation of the applicant's proposed design criteria, including the identification of those criteria that are essential to ensuring public health and safety;
- Proposed modifications and additions to the Application for Certification (AFC) that are necessary to comply with applicable engineering LORS; and
- Conditions of Certification proposed by staff to ensure that the project will be designed and constructed to assure public health and safety and comply with all applicable engineering LORS.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

Lists of LORS applicable to each engineering discipline (civil, structural, mechanical and electrical) are described in the AFC (PG&E 2006a, Appendix 10). The key LORS are listed in **Facility Design Table 1** below:

Facility Design Table 1 Key Engineering Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Federal	Title 29 Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health Standards
State	California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations)
Local	Humboldt County, Regulations and Ordinances
General	American National Standards Institute (ANSI) American Society of Mechanical Engineers (ASME) American Welding Society (AWS) American Society for Testing and Materials (ASTM)

SETTING

The Humboldt Bay Repowering Project (HBRP) will be located at 1000 King Salmon Avenue, approximately 3 miles south of the City of Eureka in an unincorporated area of Humboldt County. The project will be located on 5.4 acres within a 143-acre parcel currently occupied by PG&E Humboldt Bay Power Plant. The site will lie in seismic zone 4. For more information on the site and related project description, please see the **Project Description** section of this document. Additional engineering design details are contained in the Application for Certification (AFC), in Appendix 10 (PG&E 2006a).

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The purpose of this analysis is to ensure that the project is built to the applicable engineering codes in order to ensure public health and life safety. The analysis verifies that the applicable engineering LORS have been identified and that the project and ancillary facilities have been described in sufficient detail. It also evaluates the applicant's proposed design criteria, describes the design review and construction inspection process, and establishes Conditions of Certification to monitor and ensure compliance with the engineering LORS and any special design requirements. These conditions allow the Energy Commission Compliance Project Manager (CPM) and the applicant to adopt a compliance monitoring scheme that will verify compliance with these LORS.

SITE PREPARATION AND DEVELOPMENT

Staff has evaluated the proposed design criteria for grading, flood protection, erosion control, site drainage, and site access. Staff has assessed the criteria for designing and constructing linear support facilities such as natural gas and electric transmission interconnections. The applicant proposes to use accepted industry standards (see PG&E 2006a, Appendix 10 for a representative list of applicable industry standards), design practices and construction methods in preparing and developing the site. Staff concludes that the project, including its linear facilities, would most likely comply with all

applicable site preparation LORS, and proposes Conditions of Certification (see below and the **Geology and Paleontology** section of this document) to ensure compliance.

MAJOR STRUCTURES, SYSTEMS AND EQUIPMENT

Major structures, systems and equipment are defined as those structures and associated components or equipment that are necessary for power production and are costly or time consuming to repair or replace, that are used for the storage, containment, or handling of hazardous or toxic materials, or may become potential health and safety hazards if not constructed according to the applicable engineering LORS. Major structures and equipment will be identified through compliance with proposed Condition of Certification **GEN-2** (below).

The AFC contains lists of the civil, structural, mechanical and electrical design criteria that demonstrate the likelihood of compliance with applicable engineering LORS, and that staff believes are essential to ensuring that the project is designed in a manner that protects public health and safety.

The project shall be designed and constructed to the 2001 edition of the California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations), which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and other applicable codes and standards in effect at the time design and construction of the project actually commences. In the event the initial designs are submitted to the Chief Building Official (CBO) for review and approval when the successor to the 2001 CBSC is in effect, the 2001 CBSC provisions, identified herein, shall be replaced with the applicable successor provisions. (The 2007 CBSC will be in effect on January 1, 2008.)

Certain structures in a power plant may be required, under the CBC, to undergo dynamic lateral force (structural) analysis; others may be designed using the simpler static analysis procedure. In order to ensure that structures are analyzed using the appropriate lateral force procedure, staff has included Condition of Certification **STRUC-1** (below), which in part, requires review and approval by the CBO of the project owner's proposed lateral force procedures prior to the start of construction.

PROJECT QUALITY PROCEDURES

The AFC (PG&E 2006a, § 2.7.5) describes a project Quality Program that will be used on the HBRP project to maximize confidence that systems and components will be designed, fabricated, stored, transported, installed and tested in accordance with the technical codes and standards appropriate for a power plant. Compliance with design requirements will be verified through an appropriate program of inspections and audits. Employment of this quality assurance/quality control (QA/QC) program would ensure that the project is actually designed, procured, fabricated, and installed as contemplated in this analysis.

COMPLIANCE MONITORING

Under Section 104.2 of the CBC, the building official is authorized and directed to enforce all the provisions of the CBC. For all energy facilities certified by the Energy Commission, the Energy Commission is the building official and has the responsibility to enforce the code. In addition, the Energy Commission has the power to render interpretations of the CBC and to adopt and enforce rules and supplemental regulations to clarify the application of the CBC's provisions.

The Energy Commission's design review and construction inspection process is developed to conform to CBC requirements and to ensure that all facility design Conditions of Certification are met. As provided by Section 104.2.2 of the CBC, the Energy Commission appoints experts to carry out the design review and construction inspections and act as delegate CBO on behalf of the Energy Commission. These delegates typically include the local building official and/or independent consultants hired to provide technical expertise not provided by the local official. The applicant, through permit fees as provided by CBC Sections 107.2 and 107.3, pays the costs of the reviews and inspections. While building permits in addition to the Energy Commission certification are not required for this project, in lieu permit fees are paid by the applicant consistent with CBC Section 107, to cover the costs of reviews and inspections.

Engineering and compliance staff will invite the local building authority, Humboldt County, or a third party engineering consultant, to act as CBO for the project. When an entity has been identified to perform the duties of CBO, Energy Commission staff will complete a Memorandum of Understanding (MOU) with that entity that outlines its roles and responsibilities and those of its subcontractors and delegates.

Staff has developed proposed Conditions of Certification to ensure public health and safety and compliance with engineering design LORS. Some of these conditions address the roles, responsibilities and qualifications of the applicant's engineers responsible for the design and construction of the project (proposed Conditions of Certification **GEN-1** through **GEN-8**). Engineers responsible for the design of the civil, structural, mechanical and electrical portions of the project are required to be registered in California, and to sign and stamp each submittal of design plans, calculations and specifications submitted to the CBO. These conditions require that no element of construction subject to CBO review and approval shall proceed without prior approval from the CBO. They also require that qualified special inspectors be assigned to perform or oversee special inspections required by the applicable LORS.

While the Energy Commission and delegate CBO have the authority to allow some flexibility in scheduling construction activities, these conditions are written to require that no element of construction of permanent facilities subject to CBO review and approval, which would be difficult to reverse or correct, may proceed without prior approval of plans by the CBO. Those elements of construction that are not difficult to reverse are allowed to proceed without approval of the plans. The applicant shall bear the responsibility to fully modify those elements of construction to comply with all design changes that result from the CBO's subsequent plan review and approval process.

FACILITY CLOSURE

The removal of a facility from service, or decommissioning, as a result of the project reaching the end of its useful life, may range from “mothballing” to removal of all equipment and appurtenant facilities and restoration of the site. Future conditions that may affect the decommissioning decision are largely unknown at this time.

In order to assure that decommissioning of the facility will be completed in a manner that is environmentally sound, safe and will protect public health and safety, the applicant shall submit a decommissioning plan to the Energy Commission for review and approval prior to the commencement of decommissioning. The plan shall include a discussion of:

- proposed decommissioning activities for the project and all appurtenant facilities constructed as part of the project;
- all applicable LORS, local/regional plans and the conformance of the proposed decommissioning activities to the applicable LORS and local/regional plans;
- the activities necessary to restore the site if the plan requires removal of all equipment and appurtenant facilities; and
- decommissioning alternatives, other than complete site restoration.

The above requirements should serve as adequate protection, even in the unlikely event of project abandonment. Staff has proposed general conditions (see **General Conditions**) to ensure that these measures are included in the Facility Closure plan.

CONCLUSIONS

1. The laws, ordinances, regulations and standards (LORS) identified in the AFC and supporting documents are those applicable to the project.
2. Staff has evaluated the proposed engineering LORS, design criteria and design methods in the record, and concludes that the design, construction and eventual closure of the project are likely to comply with applicable engineering LORS.
3. The Conditions of Certification proposed will ensure that the proposed facilities are designed and constructed in accordance with applicable engineering LORS. This will occur through the use of design review, plan checking and field inspections, which are to be performed by the CBO or other Energy Commission delegate. Staff will audit the CBO to ensure satisfactory performance.
4. Whereas future conditions that may affect decommissioning are largely unknown at this time, it can reasonably be concluded that if the project owner submits a decommissioning plan as required in the **General Conditions** portion of this document prior to the commencement of decommissioning, the decommissioning procedure is likely to occur in compliance with all applicable engineering LORS.

Energy Commission staff recommends that:

1. The Conditions of Certification proposed herein be adopted to ensure that the project is designed and constructed to assure public health and safety, and to ensure compliance with all applicable engineering LORS;
2. The project be designed and built to the 2001 CBSC (or successor standard, if such is in effect when the initial project engineering designs are submitted for review); and
3. The CBO shall review the final designs, conduct plan checking and perform field inspections during construction. Energy Commission staff shall audit and monitor the CBO to ensure satisfactory performance.

CONDITIONS OF CERTIFICATION

GEN-1 The project owner shall design, construct and inspect the project in accordance with the 2001 California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations), which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and all other applicable engineering LORS in effect at the time initial design plans are submitted to the CBO for review and approval. (The CBSC in effect is that edition that has been adopted by the California Building Standards Commission and published at least 180 days previously.) The project owner shall insure that all the provisions of the above applicable codes be enforced during any construction, addition, alteration, moving, demolition, repair, or maintenance of the completed facility [2001 CBC, Section 101.3, Scope]. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

In the event that the initial engineering designs are submitted to the CBO when a successor to the 2001 CBSC is in effect, the 2001 CBSC provisions identified herein shall be replaced with the applicable successor provisions. Where, in any specific case, different sections of the code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

The project owner shall insure that all contracts with contractors, subcontractors and suppliers shall clearly specify that all work performed and materials supplied on this project comply with the codes listed above.

Verification: Within 30 days after receipt of the Certificate of Occupancy, the project owner shall submit to the Compliance Project Manager (CPM) a statement of verification, signed by the responsible design engineer, attesting that all designs, construction, installation and inspection requirements of the applicable LORS and the Energy Commission's Decision have been met in the area of facility design. The project

owner shall provide the CPM a copy of the Certificate of Occupancy within 30 days of receipt from the CBO [2001 CBC, Section 109 – Certificate of Occupancy].

Once the Certificate of Occupancy has been issued, the project owner shall inform the CPM at least 30 days prior to any construction, addition, alteration, moving, demolition, repair, or maintenance to be performed on any portion(s) of the completed facility which may require CBO approval for the purpose of complying with the above stated codes. The CPM will then determine the necessity of CBO approval on the work to be performed.

GEN-2 Prior to submittal of the initial engineering designs for CBO review, the project owner shall furnish to the CPM and to the CBO a schedule of facility design submittals, a Master Drawing List and a Master Specifications List. The schedule shall contain a list of proposed submittal packages of designs, calculations and specifications for major structures and equipment. To facilitate audits by Energy Commission staff, the project owner shall provide specific packages to the CPM when requested.

Verification: At least 60 days (or project owner and CBO approved alternative timeframe) prior to the start of rough grading, the project owner shall submit to the CBO and to the CPM the schedule, the Master Drawing List and the Master Specifications List of documents to be submitted to the CBO for review and approval. These documents shall be the pertinent design documents for the major structures and equipment listed in **Facility Design Table 2** below. Major structures and equipment shall be added to or deleted from the table only with CPM approval. The project owner shall provide schedule updates in the Monthly Compliance Report.

**Facility Design Table 2
Major Structures and Equipment List**

Equipment/System	Quantity (Plant)
Engine Generator Set Foundations and Connections	10
Engine Housing Structure, Foundations and Connections	1
Crankcase Ventilation Foundations and Connections	10
Stack Structure, Foundations and Connections	10
Radiator Set Structure, Foundations and Connections	40
Station Transformer Foundations and Connections	3
Exhaust Gas Silencer Structure, Foundations and Connections	10
Rupture Disc Foundations and Connections	24
DeNox SCR Structure, Foundations and Connections	10
Black Start Unit Foundations and Connections	1
LV Room Structure, Foundations and Connections	1
MV Building/Control Structure, Foundations and Connections	1
Control Room/Office/Work Shop Building Structure, Foundations and Connections	1
Clean LO Tank Structure, Foundations and Connections	1
Used LO Tank Structure, Foundations and Connections	1
Lube Oil Service Tank Structure, Foundations and Connections	1
Fire Fighting Container Structure, Foundations and Connections	1
Fire/Raw Water Tank Structure, Foundations and Connections	1
Diesel Tank Structure, Foundations and Connections	1
Sludge Tank Structure, Foundations and Connections	1
Pump Shelter Structure, Foundations and Connections	1
Oily Water Separator Foundation and Connections	1
Ammonia Storage Tank Structure, Foundations and Connections	2
Drainage Systems (including sanitary drain and waste)	1 Lot
High Pressure and Large Diameter Piping and Pipe Racks	1 Lot
HVAC and Refrigeration Systems	1 Lot
Temperature Control and Ventilation Systems (including water and sewer connections)	1 Lot
Building Energy Conservation Systems	1 Lot
Switchyard, Buses and Towers	1 Lot
Electrical Duct Banks	1 Lot

GEN-3 The project owner shall make payments to the CBO for design review, plan check and construction inspection based upon a reasonable fee schedule to be negotiated between the project owner and the CBO. These fees may be consistent with the fees listed in the 2001 CBC [Chapter 1, Section 107 and Table 1-A, Building Permit Fees; Appendix Chapter 33, Section 3310 and Table A-33-A, Grading Plan Review Fees; and Table A-33-B, Grading Permit Fees], adjusted for inflation and other appropriate adjustments; may be based

on the value of the facilities reviewed; may be based on hourly rates; or may be as otherwise agreed by the project owner and the CBO.

Verification: The project owner shall make the required payments to the CBO in accordance with the agreement between the project owner and the CBO. The project owner shall send a copy of the CBO's receipt of payment to the CPM in the next Monthly Compliance Report indicating that the applicable fees have been paid.

GEN-4 Prior to the start of rough grading, the project owner shall assign a California registered architect, structural engineer or civil engineer, as a resident engineer (RE), to be in general responsible charge of the project [Building Standards Administrative Code (Cal. Code Regs., tit. 24, § 4-209, Designation of Responsibilities)]. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

The RE may delegate responsibility for portions of the project to other registered engineers. Registered mechanical and electrical engineers may be delegated responsibility for mechanical and electrical portions of the project, respectively. A project may be divided into parts, provided each part is clearly defined as a distinct unit. Separate assignment of general responsible charge may be made for each designated part.

The RE shall:

1. Monitor construction progress of work requiring CBO design review and inspection to ensure compliance with LORS;
2. Ensure that construction of all the facilities subject to CBO design review and inspection conforms in every material respect to the applicable LORS, these Conditions of Certification, approved plans, and specifications;
3. Prepare documents to initiate changes in the approved drawings and specifications when directed by the project owner or as required by conditions on the project;
4. Be responsible for providing the project inspectors and testing agency(ies) with complete and up-to-date set(s) of stamped drawings, plans, specifications and any other required documents;
5. Be responsible for the timely submittal of construction progress reports to the CBO from the project inspectors, the contractor, and other engineers who have been delegated responsibility for portions of the project; and
6. Be responsible for notifying the CBO of corrective action or the disposition of items noted on laboratory reports or other tests as not conforming to the approved plans and specifications.

The RE shall have the authority to halt construction and to require changes or remedial work, if the work does not conform to applicable requirements.

If the RE or the delegated engineers are reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the resume and registration number of the RE and any other delegated engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the RE and other delegated engineer(s) within five days of the approval.

If the RE or the delegated engineer(s) are subsequently reassigned or replaced, the project owner has five days in which to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-5 Prior to the start of rough grading, the project owner shall assign at least one of each of the following California registered engineers to the project: A) a civil engineer; B) a soils engineer, or a geotechnical engineer or a civil engineer experienced and knowledgeable in the practice of soils engineering; and C) an engineering geologist. Prior to the start of construction, the project owner shall assign at least one of each of the following California registered engineers to the project: D) a design engineer, who is either a structural engineer or a civil engineer fully competent and proficient in the design of power plant structures and equipment supports; E) a mechanical engineer; and F) an electrical engineer. [California Business and Professions Code section 6704 et seq., and sections 6730, 6731 and 6736 requires state registration to practice as a civil engineer or structural engineer in California.] All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

The tasks performed by the civil, mechanical, electrical or design engineers may be divided between two or more engineers, as long as each engineer is responsible for a particular segment of the project (e.g., proposed earthwork, civil structures, power plant structures, equipment support). No segment of the project shall have more than one responsible engineer. The transmission line may be the responsibility of a separate California registered electrical engineer.

The project owner shall submit to the CBO for review and approval, the names, qualifications and registration numbers of all responsible engineers assigned to the project [2001 CBC, Section 104.2, Powers and Duties of Building Official].

If any one of the designated responsible engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned responsible

engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

A. The civil engineer shall:

1. Review the Foundation Investigations Report, Geotechnical Report or Soils Report prepared by the soils engineer, the geotechnical engineer, or by a civil engineer experienced and knowledgeable in the practice of soils engineering;
2. Design, or be responsible for design, stamp, and sign all plans, calculations and specifications for proposed site work, civil works and related facilities requiring design review and inspection by the CBO. At a minimum, these include: grading, site preparation, excavation, compaction, construction of secondary containment, foundations, erosion and sedimentation control structures, drainage facilities, underground utilities, culverts, site access roads and sanitary sewer systems; and
3. Provide consultation to the RE during the construction phase of the project and recommend changes in the design of the civil works facilities and changes in the construction procedures.

B. The soils engineer, geotechnical engineer, or civil engineer experienced and knowledgeable in the practice of soils engineering, shall:

1. Review all the engineering geology reports;
2. Prepare the Foundation Investigations Report, Geotechnical Report or Soils Report containing field exploration reports, laboratory tests and engineering analysis detailing the nature and extent of the soils that may be susceptible to liquefaction, rapid settlement or collapse when saturated under load [2001 CBC, Appendix Chapter 33, Section 3309.5, Soils Engineering Report; Section 3309.6, Engineering Geology Report; and Chapter 18, Section 1804, Foundation Investigations];
3. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with the requirements set forth in the 2001 CBC, Appendix Chapter 33; Section 3317, Grading Inspections (depending on the site conditions, this may be the responsibility of either the soils engineer or engineering geologist or both); and
4. Recommend field changes to the civil engineer and RE.

This engineer shall be authorized to halt earthwork and to require changes if site conditions are unsafe or do not conform with predicted conditions used as a basis for design of earthwork or foundations [2001 CBC, section 104.2.4, Stop orders].

C. The engineering geologist shall:

1. Review all the engineering geology reports and prepare final soils grading report; and
2. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with the requirements set forth in the 2001 CBC, Appendix Chapter 33; Section 3317, Grading Inspections (depending on the site conditions, this may be the responsibility of either the soils engineer or engineering geologist or both).

D. The design engineer shall:

1. Be directly responsible for the design of the proposed structures and equipment supports;
2. Provide consultation to the RE during design and construction of the project;
3. Monitor construction progress to ensure compliance with engineering LORS;
4. Evaluate and recommend necessary changes in design; and
5. Prepare and sign all major building plans, specifications and calculations.

E. The mechanical engineer shall be responsible for, and sign and stamp a statement with, each mechanical submittal to the CBO, stating that the proposed final design plans, specifications, and calculations conform with all of the mechanical engineering design requirements set forth in the Energy Commission's Decision.

F. The electrical engineer shall:

1. Be responsible for the electrical design of the project; and
2. Sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible civil engineer, soils (geotechnical) engineer and engineering geologist assigned to the project.

At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of construction, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible design engineer, mechanical engineer and electrical engineer assigned to the project.

The project owner shall notify the CPM of the CBO's approvals of the responsible engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-6 Prior to the start of an activity requiring special inspection, the project owner shall assign to the project, qualified and certified special inspector(s) who shall be responsible for the special inspections required by the 2001 CBC, Chapter 17 [Section 1701, Special Inspections; Section 1701.5, Type of Work (requiring special inspection)]; and Section 106.3.5, Inspection and observation program. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

A certified weld inspector, certified by the American Welding Society (AWS), and/or American Society of Mechanical Engineers (ASME) as applicable, shall inspect welding performed on-site requiring special inspection (including structural, piping, tanks and pressure vessels).

The special inspector shall:

1. Be a qualified person who shall demonstrate competence, to the satisfaction of the CBO, for inspection of the particular type of construction requiring special or continuous inspection;
2. Observe the work assigned for conformance with the approved design drawings and specifications;
3. Furnish inspection reports to the CBO and RE. All discrepancies shall be brought to the immediate attention of the RE for correction, then, if uncorrected, to the CBO and the CPM for corrective action [2001 CBC, Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector]; and
4. Submit a final signed report to the RE, CBO, and CPM, stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans and specifications and the applicable provisions of the applicable edition of the CBC.

Verification: At least 15 days (or project owner and CBO approved alternative timeframe) prior to the start of an activity requiring special inspection, the project owner shall submit to the CBO for review and approval, with a copy to the CPM, the name(s) and qualifications of the certified weld inspector(s), or other certified special inspector(s) assigned to the project to perform one or more of the duties set forth above. The project owner shall also submit to the CPM a copy of the CBO's approval of the qualifications of all special inspectors in the next Monthly Compliance Report.

If the special inspector is subsequently reassigned or replaced, the project owner has five days in which to submit the name and qualifications of the newly assigned special inspector to the CBO for approval. The project owner shall notify the CPM of the CBO's approval of the newly assigned inspector within five days of the approval.

GEN-7 If any discrepancy in design and/or construction is discovered in any engineering work that has undergone CBO design review and approval, the project owner shall document the discrepancy and recommend the corrective action required [2001 CBC, Chapter 1, Section 108.4, Approval Required; Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector; Appendix Chapter 33, Section 3317.7, Notification of Noncompliance]. The discrepancy documentation shall be submitted to the CBO for review and approval. The discrepancy documentation shall reference this Condition of Certification and, if appropriate, the applicable sections of the CBC and/or other LORS.

Verification: The project owner shall transmit a copy of the CBO's approval of any corrective action taken to resolve a discrepancy to the CPM in the next Monthly Compliance Report. If any corrective action is disapproved, the project owner shall advise the CPM, within five days, of the reason for disapproval and the revised corrective action to obtain CBO's approval.

GEN-8 The project owner shall obtain the CBO's final approval of all completed work that has undergone CBO design review and approval. The project owner shall request the CBO to inspect the completed structure and review the submitted documents. The project owner shall notify the CPM after obtaining the CBO's final approval. The project owner shall retain one set of approved engineering plans, specifications and calculations (including all approved changes) at the project site or at another accessible location during the operating life of the project [2001 CBC, Section 106.4.2, Retention of Plans]. Electronic copies of the approved plans, specifications, calculations and marked-up as-builts shall be provided to the CBO for retention by the CPM.

