Final Staff Assessment

WALNUT ENERGY CENTER PART 2

Application For Certification (02-AFC-4)
Stanislaus County

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CALIFORNIA
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STAFF REPORT

AUGUST 2003
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Gray Davis, Governor

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CALIFORNIA ENERGY COMMISSION

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EXECUTIVE SUMMARY

(FSA Part 2)

With the goal of facilitating timely project hearings, staff published the Final Staff Assessment (FSA) in two parts. Part 1 of the FSA, published on August 8, 2003, contained staff's analysis and recommendations for all technical areas except for Hazardous Materials Management. This FSA Part 2 contains staff analysis of Hazardous Materials Management, as well as staff's final recommendation on the proposed project.

INTRODUCTION

This Final Staff Assessment (FSA) Part 2 contains the California Energy Commission (Energy Commission) staff's independent analysis and recommendation on the Walnut Energy Center (WEC or project). The WEC and related facilities, such as the natural gas line, reclaimed and potable water supply lines, are under the Energy Commission's jurisdiction. When issuing a license, the Energy Commission is the lead state agency under the California Environmental Quality Act, and its process is functionally equivalent to the preparation of an environmental impact report.

The Energy Commission staff has the responsibility to complete an independent assessment of the project's potential effects on the environment, the public's health and safety, and whether the project conforms with all applicable laws, ordinances, regulations and standards (LORS). The staff also recommends measures to mitigate potential significant adverse environmental effects and conditions for construction, operation and eventual closure of the project, if approved by the Energy Commission.

This FSA is not the decision document for these proceedings nor does it contain findings of the Energy Commission related to environmental impacts or the project's compliance with LORS. The FSA will serve as staff's testimony in evidentiary hearings to be held by the Committee of two Commissioners who are hearing this case. The Committee will hold evidentiary hearings and will consider the recommendations presented by staff, the applicant, all parties, government agencies, and the public prior to proposing its decision. The Energy Commission will make the final decision, including findings, after the Committee's publication of its proposed decision.

PROJECT LOCATION AND DESCRIPTION

On November 19, 2002, the Turlock Irrigation District (TID) filed an Application for Certification (AFC), for its proposed Walnut Energy Center (WEC) project with the California Energy Commission seeking approval to construct and operate a 250 megawatt (MW) natural gas-fired, combined-cycle electric generating facility. The plant would be owned and operated by TID. The Energy Commission determined the application to be data adequate on December 18, 2002. This determination initiated staff's independent analysis of the proposed project.

The WEC would be located in an industrially zoned area, currently used for agricultural production, about four miles west of the downtown portion of the City of Turlock, in

Stanislaus County. The project site is located southeast of the intersection of West Main Street and South Washington Road. Access to the site will be via a new 1,900-foot road built off South Washington Road through the west side of the project parcel. **PROJECT DESCRIPTION Figure 1** in Part 1 of the Final Staff Assessment shows the regional setting and **PROJECT DESCRIPTION Figure 2** provides the local setting for the proposed project.

The WEC would consist of two combustion turbine generators (CTGs) equipped with dry, low oxides of nitrogen (NO_x) combustors; two heat recovery steam generators (HRSGs); one condensing steam turbine generator (STG); a deaerating surface condenser; a five-cell mechanical-draft cooling tower; and associated support equipment providing a total nominal generating capacity of 250 MW (at average annual ambient conditions). The combustion turbines would be General Electric Frame 7EA units.

To control emissions of air pollutants, the WEC will utilize a control system designed to meet the proposed air emission limits. NO_x emissions from the WEC will be controlled to 2.0 parts per million by volume, dry basis, corrected to 15 percent oxygen (ppmc), by a combination of low NO_x combustors in the CTGs and selective catalytic reduction (SCR) systems in the HRSGs. An oxidation (CO) catalyst will be installed in the HRSGs to limit stack CO emissions to 4.0 ppm.

The WEC project would use up to 1,800 acre feet per year (afy) of reycled water provided by the City of Turlock's Waste Water Treatment Plant (WWTP) for cooling tower make-up. Recycled water for WEC will be produced by new treatment facilities, located in Turlock's existing WWTP.

The recycled water will be delivered to WEC through a new 12- to 24-inch pipeline, approximately 1.6 miles in length. The recycled water pipeline will be routed from the boundary of the Turlock WWTP on South Kilroy Road and will run generally west to WEC (see **PROJECT DESCRIPTION Figure 2**).

A zero liquid discharge (ZLD) system will be used to recycle cooling tower blowdown onsite. A portion of the distillate generated from the ZLD process will be further treated and used as steam cycle make-up water. Distillate from the ZLD treatment system will be used to provide all of the steam cycle makeup water for WEC.

The WEC facility will be connected to TID's transmission system by looping both a 69-kV and 115-kV line into the WEC. At the 69-kV level, this will be accomplished by intercepting the existing 69-kV transmission line, located immediately south of the proposed site, and installing a double-circuit pole line into the WEC 69-kV switchyard. At the 115-kV level, this will be accomplished by intercepting one of two existing 115-kV transmission lines that run along the west side of South Washington Road and installing a double-circuit pole line into the WEC 115-kV switchyard.

A more complete description of the project is contained in the **PROJECT DESCRIPTION** section of Part 1 of the FSA.

PUBLIC AND AGENCY COORDINATION

The Energy Commission's WEC Committee conducted an Informational Hearing and Site Visit on January 24, 2003. This hearing provided a forum for the public to learn about the project, the Energy Commission's process, and to raise their questions and concerns about the proposed power plant.

When the AFC was filed, staff mailed a notice to all property owners adjacent to the proposed project informing them of the proposed facility, the Energy Commission's review process, and how they could participate.

The Energy Commission's Public Advisor's Office (PAO) sent the application to the Turlock Library and prepared a library and neighborhood poster announcing the project and displaying key contact information. Along with this application, the PAO sent 25 copies of a one-page project description with detailed information about the proposed project. The PAO also sent 1,000 bilingual (English and Spanish) newspaper inserts announcing the time, date and location of the Informational Hearing and Site Visit to the Turlock Journal.

Staff filed its Preliminary Staff Assessment (PSA) on May 21, 2003. Staff held workshops on the PSA on June 17 and 20, 2003 and has also coordinated its review of the WEC with relevant local, state and federal agencies, such as the City of Turlock, Stanislaus County, California Independent System Operator, the San Joaquin Valley Air Pollution Control District, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers. This FSA Part 2 provides agencies and the public the opportunity to review the Energy Commission staff's analysis of the proposed project.

RESPONSE TO COMMENTS

National Marine Fisheries Service

The National Marine Fisheries Service (NMF) provided comments on staff's PSA of the WEC on July 7, 2003. NMF's commented that they agreed with staff's biological assessment for listed salmonids in the project area; was in support of using reclaimed water, urged further conservation of any potable water use at the facility; and expressed concerns regarding the potential growth inducing impacts of the proposed project.

NMF's comments regarding biological resources are discussed in the **Biological Resources, Water Resources,** and **Land Use (growth inducing impacts)** and can be found in their respective sections of Part 1 of the FSA.

City of Turlock Engineering Services

Staff received an email from Brad Klavano, City Engineer for the City of Turlock on June 20, 2003, regarding the alignment of a road associated with the proposed project and the potential for an additional well for fire protection. The City's comments are discussed in the **Traffic and Transportation** and **Soil and Water Resources** sections of Part 1 of the FSA.

STAFF'S ASSESSMENT

Each technical area section of the FSA contains a discussion of impacts, staff's preliminary conclusions and recommendations, and, where appropriate, mitigation measures and conditions of certification. The FSA includes staff's assessments of:

- the environmental setting of the proposal;
- impacts on public health and safety, and measures proposed to mitigate these impacts;
- environmental impacts, and measures proposed to mitigate these impacts;
- the engineering design of the proposed facility, and engineering measures proposed to ensure the project can be constructed and operated safely and reliably;
- project closure;
- project alternatives; and
- compliance of the project with all applicable laws, ordinances, regulations and standards (LORS) during construction and operation.

OVERVIEW OF STAFF'S CONCLUSIONS

Staff believes that the project's environmental impacts can be mitigated to less than significant levels. Staff's analysis also indicates that the project can comply with all applicable LORS. Below is a summary of the potential environmental impacts and LORS compliance for all technical areas contained in parts 1 and 2 of the FSA.

Technical Discipline	Environmental / System Impact	LORS Conformance
Air Quality	Impacts Mitigated	Yes
Biological Resources	Impacts Mitigated	Yes
Cultural Resources	Impacts Mitigated	Yes
Power Plant Efficiency	No Impact	N/A
Power Plant Reliability	No Impact	N/A
Facility Design	Impacts Mitigated	Yes
Geology	Impacts Mitigated	Yes
Hazardous Materials	Impacts Mitigated	Yes
Land Use	Impacts Mitigated	Yes
Noise	Impacts Mitigated	Yes
Public Health	Impacts Mitigated	Yes
Socioeconomics	No Impact	Yes
Traffic and Transportation	Impacts Mitigated	Yes
Transmission Line Safety	Impacts Mitigated	Yes
Transmission System Engineering	Impacts Mitigated	Yes
Visual Resources	Impacts Mitigated	Yes
Waste Management	Impacts Mitigated	Yes
Water and Soils	Impacts Mitigated	Yes
Worker Safety	Impacts Mitigated	Yes

ENVIRONMENTAL JUSTICE

EPA guidelines on environmental justice state that if 50 percent of the population affected by a project has minority or low-income status, it must be determined if these populations are exposed to disproportionately high and adverse human health or environmental impacts.

