COMANCHE PEAK STEAM ELECTRIC STATION

ENVIRONMENTAL REPORT OPERATING LICENSE STAGE

SEPTEMBER 1980 AMENDMENT

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COMANCHE PEAK STEAM ELECTRIC STATION

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

Preface

In response to the requirements of 10 CFR Part 51, this Environmental Report is hereby submitted to the Nuclear Regulatory Commission by Texas Utilities Generating Company (TUGCO) of Dallas, Texas, for the Comanche Peak Steam Electric Station, a two-unit nuclear fueled electric generating station located near Glen Rose, Texas. Ownership of the project was originally vested equally in Dallas Power & Light Company (DPL), Texas Electric Service Company (TESCO), and Texas Power & Light Company (TPL). Ten percent of the plant has subsequently been sold by DPL to Brazos Electric Power Cooperative, Inc., and the Texas 1
Municipal Power Agency. On May 6, 1980, TPL entered into letter of intent to sell up to 4.35% interest in CPSES to TEX-LA Electric Cooperative of Texas, Inc. TUGCO, a corporate affiliate of the original joint owners, is acting in behalf of all the owners in the preparation and submission of this report, and will operate the station as their agent.

This report is being submitted in accordance with requirements for the issuance of an operating license for the subject nuclear facility. It is similar to the report which was submitted at the time of the application for construction permit. The principal differences between that report and this report are updatings due to the passage of time, submission of actual instead of estimated data in many instances, and where appropriate, the expansion of treatment of certain subject matter in response to regulatory emphasis or revision.

The Nuclear Steam Supply System (NSSS) for the plant will incorporate 1
two Westinghouse pressurized water reactors (PWR) with a nominal rating
of 1150 MWe each. Unit No. 1 is scheduled for operation in 1982, with 1
Unit No. 2 scheduled in 1984.

The three original owners and TUGCO are subsidiaries of Texas Utilities 1
Company of Dallas, Texas. Other subsidiaries of Texas Utilities Company are: Texas Utilities Services, Inc. (TUSI), which furnishes engineering, financial, and other services at cost to other affiliated companies; Texas Utilities Fuel Company, which acquires and transports fuels for the three electric utility subsidiaries for the generation of electric energy; Chaco Energy Company, organized in August 1976 to manage the acquisition, production, and delivery of coal and uranium; and Basic Resources Inc., organized in October 1977 for the purpose of development of potential energy sources and technology. Old Ocean Fuel Company is a subsidiary of, and provides fuel transportation services for, Texas Electric Service Company. The above named companies, incorporated under the laws of the State of Texas, except for Chaco which is incorporated in New Mexico, comprise the Texas Utilities Company System (TUCS).

Each of the three original owners is a corporate entity and each is responsible for providing adequate facilities to serve its own customers; however, planning for generation and major transmission
facilities is carried out by them on a TUCS coordinated basis. Most if 1
not all the tables showing capabilities, demands and other data pertaining to justification for the subject facility are reported on the basis of the 90% TUCS portion only in appropriate later sections of this report.

All the owners have representation in the Texas Interconnected System
(TIS), a group of twelve interconnected electric systems as follows: 1

1. Dallas Power & Light Company

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2. Texas Electric Service Company
3. Texas Power & Light Company
4. Texas Municipal Power Pool (consisting of the cities of Bryan, Garland, Greenville and Denton, and Brazos Electric Power Cooperative)
5. Houston Lighting & Power Company
6. Central Power & Light Company
7. Lower Colorado River Authority
8. City of Austin
9. City Public Service Board - San Antonio
10. West Texas Utilities Company
11. South Texas and Medina Electric Cooperatives
12. City of Brownsville 1

There are no membership obligations. Each company is obligated to its own customers to provide reliable electric service. Nothing in the TIS Coordination Agreement can be construed as limiting or interfering with in any way the power or right of each member to control the use and operation of its own facilities. Nothing in the Agreement can be construed as creating an association, joint venture, trust or partnership or imposing a trust or partnership duty, obligation, or liability on any member of TIS.

Reserve requirement is 15 percent above expected peak load. On the average, each company is expected to comply with this minimum reserve requirement. A basic assumption of this reserve requirement is that the plants that make up this reserve have an assured fuel supply. Natural gas and oil fired plants do not have an assured fuel supply. Therefore a reserve margin much greater than 15 percent is not excessive if a large part of the generating capacity is gas or oil. See Section 1.3.3.

The owners also have representation in the Electric Reliability Council of Texas (ERCOT), which is one of nine regional reliability councils comprising the National Electric Reliability Council (NERC). ERCOT is comprised of 26 municipalities, 49 cooperatives, 8 investor-owned companies and one state agency. ERCOT is a voluntary association and there are no legal obligations on any member. Each member retains sole control of its own facilities and the use thereof. Nothing in the ERCOT agreement impairs the ability of or right of any member to take such actions or to fail to act, as it deems necessary or desirable, with respect to the management, extension, construction, maintenance and operation of its own facilities, present and future. A list of members is shown below. 1

Municipalities

Austin 1
Boerne
Brady
Brenham
Brownsville 1
Bryan
Coleman
Crosbyton
Cuero
Denton
Garland
Giddings
Goldthwaite
Gonzales 1
Greenville

Hemphill
Hondo
La Grange
Livingston
Lockhart
Luling
New Braunfels
Robstown
San Antonio
Schulenburg
Seguin

Cooperatives

B - K
Bartlett
Belfalls

Hamilton County
Hill County
Hunt-Collin

Medina
Mid-South
Midwest

Bluebonnet
Brazos
Cap Rock
Comanche County
Concho Valley
Deep East Texas
Denton County
De Witt County
Dickens County
Fannin County
Farmers
Fayette
Grayson-Collin
Guadalupe Valley
J-A-C
Jackson
Jasper-Newton
Johnson County
Kaufman County
Kimble
Lamar County
Limestone County
Lone Wolf
Magic Valley
McCulloch
McLennan County
Robertson
Sam Houston
Navarro County
New Era
Pedernales
San Bernard 1

South Texas
Southwest Texas
Stamford
Taylor
Tri-County
Victoria County
Wharton County
Wise

Investor-Owned

Central Power & Light Company
Community Public Service Company
Dallas Power & Light Company
Houston Lighting & Power Company
Southwestern Electric Service Company
Texas Electric Service Company
Texas Power & Light Company
West Texas Utilities Company

State Agencies

Lower Colorado River Authority

Reserve requirement is 15 percent reserve above expected peak load. On the average, each member with generating capacity and responsibility is expected to comply with this minimum reserve requirement. Reserves in recent years have been higher than 15 percent because of the transition away from the use of gas and oil to less costly and more plentiful fuels. See Section 1.3.3.

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1.0 PURPOSE OF THE PROPOSED FACILITY AND ASSOCIATED TRANSMISSION

1.1 NEED FOR POWER

The subject facility is a major and integral part of planned supply facilities for the owners for both capacity and energy. The combined service area of the TUCS owners covers approximately 75,000 square 1
miles and has a population estimated at more than 4,000,000. Dallas Power provides electric service primarily in Dallas County, including the cities of Dallas, Highland Park, University Park and Cockrell Hill. TESCO serves customers in 48 counties in North Central and West Texas; and TPL serves customers in 51 counties in North Central and East Texas.

Until 1972, essentially all fuel for generating stations of TUCS was 1
natural gas with oil as a stand-by fuel. During 1971 and 1972 the first lignite-fueled units, jointly owned by the three subsidiary companies, were placed in service. The third and fourth lignite units, at the second site, were placed in service in 1974 and 1975 respectively, and the fifth and sixth units, at a third site, were placed in service in 1977 and 1978 respectively. Two additional units at existing sites were placed in service, one in 1978 and one in 1979. Five other lignite units are under construction. The subject nuclear facility represents the next logical step in energy source development. 1
Baseload nuclear generation, in proper mix with other types, is necessary for projected demand and energy requirements at the present and projected annual load factor of approximately 53-57 percent.

The practice of the TUCS owner companies is to review construction plans annually in the light of customer requirements for energy. This report reflects the plan for system development which was adopted as a result of the latest such annual review. Further discussion of growth 1
rates and load forecasts will be found later in this chapter (Section 1.1.1.2, Demand Projections).

1 Need for the subject units is based on the expected load growth in
demand and energy of the owners only. Historic and projected demand
and energy data for TUCS are given in Table 1.1-1.

1.1.1 Load Characteristics

The three TUCS owners of the subject facility are members of the Texas
Interconnected System (TIS) and the Electric Reliability Council of
1 Texas (ERCOT) as indicated in the Preface. Brazos Electric Power
Cooperative (BEPC) and Texas Municipal Power Agency (TMPA), the new
owners, are also represented in these organizations through the
municipalities they serve.

Although neither the TIS nor ERCOT has consolidated generation and transmission planning responsibilities, data which are available pertaining to demands for them are presented in Tables 1.1-2 and 1.1-3 respectively.

The area served by members of ERCOT is shown in Figure 1.1-1 of the original ER, with that of the TIS being virtually the same. Currently, ERCOT members provide approximately 80 percent of the electric service in Texas.

1.1.1.1 Load Analysis

TUCS and ERCOT are summer peaking areas with very little diversity
between individual systems. In 1981 and 1983, the annual load factor
1 of TUCS is estimated to be approximately 54 percent, with that of ERCOT
somewhat higher.

Demand and energy projection methodology for the TUCS owners is based
1 on past load patterns and rates of growth that have been experienced.
Demand and energy forecasts are extrapolations of historical trends
with recognition, primarily in the near term, of anticipated variations
due to economic conditions and growth patterns.

Demand and energy forecasts are made in two increments - the short term which covers a period of five years, and the long term which extends to twenty years. A discussion of local forecasting practice for each electric utility subsidiary follows.

1.1.1.2 Demand Projections

1.1.1.2.1 Methodology

Dallas Power & Light Company

Historically, DPL has prepared demand and energy projections in two parts--the short-term covering a period of five years and the long-term extending up to twenty years into the future. Short-term projections of energy sales are derived from correlations of numbers of customers, use per customer, and information concerning significant load changes. Separate estimates are made of system energy input requirements and compared with the projected energy sales. The independent projections of sales and energy input provide a system of checks and balances and have been a reliable means of preparing demand and energy projections. Long-term projections have also considered population trends and anticipated patterns of energy use. The extended projections have been prepared using mathematical curve-fitting techniques. Regular use is made of polynomial least square curve-fitting and multiple regression analyses. In addition, Gompertz and logistic curves, exponential smoothing, and the statistical theory of extreme values have been tested for application to long-term projections.

In preparing any projection, the elements of demands, energy, and load factor are always considered together. Load factor is the ratio of the average load for a period to the maximum demand, usually expressed as a percent.

$$\text{Load Factor (\%)} = \frac{\text{Total Energy (Kwh)} \times 100}{\text{Maximum Demand (Kw)} \times \text{No. of Hours}}$$

Inspection of the formula will confirm that if demand, energy or load factor is changed, one or both of the other variables must also change. The interdependence of these three factors provides an excellent means of testing the reasonableness of projections.

Texas Electric Service Company

Forecasts of energy requirements at TESCO are based on individual estimates for each revenue class. For those classes with consistent growth patterns in usage per customer, the energy sales to customers of each class are derived from correlations of numbers of customers, kilowatt-hour use per customer, and specific information concerning significant load changes. Energy sales to customers for all other classes are estimated directly from historical trends, again adjusted for known or anticipated changes.

System input energy requirements are calculated by applying line losses to the total customer sales. System line losses are estimated using historical trends. The load factor is estimated from historical trends and the maximum hour demand forecast obtained by applying the load factor to the corresponding system input energy. The values calculated are checked against separate projections of historical demand data.

Texas Power & Light Company

Load forecasting at TPL of necessity includes a forecast of three elements - demand, energy and how the two related contribute to affect load factor. The overall process of forecasting might be described as an iterative process since the influence of many factors and projections from many operational units within the organization must be reflected in the final forecast. This process can only be achieved by successive trials at forecasting until an overall best fit is achieved.

Projections of total company customers, kwh sales per customer and kwh sales by customer classes are made and compared to projections of total kwh sales. Energy use per customer (based on total company analysis) coupled with population and associated customer growth provides an additional check on the reasonableness of total energy forecasts.

Sys em energy losses are estimated based on the trend of historical dat . Net consumed system input projections are then obtained by summing total company projections of kwh sales and losses. Separate projections are made of annual peak demand using various curve fitting techniques. Load factor is then calculated using separate projections of energy and demand and checked for reasonableness.

All short and long term forecasts of energy and demand are adjusted to provide correlating data and to reflect anticipated changes not represented by trends of historical data.

General

Temperature-sensitive loads represent the predominant source of variation of experienced peak demands and energy requirements concerning the growth trend. Therefore, load versus weather analyses are undertaken in order to adjust experience to normal conditions.

Various curve-fitting and estimating techniques are used, including least squares and multiple regression. Other forms, such as Gompertz and logistic curves, exponential smoothing, and the statistical theory of extreme values, are periodically reviewed as to their applicability in forecasting. Forecasts are reviewed and compared with experience on an annual basis.

1 TUCS peak hour demands for the period 1963-1986 are shown in Table 1.1-1. Load estimates are based upon a summation of demand schedules for each of the three electric utility subsidiaries taking into account situations unique to each subsidiary. Load forecasts are prepared by each of the three operating utilities of TUCS. The TUCS load forecast consists of the sum of these three load forecasts. Situations influencing load forecasts which are unique to each operating utility are:

1. DPL - metropolitan area exclusively - limited service area

2. TPL - combination of rapidly-developing suburban communities and rural areas

3. TESCO - Ft. Worth and West Texas service area - some irrigation pumping

Interruptible load is excluded from power planning studies and is not used to reduce either annual peak demand or energy requirements, but is used for contingency purposes. Interruptible load is normally left on line during peak hours, but may be interrupted any time if operating conditions warrant. Being on line, it reduces reserve margin. However, since interruptible load is automatically tripped by underfrequency relays when an unusual frequency drop occurs, the reduction of reserve by the amount of the interruptible load does not increase risk to the load of other customers.

Load forecasts are prepared with interruptible load excluded. Capacity installation plans are made and reserve margins are planned, also omitting the interruptible load. The contract for interruptible load provides for interruption when system conditions warrant. In actual day-to-day practice, however, all system load, including interruptible, is supplied when sufficient capability and energy are available.
1 During the past ten years interruptible demand at the time of TUCS peak

demand has ranged from 2 to 3 percent of total demand; and interruptible energy has been between 4 and 6 percent of total energy 1 sales on TUCS for the same period. No interruptible demand or energy s scheduled or expected on TUCS after March, 1981.

Power transactions in the form of sales to and purchases from other utilities are not taken into consideration during demand forecasting, since each utility is responsible for meeting its own power demand. The net of power purchases and sales, applicable at time of annual peak, and accounted in capability, is shown in Table 1.1-4.

Two options appear reasonable for the treatment of firm purchases or sales. One is to treat them as a part of the load, with sales being positive, and purchases negative. This treatment would require consideration of net purchases in the process of load forecasting.

The other option, and the one used by the Texas Utilities Company System considers sales as a part of capability (with sales being negative and purchases positive). This technique removes completely from consideration those sales to other electric utilities when considering the preparation of load forecasts.

Actual monthly peak demand and energy loads for TUCS from 1973 through August, 1980 are shown in Table 1.1-7.

1

A TUCS load duration curve is shown by Figure 1.1-2 for the year 1982, and by Figure 1.1-3 for 1983. The assumptions upon which these curves are derived are as follows:

1

For 1982 Operation (Peak Load of 13,735 MW)

Fuel	Capability (MWe)	Capacity Factor (%)
Nuclear	1,035	29
Lignite	5,845	69
Gas/Oil	11,972	30
Purchases	95	5

For 1984 Operation (Peak Load of 15,035 MW)

Fuel	Capability (MWe)	Capacity Factor (%)
Nuclear	2,070	53
Lignite/Coal	5,845	68
Gas/Oil	11,777	31
Purchases	95	5

DPL, TESCO and TPL are not members of any coordination group other than TIS and ERCOT. As noted previously under Section 1.1.1, Load Characteristics, ERCOT does not have consolidated generation and transmission planning responsibilities. However, historic and projected demand and energy data for this group are presented in that section.

1.1.1.2.2 Energy Conservation

Two aspects of energy conservation will be treated in this section:

1. Public Information Programs to Encourage Conservation

2. Discernible Effects of Energy Conservation

Each of the operating utility subsidiaries administer public information programs to encourage conservation. These programs are described below.

Dallas Power & Light Company

Educational and informational programs have been a part of DP&L's customer service activities since its earliest days. For many decades the company has conducted cooking schools, demonstrated the proper use of appliances, and assisted commercial and industrial customers with the efficient utilization of electric service. Programs in the school system have helped thousands of young people learn the efficient use of electric appliances.

The company is also cooperating in the national conservation effort which began in the winter of 1973-74 during the oil embargo. The conservation objectives which were reported to the Federal Power Commission pursuant to FPC Order No. 496 are shown in Exhibit 1A, which is appended to this section. Conservation measures affecting energy use at company facilities are being continued.

Currently DP&L is conducting a program entitled "The Unhandy Persons Guide to E-OK." This program is designed to inform the customer of energy savings and economical use of electricity through do-it-yourself home improvements. Another program informs the apartment resident of ways to use electric appliances and their heating and cooling equipment in the most efficient manner possible. These programs are totally oriented to encouraging the wise and efficient use of electricity. They are not promotional and do not in any way encourage unnecessary use of electricity. Rather, they directly advise the customer of ways to use less electricity and to save money. 1

The "Unhandy Persons Guide" program takes the form of educating the customer within specific areas. Foremost among these is air conditioning. Approximately 80 percent of customers in Dallas use air conditioning and the company has long experienced summer peaks due to the use of air conditioning. For many years the company has encouraged customers to keep such equipment in proper operating condition and to use it economically by selecting reasonable thermostat settings.

The present program explains in everyday terms how to insulate a home, how to maintain equipment, how to build storm windows, how to insulate ductwork, and how to use caulking and weatherstripping materials. Programs of this type have been provided for many years to encourage the efficient use of electric service by customers.

Other current programs also offer information on how to select the most efficient air conditioning equipment. Educational messages explain the relationship of BTU output and wattage and offer specific examples of operating costs of air conditioning units. The programs also cover home heating in a way comparable to the information provided on air conditioning.

Other educational information in the program explains the wise and efficient use of electric ranges, clothes dryers, dishwashers, and
1 water heaters.

Another segment provides information on the efficient use of lighting in the home and answers commonly asked questions concerning the performance of lighting equipment.

The programs are announced in newspaper, magazine, television and radio advertising. Consumer booklets on conservation information have been published and widely distributed and are available to the public upon request through the mail and at company facilities.

Company representatives work directly with various customer groups in the following ways:

1. Home builders are encouraged through the company's National Energy Watch E-OK program and other means to use construction methods and equipment that enable the buyer to conserve energy.

2. Commercial and industrial customers are personally counseled on the efficient use of air conditioning and improving the energy efficiency of the structure.

3. Commercial and industrial customers are counseled on efficient use of both interior and exterior lighting.

4. Institutional and commercial cooking customers are counseled on the efficient use of cooking and kitchen equipment.

5. Printed material is distributed to commercial and industrial customers to encourage the wise and efficient use of electric service.

Texas Electric Service Company

Throughout its history TESCO has encouraged the efficient use of electricity by providing specialized assistance to its customers. This effort takes many forms, including counseling services of residential,
commercial and industrial specialists, which often includes engineering 1
assistance.

Its advertising and information programs encourage energy conservation through efficient use. Beginning in 1972 these efforts were intensified and will continue to be dominant in the future.

Further, the company is demonstrating conservation internally through new programs which reduce energy consumption. These steps include lower heating, cooling, and lighting levels where practical, reduced sign lighting, reduction of vehicles and the use of smaller vehicles where practical.

The company cooperated in the national conservation effort which began in the winter of 1973-74 during the oil embargo. The conservation objectives which were reported to the Federal Power Commission pursuant to FPC Order No. 496 are shown in Exhibit 1A. Conservation measures affecting energy use at company facilities are being continued. Energy conservation through efficient use of electricity is a continuing company practice and objective.

Some specific examples of energy conservation efforts currently active are as follows:

1. The Marketing and Customer Services Action Plan for the 1980's communicates to managers, supervisors and employees the objectives of both improving utilization of generating capability and conservation of energy.

2. Construction of new homes to high levels of energy efficiency is encouraged through the E-OK Program with builders. Retrofitting of existing homes is encouraged through the EEI National Energy
1 Watch program.

3. An instructional self-help energy conservation program, Operation Tighten-Up, was presented to 18,140 residential customers at 470 separate meetings during 1979.

4. An Energy Conservation Program for Employees' Homes was established to encourage energy conservation by employees and to have them serve as examples for friends and neighbors.

5. A computerized energy analysis program was developed and made available to residential customers.

6. An Energy Management Action course was made available to commercial and industrial customers.

7. A great amount of effort has been expended in preparation for implementation of the Residential Conservation Program as required by NECPA.

8. Various research activities have been sponsored or monitored in the field of solar and wind generation of energy. 1

9. About 60% of advertising has been directed toward energy conservation by our customers.

These activities are expected to continue through 1980 and will be supplemented as appropriate activities are developed.

Texas Power & Light Company

For over thirty years, TPL has maintained a technically competent 1 advisory group which offers assistance to customers in an attempt to reduce the customer's overall energy use and bill. The company has recently strengthened its program to solicit its customers to conserve electrical energy. This solicitation is part of a continuing program carried on through the years to keep customers aware of the problems and needs of the electric utility industry.

Specifically, the following active steps have been taken:

1. All sales promotion advertising aimed at adding load has been 1 discontinued.

2. Current newspaper advertising concerns conservation of energy in the use of air conditioners and heating equipment, and is published in about 150 newspapers in the company's service area. Similar matter has been and will be contained in "bill stuffers" 1 and in handouts to customers.

3. All promotional incentive payments have been eliminated.
Concentrated manpower efforts remain and are aimed at increasing
1 the saturation of the highly energy efficient E-OK homes.

4. Guidelines for conservation of energy at company facilities have
been issued. Lighting and air conditioning practices at all
company offices, storerooms, warehouses, loading docks and power
1 plants have been revised to conserve energy. Every company
office visibly complied with the Energy Building Temperature
Restrictions of 1979-1980 in order to be an example in each
community.

5. Customer service personnel activities are principally devoted to educating and influencing all classes of customers, dealers and manufacturers of electric appliances and equipment toward the goal of the wise and efficient use of electricity and its conservation. In 1979 there were 5,083 heat pumps installed on TPL lines.

6. Wholesale power customers of TPL continue to be apprised of the Company's energy conservation efforts and are urged to do likewise.

7. Research has been conducted and documented which demonstrates
that infiltration is one of the major causes of heat loss to a
1 home. the reports or infiltration have been shared with other
utilities, federal agencies, and with the governor's staff which
prepared the State Energy Conservation Programs.