Verification: Within 15 days of the completion of any work, the project owner shall submit to the CBO, with a copy to the CPM, in the next Monthly Compliance Report, (a) a written notice that the completed work is ready for final inspection, and (b) a signed statement that the work conforms to the final approved plans. After storing final approved engineering plans, specifications and calculations as described above, the project owner shall submit to the CPM a letter stating that the above documents have been stored and indicate the storage location of such documents.

Within 90 days of the completion of construction, the project owner shall provide to the CBO three sets of electronic copies of the above documents at the project owner's expense. These are to be provided in the form of "read only" adobe .pdf 6.0 files, with restricted printing privileges (i.e. password protected), on archive quality compact discs.

CIVIL-1 The project owner shall submit to the CBO for review and approval the following:

1. Design of the proposed drainage structures and the grading plan;

2. An erosion and sedimentation control plan;
3. Related calculations and specifications, signed and stamped by the responsible civil engineer; and
4. Soils Report, Geotechnical Report or Foundation Investigations Report required by the 2001 CBC [Appendix Chapter 33, Section 3309.5, Soils Engineering Report; Section 3309.6, Engineering Geology Report; and Chapter 18, Section 1804, Foundation Investigations].

Verification: At least 15 days (or project owner and CBO approved alternative timeframe) prior to the start of site grading the project owner shall submit the documents described above to the CBO for design review and approval. In the next Monthly Compliance Report following the CBO's approval, the project owner shall submit a written statement certifying that the documents have been approved by the CBO.

CIVIL-2 The resident engineer shall, if appropriate, stop all earthwork and construction in the affected areas when the responsible soils engineer, geotechnical engineer, or the civil engineer experienced and knowledgeable in the practice of soils engineering identifies unforeseen adverse soil or geologic conditions. The project owner shall submit modified plans, specifications and calculations to the CBO based on these new conditions. The project owner shall obtain approval from the CBO before resuming earthwork and construction in the affected area [2001 CBC, Section 104.2.4, Stop orders].

Verification: The project owner shall notify the CPM within 24 hours, when earthwork and construction is stopped as a result of unforeseen adverse geologic/soil conditions. Within 24 hours of the CBO's approval to resume earthwork and construction in the affected areas, the project owner shall provide to the CPM a copy of the CBO's approval.

CIVIL-3 The project owner shall perform inspections in accordance with the 2001 CBC, Chapter 1, Section 108, Inspections; Chapter 17, Section 1701.6, Continuous and Periodic Special Inspection; and Appendix Chapter 33, Section 3317, Grading Inspection. All plant site-grading operations, for which a grading permit is required, shall be subject to inspection by the CBO.

If, in the course of inspection, it is discovered that the work is not being performed in accordance with the approved plans, the discrepancies shall be reported immediately to the resident engineer, the CBO and the CPM [2001 CBC, Appendix Chapter 33, Section 3317.7, Notification of Noncompliance]. The project owner shall prepare a written report, with copies to the CBO and the CPM, detailing all discrepancies, non-compliance items, and the proposed corrective action.

Verification: Within five days of the discovery of any discrepancies, the resident engineer shall transmit to the CBO and the CPM a Non-Conformance Report (NCR), and the proposed corrective action for review and approval. Within five days of resolution of the NCR, the project owner shall submit the details of the corrective action to the CBO and the CPM. A list of NCRs, for the reporting month, shall also be included in the following Monthly Compliance Report.

CIVIL-4 After completion of finished grading and erosion and sedimentation control and drainage work, the project owner shall obtain the CBO's approval of the final grading plans (including final changes) for the erosion and sedimentation control work. The civil engineer shall state that the work within his/her area of responsibility was done in accordance with the final approved plans [1998 CBC, Section 3318, Completion of Work].

Verification: Within 30 days (or project owner and CBO approved alternative timeframe) of the completion of the erosion and sediment control mitigation and drainage work, the project owner shall submit to the CBO, for review and approval, the final grading plans (including final changes) and the responsible civil engineer's signed statement that the installation of the facilities and all erosion control measures were completed in accordance with the final approved combined grading plans, and that the facilities are adequate for their intended purposes, with a copy of the transmittal letter to the CPM. The project owner shall submit a copy of the CBO's approval to the CPM in the next Monthly Compliance Report.

STRUC-1 Prior to the start of any increment of construction of any major structure or component listed in **Facility Design Table 2** of Condition of Certification **GEN-2**, above, the project owner shall submit to the CBO for design review and approval the proposed lateral force procedures for project structures and the applicable designs, plans and drawings for project structures. Proposed lateral force procedures, designs, plans and drawings shall be those for the following items (from **Table 2**, above):

1. Major project structures;
2. Major foundations, equipment supports and anchorage; and
3. Large field fabricated tanks.

Construction of any structure or component shall not commence until the CBO has approved the lateral force procedures to be employed in designing that structure or component.

The project owner shall:

1. Obtain approval from the CBO of lateral force procedures proposed for project structures;
2. Obtain approval from the CBO for the final design plans, specifications, calculations, soils reports and applicable quality control procedures. If there are conflicting requirements, the more stringent shall govern (i.e., highest loads, or lowest allowable stresses shall govern). All plans, calculations and specifications for foundations that support structures shall be filed concurrently with the structure plans, calculations and specifications [2001 CBC, Section 108.4, Approval Required];
3. Submit to the CBO the required number of copies of the structural plans, specifications, calculations and other required documents of the designated major structures prior to the start of on-site fabrication and

installation of each structure, equipment support, or foundation [2001 CBC, Section 106.4.2, Retention of plans; and Section 106.3.2, Submittal documents];

4. Ensure that the final plans, calculations and specifications clearly reflect the inclusion of approved criteria, assumptions and methods used to develop the design. The final designs, plans, calculations and specifications shall be signed and stamped by the responsible design engineer [2001 CBC, Section 106.3.4, Architect or Engineer of Record]; and
5. Submit to the CBO the responsible design engineer's signed statement that the final design plans conform to the applicable LORS [2001 CBC, Section 106.3.4, Architect or Engineer of Record].

Verification: At least 60 days (or project owner and CBO approved alternative timeframe) prior to the start of any increment of construction of any structure or component listed in **Facility Design Table 2** of Condition of Certification **GEN-2** above, the project owner shall submit to the CBO the above final design plans, specifications and calculations, with a copy of the transmittal letter to the CPM.

The project owner shall submit to the CPM, in the next Monthly Compliance Report a copy of a statement from the CBO that the proposed structural plans, specifications and calculations have been approved and are in compliance with the requirements set forth in the applicable engineering LORS.

STRUC-2 The project owner shall submit to the CBO the required number of sets of the following documents related to work that has undergone CBO design review and approval:

1. Concrete cylinder strength test reports (including date of testing, date sample taken, design concrete strength, tested cylinder strength, age of test, type and size of sample, location and quantity of concrete placement from which sample was taken, and mix design designation and parameters);
2. Concrete pour sign-off sheets;
3. Bolt torque inspection reports (including location of test, date, bolt size, and recorded torques);
4. Field weld inspection reports (including type of weld, location of weld, inspection of non-destructive testing (NDT) procedure and results, welder qualifications, certifications, qualified procedure description or number (ref: AWS); and
5. Reports covering other structural activities requiring special inspections shall be in accordance with the 2001 CBC, Chapter 17, Section 1701, Special Inspections; Section 1701.5, Type of Work (requiring special inspection); Section 1702, Structural Observation and Section 1703, Nondestructive Testing.

Verification: If a discrepancy is discovered in any of the above data, the project owner shall, within five days, prepare and submit an NCR describing the nature of the discrepancies and the proposed corrective action to the CBO, with a copy of the transmittal letter to the CPM [2001 CBC, Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector]. The NCR shall reference the Condition(s) of Certification and the applicable CBC chapter and section. Within five days of resolution of the NCR, the project owner shall submit a copy of the corrective action to the CBO and the CPM.

The project owner shall transmit a copy of the CBO's approval or disapproval of the corrective action to the CPM within 15 days. If disapproved, the project owner shall advise the CPM, within five days, the reason for disapproval, and the revised corrective action to obtain CBO's approval.

STRUC-3 The project owner shall submit to the CBO design changes to the final plans required by the 2001 CBC, Chapter 1, Section 106.3.2, Submittal documents and Section 106.3.3, Information on plans and specifications, including the revised drawings, specifications, calculations, and a complete description of, and supporting rationale for, the proposed changes, and shall give to the CBO prior notice of the intended filing.

Verification: On a schedule suitable to the CBO, the project owner shall notify the CBO of the intended filing of design changes, and shall submit the required number of sets of revised drawings and the required number of copies of the other above-mentioned documents to the CBO, with a copy of the transmittal letter to the CPM. The project owner shall notify the CPM, via the Monthly Compliance Report, when the CBO has approved the revised plans.

STRUC-4 Tanks and vessels containing quantities of toxic or hazardous materials exceeding amounts specified in Chapter 3, Table 3-E of the 2001 CBC shall, at a minimum, be designed to comply with the requirements of that Chapter.

Verification: At least 30 days (or project owner and CBO approved alternate timeframe) prior to the start of installation of the tanks or vessels containing the above specified quantities of toxic or hazardous materials, the project owner shall submit to the CBO for design review and approval final design plans, specifications and calculations, including a copy of the signed and stamped engineer's certification.

The project owner shall send copies of the CBO approvals of plan checks to the CPM in the following Monthly Compliance Report. The project owner shall also transmit a copy of the CBO's inspection approvals to the CPM in the Monthly Compliance Report following completion of any inspection.

MECH-1 The project owner shall submit, for CBO design review and approval, the proposed final design, specifications and calculations for each plant major piping and plumbing system listed in **Facility Design Table 2**, Condition of Certification **GEN-2**, above. Physical layout drawings and drawings not related to code compliance and life safety need not be submitted. The submittal shall also include the applicable QA/QC procedures. Upon completion of construction of any such major piping or plumbing system, the

project owner shall request the CBO's inspection approval of said construction [2001 CBC, Section 106.3.2, Submittal Documents; Section 108.3, Inspection Requests; Section 108.4, Approval Required; 2001 California Plumbing Code, Section 103.5.4, Inspection Request; Section 301.1.1, Approval].

The responsible mechanical engineer shall stamp and sign all plans, drawings and calculations for the major piping and plumbing systems subject to the CBO design review and approval, and submit a signed statement to the CBO when the said proposed piping and plumbing systems have been designed, fabricated and installed in accordance with all of the applicable laws, ordinances, regulations and industry standards [Section 106.3.4, Architect or Engineer of Record], which may include, but not be limited to:

- American National Standards Institute (ANSI) B31.1 (Power Piping Code);
- ANSI B31.2 (Fuel Gas Piping Code);
- ANSI B31.3 (Chemical Plant and Petroleum Refinery Piping Code);
- ANSI B31.8 (Gas Transmission and Distribution Piping Code);
- Title 24, California Code of Regulations, Part 5 (California Plumbing Code);
- Title 24, California Code of Regulations, Part 6 (California Energy Code, for building energy conservation systems and temperature control and ventilation systems);
- Title 24, California Code of Regulations, Part 2 (California Building Code); and
- Humboldt County code.

The CBO may deputize inspectors to carry out the functions of the code enforcement agency [2001 CBC, Section 104.2.2, Deputies].

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of any increment of major piping or plumbing construction listed in **Facility Design Table 2**, Condition of Certification **GEN-2** above, the project owner shall submit to the CBO for design review and approval the final plans, specifications and calculations, including a copy of the signed and stamped statement from the responsible mechanical engineer certifying compliance with the applicable LORS, and shall send the CPM a copy of the transmittal letter in the next Monthly Compliance Report.

The project owner shall transmit to the CPM, in the Monthly Compliance Report following completion of any inspection, a copy of the transmittal letter conveying the CBO's inspection approvals.

MECH-2 For all pressure vessels installed in the plant, the project owner shall submit to the CBO and California Occupational Safety and Health Administration (Cal-OSHA), prior to operation, the code certification papers and other documents required by the applicable LORS. Upon completion of the

installation of any pressure vessel, the project owner shall request the appropriate CBO and/or Cal-OSHA inspection of said installation [2001 CBC, Section 108.3, Inspection Requests].

The project owner shall:

1. Ensure that all boilers and fired and unfired pressure vessels are designed, fabricated and installed in accordance with the appropriate section of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, or other applicable code. Vendor certification, with identification of applicable code, shall be submitted for prefabricated vessels and tanks; and
2. Have the responsible design engineer submit a statement to the CBO that the proposed final design plans, specifications and calculations conform to all of the requirements set forth in the appropriate ASME Boiler and Pressure Vessel Code or other applicable codes.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of on-site fabrication or installation of any pressure vessel, the project owner shall submit to the CBO for design review and approval, the above listed documents, including a copy of the signed and stamped engineer's certification, with a copy of the transmittal letter to the CPM.

The project owner shall transmit to the CPM, in the Monthly Compliance Report following completion of any inspection, a copy of the transmittal letter conveying the CBO's and/or Cal-OSHA inspection approvals.

MECH-3 The project owner shall submit to the CBO for design review and approval the design plans, specifications, calculations and quality control procedures for any heating, ventilating, air conditioning (HVAC) or refrigeration system. Packaged HVAC systems, where used, shall be identified with the appropriate manufacturer's data sheets.

The project owner shall design and install all HVAC and refrigeration systems within buildings and related structures in accordance with the CBC and other applicable codes. Upon completion of any increment of construction, the project owner shall request the CBO's inspection and approval of said construction. The final plans, specifications and calculations shall include approved criteria, assumptions and methods used to develop the design. In addition, the responsible mechanical engineer shall sign and stamp all plans, drawings and calculations and submit a signed statement to the CBO that the proposed final design plans, specifications and calculations conform with the applicable LORS [2001 CBC, Section 108.7, Other Inspections; Section 106.3.4, Architect or Engineer of Record].

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of construction of any HVAC or refrigeration system, the project owner shall submit to the CBO the required HVAC and refrigeration calculations, plans and specifications, including a copy of the signed and stamped statement from

the responsible mechanical engineer certifying compliance with the CBC and other applicable codes, with a copy of the transmittal letter to the CPM.

ELEC-1 Prior to the start of any increment of electrical construction for all electrical equipment and systems 480 volts and higher (see a representative list, below), with the exception of underground duct work and any physical layout drawings and drawings not related to code compliance and life safety, the project owner shall submit, for CBO design review and approval, the proposed final design, specifications and calculations [CBC 2001, Section 106.3.2, Submittal documents]. Upon approval, the above listed plans, together with design changes and design change notices, shall remain on the site or at another accessible location for the operating life of the project. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS [2001 CBC, Section 108.4, Approval Required, and Section 108.3, Inspection Requests]. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

A. Final plant design plans shall include:

1. one-line diagrams for the 13.8 kV, 4.16 kV and 480 V systems; and
2. system grounding drawings.

B. Final plant calculations must establish:

1. short-circuit ratings of plant equipment;
2. ampacity of feeder cables;
3. voltage drop in feeder cables;
4. system grounding requirements;
5. coordination study calculations for fuses, circuit breakers and protective relay settings for the 13.8 kV, 4.16 kV and 480 V systems;
6. system grounding requirements; and
7. lighting energy calculations.

C. The following activities shall be reported to the CPM in the Monthly Compliance Report:

1. Receipt or delay of major electrical equipment;
2. Testing or energization of major electrical equipment; and
3. A signed statement by the registered electrical engineer certifying that the proposed final design plans and specifications conform to requirements set forth in the Energy Commission Decision.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of each increment of electrical construction, the project owner shall submit to the CBO for design review and approval the above listed documents. The project owner shall include in this submittal a copy of the signed and stamped statement from the responsible electrical engineer attesting compliance with the applicable LORS, and shall send the CPM a copy of the transmittal letter in the next Monthly Compliance Report.

REFERENCES

PG&E 2006a — PG&E/R. Kuga (tn: 38050). Humboldt Bay Repowering Project AFC
Vol. 1 & 2. 9/29/2006.

GEOLOGY AND PALEONTOLOGY

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SUMMARY OF CONCLUSIONS

The proposed Humboldt Bay Repowering Project (HBRP) is situated in an active geologic environment on the Northern California coast and near the junction of three tectonic plates. As a result of this geologic setting, the site could be subject to extreme levels of earthquake-related ground shaking and possible inundation by a tidal wave. While the potential for earthquake ground rupture is low, for the relatively short project life, the site is on or very near active faults, the locations of which are not precisely established. The effects of strong ground shaking, localized liquefaction, and tsunami inundation must be mitigated, to the extent practical, through structural design as required by the California Building Code (CBC, 2001). At this site it may be prudent to provide structural design in accordance with the more stringent requirements of the International Building Code (ICC, 2003). Compressible and expansive soils should be mitigated based on the recommendations in the geotechnical report. There are no known viable geologic or mineralogical resources. Paleontological resources have been documented in the general area of the project, though no significant fossils were found during field explorations in the immediate vicinity. The potential impacts to paleontological resources due to construction activities will be mitigated as required by the Conditions of Certification.

Based on this information, it is staff's opinion that the potential for significant adverse cumulative impacts to the project from geologic hazards during its design life and to potential geologic, mineralogic, and paleontologic resources from the construction, operation, and closure of the proposed project, is low. It is Energy Commission staff's opinion that the HBRP can be designed and constructed in accordance with all applicable laws, ordinances, regulations, and standards (LORS), and in a manner that protects environmental quality and assures public safety, to the extent practical.

INTRODUCTION

In this section, California Energy Commission (Energy Commission) staff discusses potential impacts of the proposed HBRP regarding geologic hazards and geologic, mineralogic, and paleontologic resources. Staff's objective is to ensure that there will be no consequential adverse impacts to significant geological and paleontological resources during project construction, operation, and closure and that operation of the plant will not expose occupants to high-probability geologic hazards. A brief geological and paleontological overview is provided. The section concludes with staff's proposed monitoring and mitigation measures with respect to geologic hazards and geologic, mineralogic, and paleontologic resources, with the inclusion of proposed conditions of certification.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

The applicable LORS are listed in the Application for Certification (AFC) (Pacific Gas & Electric [PG&E], 2006a, §§8.4.5, 8.8.5). The following is a brief description of the current LORS for geologic hazards and resources and mineralogic and paleontologic resources.

**GEOLOGY AND PALEONTOLOGY Table 1
Laws, Ordinances, Regulations, and Standards (LORS)**

<u>Applicable Law</u>	<u>Description</u>
<u>Federal</u>	The proposed HBRP is not located on federal land. There are no federal LORS for geologic hazards and resources for this site.
<u>State</u>	
California Building Code (2001)	The CBC includes a series of standards that are used in project investigation, design, and construction (including grading and erosion control).
Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code Section 2621–2630	Mitigates against surface fault rupture of active faults. Requires disclosure to potential buyers of existing real estate and a 50-foot setback for new occupied buildings. The site is not located within, but is near, a designated Alquist-Priolo Fault Zone.
The Seismic Hazards Mapping Act, Public Resources Code Section 2690–2699	Areas subject to the effects of strong ground shaking, such as liquefaction, landslides, tsunamis, and seiches, are identified.
California Coastal Act Sections 30244 and 30253	Section 30244 requires mitigation for adversely impacted archaeological and paleontological resources. Section 30253 requires that risks to life and property that may result from geologic, flood, and fire hazards be minimized and that the “stability and structural integrity” of the site and natural landforms in the surrounding area be maintained.
Public Resources Code Section 25527 and 25550.5(i)	The Warren-Alquist Act requires the California Energy Commission to “give the greatest consideration to the need for protecting areas of critical environmental concern, including, but not limited to, unique and irreplaceable scientific, scenic, and educational wildlife habitats; unique historical, archaeological, and cultural sites...” With respect to paleontologic resources, the Energy Commission relies on guidelines from the Society for Vertebrate Paleontology (SVP), indicated below. Section 25550.5(i) defines the criteria for a repowering project that involves modification of an existing power plant rather than construction of a new facility.

Applicable Law	Description
California Environmental Quality Act (CEQA), Appendix G	Mandates that public and private entities identify the potential impacts on the environment during proposed activities. Appendix G outlines the requirements for compliance with CEQA and provides a definition of significant impacts on a fossil site.
Society for Vertebrate Paleontology (SVP), 1995	The “Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontological Resources: Standard Procedures” is a set of procedures and standards for assessing and mitigating impacts to vertebrate paleontological resources. The measures were adopted in October 1995 by the Society for Vertebrate Paleontology, a national organization of professional scientists.
Local	
Humboldt County Zoning Regulations	Requires compliance with a number of development standards. Applicable standards include preparation of and compliance with preliminary geological engineering and soils reports, preparation of a Supplementary Information Report for projects located in coastal zones, and compliance with construction standards in accordance with the Uniform Building Code, Section 2312, Earthquake Regulations, and sections of the California Coastal Act.
Humboldt County General Plan	Requires compliance with construction standards in accordance with the California Coastal Act and preparation of a project geotechnical report. The Plan also specifies design criteria for facilities to be constructed below the 100-year tsunami run-up elevation and within the 100-year flood plain.

SETTING

The proposed HBRP will be constructed on a 143-acre site within the Humboldt Bay Power Plant complex, located on the eastern shore of Humboldt Bay south of Eureka, California. The power plant complex site is currently occupied by an operating 105-megawatt (MW) electrical generating plant, an inoperable nuclear-powered plant, and two 15-MW mobile emergency power plants. The primary power plant consists of steam-driven turbine-generators capable of burning both natural gas and fuel oil. The facility has been in operation for approximately 50 years and is slated for decommissioning following construction of the new power plant. The proposed repowering project is to consist of 10 natural gas-fired reciprocating engine generators and associated air radiator cooling system, exhaust gas silencing stacks, and catalytic reduction system. The facility is designed to produce a total of 163 MW of electricity. The unit will be capable of burning diesel fuel when natural gas supplies are limited or interrupted. Electrical transmission lines will be constructed to connect the new plant to an existing substation on site, and water, sanitary sewer, and high-pressure gas lines will connect to existing pipelines on site.

REGIONAL SETTING

The HBRP site is located on the eastern shore of Humboldt Bay within the Eel River Basin, which is at the north end of the Coast Ranges geomorphic province (Norris and

Webb, 1990). This segment of the northern coast of California is characterized by young and very active tectonism as shown in **Geology & Paleontology Figure 1**. The Mendocino Triple Junction (MTJ), which represents the zone of collision of the northward-moving Pacific Oceanic Plate, the eastward-moving Gorda Oceanic Plate, and the stationary North American Continental Plate, is located approximately 30 to 35 miles south to southwest of Humboldt Bay (Clarke, 1992). The Coast Ranges geomorphic province south of the MTJ is generally characterized by north-northwest-trending right-lateral strike-slip faults similar to the San Andreas Fault Zone. However, north- to northwest-striking, east-dipping thrust and reverse faulting is predominant north of the MTJ in the area that includes the HBRP. The swarms of imbricate thrust faults present in this Cascadia Subduction Zone are the result of collision and subduction of the Gorda Plate beneath the North American Plate. The Seaward Edge of the Cascadia Subduction Zone, which roughly correlates to the zone of contact between oceanic and continental rocks, is located beneath the ocean approximately 35 miles west of Humboldt Bay (CDMG, 1994). An eastward dip of the subduction zone of 10 to 11 degrees has been interpreted, which places the zone at a depth of approximately 8 to 10 miles below Humboldt Bay and the project site (Cockerham, 1984).