In the Socioeconomics section of Part 1 of the FSA, staff presented the results of their "environmental justice screening analysis." The purpose of this analysis is to determine whether a low-income or minority population exists within the potential affected area of the proposed project.

Energy Commission staff have reviewed Census 2000 information that shows the minority population is less than 50 percent within a six-mile radius of the proposed WEC. However, as indicated in **Socioeconomics Figure 1**, there are multiple census blocks with greater than 50 percent minority persons within the six-mile radius; staff considers these to be pockets or clusters of minority population. Staff considers these pockets to require an environmental justice analysis.

When a minority /or low-income population is identified, staff in the technical areas of air quality, public health, hazardous materials, noise, water, waste, traffic and transportation, visual resources, land use, socioeconomics, and transmission line safety and nuisance must consider possible impacts on the minority/low-income population as part of their analysis. This environmental justice analysis consists of identification of significant impacts (if any), identification of mitigation, and determination of whether there is a disproportionate impact if an unmitigated significant impact has been identified.

Based on its analysis contained in Parts 1 and 2 of the FSA, staff has not identified any significant unmitigated impacts for the technical areas listed above, if staff's proposed mitigation measures are implemented.

CONCLUSION AND RECOMMENDATIONS

Staff has determined that, with the mitigation recommended in Parts 1 and 2 of the FSA, the construction and operation of the Walnut Energy Center would not create a significant impact to the environment, public health and safety, or the electric transmission system.

Staff recommends that the Commission approve the proposed Walnut Energy Center with the mitigation contained in staff's complete FSA.

HAZARDOUS MATERIALS MANAGEMENT

Testimony of Geoff Lesh, P.E. and Rick Tyler

INTRODUCTION

The purpose of this analysis is to determine if the proposed Walnut Energy Center (WEC) has the potential to cause a significant impact on the public as a result of the use, handling or storage of hazardous materials at the proposed facility. If significant adverse impacts to the public are identified, Energy Commission staff must also evaluate the potential for facility design alternatives and additional mitigation measures to reduce impacts to the extent feasible.

This analysis does not address potential exposure of workers to hazardous materials used at the proposed facility. The regulatory framework applicable to protection of employees from workplace risk is considerably different than the framework applicable to protection of the public. Employers must inform employees of hazards associated with their work and employees thus routinely accept higher levels of risk than the general public as a tradeoff for employment. Workers typically do not receive the same level of protection normally provided to the public. It is also nearly impossible and would be prohibitively expensive to provide workers the same level of protection as a result of their proximity to the hazard. Further, workers can be provided with special protective equipment and training to reduce the potential for health impacts associated with the handling of hazardous materials. Staff's **Worker Safety and Fire Protection** analysis describes the requirements applicable to the protection of workers from workplace risks.

The applicant has proposed to store five hazardous materials at the WEC in quantities exceeding the reportable amounts defined in the California Health and Safety Code, section 25532 (j): anhydrous ammonia, sodium hydroxide, sulfuric acid, sodium hypochlorite, and mineral and lubricating oils (see Appendix C). Of these, anhydrous ammonia presents the greatest potential for off-site consequences. The use of anhydrous ammonia significantly increases the risk that would otherwise be associated with use of the safer aqueous form of ammonia. The anhydrous form, with its high internal energy, is stored as a liquefied gas at elevated pressure. The high internal energy associated with the anhydrous form of ammonia can act as a driving force in an accidental release, which can rapidly introduce large quantities of the material to the ambient air, where it can be transported in the atmosphere and result in high down-wind concentrations. Spills associated with the aqueous form are much easier to contain and the slow mass transfer from the surface of the spilled material limits emissions.

Other hazardous materials stored in smaller quantities, such as corrosion inhibitors and water conditioners, will be present at the proposed facility. Hazardous materials used during the construction phase include gasoline, diesel fuel, oil, welding gases, lubricants, solvents and paint. No acutely toxic hazardous materials will be used on-site during construction. None of these materials pose significant potential for off-site impacts because of their small quantities on-site, their relative toxicity, and/or their lack of environmental mobility. Although no natural gas is stored, the project will involve the construction and operation of a natural gas pipeline and handling of large amounts of natural gas. Natural gas poses some risk of both fire and explosion. This pipeline will be approximately 3.6 miles in length including on and off-site segments.

The WEC will also require the transportation of anhydrous ammonia to the facility. Analysis of the potential for impact associated with such deliveries is addressed below.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

The following federal, state, and local laws and policies apply to the protection of public health and hazardous materials management. Staff's analysis examines the project's compliance with these requirements.

FEDERAL

The Superfund Amendments and Reauthorization Act of 1986 (Pub. L. 99-499, §301,100 Stat. 1614 [1986]), also known as SARA Title III, contains the Emergency Planning and Community Right To Know Act (EPCRA) as codified in 42 U.S.C. §11001 et seq. This Act requires that certain information about any release to the air, soil, or water of an extremely hazardous material must be reported to state and local agencies.

The Clean Air Act (CAA) of 1990 (42 U.S.C. §7401 et seq. as amended) established a nationwide emergency planning and response program and imposed reporting requirements for businesses which store, handle, or produce significant quantities of extremely hazardous materials. The CAA section on Risk Management Plans - codified in 42 U.S.C. §112(r) - requires states to implement a comprehensive system to inform local agencies and the public when a significant quantity of such materials is stored or handled at a facility. The requirements of the CAA are reflected in the California Health and Safety Code, section 25531 et seq.

The natural gas pipeline must be constructed and operated in accordance with the Federal Department of Transportation (DOT) regulations, Title 49, Code of Federal Regulations, sections 190, 191, and 192: Of the Federal LORS applying to the planned natural gas pipeline, Title 49, Code of Federal Regulations, section 190, outlines the pipeline safety program procedures. Title 49, Code of Federal Regulations, section 191, Transportation of Natural and Other Gas by Pipeline; Annual Reports, Incident Reports, and Safety-Related Condition Reports, requires operators of pipeline systems to notify the U.S. Department of Transportation of any reportable incident by telephone and then submit a written report within 30 days.

Federal regulations applying to shipment of hazardous materials on California highways to ensure safe handling in general transportation include the Federal Hazardous Materials Transportation Law [49 U.S.C. §5101 et. seq.], and the U.S. Department of Transportation Regulations [49 C.F.R. Subpart H, §172-700]. Recent changes to enhance security of hazardous materials in transport require shippers and carriers of certain highly hazardous materials to implement security plans, and to ensure their employee training includes a security component, with the goal to implement security requirements that will be effective in preventing hazardous materials from being used as tools of destruction and terror. The new rules are intended to help to deter and prevent terrorists from using hazardous materials in the transportation system as weapons of destruction or intimidation. Additionally, the U.S. Department of Homeland Security Regulations [49 C.F.R. Parts 1570 and 1572], establishes security threat assessment standards for determining whether an individual poses a security threat warranting denial of a hazardous materials endorsement for a commercial drivers license (CDL). States are prohibited from issuing, renewing, transferring, or upgrading a CDL with a hazardous material endorsement unless the Department of Justice has first conducted a background records check of the applicant, and the determination has been made that the applicant does not pose a security threat.

STATE

The California Accidental Release Prevention Program (Cal-ARP) - Health and Safety Code, section 25531 - directs facility owners storing or handling acutely hazardous materials in reportable quantities, to develop a Risk Management Plan (RMP) and submit it to appropriate local authorities, the United States Environmental Protection Agency (EPA), and the designated local Administering Agency for review and approval. The plan must include an evaluation of the potential impacts associated with an accidental release, the likelihood of an accidental release occurring, the magnitude of potential human exposure, any preexisting evaluations or studies of the material, the likelihood of the substance being handled in the manner indicated, and the accident history of the material.

Section 25503.5 of the California Health and Safety Code requires facilities, which store or use hazardous materials, to prepare and file a Business Plan with the local Certified Unified Program Authority (CUPA), in this case the Stanislaus County Department of Environmental Resources. This Business Plan is required to contain information on the business activity, the owner, a hazardous materials inventory, facility maps, an Emergency Response Contingency Plan, an Employee Training Plan, and other recordkeeping forms.

Title 8, California Code of Regulations, section 5189, requires facility owners to develop and implement effective safety management plans to ensure that large quantities of hazardous materials are handled safely. While such requirements primarily provide for the protection of workers, they also indirectly improve public safety and are coordinated with the RMP process.

Title 8, California Code of Regulations, section 458 and sections 500 – 515, set forth requirements for design, construction and operation of vessels and equipment used to store and transfer anhydrous ammonia. These sections generally codify the requirements of several industry codes, including the ASME Pressure Vessel Code, ANSI K61.1 and the National Boiler and Pressure Vessel Inspection Code. While these codes apply to anhydrous ammonia, they may also be used to design storage facilities for aqueous ammonia.

California Health and Safety Code, section 41700, requires that "No person shall discharge from any source whatsoever such quantities of air contaminants or other material which causes injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property."

The safety requirements for pipeline construction vary according to the population density and land use, which characterize the surrounding land. The natural gas pipeline constructed for the WEC would be designed for Class 3 service and will meet California Public Utilities Commission General Order 112-D and 58-A standards, as well as various Pacific Gas & Electric Company (PG&E) standards.

LOCAL AND REGIONAL

The Uniform Fire Code (UFC) contains provisions regarding the storage and handling of hazardous materials in Articles 79 and 80. The California Building Code contains requirements regarding the storage and handling of hazardous materials. The Chief Building Official must inspect and verify compliance with these requirements prior to issuance of an occupancy permit. A further discussion of these requirements is provided in the **Seismic Issues** portion of this analysis.