8. Builder programs have been instituted and accepted whereby typical homes need only 52 percent of the heat energy as would have been required for the structure had 1970 construction practices been applied.

9. A trained field customer service organization is present to conduct energy audits upon request by all classes of customers. Typical building surveys have been filmed and offered to similar users during their trade association meetings.

10. TP&L participates in the nationally recognized NEW (National Energy Watch) programs for new and existing homes and for commercial and industrial customers. Energy Management action courses are presented by company personnel to aid commercial and industrial customers to implement their own energy management programs. 1

TPL also participated in the national conservation effort which had its beginning in the winter of 1973-74. The conservation objectives which were reported to the Federal Power Commission pursuant to FPC Order No. 496 are shown in Exhibit 1A. Conservation measures remain in effect at company facilities.

Discernible Effects of Energy Conservation - The oil embargo in the winter of 1973-74 appears to have been a dramatic turning point in the business of TUCS, and perhaps for other electric utilities and energy industries. The turn appeared dramatic, but was not necessarily caused by the action of the Arabs, since the factors at work in energy industries were known before that time. Indeed, if the cut-off of Mideast oil had not occurred, some other disturbance to the delicate national energy balance might have produced a similar result. The forces which made the fuel crisis inevitable have been known and appreciated for many years. 1

The embargo appears to be a dramatic turning point because of the reaction of customers and the reactions of the economy to the crisis. The conditions were there for some time and the crisis was inevitable; the embargo forced the recognition of the situation on a national scale.

Studies have been done and are being done on a continuing basis to attempt to ascertain the effects of the energy situation on TUCS business. One such study is shown in Exhibit 1B, which is appended to this section. This appendix contains actual monthly TUCS energy data
1 from 1963-1979. The study, based on the years 1969-1979, seems to indicate the following:

1. a lower growth trend since December 1973 than that which was experienced before that time

2. a greater degree of uncertainty (shown by a lower correlation coefficient) since December 1973 than that experienced before that time

These effects on TUCS energy requirements appear to be attributable to a number of factors, one of which is customer conservation. A partial list might be:

1. Customer conservation

   (a) because of price elasticity, or price resistance and also due to increased consciousness caused by $1 + gasoline prices.

   (b) in direct response to national programs, and the various
1 State programs.

   (c) in response to the operating companies' public information programs outlined previously and energy efficient home programs.

2. Slackened economy. A generally slackened economy no doubt had an effect during this period on energy requirements. Fewer housing units completed than in previous periods; commercial ventures

postponed or cancelled because of business uncertainty; customer purchases of goods and services cancelled or postponed because of diversion of earnings to other areas; all had effects during the embargo and the following months.

The several factors enumerated above are very difficult to quantify. The study shown in the attached exhibit is an attempt to determine the total effect for the period in question.

The question of major significance is how will these factors and others affect future energy requirements? This is the question which all energy industries ponder, to which management attention is directed, on which major strategies are focused, and for which major funds are committed at considerable risk.

It may be that a major portion of voluntary conservation has already run its course, and that further conservation from this point will begin to deteriorate living standards and represent a greater or less degree of adjustment or hardship.

A countervailing factor with respect to electric energy requirements is the possible substitution of electricity for the various forms of gas and oil. Electric space heating is already strong in TUCS; it should
become even stronger as the cost of other forms of energy increases and 1
their availability decreases.

The present estimates of demand and energy for TUCS represent a significant change from those of the original filing, and incorporate all known factors which can be quantified, and on which reasonable judgments can be made. A comparison of present projections of
capability, demand, and reserve with projections in the original filing 1
is shown in Table 1.1-8a.

1.1.1.3 Power Exchanges

There are no significant power exchanges affecting demand estimates, either past or projected, as given in Table 1.1-1. Arrangements have been made for economy energy sales to other ERCOT companies to be implemented when conditions develop for mutual benefit. At present such sales are an extremely small factor in company operations. Power interchange policy is such as to encourage mutual assistance during emergencies to enhance reliability. However, no large net transfers of energy are anticipated as each area is expected to provide its own fuel resources. Further discussion of interchange to enhance relability will be found in Section 1.1.3, Reserve Margins.

1.1.2 SYSTEM CAPACITY

The bulk power supply planning for TUCS is based on the TUCS area only and is keyed to the development of fuel resources of the area to meet the energy requirements of our customers.

Since three basic fuel resources - gas, oil, and lignite - are located in the service area, plans are currently being implemented to use each of these to the best advantage, with due consideration for economics and fuel supply. The use of nuclear energy is the next logical step in development of major energy sources for the area. All of these energy resources in the proper mix are deemed essential for economic and dependable energy supply in the TUCS service area.

Information on TUCS capacity resources is as follows:

1. The capability assigned to each category of generation for year 1963 [illegible] by Table 1.1-5, and changes in capability by type and [illegible] are given in Table 1.1-6.

2. Sale of 10 percent of each of the subject nuclear units to BEPC and TMPA has been completed and capacity reserves for TUCS include only the TUCS ownership. TPL has entered into letter of intent to sell up to 4.35% interest in CPSES to TEX-LA 1
Cooperative of Texas Inc., subject to approval by appropriate regulatory authorities. There are no other actual or projected sales affecting capacity resources of TUCS during the subject period.

3. Capacity purchases for 1963 are shown in Table 1.1-5, and changes by years through 1985 are given in Table 1.1-6.

4. New generating units and their projected capabilities are shown in Table 1.1-6.

5. Retirements of generating units are shown in Table 1.1-6.

A summary of generating capacity by type (base, intermediate, and peaking) for the year 1963 and installations by type and by years thereafter is given in Tables 1.1-5 and 1.1-6. The generating capacity additions are indicated to be base, intermediate, or peaking according to the type of service expected for the first few years. Purchases, which are included in these Tables, are indicated to be a very minor part of the power supply of TUCS.

A curve for the peak day of 1979, giving the hourly integrated loads of 1
TUCS and depicting the use of base, intermediate, and peaking capacity, is provided in Figure 1.1-4.

In the past, when natural gas was virtually the only fuel used by TUCS, and when each new unit was more efficient than its predecessors, each new unit would experience a relatively high annual capacity factor for the first few years, and then would gradually decline as other capacity came on line. More recently, solid fuel has been utilized, and the cost differential between solid fuel and natural gas has altered this pattern. Certain units (indicated in Table 1.1-6) now have a low annual capacity factor from the date of installation, and other units, installed as base or intermediate, will be relegated to peaking service as additional lignite-fueled or nuclear-fueled capacity comes on line, and as natural gas use decreases. The key to the type of service which a unit will experience depends fundamentally on availability and economics of the fuel which it utilizes.

A forecast indicating proportions of expected fuel use, and indicating the transition from natural gas to other forms of energy, which will affect the usage of all generating units, is given in Table 1.1-12.

1.1.3 RESERVE MARGINS

The reserve margin of TUCS is planned with the assumption that unit maintenance will be accomplished in off-peak periods. No unit maintenance is planned during the summer peak load period. Periods other than the summer have been, and it appears these periods will be, sufficient to accomplish all needed maintenance on generating units and associated equipment. Gas curtailment periods during the winter season also have an effect on unit maintenance schedules. Maintenance schedules are planned to maximize energy production from lignite units and to enhance fuel supply security for the system.

Criteria used by TUCS in determining reserve margin and in planning the bulk power system are as follows:

1. System generating capability is planned to meet estimated load requirements under reasonably predictable operating conditions and with the assumption that construction schedules are met. The planned minimum generating capability will be the greater of:

a. 15 percent of forecast maximum hour demand or

b. that required to insure a likelihood of insufficient generating capability no greater than once in ten years, with due consideration given to unit size, expected forced outage rates, interconnection capacity, installed reserve of neighbors, and the eventuality of loads greater than forecast.

2. Projected TUCS planning will include simulated testing to insure that the system will not experience cascading break-up and collapse initiated by the occurrence of contingencies such as:

a. loss of all generating capacity at any generating station,

b. loss of any two generating units,

c. outage of any circuit or generating unit during scheduled maintenance on any other transmission line or generating unit,

d. outage of any single or double circuit transmission line, generating unit, transformer, or bus,

e. simultaneous outage of overhead transmission lines parallel to each other for a substantial distance having a spacing between circuits of less than the height of the structures,

f. any fault cleared by normal operation of back-up relays,

g. loss of any large load or concentrated load area.

Factors considered in establishing the reserve criteria are:

1. Accuracy of load forecasts

    a. Temperature variations (from normal)

    b. Lead time (extent into the future)

    c. Economic changes

    d. Load characteristics, new or special loads (from technological change), load factor, and seasonal characteristics

2. Expected operating conditions

    a. Equipment failure (number, size, rate)

    b. Fuel supply

    c. Time of repair

    d. Transmission limitations

    e. Interconnections

    f. Maintenance scheduling

    g. Reserve of interconnected neighboring utilities

The minimum reserve criteria do not take into account system energy requirements during the transition from predominantly natural gas to solid fuel. The rapid decline in supply and dramatically escalating cost of natural gas prompts installation of units using solid fuel on a more rapid schedule than would be determined by capacity requirements alone. During transition from natural gas to other fuels, capacity reserves tend to be higher than that determined by the minimum criteria.

In addition, the minimum reserve criteria do not include an amount for serving interruptible load, or an amount for long term construction delay. Plans vary from the reserve criteria to the extent that these factors are considered. Where long term construction delays are possible plans generally reflect higher than 15 percent reserve due to use of present "best estimate" of completion dates without unusual expected delays.

Experience of the last several years of lower peak loads than expected has caused actual reserve to be higher than that planned when unit commitments were made. Yet the need still exists to construct solid fueled and nuclear fueled units so that the transition from natural gas and oil to more abundant fuels can proceed in conformity with state regulations and orders, federal legislation, and in conformity with the national interest. Reserves are expected to continue higher than normal during this transition period. 1

The operation of the proposed Comanche Peak Steam Electric Station is not expected to have any significant effect on the TUCS reserve criteria as presented above. In addition, present and planned interconnections are not expected to affect these criteria.

ERCOT members install generating capacity to maintain at least 15 percent reserve above expected peak load. This is stated in the Planning Criteria as follows:

> Sufficient generating capacity will be provided, as nearly as practicable, to insure a reserve of at least 15% of the forecasted maximum hour demand of the Interconnected System.

Each company with generating capacity and responsibility is expected, on the average, to provide its proportionate share of this generating capacity. Inasmuch as there is little or no diversity between load demands of the various companies, there is little occasion for diversity interchange among companies. Reserves of TUCS are now greater than 15 percent because of the fuel supply situation. See Section 1.3.3.

Interchange of power between companies is viewed as a prime avenue for increasing reliability through mutual assistance in emergencies, and to this end the substantial part of intercompany transmission tie capacity is reserved for emergency use, and generating capacity is maintained and operated so as to be in a constant state of readiness to assist in any emergency which may arise throughout the system. Spinning reserve is distributed both among units and geographically so that maximum benefit is available to all parts of the isolated interconnected system when emergencies arise. Distribution of spinning reserve among units controls frequency most effectively during emergencies and returns frequency to normal in the shortest time after loss of generation.

Power interchange policy is such as to encourage this mutual emergency assistance, with energy so delivered to be paid back in kind when the
1 emergency is past. When an occasion for economy interchange arises of a more extended duration, such interchange would be subject to operating rules governing minimum spinning reserves to be in service by areas, and to mutual agreement between the parties.

Interconnection capacity of TUCS planned for 1981-1983 is approximately 1200 MW. This amount of power could be imported with the transmission system normal, and could be sustained with the further loss of any one major transmission circuit.

The interconnection capacity is needed in its entirety for system reliability. As stated above, interconnections are normally operated lightly loaded. It is necessary to operate in this manner so that they are able to withstand other severe contingencies, such as loss of an entire plant, as indicated in the Planning Criteria enumerated earlier in this section.

TUCS' ability to import bulk power is limited to about 900 MW at present, grows to about 1200 MW by 1981, and remains at that level through 1985. It is, of course, subject to availability of generating reserves in other parts of ERCOT, and energy transfers would also be subject to energy availability. Any sustained transfers would also be subject to energy availability and to contingencies in the transmission network. Reliability would be compromised by any sustained large transfer, as compared with the present practice of operation with lightly loaded ties.

The following information is shown in the accompanying Table 1.1-8 which shows need for the subject facility:

1. TUCS capability resources with the proposed project

2. TUCS capability resources without the proposed project

3. TUCS annual system peak demand

As can be noted from Table 1.1-4, the small quantities of purchased capability range from 2.3 percent to 0.5 percent of total capability resources for the period 1968-1985. For this reason, the generating capability of the TUCS is essentially identical to the owned capability resources. Although need for the subject facility as shown in the tables is based on reserves, energy requirements, and capacity 1
requirements of TUCS only, a study of projected capacity additions and reserve margin for ERCOT for the years 1981-1985 is shown in Table 1.1-9, with and without the subject project.

The latest dates the proposed nuclear units can be placed in service without endangering the adequacy and reliability of the projected bulk power supply are:

Unit 1 - 1982

1 Unit 2 - 1984

1.1.4 EXTERNAL SUPPORTING STUDIES

1 Since the need for the subject units, as shown in the tables, is based on the expected load growth of only the TUCS as stated previously, there are no studies of an external system which are available or are needed in support of the subject facility. Demand and energy data for TIS and ERCOT are presented in Tables 1.1-2 and 1.1-3 respectively.

TABLE 1.1-1 (Sheet 2 of 2)

TUCS PEAK-HOUR DEMAND AND ANNUAL ENERGY (1)

Year	Demand MW	Increase MW	Increase %	Energy 10^6 Kwh	Increase 10^6 Kwh	Increase %	Annual Load Factor (%)
Actual							
1976	10,002	497	5.2	45,798	1,787	4.1	52.13
1977	10,525	523	5.2	50,443	4,645	10.1	54.71
1978	11.232	707	6.7	54,158	3,715	7.4	55.04
1979	10,880	(352)	(3.1)	54,256	98	0.2	56.93
1980	12,591	1.711	15.7				
Projected							
1980	12,367	1,487	13.7	58.865	4,609	8.5	54.2
1981	13,130	539	4.3	63,080	4,215	7.2	54.8
1982	13,735	605	4.6	66,964	3,884	6.2	55.7
1983	14,365	630	4.6	70,165	3.201	4.8	55.8
1984	15,035	670	4.7	73,682	3,517	5.0	55.9
1985	15,755	720	4.8	77,773	3,591	4.9	56.0
1986	16,485	730	4.6	80,994	3,721	4.8	56.1

(1) Excluding interruptible demand and energy supplied to a large industrial customer.

TABLE 1.1-1a

TUCS GOEGRAPHIC LOAD DISTRIBUTION PATTERN

Year	Dallas (City Only) %	TPL Central Div. %	Ft. Worth %	TES Eastland %	Wichita Falls %	TES Western %	TPL Northern %	TPL Eastern %	TPL Southern %
				Historical					
1963	29.6	8.7	18.1	1.2	4.4	12.6	6.7	8.2	10.5
1964	29.7	9.4	18.1	1.2	4.3	12.0	6.3	8.3	10.7
1965	29.5	9.6	18.2	1.0	4.3	12.0	6.3	8.5	10.6
1966	29.1	10.2	18.3	1.0	4.3	12.0	6.0	8.7	10.4
1967	28.5	10.8	18.5	1.1	4.0	11.8	6.1	8.5	10.7
1968	27.9	11.2	19.4	1.0	4.0	11.5	6.3	8.5	10.2
1969	27.6	11.6	19.6	1.0	3.8	10.8	6.5	9.0	10.1
1970	27.4	12.1	19.5	1.0	3.7	10.7	6.5	9.1	10.0
1971	26.8	12.6	19.2	1.0	3.6	10.2	6.8	9.7	10.1
1972	26.2	13.2	19.4	.9	3.5	9.9	6.7	9.8	10.4
1973	25.4	13.9	18.6	1.0	3.5	10.1	6.7	10.2	10.6
1974	24.9	14.6	18.5	1.0	3.5	10.1	6.7	10.2	10.5
1975	24.3	14.7	18.6	1.0	3.4	10.1	7.1	10.2	10.6
1976	23.6	15.1	18.9	1.1	3.6	10.3	6.5	10.5	10.4
1977	23.4	14.6	19.1	1.1	3.5	10.4	6.7	10.7	10.5
1978	22.2	14.7	18.1	1.1	3.4	10.1	6.8	10.3	13.3
1979	21.8	15.3	18.5	1.0	3.2	10.4	6.5	10.5	12.8
				Estimated					
1980	22.4	15.2	20.3	1.0	3.3	10.1	6.7	10.8	10.2
1981	22.1	15.1	20.3	1.0	3.3	10.0	6.5	10.5	11.2
1982	21.8	15.5	20.4	1.0	3.2	9.8	6.6	10.6	11.1
1983	21.5	15.8	20.5	1.0	3.2	9.8	6.6	10.7	10.9
1984	21.3	16.1	20.6	1.0	3.1	9.7	6.6	10.8	10.8
1985	21.1	16.5	20.7	0.9	3.0	9.6	6.6	10.9	10.7

TABLE 1.1-2

TIS PEAK-HOUR DEMAND AND ANNUAL ENERGY

Year	Peak-Hour Demand, Mw	Increase Mw	Increase %	Annual Energy 10^6 Kwh	Increase 10^6 Kwh	Increase %	Annual Load Factor (%)
1963	8,501			41,315			55.48
1964	9,367	866	10.2	44,372	3,057	7.4	53.93
1965	9,895	528	5.6	48,209	3,837	8.6	55.62
1966	11,087	1,192	12.1	53,608	5,399	11.2	55.20
1967	12,302	1,215	11.0	59,347	5,739	10.7	55.07
1968	13,257	955	7.8	65,524	6,177	10.4	56.27
1969	15,580	2,323	17.5	74,762	9,238	14.1	54.78
1970	16,410	830	5.3	80,054	5,292	7.1	55.69
1971	17,614	1,204	7.3	87,347	7,293	9.1	56.61
1972	19,366	1,752	9.9	97,958	10,611	12.1	57.58
1973	20,481	1,115	5.8	105,370	7,412	7.6	58.73
1974	22,692	2,211	10.8	108,576	3,206	3.0	54.62
1975	23,100	408	1.8	115,591	7,015	6.5	57.12
1976	24,687	1,587	6.9	121,037	5,446	4.7	55.82
1977	26,335	1,648	6.7	136,383	15,346	12.7	59.12
1978	28,228	1,893	7.2	141,348	4,965	3.6	57.16
1979	28,201	(27)	(0.1)	144,149	2,801	2.0	58.35
1980							

NOTES: From unofficial records compiled by TIS. Demands are undiversified. Interruptible demands and energy excluded. Years 1974 and later include TMPP; prior years do not; South Texas & Medina Cooperatives included beginning in 1977: Brownsville included in 1979.

TABLE 1.1-3

ERCOT PEAK HOUR DEMAND AND ANNUAL ENERGY

Year	Peak-Hour Demand, Mw	Increase Mw	Increase %	Annual Energy 10^6 Kwh	Increase 10^6 Kwh	Increase %	Annual Load Factor (%)
Actual							
1969	16,499			78,344			54.2
1970	17,300	801	4.9	84,579	6,235	8.0	55.8
1971	18,582	1,282	7.4	92,110	7,531	8.9	56.6
1972	20,408	1,826	9.8	102,691	10,581	11.5	57.3
1973	21,687	1,279	6.3	108,397	5,706	5.6	57.1
1974	23,332	1,645	7.6	111,783	3,386	3.1	54.7
1975	23,525	193	0.8	115,989	4,206	3.8	56.3
1976	25,400	1,875	8.0	124,600	8,611	7.4	55.8
1977	26,819	1,419	5.6	136,413	11,813	9.5	58.1
1978	28,645	1,826	6.8	147,371	10,958	8.0	58.7
1979	28,468	(177)	(0.6)	150,533	3,162	2.1	60.4
1980	31,871	3,403	12.0				
Projected							
1980	32,096	1,653	5.4	159,872	8,747	5.8	56.7
1981	33,819	1,723	5.4	169,353	9,481	5.9	57.2
1982	35,531	1,712	5.1	178,221	8,868	5.2	57.3
1983	37,306	1,775	5.0	187,154	8,933	5.0	57.3
1984	39,276	1,970	5.5	196,010	8,856	4.7	56.8
1985	41,281	2,005	5.1	206,179	10,169	5.2	57.0

NOTES: Source of data is EEI Electric Power Survey Committee.
Undiversified.

TABLE 1.1-4

TUCS GENERATION CAPACITY RESOURCES (MW)
AT TIME OF ANNUAL PEAK
1963 - 1986

Year	Gas/Oil	Lignite/ Coal	Nuclear	Purchases	Total
Actual					
1963	4,085.1	0	0	187.5	4,272.6
1964	4,472.9	0	0	187.5	4,660.4
1965	4,812.9	0	0	187.5	5,000.4
1966	5,496,1	0	0	162.5	5,658.6
1967	6,330.9	0	0	162.5	6,493.4
1968	6,865.3	0	0	162.5	7,027.8
1969	7,240.3	0	0	162.5	7,402.8
1970	8,152.3	0	0	162.5	8,314.8
1971	8,900.0	0	0	162.5	9,062.5
1972	9,617.0	575.0	0	162.5	10,354.5
1973	9,617.0	1,150.0	0	162.5	10,929.5
1974	10,717.0	1,150.0	0	140.0	12,007.0
1975	11,492.0	1,725.0	0	135.0	13,352.0
1976	11,468.8	2,300.0	0	95.0	13,863.8
1977	11,774.3	3,050.0	0	95.0	14,919.3
1978	12,037.4	3,800.0	0	95.0	15,932.4
1979	12,037.4	5,300.0	0	95.0	17,432.4
1980	12,017.2	5,300.0	0	95.0	17,412.2
Projected					
1981	12,017.2	5,845.0		95.0	17,957.2
1982	11,972.2	5,845.0	1,035.0(1)	95.0	18,947.2
1983	11,950.2	5,845.0	1,035.0(1)	95.0	18,925.2
1984	11,777.2	5,845.0	2,070.0(1)	95.0	19,787.2
1985	11,630.2	7,157.5	2,070.0(1)	145.0	21,002.7
1986	11,086.2	7,684.0	2,070.0(1)	195.0	21,470.2

(1) TUCS ownership only of Comanche Peak units.