The Eel River Basin is a forearc basin associated with Cascadia Subduction Zone tectonics. Continuous sedimentation from the subaerial portion of the North American Plate loads the adjacent offshore crust, which causes isostatic adjustment and subsidence. As much as 12,000 feet of lower Miocene and younger sediments have accumulated in the accretionary prism (Clarke, 1992). Subduction of the oceanic plate has caused the sedimentary rocks to be complexly folded, uplifted, and thrust-faulted at the same time that isostatic subsidence is occurring. The HBRP and Humboldt Bay are located at the southern, onshore end of the forearc basin, which extends approximately 24 miles to the southwest roughly following the Eel River (USGS, 2000).

Nearly all of the major faults and fault zones in the HBRP regional area are northwest- to north-northwest striking reverse faults that dip to the northeast (CDMG, 1994; USGS, 2000). The nearest is the Little Salmon Fault Zone, part of which passes through the project area. The Fault Activity Map of California (CDMG, 1994) indicates that splays within this fault zone in the Humboldt Bay area have been active as recently as 200 to 10,000 years ago (Little Salmon Fault) and 700,000 to 1.6 million years ago (Bay Entrance Fault). The surface trace of the Little Salmon Fault mapped by the California Division of Mines and Geology (CDMG, 1994) is approximately 1.4 miles southwest of the HBRP site and has been projected to be between 4,000 to 5,000 feet below the site (PG&E, 2006a). The Little Salmon Fault is a designated Alquist-Priolo Special Studies Zone (SSZ), but the northern boundary of the zone is about 1 mile south of the HBRP (CDMG, 1991). Other fault zones in the region include the Mad River Fault Zone, which is located 11 miles to the northeast of the HBRP site and has had movement between 200 and 10,000 years ago (the Mad River Fault is also within an Alquist-Priolo SSZ [CDMG, 1983]), the Goose Lake Fault Zone (Little Salmon Fault of the U.S.G.S., 2000), which is located 9.5 miles to the southwest and has also had movement between 200 and 10,000 years ago, and the Russ Fault Zone, which is located 15.5 miles to the southwest and has had movement between 700,000 and 1.6 million years ago (CDMG, 1994). The Freshwater Fault Zone (also called the Coastal Belt Thrust), located 8.5 miles to the northeast, is an older fault zone with only localized movement in the Quaternary (Clarke, 1992).

Sedimentation in the Eel River Basin is complex due to the continuously changing basin geometry caused by tectonic activity. Vertical and lateral facies changes are rapid, and units are not always laterally extensive. Basement rocks are composed of Paleocene to Eocene Coastal Belt rocks of the Franciscan Complex (Clarke, 1992). Shale and sandstone of the lower to middle Miocene Age Bear River Beds, deposited in continental shelf and slope environments, unconformably overlie the basement rocks. The upper Miocene to middle Pleistocene Wildcat Group, a thick section of shallow marine shales, siltstones and sandstones, was deposited over the Bear River Beds. The uppermost unit of the Wildcat Group, the Carlotta Formation, consists of non-marine sandstone and conglomerates that were deposited as the shoreline regressed westward (Ogle, 1953). The Wildcat Group is unconformably overlain by coastal plain and fluvial sediments of the middle to late Pleistocene Hookton and Rohnerville Formations.

PROJECT SITE DESCRIPTION

The surface material at the HBRP site is 2 to 6 feet of silty clay to sandy, clayey gravel fill that has been placed over marshland on the east shore of Humboldt Bay (Kleinfelder, 2006). The fill was placed over Holocene age bay deposits, which consist of organic-rich clays, silts, and occasional clayey sands that are 2 to 20 feet thick overall. Auger drilling presented in Kleinfelder's 2006 draft geotechnical report indicates that the bottom of the bay deposits ranges from 9 feet deep at the south and west ends to 22 feet deep at the east end within the new facility footprints. The soils are compressible and grade downward from soft or loose to stiff or medium dense. Peat deposits are rare and occur only locally in discontinuous beds.

The Pleistocene Upper Hookton Formation underlies the bay deposits and is divided into three subunits. The uppermost unit is the 1st Bay Clay, which consists of stiff to hard clays, silts, and occasional sands that are 20 to 35 feet thick (Kleinfelder, 2006). Below the clay horizon are the Upper Sand Beds, which are composed of clayey sands, silty sands, and occasional gravels that are 20 to 40 feet thick. The lowermost subunit is the 2nd Bay Clay, which is similar in composition and consistency to the 1st Bay Clay and is 15 to 25 feet thick. Several borings penetrated the medium dense to dense clayey sands, silty sands, and gravelly sands of the Pleistocene Lower Hookton Formation at depths ranging from 80 to 96 feet. Groundwater was encountered at depths of 5 to 6 feet.

Fault traces that are thought to be part of the Little Salmon Fault Zone are present on the west and east edges of the HBRP site. Both are northwest-trending reverse faults, and neither is included in the Little Salmon Fault SSZ (CDMG, 1982 and 1991). Borings suggest approximately 25 feet of down-to-the-southwest offset on the northeast-dipping Buhne Point Fault and the Buhne Point Splay Fault (PG&E, 2006a). The splay is responsible for uplift of Buhne Hill, located northwest of the site, and is shown well north of the HBRP on Figure 8.4-5 of the Application for Certification (AFC) (PG&E, 2006a). The suspected surface trace of the Buhne Point fault is located roughly 70 to 80 feet southwest of the proposed new power plant boundary. Ten feet of down-to-the-northeast movement has been postulated on the Discharge Canal Fault, which is present on the northeastern boundary of the HBRP site. The geometry of these faults indicates that the HBRP site is on an uplifting structural wedge, and it would suggest that a single fault at depth splays upward into the Buhne Point and Discharge Canal

Faults at some depth below the project site. However, perpendicular cross-sections across the site in Kleinfelder's draft soils report (Kleinfelder, 2006) do not show any recognizable offset of units to the depths drilled.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section considers two types of impacts. The first is geologic hazards, which could impact proper functioning of the proposed facility and include life/safety concerns. The second is potential impacts the proposed facility could have on existing geologic, mineralogic, and paleontologic resources in the area.

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

No federal LORS with respect to geologic hazards and geologic and mineralogic resources apply to this project. The California Building Standards Code (CBSC) and CBC (2001) provide geotechnical and geological investigation and design guidelines, which engineers must adhere to when designing a proposed facility. As a result, the criteria used to assess geologic hazard impact significance includes evaluating each potential hazard in relation to the ability to adequately design and construct the proposed facility. Geologic hazards to be considered include faulting and seismicity, liquefaction, dynamic compaction, hydrocompaction, subsidence, expansive soils, landslides, tsunamis, and seiches.

The California Environmental Quality Act (CEQA) Guidelines, Appendix G, provides a checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts.

- Section (V) (c) asks if the project will directly or indirectly destroy a unique paleontological resource or site or unique geological feature.
- Sections (VI) (a), (b), (c), (d), and (e) pose questions that focus on whether or not the project would expose persons or structures to geologic hazards.
- Sections (X) (a) and (b) pose questions about the project's effect on mineral resources.

With respect to impacts the proposed facility may have on existing geologic and mineralogic resources, staff has reviewed geologic and mineral resource maps for the surrounding area, as well as any site-specific information provided by the applicant, to determine if geologic and mineralogic resources are present in the area. When available, staff also reviews operating procedures of the proposed facility—in particular ground water extraction and mass grading—to determine if such operations could adversely impact such resources.

Staff reviewed existing paleontologic information for the surrounding area, as well as site-specific information generated by the applicant for the HBRP. All research was conducted in accordance with accepted assessment protocol (SVP, 1995) to determine if there are any known paleontologic resources in the general area. If present or likely to exist, conditions of certification are proposed for the project approval, which outlines procedures required during construction to mitigate impacts to potential resources.

DIRECT/INDIRECT IMPACTS AND MITIGATION

Ground shaking, ground rupture and localized liquefaction during an earthquake, tsunami inundation resulting from an offshore earthquake, compression of fine-grained soils, and possible clay expansion represent the main geologic hazards at this site. Proper design can mitigate the potential hazards. Specifically, proposed Conditions of Certification **GEN-1, GEN-5, and CIVIL-1** in the **Facility Design** section and **GEO-1**, presented herein, should mitigate these impacts to a less than significant level.

No viable geologic or mineralogic resources are known to exist within 2 miles of the site. The potential for useful paleontological resources in fill, which represents the upper 2 to 6 feet of soils that will be impacted by project grading, is negligible due to disturbance of the material. Similarly, the potential to encounter significant paleontological resources in the Holocene bay deposits, which is present to depths ranging from 9 to 22 feet within the new construction boundary, is low due to the young age of the sediments. However, paleontological resources below the fill and bay deposits in the Pleistocene Hookton Formation sediments have the potential to be highly sensitive to construction activities and to be very significant. Such important paleontological resources were not observed on the site or nearby areas during construction of the existing power plant facilities or during the paleontological survey conducted for this AFC. However, a vertebrate fossil site has been excavated at Buhne Point (PG&E, 2006a). A total of three fossil sites have been encountered in Hookton Formation sediments within 3 miles of the project site. Since the proposed HBRP will include significant amounts of grading, foundation excavation, pile driving, and utility trenching, staff considers the probability that paleontological resources will be encountered during such activities to be high in native materials below fill. This assessment is based on SVP criteria and the confidential paleontological report appended to the AFC. Proposed Conditions of Certification **PAL-1** to **PAL-7** are designed to mitigate any paleontological resource impacts, as discussed above, to a less than significant level.

The proposed conditions of certification are to allow the Energy Commission Compliance Project Manager (CPM) and the applicant to adopt a compliance monitoring scheme that will ensure compliance with LORS applicable to geologic hazards and to protection of geologic, mineralogic, and paleontologic resources.

Based on the information below, it is staff's opinion that the potential is very low for significant adverse direct and indirect impacts from the proposed project to geologic hazards and to potential geologic, mineralogic, and paleontologic resources.

GEOLOGICAL HAZARDS

The AFC (PG&E, 2006a) provides documentation of potential geologic hazards at the HBRP plant site, in addition to some subsurface exploration information. Review of the AFC, coupled with staff's independent research, indicates that the potential for geologic hazards to impact the plant site, during its practical design life, is low.

Staff's independent research included review of available geologic maps, reports, and related data of the HBRP plant site. Geological information was available from the California Geological Survey (CGS), (CDMG), and other governmental organizations.

Faulting and Seismicity

Energy Commission staff reviewed the CDMG publication *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions* (1994) and Alquist-Priolo Special Studies Zone mapping and reports (CDMG, 1982, 1983, 1991, and 2003). No active faults are shown on published maps as crossing the boundary of new construction on the proposed HBRP site. The closest mapped active fault is the Little Salmon Fault, a regional reverse fault located 1.4 miles southwest of the proposed energy facility. The next closest active faults are in the Mad River Fault Zone, a regional swarm of imbricate thrusts located 11 miles northeast of the proposed energy facility. Both of these fault zones are designated as Type A faults (CDMG, 1994; ICBO, 1998; PG&E, 2006a).

The California Division of Mines and Geology completed a fault evaluation report on the Little Salmon and Yager faults, presenting the rationale for not including these faults in an Alquist-Priolo Special Studies Zone at that time (CDMG, 1982). Subsequently, the Little Salmon fault was included in a Special Studies Zone, but not in the area around the HBRP site (CDMG, 1991). In the 1982 CDMG report, the author refers to an investigation done by the consulting firm Woodward-Clyde in 1980 at the PG&E Power Plant north of the HBRP site. The Woodward-Clyde report used Carbon-14 dating and geologic reasoning to show that the Buhne Point splay of the Little Salmon fault has not moved in at least 37,000 years. Therefore, by definition that active faults are characterized as those that have moved during the last 11,000 years, the Buhne Point fault, and likely the related Discharge Canal fault, would not be considered active.

The CDMG report (1982) also shows the Buhne Point fault along and parallel to King Salmon Avenue, well west of the proposed HBRP and west of the location shown on Figure 8.4-5 of the AFC (PG&E, 2006a). The CDMG report (1982) does not show or discuss the Discharge Canal fault. The California Coastal Commission, reportedly, has more recent studies verifying that the Little Salmon fault, and presumably its splays (Buhne Point and Discharge Canal faults), are active, with movement possibly as recent as 300 years (Coastal Commission, 2007b).

Unless proven otherwise by specific fault investigations, both the Buhne Point and the Discharge Canal Faults should be considered as active faults, if only on the basis of their dynamic tectonic environment. Linear structures will likely cross the faults and should be designed accordingly, with automatic shut-off systems and flexible crossings, where appropriate.

Geology & Paleontology Figure 2 shows the fault traces of the Buhne Point and Discharge Canal Faults very near the southwest and northeast project boundaries, respectively. The uncertainties with the fault locations are also depicted and indicate that the actual surface trace of either or both faults could lie just within the project site. Neither fault, even in the worst case, would appear to lie within 50 feet of the proposed control room, the only building expected to have human occupancy. The Alquist-Priolo Act of 1973 and subsequent California state law (California Code of Regulations, 2001) require that all occupied structures be set back 50 feet or more from the surface trace of an active fault. The setback can be reduced if it is demonstrated that no fault splays are present within this 100-foot-wide zone. Non-critical structures can also be designed to withstand ground rupture.

The HBRP site is located on the hanging wall block of the Discharge Canal fault and this block would likely be subject to localized shearing/faulting with movement of any of the faults in this area. For this reason, and the uncertainty of the location of the Discharge Canal fault, the applicant will design occupied and other important structures to accommodate vertical displacement of about 12 inches and lateral offsets of about 4 inches (CH2MHill, 2007f).

The project is located within Seismic Zone 4, as delineated on Figure 16-2 of the 2001 edition of the California Building Code (CBC). The soil profile for this site is classified as S_D . Given that the site is located within 2 kilometers of a known Type A seismic source—faults of the Little Salmon Fault Zone—(ICBO, 1998), seismic coefficients of $C_a = 0.66$ and $C_v = 1.28$ are derived. These values are consistent with the results presented in the draft geotechnical report submitted with the AFC (Kleinfelder, 2006).

The estimated peak horizontal ground acceleration for the power plant is 0.83 times the acceleration of gravity (0.83g) for bedrock acceleration based on 10 percent probability of exceedence in 50 years under CBC criteria, or 1.43g for 2 percent probability of exceedence in 50 years under International Building Code (ICC, 2003) criteria (<http://eqdesign.cr.usgs.gov/cgi.bin/>). The high values are reasonable given the location of the HBRP site relative to an active subduction zone and the Mendocino Triple Junction. If the International Building Code is adopted by the State of California prior to approval of project design plans, the 2 percent probability in 50 years criteria will be the design standard. In either case, the occupied structure (control room) and other structures deemed important to operations, will be designed to tolerate significant ground rupture. Based on known recurrence laterals on the Little Salmon fault, interpreted recurrence laterals on the Buhne Point fault and an estimated offsets recurrence of 12 inches per 8,000 years for the Canal Discharge fault, design offset of one foot vertical and 4 inches lateral will be utilized. No current or proposed building code requires that the structures be serviceable after a major earthquake, only that the occupants can be safely evacuated.

Liquefaction

Liquefaction is a condition in which a cohesionless soil may lose shear strength due to a sudden increase in pore water pressure. Standard penetration tests (SPT) taken during advancement of mud rotary borings generally yielded blow counts of less than 25 blows per foot in the upper 35 feet of the site. These low blow counts, coupled with a high ground water table of 5 to 6 feet, would indicate a moderate to high potential for liquefaction during an earthquake, particularly in the zone of 4 to 14 feet below the ground surface. Sandy soils are more abundant below 35 feet, but blow counts are greater than 30 blows per foot with only one or two exceptions. Therefore, although liquefaction of localized and discontinuous granular soils may occur, the potential for significant liquefaction at the HBRP site is considered low. This conclusion is supported by the lack of historic settlement and lateral spreading during earthquakes that have produced high peak ground accelerations, such as those that occurred in 1975 and 1994 that produced ground motions of 0.30g and 0.55g, respectively, on the site (PG&E, 2006a). The design-level geotechnical investigation will further evaluate liquefaction potential and provide appropriate recommendations for mitigation. If California adopts the International Building Code prior to design plans approval, the

required design peak ground acceleration will be substantially higher and may indicate liquefaction potential in areas considered unlikely under the current code. In either case, the geotechnical consultant (Kleinfelder, 2006) recommends that heavily loaded or settlement sensitive structures be founded on driven pile foundations. The piles will penetrate any liquefiable soils and bear in the dense underlying clays of the Hookton Formation. Depending on spacing, the process of driving piles may densify the loose soil, reducing its liquefaction potential.

Dynamic Compaction

Dynamic compaction of soils results when relatively unconsolidated granular materials experience vibration associated with seismic events. The vibration causes a decrease in soil volume, as the soil grains tend to rearrange into a more dense state (an increase in soil density). The decrease in volume can result in settlement of overlying structural improvements.

The potential for dynamic compaction is considered very low since geotechnical exploration borings indicate a fine-grained and clay soils profile above 35 feet and medium-dense to dense and stiff to hard soils below 35 feet.

Hydrocompaction

Hydrocompaction (more commonly known as hydro-collapse) is generally associated with soils that were deposited rapidly and in a saturated state, such as during flash-floods. The soils dry out, leaving in place an unconsolidated material with excessive void spaces. Structures built on soils of this type tend to settle due to the loss of soil and collapse upon the application of water. Because the native and fill soils at the site have been deposited in a relatively compact condition, hydrocompaction is not considered to be a potential problem at the HBRP.

Subsidence

Local subsidence (settlement) may occur where areas that contain compressible soils are subjected to foundation loads. Consolidation tests performed on lean clays and silts in the preliminary geotechnical report (Kleinfelder, 2006) indicate that a significant amount of settlement may occur beneath the heaviest structures. However, these impacts will be mitigated by following the recommendations outlined in the geotechnical report, primarily using deep foundation systems.

A thin, 1-foot-thick peat bed was observed in Holocene bay deposits in one boring during drilling (Kleinfelder, 2006). Peat and other organic-rich materials are considered to be highly compressible because oxidation of the materials causes severe volume loss. However, organic-rich or equivalent materials were not encountered in other borings on the site and are considered to be localized. Therefore, only a minimal potential exists for subsidence due to consolidation of peat beds.

Regional ground subsidence is typically caused by petroleum or ground water withdrawal that increases the effective unit weight of the soil profile, which in turn increases the effective stress on the deeper soils. This results in consolidation or settlement of the underlying soils. The abandoned Table Bluff gas field is located approximately 4 miles southwest of the site, and the Tomkins Hill gas field is located

8 miles to the south (CDC, 2001). There are no known petroleum fields in Humboldt County. Raw ground water for process needs other than once-thru cooling has been extracted from a well on the HBRP property during continuous operation of the existing power generating facilities (PG&E, 2006a). No subsidence due to ground water extraction has been documented for existing facilities. The new power plant will use a closed loop air radiator cooling system, further reducing the potential for subsidence due to ground water withdrawal. Potable water will continue to be obtained from the Humboldt Community Services District.

Expansive Soils

Soil expansion occurs when clay-rich soils with an affinity for water exist in-place at a moisture content below their plastic limit. The addition of moisture from irrigation, capillary tension, water line breaks, etc. causes the clay soils to collect water molecules in their structure, which in turn causes an increase in the overall volume of the soil. This increase in volume can correspond to movement of overlying structural improvements. The top 5 to 6 feet of native and fill soil above the ground water table commonly contain lean clays with medium expansion potential and could result in some shrink-swell behavior. Mitigation of expansive soil, by over-excavation and replacement of these materials under the proposed structures, is recommended by the draft geotechnical report (Kleinfelder, 2006). The design-level report will provide a more specific evaluation of expansive clays and mitigation options.

Landslides

Landsliding potential at the HBRP site is negligible, since the proposed energy facility is located on a broad, gently sloping to flat-lying estuary on the east shore of Humboldt Bay. The nearest mapped landslides and fault scarps possibly associated with landslide activity are located in steeper terrain approximately 1¾ miles to the east across the Elk River Valley and approximately 1¾ miles south on the west flank of Humboldt Hill (CDMG, 1985). The California Coastal Commission (2005) has identified potential earthquake-induced slope failures in Buhne Point, which is far enough away so as not to affect the HBRP.

Flooding

The HBRP lies on a flat-lying to very gently sloping coastal plain that varies from 8 to 12 feet above sea level. Such area features are commonly inundated by flood events. The Federal Emergency Management Agency (FEMA) has identified the site as lying in Zone A, which is subject to 100-year flooding (FEMA, 1986). Humboldt County has established the base flood elevation for the 100-year flood at +6 feet. The HBRP plant grade would be established at +11 to +12 feet, with finished floor elevations at +13 feet. Therefore, HBRP would be constructed above the 100-year flood zone (CH2MHill, 2007a).

Tsunamis and Seiches

Humboldt Bay and the proposed HBRP site are in an area that could be inundated by a tsunami. Bernard and others (1994) used computer modeling, based on a magnitude (M_w) 8.4 earthquake occurring within the Cascadia Subduction Zone, to show that a tsunami with an amplitude of 30 feet (10 meters) would inundate the shoreline to a point

near the railroad tracks east of the project site. Other studies indicate that the run-up height due to an earthquake-induced tsunami could be 30 to 40 feet at the entrance to Humboldt Bay, 21 to 36 feet at the HBRP site at mean lower low water (MLLW) and 28 to 43 feet at the HBRP site at mean higher high water (MHHW) (PG&E, 2003). Because the project site lies within a tsunami inundation zone, the facilities would be constructed in a manner that would minimize the impacts of flooding and potentially high wave forces. All major structures would also be anchored to avoid floatation from buoyancy (PG&E, 2006a, Sec. 8.15.1.3). There is also potential for a seiche wave in Humboldt Bay to impact the operation of the facility, although the anticipated potential impact on the HBRP site would be less than the impact resulting from a 100-year flood.

GEOLOGIC, MINERALOGIC, AND PALEONTOLOGIC RESOURCES

Energy Commission staff has reviewed applicable geologic maps and reports for this area (CDC, 2001; CDMG, 1962; CDMG, 1980; CDMG, 1985; CDMG, 1990; CDMG, 1998; CDMG, 1999; USGS, 2000). Staff did not identify any geological resources at the energy facility location or at the proposed utility connections. No known petroleum fields exist in Humboldt County; however, two gas fields are located within 10 miles of the project site. The abandoned Table Bluff gas field is located approximately 4 miles southwest of the site, and the Tomkins Hill gas field is located 8 miles to the south (CDC, 2001). No mineralogical resources, including sand, gravel, and precious or base metals, are present in the vicinity of the project. Given the soil profile determined from the geotechnical exploration, there is low potential for this site to have economically valuable sand and gravel or other mineral deposits.

Regarding paleontological resources, Energy Commission staff has reviewed the paleontological resources assessment in Section 8.8 of the AFC (PG&E, 2006a) as well as the confidential paleontologic site report. No paleontological finds have been documented on the HBRP.

