COMANCHE PEAK STEAM ELECTRIC STATION
ENVIRONMENTAL REPORT OPERATING LICENSE STAGE
DECEMBER 1980 AMENDMENT
INSTRUCTION SHEET

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TABLE 3.6-1

CHEMICALS CONSUMPTION DURING
CPSES OPERATION - UNITS 1 AND 2

Chemical	Average (lb/day)
Sulfuric acid	630
Sodium hydroxide	270
Morpholine	160
Hydrazine	16
Boric acid	Variable
Potassium chromate	0.062
Chlorine, circulating water	1650
Chlorine, service water	1400
Sodium hypochlorite	50
Sodium sulfite	8*
Lithium hydroxide	Variable
Sodium hexametaphosphate (Reverse osmosis system)	10
Polymer** (Water clarifier)	7
Calgon corrosion inhibitor - CS (72% sodium nitrite, 28% borax)	0.032
Formaldehyde (Reverse osmosis system)	0.2
Powdex resin*** (Condensate polishers)	180

* Used for auxiliary boiler chemical treatment only 30 days per year at 8 lb/day

** This is a proprietary chemical supplied by Nalco as their product No. 8101. Information concerning its chemical composition is unavailable.

*** This is supplied by Ecodyne-Graver and is a styrene divinylbenzene polymer.

unlikely that it would be used for this purpose after CPSES has been decommissioned.

5.8.1.2 Cost

NUREG/CR-0130 estimates the cost to dismantle the reference PWR to be $42.1 million (1978 dollars). The table below is from reference [1]. It is printed here to show how the study allocated cost among various categories.

TABLE 10.1-1. Summary of Estimated [1] Dismantlement Costs for the Reference PWR Facility

1

Category	Cost of Millions of 1978 Dollars	Percent of Total
Spent Fuel Disposal	2.467	7.3
Activated Materials Disposal	2.734	
Containment Internals Disposal	0.961	
Other Building Internals Disposal	4.222	25.6
Waste Disposal	0.693	
Staff Labor	8.986	26.7
Electrical Power	3.500	10.4
Special Equipment	0.822	2.4
Miscellaneous Supplies	1.559	4.6
Facility Demolition (non-radioactive)	6.410	19.0
Specialty Contractors	0.390	1.2
Nuclear Insurance	0.800	2.4
Environmental Surveillance	0.154	0.5
SUBTOTAL	33.698	
25% Contingency	8.425	
TOTAL DISMANTLING COSTS (ROUNDED)	42.1	

For the purpose of estimating decommissioning cost for CPSES, the $42.1 million (1978 dollars) is escalated at ten percent per year for two years to give approximately $50 million (1980 dollars). The cost estimate for decommissioning CPSES is $50 million per unit (1980 dollars).

1 5.8.2 REFERENCES

[1] Technology, Safety and Cost of Decommissioning a Reference Pressurized Water Reactor Power Station. NUREG/CR-0130, Pacific Northwest Laboratory for U.S. Nuclear Regulatory Commission, June 1978.

[2] Technology, Safety and Cost of Decommissioning a Reference Pressurized Water Reactor Power Station. NUREG/CR-0130 ADDENDUM, Pacific Northwest Laboratory for U.S. Nuclear Regulatory Commission, August 1979.

6.2 APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

This section supercedes the presentation contained in Section 6.2 of
the original ER, and discusses the environmental monitoring programs
that will be conducted during CPSES operation. Some aspects of the
program will be developed in more detail in the Environmental Technical 1
Specifications (ETS) which will be established in accordance with
applicable NRC Regulations. In addition, the terms of the National
Pollutant Discharge Elimination System (NPDES) permit issued by the
U.S. Environmental Protection Agency (EPA) form the basis for some
portions of the thermal and chemical monitoring requirements. In
general, those facets of the program covered directly by the NPDES 1
permit are not described in detail within this section.