TABLE 1.1-6 (Sheet 1 of 6)

TUCS GENERATION CAPACITY RESOURCES
DETAIL OF CAPABILITY CHANGES
FROM ANNUAL PEAK TO ANNUAL PEAK
1963 - 1986

Unit and Year	Capability by Energy Source, MW: Gas/Oil	Lig./Coal	Nuc.	Purchases MW	Type (Base, Intermediate, or Peaking) (1)
1964					
Brownwood 1, 2, 3 (Ret)	-.4				P (TPL)
Handley 3 (Adjmt.)	140				B (TES)
Terrell 1, 2 (Ret)	-1.85				P (TPL)
North Lake 3	250				B (DPL)
1965					
North Lake 3 (Adjmt.)	100				B (DPL)
Trinidad 6	240				I (TPL)
1966					
Stryker 2	500				B (TPL)
Odessa 0, 1, 2, 3, 4, 5 (Ret)	-2.67				P (TES)
Leon 1, 2 (Ret)	-7.8				P (TES)
BEPC (Morris Sheppard)				+3.0	-
BEPC (Whitney)				-28.0	-
Waco 1, 2 (Ret)	-14.0				P (TPL)
Big Spring 7, 8 (Move to Morgan Crk.)	-2.272				P (TES)
Morgan Creek 6	210				B (TES)
1967					
Snyder 0 (Moved to Permian Basin)	-1.136				P (TES)
Leon 3 (Ret)	-7.8				P (TES)

(1) At time of installation. Estimated annual capacity factor ranges:

	Base	Intermed.	Peaking
Gas/Oil	40-60	20-39	0-19
Other	50-75	20-50	0-19

TABLE 1.1-6 (Sheet 2 of 6)

TUCS GENERATION CAPACITY RESOURCES
DETAIL OF CAPABILITY CHANGES
FROM ANNUAL PEAK TO ANNUAL PEAK
1963 - 1986

Unit and Year	Capability by Energy Source, MW: Gas/Oil	Liq./Coal	Nuc.	Purchases MW	Type (Base, Intermediate, or Peaking)(1)
1967					
Morgan Crk 6(Adjmt.)	290				B (TES)
Grand Falls (Ret)	-.8				I (TES)
Stryker (5-2,000 kw Diesels)	10				P (TPL)
Trinidad (2-2,000 kw Diesels)	4				P (TPL)
Lake Creek (3-2,000 kw Diesels)	6				P (TPL)
Permian Basin (Moved from Snyder)	1.136				P (TES)
Sweetwater 0, 5	-2.272				P (TES)
Morgan Creek (Moved from Big Spring)	+2.272				P (TES)
Leon 4 (Ret)	-7.9				P (TES)
Wichita Falls 4, 5 (Ret)	-8.7				P (TES)
Mountain Creek 8	550				B (DPL)
1968					
Valley 2	550				B (TPL)
Leon 5 (Ret)	-15.6				P (TES)
1969					
Graham 2	+375				B (TES)

(1) At time of installation. Estimated annual capacity factor ranges:

	Base	Intermed.	Peaking
Gas/Oil	40-60	20-39	0-19
Other	50-75	20-50	0-19

TABLE 1.1-6 (Sheet 3 of 6)

TUCS GENERATION CAPACITY RESOURCES
DETAIL OF CAPABILITY CHANGES
FROM ANNUAL PEAK TO ANNUAL PEAK
1963 - 1986

Unit and Year	Capability by Energy Source, MW Gas/Oil	Lig./ Coal	Nuc.	Purchases MW	Type (Base, Intermediate, or Peaking)(1)
1970					
Tradinghouse Creek 1	+565				B (TPL)
Lake Hubbard 1	+375				P (DPL)
Mountain Creek 4	-14				P (DPL)
Mountain Creek 5	-14				P (DPL)
1971					
Terrell	-2.3				P (TPL)
Valley 3	+375				P (TPL)
Eagle Mountain 3	+375				P (TES)
1972					
Big Brown 1		+575			B (Joint)
Waco 3	-13				P (TPL)
Tradinghouse Crk 2	+730				B (TPL)
1973					
Big Brown 2		+575			B (Joint)
1974					
Lake Hubbard 2	+515				B (DPL)
Permian Basin 6	+540				B (TES)
Purchases				-22.5	-
Tradinghouse 2(Adjmt)	+45				B (TPL)
1975					
Monticello 1		+575			B (Joint)

(1) At time of installation. Estimated annual capacity factor ranges:

	Base	Intermed.	Peaking
Gas/Oil	40-60	20-39	0-19
Other	50-75	20-50	0-19

TABLE 1.1-6 (Sheet 4 of 6)

TUCS GENERATION CAPACITY RESOURCES
DETAIL OF CAPABILITY CHANGES
FROM ANNUAL PEAK TO ANNUAL PEAK
1963-1986

Unit and Year	Capability by Energy Source, Mw: Gas/Oil	Lig./ Coal	Nuc.	Purchases Mw	Type (Base, Intermediate, or Peaking)(1)
1975					
DeCordova 1	+775				B (TPL)
Purchases				-5.0	-
1976					
Monticello 2		+575			B (Joint)
Morgan Creek 1	-22				P (TES)
Trinidad House Service	-1.2				P (TPL)
Purchases				-40	-
1977					
Handley 4	+425				P (TES)
Clarksville	-1				P (TPL)
Dallas 0, 1, 2	-78.5				P (DPL)
Mountain Creek 1	-34.5				P (DPL)
Martin Lake 1		+750			B (Joint)
Gainesville 1, 2	-5.5				P (TPL)
1978					
Handley 5	+425				P (TES)
Martin Lake 2		+750			B (Joint) 1
North Main 0, 1	-40.8				P (TES)
Trinidad 1, 2, 3, 4	-116.6				P (TPL)

(1) At time of installation. Estimated annual capacity factor ranges:

	Base	Intermed.	Peaking
Gas/Oil	40-60	20-39	0-19
Other	50-75	20-50	0-19

TABLE 1.1-6 (Sheet 5 of 6)

TUCS GENERATION CAPACITY RESOURCES
DETAIL OF CAPABILITY CHANGES
FROM ANNUAL PEAK TO ANNUAL PEAK
1963 - 1986

Unit and Year	Capability by Energy Source, Mw: Gas/Oil	Coal	Nuc.	Purchases Mw	Intermediate, or Peaking) (1)
1978					
Brownwood 4,5	-4.5				P (TPL)
1979					
Monticello 3		+750			B (Joint)
Martin Lake 3		+750			B (Joint)
1980					
Commerce	6				P (TPL)
Unannounced Retirements	-26				P (TES)
1981					
Sandow 4		+545			B (TPL)
1982					
Comanche Peak 1		+1150(2)			B (Joint)
Unannounced Retirements	-45				P (TES)
1983					
Unannounced Retirements	-22				P (TES)

(1) At time of installation. Estimated annual capacity factor ranges:

	Base	Intermed.	Peaking
Gas/Oil	40-60	20-39	0-19
Other	50-75	20-50	0-19

(2) Ten Percent of this unit has been sold to others.

TABLE 1.1-6 (Sheet 6 of 6)

TUCS GENERATION CAPACITY RESOURCES
DETAIL OF CAPABILITY CHANGES
FROM ANNUAL PEAK TO ANNUAL PEAK
1963 - 1986

Unit and Year	Capability by Energy Source, Mw: Gas/Oil	Coal	Nuc.	Purchases Mw	Intermediate, or Peaking)(1)
1984					
Comanche Peak 2			+1150(2)		B (Joint)
Unannounced Retirements	- 70				P (TES)
	-103				P (DPL)
1985					
Forest Grove 1		+750			B (Joint)
Unannounced Retirements	- 26				P (TES)
	- 6				P (TPL)
Unannounced Retirements	-115				P (DPL)
Twin Oak 1		+562.5			B (TPL)
Purchase				+50	P (TPL)
1986					
Unannounced Retirements	-145				P (DPL)
Twin Oak 2		+562.5			B (TPL)
Purchase				+50	P (TPL)

(1) At time of installation. Estimated annual capacity factor ranges:

	Base	Intermed.	Peaking
Gas/Oil	40-60	20-39	0-19
Other	50-75	20-50	0-19

TABLE 1.1-7

TUCS MONTHLY DEMANDS AND ENERGY

Month	Peak Demand	Energy 10^6 Kwh	Peak Demand	Energy 10^6 Kwh	Peak Demand	Energy 10^6 Kwh	Peak Demand	Energy 10^6 Kwh
	1973		1974		1975		1976	
Jan	5,530	3,053	5,684	3,121	5,808	3,213	6,898	3,551
Feb	5,422	2,681	5,416	2,667	5,905	2,933	6,348	3,100
March	4,657	2,778	5,164	2,945	5,701	3,080	5,698	3,337
April	5,326	2,746	5,451	2,894	6,461	3,044	5,843	3,167
May	7,287	3,332	8,146	3,855	7,448	3,544	7,309	3,455
June	7,982	3,858	8,453	4,108	8,611	4,325	9,283	4,369
July	8,633	4,588	9,602	4,989	9,263	4,866	9,425	4,744
Aug	8,670	4,645	9,178	4,569	9,427	5,053	10,002	5,249
Sept	7,957	3,842	7,202	3,245	9,505	3,937	8,876	4,125
Oct	7,395	3,340	6,161	3,178	7,442	3,437	7,104	3,487
Nov	5,196	2,829	5,336	2,958	6,122	3,156	6,517	3,500
Dec	5,784	2,912	5,661	3,185	6,337	3,422	6,600	3,713
	1977		1978		1979		1980	
Jan	7,185	4,068	7,637	4,402	8,379	4,789	8,463	4,475
Feb	6,547	3,224	7,537	3,871	8,289	4,071	8,397	4,160
March	5,654	3,416	7,169	3,752	6,877	3,908	7,869	4,074
April	6,072	3,284	7,026	3,554	7,209	3,662	7,114	3,832
May	8,082	4,063	8,973	4,399	7,830	4,091	9,777	4.582
June	9,581	5,003	10,495	5,230	10,695	4,997	12,412	5,958
July	10,339	5,666	11,232	6,302	10,880	5.836	12,591	7,030
Aug	10,525	5,669	11,021	5,847	10,792	5,740	12,469	6,422(E)
Sept	10,426	5,087	10,308	4,955	10,672	4,758	11,807(E)	5,3[illegible]6(E)
Oct	8,871	3,776	8,714	3,982	9,557	4.292	10.161(E)	4,589(E)
Nov	6,219	3,424	6,882	3,700	7,793	3,909	8,251(E)	4,244(E)
Dec	6,992	3,765	8,097	4,166	8,328	4,202	8,764(E)	4,692(E)

(E) ESTIMATED

Table 1.1-8 (Sheet 1 of 6)

TEXAS UTILITIES COMPANY SYSTEM
CAPABILITIES, DEMANDS AND RESERVES BY COMPANIES
1963 - 1986

KILOWATTS

Historic	DPL	TES	TPL*	TUCS*
1963				
Added Capability	0	250,300	168,500	418,800
Total Capability	1,306,000	1,642,500	1,324,135	4,272,635
Demand	1,122,000	1,374,100	1,288,800	3,770,600
Reserve	184,000	268,400	35,335	502,035
% Reserve	16.4	19.5	2.7	13.3
Time of Peak	July 24	July 24	Aug. 28	Aug. 28
1964*				
Added Capability	250,000	140,000	(2,250)	387,750
Total Capability	1,556,000	1,782,500	1,321,885	4,660,385
Demand	1,256,000	1,502,300	1,464,600	4,181,900
Reserve	300,000	280,200	(142,715)	478,485
% Reserve	23.9	18.7	(9.7)	11.4
Time of Peak	Aug. 11	Aug. 6	Aug. 5	Aug. 5
1965*				
Added Capability	100,000	0	240,000	340,000
Total Capability	1,656,000	1,782,500	1,561,885	5,000,385
Demand	1,289,000	1,548,800	1,531,000	4,330,700
Reserve	367,000	233,700	30,885	669,685
% Reserve	28.5	15.1	2.0	15.5
Time of Peak	July 13	July 13	Sept. 14	July 23
1966*				
Added Capability	0	184,758	473,500	658,258
Total Capability	1,656,000	1,967,258	2,035,385	5,658,643
Demand	1,429,000	1,747,200	1,725,700	4,891,100
Reserve	227,000	220,058	309,685	767,543
% Reserve	15.9	12.6	17.9	15.7
Time of Peak	Aug. 1	Aug. 1	Aug. 1	Aug. 1
1967*				
Added Capability	550,000	264,800	20,000	834,800
Total Capability	2,206,000	2,232,058	2,055,385	6,493,443
Demand	1,538,000	1,915,700	1,956,300	5,410,000
Reserve	668,000	316,358	99,085	1,083,443
% Reserve	43.4	16.5	5.1	20.0
Time of Peak	Aug. 9	Aug. 9	Aug. 9	Aug. 9

*Excluding Alcoa interruptible demand.

TABLE 1.1-8 (Sheet 2 of 6)

TEXAS UTILITIES COMPANY SYSTEM
CAPABILITIES, DEMANDS AND RESERVES BY COMPANIES
1963 - 1986

KILOWATTS

HISTORIC	DPL	TES	TPL*	TUCS*
1968*				
Added Capability	0	(15,600)	550,000	534,400
Total Capability	2,206,000	2,216,458	2,605,385	7,027,843
Demand	1,602,000	2,062,300	2,077,000	5,699,100
Reserve	604,000	154,158	528,385	1,328,743
% Reserve	37.7	7.5	25.4	23.3
Time of Peak	Aug. 8	Aug. 8	Aug. 7	Aug. 7
1969*				
Added Capability	0	375,000	0	375,000
Total Capability	2,206,000	2,591,458	2,605,385	7,402,843
Demand	1,887,000	2,408,000	2,549,000	6,828,000
Reserve	319,000	183,458	56,385	574,843
% Reserve	16.9	7.6	2.2	8.4
Time of Peak	Aug. 14	Aug. 13	Aug. 13	Aug. 13
1970*				
Added Capability	347,000	0	565,000	912,000
Total Capability	2,553,000	2,591,458	3,170,385	8,314,843
Demand	1,973,000	2,515,000	2,721,000	7,188,000
Reserve	580,000	76,458	449,385	1,126,843
% Reserve	29.4	3.0	16.5	15.7
Time of Peak	Aug. 7	Aug. 18	Aug. 18	Aug. 18
1971*				
Added Capability	0	375,000	372,665	747,665
Total Capability	2,553,000	2,966,458	3,543,050	9,062,508
Demand	2,056,000	2,612,000	3,011,000	7,679,000
Reserve	497,000	354,458	532,050	1,383,508
% Reserve	24.2	13.6	17.7	18.0
Time of Peak	July 15	July 15	July 15	July 15
1972*				
Added Capability	191,666	191,667	908,666	1,292,000
Total Capability	2,744,666	3,158,125	4,451,716	10,354,508
Demand	2,193,000	2,820,000	3,352,000	8,285,000
Reserve	551,666	338,124	1,099,716	2,069,508
% Reserve	25.2	12.0	32.8	25.0
Time of Peak	June 26	June 28	Aug. 21	June 28

*Excluding Alcoa interruptible demand.

TEXAS UTILITIES COMPANY SYSTEM
CAPABILITIES, DEMANDS AND RESERVES BY COMPANIES
1963 - 1986

KILOWATTS

HISTORIC	DPL	TES	TPL*	TUCS*
1973*				
Added Capability	191,667	191,667	191,667	575,000
Total Capability	2,936,333	3,349,792	4,643,383	10,929,508
Demand	2,231,000	2,870,000	3,638,000	8,670,000
Reserve	705,334	479,792	1,005,384	2,259,508
% Reserve	31.6	16.7	27.6	26.1
Time of Peak	Aug. 14	Aug. 23	Aug. 21	Aug. 21
1974*				
Added Capability	515,000	528,750	33,750	1,077,500
Total Capability	3,451,333	3,878,542	4,677,133	12,007,008
Demand	2,408,000	3,160,000	4,071,000	9,602,000
Reserve	1,043,333	718,542	606,133	2,405,008
% Reserve	43.3	22.7	14.9	25.0
Time of Peak	July 23	July 23	July 23	July 23
1975*				
Added Capability	115,000	172,500	1,057,500	1,345,000
Total Capability	3,566,333	4,051,042	5,734,633	13,352,008
Demand	2,354,000	3,139,000	4,121,000	9,505,000
Reserve	1,212,333	912,042	1,613,633	3,847,008
% Reserve	51.5	29.1	39.2	40.5
Time of Peak	Aug. 14	Sept. 3	Sept. 3	Sept. 3
1976*				
Added Capability	115,000	150,500	246,300	511,800
Total Capability	3,681,333	4,201,542	5,980,933	13,863,808
Demand	2,378,000	3,392,000	4,283,000	10,002,000
Reserve	1,303,333	809,542	1,697,933	3,861,808
% Reserve	54.8	23.9	39.6	38.6
Time of Peak	Aug. 9	Aug. 10	Aug. 9	Aug. 10
1977*				
Added Capability	37,000	575,000	443,500	1,055,500
Total Capability	3,718,333	4,776,542	6,424,433	14,919,308
Demand	2,495,000	3,594,000	4,477,000	10,525,000
Reserve	1,223,333	1,182,542	1,947,433	4,394,308
% Reserve	49.0	32.9	43.5	41.8
Time of Peak	Aug. 24	July 26	Aug. 17	Aug. 24

*Excluding Alcoa interruptible demand.

TABLE 1.1-8 (Sheet 4 of 6)

TEXAS UTILITIES COMPANY SYSTEM
CAPABILITIES, DEMANDS AND RESERVES BY COMPANIES
1963 - 1986

Kilowatts

	DPL	TES	TPL*	TUCS*
1978*				
Added Capability	150,000	534,200	328,900	1,013,100
Total Capability	3,868,333	5,310,742	6,753,333	15,932,408
Demand	2,609,000	3,802,000	4,926,000	11,232,000
Reserve	1,259,333	1,508,742	1,827,333	4,700,408
% Reserve	48.3	39.7	37.1	41.8
Time of Peak	July 14	July 17	July 18	July 18
1979*				
Added Capability	187,500	712,500	600,000	1,500,000
Total Capability	4,055,833	6,023,242	7,353,333	17,432,408
Demand	2,473,000	3,722,000	4,732,000	10,880,000
Reserve	1,582,833	2,301,242	2,621,333	6,552,408
% Reserve	64.0	61.8	55.4	60.2
Time of Peak	Aug. 30	July 16	Aug. 6	July 9
1980*				
Added Capability	0	(26,000)	5,752	(20,248)
Total Capability	4,055,833	5,997,242	7,359,085	17,412,160
Demand	2,844,000	4,251,000	5,586,000	12,591,000
Reserve	1,211,833	1,746,242	1,773,085	4,821,160
% Reserve	42.6	41.1	31.7	38.3
Time of Peak	Aug. 22	July 2	Aug. 21	July 2
PROJECTED WITH COMANCHE PEAK IN SERVICE				
1981*				
Added Capability	0	0	545,000	545,000
Total Capability	4,055,833	5,997,242	7,904,085	17,957,160
Demand	2,850,000	4,280,000	6,000,000	13,130,000
Reserve	1,205,833	1,717,242	1,904,085	4,827,160
% Reserv	42.3	40.1	31.7	36.8
1982*				
Added Capability	210,834**	367,083**	412,083**	990,000**
Total Capability	4,266,667	6,364,325	8,316,168	18,947,160
Demand	2,950,000	4,495,000	6,290,000	13,735,000
Reserve	1,316,667	1,869,325	2,026,168	5,212,160
% Reserve	44.6	41.6	32.2	37.9

*Excluding Alcoa interruptile demand.
**Includes TUCS ownership only in Comanche Peak units.

TABLE 1.1-8 (Sheet 5 of 6)

TEXAS UTILITIES COMPANY SYSTEM
CAPABILITIES, DEMANDS AND RESERVES BY COMPANIES
1963 - 1986

Kilowatts

PROJECTED WITH COMANCHE PEAK	DPL	TES	TPL*	TUCS*
1983*				
Added Capability	0	(22,000)	0	(22,000)
Total Capability	4,266,667	6,342,325	8,316,168	18,925,160
Demand	3,050,000	4,715,000	6,600,000	14,365,000
Reserve	1,216,667	1,627,325	1,716,168	4,560,160
% Reserve	39.9	34.5	26.0	31.7
1984*				
Added Capability	107,833**	342,083**	412,084**	862,000**
Total Capability	4,374,500	6,684,408	8,728,252	19,787,160
Demand	3,150,000	4,945,000	6,940,000	15,035,000
Reserve	1,224,500	1,739,408	1,788,252	4,752,160
% Reserve	38.9	35.2	25.8	31.6
1985*				
Added Capability	35,000	424,000	756,500	1,215,500
Total Capability	4,409,500	7,108,408	9,484,752	21,002,660
Demand	3,250,000	5,185,000	7,320,000	15,755,000
Reserve	1,159,500	1,923,408	2,164,752	5,247,660
% Reserve	35.7	37.1	29.6	33.3
1986*				
Added Capability	(145,000)	0	612,500	467,500
Total Capability	4,264,500	7,108,408	10,097,252	21,470,160
Demand	3,350,000	5,435,000	7,700,000	16,485,000
Reserve	914,500	1,673,408	2,397,252	4,985,160
% Reserve	27.3	30.8	31.1	30.2
PROJECTED WITHOUT COMANCHE PEAK				
1981*				
Added Capability	0	0	545,000	545,000
Total Capability	4,055,833	5,997,242	7,904,085	17,957,160
Demand	2,850,000	4,280,000	6,000,000	13,130,000
Reserve	1,205,833	1,717,242	1,904,085	4,827,160
% Reserve	42.3	40.1	31.7	36.8

*Excluding Alcoa interruptible demand.
**Includes TUCS ownership only in Comanche Peak units.

TABLE 1.1-8 (Sheet 6 of 6)

TEXAS UTILITIES COMPANY SYSTEM
CAPABILITIES, DEMANDS AND RESERVES BY COMPANIES
1963 - 1986

Kilowatts

PROJECTED WITHOUT COMANCHE PEAK

1982*	DPL	TES	TPL*	TUCS*
Added Capability	0	(45,000)	0	(45,000)
Total Capability	4,055,833	5,952,242	7,904,085	17,912,160
Demand	2,950,000	4,495,000	6,290,000	13,735,000
Reserve	1,105,833	1,457,242	1,614,085	4,177,160
% Reserve	37.5	32.4	25.7	30.4
1983*				
Added Capability	0	(22,000)	0	(22,000)
Total Capability	4,055,833	5,930,242	7,904,085	17,890,160
Demand	3,050,000	4,715,000	6,600,000	14,365,000
Reserve	1,005,833	1,215,242	1,304,085	3,525,160
% Reserve	33.0	25.8	19.8	24.5
1984*				
Added Capability	(103,000)	(70,000)	0	(173,000)
Total Capability	3,952,833	5,860,242	7,904,085	17,717,160
Demand	3,150,000	4,945,000	6,940,000	15,035,000
Reserve	802,833	915,242	964,085	2,682,160
% Reserve	25.5	18.5	13.9	17.8
1985*				
Added Capability	35,000	424,000	756,500	1,215,500
Total Capability	3,987,833	6,284,242	8,660,585	18,932,660
Demand	3,250,000	5,185,000	7,320,000	15,755,000
Reserve	737,833	1,099,242	1,340,585	3,177,660
% Reserve	22.7	21.2	18.3	20.2
1986*				
Added Capability	(145,000)	0	612,500	467,500
Total Capability	3,842,833	6,284,242	9,273,085	19,400,160
Demand	3,350,000	5,435,000	7,700,000	16,485,000
Reserve	492,833	849,242	1,573,085	2,915,160
% Reserve	14.7	15.6	20.4	17.7

*Excluding Alcoa interruptible demand.