Geology at the energy facility footprint location is made up of 2 to 6 feet of fill underlain by Holocene bay deposits and Pleistocene marine and non-marine sediments. Surface man-made fills have negligible paleontological sensitivity due to disturbance of the material; any fossil discovered would lack stratigraphic context. Holocene bay deposits are of low paleontological sensitivity because the sediments are very young and are not likely to be scientifically significant or possess educational value. Construction activities that excavate beneath fill and Holocene bay deposits at depths of 9 feet at the south and west ends to 22 feet at the east end below the existing ground surface would encounter the Pleistocene Hookton Formation. The Hookton Formation is considered to have high paleontological sensitivity based on the historic occurrence of vertebrate fossils that have yielded important information regarding Pleistocene ecosystems in Northern California.

Three paleontological sites are recorded in each of the following sites: the upper Miocene to middle Pleistocene Wildcat Group and the middle-to-late Pleistocene Hookton Formation (PG&E, 2006a). The locations of these sites are provided in Appendix 8.8A of the AFC, which is confidential and unavailable for general review. Vertebrate fossils recovered from the three Hookton Formation localities include remains of the Columbian mammoth (*Mammuthus columbi*), the American mastodon (*Mammot americanum*), and the Pleistocene bison (*Bison latifrons*), (PG&E, 2006a).

The bison remains are significant to the HBRP because the remains were recovered from Buhne Point. Twelve fossil localities are present within the combined area covered by the Eureka and Field's Landing 7½-minute quadrangles (CDMG, 1980; from Ogle, 1953). Only one of these sites, located approximately 6 miles south of the HBRP and near the south shore of Humboldt Bay, is considered to possess scientific significance. The fossil remains are marine molluscan fauna from the Wildcat Formation that include *Saxidomus nuttali* and *Protothaca staminea* (Ogle, 1953). No fossil remains were encountered during the cursory paleontological survey conducted on the HBRP site by W. Geoffrey Spaulding, Ph.D. (PG&E, 2006a). The survey examined surface exposures only. Fossils may be present in certain formations in the subsurface.

Staff has proposed conditions of certification **PAL-1** through **PAL-7** that will enable the applicant to mitigate impacts upon paleontological resources to a less than significant level should they be encountered during construction, operation, and closure of the project. Staff will entertain the prospect of reducing the level of monitoring if recommended by the project Paleontologic Resource Specialist (PRS), after examination of representative deep excavations.

Construction Impacts and Mitigation

Compressible silts, clays, localized peats, and to a lesser extent, expansive clays present on the site must be addressed during construction (See **Proposed Conditions of Certification, Facility Design**).

As noted above, no viable geologic or mineralogic resources are known to exist in the area. Significant paleontological resources have been documented in Pleistocene sediments within 1.5 miles of the project site so that native materials below the organic-rich Holocene bay deposits may exhibit a high sensitivity rating with respect to containing significant paleontologic resources. The draft geotechnical report indicates that the top of the Hookton Formation ranges from 9 to 22 feet within the limits of new construction (Kleindfelder, 2006). Construction of the proposed project will include grading, foundation excavation, and utility trenching. Staff considers the probability of encountering paleontological resources to be generally low based on the soils profile, SVP assessment criteria, and the shallow depths required for most excavations. However, the AFC (PG&E, 2006a) indicates that the Hookton Formation may be as shallow as 3 feet below the ground surface elsewhere on the HBRP property, based on drilling outside the power plant footprint. Excavations for ancillary facilities and new pipelines and on-site excavations deeper than 3 feet outside the footprint may have a higher probability of encountering the Hookton Formation and potentially high sensitivity materials. Proposed Conditions of Certification **PAL-1 to PAL-7** are designed to mitigate any paleontological resource impacts, as discussed above, to a less than significant level.

Based upon the literature and archives search, field surveys, and compliance documentation for the HBRP, the applicant has proposed monitoring and mitigation measures to be followed during the construction of the HBRP. Energy Commission staff believes that the facility can be designed and constructed to minimize the effect of geologic hazards at the site during project design life and that impacts to vertebrate fossils encountered during construction of the power plant and associated linears would be mitigated to a level of insignificance.

Operation Impacts and Mitigation

Operation of the proposed new gas-fired electricity generating facility should not have any adverse impact on geologic, mineralogic, or paleontologic resources.

CUMULATIVE IMPACTS AND MITIGATION

The proposed HBRP is situated in an active geologic environment. Strong ground shaking, localized liquefaction, and tsunami inundation potential must be mitigated through foundation and structural design as required by the CBC (2001). Compressible materials, expansive clays, and disturbed surface soil, which are present in the man-made fill (upper 2 to 6 feet soils profile) and Holocene bay deposits (to depths of 9 to 22 feet), must be mitigated in accordance with the project geotechnical investigation (Kleinfelder, 2006) and proposed Conditions of Certification **GEN-1, GEN-5, and CIVIL-1** under **Facility Design**. Paleontological resources have been documented in the general area of the project, including at Buhne Point. However, to date, none have been found during construction of the existing Humboldt Bay Power Plant facilities. The potential impacts to paleontological resources due to construction activities will be mitigated as required by proposed Conditions of Certification **PAL-1 to PAL-7**.

It is staff's opinion that the potential for significant adverse cumulative impacts to the proposed project from geologic hazards, during project design-life, is low and to potential geologic, mineralogic, and paleontologic resources from the proposed project, very low. Because of the potential for very high ground acceleration in this area, and even some potential for surface rupture, it may be prudent to base the design on the more stringent seismic criteria of the International Building Code (ICC, 2003).

Based upon the literature and archives search, field surveys and compliance documentation for the HBRP project, the applicant has proposed monitoring and mitigation measures to be followed during the construction of the HBRP. Energy Commission staff agree with the applicant that the facility can be designed and constructed to minimize the effect of geologic hazards at the site, and that impacts to vertebrate fossils encountered during construction of the power plant and associated linears would be mitigated to a level of insignificance.

The proposed conditions of certification are to allow the Energy Commission (CEM) and the applicant to adopt a compliance monitoring scheme that will ensure compliance with LORS applicable to geologic hazards and geologic, mineralogic, and paleontologic resources.

FACILITY CLOSURE

Facility closure activities are not anticipated to impact geologic, mineralogic, or paleontologic resources as no such resources are known to exist at the power plant location or along its proposed linears. In addition, decommissioning and closure of the power plant should not negatively affect geologic, mineralogic, or paleontologic resources since the majority of the ground disturbed in plant decommissioning and closure would have been disturbed, and mitigated as required, during construction and operation of the facility.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

PUBLIC COMMENTS

Staff has not received public comments regarding geologic hazards, mineral resources, or paleontology at this time.

CONFORMANCE WITH THE CALIFORNIA COASTAL ACT

Section 30253 of the California Coastal Act states that new development shall: *“Minimize risks to life and property in areas of high geologic, flood and fire hazard.”* The California Coastal Commission (Coastal Commission 2005; Personal Communication, 2007a) has expressed concern that the precise locations of the Buhne Point and Discharge Canal faults are not known. In a recent data request, the California Coastal Commission asked that the faults be better located or that some assurance be provided that the project will be designed to tolerate ground rupture. In response (CH2MHill, 2007f), the applicant has presented additional data regarding the locations, recurrence intervals and general structure of the Buhne Point and Discharge Canal faults. The HBRP site clearly lies within the hanging wall of the Discharge Canal fault. Even if the Discharge Canal fault trace is east of the HBRP, as it appears to be, movement along any of the faults in the area could produce minor shears/faults in the hanging wall block between the Discharge Canal fault and the Buhne Point fault to the west. For this reason, occupied buildings and other important structures will be designed to accommodate up to 12 inches of vertical offset and 4 inches of lateral offset. This can be accomplished by the use of post-tensioned floor slabs, increased concrete reinforcement, stronger connections, and other standard structural design methods. Design in accordance with these concepts should be effective in “minimizing the risk to life and property.”

CONCLUSIONS

The applicant will likely be able to comply with applicable LORS, provided that the proposed conditions of certification are followed. The design and construction of the project should have no adverse impact with respect to geologic, mineralogic, and paleontologic resources. Staff proposes to ensure compliance with applicable LORS through the adoption of the proposed conditions of certification listed below.

PROPOSED CONDITIONS OF CERTIFICATION

General conditions of certification with respect to Engineering Geology are proposed under Conditions of Certification **GEN-1, GEN-5, and CIVIL-1** in the **Facility Design** section and **GEO-1** below. Proposed paleontological Conditions of Certification follow. It is staff's opinion that potential to encounter paleontologic resources is very low in the upper 9 feet at the south and west ends to 22 feet at the east end and moderate below 9 to 22 feet. Staff will entertain the prospect of reducing monitoring intensity, at the recommendation of the project PRS, following examination of sufficient, representative deep excavations.

GEO-1 All occupied structures shall be designed to withstand a reasonable level of vertical and horizontal fault offset, directly beneath the building. The design ground rupture shall be for a single event based on geological estimates of total offset along the Canal Discharge fault and probable recurrence intervals. In accordance with the current California Building Code (CBC, 2001), the design would require only that occupants could be safely evacuated but not necessarily that the structure remain serviceable.

Verification: At least 30 days prior to start of grading, the project owner shall submit to the CPM a letter from the project structural engineer describing the offset resistant design and verifying that the design intent is to resist the prescribed magnitudes of horizontal and vertical movement.

PAL-1 The project owner shall provide the Compliance Project Manager (CPM) with the resume and qualifications of its Paleontological Resource Specialist (PRS) for review and approval. If the approved PRS is replaced prior to completion of project mitigation and submittal of the Paleontological Resources Report, the project owner shall obtain CPM approval of the replacement PRS. The project owner shall submit to the CPM to keep on file resumes of the qualified Paleontological Resource Monitors (PRMs). If a PRM is replaced, the resume of the replacement PRM shall also be provided to the CPM.

The PRS resume shall include the names and phone numbers of references. The resume shall also demonstrate to the satisfaction of the CPM the appropriate education and experience to accomplish the required paleontological resource tasks.

As determined by the CPM, the PRS shall meet the minimum qualifications for a vertebrate paleontologist as described in the Society of Vertebrate Paleontology (SVP) guidelines of 1995. The experience of the PRS shall include the following:

1. Institutional affiliations, appropriate credentials, and college degree,
2. Ability to recognize and collect fossils in the field;
3. Local geological and biostratigraphic expertise;
4. Proficiency in identifying vertebrate and invertebrate fossils; and
5. At least three years of paleontological resource mitigation and field experience in California and at least one year of experience leading paleontological resource mitigation and field activities.

The project owner shall ensure that the PRS obtains qualified paleontological resource monitors to monitor as he or she deems necessary on the project. Paleontologic Resource Monitors (PRMs) shall have the equivalent of the following qualifications:

- BS or BA degree in geology or paleontology and one year of experience monitoring in California; or
- AS or AA in geology, paleontology, or biology and four years' experience monitoring in California; or
- Enrollment in upper division classes pursuing a degree in the fields of geology or paleontology and two years of monitoring experience in California.

Verification: (1) At least 60 days prior to the start of ground disturbance, the project owner shall submit a resume and statement of availability of its designated PRS for on-site work.

(2) At least 20 days prior to ground disturbance, the PRS or project owner shall provide a letter with resumes naming anticipated monitors for the project and stating that the identified monitors meet the minimum qualifications for paleontological resource monitoring required by the condition. If additional monitors are obtained during the project, the PRS shall provide additional letters and resumes to the CPM. The letter shall be provided to the CPM no later than one week prior to the monitor's beginning on-site duties.

(3) Prior to the termination or release of a PRS, the project owner shall submit the resume of the proposed new PRS to the CPM for review and approval.

PAL-2 The project owner shall provide to the PRS and the CPM, for approval, maps and drawings showing the footprint of the power plant, construction laydown areas, and all related facilities. Maps shall identify all areas of the project where ground disturbance is anticipated. If the PRS requests enlargements or strip maps for linear facility routes, the project owner shall provide copies to the PRS and CPM. The site grading plan and the plan and profile drawings for the utility lines would be acceptable for this purpose. The plan drawings should show the location, depth, and extent of all ground disturbances and can be at a scale of 1 inch = 40 feet to 1 inch = 100 feet range. If the footprint of the power plant or linear facility changes, the project owner shall provide maps and drawings reflecting these changes to the PRS and CPM.

If construction of the project will proceed in phases, maps and drawings may be submitted prior to the start of each phase. A letter identifying the proposed schedule of each project phase shall be provided to the PRS and CPM. Prior to work commencing on affected phases, the project owner shall notify the PRS and CPM of any construction phase scheduling changes.

At a minimum, the project owner shall ensure that the PRS or PRM consults weekly with the project superintendent or construction field manager to confirm area(s) to be worked during the next week, until ground disturbance is completed.

Verification: (1) At least 30 days prior to the start of ground disturbance, the project owner shall provide the maps and drawings to the PRS and CPM.

(2) If there are changes to the footprint of the project, revised maps and drawings shall be provided to the PRS and CPM at least 15 days prior to the start of ground disturbance.

(3) If there are changes to the scheduling of the construction phases, the project owner shall submit a letter to the CPM within 5 days of identifying the changes.

PAL-3 The project owner shall ensure that the PRS prepares, and the project owner submits to the CPM for review and approval a Paleontological Resources Monitoring and Mitigation Plan (PRMMP) to identify general and specific measures to minimize potential impacts to significant paleontological resources. Approval of the PRMMP by the CPM shall occur prior to any ground disturbance. The PRMMP shall function as the formal guide for monitoring, collecting, and sampling activities and may be modified with CPM approval. This document shall be used as a basis for discussion in the event that on-site decisions or changes are proposed. Copies of the PRMMP shall reside with the PRS, each monitor, the project owner's on-site manager, and the CPM.

The PRMMP shall be developed in accordance with the guidelines of the Society of Vertebrate Paleontology (SVP, 1995) and shall include, but not be limited, to the following:

1. Assurance that the performance and sequence of project-related tasks, such as any literature searches, pre-construction surveys, worker environmental training, fieldwork, flagging or staking, construction monitoring, mapping and data recovery, fossil preparation and collection, identification and inventory, preparation of final reports, and transmittal of materials for curation will be performed according to the PRMMP procedures;
2. Identification of the person(s) expected to assist with each of the tasks identified within the PRMMP and the Conditions of Certification;
3. A thorough discussion of the anticipated geologic units expected to be encountered, the location and depth of the units relative to the project when known, and the known sensitivity of those units based on the occurrence of fossils either in that unit or in correlative units;
4. An explanation of why, how, and how much sampling is expected to take place and in what units. Include descriptions of different sampling procedures that shall be used for fine-grained and coarse-grained units;
5. A discussion of the locations of where the monitoring of project construction activities is deemed necessary, and a proposed plan for the monitoring and sampling;
6. A discussion of the procedures to be followed in the event of a significant fossil discovery, halting construction, resuming construction, and how notifications will be performed;

7. A discussion of equipment and supplies necessary for collection of fossil materials and any specialized equipment needed to prepare, remove, load, transport, and analyze large-sized fossils or extensive fossil deposits;
8. Procedures for inventory, preparation, and delivery for curation into a retrievable storage collection in a public repository or museum, which meets the Society of Vertebrate Paleontology standards and requirements for the curation of paleontological resources;
9. Identification of the institution that has agreed to receive any data and fossil materials collected, requirements or specifications for materials delivered for curation and how they will be met, and the name and phone number of the contact person at the institution; and
10. A copy of the paleontological Conditions of Certification.

Verification: At least 30 days prior to ground disturbance, the project owner shall provide a copy of the PRMMP to the CPM. The PRMMP shall include an affidavit of authorship by the PRS, and acceptance of the PRMMP by the project owner evidenced by a signature.

PAL-4 Prior to ground disturbance and for the duration of construction, the project owner and the PRS shall prepare and conduct weekly CPM-approved training for all recently employed project managers, construction supervisors, and workers who are involved with or operate ground disturbing equipment or tools. Workers shall not excavate in sensitive units prior to receiving CPM-approved worker training. Worker training shall consist of an initial in-person PRS training during the project kick-off for those mentioned above. Following initial training, a CPM-approved video or in-person training may be used for new employees. The training program may be combined with other training programs prepared for cultural and biological resources, hazardous materials, or any other areas of interest or concern. No ground disturbance shall occur prior to CPM approval of the Worker Environmental Awareness Program (WEAP), unless specifically approved by the CPM.

The WEAP shall address the potential to encounter paleontological resources in the field, the sensitivity and importance of these resources, and the legal obligations to preserve and protect such resources.

The training shall include:

1. A discussion of applicable laws and penalties under the law;
2. Good quality photographs or physical examples of vertebrate fossils for project sites containing units of high paleontologic sensitivity;
3. Information that the PRS or PRM has the authority to halt or redirect construction in the event of a discovery or unanticipated impact to a paleontological resource;
4. Instruction that employees are to halt or redirect work in the vicinity of a find and to contact their supervisor and the PRS or PRM;
5. An informational brochure that identifies reporting procedures in the event of a discovery;
6. A WEAP Certification of Completion form signed by each worker indicating that he/she has received the training; and
7. A sticker that shall be placed on hard hats indicating that environmental training has been completed.

Verification: (1) At least 30 days prior to ground disturbance, the project owner shall submit the proposed WEAP, including the brochure, with the set of reporting procedures the workers are to follow.

(2) At least 30 days prior to ground disturbance, the project owner shall submit the script and final video to the CPM for approval if the project owner is planning on using a video for interim training.

(3) If the owner requests an alternate paleontological trainer, the resume and qualifications of the trainer shall be submitted to the CPM for review and approval prior to installation of an alternate trainer. Alternate trainers shall not conduct training prior to CPM authorization.

(4) In the Monthly Compliance Report (MCR) the project owner shall provide copies of the WEAP Certification of Completion forms with the names of those trained and the trainer or type of training (in-person or video) offered that month. The MCR shall also include a running total of all persons who have completed the training to date.

PAL-5 The project owner shall ensure that the PRS and PRM(s) monitor consistent with the PRMMP all construction-related grading, excavation, trenching, and augering in areas where potentially fossil-bearing materials have been identified, both at the site and along any constructed linear facilities associated with the project. We anticipate that monitoring will not be required for on-site excavations 6 feet deep or less and for linear-related excavations, outside the power plant site, that do not extend more than 3 feet below existing grade. In the event that the PRS determines full-time monitoring is not necessary in locations that were identified as potentially fossil-bearing in

the PRMMP, the project owner shall notify and seek the concurrence of the CPM.

The project owner shall ensure that the PRS and PRM(s) have the authority to halt or redirect construction if paleontological resources are encountered. The project owner shall ensure that there is no interference with monitoring activities unless directed by the PRS. Monitoring activities shall be conducted as follows:

1. Any change of monitoring different from the accepted schedule presented in the PRMMP shall be proposed in a letter or email from the PRS and the project owner to the CPM prior to the change in monitoring and included in the Monthly Compliance Report. The letter or email shall include the justification for the change in monitoring and be submitted to the CPM for review and approval.
2. The project owner shall ensure that the PRM(s) keeps a daily log of monitoring of paleontological resource activities. The PRS may informally discuss paleontological resource monitoring and mitigation activities with the CPM at any time.
3. The project owner shall ensure that the PRS immediately notifies the CPM within 24 hours of the occurrence of any incidents of non-compliance with any paleontological resources Conditions of Certification. The PRS shall recommend corrective action to resolve the issues or achieve compliance with the Conditions of Certification.
4. For any significant paleontological resources encountered, either the project owner or the PRS shall notify the CPM within 24 hours or Monday morning in the case of a weekend when construction has been halted due to a paleontological find.

The project owner shall ensure that the PRS prepares a summary of the monitoring and other paleontological activities that will be placed in the Monthly Compliance Reports (MCR). The summary will include the name(s) of PRS or PRM(s) active during the month, general descriptions of training and monitored construction activities and general locations of excavations, grading, etc. A section of the report shall include the geologic units or subunits encountered, descriptions of sampling within each unit, and a list of identified fossils. A final section of the report will address any issues or concerns about the project relating to paleontologic monitoring including any incidents of non-compliance and any changes to the monitoring plan that have been approved by the CPM. If no monitoring took place during the month, the report shall include an explanation in the summary as to why monitoring was not conducted.

Verification: The project owner shall ensure that the PRS submits the summary of monitoring and paleontological activities in the MCR. When feasible, the CPM shall be notified 10 days in advance of any proposed changes in monitoring different from the

plan identified in the PRMMP. If there is any unforeseen change in monitoring, the notice shall be given as soon as possible prior to implementation of the change.

PAL-6 The project owner, through the designated PRS, shall ensure that all components of the PRMMP are adequately performed including collection of fossil materials, preparation of fossil materials for analysis, analysis of fossils, identification and inventory of fossils, the preparation of fossils for curation, and the delivery for curation of all significant paleontological resource materials encountered and collected during the project construction.

Verification: The project owner shall maintain in his/her compliance file copies of signed contracts or agreements with the designated PRS and other qualified research specialists. The project owner shall maintain these files for a period of three years after completion and approval of the CPM-approved Paleontological Resource Report (see **PAL-7**). The project owner shall be responsible to pay any curation fees charged by the museum for fossils collected and curated as a result of paleontological mitigation. A copy of the letter of transmittal submitting the fossils to the curating institution shall be provided to the CPM.

PAL-7 The project owner shall ensure preparation of a Paleontological Resources Report (PRR) by the designated PRS. The PRR shall be prepared following completion of the ground disturbing activities. The PRR shall include an analysis of the collected fossil materials and related information and submitted to the CPM for review and approval.

The report shall include, but is not limited to, a description and inventory of recovered fossil materials; a map showing the location of paleontological resources encountered; determinations of sensitivity and significance; and a statement by the PRS that project impacts to paleontological resources have been mitigated below the level of significance.

Verification: Within 90 days after completion of ground disturbing activities, including landscaping, the project owner shall submit the Paleontological Resources Report under confidential cover to the CPM.

Certification of Completion Worker Environmental Awareness Program Humboldt Bay Repowering Project (06-AFC-7)

This is to certify these individuals have completed a mandatory California Energy Commission-approved Worker Environmental Awareness Program (WEAP). The WEAP includes pertinent information on cultural, paleontological, and biological resources for all personnel (that is, construction supervisors, crews, and plant operators) working on site or at related facilities. By signing below, the participant indicates that he/she understands and shall abide by the guidelines set forth in the program materials. Include this completed form in the Monthly Compliance Report.

