



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

The February 29, 2004 inspection report for the inspection of Calpine Greenleaf Unit 2 was issued as an attachment to the April 20, 2004 EPA request for information under Section 308 of the Clean Water Act.

Greg V. Arthur



U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 9
CLEAN WATER ACT COMPLIANCE OFFICE

NPDES COMPLIANCE EVALUATION INSPECTION REPORT

Industrial User: Calpine Greenleaf Unit 2
845 North Walton Avenue, Yuba City, California 95993
Non-categorical Significant Industrial User

Treatment Works: Yuba City Wastewater Treatment Plant
(NPDES Permit CA0079260)

Dates of Inspection: August 20, 2003

Inspection Participants:

US EPA: Greg V. Arthur, CWA Compliance Office, (415) 972-3504
Meg Masquelier, CWA Compliance Office, (415) 972-3536

RWQCB: No Representative

Yuba City: Mike Paulucci, Chemist, (530) 822-7695

Calpine: Diane Tullos, Compliance Manager, (530) 821-2074
Scott Alcantara, Compliance Specialist, (530) 821-2060

Report Prepared By: Greg V. Arthur, Environmental Engineer
February 29, 2004

Section 1

Introduction and Background

1.0 Scope and Purpose

On August 20, 2003, EPA conducted a compliance sampling inspection of Calpine Greenleaf Unit 2 Power Plant (“Greenleaf Unit 2”) in Yuba City. The purpose was to ensure compliance with the Federal regulations covering the discharge of non-domestic wastewaters into the sewers. In particular, it was to ensure:

- Classification in the proper Federal categories;
- Application of the correct standards at the correct points;
- Consistent compliance with the standards; and
- Fulfillment of Federal self-monitoring requirements.

Greenleaf Unit 2 is one of three significant industrial users (“SIUs”) in Yuba City whose compliance was assessed as part of EPA’s 2004 evaluation of the Yuba City pretreatment program. Yuba City and Calpine received individual reports. The inspection participants are listed on the title page. Arthur conducted the inspection and collected samples on August 20.

1.1 Facility Description

Greenleaf Unit 2 is a 49.5 megawatt electric power and cogenerating plant in operation since 1989 at 845 North Walton Avenue in Yuba City. It generates power by burning natural gas in a combustion gas turbine. It also cogenerates steam for Sunsweet Growers next door by passing the exhaust over water-filled heat exchangers. The gas exhaust then discharges through two fume scrubbers to a stack. The first is a selective catalyst reduction scrubber that injects ammonia into the exhaust to convert nitrous oxides into steam and nitrogen. The second catalytically oxidizes carbon monoxide into carbon dioxide. Greenleaf Unit 2 does not employ steam stripping or any other type of wet fume scrubbing. See Figure 1.

The power plant also employs a boiler, a steamside cooling tower to cool the chillers for incoming air, a lube oil cooling tower, and a ion exchange water softener. The operation of the cooling towers and boiler involves the introduction of various anti-scaling agents and biocides. The delivery of steam to Sunsweet involves the on-site water softening and the chemical addition of cyclohexylamine, morpholine, diethylethanolamine, and sodium nitrate.

Section 1 – Introduction and Background

1.2 Waste Streams

Cooling Tower Blowdown – Both cooling towers generate blowdown for discharge to the sewers. The chemical additives used in the cooling towers and expected in their blowdown include bromine as a biocide, and a molybdenum-based descalant. The blowdown would be expected to contain the minerals concentrated out of the incoming water supply but EPA cannot determine whether it would be acidic, caustic or neutral in pH.

Boiler Blowdown – The boiler also generates a blowdown for discharge to the sewers. The chemical additives used in the boiler and expected in the blowdown include sodium hydroxide, sodium tripolyphosphate, diethylethanolamine, erythorbic acid, and sodium bisulfite. The blowdown would be expected to be caustic in nature.

Water Softener Regenerant – The ion exchange water softener is regenerated on-site with the regenerant discharged to the sewers. The regenerant would be expected to contain salts extracted from the incoming water supply as well as the strong caustics and acids used to regenerate ion exchange columns.