6.2.1 RADIOLOGICAL MONITORING

The radiological monitoring program, operational stage, will be a
continuation of the preoperational program previously described in
Section 6.1.5 and paragraph 3/4.12.1 of the Standardized Radiological 1
Effluent Technical Specification, NUREG 0472. The operational phase
will be continued for the first three full years of commercial
operation to verify the adequacy of source control. If data from the
program and effluent calculations indicate that doses and
concentrations associated with a particular pathway are sufficiently
small, the number of media sampled in the pathway and the frequency of
sampling may be appropriately reduced.

6.2.2 CHEMICAL EFFLUENT MONITORING

Under normal operating conditions, chemicals (other than chlorine) will
not be discharged from the plant into Squaw Creek Reservoir (SCR), but
will be routed to an onsite evaporative storage pond. This pond has an
impermeable clay liner to prevent contamination of the local surface
and groundwater resources, and has been designed to accommodate the

non-radioactive chemical wastes accumulated during the expected operating life of the plant.

A chlorine minimization study will be conducted during the first year of operation of each unit to develop a sound, scientifically based
1 chlorination program to maintain condenser efficiency using a minimum of chlorine. This study has been approved and will be performed under conditions in the NPDES permit.

6.2.3 THERMAL EFFLUENT MONITORING

The monitoring of thermal effluents will be performed as specified within the NPDES permit. Under the terms of the permit, temperatures will be measured where the circulating water discharge canal meets SCR. Additionally, two SCR monitoring programs will be undertaken to assess the thermal efficiency of SCR and thermally characterized biological collecting stations (see Section 6.2.6.1.1).

6.2.4 METEOROLOGICAL MONITORING

Prior to fuel load of Unit One, the meteorological measurements program of the Comanche Peak Steam Electric Station shall consist of the following:

1. A primary meteorological measurements program.

2 2. A backup meteorological measurements system.

3. A system for making near real-time predictions of the atmospheric effluent transport and diffusion.

4. A capability for remote interrogation, on demand, of the atmospheric measurements and prediction systems by the licensee, emergency response organizations, and the NRC Staff.

To accomplish these goals, the preoperational meteorological instrument system will be modified to transmit meteorological parameters to the Meteorological instrument Panel in the Control Room and the Radiation Monitoring System computer.

The parameters, which are wind speed and wind direction at 10 and 60 meters and delta-temperature between 10 and 30 meters and 10 to 60 meters, will be 1) continuously recorded at the Meteorological Instrument Panel and 2) scanned once per minute by the radiation monitoring system computer where they will be averaged each hour and stored. A time-history of the meteorological data will be available in analog form (strip charts) and from the hourly averaged digital data provided by the computer.

The ambient temperature at 10m level will also be displayed on strip chart recorders on the Meteorological Instrument Panel in the Control 2
Room.

The computer will keep track of current averages of diffusion meteorology, measured effluent release rates, and the inventory for fission products released. The system will include the required software which will permit plant operators to make real-time, site-specific estimates and predictions of atmospheric effluent transport and diffusion during and immediately following an accidental airborne radioactivity release from the plant.

A viable backup system to provide measurements respresentative of site conditions of wind speed and direction and delta-temperature for substitution of lost or invalid primary data will be available before fuel load of Unit One.

The operational program will be conducted in accordance with the requirements specified in Regulatory Guide 1.21 and 4.1, proposed revision 1 to Regulatory Guide 1.23, and revision 1 to NUREG-0654.

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TABLE 8.1-21 (Sheet 1 of 2)

PRINCIPAL BENEFITS OF
COMANCHE PEAK STEAM ELECTRIC STATION
(1983)

Direct Benefits

Expected average annual power generation (million kwh)	9,300
Capacity of plant, kilowatts (Unit 1)	2,300,000

Proportional distribution of electrical energy
Expected Annual Delivery (in millions of kwh)

Customer Group	TOTAL	PERCENT
Industrial	1,120	32
Commercial	700	20
Residential	1,400	40
Public	105	3
Other	175	5
Total	3,500	100

Total Annual Revenues $211.036 million[(a)]

Indirect Benefits

Taxes:

	Average Annual ($000)
Local (property)[(b)]	$628,551.56
State [(b)]	19,743.17
Federal [(c)]	0.00
	$648,394.73

Regional Product:

Value added in value of output of businesses in project area corresponding to direct annual wages of employees, plus induced consumption and investment as result of multiplier effect. (See Section 8.1.4).