No.	Employee Name	Title/Company	Signature
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Cultural Trainer: _____ Signature: _____ Date: ___/___/___

PaleoTrainer: _____ Signature: _____ Date: ___/___/___

Biological Trainer: _____ Signature: _____ Date: ___/___/___

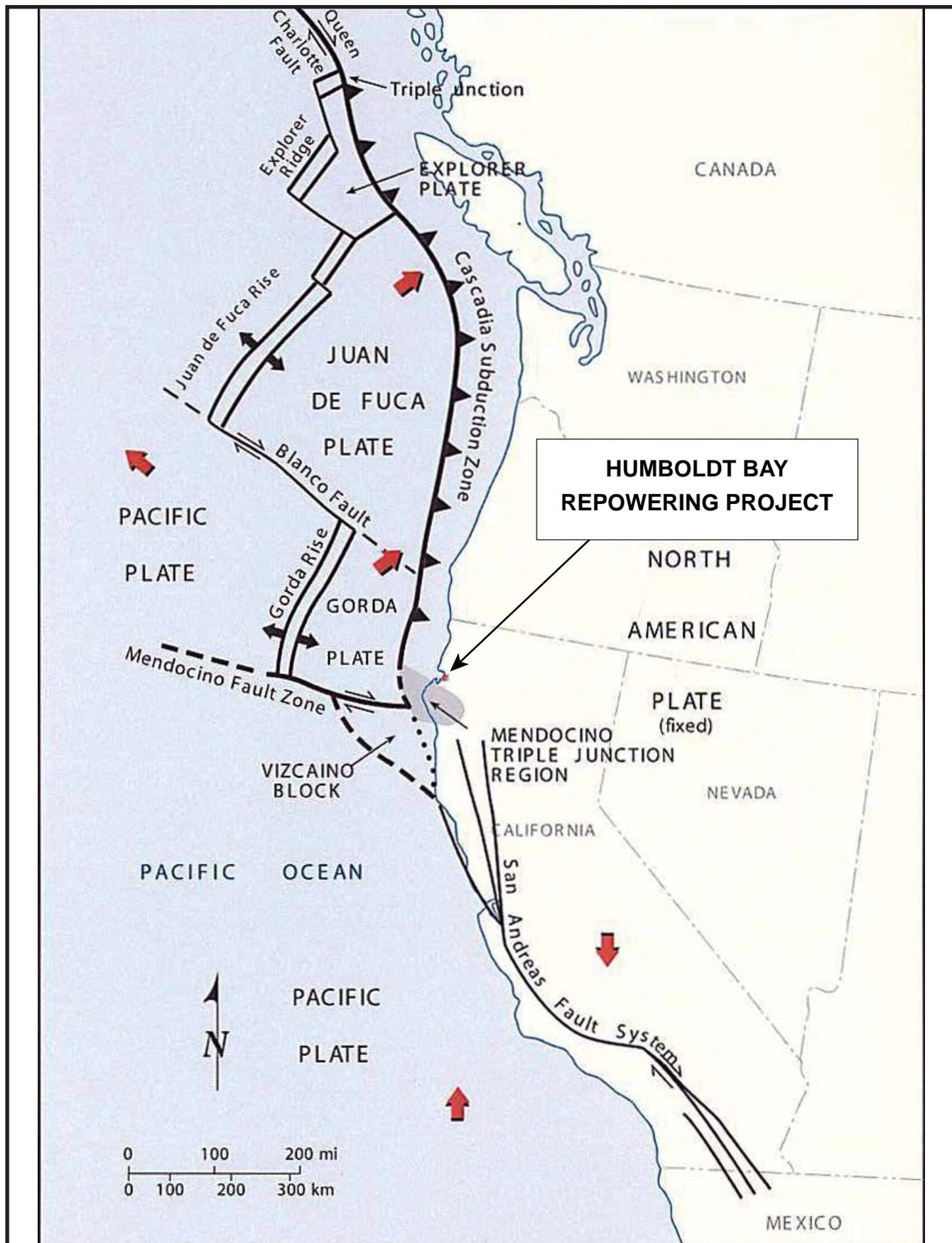
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GEOLOGY & PALEONTOLOGY - FIGURE 1
 Humboldt Bay Repowering Project - Regional Tectonics



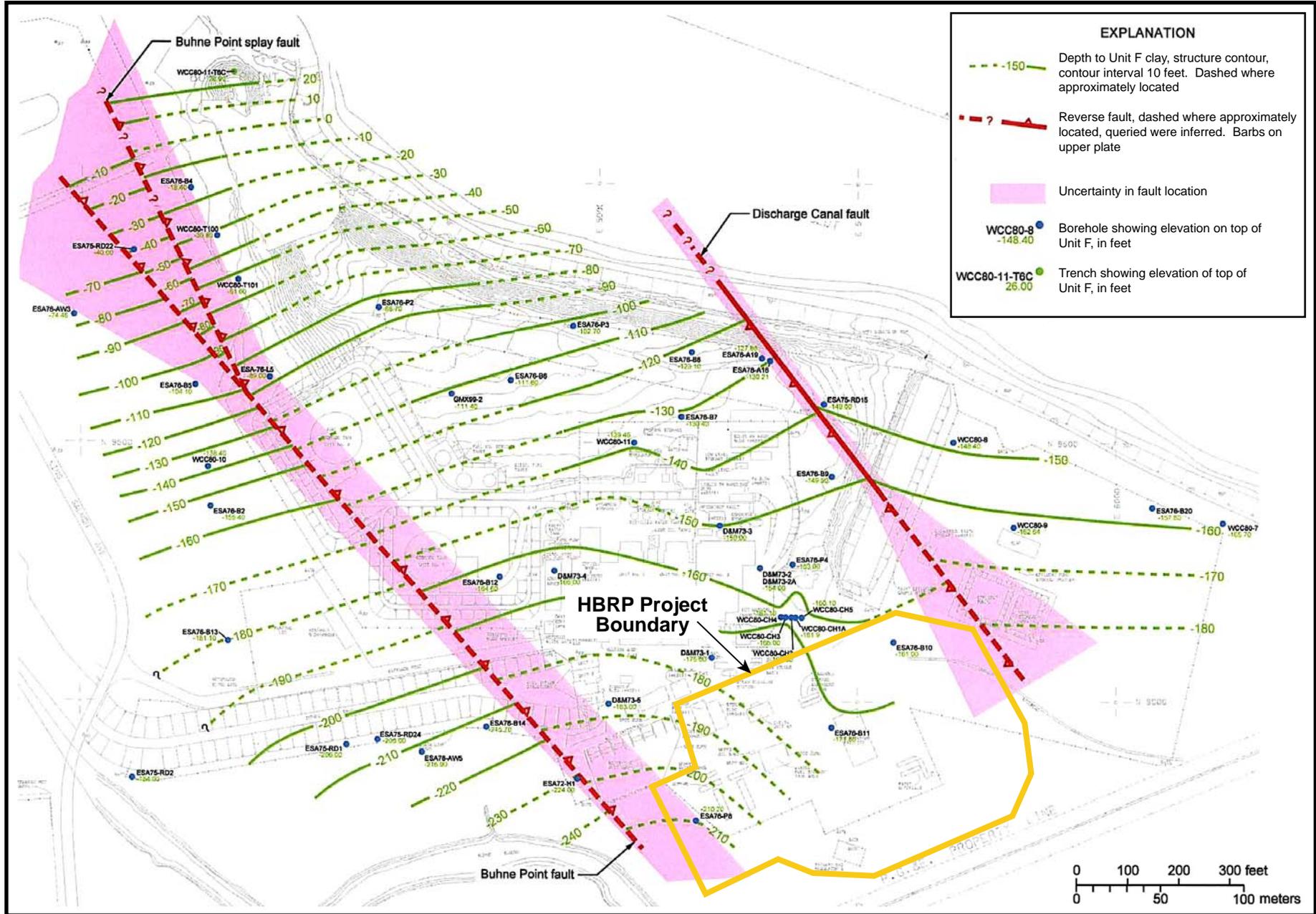
CALIFORNIA ENERGY COMMISSION - ENERGY FACILITY SITING DIVISION, NOVEMBER 2007

SOURCE: AFC Figure 8.4-1

GEOLOGY & PALEONTOLOGY - FIGURE 2
 Humboldt Bay Repowering Project - Onsite Faults

NOVEMBER 2007

GEOLOGY & PALEONTOLOGY



POWER PLANT EFFICIENCY

Steve Baker

SUMMARY OF CONCLUSIONS

The project, if constructed and operated as proposed, would generate a nominal 163 MW of load following and daily cycling electric power, at an overall project fuel efficiency of 47% lower heating value (LHV) at loads ranging from 12 to 163 MW. While it will consume substantial amounts of energy, it will do so in the most efficient manner practicable. It will not create significant adverse effects on energy supplies or resources, will not require additional sources of energy supply, and will not consume energy in a wasteful or inefficient manner. No energy standards apply to the project. Staff therefore concludes that the project would present no significant adverse impacts upon energy resources.

INTRODUCTION

The Energy Commission makes findings as to whether energy use by the Humboldt Bay Repowering Project (HBRP) will result in significant adverse impacts on the environment, as defined in the California Environmental Quality Act (CEQA). If the Energy Commission finds that the HBRP's consumption of energy would create a significant adverse impact, it must determine whether there are any feasible mitigation measures that could eliminate or minimize the impacts. In this analysis, staff addresses the issue of inefficient and unnecessary consumption of energy.

In order to support the Energy Commission's findings, this analysis will:

- examine whether the facility will likely present any adverse impacts upon energy resources;
- examine whether these adverse impacts are significant; and if so,
- examine whether feasible mitigation measures exist that would eliminate the adverse impacts, or reduce them to a level of insignificance.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

No Federal, State or local/county laws, ordinances, regulations and standards (LORS) apply to the efficiency of this project.

SETTING

Pacific Gas & Electric Company (PG&E) proposes to construct and operate the 163 MW (nominal net output) HBRP, which would replace the existing 50-year old Humboldt Bay Power Plant, serving local load and maintaining local system reliability by providing load following and daily cycling power in the Humboldt Load Pocket. The HBRP would be dispatched by PG&E as required (PG&E 2006a, AFC §§ 1.1, 1.2, 2.0, 2.5.2, 2.5.16, 2.7.1, 10.2.2). The applicant intends for the project to operate year-round, at annual availability from 90 to 97% (PG&E 2006a, AFC §§ 2.5.16, 2.7.1, 10.2.2). The project will

consist of 10 dual-fuel Wärtsilä diesel cycle reciprocating engine-generator sets and auxiliary equipment. Each engine will be turbocharged and intercooled, and will be equipped with a selective catalytic reduction (SCR) system to control oxides of nitrogen emissions and a combustion catalyst to control carbon monoxide emissions. Each engine's water jacket, intercooler and lube oil will be air cooled by a closed-loop cooling system employing four radiators (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 2.5.4, 2.7.2.1, 2.7.3).

The project will be constructed on 5.4 acres of the 143-acre Humboldt Bay Power Plant (HBPP) site, about three miles south of the City of Eureka in Humboldt County. The site has existing connections to natural gas, electric transmission and ground well water, and access to potable water (PG&E 2006a, AFC §§ 1.1, 2.0, 2.3, 2.4, 2.5.6, 2.5.7.2, 2.7.3.1, 2.7.4, 6.1.1, 6.2, 7.1, 10.2.1).

ASSESSMENT OF IMPACTS

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE OF ENERGY RESOURCES

CEQA Guidelines state that the environmental analysis "...shall describe feasible measures which could minimize significant adverse impacts, including where relevant, inefficient and unnecessary consumption of energy" (Cal. Code Regs., tit. 14, § 15126.4(a)(1)). Appendix F of the Guidelines further suggests consideration of such factors as the project's energy requirements and energy use efficiency; its effects on local and regional energy supplies and energy resources; its requirements for additional energy supply capacity; its compliance with existing energy standards; and any alternatives that could reduce wasteful, inefficient and unnecessary consumption of energy (Cal. Code Regs., tit. 14, § 15000 et seq., Appendix F).

The inefficient and unnecessary consumption of energy, in the form of non-renewable fuels such as natural gas and oil, constitutes an adverse environmental impact. An adverse impact can be considered significant if it results in:

- adverse effects on local and regional energy supplies and energy resources;
- a requirement for additional energy supply capacity;
- noncompliance with existing energy standards; or
- the wasteful, inefficient and unnecessary consumption of fuel or energy.

PROJECT ENERGY REQUIREMENTS AND ENERGY USE EFFICIENCY

Any power plant large enough to fall under Energy Commission siting jurisdiction will consume large amounts of energy. Under the projected load scenario, the HBRP would burn natural gas at a rate between 125 and 130 million Btu¹ per hour LHV (PG&E 2006a, AFC §§ 2.5.6, 6.1.1). This is a substantial rate of energy consumption, and holds

¹ British thermal units.

the potential to impact energy supplies. Under expected project operating conditions,² electricity will be generated at a full load efficiency of approximately 47% LHV (PG&E 2006a, AFC §§ 2.5.3, 6.1.2, 10.3; Wärtsilä 2006).

ADVERSE EFFECTS ON ENERGY SUPPLIES AND RESOURCES

The applicant has described its sources of supply of natural gas for the project (PG&E 2006a, AFC §§ 1.1, 2.0, 2.4, 2.5.6, 2.7.3.1, 6.1.1, 6.2, 10.2.1; App. 6A). Natural gas for the HBRP would be supplied from the existing high pressure³ PG&E natural gas spur line that currently serves the HBPP. This line, in turn, is supplied by a 145-mile extension from a PG&E backbone pipeline to the east. The PG&E natural gas system has access to gas from the Rocky Mountains, Canada and the Southwest. Additional gas supplies are obtained from wells at nearby Tomkins Hill. This represents a resource of considerable capacity, an adequate source for a project of this size. It is therefore highly unlikely that the project could pose a significant adverse impact on natural gas supplies in California.

ADDITIONAL ENERGY SUPPLY REQUIREMENTS

PG&E will deliver the requisite natural gas fuel to the project from the existing PG&E pipeline via a short 10 inch diameter interconnection on the project site (PG&E 2006a, AFC §§ 1.1, 2.4, 6.2). PG&E's gas supply division has issued a Will-Serve Letter verifying that adequate natural gas supplies are available to serve the project (PG&E 2006a, AFC App. 6A). Under normal conditions, this is a resource with adequate delivery capacity for a project of this size. The HBRP, however, requires a backup source of fuel.

Backup Fuel Supply

A unique feature of the HBPP, and of the HBRP that is proposed to replace it, is its need for a backup fuel supply in the event of curtailment or emergency interruption of the natural gas fuel supply. The natural gas supply system that serves Humboldt County and the Eureka area is tenuous, stretching 145 miles across the Coast Range mountains. In the winter, when residential heating consumes large quantities of gas, supplies to industrial users must typically be curtailed. The HBPP, and the proposed HBRP, see gas curtailment whenever ambient temperatures drop below 50°F. Additionally, landslides and adverse weather conditions occasionally cause loss of service (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 2.5.3, 2.7.3, 2.7.3.1, 2.7.3.2, 6.1, 6.1.1, 6.1.2, 9.3, 9.9.1, 9.9.2, 10.2.1).

In order for the plant to continue to operate, it must be able to switch to an alternate supply of fuel. The HBRP will rely on low-sulfur diesel fuel when gas supplies are inadequate. This fuel is readily available from local suppliers; a four-day supply (634,000 gallons) would be stored in tanks on-site (PG&E 2006a, AFC §§ 2.7.3.1, 2.7.3.2, 6.1.1, 10.2.1).

² Each engine produces power at constant fuel efficiency from approximately 75% load (12 MW) to full load.

³ Gas is supplied to the site at a pressure between 170 and 320 psig, then reduced at the power plant to between 90 and 95 psig (PG&E 2006a, AFC §§ 2.5.6, 6.1.1, 6.3).

Given this provision for a backup fuel supply, there is no real likelihood that the HBRP will require the development of additional energy supply capacity.

COMPLIANCE WITH ENERGY STANDARDS

No standards apply to the efficiency of the HBRP or other non-cogeneration projects.

ALTERNATIVES TO REDUCE WASTEFUL, INEFFICIENT AND UNNECESSARY ENERGY CONSUMPTION

The HBRP could be deemed to create significant adverse impacts on energy resources if alternatives existed that would reduce the project's use of fuel. Evaluation of alternatives to the project that could reduce wasteful, inefficient or unnecessary energy consumption first requires examination of the project's energy consumption. Project fuel efficiency, and therefore its rate of energy consumption, is determined by the configuration of the power producing system and by the selection of equipment used to generate power.

Project Configuration

The project objective is to serve local load and maintain local system reliability by providing load following and daily cycling power in the Humboldt Load Pocket. The HBRP will be dispatched by PG&E (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 2.5.16, 2.7.1, 9.3, 10.2.2). The project configuration of multiple reciprocating engine-generator sets is consistent with this objective. The HBRP will be configured as 10 engine gensets in parallel, in which up to 16.3 MW of electricity is generated by each of one or more engine gensets. This configuration, with its short start-up time, fast ramping⁴ capability and consistently high fuel efficiency throughout the load range, is well suited to providing intermediate and cycling power. When reduced output is required, one or more engine-generators can be shut down, allowing the remaining machine(s) to produce a percentage of the full power at optimum efficiency, rather than operating a single, larger machine at a less efficient part load output (PG&E 2006a, AFC §§ 1.1, 1.4, 2.0, 2.5.2, 2.5.4, 2.5.16, 2.7.1, 2.7.2.1, 2.7.3, 10.3).

The applicant intends for this facility to operate in intermediate and daily cycling duty at an annual capacity factor from 25 to 74% for all 10 engine gensets (PG&E 2006a, AFC § 10.3). This is equivalent to each machine running between 2,147 and 6,497 hours per year.

Equipment Selection

Modern reciprocating engine-generator sets represent highly fuel-efficient electric generating technology. The HBRP will employ 10 Wärtsilä 18V50DF dual-fuel engine gensets operating on natural gas fuel, with diesel oil as a backup fuel. The 50DF engine is one of the most efficient and cleanest-burning such machines available. This engine is nominally rated at 16.6 MW gross (16.3 MW net) at a fuel efficiency exceeding 47% LHV (Wärtsilä 2006). The HBRP would actually produce 163 MW net (16.3 MW per machine) at a site rated fuel efficiency of 47% LHV (PG&E 2006a, AFC §§ 1.1, 2.0, 2.4, 2.5.2, 2.5.3, 6.1.2, 10.3; Wärtsilä 2006).

⁴ Ramping is increasing and decreasing electrical output to meet fluctuating load requirements.

Efficiency of Alternatives to the Project

Alternative Generating Technologies

Alternative generating technologies for the HBRP are considered in the AFC (PG&E 2006a, AFC §§ 1.4, 9.3, 9.9). Rankine cycle steam boiler units (fueled with coal, oil or natural gas), simple cycle and combined cycle gas turbine units, advanced gas turbine technologies, geothermal, hydroelectric, biomass, waste-to-energy, solar and wind power were all considered. None of the renewable energy technologies offers the year-round dispatchability required of the HBRP. Coal and heavy fuel oil were ruled out due to supply and pollution concerns. Staff agrees with the applicant that only natural gas-burning technologies are feasible for this project.

Natural Gas-Burning Technologies

Fuel consumption is one of the most important economic factors in selecting an electric generator; fuel typically accounts for over two-thirds of the total operating costs of a fossil-fired power plant (Power 1994). Under a competitive power market system, where operating costs are critical in determining the competitiveness and profitability of a power plant, the plant owner is thus strongly motivated to purchase fuel-efficient machinery.

The Wärtsilä 18V50DF

PG&E would employ 10 Wärtsilä 18V50DF dual fuel engine generator sets in the HBRP (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 2.7.3). The Wärtsilä engine genset chosen is the largest and most efficient such machine now available. This machine is nominally rated at 16.6 MW gross and 47% efficiency LHV at ISO⁵ conditions (Wärtsilä 2006). (Staff compares alternative machines' ISO ratings as a common baseline, since project-specific ratings are not available for the alternative machines.)

Where a gas turbine generator's fuel efficiency drops off rapidly when the machine is operated at less than full load, the efficiency of a reciprocating engine such as the Wärtsilä suffers much less at lower output. From 75% load to full load, the Wärtsilä's efficiency is nearly constant; at 50% load, it drops only to about 90% of full-load efficiency. Further, the machine is capable of ramping at high rates. In addition, the Wärtsilä can go from a cold start to full load in ten minutes (PG&E 2006a, AFC §§ 1.4, 2.5.3, 10.2.2, 10.3; Wärtsilä 2006). Such operating flexibility makes this the most capable machine available in its size range for providing the required load following and daily cycling service.

⁵ International Standards Organization (ISO) standard conditions are 15°C (59°F), 60% relative humidity, and one atmosphere of pressure (equivalent to sea level).

Alternatives to the Wärtsilä 18V50DF

Alternative machines that might meet the project's objectives are simple cycle gas turbines, and other reciprocating engines.

Gas Turbine Generators

Gas turbine generators that could perform in load following and daily cycling service include the General Electric (GE) LM6000 SPRINT, the Siemens Power SGT-800 and the Pratt & Whitney FT8 TwinPac, which are aeroderivative machines adapted from aircraft engines; and the GE LMS100, a new hybrid machine incorporating both aeroderivative and industrial turbine technology.

The General Electric LM6000PC SPRINT gas turbine generator in a simple cycle configuration is nominally rated at 50.1 MW and 40.5% efficiency LHV at ISO conditions (GTW 2006).

The Pratt & Whitney FT8 TwinPac gas turbine generator in a simple cycle configuration is nominally rated at 51.4 MW and 38.4% efficiency LHV at ISO conditions (GTW 2006).

The Siemens SGT-800 gas turbine generator in a simple cycle configuration is nominally rated at 45 MW and 37% efficiency LHV at ISO conditions (GTW 2006).

The GE LMS100, currently available only in simple cycle configuration, is nominally rated at 98.8 MW and 45.1% efficiency at ISO conditions (GTW 2006).

Machine	Generating Capacity (MW)	ISO Efficiency (LHV)
GE LM6000PC SPRINT	50.1	40.5 %
P & W FT8 TwinPac	51.4	38.4 %
Siemens SGT-800	45	37.0 %
GE LMS100	98.8	45.1 %
Wärtsilä 18V50DF	16.3	47 %

Source: GTW 2006, Wärtsilä 2006

While the LMS100 nearly equals the fuel efficiency of the Wärtsilä machine, the Wärtsilä's smaller generating capacity makes it more attractive for load following. The LMS100 has been specifically designed for flexible output and high efficiency at part load; in this respect it nearly matches the Wärtsilä. However, the nearly 100 MW output of the LMS100 limits its flexibility. It can be curtailed only to about 30 MW or so before fuel efficiency drops prohibitively low. The HBRP, however, with 10 reciprocating engines, could be curtailed to about 8 MW without a significant drop in fuel efficiency. An additional consideration is that the LMS100 is not currently available in a dual fuel configuration. Staff agrees with the applicant that a battery of large reciprocating engines is the most appropriate choice for the HBRP.

Reciprocating Engines

The Wärtsilä was selected based on generating capacity (one of the largest available), air emissions, fuel efficiency, cost and schedule concerns. Staff cannot find fault with the applicant's choice of Wärtsilä as its engine supplier.

In conclusion, the project configuration and generating equipment chosen (10 Wärtsilä 18V50DF reciprocating engines) appear to represent the most efficient feasible combination to satisfy the project objectives. There are no alternatives that could significantly reduce energy consumption.