Chemical Cleaning – Boiler and heat exchanger tubes require periodic chemical cleaning involving strong metal surface cleaners such as hydrochloric acid with chelating agents, phosphoric acid and phosphoric/nitric acid descalants, ammoniated oxidizers, as well as pressure washing and alkaline removal of organic deposits. So far, Calpine has never had to chemically clean the boiler and heat exchanger tubes at Greenleaf Unit 2.

1.3 Wastewater and Waste Handling

Sewered Discharges – The cooling towers blowdown, boiler blowdown, and the water softener regenerant discharge on-demand to an in-plant sewer that empties through a single connection into the sewers. The Yuba City permit authorizes discharge flow rates up to 200,000 gpd. The 2003 discharge flow rate averaged 47,600 gpd with single-day peaks as high as 173,000 gpd. See Table 1 for a water quality summary.

Treatment On-site – The only on-site treatment is pH adjustment of the water softener regenerant. The regenerant fills a holding tank for pH adjustment in two 20,000 gallon reactor tanks prior to discharge to the sewers. All other wastewaters discharge without treatment to the sewers. The water quality of the 2003 discharges varies greatly with specific conductivities (“EC”) ranging from 56 to 7850 umohs/cm. On the day of this inspection the pH was recorded to be 12.6 s.u. See Table 3 for sampling results.

1.4 Wastewater Discharge Permitting

Greenleaf Unit 2 operates under Yuba City permit No. 02-5. The Greenleaf Unit 2 permit authorizes the discharge of non-domestic wastewaters to the sewers through a sample box

Section 1 – Introduction and Background

located in a shed at the edge of the property. This sample point is not designated in the permit itself, but is referred to in this report as IWD-LOC1. The Yuba City Cogeneration Plant operates on an adjacent property with the same mailing address under a separate Yuba City permit. The Yuba City Cogeneration Plant was not inspected as part of this inspection.

Section 2

Sewer Discharge Standards and Limits

Federal categorical pretreatment standards (where they exist), national prohibitions, and the local limits (where they exist) must be applied to the sewer discharges from industrial users. 40 CFR 403.5 and 403.6.

2.0 Summary

No Federal categorical pretreatment standards apply to the process wastewater discharges from Greenleaf Unit 2. The Yuba City permit only applies local limits for pH and specific conductivity. Moreover, the local limits were adopted in the 1970's and are not reflective of current regulatory requirements, which now include effluent limits for toxics derived from the California Toxic Rule. As a result, the permit does not state the discharge requirements. The application of Federal categorical standards, national prohibitions and local limits was determined through visual inspection. See Table 2 for the discharge requirements.

Requirements

- The permit must apply the national prohibitions against causing adverse impacts to the Yuba City treatment works.
- The permit must be revised to apply local limits for all pollutants of concern once Yuba City redetermines them to be reflective of the current regulatory requirements.

Recommendations

2.1 Classification by Federal Point Source Category

Greenleaf Unit 2 is a significant industrial user discharging over 25,000 gpd to the sewers. It does not qualify as a categorical industrial user subject to the Federal steam electric power generating standards in 40 CFR 423. The steam electric rule does not apply because Greenleaf Unit 2 satisfies just two of the three qualifying conditions in 40 CFR 423.10; it generates electrical power for sale, burns a fossil or nuclear fuel, but does not generate any power through steam-driven turbines. The steam electric rule would cover a combined-cycle cogeneration plant that uses steam-driven turbines to generate power from exhaust heat.

Section 2 – Sewer Discharge Standards and Limits

2.2 Local Limits and National Prohibitions

Local limits and the national prohibitions are meant to express the limitations on non-domestic discharges necessary to protect the sewers, treatment plants and their receiving waters from adverse impacts. In particular, they prohibit discharges that can cause the pass-through of pollutants into the receiving waters or into reuse, the operational interference of the sewerage works, the contamination of the sewage sludge, sewer worker health and safety risks, fire or explosive risks, and corrosive damage to the sewers.