If not for Energy Commission jurisdiction, the Stanislaus County Department of Environmental Resources would be the issuing agency for the Consolidated Hazardous Materials Permit. The permit review and mitigation authority covers hazardous materials, hazardous waste, compressed gases and tiered treatment, the Hazardous Materials Business Plan, and the Risk Management Plan for anhydrous ammonia. In regard to seismic safety issues, the site is located in UBC Seismic Risk Zone *3*. Construction and design of buildings and vessels storing hazardous materials must conform to the 2000 Uniform Building Code, the 2001 California Building Code, and the Stanislaus County Building Code.

SETTING

The proposed project is to be located in an industrially-zoned area about four miles west of the downtown portion of the City of Turlock, in Stanislaus County, near the intersection of West Main Street and Washington Road. The project site is level, at an elevation of approximately 85 feet above sea level. Essentially flat terrain extends for many miles on all sides of the project site. Some tall industrial structures, consistent with mixed industrial, agricultural, and residential uses, including power transmission facilities, are located in the surrounding area within one mile of the project. The land uses surrounding the proposed facility for three or more miles in the north, west, and southerly directions consist of mixed agriculture, and low-density rural residences. The same holds for the easterly direction, up to U.S. Highway 99 at approximately 1.5 miles, where residential density increases. Hazardous materials usage and transportation are commonly associated with the industrial/agricultural activities in the area.

Several factors associated with the area in which a project is to be located affect its potential to cause public health impacts from an accidental release of a hazardous material. These include:

- local meteorology;
- terrain characteristics; and

- location of population centers and sensitive receptors relative to the project.

METEOROLOGICAL CONDITIONS

Meteorological conditions, including wind speed, wind direction and air temperature, affect the extent to which accidentally released hazardous materials would be dispersed into the air and the direction in which they would be transported. This affects the level of public exposure to such materials and the associated health risks. When wind speeds are low and stable, dispersion is severely reduced and can lead to increased localized public exposure.

Recorded wind speeds and ambient air temperatures are described in the Air Quality section of the AFC (WEC 2002, AFC chapter 8.1). Staff agrees with the applicant that use of atmospheric stability class F (stagnated air, very little mixing) and 1.5-meters per second wind speed is appropriate for use in its modeling of an accidental release. Staff believes these represent a reasonably conservative scenario and thus reflects worst case atmospheric conditions.

TERRAIN CHARACTERISTICS

The location of elevated terrain (terrain above the power plant stack height) is often an important factor to be considered in assessing potential exposure. An emission plume resulting from an accidental release may impact high elevations before impacting lower elevations. With no local terrain elevated within several miles of the site, this project will not be affected by elevated terrain. Off-site concentrations of ammonia beyond the facility fence-line, however, may impact nearby receptors and potentially pose a hazard to the public.

LOCATION OF EXPOSED POPULATIONS AND SENSITIVE RECEPTORS

The general population includes many sensitive subgroups that may be at greater risk from exposure to emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. In addition, the location of the population in the area surrounding a project site may have a large bearing on health risk. Figure 8.6-1 (AFC) shows the location of the closest sensitive receptor in the project vicinity. The AFC states that the nearest sensitive receptor is a public child care facility (Stanislaus County Child Care) located approximately 0.9 mile east of the project. To the west, the nearest sensitive receptor is a school (Chatom Elementary), at approximately 1.9 miles. To the north and south, there are no sensitive receptors within three miles.

IMPACTS AND ANALYSIS

Staff thoroughly reviewed and assessed the potential for the transportation, handling, and use of hazardous materials to impact the surrounding community. All chemicals proposed for use at the facility, including natural gas, were evaluated.

METHODOLOGY

In order to assess the potential for released hazardous materials to travel offsite and impact on the public, staff analyzed several aspects of the proposed use of these materials at the facility. Staff recognizes that hazardous chemicals are frequently used at power plants. Therefore, staff conducted its analysis by examining the need for hazardous materials, the choice of chemical to be used and its amount, the manner in which the applicant will use the chemical, the manner it will be transported to the facility and transferred to facility storage tanks, and the way the applicant chooses to store the material on-site.

Staff reviewed the applicant's proposed engineering controls and administrative controls concerning hazardous materials usage. Engineering controls are those physical or mechanical systems (such as storage tanks or automatic shut-off valves) which can prevent a spill of hazardous material from occurring or which can limit the spill to a small amount or confine it to a small area. Administrative controls are those rules and procedures that workers at the facility must follow that will help to prevent accidents or keep them small if they do occur. Both engineering and administrative controls can act as methods of prevention or as methods of response and minimization. In both cases, the goal is to prevent a spill from moving offsite and causing harm to people.

Staff conducted a thorough review and evaluation of the applicant's proposed use of hazardous materials as described by the applicant in the AFC (Sections 2.2.10 and 8.12). Staff's assessment followed the five steps listed below:

- Step 1: Staff reviewed the chemicals and the amounts proposed for on-site use as listed in Tables 8.12-3 and 8.12-4 of the AFC (see Appendix C) and determined the need and appropriateness of their use.
- Step 2: Those chemicals, proposed for use in small amounts or whose physical state is such that there is virtually no chance that a spill would migrate off the site and impact the public, were removed from further assessment.
- Step 3: Measures proposed by the applicant to prevent spills were reviewed and evaluated. These included engineering controls such as automatic shut-off valves and different size transfer-hose couplings and administrative controls such as worker training and safety management programs.
- Step 4: Measures proposed by the applicant to respond to accidents were reviewed and evaluated. These measures also included engineering controls, such as catchment basins and methods to keep vapors from spreading, and administrative controls such as training emergency response crews.
- Step 5: Staff analyzed the potential impacts to the public of a worst-case spill of hazardous materials with the mitigation measures proposed by the applicant. If the mitigation methods proposed by the applicant are found to be sufficient, no further mitigation will be recommended. If the mitigation proposed by the applicant is found to be insufficient to reduce the potential for adverse impacts to an insignificant level, staff will propose additional prevention and response controls to reduce potential impacts to an insignificant level. It is only at this point that staff can recommend that the facility be permitted to use hazardous materials.

PROJECT IMPACTS

Small Quantity Hazardous Materials

During the construction phase of the project, the only hazardous materials proposed for use include paint, paint thinner, cleaners, solvents, sealants, gasoline, diesel fuel, motor oil, hydraulic fluid, welding flux and gases, lubricants and emergency refueling containers. Any impact resulting from spills or other releases of these materials will be limited to the site due to the small quantities involved. Fuels such as mineral oil, lube oil, and diesel fuel are all of very low volatility and represent a limited off-site hazard even in larger quantities (Section 8.12.4.1).

In conducting the analysis, staff determined in Steps 1 and 2 that most of the hazardous materials proposed for use at the WEC, pose a minimal potential for off-site impacts as they will either be stored in a solid form, in smaller quantities, or have very low toxicity. These hazardous materials were thus removed from further assessment. For example, one such group of chemicals includes the scale inhibitor chosen for use at the site. Scale inhibitors are used to control and reduce the potential for scale and corrosion to form within the pipeline system. The scale control agent listed in Appendix C includes polyacrylate for use in the cooling tower. This chemical is safer to use than others often used at other facilities for this purpose, such as hydrazine. Staff has determined that the potential for impacts on the public are insignificant if the applicant uses these or similar scale inhibitors. See Appendix C for a list of chemicals that will be used at the power plant.

After removing from consideration those chemicals that fit into Steps 1 and 2, staff continued with Steps 3, 4 and 5 to review the only remaining hazardous materials: sulfuric acid, sodium hydroxide, sodium hypochlorite, natural gas, and anhydrous ammonia.

Large Quantity Hazardous Materials

Sulfuric acid, sodium hydroxide, sodium hypochlorite, and anhydrous ammonia will be present in excess of the Reportable Quantity (RQ) and, therefore, must be included in the Hazardous Materials Business Plan (HMBP) and Risk Management Plan (RMP). Natural gas, although not stored on-site, will be brought on-site through pipeline and used in large quantities.

Sulfuric Acid

Sulfuric acid would not pose a risk of off-site impacts, because it has a relatively low vapor pressure and thus emissions from spills would be confined to the site. Because of public concern at another proposed energy facility in 1995, staff conducted a quantitative assessment of the potential for impact associated with sulfuric acid use, storage, and transportation. Staff found no hazard would be posed to the public. However, should a fire occur in the immediate vicinity of the sulfuric acid tank, the potential exists for the tank to rupture and for sulfuric acid to become vaporized and migrate off-site. In order to protect against risk of fire causing this accidental release, Condition of Certification (**HAZ-5**) requires the project owner to ensure that no combustible or flammable materials would be stored within 100 feet of the sulfuric acid tank.

Sodium Hydroxide

Sodium hydroxide is a strong base that is used in water treatment. It has a very low vapor pressure and therefore poses no risk of atmospheric transport off-site. Sodium hydroxide does pose a risk of soil and water contamination. However, it will be stored using an impervious secondary containment structure that will prevent such contamination. It is staff's conclusion that use of sodium hydroxide poses no risk of impacting surrounding populations in the event of an accidental release at the facility.