TABLE 1.1-8a

COMPARISON OF PAST AND PRESENT PROJECTIONS
TUCS CAPABILITIES, DEMANDS, AND RESERVES

	Original Filing				Present Filing[1]				Change			
	Cap. Mw	Demand Mw	Reserve Mw	Reserve %	Cap. Mw	Demand Mw	Reserve Mw	Reserve %	Cap. Mw	Demand Mw	Reserve Mw	Reserve %
1974	12,007	10,286	1,721	16.7	12,007	9,602	2,405	25.0	-	-684	684	8.3
1975	13,357	11,218	2,139	19.1	13,352	9,505	3,847	40.5	-5	-1,713	1,708	21.4
1976	14,238	12,224	2,014	16.5	13,864	10,002	3,862	38.6	-374	-2,222	1,848	22.1
1977	15,473	13,310	2,163	16.2	14,919	10,525	4,394	41.8	-554	-2,785	2,231	25.6
1978	16,973	14,489	2,484	17.1	15,932	11,232	4,700	41.8	-1,041	-3,257	2,216	24.7
1979	18,473	15,752	2,721	17.3	17,432	10,880	6,552	60.2	-1,041	-4,872	3,831	42.9
1980	20,323	17,100	3,223	18.8	17,412	12,591	4,821	38.3	-2,911	-4,509	1,598	19.5
1981	21,636	18,536	3,100	16.7	17,957	13,130	4,827	36.8	-3,679	-5,406	1,727	[illegible]
1982	23,348	20,074	3,274	16.3	18,947	13,735	5,212	37.9	-4,401	-6,339	1,938	21.6
1983	25,564	21,722	3,842	17.7	18,925	14,365	4,560	31.7	-6,639	-7,357	718	14.0
1984	27,464	23,484	3,980	16.9	19,787	15,035	4,752	31.6	-7,677	-8,449	772	14.7
1985					21,003	15,755	5,248	33.3				
1986					21,470	16,485	4,985	30.2				

[1]Actual through 1980.

[2]Includes only that portion of Comanche Peak units which is owned by TUCS.

TABLE 1.1-9

ERCOT CAPACITY RESOURCES, PEAK-HOUR DEMANDS, AND RESERVE MARGINS

Year	Resources, Mw	Peak-Hour Demands, Mw(1)(2)	Reserve Margin (Mw)	Reserve Margin (%)
Actual				
1972	25,550	20,408	5,142	25.2
1973	26,475	21,687	4,788	22.1
1974	30,010	23,332	6,678	28.6
1975	32,055	23,525	8,530	36.3
1976	33,600	25,400	8,200	32.3
1977	36,440	26,819	9,621	35.9
1978	39,099	28,645	10,454	36.5
1979	39,623	28,556	11,067	38.8
1980	42,141	32,126	10,015	31.2
Projected With Comanche Peak				
1981	42,086	33,306	8,780	26.4
1982	44,701	35,089	9,612	27.4
1983	45,273	36,873	8,400	22.8
1984	47,391	38,796	8,595	22.2
1985	49,013	40,744	8,269	20.3
1986	51,142	42,735	8,407	19.7
Projected Without Comanche Peak				
1981	42,086	33,306	8,780	26.4
1982	43,551	35,089	8,462	24.1
1983	44,123	36,873	7,250	19.7
1984	45,091	38,796	6,295	16.2
1985	46,713	40,744	5,969	14.7
1986	48,842	42,735	6,107	14.3

(1) Projections include interruptible demands.
(2) Undiversified.

Source: EEI Electric Power Survey Committee.

TABLE 1.1-10 (Sheet 1 of 3)

TEXAS UTILITIES COMPANY SYSTEM
ELECTRIC ENERGY SALES BY CUSTOMER CLASS
1963-1979 (HISTORICAL)

	1963		1964		1965	
	MWH	%	MWH	%	MWH	%
Residential	4,558,869	30	4,871,843	29	5,321,418	29
Commercial	4,193,598	27	4,429,626	27	4,835,472	27
Industrial*	4,831,514	32	5,433,984	33	5,946,933	33
Government & Municipal	585,053	4	640,427	4	689,845	4
Other Electric Utilities	1,028,253	7	1,133,834	7	1,178,004	7
TOTAL	15,197,287	100	16,509,719	100	17,971,672	100

*Includes interruptible service to a large industrial customer

	1963	1964	1965
		226,265	228,901

	1966		1967		1968	
	MWH	%	MWH	%	MWH	%
Residential	5,716,174	29	6,415,514	29	7,281,535	30
Commercial	5,218,604	26	5,739,264	26	6,226,452	25
Industrial*	7,032,983	35	7,934,421	35	8,597,143	35
Government & Municipal	740,902	4	817,445	4	845,171	4
Other Electric Utilities	1,246,332	6	1,371,243	6	1,584,018	6
TOTAL	19,954,995	100	22,277,887	100	24,534,319	100

*Includes interruptible service to a large industrial customer

	1966	1967	1968
	411,742	595,674	551,333

TABLE 1.1-10 (Sheet 2 of 3)

TEXAS UTILITIES COMPANY SYSTEM
ELECTRIC ENERGY SALES BY CUSTOMER CLASS
1963-1979 (HISTORICAL)

	1969		1970		1971	
	MWH	%	MWH	%	MWH	%
Residential	9,073,588	32	10,098,405	32	10,915,310	32
Commercial	7,022,941	24	7,602,034	24	8,307,851	25
Industrial*	10,055,445	35	10,949,552	35	11,267,589	34
Government & Municipal	955,257	3	1,019,789	3	1,111,712	3
Other Electric Utilities	1,685,484	6	1,832,415	6	2,043,500	6
TOTAL	28,792,715	100	31,502,195	100	33,645,962	100

*Includes interruptible service to a large industrial customer

	1969	1970	1971
	1,401,417	1,947,850	1,945,309

	1972		1973		1974	
	MWH	%	MWH	%	MWH	%
Residential	12,748,036	34	13,122,546	33	13,532,494	33
Commercial	9,471,615	26	10,130,629	26	10,285,297	25
Industrial*	11,535,114	31	12,715,469	32	13,231,004	32
Government & Municipal	1,227,335	3	1,226,292	3	1,293,641	3
Other Electric Utilities	2,379,287	6	2,550,454	6	2,751,057	7
TOTAL	37,361,387	100	39,745,390	100	41,093,493	100

*Includes interruptible service to a large industrial customer

	1972	1973	1974
	1,500,644	2,001,058	2,431,269

TABLE 1.1-10 (Sheet 3 of 3)

TEXAS UTILITIES COMPANY SYSTEM
ELECTRIC ENERGY SALES BY CUSTOMER CLASS
1963-1979 (HISTORICAL)

	1975		1976		1977	
	MWH	%	MWH	%	MWH	%
Residential	14,575,846	34	14,548,407	33	16,642,382	33
Commercial	11,026,495	26	11,338,371	26	12,347,755	25
Industrial*	12,962,019	30	13,917,588	31	15,678,254	32
Govn. & Mun.	1,333,765	3	1,425,665	3	1,565,518	3
Other Electric Utilities	2,951,890	7	3,100,357	7	3,445,403	7
TOTAL	42,850,015	100	44,330,388	100	49,679,312	100

*Includes interruptible service to a large industrial customer

	1975	1976	1977
	2,038,618	1,822,488	2,786,027

	1978		1979	
	MWH	%	MWH	%
Residential	17,943,224	34	17,394,402	32
Commercial	13,117,202	25	13,264,436	25
Industrial*	16,469,636	31	17,275,859	32
Govn. & Mun.	1,728,056	3	1,669,726	3
Other Electric Utilities	3,976,161	7	4,521,017	8
TOTAL	53,234,279	100	54,125,440	100

*Includes interruptible service to a large industrial customer

	1978	1979
	2,891,259	3,076,399

TABLE 1.1-11

INDUSTRIES SERVED BY TUCS

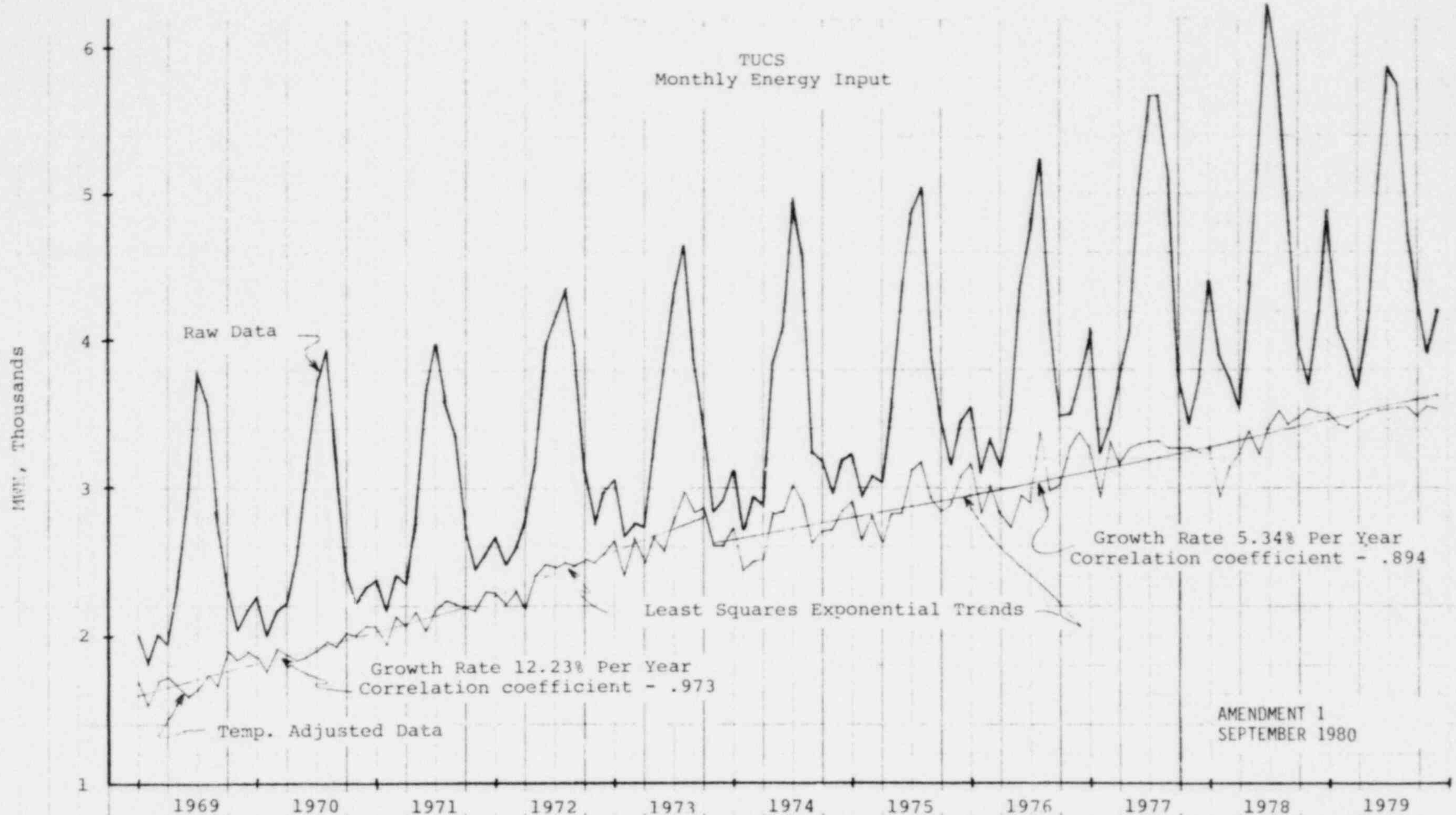
Classification	1979 Industrial Revenue ($1,000)	Percent of Total
Apparel and similar finished products	$ 5,385	1.3
Chemical and allied products	22,735	5.4
Electrical machinery and equipment	28,105	6.7
Fabricated metal products, other	15,942	3.8
Food and kindred products	28,556	6.8
Furniture and fixtures	2,833	0.7
Lumber and wood products	8,849	2.1
Machinery, except electrical	15,352	3.7
Paper and allied products	15,811	3.8
Petroleum industries:		
Crude petroleum and natural gas	66,147	15.8
Petroleum refining & related industries	8,889	2.1
Pipe line transportation	21,999	5.2
Primary metal industries*	82,811	19.8
Printing, publishing, etc.	8,459	2.0
Rubber and plastics products	16,523	3.9
Stone, clay and glass products	37,712	9.0
Textile mill products	1,708	0.4
Transportation equipment:		
Aircraft and parts	13,251	3.2
Motor vehicles and other transportation equipment	4,971	1.2
Other industrial	13,186	3.1
TOTAL	$419,224	100

*Includes interruptible sales to a large industrial customer: $48,400

TABLE 1.1-12

RELATIVE PROPORTIONS OF
TUCS ACTUAL AND PROJECTED FUEL USE
1970-1986

Year	Gas/Oil %	Lignite/Coal %	Nuclear %	Total %
1970(Actual)	100.0	0		100.0
1971(Actual)	100.0	0		100.0
1972(Actual)	94.0	6.0		100.0
1973(Actual)	85.1	14.9		100.0
1974(Actual)	84.3	15.7		100.0
1975(Actual)	75.3	24.7		100.0
1976(Actual)	68.8	31.2		100.0
1977(Actual)	67.7	32.3		100.0
1978(Actual)	59.3	40.7		100.0
1979(Actual)	50.8	49.2		100.0
1980	49.4	50.6		100.0
1981	49.3	49.8	0.3	100.0
1982	48.1	47.8	4.1	100.0
1983	46.9	44.7	8.4	100.0
1984	43.2	43.5	13.3	100.0
1985	35.0	49.7	15.2	100.0
1986	34.0	50.3	15.7	100.0



AMENDMENT 1
SEPTEMBER 1980

TEXAS UTILITIES COMPANY SYSTEM

MONTHLY NET ENERGY INPUT IN MILLIONS KWH
(Excluding Sales To Alcoa)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1963	1123	990	1095	1174	1353	1644	1947	2010	1582	1384	1138	1191
1964	1205	1122	1180	1241	1423	1757	2207	2131	1693	1304	1248	1309
1965	1299	1200	1333	1367	1498	1872	2336	2216	1942	1471	1382	1443
1966	1483	1335	1474	1462	1752	2090	2622	2397	1921	1662	1559	1639
1967	1627	1483	1669	1737	1940	2441	2618	2729	2024	1864	1702	1793
1968	1848	1698	1789	1771	2084	2522	2848	3067	2290	2093	1874	1976
1969	2008	1813	2011	1970	2337	2939	3794	3562	2793	2357	2049	2194
1970	2280	2000	2168	2218	2540	3147	3700	3919	3171	2431	2220	2339
1971	2380	2179	2404	2354	2756	3642	3988	3591	3358	2711	2422	2552
1972	2673	2479	2590	2749	3157	3974	4181	4351	3910	3108	2742	2974
1973	3053	2681	2778	2746	3332	3858	4588	4645	3842	3340	2829	2912
1974	3121	2667	2945	2894	3855	4108	4989	4569	3245	3178	2958	3185
1975	3213	2933	3080	3044	3544	4325	4866	5053	3937	3437	3156	3422

Texas Utilities Company System

Monthly Net Energy Input in Millions Kwh
(Excluding Interruptible Energy to Alcoa)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1976	3551	3100	3337	3167	3455	4369	4744	5249	4125	3487	3500	3713	45798
1977	4068	3224	3416	3284	4063	5003	5666	5669	5087	3776	3424	3765	50443
1978	4402	3871	3752	3554	4399	5230	6302	5847	4955	3982	3700	4166	54158
1979	4789	4071	3908	3662	4091	4997	5836	5740	4758	4292	3909	4202	54256

TEXAS UTILITIES MONTHLY ENERGY-TEMP ADJUSTED
LEAST SQUARES EXPONENTIAL TREND-NOV 73 TO DEC 79

1ST. YEAR OF DATA TRENDED- 59
LAST YEAR OF DATA TRENDED- 132

TREND RATE OF GROWTH- .434643 PERCENT PER ~~YEAR~~ MONTH 5.34 % PER YEAR

YEAR	ACTUAL	ESTIMATE	ERROR IN TRENDED ESTIMATE ABSOLUTE-MW	PERCENT
59	2621	2647.63	26.6282	1.01596
60	2607	2659.14	52.1359	1.99984
61	2727	2670.69	-56.3063	-2.06477
62	2450	2682.3	232.302	9.4817
63	2496	2693.96	197.96	7.93109
64	2549	2705.67	156.669	6.1463
65	2831	2717.43	-113.571	-4.01168
66	2851	2729.24	-121.76	-4.27077
67	3009	2741.1	-267.897	-8.9032
68	2880	2753.02	-126.983	-4.40914
69	2627	2764.98	137.983	5.25248
70	2709	2777.	68.0005	2.51017
71	2720	2789.07	69.0705	2.53936
72	2851	2801.19	-49.807	-1.747
73	2920	2813.37	-106.632	-3.65177
74	2628	2825.6	197.596	7.51889
75	2822	2837.88	15.8776	.562636
76	2656	2850.21	194.212	7.31221
77	2836	2862.6	26.6005	.937958
78	2876	2875.04	-.957403	-3.32894E-2
79	3126	2887.54	-238.461	-7.62832
80	3193	2900.09	-292.911	-9.17353
81	2942	2912.69	-29.3057	-.996114
82	2850	2925.35	75.3541	2.644
83	2879	2938.07	59.069	2.05172
84	3095	2950.84	-144.161	-4.65786
85	3175	2963.66	-211.335	-6.65623
86	2826	2976.55	150.546	5.32718
87	3061	2989.48	-71.5165	-2.33638
88	2832	3002.48	170.477	6.01967
89	2747	3015.53	268.527	9.77529
90	2965	3028.63	63.6339	2.14617
91	2902	3041.8	139.798	4.81729
92	3398	3055.02	-342.981	-10.0936
93	2982	3068.3	86.2971	2.89393
94	3028	3081.63	53.6332	1.77124
95	3295	3095.03	-199.973	-6.06897
96	3395	3108.48	-286.52	-8.43948
97	3271	3121.99	-149.01	-4.55547

POOR ORIGINAL

TEXAS UTILITIES MONTHLY ENERGY-TEMP ADJUSTED
LEAST SQUARES EXPONENTIAL TREND-NOV 73 TO DEC 79

1ST. YEAR OF DATA TRENDED- 59
LAST YEAR OF DATA TRENDED- 132

TREND RATE OF GROWTH- .434643 PERCENT PER ~~YEAR~~ MONTH

YEAR	ACTUAL	ESTIMATE	ERROR IN TRENDED ESTIMATE ABSOLUTE-MW	PERCENT
98	2949	3135.56	186.56	6.32621
99	3352	3149.19	-202.812	-6.05046
100	3174	3162.88	-11.1238	-.350466
101	3263	3176.62	-86.3766	-2.64715
102	3303	3190.43	-112.57	-3.4081
103	3366	3204.3	-161.703	-4.804
104	3369	3218.22	-150.775	-4.47537
105	3287	3232.21	-54.7875	-1.66679
106	3276	3246.26	-29.7389	-.907782
107	3298	3260.37	-37.6293	-1.14097
108	3234	3274.54	40.5417	1.25361
109	3272	3288.77	16.7743	.512661
110	2914	3303.07	389.069	13.3517
111	3152	3317.43	165.425	5.24826
112	3254	3331.84	77.8442	2.39226
113	3399	3346.33	-52.6741	-1.54969
114	3230	3360.87	130.87	4.05172
115	3402	3375.48	-26.5217	-.779593
116	3547	3390.15	-156.85	-4.42206
117	3455	3404.88	-50.1154	-1.45052
118	3482	3419.68	-62.3163	-1.78967
119	3552	3434.55	-117.453	-3.30667
120	3522	3449.48	-72.5248	-2.05919
121	3522	3464.47	-57.5319	-1.6335
122	3429	3479.53	50.5262	1.4735
123	3409	3494.65	85.6497	2.51246
124	3462	3509.84	47.8389	1.38183
125	3491	3525.09	34.0942	.976632
126	3531	3540.42	9.4158	.266661
127	3536	3555.8	19.804	.560067
128	3540	3571.26	31.259	.883024
129	3550	3586.78	36.7813	1.03609
130	3492	3602.37	110.371	3.16068
131	3561	3618.03	57.0284	1.60147
132	3545	3633.75	88.754	2.50364

THE COEFFICIENT OF CORRELATION IS .893735

SBU 0.969 UNTS.

POOR ORIGINAL

AMENDMENT 1
SEPTEMBER 1980

1.3 CONSEQUENCES OF DELAY

Major consequences will be experienced in the areas of fuel supply and use, economics, and system reserves if the subject facility is delayed. Each of these areas will be discussed individually.

1.3.1 FUEL SUPPLY AND USE

The subject facility has been an integral part of fuel supply planning for TUCS since its inception. A major objective of TUCS' fuel supply planning for a number of years has been to reduce dependence on gas and oil, which have experienced dramatic escalation in cost and have been in increasingly short supply, by increased use of lignite, coal, and initial use of nuclear energy in the subject facility. The transition in fuel sources is in the best interest of customers and is consistent
with state and national goals. This transition has been proceeding as 1
rapidly as construction financing and prudence will allow. As late as 1975, approximately three-fourths of system fuel needs were from gas/oil and one-fourth from lignite (See Table 1.1-12). In 1983, with present plans and energy estimates, and with Comanche Peak on schedule,
a substantial further reduction can be made in the use of gas/oil, so 1
that less than half of system energy needs come from this resource. These plans are consistent with the public interest in diminishing use of natural gas as boiler fuel in favor of other uses, and in refraining from too-great dependence on fuel oil, with its precarious supply and balance-of-payments problems. The best interest of our customers from the standpoints of cost, fuel supply security and system reliability will be served by the completion and placing in service of the Comanche Peak facility on schedule.

Assuming a lifetime average capacity factor, if one Comanche Peak unit were delayed one year, more than 10 million barrels of oil or 65 BCF of natural gas would be required to replace the lost energy. Even if it were assumed that 10 percent of this fuel requirement could be transferred to existing coal/lignite units, the deficit would still be over 9 million barrels of oil or 59 BCF of gas. It is extremely doubtful if either would be available.

1.3.2 ECONOMICS

Economics and the financial health of the companies will be adversely affected by a delay in service of Comanche Peak. At the time of initiation of the project, TUCS was figuratively at a fork in the road. Having made the heavy financial commitments required for this project, a non-nuclear course is not an alternate route--it is a detour, and an extremely costly one. A delay, while not a detour, is merely marking time, and costs continue unabated. Costs in the form of interest on committed capital, and high replacement cost of energy would continue during the period of any delay, and would seriously impact the financial situation of TUCS.