The major component of operating and maintenance expense (O&M) is fuel cost. Using 1980 Dollars and a 70 percent annual load factor, the annual fuel cost and other representative O&M costs are as follows: 1 Q33

	(Thousands)
Fuel cost	$69,956
All other O&M cost	$20,972
Total	$90,928

Fuel cost is based upon 1980 market values of the various fuel cycle components. The O&M costs are based current estimates in 1980 dollars.

The major cost elements included in the non-fuel portion of O&M costs are operating and maintenance labor, other maintenance expense, quality assurance, home office technical support, license fees and directly related taxes. Ad valorem taxes and insurance are not included here, but are included in the fixed charges shown in Section 8.2.1.4.

8.2.1.3 Decommissioning Cost

Decommissioning of CPSES is projected to commence in the year 2022. The cost is estimated to be $50 million per Unit (1980 dollars). See Section 5.8 for details of this estimate. 2 Q33

8.2.1.4 Power Generating Cost

On the basis of the foregoing estimates of capital, direct operating and decommissioning costs, it is estimated that the 1980 present value of power generating cost over the first 30 years of useful life is $5,350 million. This estimate is comprised of the following components: 2

	(Millions)
Fixed Charges	\$ 3,172
Operating, Maintenance and Fuel Costs	\$ 2,078
2 Allowance for Decommissioning	\$ 100
Total (lifetime cost)	\$5,350

The fixed charges were determined by using a levelized fixed charge rate of 20% of the capital cost of the facility. This annual cost, when multiplied by the present worth factor for a 30-year economic life at a 10% discount rate (9.4269) is equal to:

(0.20) X (\$2,239,417,000) X (9.4269) = \$4,222,152,000

This \$4,222 million value is representative of the 1983 (mean c.o. date of the two units) present value. When this value is present worthed to 1980 at 10% (a factor of 0.7513) the 1980 present value is:

1 Q37 (\$4,222 million) X (0.7513) = \$3,172 million

The combined operations maintenance and fuel cost was developed from the annual cost shown in 8.2.1.2 (\$90,928,000) by assuming an 8% escalation factor in these costs over the 30 year economic life of the plant. When discounted at 10%, the equivalent present value for any year is determined by multiplying the 1980 annual cost by the compound sum factor for 8% escalation for that year and then multiplying this product by the present worth Factor for that year.
Or:

Annual Cost = (Base Cost) (8% Compound Sum Factor) (10% Present Worth Factor)

$$= (\text{Base Cost}) \times \left[\frac{(1+i)^n - 1}{i}\right]_{8\%} \times \left[\frac{(1+i)^n - 1}{i\,(1+i)^n}\right]_{10\%}$$

Using the above copper release rate a copper concentration can be inferred as follows: The copper going into the solution will be in the form of elemental copper, Cu^{+2}, and copper oxide, CuO.

In lakes, copper in solution is in (1) ionic form (Cu^{+2}); (2) complexed in organic materials; (3) absorbed and precipitated on solids; and (4) incorporated in other crystalline structures. Most copper is tied up in the crystalline structure of sedimentary materials, less is in organic complexes and dead seston, and very little is in solution. In natural waters, the concentration of Cu^{+2} ranges from 1 to 50 µg/l.[1] The ionic form, Cu^{+2}, has a biomagnification factor of about 30 - 60×10^3 and is the 2
form of copper most related to aquatic life toxicity.[2]

The copper entering the lake with the cooling water will rapidly reach equilibrium with a complex chemical species leaving little in solution as toxic ionic copper. The amount can be quantified once the ionic equilibrium is identified and then perturbated by the rates of loss at the condenser. Pagenkopf[3], among others, suggests that the low copper concentrations in water can be described by a carbonate equilibrium of:

$$\left[CuCO_3\right]_{aq} \rightleftharpoons \left[Cu^{+2}\right] + \left[CO_3^{-2}\right], \; K = 2.34 \times 10^{-10} M \qquad (1)$$

where CO_3^{-2} represents the carbonate balance. Carbonate concentrations in natural waters range from 50 mg/l to 150 mg/l (8.3×10^{-4} to 2.5×10^{-3} M).