The national prohibitions apply nationwide to all non-domestic sewer discharges. Local limits, like those for Yuba City, are meant to translate the predominantly narrative national prohibitions into numeric limits that apply strictly to the non-domestic discharges within its sewer service area. However, the Yuba City local limits are not based on the protection of its sewerage works as they are currently configured and operated. Instead the version of the local limits incorporated into the permits was adopted in the 1970's. A later 1990's version of the local limits, not adopted by the city council, also would no longer be protective. The 2003 version of the NPDES permit for the Yuba City wastewater treatment plant now has a more involved list of pollutant limits, including new limits for toxics derived from the California Toxics Rule. Although Yuba City has challenged this permit, no matter the outcome, it will likely have to develop new local limits to reflect the specific discharge requirements upon its wastewater treatment facility now.

2.3 Compliance Sampling and Point(s) of Compliance

The sampling shack at the property edge serves as the compliance sampling point, as long as all non-domestic wastewaters discharged on-site do so through the sampling shack. The non-domestic wastewaters identified during this inspection are cooling tower blowdown, water softener regenerant, boiler blowdown, and secondary containment run-off, although there may be others. The sampling shack is designated in this report as IWD-LOC1. Local limits and the national prohibitions are instantaneous-maximums that are comparable to samples of any length including single grab samples.

2.4 Pollutants of Concern

The permit should advance local limits and self-monitoring requirements for aluminum, copper, iron, molybdenum, and zinc, since the discharges include significant concentrations of these pollutants and the Yuba City wastewater treatment plant is regulated for them by the NPDES permit and the Federal sludge standards. The permit should also advance local limits for both minimum and maximum pH and specific conductivity since there are strongly alkaline and acidic wastewaters, as well as brines. The numeric limits would be expected to change once Yuba City re-determines its local limits based on current wastewater treatment plant performance.

Section 3

Compliance with Federal Standards

Industrial users must comply with the Federal categorical pretreatment standards that apply to their process wastewater discharges. 40 CFR 403.6(b).

Categorical industrial users must comply with the prohibition against dilution of the Federally-regulated waste streams as a substitute for treatment. 40 CFR 403.6(d).

Industrial users must comply with the provision restricting the bypass of treatment necessary to comply with any pretreatment standard or requirement. 40 CFR 403.17(d).

3.0 Summary

No Federal categorical pretreatment standards apply to Greenleaf Unit 2 because power is generated with combustion gas turbines and the cogenerated steam is not used to generate electrical power. Moreover, as a result, there can be no dilution as a substitute for treatment nor any bypass of treatment necessary to comply with Federal standards.

Requirements

- None.

Recommendations

- None.

Section 4

Compliance with Local Limits and National Prohibitions

All non-domestic wastewater discharges to the sewers must comply with local limits and the national prohibitions. 40 CFR 403.5(a,b,d).

Industrial users must comply with the provision restricting the bypass of treatment necessary to comply with any pretreatment standard or requirement. 40 CFR 403.17(d).

4.0 Summary

Greenleaf Unit 2 has not consistently complied with the local limits for all pollutants of concern (*aluminum, copper, iron, molybdenum, zinc*) nor for all those associated with the performance of the Yuba City sewerage works (*pH, EC, TDS, flow*). One pH measurement was high enough to qualify the discharge as a characteristic hazardous waste. However, for two reasons, no definitive conclusions can be made regarding compliance. First, the local limits do not reflect the current regulatory requirements and thus are not protective of the sewerage works. Second, Greenleaf Unit 2 generates a non-uniform schedule of wastewaters of widely varying strengths and flows. Yuba City will have to develop new local limits reflective of new regulatory requirements, in particular for aluminum and iron, and determine a statistically representative sampling schedule. See item 5 of this report.

Requirements

- All waste streams must be identified by water quality, flow rate, and discharge schedule.

- All acidic and alkaline waste streams should be batch treated for pH prior to discharge.

- Highly acidic and alkaline waste streams, after pH adjustment, as well as other high-TDS waste streams, should be metered into the sewer or hauled off-site.

- The aluminum and iron content of each waste stream should be determined.