1.3.3 CAPACITY RESERVES

Reserve for the Texas Utilities Company System is higher at this time than when the Comanche Peak units were planned (Ref. Table 1.1-8a). It has been necessary to pursue construction of new generating capacity, including Comanche Peak, even when reserves appear adequate because of the fuel supply situation. The gas/oil fired capacity of the system, comprising some 12,000 megawatts, does not have a fuel supply sufficient for the energy needs of customers. A phase-out of natural gas use in utility boilers has been ordered by the Fuel Use Act of 1978.

1 Under Fuel Use Act of 1978 (Public Law 95-619).

(a) <u>Existing</u> electric power plants may not use natural gas after January 1, 1990, without specific exemption from DOE; and

(b) New electric power plants may not use natural gas or petroleum as primary energy source, and must be constructed with capability to burn coal or alternate fuels.

Under Environmental Coordination Act of 1974 (Public Law 93-319).

(a) Existing electric power plants may be prohibited from burning natural gas or petroleum, to meet certain requirements.

(b) Administrator may require new electric power plants to be designed and constructed to use coal.

The Fuel Use Act of 1978, by prohibiting the use of natural gas and 1
petroleum as primary energy sources for electric power plants after January 1, 1990, could limit or make useless some 10,000 MW of generating capability on TUCS. Thereby, increasing capital investment and operating costs; and reducing system reliability by retiring all gas/oil units. For reference, see "Fuel Supply" in Chapter 1.3.1.

As discussed in 1.3.1, Fuel Supply and Use, TUCS must press forward with new capacity utilizing nuclear and solid fuels, even though reserves may appear higher than normal, until the transition away from natural gas is more nearly complete. As this transition approaches completion, reserves are expected to decline to a level as determined by requirements for system reliability.

Reserves as indicated in this report, while appearing high, have been carefully planned recognizing the fuel supply situation. Delay of the subject units would produce reserves which may appear adequate numerically, but are in fact inadequate because of the lack of an assured fuel supply. The energy shortage which would result would in all likelihood cover the entire Texas Utilities Company System, including the Dallas - Ft. Worth metropolitan area, and many other communities in North, Central and West Texas.

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LIST OF TABLES (Continued)

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 SITE LOCATION AND DESCRIPTION

2.1.1.1 Specification of Location

The CPSES site is located in Somervell County in North Central Texas. Squaw Creek Reservoir (SCR), established for Station cooling, extends northward into Hood County. The 7,669 acre site is owned by the Applicants and is situated along Squaw Creek, a tributary of the Paluxy River, which is a tributary of the Brazos River. The Station site is over 30 miles southwest of the nearest portion of the Fort Worth area and approximately 4.5 miles north-northwest of Glen Rose, the nearest community (see Figure 2.1-1). Site coordinates are: 1

	Unit No. 1	Unit No. 2
Texas Coordinate System (North Central Zone) (Feet)	Y=229,723.96	Y=230,010.86
	X=1,911,921.11	X=1,911,951.27
U.T.M. Grid (Zone 14) (Meters)	N=3,573,903	N=3,573,991
	E=614,393	E=614,401
Latitude	32o 17' 52.02"	32o 17' 54.85"
Longitude	97o 47' 06.15"	97o 47' 05.79"

2.1.1.2 Site Area

The site area map (Figure 2.1-2) shows the plant property and site boundary lines, the Exclusion Area, and (SCR). Station access is by a railroad spur line which connects to the Atchison, Topeka and Santa Fe Railroad Company main line, and by plant access road which connects to Farm Road 201. The plant railroad and access road are owned and
1 controlled by the Applicants. There are no other highways, railways or
Q13 navigable waterways which traverse or are immediately adjacent to the site, nor are there any industrial, recreational or occupied residential structures within the site area. Principal plant structures are shown in Section 3.1.

2.1.1.3 Boundaries for Establishing Effluent Release Limits

1 The Exclusion Area consists of approximately 4,170 acres. Figure 2.1-2
Q13 depicts the Exclusion Area boundary. This boundary is used for establishing effluent release limits and enables the Applicants to fulfill their obligations with respect to the requirements of 10 CFR Parts 20 and 100.

Figure 2.1-2 shows that the points of release for each of the two units are located closer to the southwest property line than to any other segment of the property line. This southwesterly distance is the minimum Exclusion Area boundary distance.

2.1.2 EXCLUSION AREA AUTHORITY AND CONTROL

2.1.2.1 Authority

The Applicants have acquired and will maintain surface ownership of all
1 the land within the Exclusion Area as identified on Figure 2.1-2.
Q13 Accordingly, the Applicants, have the necessary authority to control activities within this area.

The minimum distance to the Exclusion Area boundary from the centerline between Containment Buildings is 5,067 feet (1544 meters) to the west-southwest. Q13

2.1.2.2 Control of Activities Unrelated to Plant Operation

Activities unrelated to plant operation which may be permitted within the Exclusion Area include the exercising of mineral rights, and the maintenance of pipelines. The Applicants will have the necessary control to determine these activities.

Recreational activities within the Exclusion Area will include a visitor's overlook area, shown on Figure 2.1-2, which will be open to the public. Access to this area is provided by a spur from the main plant access road. The Applicants have the authority to exclude or 1
remove any person from this area at any time.

In addition, Squaw Creek Reservoir may be opened to the public for recreational use. In this case, appropriate and effective arrangements will be made (in coordination with appropriate state agencies) to control access to, activities on, and the removal of persons and property from the reservoir in case of emergency.

The plant staff will have knowledge of the approximate number and location of persons within the Exclusion Area engaged in such activities. Normal evacuation of persons within the Exclusion Area 1
will take no more than two hours.

2.1.3 POPULATION DISTRIBUTION

The purpose of this section is to provide detailed estimates of the present and projected size and distribution of population within a 50-mile radius of the Comanche Peak Steam Electric Station (CPSES). In accordance with Regulatory Guide 4.2 (Revision 1), population estimates given in the original Environmental Report (ER) have been reviewed, revised, and updated for purposes of this present ER. In this section, estimates of population distribution are provided for 1970 (most recent census year), 1976, and for census decades 1980 through 2020.

The population estimates and projected distribution of population for the census year 1980 are also intended as the estimates of population distribution for the first year of plant operation. The schedule for initation of on-line, commercial operations of CPSES Unit 1 was orginally set at January 1, 1980. As noted in Chapter 1, the original schedule has been revised and the initiation of full on-line, commercial operation of Unit 1 has been rescheduled to January, 1981. With this revised schedule, however, 1980 will include a period of trial operation of Unit 1. Accordingly, 1980 is taken as the first year of plant operation for purposes of this particular estimate of population distribution.

In reviewing and updating the sector-by-sector and sector-area estimates of population in the original ER (CP Stage), it was recognized that the actual centerline locations of the Containment Buildings for Units 1 and 2 differ slightly (approximately 88 feet) from the locations as originally shown. In these revised population estimates, the actual centerline of the Unit 1 Containment Building has been taken as the point of origin for the sector lines and concentric distance circles which form the sector-areas used in portraying

The fish populations were represented by several species that are indicative of both lentic and lotic waters. The quiet backwater areas were represented by several species of Centrarchids, including the bluegill, orangespotted sunfish, longear sunfish, warmouth sunfish, green sunfish and largemouth bass. The flowing waters provide habitat for species of darters including the logperch and the orangethroat darter.

There are several species of aquatic macrophytes found in the habitats. These include both emergent and submergent types. The importance of the aquatic macrophytes cannot be overemphasized since they provide support and shelter for the higher trophic levels and contribute to the primary productivity of the aquatic habitat.

The water of the aquatic ecosystems in the site vicinity is considered to be of good quality overall. However, there are areas where the dissolved oxygen content of the water at certain times of the year drops below the minimum standard of 4.0 parts per million (ppm) established by the Texas Water Quality Board for this segment of the Brazos River system (1967). These areas are in the hypolimnion of Lake Granbury, and also in part of the Paluxy River near the town of Glen Rose. The outfall of the sewage treatment plant is located on the Paluxy River, and below the outfall the oxygen sag curve is apparent with high biochemical oxygen demand (BOD) readings. However, this situation occurs only for a short distance on the river and recovery of the oxygen level to readings above 4.0 ppm soon takes place (Ubelaker, 1974).

The following sections present an analysis of the aquatic habitats since construction activities were initiated at the site.

2.2.2.2 Physical Description of Site Area

2.2.2.2.1 Squaw Creek

In the site vicinity Squaw Creek is an intermittent stream, which flows in a southeasterly direction for 23 miles to its confluence with the Paluxy River. The creek is characterized by riffles, pools, and cascades. The substrate is composed of bedrock with overlying organic material and gravel.

The volume of water in the creek is dependent on local climatic conditions. The upper portion of Squaw Creek is dependent on surface runoff, while the lower segment derives its flow from surface runoff and groundwaters.

The water temperature corresponds closely with that of the atmosphere, except in areas that receive groundwaters. Temperatures recorded during the study period range from a low of $0^{o}C$ in winter to a high of $34^{o}C$ in July and August. The water is very clear for the most part, indicating high transparency, as shown by the secchi disc readings and the low turbidity readings. Extremes of selected water quality parameters measured during the study period are summarized in Table 2.2-21. Details of the water quality monitoring program may be found in Appendix D of the original ER; Ubelaker (1974, 1976); Appendix A, Annual Summary (1975); and Annual Summary (1976).

2.2.2.2.2 Lake Granbury

Lake Granbury is a 33 mile long reservoir on the Brazos River that is
1 used for flood control, municipal, industrial, and agricultural
purposes. Lake Granbury has a maximum depth of approximately 75 feet at the base of the dam and has an average channel depth of 43 feet (Mecom, 1972). The lake circulates from about October thru mid-April. The remainder of the year it is stratified. Temperatures recorded

during the study period range from 13^{o}C in the hypolimnion (measured in January, 1974) to a high of 32^{o}C at the surface (measured in July and August, 1974).

Turbidity measurements were made for surface and bottom waters. The range of values included 8-16 JTU (Jackson Turbidity Units) for surface waters and 14-84 JTU for bottom waters. Extremes of selected water quality parameters are presented in Table 2.2-21. Details of the water quality monitoring program are presented in Appendix D of the original ER and in Ubelaker (1974).

2.2.2.2.3 Paluxy River

The Paluxy River flows in a southeasterly direction and empties into the Brazos River east of the town of Glen Rose. The stream has an average depth of 2.5 feet and an average width of 85 feet and is characterized by riffles, shallow pools, and small waterfalls (Ubelaker, 1974).

Water temperatures in the Paluxy River correspond closely with atmospheric conditions. The range of temperatures measure include a low of 11^{o}C (recorded in November, 1974) to a high of 32^{o}C (recorded in August, 1974). Generally speaking, water temperatures were somewhat higher during the 1974 study than the previous year and this was attributed to the decreased flow of water.

Extremes of selected water quality parameters are presented in Table 2.2-21. Details of the Water Quality Monitoring program are presented in Appendix D (original ER) and in Ubelaker (1974).

2.2.2.2.4 Brazos River

The Brazos River flows southeasterly across the state of Texas and empties in the Gulf of Mexico. In the site vicinity the Brazos receives water from Squaw Creek and the Paluxy River. In this vicinity the substrate of the Brazos is composed mainly of sand and gravel (Lamb, 1959). During the study period, water temperatures of the river range from a low of 11.5°C (measured in November, 1974) to a high of 31.8°C (measured in August, 1974). The temperatures as recorded at the U.S.G.S. Station 8-0910 range from 1.7°C in winter to 35.6°C in summer. Extremes of selected water quality parameters are presented in Table 2.2-21. Details of the Water Quality Monitoring Program are presented in Appendix D (original ER) and Annual Summary (1975, 1976).

2.2.2.3 Aquatic Biota of Squaw Creek

2.2.2.3.1 Aquatic Vegetation

Submergent and emergent life forms are found in Squaw Creek. The water flow probably prohibits the growth of floating-leaved plants in the creek. Aquatic macrophytes must have sufficient light and critical gases to carry on photosynthesis to survive in the aquatic environment. Light transparency of the water does not appear to be the critical factor limiting plant growth in Squaw Creek because the water is clear.

Submergents are probably the most important macrophytes within Squaw Creek because they are more abundant than emergents. They provide more habitat and cover for aquatic invertebrates and vertebrates (Table 2.2-22). Stonewort (Chara sp.), an algae, is an excellent producer of fish food (especially for bass). It also has a softening effect on water by extracting lime and carbon dioxide and depositing marl. Common hornwort (Ceratophyllum demersum) offers excellent shelter for young fish and supports insects which are valuable as fish food. Water-milfoil (Myriophyllum heterophyllum) offers shelter and is a valuable food producer supporting many insects species.

When emergent species occur in abundance they offer excellent cover for small fish and support numerous insects. However, emergent species are

APPENDIX 2.2A

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants
3010 S. LAMAR • AUSTIN, TEXAS 78704
(512) 444-3151

Document No. 8087
EH&A Job No. 955-02

ENDANGERED AND THREATENED SPECIES OF WILDLIFE AND PLANTS POTENTIALLY OCCURRING IN THE VICINITY OF THE COMANCHE PEAK STEAM ELECTRIC STATION

Prepared for:

Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75301

Prepared by:

Espey, Huston and Associates, Inc.
3010 South Lamar Blvd.
P. O. Box 519
Austin, Texas 78767

2.2A
28 March 1980

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ENDANGERED AND THREATENED SPECIES OF WILDLIFE AND PLANTS POTENTIALLY OCCURRING IN THE VICINITY OF THE COMANCHE PEAK STEAM ELECTRIC STATION

1.0 AQUATIC SPECIES

1.1 INVERTEBRATES

No aquatic invertebrate species listed by the U.S. Fish and Wildlife Service (1979a) are likely to occur in Hood or Somervell Counties in the vicinity of the Comanche Peak Steam Electric Station site.

1.2 FISH

The U.S. Fish and Wildlife Service (1979a) list of threatened and endangered species contains no fish species known to occur in the Comanche Peak Steam Electric Station area. Four species of potential occurrence at the site are listed as problematical by Hubbs (1976). The blue sucker (Cycleptus elongatus) is listed as "depleted", having lower abundances than in former times. The suckermouth minnow (Phenacobius mirabilis), gray redhorse (Moxostoma congestum) and big scale logperch (Percina macrolepida) are described as "limited", occurring in only a few areas within a broad distribution. Only one of the species previously listed (gray redhorse in 1976 and 1977) were collected at the Squaw Creek Reservoir area. Although the geographic range of each species extends into this portion of Texas, the presence of the blue sucker is uncommon throughout its range and its capture is unlikely. Potential habitat for the suckermouth minnow, gray redhorse and big scale logperch is available but confined to limited areas of this region.

2.0 TERRESTRIAL SPECIES

2.1 PLANTS

None of the endangered and threatened plant species listed by the U.S. Fish and Wildlife Service (USFWS, 1979a, b) occur in the Squaw Creek Area. Nine species are listed for Texas, all of which have limited distributions and occur far to the south and west of the project area.

Of the 230 plant species proposed for federal protection in Texas (USFWS, 1975, 1979c), one occurs near the Squaw Creek area. Petalostemon reverchonii, a perennial herb, occurs on the rocky summit of Comanche Peak. Until recently, it was known only from this locality, being last collected in 1900. It had been thought to be extinct (Wemple, 1970). A colony has recently been discovered by Barneby (1977) in Parker County. Two other species, Euphorbia roemeriana and Solidago lindheimeriana, occur in adjacent counties. Euphorbia roemeriana, an annual herb, occurs on rich calcareous soils in creek canyons of the eastern part of the Edwards Plateau. Solidago lindheimeriana, a perennial herb, occurs on upland areas. Both Gould (1975) and Correll and Johnston (1970) list this species as a synonym of Solidago petiolaris, a species of wide distribution.

A number of plants have been proposed as rare in Texas by the Rare Plant Study Center (1974). One species from this list, Dyssodia tagetoides, is known to occur in Hood County. This plant, an annual or short-lived perennial, occurs from central Oklahoma to south-central Texas (Correll and Johnston, 1970; Strother, 1969). Another species, Poa arachnifera, occurs in several surrounding counties. This perennial grass is scattered throughout Texas and Oklahoma.

2.2 WILDLIFE

Several species which are considered endangered, threatened or peripheral by the U.S. Fish and Wildlife Service (USFWS, 1979a), Texas Parks and Wildlife Department (TPWD, 1977), and/or the Texas Organization for Endangered Species (TOES, 1979) are of potential or actual occurrence in Village Bend, Hood and Somervell Counties. These species and their status as determined by each organization are presented in Table 2-1. None of these species was observed on the CPSES site during the five-year monitoring survey. Their potential occurrence in the CPSES area is discussed in the following paragraphs.

Three species listed in Table 2-1 are considered endangered by the USFWS. These are the Bald Eagle, Peregrine Falcon (Falco peregrinus) and Whooping Crane (Grus americana). A fourth species, the Brazos River water snake, is currently under study to determine its status (Maxwell, 1979); however, this species is found only on the Brazos River and is not found in the CPSES area.

Although the Bald Eagle is known to nest in Texas, breeding is largely confined to the coastal region (Oberholser, 1974; USFWS, 1978). Aerial surveys conducted by the TPWD indicate no active nests more than 81 kilometers from the coast (TPWD, 1979b). The Bald Eagle does, however, occur as a winter resident or migrant in various parts of the state including Hood and Somervell Counties. Since the Bald Eagle is primarily a fish eater, waters of sufficient size and clarity are necessary to provide their dietary requirements. Reilly (1968) determined that fish compose 50-90% of its diet, the balance of which consists of ducks, rabbits and rodents, mostly as carrion. Squaw Creek Reservoir appears to provide suitable feeding habitat for the Bald Eagle.

The Peregrine Falcon occurs in Hood and Somervell Counties during migration to the coastal zone. This species prefers lakes and mountainous habitat.

Birds make up the bulk of its diet (84%), although periodically mammals and large insects are preyed upon (Reilly, 1968).

Hood and Somervell Counties lie within the migration route of the Whooping Crane between its wintering grounds at Aransas National Wildlife Refuge on the Texas coast and its northern breeding ground in Canada. This species, whose total population is only about 100 individuals, is known to stop migration at locations in Oklahoma, Kansas, Nebraska and other northern areas; however, in Texas the USFWS Whooping Crane Recovery Team (1978) lists only one confirmed ground sighting of Whooping Cranes during migration (October 25, 1977, Comanche County). It is highly unlikely that Whooping Cranes would occur at the Comanche Peak Steam Electric Station.

Other species listed in Table 2-1 are discussed briefly in the following paragraphs.

The Texas horned lizard is considered threatened by the Texas Organization for Endangered Species (TOES, 1979) and the Texas Parks and Wildlife Department (TPWD, 1977). It may be found in arid, flat, open terrain with sparse plant cover, and in areas of mesquite and prickly pear. Foods consist primarily of spiders, sowbugs and ants (Conant, 1975).

The White-faced Ibis is threatened according to TOES (1979) and TPWD (1977). It is a resident along the Texas Gulf coast; however, it may wander into Hood and Somervell Counties (Peterson, 1967). The White-faced Ibis inhabits marshes, rice fields and swamps, where it feeds on a variety of aquatic organisms including fish, insects, crayfish and snails (Martin et al., 1961). It nests in colonies, forming cup-like nests of old reeds and sticks in which it lays three to four pale blue eggs.

The Merlin may be expected in Hood and Somervell Counties enroute during migration periods (March-April, September-October). It prefers open forests, marshes and hilly country while migrating to South America. It preys extensively on small birds (60%); however, the balance is predominantly large insects and small mammals (Reilly, 1968). This species is classified as threatened by TOES (1979).

The Golden-cheeked Warbler is classified as threatened by TOES (1979) and TPWD (1977). It winters from southern Mexico to Honduras, and nests in the Edwards Plateau (March-July), but also ranges northward into Palo Pinto County (Pulich, 1976). This species has a very narrow ecological niche, nesting only in juniper-oak woodlands in Texas. Habitat loss is the principal factor which has reduced the range of this species. Pulich (1976) states that there are some isolated areas of suitable habitat for this species in parts of Hood and Somervell Counties. No warblers or suitable habitat were noted on the CPSES site.

The Golden Eagle (listed as threatened by TOES) is distributed in mountains and hilly country statewide. Indiscriminate shooting is listed by TOES as the reason for its threatened status.

The Prairie Falcon (listed as threatened by TOES) is an inhabitant of open, arid country in all parts of the state but the extreme east. Pesticides (which cause egg shell thinning) and nest robbing are the primary causes of its status. No Prairie Falcons were observed during the surveys of the project area.

The Inland Least Tern (listed as endangered by TPWD and TOES) is a breeding species which nests on river sand bar habitats primarily in the Red River Drainage. One of the few summer records recorded by Oberholser (1974) was for Palo Pinto County adjacent to Hood County. No habitat for this species occurs in the CPSES area.

TABLE 2-1

ENDANGERED, THREATENED AND PERIPHERAL WILDLIFE[1]
OF POTENTIAL OCCURRENCE
IN HOOD AND SOMERVELL COUNTIES, TEXAS

Common Name	Scientific Name	USFWS[2]	TPWD	TOES
Texas Horned Lizard	Phrynosoma cornutum	NL	T	T
Brazos Water Snake	Nerodia harteri harteri	NL	E	E
White-faced Ibis	Plegaids chihi	NL	T	T
Whooping Crane	Grus americanus	E	E	E
Inland Least Tern	Sterna albifrons	NL	E	E
Bald Eagle	Haliaeetus leucocephalus	E	E	E
Golden Eagle	Aquila chryaetos	NL	NL	T
Prairie Falcon	Falco mexicanus	NL	NL	T
Peregrine Falcon	Falco peregrinus	E	E	E
Merlin	Falco columbarius	NL	NL	T
Golden-cheeked Warbler	Dendroica chrysoparia	NL	T	T

[1]Geographic ranges of reptiles determined from Raun and Gehlbach (1972), birds from Oberholser (1974) and Wolfe et al. (1974), and mammals from Davis (1974).

[2]E = endangered; in danger of extinction in all or most of its geographic range in the U.S., particularly in Texas.

T = threatened; depleted or impacted by man so as likely to become endangered in the future.

NL = not listed.

3.0 LITERATURE CITED

Barneby, R. C. 1977. Daleae Imagines. Mem. New York Bot. Gard. 27:1-892.

Conant, R. 1975. A field guide to the reptiles and amphibians. Houghton-Mifflin Co., Boston. 366 pp.

Correll, D. S. and M. C. Johnston. 1970. Manual of the vascular plants of Texas.

Davis, W. B. 1974. The mammals of Texas. 3rd ed. Texas Parks and Wildlife Dept. Bull. 41. 294 pp.

Gould, F. W. 1975. Texas plants — a checklist and ecological summary. Texas A&M Univ. Tex. Agric. Exp. Stn. MP-585/Rev., College Station.