Sodium Hypochlorite

The aqueous mixture of sodium hypochlorite will likewise have a low potential to affect the off-site public because its vapor pressure is also low and the concentration of hypochlorite is low (12.5 percent). In fact, hypochlorite is used at many such facilities as a substitute for chlorine gas, which is much more toxic and much more likely to migrate off-site because it is a gas and is stored in concentrated form. Thus, a water solution of sodium hypochlorite is much safer to use than the alternative, which is chlorine gas. However, accidental mixing of sodium hypochlorite with acids or anhydrous ammonia could result in toxic gases. Given the large volumes of both anhydrous ammonia (10,200 gals) and sodium hypochlorite (8000 gals) proposed for storage at this facility, the chances for accidental mixing of the two - particularly during transfer from delivery vehicles to storage tanks - should be reduced as much as possible. Thus, measures to prevent such mixing are extremely important and will be required as an additional section within the required Safety Management Plan for delivery of anhydrous ammonia. However, staff does note that in the AFC (Section 8.6.5.3) the applicant proposes to separate incompatible materials to prevent accidental mixing and provide separate containment facilities for each material.

Natural Gas

Natural gas poses a fire and/or explosion risk as a result of its flammability. Natural gas is composed of mostly methane but also contains ethane, propane, nitrogen, butane, isobutane and isopentane. It is colorless, odorless, and tasteless and is lighter than air. Natural gas can cause asphyxiation when methane is ninety percent in concentration. Methane is flammable when mixed in air at concentrations of 5 to 14 percent, which is also the detonation range. Natural gas, therefore, poses a risk of fire and/or explosions if a release were to occur. In particular, gas explosions can occur in the Heat Recovery Steam Generator (HRSG) and during start-up. However, it should be noted that, due to its tendency to disperse rapidly (Lees 1983), natural gas is less likely to cause explosions than many other fuel gases, such as propane or liquefied petroleum gas. While natural gas will be used in significant quantities, it will not be stored on-site. In addition, risk of a fire and/or explosion on-site can be reduced to insignificant levels through adherence to applicable codes and development and implementation of effective safety management practices. For example, the National Fire Protection Association (NFPA 85A) requires: 1) the use of double block and bleed valves for gas shut-off; 2) automated combustion controls; and 3) burner management systems. These measures will significantly reduce the likelihood of an explosion in gas-fired equipment. Additionally, start-up procedures will require air purging of the gas turbines prior to start-up, thus precluding the presence of an explosive mixture. The safety management plan proposed by the applicant will address the handling and use of natural gas and significantly reduce the potential for equipment failure due to improper maintenance or human error.

Since the proposed facility will require the installation of a new gas pipeline off-site, impacts from this pipeline need to be evaluated. The design of the natural gas pipeline is governed by laws and regulations that require use of high quality arc welding techniques by certified welders and inspection of welds. Many failures of older natural gas lines have been associated with poor quality gas welds. Many failures in older pipelines have also resulted from corrosion. Current codes address this failure mode by requiring use of corrosion resistant coatings and cathodic corrosion protection. Another major cause of pipeline failure is damage resulting from excavation activities near pipelines. Current codes address this mode of failure by requiring clear marking of the pipeline route. An additional mode of failure particularly relevant to the project area is damage caused by earthquake. Existing codes also address seismic hazard in design criteria (see discussion below). Evaluation of pipeline performance in recent earthquakes indicates that pipelines designed to modern codes perform well in seismic events while older lines frequently fail. Staff believes that existing regulatory requirements are sufficient to reduce the risk of accidental release from the pipeline to insignificant levels.

In the United States, extensive federal and state pipeline codes and safety enforcement minimize the risk of severe accidents related to natural gas pipelines. The DOT Office of Pipeline Safety is proposing new rules that include a program requiring the preparation of risk management plans for gas pipelines throughout the United States. These risk management plans must include the use of diagnostic techniques to detect internal and external corrosion or cracks in pipelines and to perform preventive maintenance. The pipeline owner, PG&E, will be required to develop and implement these plans as required by the new rules when adopted by DOT. [US Department of Transportation Regulations [49 C.F.R. Part 192] (68 FR 4278; January 28, 2003)].

Staff believes that the existing regulatory framework, combined with the standard operating procedures established by PG&E, are sufficient to ensure there will be no significant potential for off-site impacts due to the natural gas pipeline.

Anhydrous Ammonia Storage

Based on the discussion above, anhydrous ammonia is the only hazardous material that may pose a risk of off-site impacts. Anhydrous ammonia will be used in controlling the emission of oxides of nitrogen (NO_x) from the combustion of natural gas in the facility. One 12,000-gallon pressure vessel tank will be used to store the anhydrous ammonia. The maximum amount of ammonia stored in it will be limited to 10,200 gallons by engineering and administrative measures. Anhydrous ammonia is a gas at ambient temperature and is therefore stored under pressure to maintain it in the liquid state. An event causing the rupture of the tank, a pipe, or valve would result in a mixed-phase, liquid-gas jet of ammonia leaving the containment structure at a high rate. Because of its relatively high vapor pressure and the large amounts of anhydrous ammonia that will be stored on-site, the accidental release of anhydrous ammonia without proper mitigation could, in some circumstances, result in high down-wind concentrations of ammonia gas.

To assess the potential impacts associated with a potential release of ammonia, staff typically evaluates where four "bench mark" exposure levels of ammonia gas occur off-site. These exposure levels include: 1) the lowest concentration posing a risk of lethality, 2,000 PPM; 2) the Immediately Dangerous to Life and Health (IDLH) level of 300 PPM; 3) the Emergency Response Planning Guideline (ERPG) level 2 of 200 PPM, which is also the Risk Management Planning (RMP) level 1 criterion used by EPA and California; and 4) the level considered by the Energy Commission staff to be without serious adverse effects on the public for a one-time accidental exposure of 75 PPM. (A detailed discussion of the exposure criteria considered by staff and their applicability to different populations and exposure-specific conditions is provided in Appendix A of this analysis.)

Staff considers the exposure level of 75 PPM to be de minimus. If the potential exposure associated with a potential release does not exceed 75 PPM at any public receptor, staff will presume that the potential release does not pose a risk of significant impact. If the potential exposure associated with a potential release does exceed 75 PPM at any public receptor, staff may assess the potential exposure levels and/or the nature of the potentially exposed population in combination with the probability of occurrence of the release. Based on such analysis, staff will evaluate the likelihood and extent of potential exposure and make a recommendation regarding its potential impact and acceptability.

To analyze the potential risk associated with hazardous materials stored at a proposed facility, staff conducts a conservative (i.e. pessimistic) analysis of a worst-case potential release. In cases where the potential exposure level to public receptors exceeds 75 PPM, the estimated potential impact to the public is based on an estimate of the number of potential fatalities that could be expected to result from the release. Potential fatalities (as opposed to potential injuries) are estimated because available data from actual releases are most reliable for this method. Tabulations of existing data which might be used to define and estimate injuries resulting from accidental exposures to hazardous materials vary widely and are generally considered to be unreliable and unsuitable for purposes of risk assessment (Lees 1996). However, it can be concluded that the mitigation of fatalities does result in the simultaneous mitigation of injuries because studies which have included an accounting for both injuries and fatalities do show that the number of injuries scales proportionately with the number of fatalities, although scale factors vary depending on how the injuries have been defined and counted in each study. The observed scaling factors vary from approximately two to ten injuries per fatality, depending on the study (Hirschberg). Staff believes that estimating potential impacts through the estimation of fatalities provides a reasonable and consistent metric that can be used for comparing the relative magnitudes of potential impacts that involve both fatalities and injuries.

To gauge the significance level of potential impacts to public receptors from a proposed facility, staff uses the internationally accepted and generally used de minimus level of societal risk, *(SR),* equal to 10^{-4} fatalities per year. Societal risk is defined as the product of the estimated annual frequency of the incident *(F)* multiplied by the estimated number of fatalities resulting from the incident *(N)* (AIChE 1998). As an example, a societal risk level of 10^{-4} would result from an event with an expected annual frequency, or the annual probability of occurrence, of 10^{-6}, that has a potential for up to 100 fatalities, ($SR = 10^{-6} \times 100 = 10^{-4}$). This level of risk could also be described as 100 expected fatalities per million years, or equivalently, as 1 expected fatality per 10,000 years.

For cases where the societal risk falls below 1×10^{-4} fatalities per year, the risk is considered de minimus, and further mitigation is not required. For cases where the societal risk is greater than 1×10^{-4}, but less than 1×10^{-1}, the risk may either be deemed acceptable, or, further risk reduction may be required, depending on the level of risk found and the feasibility of further mitigation. For cases were societal risk is found to be greater than 1×10^{-1}, the risk is generally considered to be unacceptable.

For the particular case of WEC, the applicant provided modeling results and analysis of a worst-case accidental release of anhydrous ammonia using conditions and assumptions recommended by staff. Modeling of the atmospheric dispersion of the resulting plume was done using the SLAB computer code, consistent with accepted denser-than-air initial plume assumptions for anhydrous ammonia releases (Ermak). Following the U.S. EPA's RMP Offsite Consequence Analysis Guidance (EPA 1999), the modeled release scenario considered, as a worst case, the release of the entire tank's contents over a ten minute period, under meteorological conditions of poor atmospheric dispersion, with low but steady wind speed. Under these combined worst-case conditions, the expected number of impacted public receptors and the probabilities of occurrence were examined and considered.