4.1 National Objectives

The general pretreatment regulations were promulgated in order to fulfill the national objectives to prevent the introduction of pollutants that:

- (1) cause operational interference with sewage treatment or sludge disposal,

Section 4 – Compliance with Local Limits and National Prohibitions

- (2) pass-through sewage treatment into the receiving waters or sludge,
- (3) are in any way incompatible with the sewerage works, or
- (4) do not improve the opportunities to recycle municipal wastewaters and sludge.

This evaluation did not include an evaluation of whether achievement of the national objectives in 40 CFR 403.2 have been demonstrated by consistent compliance with the sludge and discharge limits at the Yuba City wastewater treatment plant. That analysis will be available later as part of the EPA evaluation report for Yuba City expected for release in late March 2003. If the objectives are not found to have been achieved in Yuba City, then Greenleaf Unit 2 and the other industrial users in the Yuba City sewer service area would have to comply with new Yuba City local limits recalculated to be protective of the sewerage works.

4.2 Local Limits for Metals

The 2000-2003 sample record consists of only four sample results for metals, including one collected by EPA during this inspection. The EPA sample exceeded the local limit for iron, and approached the local limits for copper, aluminum, and zinc. The permit for Greenleaf Unit 2 lists none of the applicable local limits for metals. Nevertheless, even if it did list them, no definitive conclusions regarding protection of the sewerage works can be made because the local limits do not reflect the current regulatory requirements. However, the samples are indicative of the widely varying discharge quality related to various unidentified operational schedules at Greenleaf Unit 2 and of its contribution to Yuba City's difficulties in achieving compliance with its NPDES permit limits for iron and aluminum. See item 5 of this report.

4.3 Local Limits for Solvents and The National Prohibition Against Flammability

Flammability is not a risk because of an expected lack of organic solvents in the waste streams. See Table 1.

4.3 Local Limits for pH and The National Prohibition Against Corrosive Structural Damage

The discharge involves the introduction of various acidic and alkaline wastewaters discharged on unidentified operational schedules without controlled pH adjustment. On numerous occasions the pH of the overall discharge at IWD-LOC1 exceeded the upper pH local limit of 9.5 s.u. In particular, on the day of this inspection, EPA measured the pH of the discharge to be 12.6 s.u., which is caustic enough to qualify the wastewater as a characteristic hazardous waste under 40 CFR 261.22. Control of the pH would likely involve the pH adjustment and metered handling or off-hauling of certain wastewaters identified as particularly caustic.

Section 5

Compliance with Federal Monitoring Requirements

Significant industrial users must self-monitor for all regulated parameters at least twice per year unless the sewerage agency monitors in place of self-monitoring. 40 CFR 403.12(e) & 403.12(g).

Each sample must be representative of the sampling day's operations. Sampling must be representative of the conditions occurring during the reporting period. 40 CFR 403.12(g) & 403.12(h).

5.0 Summary

There are not enough self-monitoring results collected under the right conditions to satisfy the requirements for representative sampling. In particular, the widely varying discharge quality (as shown by the specific conductivity measurements) is indicative of various contributing waste streams discharging on unidentified operational schedules. Once Calpine identifies the operational schedule of wastewater discharges, the twice per year self-monitoring per waste stream can begin, thereby ensuring the sample record is representative of the discharges expected from Greenleaf Unit 2. Furthermore, unless the entire discharge undergoes controlled pH adjustment, the sampling for pH must be continuous in order to be statistically representative of the uncontrolled nature of the discharges. See item 4 of this report.

Requirements

- The overall discharge to the sewers must be self-monitored for aluminum, copper, iron, molybdenum, zinc, pH, TDS, and EC.
- The overall discharge to the sewers must be self-monitored enough times to ensure that the sample record accounts for each of the contributing waste streams twice per year.
- The overall discharge to the sewers must be continuously self-monitored for pH.

Recommendations

- Each of the contributing waste streams identified as discharging to the sewers should be separately sampled at least once per year for the same pollutants of concern.
- The continuous pH measurements should be reported in minutes per day over 9.5 and 12.5 s.u., and under 6.5, 5.0 and 2.0 s.u.