CUMULATIVE IMPACTS

The only nearby project that has been identified that could potentially combine with the HBRP to create cumulative impacts on natural gas resources is the HBPP, consisting of two steam boiler units (Unit 1, 52 MW capacity; and Unit 2, 53 MW capacity) and two trailer-mounted 15 MW simple cycle gas turbines. The PG&E natural gas supply system (combined with diesel fuel as backup) is expected to be adequate to supply both the HBPP and the HBRP during HBRP startup and commissioning without adversely impacting its other customers. Once the HBRP has been declared commercial, the HBPP will be shut down permanently and its air emission permits surrendered (PG&E 2006a, AFC §§ 1.1, 2.0, 2.2.3). Staff believes that the HBRP will create no cumulative impacts on natural gas fuel supplies.

NOTEWORTHY PUBLIC BENEFITS

The applicant proposes to increase the fuel efficiency and decrease overall air emissions of the existing HBPP, while continuing to provide reliable load following and daily cycling power to the Humboldt Load Pocket, by replacing the HBPP with the HBRP (PG&E 2006a, AFC §§ 1.1, 1.7.1, 1.7.3, 2.5.2, 2.5.16, 2.7.1, 9.3, 10.2.2). By doing so in this most fuel-efficient manner, i.e., employing 10 of the most efficient dual fuel reciprocating engine generator sets available, the HBRP will provide a benefit to the electric consumers of Humboldt County.

CONCLUSIONS

The project, if constructed and operated as proposed, would generate a nominal 163 MW of load following and daily cycling electric power, at an overall project fuel efficiency of 47% LHV at loads from 12 MW to 163 MW. While it will consume substantial amounts of energy, it will do so in the most efficient manner practicable. It will not create significant adverse effects on energy supplies or resources, will not require additional sources of energy supply, and will not consume energy in a wasteful or inefficient manner. No energy standards apply to the project. Staff therefore concludes that the project would present no significant adverse impacts upon energy resources. No cumulative impacts on energy resources are likely.

PROPOSED CONDITIONS OF CERTIFICATION

No conditions of certification are proposed.

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POWER PLANT RELIABILITY

Steve Baker

SUMMARY OF CONCLUSIONS

Pacific Gas & Electric Company (PG&E) predicts an availability factor of 90 to 97%, which staff believes is achievable. Based on a review of the proposal, staff concludes that the Humboldt Bay Repowering Project (HBRP) will be built and operated in a manner consistent with industry norms for reliable operation. This should provide an adequate level of reliability. No conditions of certification are proposed.

INTRODUCTION

In this analysis, Energy Commission staff addresses the reliability issues of the project to determine if the power plant is likely to be built in accordance with typical industry norms for reliability of power generation. Staff uses this level of reliability as a benchmark because it ensures that the resulting project would likely not degrade the overall reliability of the electric system it serves (see **Setting** below).

The scope of this power plant reliability analysis covers:

- equipment availability;
- plant maintainability;
- fuel and water availability; and
- power plant reliability in relation to natural hazards.

Staff examined the project design criteria to determine if the project is likely to be built in accordance with typical industry norms for reliability of power generation. While PG&E has predicted an equivalent availability factor from 90 to 97% for the HBRP (see below), staff uses typical industry norms as a benchmark, rather than PG&E's projection, to evaluate the project's reliability.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

No Federal, State or local/county laws, ordinances, regulations and standards (LORS) apply to the reliability of this project.

SETTING

In the restructured competitive electric power industry, the responsibility for maintaining system reliability falls largely to the State's control area operators, such as the California Independent System Operator (Cal-ISO), that purchase, dispatch, and sell electric power throughout the State. How the Cal-ISO and other control area operators will ensure system reliability is an ongoing process; protocols are still being developed and put in place that will allow sufficient reliability to be maintained under the competitive market system. "Must-run" power purchase agreements and "participating generator"

agreements are two mechanisms being employed to ensure an adequate supply of reliable power.

The Cal-ISO also requires those power plants selling ancillary services, as well as those holding reliability must-run contracts, to fulfill certain requirements, including:

- filing periodic reports on plant reliability;
- reporting all outages and their causes; and
- scheduling all planned maintenance outages with the Cal-ISO.

The Cal-ISO's mechanisms to ensure adequate power plant reliability apparently have been devised under the assumption that the individual power plants that compete to sell power into the system will each exhibit a level of reliability similar to that of power plants of past decades. However, there is cause to believe that, under free market competition, financial pressures on power plant owners to minimize capital outlays and maintenance expenditures may act to reduce the reliability of many power plants, both existing and newly constructed (McGraw-Hill 1994). It is possible that, if significant numbers of power plants were to exhibit individual reliability sufficiently lower than this historical level, the assumptions used by Cal-ISO to ensure system reliability would prove invalid, with potentially disappointing results. Until the restructured competitive electric power system has undergone an adequate shakeout period, and the effects of varying power plant reliability are thoroughly understood and compensated for, staff will recommend that power plant owners continue to build and operate their projects to the level of reliability to which all in the industry are accustomed.

The applicant proposes to construct and operate the 163 MW (nominal net output) HBRP, which would replace the aging Humboldt Bay Power Plant (HBPP) and ensure local system reliability by providing load following and daily cycling power to the Humboldt Load Pocket (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 9.3, 10.2.2). The project is expected to achieve an availability factor of 90 to 97%. The HBRP is intended to operate between approximately 7.5% and 100% of base load (12 to 163 MW), and is projected to actually operate in load following and daily cycling service at a capacity factor between 25 and 74% (PG&E 2006a, AFC §§ 1.4, 2.5.16, 2.7.1, 10.2.2, 10.3).

ASSESSMENT OF IMPACTS

METHOD FOR DETERMINING RELIABILITY

The Commission must make findings as to the manner in which the project is to be designed, sited and operated to ensure safe and reliable operation [Cal. Code Regs., tit. 20, § 1752(c)]. Staff takes the approach that a project is acceptable if it does not degrade the reliability of the utility system to which it is connected. This is likely the case if the project exhibits reliability at least equal to that of other power plants on that system.

The availability factor for a power plant is the percentage of the time that it is available to generate power; both planned and unplanned outages subtract from its availability. Measures of power plant reliability are based on its actual ability to generate power

when it is considered available and are based on starting failures and unplanned, or forced, outages. For practical purposes, reliability can be considered a combination of these two industry measures, making a reliable power plant one that is available when called upon to operate. Throughout its intended 30-year life (PG&E 2006a, AFC §§ 2.7.1, 10.2.2), the HBRP will be expected to perform reliably.

Power plant systems must be able to operate for extended periods without shutting down for maintenance or repairs. Achieving this reliability is accomplished by ensuring adequate levels of equipment availability, critical component redundancy, plant maintainability with scheduled maintenance outages, fuel and water availability, and resistance to natural hazards. Staff examines these factors for the project and compares them to industry norms. If they compare favorably, staff can conclude that the HBRP will be as reliable as other power plants on the electric system, and will therefore not degrade system reliability.

EQUIPMENT AVAILABILITY

Equipment availability will be ensured by use of appropriate quality assurance/ quality control (QA/QC) programs during design, procurement, construction and operation of the plant, and by providing for adequate maintenance and repair of the equipment and systems (discussed below).

Quality Control Program

The applicant describes a QA/QC program (PG&E 2006a, AFC § 2.7.5) typical of the power industry. Equipment will be purchased from qualified suppliers, based on technical and commercial evaluations. Suppliers' personnel, production capability, past performance, QA programs and quality history will be evaluated. The project owner will perform receipt inspections, test components, and administer independent testing contracts. Staff expects implementation of this program to yield typical reliability of design and construction. To ensure such implementation, staff has proposed appropriate conditions of certification under the portion of this document entitled **Facility Design**.

PLANT MAINTAINABILITY

Equipment Redundancy

A generating facility used in daily cycling commonly offers adequate opportunity for maintenance work during its downtime. During periods of extended dispatch, however, as could occur if other major generating or transmission assets were disabled, the facility may be required to operate for extended periods. A typical approach for achieving reliability in such circumstances is to provide redundant examples of those pieces of equipment most likely to require service or repair.

The applicant plans to provide appropriate redundancy of function for the project (PG&E 2006a, AFC §§ 2.4, 2.5.5, 2.5.13.3, 2.7.2.2, 2.7.2.3; Table 2.7-1). The fact that the project consists of 10 reciprocating engine-generators operating in parallel as independent equipment trains provides inherent reliability. A single equipment failure cannot disable more than one train, thus allowing the plant to continue to generate (at slightly reduced output). Further, all plant ancillary systems are also designed with

adequate redundancy to ensure continued operation in the face of equipment failure. A backup plant operator's station and a backup station service auxiliary transformer, two 100% capacity starting air compressors¹ and three 50% service air compressors augment the typical redundancy in the plant control and emergency power systems. Staff believes that equipment redundancy will be sufficient for a project such as this.

Maintenance Program

PG&E proposes to establish a preventive plant maintenance program typical of the industry (PG&E 2006a, AFC §§ 2.7.1, 10.2.2). Equipment manufacturers provide maintenance recommendations with their products; the applicant will base its maintenance program on these recommendations. The program will encompass preventive and predictive maintenance techniques. Maintenance outages will be planned for periods of low electricity demand. In light of these plans, staff expects that the project will be adequately maintained to ensure acceptable reliability.

FUEL AND WATER AVAILABILITY

For any power plant, the long-term availability of fuel and of water for cooling or process use is necessary to ensure reliability. The need for reliable sources of fuel and water is obvious; lacking long-term availability of either source, the service life of the plant may be curtailed, threatening the supply of power as well as the economic viability of the plant.

Fuel Availability

The HBRP will burn chiefly natural gas from the PG&E system. Natural gas fuel will be supplied to the project via a short 10-inch diameter connection from the existing PG&E high pressure² gas line on the HBPP site (PG&E 2006a, AFC §§ 1.1, 2.0, 2.4, 2.5.6, 2.7.3.1, 6.1, 6.2, 10.2.1; App. 6A). This line, in turn, is supplied by a 145-mile extension spur from a PG&E backbone pipeline to the east. The PG&E natural gas system offers access to adequate supplies of gas from the Rocky Mountains, Canada and the Southwest. Additional gas supplies are obtained from wells at nearby Tomkins Hill. PG&E's gas supply division has issued a Will-Serve Letter verifying that adequate natural gas supplies are available to serve the project (PG&E 2006a, AFC App. 6A). This represents a resource of considerable capacity.

A unique feature of the HBPP, and of the HBRP that is proposed to replace it, is its need for a backup fuel supply in the event of curtailment or emergency interruption of the natural gas fuel supply. The natural gas supply system that serves Humboldt County and the Eureka area is tenuous, stretching 145 miles across the Coast Range mountains. In the winter, when residential heating consumes large quantities of gas, supplies to industrial users must typically be curtailed. The HBPP, and the proposed HBRP, see gas curtailment whenever ambient temperatures drop below 50°F. Additionally, landslides and adverse weather conditions occasionally cause loss of service (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 2.5.3, 2.7.3, 2.7.3.1, 2.7.3.2, 6.1, 6.1.1, 6.1.2, 9.3, 9.9.1, 9.9.2, 10.2.1).

¹ The Wärtsilä engines are started with compressed air rather than electrically.

² Gas is supplied to the site at a pressure between 170 and 320 psig, then reduced at the power plant to between 90 and 95 psig (PG&E 2006a, AFC §§ 2.5.6, 6.1.1, 6.3).

In recognition of this inherent lack of reliability of the natural gas supply system, the existing HBPP employs heavy fuel oil and diesel oil, stored in tanks onsite, as backup fuel sources. The HBRP would also utilize liquid fuel, in the form of low-sulfur diesel oil, as a backup fuel source (PG&E 2006a, AFC §§ 1.1, 1.4, 2.0, 2.5.2, 2.7.3, 2.7.3.2, 6.1, 6.1.1, 9.3, 9.9.2, 10.2.1). The Wärtsilä 18V50DF engines to be employed in the HBRP are capable of switching from natural gas to diesel fuel automatically, without interruption, at any output up to and including full load (Wärtsilä 2006). Low-sulfur diesel fuel would be stored onsite in sufficient quantities to ensure reliability in times of natural gas supply curtailment or interruption. Sufficient diesel fuel would be stored (634,000 gallons) to operate the HBRP for four days, and replenishment is readily available from local suppliers (PG&E 2006a, AFC §§ 2.7.3.1, 2.7.3.2, 6.1.1, 10.2.1).

In light of this provision for a backup fuel supply, staff agrees with the applicant's prediction that there will be adequate fuel supply to meet the project's needs.

Water Supply Reliability

The HBRP would employ two sources of water. Raw water from the existing PG&E well No. 2 on the HBPP site would provide water for industrial uses. These include the engine cooling systems, auxiliary equipment closed cooling water system, fire water tank replenishment and landscape irrigation. Potable water from the Humboldt Community Services District water system would be supplied via a new 4-inch to 6-inch diameter, 1,200 foot long connection to the existing water line along King Salmon Avenue. Potable water would provide for sanitary uses (drinking water, sinks and toilets, emergency eyewashes and safety showers) and act as a backup source of fire water (PG&E 2006a, AFC §§ 1.1, 2.0, 2.4, 2.5.7.2, 2.5.8, 2.7.4, 7.1; App. 7A). Two 2,600 gallon maintenance water storage tanks would store engine coolant during maintenance. Since the engine gensets and auxiliaries are air cooled, plant water consumption is minimal. Staff believes this water source yields sufficient likelihood of a reliable supply of water for the plant's minimal needs. (For further discussion of water supply, see the **Soil and Water Resources** section of this document.)

POWER PLANT RELIABILITY IN RELATION TO NATURAL HAZARDS

Natural forces can threaten the reliable operation of a power plant. High winds and seiches (waves in inland bodies of water) will not likely represent hazards for this project, but seismic shaking (earthquake), tsunami (tidal wave) and flooding may present credible threats to reliable operation.

Seismic Shaking

Historically, California's power plants have sustained little or no damage in severe earthquakes. Typically, the majority of earthquake damage to power facilities is to switchyards, substations and transmission towers; broken ceramic insulators are a major cause of outages (Schiff 1999). When power plants are put out of service by earthquake, they are typically repaired and available for service before the load is ready to accept power.

During the 1987 Whittier earthquake (M_w 6.1), no power plants were damaged, although the earthquake dropped 750 MW of load, interrupting service to 325,000 customers and damaging 327 of about 2,000 distribution circuits in the area (Richter 1988, pp. 46-48).

After the October 17, 1989 Loma Prieta earthquake (M_w 6.9), service was interrupted to approximately 1.4 million customers; service was restored to all but 70,000 customers within 48 hours. In that earthquake, 1,139 MW of generation tripped off-line at Moss Landing, Hunters Point and Potrero, while approximately 4,150 MW of customer load dropped offline. The only power plant damage was the wiping of two steam turbine bearings at Moss Landing Unit 6 due to loss of electrical power to turbine lube oil pumps (PG&E 1990, p. 5).

The January 17, 1994 Northridge earthquake (M_w 6.7) left over 2.5 million customers in Southern California without power, and outages in other interconnected areas (such as 150,000 customers in rural Idaho). Power was restored to the majority of customers within 12 hours; approximately 93% had power within 24 hours, and virtually everyone within 72 hours. The majority of damage occurred in transmission and distribution systems. In general, power generation plants suffered little significant damage and were restored to service within a few hours to two days (Woods & Seiple, 1995).

The HBRP represents an unusually robust power plant layout. The individual Wärtsilä engine generator sets are, in effect, large blocks of steel. Each genset is mounted on springs (to attenuate vibration) on a solid concrete foundation slab, and all connections to the machine for air, coolant, lube oil and electricity are accomplished through flexible connectors. In an earthquake, it is highly unlikely that the individual machines would sustain significant damage. Staff expects that any requisite repairs could be made quickly, restoring the plant to service in short order.

The HBRP site lies in a geologically active area within Seismic Zone 4; see that portion of this document entitled **Geology and Paleontology**. The project will be designed and constructed to the latest appropriate LORS (PG&E 2006a, AFC §§ 2.6.1; Table 10.4-1; App. 10). Compliance with current LORS applicable to seismic design represents an upgrading of performance during seismic shaking compared to older facilities, due to the fact that these LORS have been periodically and continually upgraded. By virtue of being built to the latest seismic design LORS, this project will likely perform at least as well as, and perhaps better than, existing plants in the electric power system. Staff has proposed conditions of certification to ensure this; see that portion of this document entitled **Facility Design**.

In light of the historical performance of California power plants and the electrical system in seismic events, and of the unusually robust design of the HBRP, staff believes there is no special concern with the HBRP's functional reliability affecting the electric system's reliability due to seismic events.

Tsunami

Due to its location across from the mouth of Humboldt Bay, the HBRP could be subject to inundation in the event of a tsunami. PG&E estimates that in the most likely scenario, water levels could reach a height of 16 feet above high tide. This would surely impact the power plant. To mitigate damage to the plant and any environmental damage due to release of fluids, PG&E proposes to design the plant so that all structures and equipment are anchored to prevent flotation, collapse or lateral displacement (PG&E 2006a, AFC § 2.6.1). Staff believes this to be a reasonable approach; see that portion of this document entitled **Geology and Paleontology**. As explained above regarding

earthquakes, the HBRP would represent a physically robust design. Any tsunami damage would likely be quickly repairable. Staff believes there is no special concern with the HBRP's functional reliability affecting the electric system's reliability due to tsunami.

Flooding

While the site lies within a special flood hazard area, flooding should cause no significant concern. PG&E plans to follow Humboldt County guidelines and design the HBRP to an elevation of one foot above existing site elevation; this should provide adequate protection from flooding (PG&E 2006a, AFC § 2.6.1). Staff therefore believes there are no concerns with power plant functional reliability due to flooding. For further discussion, see **Soil and Water Resources** and **Geology and Paleontology**.

COMPARISON WITH EXISTING FACILITIES

Industry statistics for availability factors (as well as many other related reliability data) are kept by the North American Electric Reliability Council (NERC). NERC continually polls utility companies throughout the North American continent on project reliability data through its Generating Availability Data System (GADS), and periodically summarizes and publishes the statistics on the Internet (<http://www.nerc.com>). NERC reports the following summary generating unit statistics for the years 2000 through 2005 (NERC 2006):

For Diesel Engine units (all MW sizes):

Equivalent Availability Factor = 94.50%

The engines that will be employed in the project are not new. Wärtsilä has been in the business of manufacturing power plants since 1834, and is widely regarded as the preeminent manufacturer of large reciprocating engines for marine and power generation duty worldwide. The 50DF series of engine and its predecessors have been on the market for many years. This technology can be regarded as fully mature.

The applicant's prediction of an annual availability factor of 90 to 97% (PG&E 2006a, AFC §§ 2.5.16, 2.7.1, 10.2.2) appears reasonable compared to the NERC figure for similar plants throughout North America (see above) and in light of the proposed dispatch scenario (load following and daily cycling duty). Since the plant will consist of 10 parallel engine gensets, maintenance can be scheduled during those times when the full plant output is not required to meet demand, typical of industry standard maintenance procedures. The applicant's estimate of plant availability, therefore, appears realistic. The stated procedures for assuring design, procurement and construction of a reliable power plant appear to be in keeping with industry norms, and staff believes they are likely to yield an adequately reliable plant.

NOTEWORTHY PROJECT BENEFITS

The applicant proposes to replace the aging Humboldt Bay Power Plant (HBPP) and ensure local system reliability by providing load following and daily cycling power to the Humboldt Load Pocket (PG&E 2006a, AFC §§ 1.1, 2.0, 2.5.2, 9.3, 10.2.2). The fact that

the project consists of 10 engine generator sets configured as independent equipment trains provides inherent reliability. A single equipment failure cannot disable more than one train, thus allowing the plant to continue to generate (at slightly reduced output).

The reciprocating engines to be employed in the HBRP represent a fully mature technology; they can be expected to exhibit high availability. The applicant's prediction of an equivalent availability factor of 90 to 97% appears achievable. Staff believes this should provide an adequate level of reliability.

CONCLUSION

PG&E predicts an equivalent availability factor of 90 to 97%, which staff believes is achievable. Based on a review of the proposal, staff concludes that the plant would be built and operated in a manner consistent with industry norms for reliable operation. This should provide an adequate level of reliability. No conditions of certification are proposed.

PROPOSED CONDITIONS OF CERTIFICATION

No conditions of certification are proposed.

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TRANSMISSION SYSTEM ENGINEERING

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SUMMARY OF CONCLUSIONS

The Humboldt Bay Repowering Project (HBRP) will replace the existing Pacific Gas & Electric (PG&E) Humboldt Bay Power Plant (HBPP) generating units 1 & 2 and Mobile Emergency Power Plant (MEPP) generating units at the HBPP site. The System Impact study (SIS) reveals that the interconnection of the new ten HBRP units to the existing 60 and 115 kV PG&E networks in the Humboldt area would have some adverse impacts including new overloads and exacerbating pre-project overloads on the downstream transmission facilities under 2008 contingent emergency system conditions. There would also be system performance issues caused by the HBRP with dynamic stability and low frequency reliability criteria violations during certain contingencies. The mitigation measures planned by PG&E are considered effective to offset the adverse impacts and would ensure system reliability in accordance with the North American Electric Reliability Council (NERC)/Western Electricity Coordinating Council (WECC) & California Independent System Operator (California ISO) planning standards, and are acceptable to staff.

- The proposed interconnection facilities, which include the new HBRP 15 kV switchgear, three dedicated step-up transformers with circuit breakers (CBs), two 60 kV short overhead lines to the existing HBPP 60 kV substation and one 115 kV short overhead line to existing Humboldt Bay-Humboldt 115 kV line, are adequate in accordance to good utility practices and acceptable to staff.
- Reconductoring the 1-mile Humboldt-Harris section of the Humboldt-Eureka 60 kV line is a planned PG&E transmission project based on pre-project overloads on the line, not a direct network upgrade requirement for interconnection of the HBRP. Therefore, the reconductoring the line is not a part of the HBRP. The Special Protection System (SPS) equipment and the PG&E 100 MVAR (see Definition of Terms) Static VAR Compensator (SVC) project will be installed within the fence line of the existing substations with no significant or unmitigated impacts.

The HBRP project, therefore, would comply with the Laws, Ordinances, Regulations and Standards (LORS) assuming implementation of the recommended Conditions of Certification. Replacing the existing old generating units at the HBPP site is necessary to meet the forecasted load demand in the area and maintain system reliability. Staff believes that the HBRP along with the PG&E 100 MVAR SVC project would provide additional reactive power supply, better performance for dynamic stability and improved voltage in the local network.

INTRODUCTION

The Transmission System Engineering (TSE) analysis examines whether or not the facilities associated with the proposed interconnection conforms to all applicable laws, ordinances, regulations and standards (LORS) required for safe and reliable electric power transmission. Staff's analysis evaluates the power plant switchyard, outlet line, termination and downstream facilities identified by the applicant. Additionally, under the

California Environmental Quality Act (CEQA), the Energy Commission must conduct an environmental review of the “whole of the action,” which may include facilities not licensed by the Energy Commission (California Code of Regulations, title 14, §15378). Therefore, the Energy Commission must identify the system impacts and necessary new or modified transmission facilities downstream of the proposed interconnection that are required for interconnection and represent the “whole of the action.” In this analysis the discussion of conformance with the applicable LORS is used to identify potential impacts under CEQA.