Staff reviewed the applicant's risk analysis and agrees with its conclusions. Based on past failure statistics, the expected failure probability for an ammonia storage tank is 1.8×10^{-6} per year (Lees 1996). From local meteorological records, the indicated stable atmospheric conditions occur in conjunction with wind speeds less than two meters per second approximately 18 percent of the time. Staff estimates that the circular arc that includes wind vectors towards nearby receptors and residences to be approximately 45 degrees. As wind directions during stable conditions are mostly random, the probability of the wind blowing towards a nearby receptor is estimated at 12 percent. Thus, the conditions described are estimated to occur 2 percent of the time. The probability of having the tank fail during the worst-case meteorological conditions to produce a worst-case (i.e.: maximum impact) release is $1.8 \times 10^{-6} \times .02 = 3.5 \times 10^{-8}$ per year. Requiring the tank to be more than 90 percent full, would reduce this probability to 3.5×10^{-9} per year.

It should be noted that several conservative assumptions are included in this worst-case storage-tank-failure scenario, which, if accounted for, would reduce its estimated probability of occurring, and/or reduce the magnitude of its impact. No attempt has been made to include these factors, in keeping with the conservative, worst-case scenario being considered. These unaccounted-for conservative assumptions include the requirements that:

- The tank is full (on average it will be at 60 percent capacity).
- The tank breach must produce a horizontal jet, below the vapor space, pointing in the downwind direction, which must also be the direction toward a nearby residence. (Most tank breaches will not meet this condition.)

- The tank breach must be large enough to empty the full tank in the allowed 10 minutes. (The resultant cooling due to rapid, adiabatic expansion would have the effect of lowering the temperature of the containment vessel and reducing the pressure and flow rate as the release continued.)
- The ambient temperature is the highest recorded temperature for the area in the last 30 years.
- The historical tank failure data has been considered here to be representative of new tanks, even though new tanks designed, constructed, and maintained per the latest AMSE code (last updated 2001) would be expected to have lower failure probability.
- Wind direction is invariant during the transport of the plume to nearby residences. (Variation in wind direction will have the effect of spreading and diluting the plume concentration.)

Modeling results from the applicant's analysis of this worst-case release scenario indicated that the downwind distance would be 700 meters to the airborne concentration of 2000 PPM, 3600 meters to 300 PPM, 5100 meters to 200 PPM, and 9800 meters to 75 PPM. Staff conducted additional modeling runs of this scenario, with further analysis to evaluate the potential for lethal exposures to reach the nearby residences. Based on summaries of exposure studies (Lees 1996), staff determined that exposure to a concentration of 2000 PPM would not produce a high potential for lethality with 10 minute exposure, particularly for anyone indoors. However, exposure to 2000 PPM could produce a high potential for lethality with 60 minutes of exposure in the absence of sheltering. Using the SLAB computer model staff could not produce a plausible scenario that resulted in exposure at 2000PPM for 60 minutes. The ammonia concentration associated with high potential for lethality in 10 minutes is 5000 PPM. Staff could produce a release scenario that would produce exposure to 5000PPM for 10 minutes at the nearest residence, but only with full tank contents which reduces the probability of occurrence to 3.5×10^{-9} per year . These distances are the maxima at which these exposure levels could be expected. In the extremely unlikely event that all the necessary conditions occurred to produce this worst-case release and exposure, staff conservatively estimates that there could exist a worst-case potential for three off-site fatalities. This consequence estimate does not include the mitigating effect that would result from receptors remaining indoors while the plume passed by (approximately 10 minutes), the sheltering effect of which can reduce exposure by up 98.5 percent (AIChE 1997).

The resulting societal risk level (frequency x consequence) is conservatively estimated to be $SR = F \times N = 3.5 \times 10^{-9}$ per year x 3 fatalities = 1×10^{-8} fatalities per year. This risk level represents a potential for one fatality in 100 million years, or approximately 10,000 times lower than the de minimus risk level of 1×10^{-4} , or one fatality in ten thousand years, which is typically used by staff in reaching its recommendation. Based on both the probabilities of occurrence and potential for exposures, staff estimates that the most probable number of fatalities that would be caused by accidental releases of anhydrous ammonia from WEC over its estimated 30 year lifespan is zero.

Staff therefore concludes that the societal risk represented by the likelihood of occurrence and the extent of potential exposure due to an accidental release of anhydrous ammonia at WEC is not sufficient to support a finding of potentially significant impact. Staff therefore makes no recommendation for additional mitigation based on the risk of accidental release.

Aqueous ammonia can be substituted for anhydrous ammonia to reduce the risk from on-site storage. However, use of aqueous ammonia increases transportation risk. To provide perspective, staff evaluated the resulting overall risk from using each material.

Risk from Hazardous Materials Transportation

Hazardous materials including ammonia, sulfuric acid, and sodium hypochlorite will be transported to the facility via tanker truck. While many types of hazardous materials will be transported to the site, it is staff's belief that because of environmental mobility, toxicity, quantities and frequency of delivery, transport of ammonia would pose the predominance of risk associated with accidental release during such transport.

Staff believes that it is appropriate to rely on the extensive regulatory program that applies to shipment of hazardous materials on California highways to ensure safe handling in general transportation (see the Federal Hazardous Materials Transportation Law [49 U.S.C. §5101 et. seq.], the U.S. Department of Transportation Regulations [49 C.F.R. Subpart H, §172-700], the U.S. Department of Homeland Security Regulations [49 C.F.R. Parts 1570 and 1572], and California Department of Motor Vehicles (DMV) Regulations on Hazardous Cargo). These regulations also address the issues of driver competence and security threat assessment. Through this regulatory program, risks from transportation have been reduced to levels that are as low as reasonably practical. Still, transportation risks are, in general, orders of magnitude greater than the risks from accidental release associated with fixed facilities. For this reason, staff evaluated the comparative transportation-related risks resulting from the use of either anhydrous or aqueous ammonia at WEC.

Risk from Anhydrous Ammonia Transportation

Staff evaluated the risk of impact to the public associated with the transportation of anhydrous ammonia using transport statistics developed by Davies and Lees (Lees 1996). Due to WEC's location, the data representing the worst-case accident rate for transport by rural multi-lane undivided roads would be applicable to the project area. The maximum rate of accidental cargo release per vehicle-mile traveled on such roads is 0.36 in one million miles traveled (Lees 1996). The incidence of significant spillage per vehicle-mile is estimated to be 1 x 10^{-7} (that is, one in every 10 million miles traveled). For vehicles transporting hazardous materials, about 10 percent of all accidents cause fatalities. Most of these fatalities occur in the immediate vicinity of the accident. Typically, such fatalities result from injuries associated with the accident itself and are not caused by accidental release of cargo (Lees 1996). On average there were about 1.5 fatalities per fatal accident, regardless of whether or not a release occurred. However, as mentioned above, nearly all (~97.5 percent) of these were the result of the accident rather than released hazardous materials. Based on differences between the number of fatalities in accidents with and without loss of hazardous materials cargo, as given by Lees (Lees 1996), staff estimated that 2.5 percent of the average fatalities are due to released materials and the rest are due to physical injuries occurring in the accident.

Further, the occurrence of fatalities and injuries as indicated by accident statistics does not imply that such impacts were on populations near the facility. In fact, the population most often impacted by ammonia transport accidents is other road users. The potential for impacts to in-route populations near highways due to releases will be highly dependent on the proximity of the in-route populations to the accident location and on other factors present at the time of the accident, such as wind direction and whether the meteorological conditions are conducive to atmospheric dispersion of the release plume. It is staff's opinion that the risk of impact (injury or fatality) to the populations along the transportation route would be at least one order of magnitude less than the risk of occurrence of the transportation-related release due to frequency of adverse meteorological conditions (Lees 1996).

To address the issue of tanker truck safety, the applicant stated that anhydrous ammonia would be delivered to the proposed facility only in certified vehicles with a design capacity of 7,500 gallons. These vehicles will be designed to DOT Code MC-330 or MC-331. These are high integrity vehicles designed for hauling caustic materials under pressure such as anhydrous ammonia.

Based on the environmental mobility, toxicity, quantities present at the site, and frequency of delivery, staff concludes that the risk associated with transportation of other hazardous materials to the proposed facility does not significantly increase the risk of impact beyond that associated with transporting other types of common hazardous goods.

Risk from Aqueous Ammonia Transportation

With aqueous forms of ammonia, the ammonia is diluted with water, so that ammonia makes up, usually, 20 or 30 percent by weight of the resulting solution. WEC's ammonia-consuming SCR No_x-reduction process requires the same amount of ammonia regardless of the delivery form. Thus, 30 percent aqueous ammonia would require approximately three times the volume of delivered solution as would anhydrous ammonia. Using 20 percent aqueous ammonia, would require approximately five times the volume of solution compared to anhydrous ammonia. Because the various dilutions of ammonia are delivered in similar trucks, of similar size, the number of truck trips will vary directly with the delivered volume required, and is thus dependent on what dilution is used in the process. The number of truck miles required per delivery would be the same regardless of which type of ammonia is used, because the source for them all is the Port of Stockton, in Stockton (Salamy). Round trip distance between WEC and the Port of Stockton is approximately 95 miles, nearly all of it on U.S. Highway 99. Since all delivery variables are equal using either anhydrous or aqueous ammonia, and hazmat driver requirements and hazmat truck requirements are similar, staff finds no basis for assuming differing accident rates for anhydrous or aqueous ammonia.

As discussed above, risks to other road users and the localities traveled through vary directly with the number of truck-miles required to maintain the required supply of ammonia. Staff found no extraordinary traffic hazards along the route leading from U.S. Highway 99 to the facility.

Relative Risk from Transportation, Storage, and Use of Aqueous Ammonia as an Alternative to Use of Anhydrous Ammonia

Depending on the population density and on implementation of appropriate engineering and operational controls, the risk to off-site receptors from accidental release can be reduced to insignificance whether anhydrous ammonia or aqueous ammonia is transported to, stored, and used at the facility. Use of the aqueous form with appropriate mitigation virtually eliminates the risk of off-site impact from any accidental release from the fixed storage facility.