The above equilibrium is perturbated by the Cu^{+2} addition. If C_1 is the <u>total</u> addition in a year, and x is the amount that ends up as Cu^{+2} in solution with (C_1 - x) added to the

$[CuCO_3]aq$ sink, then the new equilibrium is:

$$\frac{\left[Cu^{+2} + x\right]\left[CO_3^{-2}\right]}{\left[CuCO_3 + (C_1 - x)\right]} = K \qquad (2)$$

Using Equation (1) for the natural equilibrium, the increase in Cu^{+2} per addition C_1 is:

$$x/C_1 = \frac{K}{\left[CO_3^{-2} + K\right]} \qquad (3)$$

which is controlled by the carbonate alance. The amount of copper remaining in solution is, therefore, 2.7×10^{-7} times the amount added.

After the first month, there is 3.29×10^6 gm/yr added to 140,000 Acre-Ft. ($1.72 \times 10^8 m^3$) of lake. It is assumed that over a year, the added copper will go into solution uniformly throughout the lake due to plant pumping; uptake settling, decay and resolution by organic material; and, general lake seasonal circulation. The addition, C_1, over the lake volume is equivalent to a concentration addition of 0.20 mg/l per year. The addition to Cu^{+2} in solution becomes, from Equation (3), 0.54×10^{-7} mg/l per year, or 0.54×10^{-4} µg/l per year. Even over a large number of years, this is an insignificant addition to natural background levels of 1 to 50 µg/l. 2

References

1. Wetzel, R.G., Limnology, W.B. Sauders Co. Phila., 1975, pages 263-265.

2. EPA, Quality Criteria for Water, Environmental Protection Agency, Washington, DC, July 1976, pages 54-64.

3. Pagenkopf, G.K., Introduction to Natural Water Chemistry, Marcel Dekker, Inc., New York, pages 197-200. 2

WATER QUALITY

Q64. (ER Section 3.7)-Provide an updated description of the sanitary waste treatment system. Estimate flow rate during normal operation and during refueling. Describe the planned use of the package units during operation (eg. split stream treatment, or complete shutdown of one or more units). Estimate the BOD_5 and total suspended solids concentrations in the total effluent, and the amount of sanitary waste sludge produced per year. Provide a copy of the certification of the design and operation of the sewage treatment facility for both the contruction and operational phases of CPSES from the State of Texas.

R64. No records exist to estimate the amount of sludge produced per year at CPSES. It is known that the frequency of sludge removal during the construction phase was approximately twice per year.

The applicant, after discussion with the wastewater treatment facility's manufacturing representative, projects the following:

In operating the 30,000 gallon per day Extended Aeration Process system, the maximum amount of sludge anticipated would be 2200 gallons per quarter with a solids concentration of 10,000 to 30,000 mg/liter. This amount and the frequency of sludge removal will vary depending upon the number of people on site and day to day operating techniques. During the operational phase, when sludge removal is required, TUGCO will contract with an approved commercial firm to remove this sludge and dispose it at a permitted disposal area. 2

The state of Texas did not certify the design of the CPSES sanitary waste treatment system. The operator of the system is certified and the system is permitted by the Texas Department of Water Resources and the Environmental Protection Agency to operate, contingent upon demonstrating that certain operating and effluent conditions can be maintained. A copy of the Texas Department of Water Resources permit No 01885 was provided by letter dated September 12, 1980.

See revised Section 3.7.1.1 for the updated system description.