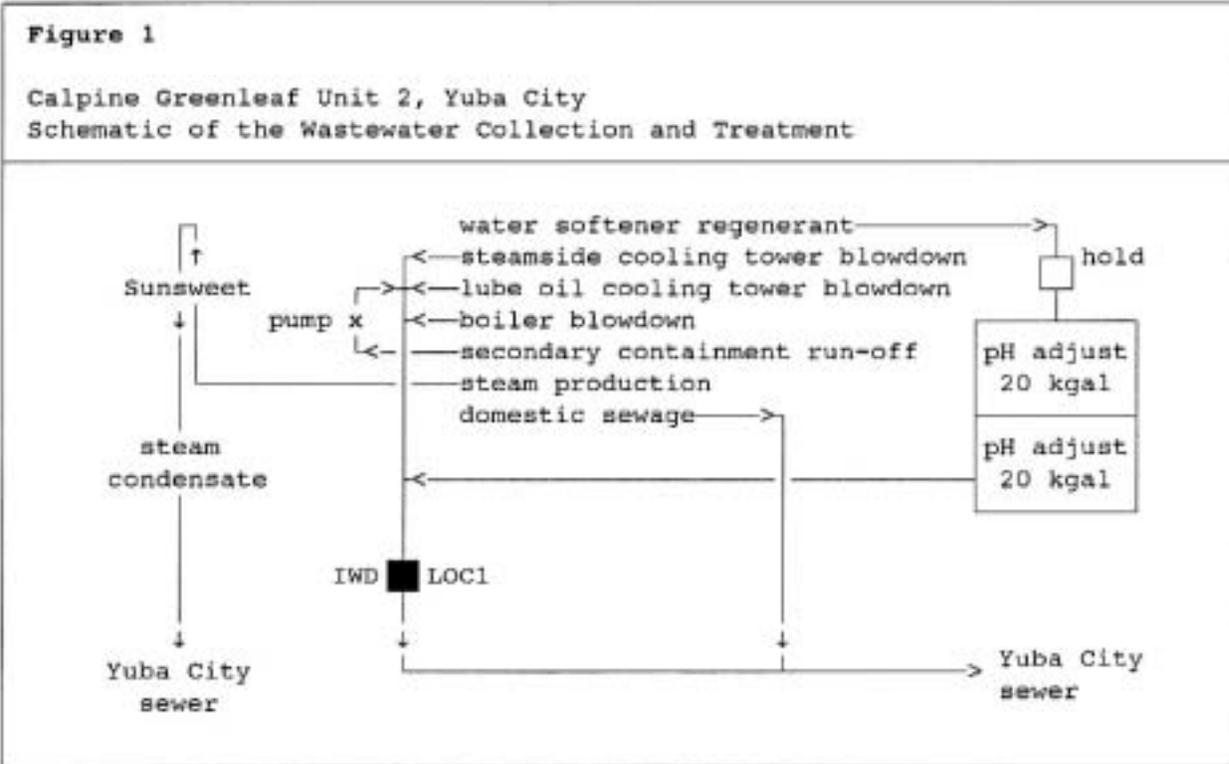


Table 1
 Discharge Quality at IWD-1
 Calpine Greenleaf Unit 2, Yuba City

| Pollutants (mg/l) Jan-2000 to Sep-2003 | Effluent | | | Fed Violations | | Local inst |
|-------------------------------------------|-------------|-------|---------|----------------|-----|------------|
| | Mean | 99th% | Max | d-max | avg | |
| arsenic | | | 0.002 | ns | ns | 0/1 |
| aluminum | | | 3.600 | ns | ns | 0/2 |
| ammonia | | | <1.000 | ns | ns | 0/1 |
| copper | 0.113 | 0.491 | 0.300 | ns | ns | 0/4 |
| iron | | | 9.800 | ns | ns | 1/2 |
| nickel | 0.022 | 0.090 | 0.064 | ns | ns | 0/4 |
| mercury | | | <0.0002 | ns | ns | ns |
| molybdenum | | | 2.000 | ns | ns | ns |
| selenium | | | 0.009 | ns | ns | 0/1 |
| zinc | 0.301 | 1.450 | 0.870 | ns | ns | 0/4 |
| semi-VOAs | | | <0.010 | ns | ns | ns |
| EC ($\mu\text{mhos/cm}^2$) | 962 | 4198 | 7850 | ns | ns | 0/91 |
| pH (s.u.) | 7.1 to 12.6 | | | 0/= | ns | >6/= |
| ns no standard | | | | | | |