While it may seem prudent to require the use of aqueous ammonia in all cases to reduce the risk of accidental release from fixed facilities at CEC power plants, this reduction in release risk would be accomplished at the expense of higher transportation-related risk. It is widely accepted that transportation risks are far greater than associated hazardous materials accidental release risks from fixed facilities. While traffic accidents are willingly accepted as a necessary aspect of all industrial societies, they are still the leading cause of accidental death, by a large margin (NSC). Thus, when using hypothetical estimates in support of regulatory decisions, consideration must be given to the basis and statistics used to estimate both the impacts resulting from the release scenario and those that are transport-related.

The estimated impacts for the modeled release scenario are based upon conservative simplifying assumptions. For hazardous material releases, historical experience is that only a small proportion of the major accidents listed in the loss prevention literature are related to hazardous material releases. Most releases disperse rapidly, causing relatively few injuries. It is therefore likely that staff's estimate of accidental release risk from the storage facility over-estimates the actual risk (Lees 1996). The contrast between the large number of fatalities given by some theoretical estimates, assuming the most unfavorable and improbable circumstances, and using models which may prove to be based on pessimistic assumptions, and the small number of fatalities shown by the historical record is particularly striking in the case of hazardous materials release. It is especially important, therefore, to consider the historical data on hazardous material releases in order to keep the problem in perspective (Lees 1996).

A recent example of an actual accidental release with less-than-would-be-modeled impact is the anhydrous ammonia release which resulted from a train derailment in Minot, North Dakota, on January 18, 2002, reported to be the largest anhydrous ammonia release in North American history. Thirty-one cars derailed shortly before 2:00 A.M. Seven tank cars were breached, releasing more than 250,000 gallons of anhydrous ammonia near a housing development. The resulting vapor cloud was estimated to be 5 miles long, and 2.5 miles wide. The accident exposed approximately 15,000 people, or 40 percent of the population of the City of Minot. The accident resulted in one fatality (NTSB).

On the other hand, there exists a large volume and a long history of transportation statistics. This makes for a more robust and reliable estimate of accident and fatality rates. A comparison of estimated off-site risks from storage and transportation between anhydrous and aqueous ammonia for WEC is shown in the following table:

	Comparison of Societal Risk for WEC Project *(fatalities per year)*		
Public Risk	*Anhydrous*	*Aqueous (29%wt)*	*Remarks*
Tank Failure	1×10^{-8}	0	
Transport	1×10^{-4}	3×10^{-4}	approx 95 mi RT from Port of Stockton
Total	1×10^{-4}	3×10^{-4}	

It can be seen in the above table that the societal risks of off-site impacts related to potential tank failure are insignificant for either type of ammonia use. On the other hand transportation-related risks to road users are four orders of magnitude greater than for either form of ammonia. However, these are accepted by the responsible transportation regulatory authorities because it has not been deemed practical to reduce them further. Therefore, staff finds no basis for recommending the use of aqueous ammonia over anhydrous ammonia, on the basis of potential for public impact.

Risk of Terrorist Attack

Other sources of risk resulting from on-site anhydrous ammonia storage include the possibility of a terrorist attack on either the storage tank or an ammonia bulk transport truck. Based on expert opinions and current literature, WEC's storage tank would not fit accepted criteria for desirability as such a target. As discussed above, any attack upon the tank will not produce large numbers of fatalities, injuries, major societal disruption, or large economic losses. WEC will not serve infrastructure critical to national security facilities, nor critical chemical/petrochemical industries (Thetford), (RMS), (Taylor), and (SOF).

Nevertheless, the release scenarios that cause maximum exposure would result from a puncture of the storage tank. However unlikely it may be, it is still conceivable that such an event could be caused by a terrorist action. To provide additional protection against such an event, staff proposes a Condition of Certification (**HAZ-6**) requiring that the tank be protected by a barrier that would block the view of the tank from off site and protect it against small arms fire. It is staff's conclusion that a terrorist attack could not result in a release causing greater exposure than predicted by a worst-case accidental release. However, it is not possible to quantify the probability of such an event. The proposed condition of certification would significantly increase the difficulty of planning and executing a successful attack on the storage tank.

An anhydrous ammonia bulk transport truck could also be the target of a terrorist hijacking, to be used at another location as a weapon. Staff's proposed security plans as required by Condition of Certification (**COM-8)**, and new regulations regarding security plans, threat assessment, and driver qualifications have been established through the U.S. Department of Transportation Regulations [49 C.F.R. Subpart H,

§172-700], and the U.S. Department of Homeland Security Regulations [49 C.F.R. Parts 1570 and 1572]. These provide a deterrent against attacks.

Seismic Issues

The possibility exists that an earthquake could cause the failure of a hazardous materials storage tank and rupture of the natural gas pipeline. An earthquake could also cause the failure of the secondary containment system (berms and dikes) as well as electrically controlled valves, pumps, neutralization systems and the foam vapor suppression system. The failure of all these preventive control measures might then result in a vapor cloud of hazardous materials moving off-site and impacting the residents and workers in the surrounding community. The effects of the Loma Prieta earthquake of 1989, the Northridge earthquake of 1994, and the 1995 earthquake in Kobe, Japan heighten the concern regarding earthquake safety

Information obtained after the January 1994 Northridge earthquake showed that some damage was caused to several large storage tanks and smaller tanks associated with the water treatment system of a cogeneration facility. Those tanks with the greatest damage - including seam leakage - were older tanks while the newer tanks sustained displacements and failures of attached lines. Staff reviewed the codes and standards which should be followed in adequately designing and building storage tanks and containment areas as well as the natural gas pipeline in order to withstand a large earthquake. Staff notes that the proposed facility will be designed and constructed to the applicable standards of the Uniform Building Code for Seismic Zone 3, CPUC General Order 112E, and Title 49, California Code of Regulations, section 192. Staff believes that compliance with applicable regulations will ensure protection from earthquake damage.

Security Issues

Anhydrous ammonia is proposed for use in controlling air emissions from WEC. This chemical is classified by the U.S. EPA as an extremely hazardous material and requires special site security measures to be developed and implemented to ensure that unauthorized access and use is prevented. The EPA published a Chemical Accident Prevention Alert regarding Site Security (EPA 2000a) and a Chemical Safety Alert (EPA 2000) concerning precautions to take to prevent theft of anhydrous ammonia. The U.S. Department of Justice published a special report on Chemical Facility Vulnerability Assessment Methodology (U.S. DOJ 2002). In order to ensure that this facility or a shipment of anhydrous ammonia is not the target of unauthorized access, staff's proposed General Condition of Certification on Construction and Operations Security Plan (**COM-8)** will require the project owner to prepare a Vulnerability Assessment and implement Site Security measures consistent with the above-referenced documents.

CUMULATIVE IMPACTS

Staff reviewed the potential for the operation of the WEC combined with other existing and foreseeable facilities to result in cumulative impacts on the population within the area. Projects that could potentially contribute to cumulative impacts are those located in the same geographic area of influence defined as within a five mile radius of the proposed power plant. Other facilities in the area of the project site store ammonia that could potentially migrate and make a minor contribution to a cumulative release. Such facilities include Super Store Industries' Turlock Dairy Division and Turlock Cold Storage located 0.5 and 0.6 miles, respectively, from the proposed site. In addition, Foster Turkey Products Plant 1 is located approximately 2.8 miles from the proposed project site. A simultaneous release from WEC and one of these facilities could cause cumulative impacts, if the migrating clouds merged. As discussed above in the section on anhydrous ammonia storage, the probability of a simultaneous large-scale release from more than one facility, at a time when the weather conditions were just right for the plumes to combine, and then to move over a populated area without significant dispersal, is not considered to be plausible. Staff therefore concludes that the proposed facility, with mitigating measures proposed (see **Haz-2, Haz-3, and Haz-4)**, will not result in potential for significant cumulative impacts.

ENVIRONMENTAL JUSTICE

Staff has reviewed Census 2000 information that shows the minority population is less than 50 percent within a six-mile radius of the proposed WEC power plant (please refer to **Socioeconomics Figure 1** in this Staff Assessment). However, as indicated in **Socioeconomics Figure 1**, there are multiple census blocks with greater than 50 percent minority persons within the six-mile radius. Staff considers these to be pockets or clusters. Staff also reviewed Census 2000 information that shows the low-income population is less than fifty percent within the same radius. Because staff has determined there to be pockets or clusters of minority population within the six-mile radius, staff has conducted a focused environmental justice analysis for **Hazardous Materials Management**.

Based on the **Hazardous Materials Management** analysis staff has not identified significant direct or cumulative impacts resulting from the construction or operation of the project, and therefore there are no **Hazardous Materials Management** environmental justice issues related to this project.

APPLICANT'S PROPOSED MITIGATION

The potential for accidents resulting in the release of hazardous materials is greatly reduced by the implementation of a safety management program, which includes the use of both engineering and administrative controls. Administrative controls include the development and implementation of a Safety Management Plan. Elements of facility controls and the safety management plan are summarized below.