Hubbs, C. 1976. A checklist of Texas freshwater fishes. Texas Parks and Wildlife Dept. Tech. Series No. 11.

Martin, A. C., H. S. Zim and A. L. Nelson. 1961. American wildlife and plants: a guide to wildlife food habits. Dover Publ., Inc., New York. 500 pp.

Maxwell, T. 1979. Personal communication. Professor, Department of Biology, Angelo State Univ. San Angelo, Tex.

Oberholser, H. S. 1974. The bird life of Texas. Univ. of Tex. Press, Austin.

Peterson, R. J. 1967. A field guide to the birds of Texas. Houghton-Mifflin Co., Boston. 304 pp.

Pulich, W. M. 1976. The Golden-cheeked Warbler: a biological study. Texas Parks and Wildlife Dept. 172 pp.

Rare Plant Study Center. 1974. Rare and endangered plants native to Texas. (Mimeo.) Univ. Texas Rare Plant Study Center, Austin.

Raun, G. G. and F. R. Gehlbach. 1972. Amphibians and reptiles in Texas. Dallas Mus. Nat. Hist., Bull. No. 2.

Reilly, E. M., Jr. 1968. The Audubon illustrated handbook of American birds. McGraw-Hill Book Co., New York. 524 pp.

Strother, J. L. 1969. Systematics of Dyssodia cavanilles (Compositae: Tageteae). Univ. California Pub. Bot. 48:1-88.

Texas Organization for Endangered Species. 1979. TOES watch-list of endangered, threatened and peripheral vertebrates of Texas. Tex. Org. for Endangered Species. Publ. No. 2.

Texas Parks and Wildlife Department. 1977. Regulations for taking, possessing, transporting, exporting and processing, selling or offering for sale, or shipping endangered species. Section 127.30. 09-001-.006.

_____. 1979. Bald Eagle-Osprey survey. Job No. 30, Fed. Aid Proj. No. W-103-R-8.

U.S. Fish and Wildlife Service. 1975. Report of the Smithsonian Institution on endangered and threatened plant species. Fed. Reg. 40:27823-23924.

_____. 1978. Range maps, threatened and endangered species. Austin, Texas.

_____. 1979a. Endangered and threatened wildlife and plants. Fed. Reg. 44(12):3636-3654.

_____. 1979b. Endangered Species Technical Bulletin Vol. IV, No. 11. USFWS, U.S. Dept. Interior. pp. 1-8.

_____. 1979c. Notice of withdrawal of five expired proposals for listing of 1876 species, and intent to revise 1975 plant notice which includes most of these species. Fed. Reg. 44(238):70796-70797.

U.S. Fish and Wildlife Service, Whooping Crane Recovery Team. 1978.

Wemple, D. K. 1970. Revision of the genus Petalostemon (Leguminosae). Iowa State J. Sci. 45:1-102.

Wolfe, L. R., W. M. Pulich and J. A. Tucker. 1974. Checklist of the birds of Texas. Tex. Ornith. Soc., Waco. 128 pp.

Worth, is only 0.3 percent of the hours observed, but the percentages for December, January, February, and March are 0.3, 2.5, 0.5, and 0.1 percent, respectively (Orton, 1965).

2.3.2.4 Storms

2.3.2.4.1 Thunderstorms

Thunderstorms, from which damaging local weather can develop (tornadoes, hail, high winds, and flooding), occur about 46 days each year based on Fort Worth data (USDC, 1973). The monthly and annual 1
distributions are displayed in Table 2.3-30. The maximum frequency of Q8
thunderstorms occurs from April to June, while the months November through February have few thunderstorms.

2.3.2.4.2 Tornadoes

Based on data compiled by the National Severe Storms Forecast Center (NSSFC) for the period from 1950-1979, there were 252 reported tornado 1
occurrences within approximately 50 nautical miles (57.6 statute miles) Q6
of the Comanche Peak site (NSSFC, 1980).

This is a mean annual frequency of 8.4. The mean path length and mean path area for these 252 tornadoes was 1.16 miles and 0.09 square miles, respectively. The most frequent month of occurrence was May, with 82 of the 252 reported tornadoes. Estimated characteristics of these tornadoes, expressed in terms of the Fujita-Pearson (FPP) tornado scale, are summarized below (NSSFC, 1980):

1 Q6

Scale No.	Maximum Windspeed[a]			Path Length		Path Width	
	F Scale (mph)	Expected Damage	No. of Occurrences	P Scale (miles)	No. of Occurrences	P Scale	No. of Occurrences
0	<73	Light	51	<1.0	153	<18 yd	55
1	73-112	Moderate	101	1.0-3.1	48	18-55 yd	110
2	113-157	Considerable	73	3.2-9.9	26	56-175 yd	41
3	158-206	Severe	14	10-31	11	176-556 yd	25
4	207-260	Devastating	3	32-91	0	0.3-0.9 mile	3
5	261-318	Incredible	1	100-315	0	1.0-3.1 mile	1
	Unknown		9	Unknown	14	Unknown	17

For example, a tornado having a wind speed of 200 mph, a path length of 10 miles, and a path width of 100 yds would be expressed on the FPP scale as 3,3,2. The above data indicate that most of the tornados in the site area have a path length of less than 3 miles (a majority or less than 1 mile), a path width of less than 175 yards, and a maximum wind speed of less than 157 mph.

2.3.2.4.3 Hurricanes

Tropical cyclones, including hurricanes, lose strength rapidly as they move inland, and the greatest concern is potential damage from winds, or flooding due to excessive rainfall. The tropical cyclone season for Texas extends from June to October; storms are more frequent in August and September, and rarely occur after the first of October. The number of tropical cyclones that significantly affected Texas during the
1 Q7 period 1901 to 1963 was approximately 71 (Cry, 1965). Of these, 29 or about one every two years were of hurricane force. During the period from 1964 - 1979, Texas has been affected by about 15 additional tropical cyclones, of which 5 were of huricane strength (USDC, 1964-1979).

2.3.2.4.4 Wind Storms

From 1955 through 1967, a total of 77 wind storms with wind speeds of 50 knots (57.5 mph) or greater occurred within the 1° latitude-longitude square containing the site ($32-33^{\circ}N$; $97-98^{\circ}W$) (Pautz, 1969). A review of storm data from 1968-1979 indicates that there were approximately 91 damaging wind storms within the 1° latitude-longitude square identified above (USDC, 1968-1979). It is estimated that a majority of these storms resulted in wind speeds above 50 knots based on damage reports and wind speed estimates. 1 Q7

Estimated extreme winds (fastest mile) for the general area based on the Frechet distribution are (Thom, 1968):

Return Period (Years)	Wind Speed (mph)
2	51
10	61
50	71
100	76

Fastest mile winds are sustained winds, normalized to 30 feet above ground and include all meteorological phenomena except tornadoes.

The "fastest mile" wind at Dallas and Fort Worth for each month is presented in Table 2.3-13 (USDC, 1973).

2.3.3 AIR POLLUTION

2.3.3.1 Air Pollution Potential

Conditions in the region generally favor turbulent mixing. Two conditions which reduce mixing, increasing the air pollution potential, are surface inversions and stable air layers aloft.

The surface inversion is generally a short-term effect and surface heating on most days creates a uniform mixing layer by midafternoon. On the other hand, if warming caused by subsiding air occurs, the second condition, namely, a subsidence inversion, may result. Because both conditions usually occur in conjunction with light winds, the air pollution potential is amplified.

Monthly mixing depths from upper air data at Carswell AFB, Fort Worth (5/72-10/73), Stephenville, Texas (11/73-4/76), and surface observations from the NWS station in Fort Worth, concurrent with the onsite data record, are presented in Table 2.3-14 (USDC, 1976b). The method used for determining mixing depths is the same as described by Holzworth (1972) with observations identified as P (precipitation), C (cold air advection), and M (missing) excluded from the record. Inclusion of P and C types would tend to increase the mean mixing depths given in Table 2.3-14. Based on data for the period 5/72 through 4/76 at Fort Worth (concurrent with the onsite record), the monthly and annual frequency distributions of stability classes are shown in Table 2.3-15 (USDC, 1976c). The stability classes are based on the Pasquill classification (Turner, 1964), and are defined in Table 2.3-15. From these data the annual frequency of stable classes is 33 percent.

The annual percent frequency distributions of stability classes onsite for the period 5/72 - 5/76 are as follows:

Channeling of air flow, the other potential topographical effect, was studied by comparing 10-meter wind directions with nearby wind direction data from Dallas Love Field, where surroundings are relatively flat. A significant increase in wind direction frequencies for both up and down valley sections (WNW, NW, NNW, ESE, and SE) should occur if channeling is an important influence. Approximately 8 months of concurrent wind direction data, shown in Figure 2.3-3, indicates that channeling of the air along Squaw Creek is not a prominent effect.

The channeling and air-drainage study results are indicative of a relatively flat terrain. There will be even less topographical variation after creation of the reservoir. This implies that there will be less topographic effect on the local airflow and, therefore, a slight improvement in diffusion meteorology. In conclusion, the onsite data collected prior to, and after, the creation of the reservoir should not change appreciably. An evaluation of the impact of the Comanche Peak Reservoir upon meteorological conditions in the area is presented in Section 5.1.3.7 of the original ER.

2.3.6 REFERENCES

Cry, George W., 1965, Tropical Cyclones of the North Atlantic Ocean U.S. Department of Commerce, Technical Paper No. 55, Washington, D.C. 1

Holzworth, G.C., 1972, Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States, EPA, Research Triangle Park, N.C.

Ludlum, David M., 1970, Extremes of Snowfall in Weatherwise, Weatherwise, Inc., Princeton, N.J., Vol. 23, p. 286-294.

National Severe Storms Forecast Center, 1980, Computer Analysis of Tornadoes Within 50 NM of Glen Rose, Texas, NSSFC, Kansas City, Missouri. 1

Urton, Robert B., 1965, The Climate of Texas and Adjacent Gulf Waters, U.S. Government Printing Office.

Pautz, M.E., 1969, Severe Local Storm Occurrences, 1955-1967, U.S. Department of Commerce, Weather Bureau, Office of Meteorological Operations, Weather Analysis and Predicting Division, Silver Springs, MD.

Texas Air Control Board, 1975, 1975 Air Quality Data Summaries for Southwest Fort Worth and Waxahachie, Texas Air Control Board, Austin, Texas.

1 Thom H.C.S., 1968, New Distributions of Extreme Winds in the United States in Journal of the Structural Division, Proceedings of the American Society of Civil Engineers, p. 1787-1801.

Turner, D.B., 1964, Diffusion Model for an Urban Area in Journal of Applied Meteorology.

U.S. Department of Agriculture, 1931, Climate Summary of U.S., Section 32 - Northeast Texas.

U.S. Department of Commerce, 1962, Climatography of the United States No. 82-41, Summary of Hourly Observations, Dallas, Texas, 1951-1960, Weather Bureau, U.S. Government Printing Office.

_____, 1963, Maximum Recorded United States Point Rainfall for 5 Minutes to 24 Hours for 296 First Order Stations, Weather Bureau Technical Paper No. 2, U.S. Government Printing Office.

1 _____, 1964-1979, North Atlantic Tropical Cyclones, 1964-1979, NOAA, National Climatic Center, Asheville, N.C.

_____. 1964, Climatography of the United States No. 86-36, Climatic Summary of the United States - Supplement for 1951 through 1960, Texas. Weather Bureau, U.S. Government Printing Office.

______, 1968-1979, Storm Data-January 1968-December 1979, NOAA, Environmental Data Service, Asheville, N.C. 1

______, 1968 Climatic Atlas of the United States, ESSA, Environmental Data Service, U.S. Government Printing Office.

______, 1973, Local Climatological Data, Dallas and Fort Worth, Texas - Annual Summary with Comparative Data, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

______, 1970-1975, Local Climatological Data, Fort Worth, Texas - Observations at 3-Hour Intervals, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

______, 1976a, Monthly and Annual Special Wind Direction vs. Wind Speed with and without Precipitation, Based on 8 obs/day, Fort Worth, Texas, NOAA, /Environmental Data Service, National Climatic Center, Asheville, N.C.

______, 1976b, Daily Mixing Height Study, Tables I & II, Fort Worth, Texas, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

______, 1976c, Monthly and Annual Wind Distribution by Pasquill Stability Classes, Based on 8 obs/day, Fort Worth, Texas, NOAA, Environmental Data Service, National Climatic Center, Asheville, N.C.

Visher, Stephen S., 1966, Climatic Atlas of the United States, Howard University Press, Cambridge, Mass.

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TABLE 2.3-30

AVERAGE NUMBER OF THUNDERSTORM DAYS[1] AND LARGE-HAIL[2] DAYS

Period	Thunderstorms Fort Worth (1954-1973)	Large Hail Texas (1955-1967)
January	1	<1/2
February	2	2
March	4	7
April	7	25
May	7	30
June	6	18
July	5	4
August	5	1
September	4	2
October	3	3
November	2	1
December	1	<1/2
Winter	4	2
Spring	18	62
Summer	16	23
Autumn	9	6
Annual	46	93

[1]Defined as day on which thunder is heard at station.

[2]3/4-inch diameter and larger.

draw-down will be about 3.3 feet for one day pumpage, and about 7.25 feet for three days pumpage at the same location. The effect of drawdown due to operational pumpage will be minimized by supplemental supply from surface Water Pre-Treatment System. (See also Section 5.6 for more detail on operational impacts.) 1

Historical groundwater levels around the plant site can be estimated from the records of four Texas Water Development Board observation wells in Somervell County. The locations of these wells are also shown in Figure 2.4-2, and their records are presented in Table 2.4-26. The records indicate fluctuation levels and also localized cones of depression.

In considering the foregoing, it should be noted that a considerable amount of off-site pumping is occurring in the vicinity of the CPSES which accounts for a portion of the drawdown noticed during certain periods of construction. Such sources of pumping include that done by the City of Glen Rose, a nearby State Park, concrete gravel wash operations, irrigation, trailer parks, and various camp organizations. In the aggregate, these sources exceed pumping at the CPSES site and therefore have a significant impact on local water levels.

Based on the geohydrologic charateristics at the site, it is estimated that the piezometric level in the Twin Mountains Formation will be depressed locally due to pumpage from the production wells, but without adverse effects on the station or on the existing wells withdrawing water from the formation. Within the Glen Rose Formation, water levels will not be affected by this pumpage.

2.4.2.5 Water Quality

Potable groundwater occurs in the Twin Mountains, Glen Rose, and Paluxy Formations.

Water in the Twin Mountains Formation is a sodium bicarbonate type with a dissolved solids content varying generally from 200-900 mg/l. In and near the outcrop areas, Twin Mountains water is used for irrigation. At the site, however, the water is unsuitable for irrigation because of local soil conditions and the higher sodium content of the water.

The quality of water obtained from the Glen Rose Formation is variable; in some localized areas it is not potable. Northwest of the site, water is drawn from this formation where it is capped by an outlier of the Paluxy Formation.

The Paluxy Formation is tapped by some domestic water wells south of the Paluxy River, where the water is typically a hard calcium bicarbonate type. Further downdip, the water becomes a progressively softer, sodium bicarbonate type.

In accordance with the monitoring program, periodic water quality measurements were performed during 1975, 1976, and 1977, in two production and four observation wells which tap water from Twin Mountains Formation. Physical and chemical characteristics are presented in Section 4.0 of the applicant's environmental monitoring program annual summary documents for 1975 and 1976.

2.4.3 WATER QUALITY CRITERIA

Water quality criteria for Texas streams are established and enforced by the Texas Water Quality Board. The Texas Water Quality standards were approved by the Environment Protection Agency (Region VI) on October 25, 1973. These standards were presented in Appendix B of the applicant's original ER.

2.4.4 REFERENCES

Arbingast, S. A., Bonine, M. E., and Kennamer, L. C., 1967, Atlas of Texas, Bureau of Business Research, Univ. of Texas, Austin, Texas

2.5.6 MINERAL RESOURCES

Except for the removal of minor quantities of sand, gravel and dimension stone in the site vicinity, no mining has occurred. The excavated areas resulting from these quarrying should have no effect upon the stability of the site. Sand and gravel sources on the site itself are essentially nonexistent.

The regional geology, test borings, and other indicators reveal no mineral resources (oil, gas, sulphur, salt, metallic minerals) underlying the site at economic depths with the exception of insignificant amounts of natural gas. The loss of mineral resources due to construction and operation of the plant is considered insignificant.

2.5.7 REFERENCES

Nagle, S., 1968, Glen Rose Cycles and Facies, Paluxy River Valley, Somervell Co.: Texas, Bureau of Economic Geology, Circular 68-1, 25 pp.

Fisher, W.L. and Rodda, Peter U., 1967, Lower Cretaceous Sands of Texas: Stratigraphy and Resources: Bureau of Economic Geology, University of Texas, Austin, Report of Investigations, No. 59.

Fiedler, A.G., 1934, Artesian Water in Somervell Co., Texas: U.S. Geological Survey Water Supply Paper, 660, 86 pp.

American Geophysical Union and U.S. Geological Survey, Bouger Gravity Anomaly Map of the U.S., 1964.

Flawn, P.T., 1961, Tectonics: The Quachita System: Texas Bureau Economic Geology, Pub. 6120, pp. 162-173.

Shurbet, D.H., 1969, Increased Seismicity in Texas: Texas Journal of Science, Vol. 21, No. 1, pp. 37-41.

U.S. Geological Survey, 1937, Thermal Springs in U.S.: Water Supply Paper, 679-B, pp 59-206.

U.S. Geological Survey, 1965, Thermal Springs of U.S.: Water Supply Paper, 492, 383 pp.

Sellards, E.H., 1935 "Balcones Zones of Faulting and Folding": The
1 University of Texas Bulletin, No. 3401.

Sellards, E.H., 1932, The Wortham-Mexia, Texas, Earthquake: The Geology of Texas, Vol. II, Structural and Economic Geology, Pt. 1, Texas Bureau of Economic Geology, Bulletin No. 3401, pp. 49-62.

Bryan, Frank, 1933, Recent Movements on a Fault of the Balcones System, McLennon Co., Texas: American Association of Petroleum Geologists Bulletin, vol. 20, No. 10, pp. 1357-1371.

Bryan, Frank, 1936, Evidence of Recent Movements along Faults of the Balcones System in Central Texas: American Association of Petroleum Geologists Bulletin, vol. 20, No. 10, pp. 1357-1371.

U.S. Geological Survey, 1964, Texas - Oil and Gas Fields, pipelines and exposed basement, 1:1,000,000: Oil and Gas Investment Map: OM-214.

Cram, E.H., Editor, 1971, Future Petroleum Provinces of the U.S.: Association of Petroleum Geologists Memoir 15.

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3.3 PLANT WATER USE

3.3.1 Surface Water

The single most important use of plant water is for heat dissipation. A reservoir, discussed in detail in Section 3.4, is provided to serve as the heat dissipation system for the plant. The heat given up by condensing steam is transferred to the reservoir water flowing through the condenser. This heated water is returned to the reservoir where it is cooled, primarily by evaporation. Reservoir water is also used for cooling equipment associated with the turbine-generator. Water used for cooling the reactor auxiliary system, fire protection and other emergency cooling, is impounded by a smaller dam (the SSI dam). The reservoir level is maintained within normal operating limits by yield from its watershed and by withdrawal and return of water from Lake Granbury, a reservoir on the Brazos River. Water flow paths to and from the reservoir are shown in Figure 3.3-1. Table 3.3-1 shows the maximum, average and minimum water use.

To limit the build-up of dissolved solids in the cooling reservoir due to evaporation, a portion of the reservoir water is returned to Lake Granbury. Expected annual usage of water and operation of the cooling reservoir are discussed in Section 3.4. Biocide used in the cooling water flowing through the condenser is discussed in Section 3.6.

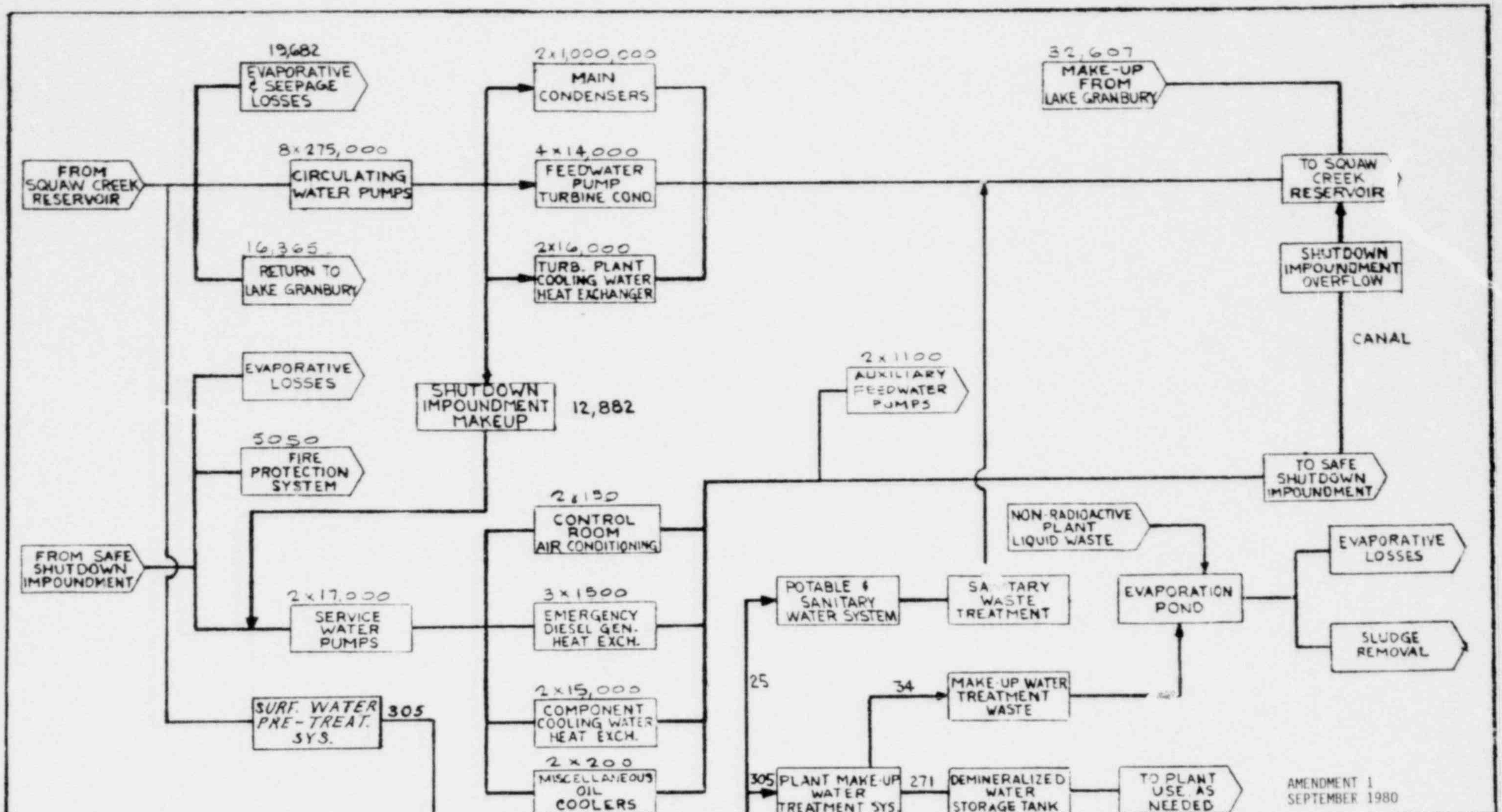
Initial filling of the reservoir will extend over approximately 24 to 27 months and is accomplished primarily by pumping from Lake Granbury. Estimated diversion rates from Lake Granbury, including allowances for inflows from Squaw Creek and evaporation during filling, are: 6300 acre-feet/month to fill in 24 months; and 5750 acre-feet/month to fill in 27 months.