Table 2

Clean Water Act Requirements - Greenleaf Unit 2, Yuba City
Sampling Shack (IWD-LOCl)

| Specific Numerical Limits (mg/l) | Nat'l Prohib Prohib inst | Local Limits Limits inst | |
|----------------------------------|---------------------------------------------|--------------------------|--|
| aluminum | - | 5.0 | |
| ammonia | - | 20.0 | |
| antimony | - | 5.0 | |
| arsenic | - | 1.0 | |
| benzene phenols derivatives | - | 1.0 | |
| bromine chlorine iodine | - | 10.0 | |
| cadmium | - | 0.1 | |
| chromium | - | 0.5 | |
| copper | - | 0.5 | |
| formaldehyde | - | 5.0 | |
| iron | - | 5.0 | |
| lead | - | 0.5 | |
| manganese | - | 1.0 | |
| molybdenum | - | - | |
| nickel | - | 1.0 | |
| oil+grease | - | 100. | |
| selenium | - | 5.0 | |
| silver | - | 0.05 | |
| zinc | - | 1.0 | |
| total solvents | - | 1.0 | |
| discharge flow (mgd) | - | 200000 | |
| temperature (°F) | - | <150°F | |
| pH-minimum (s.u.) | <5.0 | <5.0 | |
| maximum (s.u.) | - | >9.5 | |
| spec conductivity (umohs/cm) | - | 10000 | |
| Regulation | Yuba City Municipal Code Title 6, 5.4 | | |

Instantaneous limits are comparable to any sample (24-comp, grabs, etc.)

Narrative Limits

National Prohibitions

- Pass-through, interference, sludge contamination, obstruction, toxic gases/fumes, fire/explosion hazard
- Causing heat >104°F at WWTP

Table 3

Sampling Results - Calpine Greenleaf Unit2, Yuba City
August 20, 2003

| Sample Results (mg/l) | Greenleaf Unit 2 @ IWD-001 | Yuba City Influent @ IWD-YC1 |
|----------------------------|----------------------------|------------------------------|
| aluminum | 3.60 | 1.40 |
| silver | <0.0005 | 0.00085 |
| arsenic | 0.0087 | 0.0026 |
| cadmium | 0.0016 | <0.001 |
| chromium | 0.0470 | 0.0041 |
| copper | 0.300 | 0.028 |
| mercury | <0.00006 | 0.00032 |
| molybdenum | 2.00 | 0.010 |
| nickel | 0.064 | 0.0039 |
| iron | 9.80 | 0.760 |
| lead | 0.0044 | 0.0026 |
| selenium | 0.007 | 0.0007 |
| zinc | 0.87 | 0.095 |
| cyanide-total | - | <0.010 |
| hardness | - | 92 |
| sodium | 1700 | 61 |
| chloride | - | 66 |
| ammonia as N | - | 10 |
| nitrate as N | - | 0.51 |
| o-phosphate as P | - | 3.5 |
| sulfate | - | 14 |
| benzyl alcohol | <0.100 | 0.068 |
| 3,4-methylphenol | <0.100 | 0.051 |
| bis(2-ethylhexyl)phthalate | <0.100 | 0.145 |
| other semi-VOAs | <0.100 | <0.100 |
| acetone | 0.013 | - |
| chloroform | 0.0032 | - |
| bromoform | 0.0008 | - |
| chloroform | 0.0032 | - |
| other VOAs | <0.0010 | - |
| pH (s.u.) | 12.6 | - |
| EC (µmohs/cm) | - | 610 |
| closed cup flashpoint | - | - |
| Sample Number | YC008 | YC001 |
| Date | 08/20/03 | 08/27/03 |
| Type | 24-h comp | 24-h comp |

All samples collected, kept in custody, and delivered to the laboratory by Greg V. Arthur. Samples analyzed by EPA Richmond Lab. Sampling documentation including chain of custody and quality control results are part of the April 2004 pretreatment program evaluation report for Yuba City.