ENGINEERING CONTROLS

Engineering controls help to prevent accidents and releases (spills) from moving off-site and impacting the community by incorporating engineering safety design criteria into the design of the facility. The engineered safety features proposed by the applicant for use at this facility include:

- construction of dikes, berms, and/or catchment basins in the hazardous materials storage areas to contain accidental releases that might happen during storage or delivery;

- physical separation of stored chemicals in separate containment areas in order to prevent accidental mixing of incompatible materials which may result in the evolution and release of toxic gases or fumes;
- a secondary containment structure surrounding the ammonia storage tank;
- secondary containment areas surrounding other large quantity chemical tanks; and
- a sloped containment pad that will drain into a sump placed beneath the tanker truck ammonia delivering area; and sumps will be provided for each of the secondary diked areas around each large chemical storage tank.

ADMINISTRATIVE CONTROLS

Administrative controls also help to prevent accidents and releases (spills) from moving off-site and impacting the community by establishing worker training programs, process safety management programs and by complying with all applicable health and safety laws, ordinances and standards.

The worker health and safety program proposed by the applicant for use at this facility will include (but is not limited to) the following elements:

- worker training regarding chemical hazards, health and safety issues, and hazard communication;
- the proper use of personal protective equipment;
- safety procedures for operation and maintenance of systems utilizing hazardous materials; and
- fire safety and prevention and emergency response actions including facility evacuation, and hazardous material spill cleanup.

At the facility, the project owner will be required to designate an individual who has the responsibility and authority to ensure a safe and healthful workplace. The project health and safety professional oversees the health and safety program and has the authority to halt any action or modify any work practice in order to protect the workers, facility, and the surrounding community or in the event that the health and safety program is violated.

A facility Process Safety Management Program is required for the facility. This is a program for the regular inspection and maintenance of equipment, valves, piping, and appurtenances. Additionally, the process safety management program requires that only trained facility personnel are assigned to the transfer and handling of hazardous chemicals.

In order to address the issue of spill response, the facility will prepare and implement an Emergency Response Plan which includes information on: hazardous materials contingency and emergency response procedures, spill containment and prevention systems, personnel training, spill notification, on-site spill containment, prevention equipment and capabilities, etc. Emergency procedures will be established which include evacuation; spill cleanup, hazard prevention, and emergency response.

STAFF'S PROPOSED MITIGATION

The worst-case accidental release scenarios discussed by the applicant (WEC AFC 2002) assumed that a large leak would occur in the anhydrous ammonia storage vessel, thus releasing the entire contents into the air and the basin below the storage vessel, and from a transfer hose from a tanker truck onto the ground. Staff believes that the most likely event resulting in a spill would occur during transfer from the delivery tanker to the storage tank. Staff therefore proposes a condition requiring development of a Safety Management Plan for the delivery of anhydrous ammonia (**Haz-4**). The development of a Safety Management Plan addressing delivery of ammonia will further reduce the risk of any accidental release not addressed by the proposed spill prevention mitigation measures and the required Risk Management Plan (RMP).

Staff has evaluated the applicant's proposed handling, storage, and transfer methods for anhydrous ammonia and the applicant's off-site consequence analysis. Staff is confident that, when implemented, the applicant's safety program will keep accidental releases to a minimum and prevent those which do occur from impacting the off-site public. Therefore, no further mitigation is warranted.

FACILITY CLOSURE

The requirements for the handling of hazardous materials remain in effect until such materials are removed from the site regardless of facility closure. Therefore, the facility owners are responsible for continuing to handle such materials in a safe manner, as required by applicable laws. In the event that the facility owner abandons the facility in a manner which poses a risk to surrounding populations, staff will coordinate with the California Office of Emergency Services, Stanislaus County Environmental Health Department, and the California Department of Toxic Substances Control (DTSC) to ensure that any unacceptable risk to the public is eliminated. Funding for such emergency action can be provided by federal, state or local agencies until the cost can be recovered from the responsible parties (O.E.S. 1990).

REPONSES TO PUBLIC AND AGENCY COMMENTS

No comments were received.

CONCLUSIONS AND RECOMMENDATIONS

Staff's evaluation of the proposed project (with staff's proposed mitigation measures) indicates that hazardous materials use will pose little potential for significant impacts on the public. With adoption of the proposed conditions of certification, the proposed project will comply with all applicable laws, ordinances, regulations and standards (LORS).

In response to Health and Safety Code, section 25531 et seq., the applicant will be required to develop an RMP. To insure adequacy of the RMP, staff's proposed conditions of certification require that the RMP be submitted for concurrent review by EPA, Stanislaus County, and staff. In addition, staff's proposed conditions of certification require Stanislaus County to review, and the CPM to approve, the RMP prior to delivery of any hazardous materials to the facility. Other proposed conditions of certification address the issue of the transportation, storage, and use of anhydrous ammonia.

With adoption of staff's proposed conditions of certification, the project will also comply with Health and Safety Code section 41700, and it will not pose a significant potential for impacts to the public from hazardous materials releases.

Staff recommends the Energy Commission adopt the proposed conditions of certification, presented herein, to ensure that the project is designed, constructed and operated to comply with applicable LORS and to protect the public from significant risk of exposure to an accidental anhydrous ammonia release.

PROPOSED CONDITIONS OF CERTIFICATION

HAZ-1 The project owner shall not use any hazardous material not listed in Appendix C, below, or in greater quantities than those identified by chemical name in Appendix C, below, unless approved in advance by the Compliance Project Manager (CPM).

Verification: The project owner shall notify the CPM of any intended change in the types and/or quantities of materials identified in Appendix C, and shall receive approval of such change prior to making such change. The project owner will provide to the CPM, in the Annual Compliance Report, a list of hazardous materials contained at the facility in reportable quantities.

HAZ-2 The project owner shall concurrently provide a Business Plan and a Risk Management Plan (RMP) to the Certified Unified Program Authority – (CUPA) (Stanislaus County) and the CPM for review at the time the RMP is first submitted to the U.S. Environmental Protection Agency (EPA). The project owner shall reflect all recommendations of the CUPA and the CPM in the final documents. Copies of the final Business Plan and RMP, reflecting all comments, shall be provided to the CPM for approval.

Verification: At least 30 days prior to receiving any hazardous material on the site, the project owner shall provide a copy of a final Business Plan to the CPM. At least 30 days prior to delivery of ammonia to the site, the project owner shall provide the final EPA-approved RMP, to the CUPA and the CPM.

HAZ-3 The ammonia storage facility shall be designed to the ASME Boiler and Pressure Vessel Code and ANSI K61.1. The design shall include a secondary containment basin capable of holding 100 percent of the storage volume plus the volume associated with 24 hours of rain assuming the 25-year storm.

Verification: At least sixty (60) days prior to delivery of anhydrous ammonia to the facility, the project owner shall submit final design drawings and specifications for the ammonia storage tank and secondary containment basin to the CPM for review and approval.

HAZ-4 The project owner shall develop and implement a Safety Management Plan for delivery of anhydrous ammonia. The plan shall include procedures, protective equipment requirements, training and a checklist.

Verification: At least sixty (60) days prior to the delivery of anhydrous ammonia to the facility, the project owner shall provide a safety management plan as described above to the CPM for review and approval.

HAZ-5 The project owner shall ensure that no flammable material is stored within 100 feet of the sulfuric acid tank.

Verification: At least sixty (60) days prior to receipt of sulfuric acid on-site, the Project Owner shall provide copies of the facility design drawings showing the location of the sulfuric acid storage tank and the location of any tanks, drums, or piping containing any combustible or flammable material.

HAZ-6 The project owner shall provide a barrier around the anhydrous ammonia storage tank that blocks it from view from locations off-site and protects against small arms fire.

Verification: At least thirty (30) days prior to construction, the Project Owner shall provide copies of the barrier design drawings to the CPM for review and approval.

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APPENDIX A

Hazardous Material Management

Basis for Staff's Use of 75 PPM as a De Minimus Ammonia Exposure Criteria

Staff uses a health-based airborne concentration of 75 PPM as a de minimus criterion to evaluate the significance of impacts associated with potential accidental releases of ammonia. While this level is not consistent with the 200-ppm level used by EPA and Cal/EPA in evaluating such releases pursuant the Federal Risk Management Program and State Accidental Release Program, it is appropriate for use in staff's CEQA analysis. The Federal Risk Management Program and the State Accidental Release Program are administrative programs designed to address emergency planning and ensure that appropriate safety management practices and actions are implemented in response to accidental releases. However, the regulations implementing these programs do not provide clear authority to require design changes or other major changes to a proposed facility. The preface to the Emergency Response Planning Guidelines (ERPGs) states that "these values have been derived as planning and emergency response guidelines, not exposure guidelines, they do not contain the safety factors normally incorporated into exposure guidelines. Instead they are estimates, by the committee, of the thresholds above which there would be an unacceptable likelihood of observing the defined effects." It is staff's contention that these values apply to healthy adult individuals and are levels that should not be used to evaluate the acceptability of avoidable exposures for the entire population. While these guidelines are useful in decision making in the event that a release has already occurred (for example, prioritizing evacuations), they are not appropriate for and are not binding on discretionary decisions involving proposed facilities where many options for mitigation are feasible. CEQA requires permitting agencies making discretionary decisions to identify and mitigate potentially significant impacts through changes to the proposed project.