Energy Commission staff rely on the interconnecting authority for the analysis of impacts on the transmission grid as well as the identification and approval of required new or modified facilities downstream from the proposed interconnection required as mitigation measures. The proposed HBRP would interconnect to the PG&E transmission network and requires analysis by PG&E and approval of the California Independent System Operator (California ISO).

PG&E’S ROLE

PG&E is responsible for ensuring electric system reliability in the PG&E system for addition of the proposed transmission modifications. PG&E will provide the analysis and reports in their System Impact and Facilities studies, and their approval for the facilities and changes required in the PG&E system for addition of the proposed transmission modifications.

CALIFORNIA ISO’S ROLE

The California ISO is responsible for ensuring electric system reliability for all participating transmission owners and is also responsible for developing the standards necessary to achieve system reliability. The California ISO will review the studies of the PG&E system to ensure adequacy of the proposed transmission interconnection. The California ISO will determine the reliability impacts of the proposed transmission modifications on the PG&E transmission system in accordance with all applicable reliability criteria. According to the California ISO Tariffs, the California ISO will determine the “Need” for transmission additions or upgrades downstream from the interconnection point to insure reliability of the transmission grid. The California ISO will, therefore, review the System Impact Study (SIS) performed by PG&E and/or any third party, provide their analysis, conclusions and recommendations, and issue a preliminary approval or concurrence letter to PG&E. On satisfactory completion of the PG&E Facility Study, the California ISO will proceed for execution of Large Generator Interconnection Agreement (LGIA) with the project owner. The California ISO may also provide written and verbal testimony on their findings at the Energy Commission hearings if necessary.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

- California Public Utilities Commission (CPUC) General Order 95 (GO-95), “Rules for Overhead Electric Line Construction,” formulates uniform requirements for construction of overhead lines. Compliance with this order ensures adequate service and safety to persons engaged in the construction, maintenance and operation or use of overhead electric lines and to the public in general.

- California Public Utilities Commission (CPUC) General Order 128 (GO-128), “Rules for Construction of Underground Electric Supply and Communications Systems,” formulates uniform requirements and minimum standards to be used for underground supply systems to ensure adequate service and safety to persons engaged in the construction, maintenance and operation or use of underground electric lines and to the public in general.
- The National Electric Safety Code, 1999 provides electrical, mechanical, civil and structural requirements for overhead electric line construction and operation.
- NERC/WECC Planning Standards: The Western Electricity Coordinating Council (WECC) Planning Standards are merged with the North American Electric Reliability Council (NERC) Planning Standards and provide the system performance standards used in assessing the reliability of the interconnected system. These standards require the continuity of service to loads as the first priority and preservation of interconnected operation as a secondary priority. Certain aspects of the NERC/WECC standards are either more stringent or more specific than the NERC standards alone. These standards provide planning for electric systems so as to withstand the more probable forced and maintenance outage system contingencies at projected customer demand and anticipated electricity transfer levels, while continuing to operate reliably within equipment and electric system thermal, voltage and stability limits. These standards include the reliability criteria for system adequacy and security, system modeling data requirements, system protection and control, and system restoration. Analysis of the WECC system is based to a large degree on Section I.A of the standards, “NERC and WECC Planning Standards with Table I and WECC Disturbance-Performance Table” and on Section I.D, “NERC and WECC Standards for Voltage support and Reactive Power”. These standards require that the results of power flow and stability simulations verify defined performance levels. Performance levels are defined by specifying the allowable variations in thermal loading, voltage and frequency, and loss of load that may occur on systems during various disturbances. Performance levels range from no significant adverse effects inside and outside a system area during a minor disturbance (loss of load or a single transmission element out of service) to a level that seeks to prevent system cascading and the subsequent blackout of islanded areas during a major disturbance (such as loss of multiple 500 kV lines along a common right of way, and/or multiple generators). While controlled loss of generation or load or system separation is permitted in certain circumstances, their uncontrolled loss is not permitted (WECC 2006).
- North American Electric Reliability Council (NERC) Reliability Standards for the Bulk Electric Systems of North America provide national policies, standards, principles and guidelines to assure the adequacy and security of the electric transmission system. The NERC Reliability standards provide for system performance levels under normal and contingency conditions. With regard to power flow and stability simulations, while these Reliability Standards are similar to NERC/WECC Standards, certain aspects of the NERC/WECC standards are either more stringent or more specific than the NERC standards for Transmission System Contingency Performance. The NERC Reliability standards apply not only to interconnected system operation but also to individual service areas (NERC 2006).

- California ISO Planning Standards also provide standards, and guidelines to assure the adequacy, security and reliability in the planning of the California ISO transmission grid facilities. The California ISO Grid Planning Standards incorporate the NERC/WECC and NERC Reliability Planning Standards. With regard to power flow and stability simulations, these Planning Standards are similar to the NERC/WECC or NERC Reliability Planning Standards for Transmission System Contingency Performance. However, the California ISO Standards also provide some additional requirements that are not found in the WECC/NERC or NERC Standards. The California ISO Standards apply to all participating transmission owners interconnecting to the California ISO controlled grid. They also apply when there are any impacts to the California ISO grid due to facilities interconnecting to adjacent controlled grids not operated by the California ISO (California ISO 2002a).
- California ISO/FERC Electric Tariff provides guidelines for construction of all transmission additions/upgrades (projects) within the California ISO controlled grid. The California ISO determines the “Need” for the proposed project where it will promote economic efficiency or maintain System Reliability. The California ISO also determines the Cost Responsibility of the proposed project and provides an Operational Review of all facilities that are to be connected to the California ISO grid (California ISO 2007a).

EXISTING FACILITIES AND RELATED SYSTEMS

The existing PG&E HBPP is about 50 years old and nearing the end of its useful life and continued operation would require significant investment and modification. The plant’s dual-fuel (natural gas/oil-fired) steam turbine generator (STG) 52 MW unit 1 & 53 MW unit 2 are now connected to the HBPP 60 kV substation and two 15 MW MEPP backup & peaking units running on diesel at the HBPP site are connected to the Humboldt substation (about 5.6 miles northeast of the HBRP) via the Humboldt Bay-Humboldt 115 kV line. At present, about 100 MW of the HBPP is now connected at 60 kV transmission level and 30 MW of existing MEPP generation at 115 kV level. The following existing facilities are in the vicinity of the HBRP project:

- HBPP 60/13.8 kV substation with two 60/13.8 kV transformer banks.
- Humboldt Bay-Humboldt No.1 & No.2 60 kV lines.
- Humboldt Bay-Eureka 60 kV line.
- Humboldt Bay-Rio Dell Jet 60 kV line.
- Humboldt Bay-Humboldt No.1 115 kV line.
- Humboldt 115/60 kV substation with two 115/60 kV transformer banks.

Humboldt County is situated in a remote coastal zone. Besides two 115 kV lines to the PG&E Cottonwood 230/115 kV substation, the Humboldt area electrical network is not interconnected with any suitable high voltage bulk power (230 kV and above) tie line(s) so as to import power from outside into the locality. The mostly radial 60 and 115 kV transmission system with available local generation serves the area’s electrical load demand. The area has existing low voltage supply problems. Peak demand in the area occurs in winter (192 MW in 2006) due to heating loads as the limited natural gas

supply in the Humboldt Bay area is sometimes constrained. Repowering the existing generating units at the HBPP site with the proposed HBRP is, therefore, necessary to meet the forecasted load demand in the area and maintain system reliability. The HBRP qualifies as a repowering project under the Warren-Alquist Act (Public Resource Code 25550(e)).

In addition to the HBRP, PG&E has a California ISO approved planned project (T945) for installation of a 100 MVAR SVC at the Humboldt substation in replacement of the existing 20 MVAR synchronous condenser by December, 2008. This project will improve voltage support and system stability in the local network and also reduce Required Must Run (RMR) generation requirements for the Humboldt area.

PROJECT DESCRIPTION

The proposed HBRP would be located within a 143-acre site at 1000 King Salmon Avenue, Eureka, Humboldt County and within the boundaries of PG&E's existing HBPP complex. The HBRP project would consist of ten 'Wartsila' 18V50DF dual-fuel (natural gas/diesel-fired) reciprocating engine 13.8 kV generators, each with a 16.638 MW gross capacity, for a combined nominal 163 MW generation output.

On completion of the HBRP, the existing HBPP STG units 1 & 2 will be disconnected from the 60 kV-system and retired. The two existing MEPP units will cease operation, and be disconnected from the 115 kV line and decommissioned. The new plant will provide about 98 MW power to the 60 kV network and about 65 MW power to the 115 kV network. The HBRP would normally run on natural gas and will only run on diesel in the event of natural gas curtailment or its interruption in supply to ensure local system reliability. The project's commercial operation target date is August, 2009 (PG&E 2006a, sections 1.1-1.3 and pages 1-1 to 1-10).

HBRP 15 KV SWITCHGEAR, EXISTING HBPP 60 KV SUBSTATION AND INTERCONNECTION FACILITIES

The new HBRP 15 KV metal-clad indoor switchgear, which would be housed in a new building adjacent to the existing HBPP substation, would include a 4,000-ampere 13.8 kV bus with four sections (right & left sections and two middle sections) and three 4,000-ampere 13.8 kV sectionalizing circuit breakers (CB). A first set of new three generators would be connected to the right section of the 13.8 kV bus, a second set of three new generators to the left section of the 13.8 kV bus and a third set consisting of the other four new generators to the two middle sections of the 13.8 kV bus. Each generator would connect to their respective 13.8 kV bus section through a 1,200-ampere CB and 2-500 kcmil bus-duct 15 kV cables.

The first and second sets of generators (three generators for each set) would connect from their respective 13.8 kV bus section to the low voltage terminals of their respective dedicated generation station unit (GSU) 45/60/75 MVA, 60/13.8 kV step-up transformer through a 4,000-ampere 13.8 kV CB and 4-750 kcmil 15 kV cables. The high voltage terminals of the two 60/13.8 kV GSU transformers would be connected to the existing 3,000-ampere 60 kV double bus of the adjacent PG&E HBPP substation by using the existing two switch bays for the HBPP STG units 1 and 2. The facilities interconnecting

each GSU transformer to the 60 kV substation would include 1,200-ampere disconnect switches, a 1,200-ampere 60 kV CB and a new 60 kV overhead tie line composed of 715.5 kcmil aluminum conductor on a 75-90 feet high tubular steel pole. The lengths of the two 60 kV overhead tie lines would be 82-feet and 117-feet for the first and second set of generators' interconnection respectively.

The third set of four generators would connect from the 13.8 kV bus sections to the low voltage terminals of its GSU 60/80/100 MVA, 115/13.8 kV step-up transformer through a 4,000-ampere 13.8 kV CB and 5-750 kcmil 15 kV cables. The high voltage terminals of the GSU transformer would be connected directly to the existing Humboldt Bay-Humboldt 115 kV line via a new 1,200-ampere 115 kV CB, 2,000-ampere disconnect switches and a new 115 kV 496-foot long overhead tie line with 715.5 kcmil aluminum conductor on a 50-foot high tubular steel pole.

All the new CBs (13.8 kV, 60 kV & 115 kV) will have 40 kA fault interrupting capacity. Substation improvements would include replacement of the existing 60 kV circuit breakers and disconnect switches, and replacement of the existing 115 kV line steel lattice tower with a tubular steel pole. No new transmission facilities are proposed beyond the fence line of the HBPP complex. On completion of the proposed HBRP, the existing 60 kV CBs for the HBPP units 1 & 2 and 115 kV CB of the two MEPP units would be removed from the substation along with retirement of these four old generating units.

The proposed interconnection would result in two 60 kV lines providing about 98 MW HBRP generation to the 60 kV HBPP substation and a 115 kV line providing about 65 MW HBRP generation on the 115 kV line to the Humboldt substation. PG&E would build, own and operate the 15 kV HBRP switchgear and the interconnection facilities (PG&E 2006a, sections 2.3 & 2.4, page 2-5; Section 5.2, pages 5-1 to 5-2, Figure 5.2-1; PG&E 2006c, pages DA-2 to DA-5).

The configuration of the HBRP switchgear and the interconnection facilities to the existing HBPP 60 kV substation and Humboldt Bay-Humboldt 115 kV line is in accordance with good utility practices and is acceptable to staff.

TRANSMISSION SYSTEM IMPACT ANALYSIS

For the interconnection of a proposed generating unit or transmission facility to the grid, the interconnecting utility and the control area operator are responsible for insuring grid reliability. For the HBRP, PG&E and California ISO are responsible for insuring grid reliability. In accordance with FERC/California ISO/Utility Tariffs, System Impact and Facilities Studies are conducted to determine the preferred and alternate interconnection methods to the grid, the downstream transmission system impacts and the mitigation measures needed to insure system conformance with performance levels required by utility reliability criteria, NERC planning standards, WECC reliability criteria, and California ISO reliability criteria (California ISO2002a and 2003a). Staff relies on the studies and any review conducted by the responsible agencies to determine the effect of the project on the transmission grid and to identify any necessary downstream facilities or indirect project impacts required to bring the transmission network into compliance with applicable reliability standards.

The System Impact and Facilities Studies analyze the grid with and without the proposed project under conditions specified in the planning standards and reliability criteria. The standards and criteria define the assumptions used in the study and establish the thresholds through which grid reliability is determined. The studies must analyze the impact of the project for the proposed first year of operation and thus are based on a forecast of loads, generation and transmission. Load forecasts are developed by the interconnected utility, which would be PG&E in this case. Generation and transmission forecasts are established by an interconnection queue. The studies are focused on thermal overloads, voltage deviations, system stability (excessive oscillations in generators and transmission system, voltage collapse, loss of loads or cascading outages), and short circuit duties.

If the studies show that the interconnection of the project causes the grid to be out of compliance with reliability standards then the study will identify mitigation alternatives or ways in which the grid could be brought into compliance with reliability standards. If the interconnecting utility determines that the only feasible mitigation includes transmission modifications or additions which require CEQA review as part of the “whole of the action,” the Energy Commission must analyze these modifications or additions according to CEQA requirements.

SCOPE OF SYSTEM IMPACT STUDY (SIS)

The January 20, 2006 PG&E SIS was conducted with a 2008 winter peak, a 2008 summer peak and a 2008 summer off peak full loop case to reflect WECC’s transmission system, forecasted load and generation. The study included California ISO approved PG&E transmission system reliability upgrades that would be operational by winter 2008, and queue generation and transmission projects in the PG&E transmission system higher than the HBRP queue position. The 2008 base cases used in this study were developed from PG&E’s 2004 base cases using 1-in-10 year extreme weather conditions. The study included a Power Flow analysis, a Dynamic stability analysis, a Short Circuit analysis and Substation Evaluation, and a Reactive Power Deficiency analysis. The Power Flow Study was conducted before and after the addition of the HBRP with a winter peak load of 197 MW, a summer peak load of 159 MW and a summer off peak load of 81 MW for the Humboldt area. The PG&E total system load was considered as 18,261 MW for the winter peak case, 22,745 MW for the summer peak case and 12,759 MW for the summer off peak case (PG&E 2006a, section 5.3, pages 5-11 to 5-12; Appendix 5B, SIS. PG&E 2006c, Pages DA-5 to DA-8; Attachments DA5-2 to DA5-4).

In a letter dated October 27, 2006, PG&E confirmed the validity of the submitted SIS report based on 2008 system conditions for the revised HBRP on-line date of August, 2009. PG&E and the California ISO agree that the results of the study for the Humboldt area would not be affected by the one-year difference between the SIS and the on-line date. Because generation and transmission scenarios in the Humboldt area would not change significantly between 2008 and 2009, staff also considers the submitted SIS report acceptable for the HBRP interconnection (PG&E 2006c, Attachment DA5-1).

POWER FLOW STUDY RESULTS AND MITIGATION

The SIS demonstrates that the existing PG&E transmission facilities in the Humboldt area are inadequate to accommodate interconnection of the HBRP, since the addition of the HBRP would have some adverse impacts on the PG&E facilities. The power flow study results have been tabulated in the study report (PG&E 2006a, Appendix 5B, SIS, pages 7-8).

Based on the results of the SIS, there are no normal (N-0) overloads identified in the PG&E system due to the interconnection of the HBRP under 2008 winter peak, summer peak and summer off peak system conditions. However, under certain contingencies and 2008 winter peak and summer off peak system conditions, the study identified the following overloads and corresponding mitigation measures (PG&E 2006a, Appendix 5B, SIS, pages 15-17. PG&E 2006c, page DA-7, CH2MHILL 2007c):

- **Humboldt-Trinity 115 kV line**: The addition of the HBRP would cause new overloads on this line under 2008 summer off peak system conditions for the Category B outage of the Bridgeville-Cottonwood 115 kV line and the Category C outage of the Bridgeville substation 115 kV bus.

Mitigation: Two options for mitigation of the line overloads were considered by PG&E in their SIS report, either dropping one of the HBRP generating units via a special protection system (SPS) at the Humboldt Bay and Humboldt substations or reconductoring 49-miles of the Humboldt-Trinity 115 kV line with 397 ACSR (see definition of terms). The applicant preferred the SPS mitigation option and dropping one of the HBRP generation units connected to the Humboldt Bay-Humboldt 115 kV line. The February 22, 2007 California ISO letter subsequently concurred with the technical feasibility of using the selected SPS mitigation. Staff considers the mitigation measure acceptable.

- **Humboldt-Eureka 60 kV line**: The pre-project overloads would remain unchanged due to the addition of the HBRP for selected Category B outages under 2008 summer peak and winter peak system conditions.

Mitigation: The PG&E planned project T958 approved by the California ISO is not a direct network upgrade requirement for the HBRP interconnection. It involves reconductoring the 1-mile Humboldt-Harris section of the 4.5-mile Humboldt-Eureka 115 kV line with a 650-ampere emergency rated higher size conductor. However, the reconductoring project would mitigate pre-project and potential post-project overloads on this line and is expected to be completed by December 2008. Staff considers the planned mitigation measure acceptable.

- **Humboldt Bay-Eureka 60 kV line**: The pre-project overload would increase marginally due to the addition of the HBRP for the Category C outage of the Humboldt substation 60 kV bus under 2008 summer peak and winter peak system conditions.

Mitigation: The mitigation measures would include the PG&E operational procedures for dropping loads and/or transferring more HBRP units from the 60 kV HBPP substation to the Humboldt Bay-Humboldt 115 kV line and turning on the proposed 100 MVAR SVC at the Humboldt substation. Staff considers the mitigation measures acceptable.

- **Humboldt substation 115/60 kV transformer banks no. 1 & 2:** The pre-project overloads would exacerbate due to the addition of the HBRP for the Category C outage of the Humboldt Bay substation 60 kV bus under 2008 winter peak system conditions.

Mitigation: The mitigation measures would include the PG&E operational procedures for dropping loads and/or transferring more HBRP units from the 60 kV HBPP substation to the Humboldt Bay-Humboldt 115 kV line and turning on the proposed 100 MVAR SVC at the Humboldt substation. Staff considers the mitigation measures acceptable.

- **Bridgeville substation 115/60 kV transformer bank no. 1:** The pre-project overload would exacerbate due to the addition of the HBRP for the Category C outage of the Humboldt substation 115 kV bus under 2008 winter peak system conditions.

Mitigation: The mitigation measures would include the PG&E operational procedures for dropping loads and/or transferring more HBRP units from the 60 kV HBPP substation to the Humboldt Bay-Humboldt 115 kV line and turning on the proposed 100 MVAR SVC at the Humboldt substation. Staff considers the mitigation measures acceptable.

SHORT CIRCUIT STUDY RESULTS AND SUBSTATION EVALUATION

The Short Circuit Study identified that fault currents at the selected substations electrically adjacent to the HBRP in the PG&E system would increase by 1 to 40 percent from the pre-project case due to the addition of the HBRP. The study is used to determine if any equipment in the selected substations would be overstressed by the addition of the HBRP.

The substation evaluation identified no overstressed breaker or other equipment due to the addition of the HBRP. Staff concurs with the evaluation (PG&E 2006a, SIS, Pages 17-18 and 21).

DYNAMIC STABILITY STUDY RESULTS AND MITIGATION

The study results indicated that there would be system performance issues caused by the addition of the HBRP. The HBRP would cause the transmission system to be unstable for the contingency of the Humboldt substation 115 kV bus or the Humboldt-Rio Dell 60 kV line. The study also determined that during the contingency of the Humboldt Bay-Humboldt # 1 60 kV line or the Humboldt Bay-Eureka 60 kV line the system frequency at about fourteen 60 kV buses in the Humboldt area including the HBPP substation would fall below 59.6 Hertz for more than 6 cycles and that would cause violation of the California ISO reliability criteria.

Mitigation: As a mitigation plan, the SIS identified the need for installation of a SPS at the Humboldt Bay and Humboldt substations for curtailing some or all of the HBRP generating units. In a letter dated February 22, 2007, California ISO approved the selected mitigation for the SPS (CAISO 2007a). However, SPS specifications would be written once the design of PG&E project T945, a 100 MVAR SVC at the Humboldt substation, is completed, because the SVC has the potential to reduce HBRP generation curtailment or possibly eliminate the need to mitigate for dynamic problems.

According to the California ISO letter the detailed scope of the SPS will be evaluated and developed during the project implementation/design and construction phase instead of during the Facility study. Staff concurs with the mitigation plan (California ISO, 2007a).

REACTIVE POWER DEFICIENCY ANALYSIS AND MITIGATION

The Power Flow studies indicate that the addition of the HBRP would cause applicable low voltage criteria violations on four 60 kV load buses in the Humboldt area under normal 2008 summer peak load conditions and on one 60 kV load bus during normal 2008 winter peak conditions. Under contingency conditions the study could not identify any low voltage violations. The post-project voltages are marginally below the 0.95 per unit voltage requirement and less than 0.2 percent.

Mitigation: Because the substations with low voltage violations are far away from the HBRP site and the low voltages are forecasted to occur without the HBRP, PG&E decided that the HBRP is not responsible for mitigation of these minor violations. However, the California ISO has approved PG&E's plan, T945, to replace the existing 20 MVAR synchronous condenser at the Humboldt substation with a 100 MVAR SVC at the Humboldt substation 115 kV bus by December 2008. As a result the supply voltage will improve in the area. Staff concurs with the mitigation plan.

CALIFORNIA ISO REVIEW

Based on the results of the PG&E SIS, the California ISO issued their April 13, 2006 preliminary approval letter to interconnect the HBRP to the PG&E system in replacement of the existing PG&E generating units at the HBPP site. The California ISO February 22, 2007 letter confirmed the technical feasibility of installing a SPS for dropping required HBRP generation as a mitigation plan to resolve the identified dynamic stability and low frequency criteria violations and overloads on the Humboldt-Trinity 115 kV line. On satisfactory completion of the PG&E Facility study, the California ISO would proceed for execution of a LGIA with the project owner. The LGIA would comply with LORS, and therefore, would ensure system reliability for interconnection of the HBRP to the California ISO grid and as such compliance with WECC/NERC and California ISO Planning standards (California ISO 2006a & 2007a).