3.3.2 Ground Water

Water is also required for in-plant process systems as well as for laundry, shower, sanitary, and drinking uses. This water is obtained from on-site wells. Water from the wells is filtered and chlorinated for potable uses and demineralized for use in the plant process system. Alternately, water is obtained from the surface water pre-treatment
1 facilities which takes water from Squaw Creek Reservoir. The effect of drawdown due to operational pumpage will be minimized by supplemental supply from the reverse osmosis system. In-plant systems, including the primary system, the secondary system, the component cooling system, and other auxiliary and safeguard systems are closed, recirculating systems. The major continuing use of water in these systems is a small amount of makeup to replace leakage and drainage. These uses are illustrated in Figures 3.3-2 through 3.3-5.

Steam generator blowdown is collected, filtered, demineralized and returned to the condensers of each unit, to further minimize the volume of liquid effluents from the plant. Leakage in the Containment and Auxiliary buildings is collected and routed to the liquid waste treatment system, discussed in Section 3.5, for treatment to remove radioactivity. Chemicals in these systems (boron and lithium in the primary system, and corrosion inhibitors in the cooling systems) are removed by the waste treatment system. Potential leakage from equipment in the Turbine Building is normally non-radioactive, and can be routed to the evaporation pond for disposal. Further discussion appears in Section 3.6.

The demineralizers which treat water for use in the various plant systems will periodically require substantial quantities of water and chemicals (acid and caustic) for regeneration. Non-radioactive effluents, except those from the heat dissipation system and treated sanitary effluent, are routed to the evaporation pond for disposal, as shown in Figures 3.3-2 through 3.3-5.



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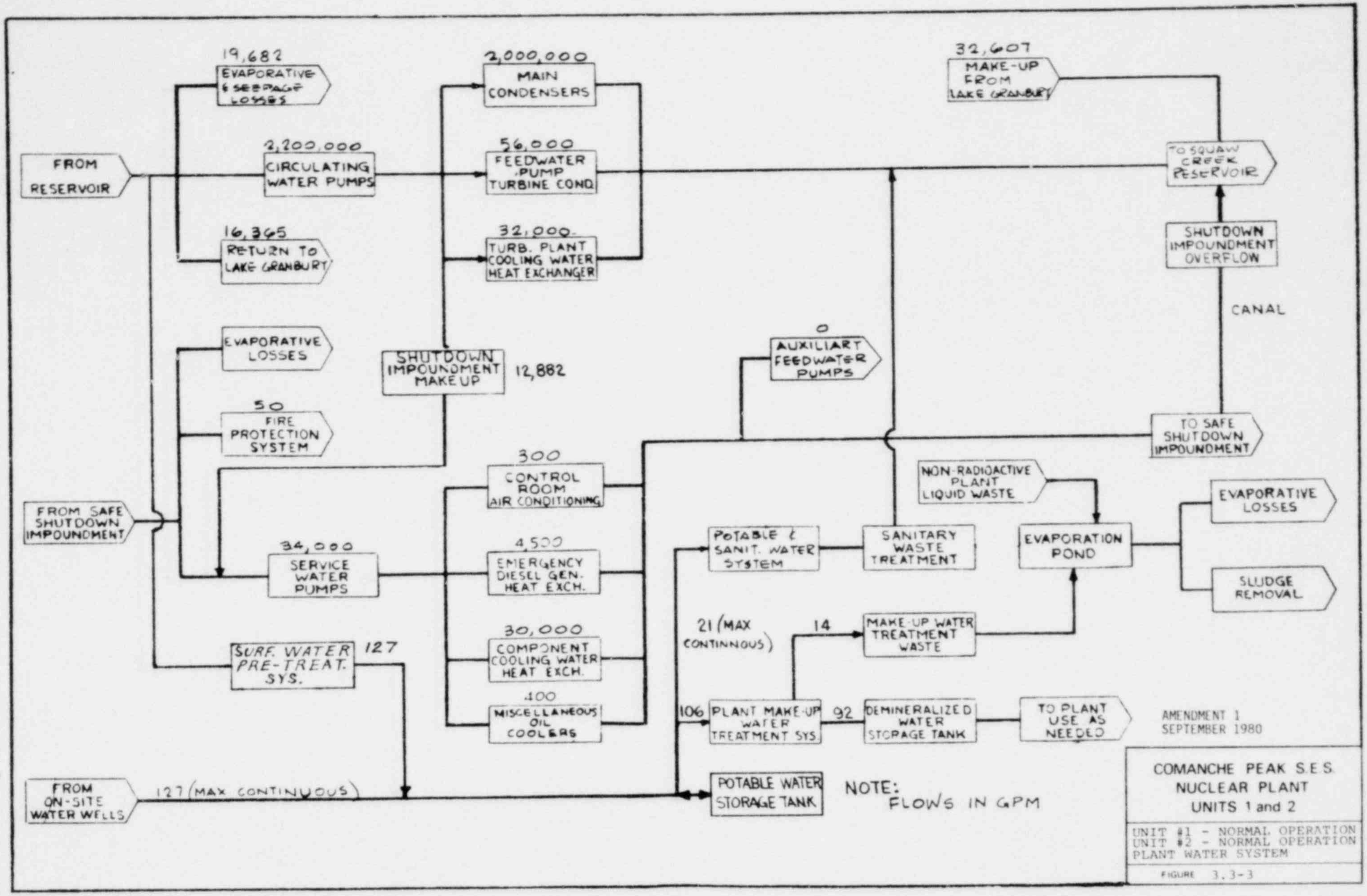
COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

GENERAL / 2 UNITS
PLANT WATER SYSTEM

FIGURE 3.3-2



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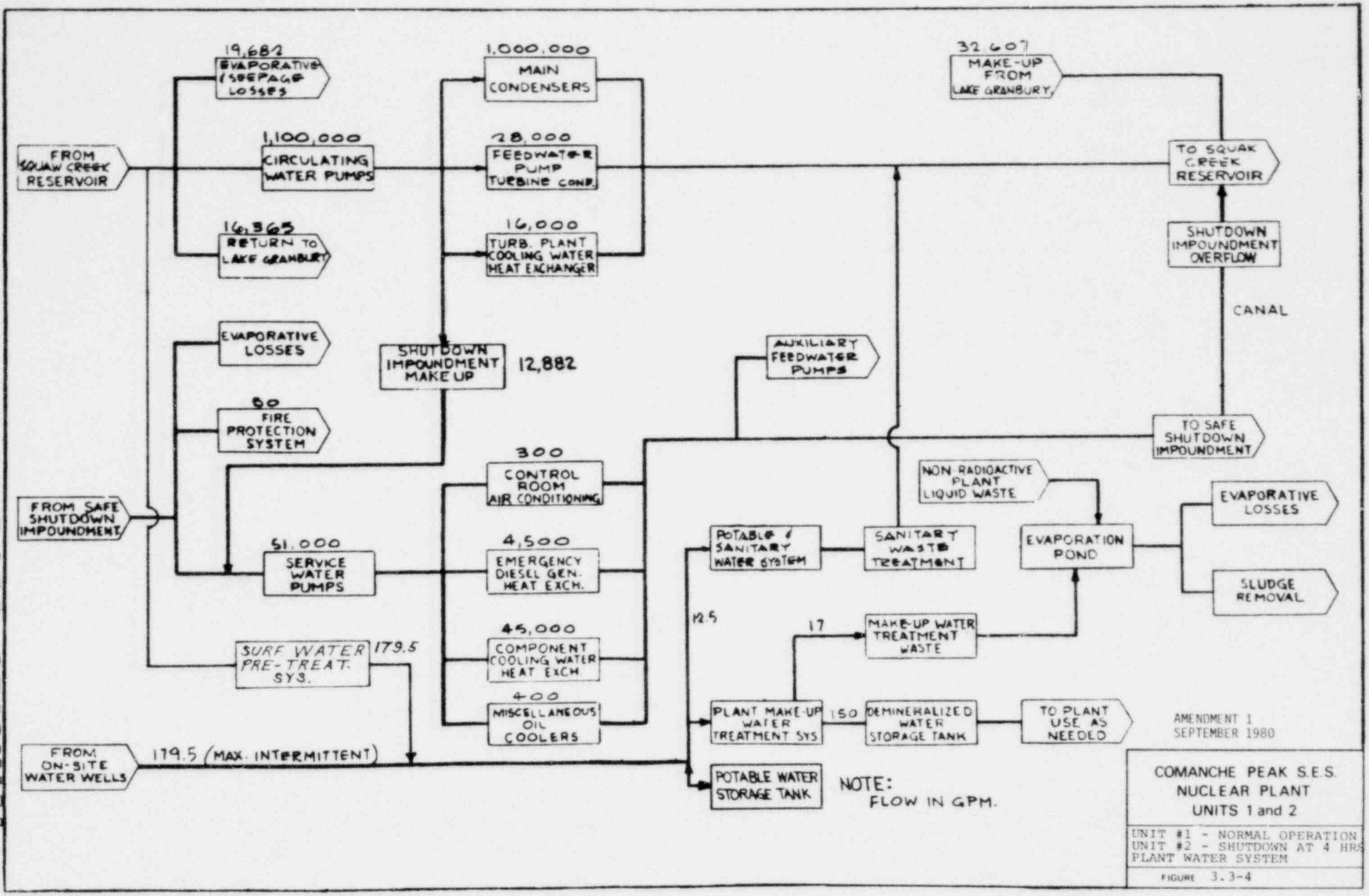
COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

UNIT #1 - NORMAL OPERATION
UNIT #2 - NORMAL OPERATION
PLANT WATER SYSTEM

FIGURE 3.3-3

POOR ORIGINAL


19,682
EVAPORATIVE / SEEPAGE LOSSES
1,000,000
MAIN CONDENSERS
32,607
MAKE-UP FROM LAKE GRANBURY
FROM SQUAW CREEK RESERVOIR
1,100,000
CIRCULATING WATER PUMPS
28,000
FEEDWATER PUMP TURBINE COND.
TO SQUAW CREEK RESERVOIR
16,365
RETURN TO LAKE GRANBURY
16,000
TURB. PLANT COOLING WATER HEAT EXCHANGER
SHUTDOWN IMPOUNDMENT OVERFLOW
CANAL
EVAPORATIVE LOSSES
SHUTDOWN IMPOUNDMENT MAKE UP
12,882
AUXILIARY FEEDWATER PUMPS
50
FIRE PROTECTION SYSTEM
TO SAFE SHUTDOWN IMPOUNDMENT
300
CONTROL ROOM AIR CONDITIONING
NON-RADIOACTIVE PLANT LIQUID WASTE
FROM SAFE SHUTDOWN IMPOUNDMENT
EVAPORATIVE LOSSES
51,000
SERVICE WATER PUMPS
4,500
EMERGENCY DIESEL GEN. HEAT EXCH.
POTABLE & SANITARY WATER SYSTEM
SANITARY WASTE TREATMENT
EVAPORATION POND
SLUDGE REMOVAL
12.5
17
MAKE-UP WATER TREATMENT WASTE
45,000
COMPONENT COOLING WATER HEAT EXCH.
SURF WATER PRE-TREAT. SYS.
179.5
400
MISCELLANEOUS OIL COOLERS
PLANT MAKE-UP WATER TREATMENT SYS
150
DEMINERALIZED WATER STORAGE TANK
TO PLANT USE AS NEEDED
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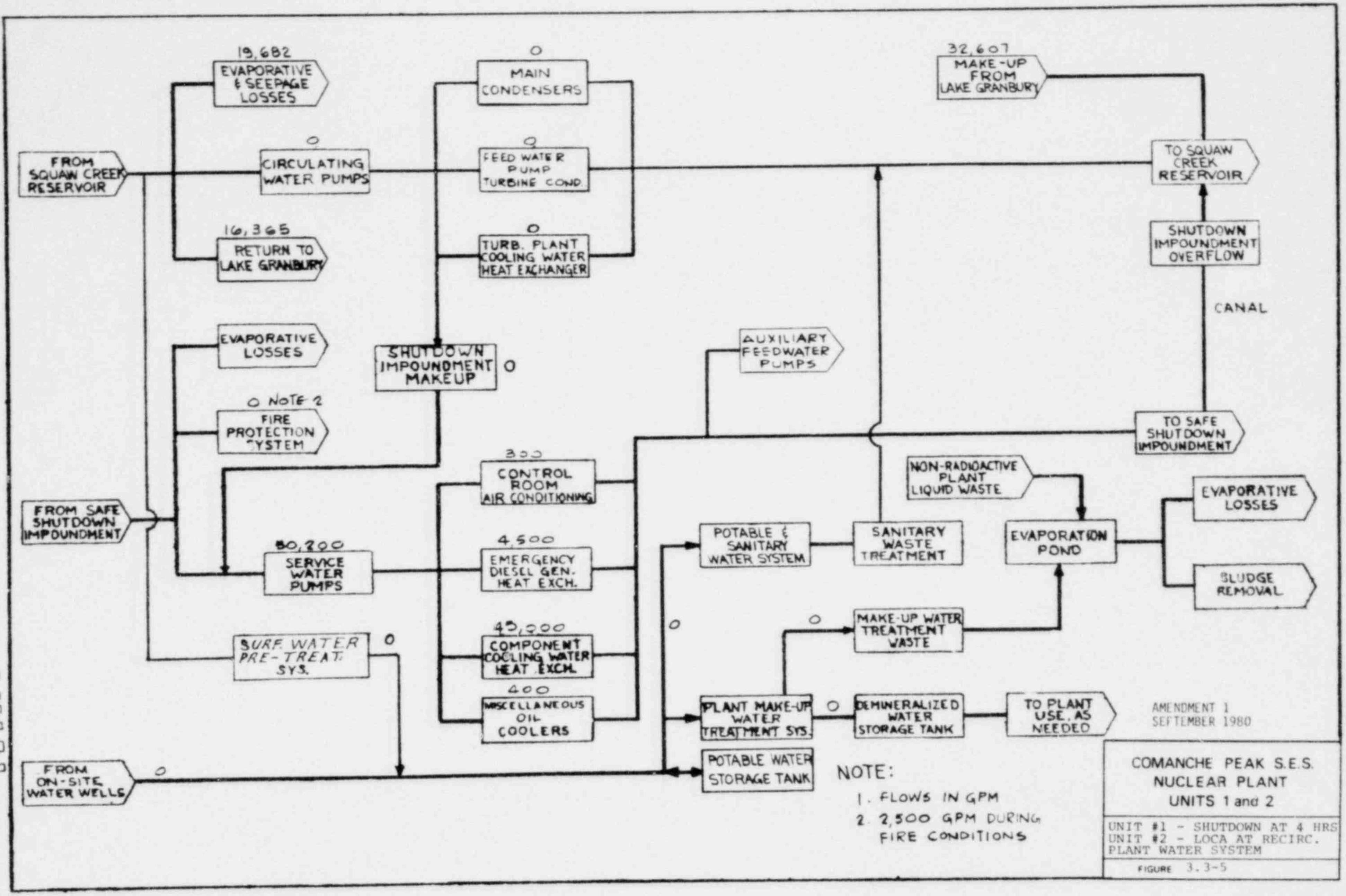
FROM ON-SITE WATER WELLS
179.5 (MAX. INTERMITTENT)
POTABLE WATER STORAGE TANK
NOTE:
FLOW IN GPM.
COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2
UNIT #1 - NORMAL OPERATION
UNIT #2 - SHUTDOWN AT 4 HRS
PLANT WATER SYSTEM
FIGURE 3.3-4



NOTE:

1. FLOWS IN GPM
2. 2,500 GPM DURING FIRE CONDITIONS

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COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

UNIT #1 - SHUTDOWN AT 4 HRS
UNIT #2 - LOCA AT RECIRC.
PLANT WATER SYSTEM

FIGURE 3.3-5

elev. 770' low 1

Screens: both operating, normally
one operating, one screen under maintenance

Velocities for normal and emergency operating conditions are given in Table 3.4-3. 1

3.4.3 WATER DISCHARGE

3.4.3.1 Circulating Water Surface Discharge

Circulating water is pumped through the condenser where its temperature will increase approximately 15^{O}F above the temperature at the intake. It is then routed back to the reservoir via one discharge tunnel per unit. These tunnels terminate in a submerged discharge structure, shown in Figure 3.4-5.

Table 3.4-5 and Figure 3.4-14 show flow rates and flow areas for various points along the circulating water system. Also tabulated are the average velocity, the temperature, the gauge pressure at the tunnel centerline and the time at a given condition.

The discharge channel is formed by a rock berm on the west side and by the natural land on the east side. The bottom of the flow channel slopes from 737.0' to 735.0' elevation, while the top of the berm is at 1
elevation 780'-0". The width varies from 61 feet at the tunnel portal Q55
to approximately 87 feet at the end of the reinforced concrete apron, over a length of 101.5 feet. The depth at the downstream end of the channel varies between 35 and 40 feet, depending on the level of the SCR.

The plume is expected to rise quickly to the surface, spread out, and distribute over the lake surface in a relatively thin layer, thus enhancing the rate of evaporation and cooling by offering a large area in contact with the atmosphere. Resevoir stratification will subject a lesser volume of lake water to the plant induced heat load than the volume obtained in fully mixed situation. The chance of short-circuiting the discharge water to intake is minimal because of the separation provided by the peninsula on which the plant in located. Expected summer and winter temperature distributions in SCR are shown in Figure 3.4-6.

The main condenser will utilize shock clorination for periodic cleaning and control of biofouling. Chlorination frequency, duration, and concentration will be determined during unit start-up and operation. For a complete description of the biocide system, see Section 3.6.1. The water chemistry of SCR is provided in Table 2.4-1 and 2.4-2.

3.4.3.2 Service Water Discharge

Present plans for the service water system include two 30 inch diameter pipes per unit discharging into an open ditch approximately 200 ft. from the plant. Water will travel approximately 400 ft. in the ditch and be discharged over a weir into the SSI. Figure 3.4-15 shows the discharge location.

3.4.4 WATER REQUIREMENTS

Because inflow from Squaw Creek is not sufficient to keep the reservoir full, and because evaporation concentrates dissolved solids in the SCR, makeup water will be pumped into SCR from Lake Granbury and blowdown from SCR will be returned to Lake Granbury. To accomplish this, two pipe connections with required pumps and valves are provided between Lake Granbury and SCR. The design capacity of these lines is sufficient to limit the dissolved solids concentration in SCR to approximately

TABLE 3.4-5

CONDITIONS OF FLOW IN CPSES CIRCULATING WATER SYSTE

Position	Flow Area Per Unit (ft3)	Flowrate Per Unit (gpm)	Velocity (ft/sec)	Static Pressure at Duct Centerline (ft gauge)	Temperature (F)	Time at Condition (sec)
1. Circulating water pump discharge pipe	63.7	275,000	9.6	30	95	6
2. Inlet duct entrance	250	1,100,000	9.8	30	95	73
3. Inlet duct highest point	250	1,100,000	9.8	17	95	73
4. Inlet duct below waterbox	250	1,100,000	9.8	55	95	73
5. Condenser water box and inlet pipes	78.7	256,250	7.2	30	95	3
6. Condenser tubes	---	1,025,000	7.0	12	95	7
7. Condenser waterbox and discharge pipes	78.7	256,250	7.2	12	110	3
8. Outlet duct below waterbox	250	1,100,000	9.8	35	110	100
9. Outlet duct highest point	250	1,100,000	9.8	-12	110	100
10. Outlet duct discharge	250	1,100,000	9.8	15	110	100

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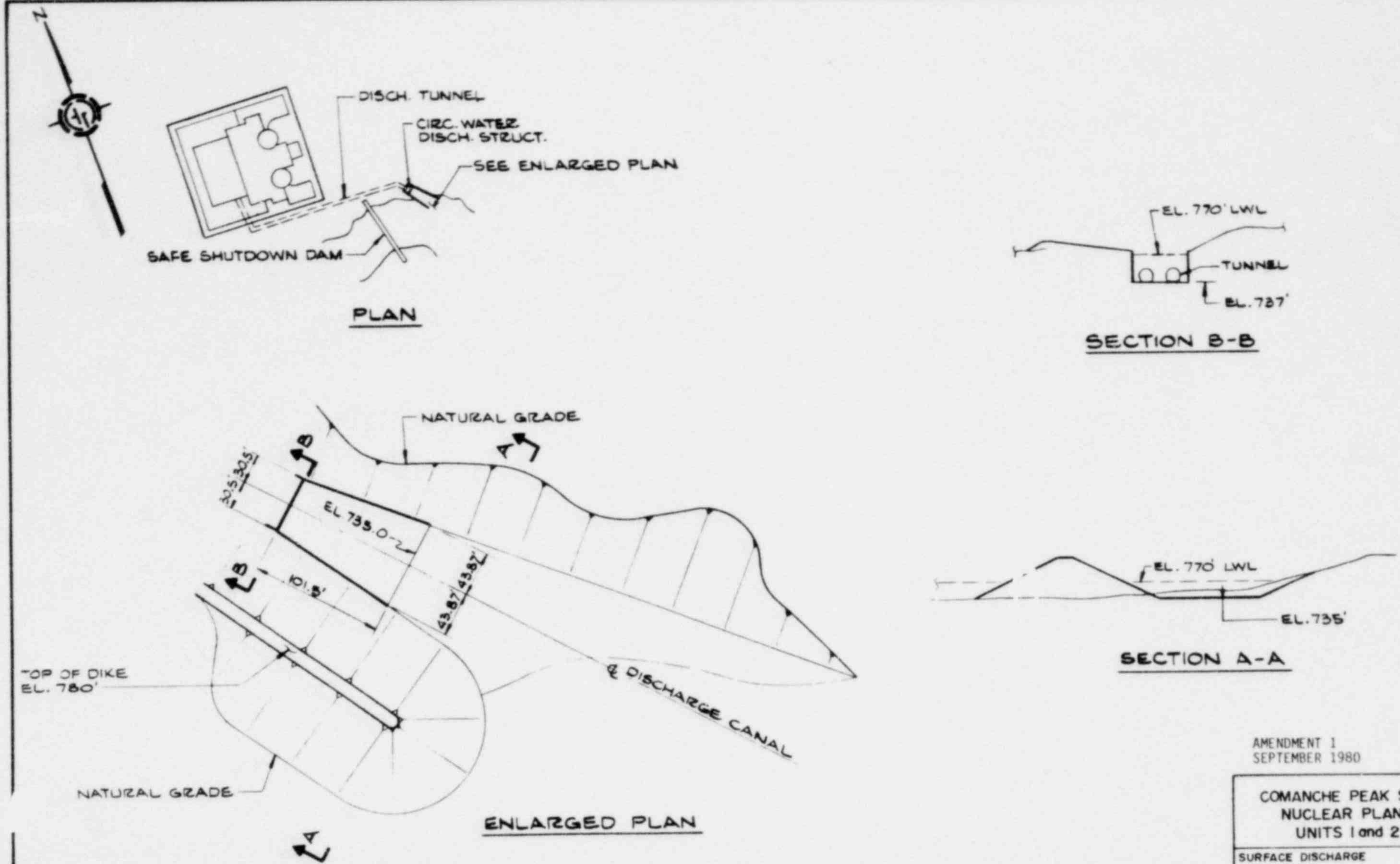