Staff has chosen to use the National Research Council's 30 minute Short Term Public Emergency Limit (STPEL) for ammonia as a de minimus criterion to evaluate the potential for significant impact. This limit is designed to apply to accidental unanticipated releases and subsequent public exposure. Exposure at this level should not result in serious effects but would result in "strong odor, lacrimation, and irritation of the upper respiratory tract (nose and throat), but no incapacitation or prevention of self-rescue." It is staff's opinion that exposures to concentrations above these levels may pose some risk of adverse health impacts to sensitive members of the general public. It is also staff's position that these exposure limits are the best available criteria to use in gauging the level of exposure below which there is little or no risk to the public from exposures associated with potential accidental releases. It is, further, staff's opinion that these limits constitute an appropriate balance between public protection and mitigation of unlikely events, and are useful in focusing mitigation efforts on those release scenarios that pose real potential for serious impacts on the public. Table 1 provides a comparison of the intended use and limitations associated with each of the various criteria that staff considered in arriving at the decision to use the 75-ppm STPEL. Appendix B provides a summary of adverse effects, which might be expected to occur at various airborne concentrations of ammonia

HAZARDOUS MATERIAL MANAGEMENT
APPENDIX A TABLE 1

Acute Ammonia Exposure Guidelines

Guideline	Responsible Authority	Applicable Exposed Group	Allowable Exposure Level	Allowable* Duration of Exposures	Potential Toxicity at Guideline Level/Intended Purpose of Guideline
IDLH[2]	NIOSH	Workplace standard used to identify appropriate respiratory protection.	300 ppm	30 min.	Intentional exposure above this level requires the use of "highly reliable" respiratory protection.
IDLH/10[1]	EPA, NIOSH	Work place standard adjusted for general population factor of 10 for variation in sensitivity	30 ppm	30 min.	Protects nearly all segments of general population from irreversible effects
STEL[2]	NIOSH	Adult healthy male workers	35 ppm	15 min. 4 times per 8 hr day	No toxicity, including avoidance of irritation
EEGL[3]	NRC	Adult healthy workers, military personnel	100 ppm	Generally less than 60 min.	Significant irritation but no impact on personnel in performance of emergency work; no irreversible health effects in healthy adults. Emergency conditions one time exposure
STPEL[4]	NRC	Most members of general population	50 ppm 75 ppm 100 ppm	60 min. 30 min. 10 min.	Significant irritation but protects nearly all segments of general population from irreversible acute or late effects. One time accidental exposure
TWA[2]	NIOSH	Adult healthy male workers	25 ppm	8 hr.	No toxicity or irritation on continuous exposure for repeated 8 hr. Work shifts
ERPG-2[5]	AIHA	Applicable only to emergency response planning for the general population (evacuation) (not intended as exposure criteria) (see preface attached)	200 ppm	60 min.	Exposures above this level entail** unacceptable risk of irreversible effects in healthy adult members of the general population (no safety margin)

1) (EPA 1987) 2) (NIOSH 1994) 3) (NRC 1985) 4) (NRC 1972) 5) (AIHA 1989)

* The (NRC 1979), (WHO 1986), and (Henderson and Haggard 1943) all conclude that available data confirm the direct relationship to increases in effect with both increased exposure and increased exposure duration.

** The (NRC 1979) describes a study involving young animals, which suggests greater sensitivity to acute exposure in young animals. The (WHO 1986) warns that the young, elderly, asthmatics, those with bronchitis and those that exercise should also be considered at increased risk based on their demonstrated greater susceptibility to other non-specific irritants

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ABBREVIATIONS FOR APPENDIX A, TABLE 1

ACGIH, American Conference of Governmental and Industrial Hygienists
AIHA, American Industrial Hygienists Association
EEGL, Emergency Exposure Guidance Level
EPA, Environmental Protection Agency
ERPG, Emergency Response Planning Guidelines
IDLH, Immediately Dangerous to Life and Health Level
NIOSH, National Institute of Occupational Safety and Health
NRC, National Research Council
STEL, Short Term Exposure Limit
STPEL, Short Term Public Emergency Limit
TLV, Threshold Limit Value
WHO, World Health Organization

APPENDIX B

SUMMARY OF ADVERSE HEALTH EFFECTS OF AMMONIA

> 5000 PPM

- Heavy casualties with 5-10 minutes exposure; shorter exposures are unlikely in practice.
- 100 percent fatalities

2500-5000 PPM

- A few fatalities with 5 minutes exposure
- 90-100 percent fatalities with 1 hour exposure, depending on concentration.

638 PPM

WITHIN SECONDS:

- Might interfere with capability to self rescue;
- Reversible effects such as severe eye, nose and throat irritation.

AFTER 30 MINUTES:

- Persistent nose and throat irritation even after exposure stopped;
- irreversible or long-lasting effects possible: lung injury;
- Sensitive people such as the elderly, infants, and those with breathing problems (asthma) experience difficulty in breathing;
- asthmatics will experience a worsening of their condition and a decrease in breathing ability, which might impair their ability to move out of area.

266 PPM

WITHIN SECONDS:

- Very strong odor of ammonia;
- Reversible moderate eye, nose and throat irritation.

AFTER 30 MINUTES:

- Some decrease in breathing ability but doubtful that any effect would persist after exposure stopped;
- Sensitive persons: experience difficulty in breathing;
- asthmatics: may have a worsening condition and decreased breathing ability, which might impair their ability to move out of the area.

64 PPM

WITHIN SECONDS:

- Most people would notice a strong odor;
- Tearing of the eyes would occur;
- Odor would be very noticeable and uncomfortable.
- Sensitive people could experience more irritation but it would be unlikely that breathing would be impaired to the point of interfering with capability of self rescue
- Mild eye, nose, or throat irritation
- Eye, ear, & throat irritation in sensitive people
- asthmatics might have breathing difficulties but would not impair capability of self rescue

22 or 27 PPM

WITHIN SECONDS:

- Most people would notice an odor;
- No tearing of the eyes would occur;
- Odor might be uncomfortable for some;
- sensitive people may experience some irritation but ability to leave area would not be impaired;
- Slight irritation after 10 minutes in some people.

4.0, 2.2, or 1.6 PPM

- No adverse effects would be expected to occur;
- doubtful that anyone would notice any ammonia (odor threshold 5 - 20 PPM);
- Some people might experience irritation after 1 hr.

APPENDIX C

TID, Walnut Energy Center Chemical Inventory

Trade Name	Chemical Name	CAS Number	Maximum Quantity Onsite
Acutely Hazardous Materials			
Anhydrous Ammonia	Anhydrous Ammonia	7664-41-7 (NH_3)	10,200 gal.
Neutralizing Amines (e.g., NALCO 356)	Cyclohexylamine (20 to 40%)	108-91-8	400 gal.
	Morpholine (5 to 10%)	110-91-8	
Sulfuric Acid	Sulfuric Acid (93%)	7664-93-9	8,000 gal.
Hazardous Materials			
Ammonium Bifluoride	Ammonium Bifluoride	1341-49-7	200 lbs. initially and once every 3 to 5 years
Anti-Foam (e.g., NALCO 71 D5 ANTIFOAM)	Hydrotreated light distillate (10-20%)	6742-47-8	400 gal.
	n-Decanol (1-5%)	112-30-1	
	n-Octanol (5-10%)	118-87-5	
Antifreeze	Propylene Glycol	57-55-6	55 gal.
Calcium Sulfate	Calcium Sulfate	10101-41-4	4,000 lbs.
Chelating Agents	Ethylenediaminetetra-acetic acid (EDTA)	60-00-4	55 gal.
Citric Acid	Citric Acid	77-92-9	100 lb.
Cleaning Chemicals/Detergents	Various	None	100 gal.
Diesel No. 2	Oil	None	500 gal.
Formic Acid	Formic Acid	64-18-6	600 lb. prior to startup. 100 gal. on a regular basis
Hydraulic Oil	Oil	None	500 gal.
Hydrochloric Acid	Hydrochloric Acid (30%)	7647-01-0	10,000 lb. initially and once every 3 to 5 years; 55 gal. on a regular basis
Hydroxyacetic Acid	Gyrolic Acid	None	1000 lb. prior to startup. 100 gal. on a regular basis
Laboratory Reagents (liquid)	Various	None	10 gal.
Laboratory Reagents (solid)	Various	None	100 lb.
Lubrication Oil	Oil	None	15,000 gal.
Mineral Insulating Oil	Oil	8012-95-1	70,000 gal.
Non-Oxidizing Biocide (e.g., NALCO 7330)	5-Chloro-2-Methyl-4-Isothiazolin-3-one (1.1%)	26172-55-4	200 gal.
	2-Methyl-4-Isothiazolin-3-one (0.3%)	2682-20-4	
Oxygen Scavenger (e.g., NALCO ELIMIN-OX)	Carbohydrazide	497-18-7	400 gal.

Trade Name	Chemical Name	CAS Number	Maximum Quantity Onsite
Scale Inhibitors (various)	Polyacrylate	Various	1,500 gal.
Sodium Bromide	Sodium Bromide	7647-15-6	6,000 gal.
Sodium Carbonate (Soda Ash)	Sodium Carbonate	497-19-8	1,000 lb. initially and once every 3 to 5 years
Sodium Hypochlorite (Bleach)	Sodium Hypochlorite (12.5%)	7681-52-9	8,000 gal.
Sodium Nitrate	Sodium Nitrate	7631-99-4	500 lb. initially and once every 3 to 5 years
Sodium Nitrite	Sodium Nitrite	7632-00-0	500 lb. initially and once every 3 to 5 years
Sodium Sulfate	Sodium Sulfate	7757-82-6	4,000 lb.
Stabilized Bromine (NALCO STABREX ST70)	Sodium Hydroxide (1 to 5%) Sodium Hypobromite (10 to 50%)	1310-73-2 13824-96-9	2,000 gal.
Sulfur Hexafluoride	Sulfur Hexafluoride	2551-62-4	200 lb.
Trisodium Phosphate	Sodium Phosphate, Tribasic	7601-54-9	400 gal.