DOWNSTREAM FACILITIES

Besides the interconnection facilities which would include the new HBRP 15 kV switchgear, three GSU transformers, two 60 kV CBs and one 115 kV CB, two 60 kV and one 115 kV short overhead tie lines, accommodating the power output of the HBRP would not require any other new downstream transmission lines. Reconductoring the 1-mile Humboldt-Harris section of the 4.5-mile Humboldt -Eureka 60 kV line is a planned transmission project of PG&E according to their annual plan based on pre-project overloads and is not a direct network upgrade requirement for interconnection of the HBRP. The SPS protection equipment for mitigating dynamic performance and overload violations will be installed at the Humboldt and Humboldt Bay substations. The PG&E planned project for a 100 MVAR SVC in replacement of the existing 20 MVAR synchronous condenser would be installed at the Humboldt substation.

CUMULATIVE IMPACTS

Depending on the amounts of generation and loads in the Humboldt area, staff believes that the addition of the proposed HBRP may have some cumulative adverse impacts on the PG&E local radial subtransmission system. The cumulative impacts due to the HBRP, as identified in the SIS, will be mitigated. Staff also believes that the HBRP along with the PG&E 100 MVAR SVC project will have some positive impacts such as providing additional reactive power, better performance for dynamic stability and voltage support in local network.

ALTERNATIVE INTERCONNECTIONS AND TRANSMISSION ROUTES

For interconnection of the HBRP's ten new generating units, alternate interconnection options of all ten units to the 60 kV Humboldt Bay substation or to the 115 kV Humboldt substation was considered in the SIS. But system analyses determined that since these interconnection options would have substantial downstream adverse impacts in the local network, the preferred interconnection of the HBRP as proposed in the AFC with six units to the existing 60 kV network and the other four units to the existing 115 kV network were chosen. This is acceptable to staff according to reliability planning standards.

Since the HBRP will replace and repower the existing HBPP units and MEPP units, the preferred feasible and shortest routes for the new two 60 kV and one 115 kV short interconnecting tie lines to be built within the HBPP substation area were considered. This is acceptable to staff. (HBRP 2006a, Section 5.1, Page 5-1 to 5-2 and Section 5.3, Pages 5-6 to 5-8)

CONFORMANCE WITH LORS AND CEQA REVIEW

In this analysis the discussion of conformance with applicable LORS is used to identify potential impacts under CEQA. The SIS demonstrates that there would be some adverse impacts in the PG&E local system for the addition of the HBRP in replacement of the existing HBRP and MEPP generating units. But the appropriate mitigation measures as planned would eliminate the adverse impacts. The interconnection, therefore, would conform to the NERC/WECC and California ISO planning standards and PG&E reliability criteria.

The proposed new interconnecting facilities including the HBRP 15 kV switchgear, three GSU transformers and circuit breakers, and two 60 kV and one 115 kV short overhead lines would be built according to the NESC standards and GO-95 Rules. The new facilities would be in accordance with good utility practices, would conform to engineering LORS and are acceptable to staff.

The new interconnection facilities, which would be located within the fence line of the existing PG&E HBPP site, would have no significant or unmitigated environmental impacts. Reconductoring the 1-mile Humboldt-Harris section of the Humboldt-Eureka 60 kV line is a planned PG&E transmission project according to their annual plan based on pre-project overloads, not a network upgrade requirement for interconnection of the

HBRP. The reconductoring project is therefore not being analyzed as part of the proposed project. The SPS protection equipment for mitigating dynamic performance and overload violations will be installed within the fence line of the Humboldt and Humboldt Bay substations with no or minimal environmental impacts. The PG&E planned project for a 100 MVAR SVC in replacement of the existing 20 MVAR synchronous condenser would be installed within the fence line of the Humboldt substation with no significant or unmitigated impacts.

The HBRP would, therefore, conform to the applicable LORs upon satisfactory compliance of the recommended Conditions of Certifications.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

No agency or public comments related to the TSE discipline have been received.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. The proposed interconnecting facilities, including the new HBRP 15 kV switchgear, three GSU transformers, two 60 kV CBs and one 115 kV CB, and two 60 kV short overhead lines to the existing HBPP 60 kV substation and one 115 kV short overhead tie line to the existing Humboldt Bay-Humboldt 115 kV line, are adequate in accordance with good utility practices and acceptable to staff according to engineering LORS.
2. The SIS demonstrates that the existing PG&E Humboldt area transmission facilities are inadequate to accommodate interconnection of the HBRP in replacement of the existing HBPP units 1 & 2 and two MEPP units. The adverse impacts include new overloads and exacerbated pre-project overloads on downstream facilities under 2008 contingent emergency system conditions. In addition system performance issues have been identified for dynamic stability and low frequency reliability criteria violations during certain contingencies. The mitigation measures planned by PG&E and approved by the ISO include a plan for installation of a SPS and curtailing HBRP generation to offset dynamic violations and new overloads on the Humboldt-Trinity 115 kV line. In order to eliminate the pre and post-project overloads, the mitigation measures include reconductoring the 1-mile Humboldt-Harris section of the Humboldt-Eureka 60 kV line and using the PG&E operational procedures. The mitigation measures are considered effective in eliminating the adverse impacts of the project and ensuring system reliability, and are acceptable to staff. The interconnection of the HBRP, therefore, would comply with the WECC/NERC & California ISO planning standards and PG&E reliability criteria.
3. Reconductoring the 1-mile Humboldt-Harris section of the Humboldt-Eureka 60 kV line is a planned PG&E transmission project based on pre-project overloads on the line, not a direct network upgrade requirement for interconnection of the HBRP. The SPS protection equipment and the PG&E 100 MVAR SVC project will be installed

within the fence line of the existing substations with no significant or unmitigated environmental impacts.

4. Based on the results of the SIS, the California ISO has issued their April 13, 2006 preliminary approval letter for interconnection of the HBRP to the PG&E system in replacement of the existing PG&E generating units at the HBPP site. The California ISO would be in a position to issue their final approval for interconnection of the HBRP on satisfactory completion of the PG&E Facility study. The California ISO's final interconnection approval to the HBRP would ensure system reliability and compliance with the WECC/NERC and California ISO planning standards.
5. The HBRP would, therefore, conform with the applicable LORS upon satisfactory compliance of the recommended Conditions of Certifications.
6. The existing PG&E Humboldt Bay Power Plant (HBPP) is about 50 years old and nearing the end of its useful life and continued operation would require significant investment and modification. The existing 60 kV and 115 kV local radial transmission system without any suitable bulk power (230 kV and above) tie line(s) and available local generation serve the electrical load demand of the remote Humboldt Bay area. Replacing and repowering the existing old local generating units at the HBPP site is, therefore, necessary to meet the forecasted load demand in the area and maintain system reliability. Staff believes that the HBRP along with the PG&E 100 MVAR SVC project will also provide additional reactive power supply, better performance for dynamic stability and improved voltage in the local network.

RECOMMENDATIONS

If the Commission approves the project, staff recommends the following Conditions of Certification to ensure system reliability and conformance with LORS.

CONDITIONS OF CERTIFICATIONS FOR TSE

TSE-1 The project owner shall furnish to the CPM and to the CBO a schedule of transmission facility design submittals, a Master Drawing List, a Master Specifications List, and a Major Equipment and Structure List. The schedule shall contain a description and list of proposed submittal packages for design, calculations, and specifications for major structures and equipment. To facilitate audits by Energy Commission staff, the project owner shall provide designated packages to the CPM when requested.

Verification: At least 60 days (or a lesser number of days mutually agreed to by the project owner and the CBO) prior to the start of construction, the project owner shall submit the schedule, a Master Drawing List, and a Master Specifications List to the CBO and to the CPM. The schedule shall contain a description and list of proposed submittal packages for design, calculations, and specifications for major structures and equipment (see a list of major equipment in **Table 1: Major Equipment List** below). Additions and deletions shall be made to the table only with CPM and CBO approval. The project owner shall provide schedule updates in the Monthly Compliance Report.

Table 1: Major Equipment List
Breakers
Step-up Transformer
Switchyard
Busses
Surge Arrestors
Disconnects and Wave-traps
Take off facilities
Electrical Control Building
Switchyard Control Building
Transmission Pole/Tower
Insulators and Conductors
Grounding System

TSE-2 Prior to the start of construction the project owner shall assign an electrical engineer and at least one of each of the following to the project: A) a civil engineer; B) a geotechnical engineer or a civil engineer experienced and knowledgeable in the practice of soils engineering; C) a design engineer, who is either a structural engineer or a civil engineer fully competent and proficient in the design of power plant structures and equipment supports; or D) a mechanical engineer. (Business and Professions Code Sections 6704 et seq., require state registration to practice as a civil engineer or structural engineer in California.)

The tasks performed by the civil, mechanical, electrical or design engineers may be divided between two or more engineers, as long as each engineer is responsible for a particular segment of the project (e.g., proposed earthwork, civil structures, power plant structures, equipment support). No segment of the project shall have more than one responsible engineer. The transmission line may be the responsibility of a separate California registered electrical engineer. The civil, geotechnical or civil and design engineer assigned in conformance with Facility Design condition **GEN-5**, may be responsible for design and review of the TSE facilities.

The project owner shall submit to the CBO for review and approval, the names, qualifications and registration numbers of all engineers assigned to the project. If any one of the designated engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer. This engineer shall be authorized to halt earthwork and to require changes if site conditions are unsafe or do not conform with predicted conditions used as a basis for design of earthwork or foundations.

The electrical engineer shall:

1. Be responsible for the electrical design of the power plant switchyard, outlet and termination facilities; and

2. Sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: At least 30 days (or a lesser number of days mutually agreed to by the project owner and the CBO) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the names, qualifications and registration numbers of all the responsible engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the name, qualifications, and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

TSE-3 If any discrepancy in design and/or construction is discovered in any engineering work that has undergone CBO design review and approval, the project owner shall document the discrepancy and recommend corrective action. (1998 CBC, Chapter 1, Section 108.4, Approval Required; Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector; Appendix Chapter 33, Section 3317.7, Notification of Noncompliance). The discrepancy documentation shall become a controlled document and shall be submitted to the CBO for review and approval and shall reference this condition of certification.

Verification: The project owner shall submit a copy of the CBO's approval or disapproval of any corrective action taken to resolve a discrepancy to the CPM within 15 days of receipt. If disapproved, the project owner shall advise the CPM, within five days, the reason for disapproval, and the revised corrective action required to obtain the CBO's approval.

TSE-4 For the power plant switchyard, outlet line and termination, the project owner shall not begin any increment of construction until plans for that increment have been approved by the CBO. These plans, together with design changes and design change notices, shall remain on the site for one year after completion of construction. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS. The following activities shall be reported in the Monthly Compliance Report:

- a) receipt or delay of major electrical equipment;
- b) testing or energization of major electrical equipment; and
- c) the number of electrical drawings approved, submitted for approval, and still to be submitted.

Verification: At least 30 days (or a lesser number of days mutually agreed to by the project owner and the CBO) prior to the start of each increment of construction, the project owner shall submit to the CBO for review and approval the final design plans,

specifications and calculations for equipment and systems of the power plant switchyard, outlet line and termination, including a copy of the signed and stamped statement from the responsible electrical engineer attesting to compliance with the applicable LORS, and send the CPM a copy of the transmittal letter in the next Monthly Compliance Report.

- TSE-5** The project owner shall ensure that the design, construction and operation of the proposed transmission facilities will conform to all applicable LORS, including the requirements listed below. The project owner shall submit the required number of copies of the design drawings and calculations to the CBO as determined by the CBO.
- a) The power plant switchyard and outlet line shall meet or exceed the electrical, mechanical, civil and structural requirements of CPUC General Order 95 or National Electric Safety Code (NESC), Title 8 of the California Code and Regulations (Title 8), Articles 35, 36 and 37 of the “High Voltage Electric Safety Orders”, Cal-ISO standards, National Electric Code (NEC) and related industry standards.
 - b) Breakers and busses in the power plant switchyard and other switchyards, where applicable, shall be sized to accommodate full output from the project and to comply with a short-circuit analysis.
 - c) Outlet line crossings and line parallels with transmission and distribution facilities shall be coordinated with the transmission line owner and comply with the owner’s standards.
 - d) The project conductors shall be sized to accommodate the full output from the project.
 - e) Termination facilities shall comply with applicable PG&E interconnection standards.
 - f) The project owner shall provide to the CPM:
 - i) The final Detailed Facility Study (DFS) from PG&E with the final selected mitigation plan for resolving identified reliability criteria violations including a description of facility upgrades, operational mitigation measures, and/or Special Protection System (SPS) sequencing and timing if applicable,
 - ii) A letter stating that the mitigation measures or projects selected by the transmission owners for each criteria violation are acceptable,
 - iii) The operational study report from the ISO and/or PG&E,
 - iv) The executed project owner and Cal-ISO Large Generator Interconnection Agreement.

Verification: At least 60 days prior to the start of construction of transmission facilities (or a lesser number of days mutually agree to by the project owner and CBO), the project owner shall submit to the CBO for approval:

- a) Design drawings, specifications and calculations conforming with CPUC General Order 95 or NESC, Title 8, Articles 35, 36 and 37 of the “High Voltage Electric Safety Orders”, NEC, applicable interconnection standards and related industry standards, for the poles/towers, foundations, anchor bolts, conductors, grounding systems and major switchyard equipment.
- b) For each element of the transmission facilities identified above, the submittal package to the CBO shall contain the design criteria, a discussion of the calculation method(s), a sample calculation based on “worst case conditions”¹ and a statement signed and sealed by the registered engineer in responsible charge, or other acceptable alternative verification, that the transmission element(s) will conform with CPUC General Order 95 or NESC, Title 8, California Code of Regulations, Articles 35, 36 and 37 of the, “High Voltage Electric Safety Orders”, NEC, applicable interconnection standards, and related industry standards.
- c) Electrical one-line diagrams signed and sealed by the registered professional electrical engineer in responsible charge, a route map, and an engineering description of equipment and the configurations covered by requirements **TSE-5** a) through f) above.
- d) The final DFS from PG&E with a final mitigation plan, including a description of facility upgrades, operational mitigation measures, and/or SPS sequencing and timing if applicable, shall be provided concurrently to the CPM.
- e) A letter stating that the mitigation measures or projects selected by the transmission owners for each criteria violation are acceptable.
- f) The operational study report from the California ISO and/or PG&E.
- g) The executed project owner and Cal-ISO Large Generator Interconnection Agreement.

TSE-6 The project owner shall inform the CPM and CBO of any impending changes that may not conform to requirements **TSE-5** a) through f), and have not received CPM and CBO approval, and request approval to implement such changes. A detailed description of the proposed change and complete engineering, environmental, and economic rationale for the change shall accompany the request. Construction involving changed equipment or substation configurations shall not begin without prior written approval of the changes by the CBO and the CPM.

Verification: At least 60 days prior to the construction of transmission facilities, the project owner shall inform the CBO and the CPM of any impending changes that may

¹ Worst case conditions for the foundations would include for instance, a dead-end or angle pole.

not conform to requirements of **TSE-5** and request approval to implement such changes.

TSE-7 The project owner shall provide the following Notice to the California Independent System Operator (Cal-ISO) prior to synchronizing the facility with the California Transmission system:

1. At least one week prior to synchronizing the facility with the grid for testing, provide the Cal-ISO a letter stating the proposed date of synchronization; and
2. At least one business day prior to synchronizing the facility with the grid for testing, provide telephone notification to the ISO Outage Coordination Department.

Verification: The project owner shall provide copies of the Cal-ISO letter to the CPM when it is sent to the Cal-ISO one week prior to initial synchronization with the grid. The project owner shall contact the Cal-ISO Outage Coordination Department, Monday through Friday, between the hours of 0700 and 1530 at (916) 351-2300 at least one business day prior to synchronizing the facility with the grid for testing. A report of conversation with the Cal-ISO shall be provided electronically to the CPM one day before synchronizing the facility with the California transmission system for the first time.

TSE-8 The project owner shall be responsible for the inspection of the transmission facilities during and after project construction, and any subsequent CPM and CBO approved changes thereto, to ensure conformance with CPUC GO-95 or NESC, Title 8, CCR, Articles 35, 36 and 37 of the, "High Voltage Electric Safety Orders", applicable interconnection standards, NEC and related industry standards. In case of non-conformance, the project owner shall inform the CPM and CBO in writing, within 10 days of discovering such non-conformance and describe the corrective actions to be taken.

Verification: Within 60 days after first synchronization of the project, the project owner shall transmit to the CPM and CBO:

- a) "As built" engineering description(s) and one-line drawings of the electrical portion of the facilities signed and sealed by the registered electrical engineer in responsible charge. A statement attesting to conformance with CPUC GO-95 or NESC, Title 8, California Code of Regulations, Articles 35, 36 and 37 of the, "High Voltage Electric Safety Orders", and applicable interconnection standards, NEC, related industry standards, and these conditions shall be provided concurrently.
- b) An "as built" engineering description of the mechanical, structural, and civil portion of the transmission facilities signed and sealed by the registered engineer in responsible charge or acceptable alternative verification. "As built" drawings of the electrical, mechanical, structural, and civil portion of the transmission facilities shall be maintained at the power plant and made available, if requested, for CPM audit as set forth in the "Compliance Monitoring Plan".

- c) A summary of inspections of the completed transmission facilities, and identification of any nonconforming work and corrective actions taken, signed and sealed by the registered engineer in charge.

REFERENCES

California ISO (California Independent System Operator) 1998a. California ISO Tariff Scheduling Protocol posted April 1998, Amendments 1,4,5,6, and 7 incorporated.

California ISO (California Independent System Operator) 1998b. California ISO Dispatch Protocol posted April 1998.

California ISO (California Independent System Operator) 2002a. California ISO Planning Standards, February 7, 2002.

California ISO (California Independent System Operator) 2007a. California ISO, FERC Electric Tariff, First Replacement Vol. No. 1, March 11, 2003.

California ISO (California Independent System Operator) 2006a. California ISO preliminary approval letter dated April 13, 2006 for interconnection of the HBRP. Received 11-3-06 with Data Adequacy supplement dated 11-1-06.

California ISO (California Independent System Operator) 2007a. California ISO letter of February 22, 2007 for confirmation of installing SPS as mitigation. Received 3-9-07 with PG&E Data response to CEC Data Requests 84-85.

CEC (California Energy Commission) 2006b. Staff's Data Requests 1-57 dated 12-8-06.

CEC (California Energy Commission) 2006c. Staff's Data Requests 58-78 dated 1-11-07.

CEC (California Energy Commission) 2007a. Staff's Data Requests 79-85 dated 2-28-07.

CH2MHILL 2007a. Applicant's response to CEC staff's Data Requests 1-57. Received 1-12-07.

CH2MHILL 2007c. Applicant's response to CEC staff's Data Requests 58-78 and Feb 1, 2007 workshop queries 1-22. Received 2-13-07.

PG&E 2006a. HBRP Application for Certification vol1 & 2. Submitted to the California Energy Commission on September 29, 2006.

PG&E 2006c. Data Adequacy Supplement dated 11-01-06. Submitted to the California Energy Commission on 11-03-2006.

PG&E 2006d. Large maps of Electrical system one line diagrams. Submitted to the California Energy Commission on 11-3-2006.

PG&E 2007b. PG&E response to CEC data requests 84-85. Received by Emails dated 3-9-07 to 3-13-07 from Robert Jenkins, PG&E.

NERC (North American Electric Reliability Council) 2006. Reliability Standards for the Bulk Electric Systems of North America, May 2 2006.

WECC (Western Electricity Coordinating Council) 2006. NERC/WECC Planning Standards, August 2002.

DEFINITION OF TERMS

ACSR

Aluminum cable steel reinforced.

AAC

All Aluminum conductor.

Ampacity

Current-carrying capacity, expressed in amperes, of a conductor at specified ambient conditions, at which damage to the conductor is nonexistent or deemed acceptable based on economic, safety, and reliability considerations.

Ampere

The unit of current flowing in a conductor.

Kiloampere

(kA) 1,000 Amperes

Bundled

Two wires, 18 inches apart.

Bus

Conductors that serve as a common connection for two or more circuits.

Conductor

The part of the transmission line (the wire) that carries the current.

Congestion Management

Congestion management is a scheduling protocol, which provides that dispatched generation and transmission loading (imports) would not violate criteria.

Emergency Overload

See Single Contingency. This is also called an L-1.

Hertz

The unit for System Frequency.

Kcmil or KCM

Thousand circular mil. A unit of the conductor's cross sectional area, when divided by 1,273, the area in square inches is obtained.

Kilovolt (kV)

A unit of potential difference, or voltage, between two conductors of a circuit, or between a conductor and the ground. 1,000 Volts.

Loop

An electrical cul de sac. A transmission configuration that interrupts an existing circuit, diverts it to another connection and returns it back to the interrupted circuit, thus forming a loop or cul de sac.

MVAR or Megavars

Megavolt Ampere-Reactive. One million Volt-Ampere-Reactive. Reactive power is generally associated with the reactive nature of motor loads that must be fed by generation units in the system.

Megavolt ampere (MVA)

A unit of apparent power, equals the product of the line voltage in kilovolts, current in amperes, the square root of 3, and divided by 1000.

Megawatt (MW)

A unit of power equivalent to 1,341 horsepower.

Normal Operation/ Normal Overload

When all customers receive the power they are entitled to without interruption and at steady voltage, and no element of the transmission system is loaded beyond its continuous rating.

N-1 Condition

See Single Contingency.

Outlet

Transmission facilities (circuit, transformer, circuit breaker, etc.) linking generation facilities to the main grid.

Power Flow Analysis

A power flow analysis is a forward looking computer simulation of essentially all generation and transmission system facilities that identifies overloaded circuits, transformers and other equipment and system voltage levels.

Reactive Power

Reactive power is generally associated with the reactive nature of inductive loads like motor loads that must be fed by generation units in the system. An adequate supply of reactive power is required to maintain voltage levels in the system.

Remedial Action Scheme (RAS)

A remedial action scheme is an automatic control provision, which, for instance, would trip a selected generating unit upon a circuit overload.

SSAC

Steel Supported Aluminum Conductor.

SF6

Sulfur hexafluoride is an insulating medium.

Single Contingency

Also known as emergency or N-1 condition, occurs when one major transmission element (circuit, transformer, circuit breaker, etc.) or one generator is out of service.

Solid dielectric cable

Copper or aluminum conductors that are insulated by solid polyethylene type insulation and covered by a metallic shield and outer polyethylene jacket.

SVC

Static VAR Compensator: An equipment made of Capacitors and Reactors with electronic controls for producing and controlling Reactive Power in the Power System.

Switchyard

A power plant switchyard (switchyard) is an integral part of a power plant and is used as an outlet for one or more electric generators.

Thermal rating

See ampacity.

TSE

Transmission System Engineering.

TRV

Transient Recovery Voltage

Tap

A transmission configuration creating an interconnection through a sort single circuit to a small or medium sized load or a generator. The new single circuit line is inserted into an existing circuit by utilizing breakers at existing terminals of the circuit, rather than installing breakers at the interconnection in a new switchyard.

Undercrossing

A transmission configuration where a transmission line crosses below the conductors of another transmission line, generally at 90 degrees.

Underbuild

A transmission or distribution configuration where a transmission or distribution circuit is attached to a transmission tower or pole below (under) the principle transmission line conductors.

VAR

Voltage Ampere Reactive, a measure for Reactive power in the power system.