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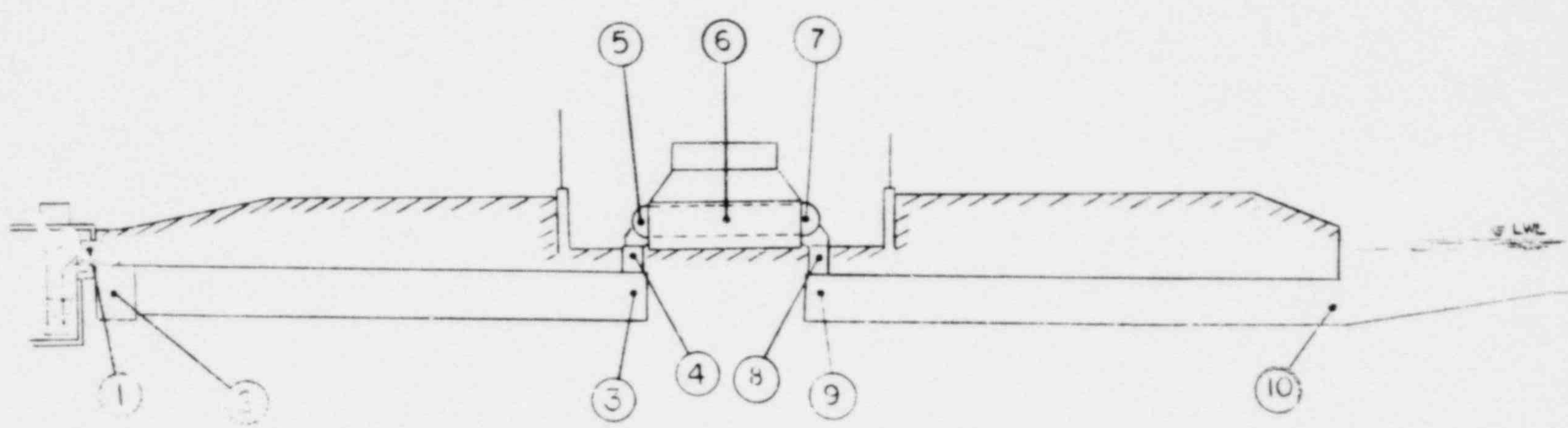
COMANCHE PEAK S.E.S
NUCLEAR PLANT
UNITS 1 and 2

SURFACE DISCHARGE

FIGURE 3.4-5



THE NUMBERS SHOWN ON THIS DRAWING REFER TO THE POSITIONS LISTED IN TABLE 3.4-5

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COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

CIRCULATING WATER
SYSTEM PROFILE

FIGURE 3.4-14

POOR ORIGINAL

3.5.2.2.1 Reactor Coolant Drain Tank Subsystem

Recyclable reactor-grade effluents enter the reactor coolant drain tank from equipment leaks and drains, valve leakoffs, pump seal leakoffs, loop drain leakoffs, and from other deaerated tritiated water sources inside the Containment. A flow diagram is shown in Figure 3.5-1, Sheet 1. This deaerated tritiated liquid is normally pumped directly to the boron recycle holdup tanks via the reactor coolant drain tank heat exchanger and processed by the BRS for reuse.

Provisions are made for cooling only and recycle to the reactor coolant drain tank or diversion to the drain channel A subsystem for processing, as necessary. Tank capacities, waste flow rates, and activities appear in Table 3.5-2.

3.5.2.2.2 Drain Channel A Subsystem

Aerated tritiated liquid enters drain channel A via the waste holdup tank as shown in Figure 3.5-1, Sheet 2. The waste holdup tank is the initial collecting point for liquids which must be processed through the waste evaporator before they can be reused in the Reactor Coolant System (RCS). The basic composition of the liquid collected is boric acid and water with some radioactivity. Waste activity, flow rates, and tank volumes appear in Table 3.5-2. Considerable surge and processing capacity is incorporated in drain channel A of the LWPS to accommodate abnormal operations. Abnormal liquid sources include leaks which may develop in the reactor coolant and auxiliary systems.

The waste is pumped through a filter to the waste evaporator for removal of radioisotopes, boron, and air. The hydrogen, fission | 1
product, and other noncondensable gases are stripped and sent to the Gaseous Waste Processing System (GWPS). The condensate leaving the waste evaporator passes through the waste evaporator condensate demineralizer and a filter to the waste evaporator condensate tank.

When a sufficient quantity of treated water has been collected in the waste evaporator condensate tank, it is pumped to the Reactor Make-up Water Storage Tank for reuse. Samples are taken at sufficiently frequent intervals to insure proper operation of the system and to minimize the need for reprocessing. If a sample indicates that further processing is required, the condensate can be passed through the waste condensate demineralizer, or if necessary, returned to the waste holdup tank for additional evaporation. The demineralizer can be bypassed when waste holdup tank samples indicate low radioactivity levels. This bypassing reduces the amount of waste resin to be solidified. The evaporator bottoms are normally solidified but may be recycled if found acceptable by analysis.

3.5.2.2.3 Drain Channel B Subsystem

Drain channel B collects and processes non-reactor-grade liquid wastes for recycle to the secondary system. These include floor drains, equipment drains containing non-reactor-grade water, and other non-reactor-grade sources. Drain channel B equipment includes three floor drain tanks, a common filter and evaporator, two waste monitor tanks, and a common demineralizer and filter. The flow diagram for drain channel B is shown on Figure 3.5-1, Sheet 3.

Waste flows and activities and tank volumes appear in Table 3.5-2. When any floor drain tank is sufficiently full, the contents are sampled and analyzed to determine the proper processing sequence. The capability to recycle the waste is dependent on its chemical properties and radioactivity level. The liquid is processed if the activity is greater than 10^{-5} Ci/ml.

Processing normally involves filtration to reduce the particulate load on the evaporator, followed by evaporation for removal of radioisotopes, boron, and non-condensable gases.

turbines, the main condenser vacuum pumps, and leaks into the Turbine Building. The leaks into the Turbine Building contribute to building ventilation releases and have been analyzed as described previously. The balance of the entrained radioactivity is released with secondary coolant gaseous effluents.

3.5.3.2.1 Steam Generator Blowdown

Each unit is equipped with a Steam Generator Blowdown Cleanup System designed to treat 100 percent of the blowdown flow. The treated blowdown is returned to the condensate cycle; thus, there are no gaseous releases associated with steam generator blowdown.

3.5.3.2.2 Condenser Vacuum Pumps

These pumps pull a vacuum on the secondary water in the main condensers. A gaseous flowrate equivalent to 60 SCFM from each condenser was assumed for analysis purposes. Equilibrium activity in the secondary system (steam generator) was based on a 20 gpd primary-to-secondary leak. An iodine partition factor of 0.15 was utilized together with a decontamination factor of 10 attributable to the charcoal filters through which condenser off gases pass enroute to the ventilation discharge duct. All of the noble gases are unlikely to exit with the vacuum pump effluent in a single pass; however, in the cyclic operation of the steam generator-condensate loop 100 percent of these gases will eventually exit via the vacuum pump. Accordingly, a value of one was assumed for the noble gas partition factor.

3.5.4 SOLID RADWASTE SYSTEM

The Applicant's original Environmental Report described the proposed Solid Waste Management System (SWMS) in Subsecton 3.5.1. That text is superseded by the following. Section numbering has been revised to conform to Regulatory Guide 4.2 (Rev. 1). A single system, located in the Fuel Building, services Units 1 and 2.

3.5.4.1 Design Objectives

The design objectives of the system are to meet the requirements of 10 CFR Parts 20, 50, and 71 and United States Department of Transportation (DOT) Hazardous Materials Regulation 49 CFR Parts 170 through 178. The SWMS consists of a waste solidification subsystem and a waste baling subsystem. The details of the subsystem are shown on Figures 3.5-3 and 3.5-4.

The solidification subsystem is designed to safely package spent resins, spent filter cartridges, evaporator concentrates, reverse osmosis wastes, and chemical drain tank contents in 50-ft^3 containers
1 using cement as the solidifying agent.

The baling subsystem uses compactor-type balers to package low-level-radiation compressible wastes such as paper, disposable clothing, rags, towels, floor coverings, shoe covers, plastics, cloth smears, and respirator filters in 55-gallon drums. These wastes are products of plant operation and maintenance.

Shielded temporary storage houses the filled containers during an appropriate decay period. Shipment to an approved burial site is discussed in Section 3.8.

3.5.4.2 Solidification Subsystem

1 ATCOR Topical Report Number 132A presents a system description and a flow diagram for the solidification subsystem.

3.5.4.3 Waste Materials Handling

3.5.4.3.1 Liquid Wastes

Predetermined quantities of liquid wastes are pumped directly from the Liquid Waste Processing Systems (LWPS) to the 2,000-gallon 316 Stainless Steel waste conditioning tank. This tank is ducted to the plant ventilation system and equipped with mechanical agitator, level controls, and an automatic flushing feature. The tank is heat traced and insulated to maintain evaporator bottoms in liquid form for processing. 1

3.5.4.3.2 Exhausted Resins

When sufficient exhausted bead resin is accumulated for solidification, the spent resin storage tank (either primary or secondary) is isolated. The tank is then pressurized with nitrogen gas. The resin outlet valve is opened and the resin slurry transferred to the waste conditioning tank of the solidification subsystem. Excess nitrogen is handled in the plant ventilation system. Dewatering of the resin slurry can be conducted simultaneously with the filling operation. The water is pumped out and returned to the LWPS (Section 3.5.2). Other radwastes, liquid or slurry, are then pumped to the waste conditioning tank. 1

When sufficient spent powdered resin from the condensate cleanup system has accumulated in the hot phase separator tank, the thickened resin slurry is transfered to the waste conditioning tank.

3.5.4.3.3 Spent Filter Cartridges

A shielded filter transfer cask is used as a carrier vehicle to protect personnel from radiation exposure while transferring spent filter cartridges from the filter housing to the drumming area by a monorail. The cask is provided with a stainless steel interior and a removable drip pan to collect any dripping liquid from the filter cartridges. Flush connections facilitate interior washdown and decontamination after operations are complete. A grapple assembly, for lifting the filter cartridge, is permanently attached to the inside of the cask. The transfer cask base opens to allow the grapple to be lowered to engage the filter cartridge. The grapple and cartridge are then retracted into the cask and the base is closed. The grapple has a fail-safe feature which locks the filter in place in the event of power failure.

In the drumming area a shielded disposable container is positioned on a rail-mounted flat bed cart beneath the filter transfer cask hatchway. The filter cartridge transfer sequence is reversed to place the cartridge in the container. The cask interior flush is remotely initiated, and the decontamination water enters the container with the filter. The container is then transported to the solidification area for processing.

3.5.4.3.4 Filled Containers

A transfer cart is used to move the containers from the filling station
1 to the capping station and to the crane pick up station in the
solidification area. The Drumming Area Bridge Crane moves containers among the flatbed cart, the storage area, and the solidification area.

Shipping shields are used to protect personnel from radiation exposure during operational handling of the filled containers. The shields have a lead core with inner and outer shells of steel and are designed to accommodate standard 50-ft^3 disposable containers. Lifting devices are permanently attached to the shields and are capable of supporting 1-1/2 times the weight of the loaded shipping shield.

3.5.4.3.5 Large Solid Waste Materials and Equipment

Large waste materials and special equipment that have been neutron activated during reactor operation (e.g., core components) are handled and packaged in a safe manner on a case-by-case basis.

3.5.4.4 Baling Subsystem

Drums used for dry solid waste consist of a DOT - 17H 55-gallon drum, drum lid, gasket, and closing ring.

Figure 3.5-4 presents a flow diagram for the baling subsystem.

3.5.4.4.1 Compressible Waste Materials Handling

Low radiation level solid wastes are accumulated in an open drum. A loosely filled drum is manually placed in the baler and the shroud door is closed. The drum will be automatically positioned to be coaxial with the baler ram. The shroud is ducted to the plant ventilation system to remove dust or particles that may be emitted from the drum during compression of the wastes. In addition, the assembly incorporates a failsafe switch that does not permit baler operation with the baler shroud door open. An operator initiates the compaction process by positioning an up/down switch in the down position to energize the hydraulic pump motor. The hydraulic pressure forces the ram down into the drum, compressing the wastes. The shroud door is then opened, the drum removed, and additional wastes added to the drum. The cycle is repeated until the drum is full. Then the lid is installed, the clamping ring tightened, and the drum stored pending shipment.

3.5.4.4.2 Containment Balers

One baler for compressible materials is located in the Containment Building to speed cleanup during refueling and to minimize transport of loose contaminated materials to the main baler area.

Baler operation is as discussed in the preceding subsection. The baler vents are local and equipped with HEPA filters.

The filled 55-gallon drums are capped inside the Containment Building. If surface contamination is suspected or detected the drums can be wrapped and routed to the drumming area for washdown per Section 3.5.4.5. Clean drums are transported to the storage area.

3.5.4.5 Storage Facilities

Sufficient storage capacity for 40 50-cubic foot containers and 25 55-gallon drums is provided in the Fuel Building and adequate shielding is supplied to reduce exposure to personnel outside the drumming station to approximately 10 mrem/hr. The location of the drum storage area within the plant is shown on Figure 3.5-5. Storage time is a variable and depends on shipment schedules. Since containers are packaged to be within all applicable shipping regulations at the time of packaging, most containers do not require long decay times prior to release for shipment. Normally drum surfaces are not contaminated by wastes; however, prior to drum shipment drum smear samples are taken to determine the surface activity. If required, the drum is returned to the drumming area where its surface is washed. The water is collected in a sump and later pumped to the LWPS chemical drain tank. After washing, smear samples are taken again. The process will be repeated until the desired decontamination has been achieved. Shipment of radioactive materials is discussed in Section 3.8.

3.5.4.6 Expected Waste Quantities

The annual volume of solidified radioactive wastes is not expected to exceed 100 containers of 50 cubic feet each.

The annual volume of low level compressed waste is not expected to exceed 120 drums of 55 gallons each.

The volumes and activities of waste packaged by the SWMS from individual sources are tabulated in Table 3.5-7.

The principal nuclides shipped from the plant site include the following:

Iodine - 131	Iron - 59
Cesium - 134	Manganese - 54
Cesium - 136	Manganese - 56
Cesium - 137	Molybdenum - 99
Cobalt - 58	Strontium - 89
Cobalt - 60	Strontium - 90
Iron - 55	Chromium - 51
	Hydrogen - 3

3.5.4.6.1 Anticipated Occurrences

Normally, spent resins from the condensate cleanup and the steam generator blowdown processing systems are not radioactive and can be disposed of via the plant solid waste disposal service. However, during periods of primary to secondary leakage, radionuclides are removed from solution and these spent resins are also routed to the SWMS for solidification.

Larger than normal volumes of fluid leakage may occur from equipment at times. The floor drain evaporator is used to reduce the volume prior to solidification. The additional containers of waste can be accommodated in the storage area.

3.5.5 PROCESS AND EFFLUENT MONITORING

3.5.5.1 Release Points

The radioactive effluent release points which are continuously monitored during releases are as follows:

1. Liquid Effluents

    a. Liquid Waste Processing System discharge line to the circulating water discharge.

    b. Turbine Building sump pump discharge line to the evaporation pond.

2. Gaseous Effluents

    a. Two plant vent stacks on the Auxiliary Building.

3.5.5.2 Monitors For Automatic Effluent Termination

The monitors that automatically terminate effluent discharges upon trip from a high radiation alarm are as follows:

1. Liquid Waste Processing System monitor (1) .

    This monitor terminates releases from the Liquid Waste Processing System. The monitor need only close the discharge valve when normally locked close control valves are open and liquid waste is routed to the circulating water discharge.

2. Plant vent stack air particulate, radioiodine, and radioactive off-line gas monitors (6)

These monitors terminate releases from the Gaseous Waste Processing Sytem (GWPS), Containment Ventilation, Control Room Ventilation Systems.

3. Plant vent stack gaseous inline duct monitor (2)

These monitors terminate releases from the GWPS, Containment ventilation and Control Room ventilation systems.

4. Containment air particulate, radioactive gas, and radioiodine monitors (6)

These monitors terminate Containment ventilation, Control Room ventilation and releases from the GWPS.

5. Component cooling water liquid monitors (3)

These monitors close the vent line valves on the drain and surge tanks if radiation is detected (this system is not normally radioactive).

3.5.5.3 Monitors For Automatic Effluent Termination and Diversion

In most cases, a high radiation alarm and trip from the monitors listed below will shut down the normal system flow path only. Routing to alternate flow paths or systems is by manual operator action.

1. Control Room intake monitors (2) initiate Control Room atmosphere recirculation and clean up.

2. Steam generator liquid sample monitors (2).

3. Steam Generator Blowdown Process System monitors (2).

4. Waste processing system liquid monitors (2).

5. Auxiliary Steam System liquid monitor (1).

6. Boron recycle evaporator condensate monitor (1).

All radioactive effluent paths are continuously monitored, and records are maintained.

evaporation from the surface of the fuel pool and refueling canals during refueling and during normal power operation. Provide the bases for the values used.

ANSWER

The process and instrumentation flow diagram for the fuel pool cooling and purification system is shown in Figure 3.5A-10. Fuel pool ventilation system process and instrumentation diagram is shown in Figure 3.5A-11.

The fuel pool volume is 350,000 gallons for each of the two pools. The refueling canal and cask pit are shared by both units. The refueling canal and cask pit volumes are 118,000 and 125,000 gallons, respectively. Makeup water to the pools is normally from the Refueling Water Storage Tank. An alternate source is the Reactor make-up Water Storage Tank.

The management of water inventories during refueling is described below.

The refueling operation follows a detailed procedure which provides a safe, efficient refueling operation. The following significant points are assured by refueling procedure:

- The refueling water and the reactor coolant contains approximately 2,000 ppm boron. This concentration, together with the negative reactivity of control rods, is sufficient to keep the core approximately 10 percent subcritical during the refueling operations. It is also sufficient to maintain the core subcritical in the unlikely event that all of the rod cluster control assemblies were removed from the core.

- The water level in the refueling cavity is high enough to keep the radiation levels within acceptable limits when the fuel assemblies are being removed from the core.

The management of water inventories during refueling is described below:

The reactor is shutdown and cooled to cold shutdown conditions with a
1 final K(eff) = 0.95 (all rods in). Following a radiation survey, the
Containment vessel is entered. At this time, the coolant level in the
reactor vessel is lowered to a point slightly below the vessel flange.

The refueling cavity is then prepared for flooding by closing the refueling canal drain holes and removing the blind flange from the fuel transfer tube. With the refueling cavity prepared for flooding, the vessel head is unseated and raised approximately one foot above the vessel flange. Water from the Refueling Water Storage Tank is pumped into the Reactor Coolant System by the residual heat removal pumps causing the water to overflow into the refueling cavity. The vessel head and the water level in the refueling cavity are raised simultaneously keeping the water level just below the head. When the water reaches a safe shielding depth, the vessel head is taken to its storage pedestal. Refueling operations are then carried out.

At the end of refueling, the above operations are carried out in a reverse sequence.

The estimated concentration of radioactive materials and the releases of radioactive materials in gaseous effluents due to spent fuel pool evaporation are presented in Table 3.5A-1. The estimated releases of radioactive materials from the refueling canal will be negligible. The basis for the above is the pool storing 1120 spent fuel assemblies at

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	10
Polymer	7
Calgon corrosion inhibitor - CS (72% sodium nitrite, 28% borax)	0.032
Formaldehyde	0.2
Powdex resin	180

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

TABLE 3.6-2

CONCENTRATION OF DISCHARGED CHEMICALS

	Normal	Maximum
Circulating Water Discharge		
Chlorine	0	0.5 mg/l
Suspended solids	Note 1	Note 2
Oil and grease	Note 1	Note 1
Radionuclides[4]	Note 3	10^{-9}uCi/cm^3
Sodium Hexametaphosphate	Note 5	20 mg/l
Turbine Building		
Drains[3]		
Suspended solids	N/A*	Variable
Oil and grease	N/A	Note 2
pH	N/A	9.6
Service Water Discharge		
Service Water Discharge		
Chlorine	0	0.5 mg/l
Suspended solids	Note 1	Note 2
Oil and grease	Note 1	Note 1

---

[1] None added nor generated in passage through the system.

[2] During off-normal operations an undetermined quantity of debris and solids which have lodged within the system may be dislodged and discharged.

[3] Infrequent (temporary) occurrence.

[4] Based on a conservative estimate: 100 gpm of waste at 10^{-5} uCi/cm^3 discharged into 1 X 10^6 gpm of cooling water (half normal flow).

[5] From surface water pretreatment facility.

*N/A - not applicable

TABLE 3.6-3

CHEMICALS INPOUNDED DURING
CPSES OPERATION - UNITS 1 AND 2

Chemical	Average (lb/day)
Sulfuric acid	127
Sodium hydroxide	55
Morpholine	2.4
Hydrazine	0.004
Boric acid	30 to 40[a]
Sodium hypochlorite	20
Sodium sulfate	9.4[b]
Lithium hydroxide	0.02[a]
Formaldehyde	0.2
Clarifier sludge	70
Potassium chromate	0.062[a]
Powdex resin	180
Ion exchange resin	20[a]
Calgon corrosion inhibitor - CS (72% sodium nitrite, 28% borax)	0.032

[a] Solidified for offsite burial, Section 3.5.4.

[b] Auxiliary boiler blowdown, operates only 30 days per year with 9.4 lb/day of sodium sulfate in the blowdown.

3.7 SANITARY AND OTHER WASTE SYSTEMS

3.7.1 SANITARY WASTES

Sanitary plant wastes are treated onsite by an extended aeration treatment plant. The effluent is chlorinated for disinfection and odor control prior to release to the circulating water discharge canal.

The plant has been designed to operate in accordance with U.S. Public Health Service and State of Texas standards. The operator holds a valid certificate of competence issued by the Texas State Department of Health.

3.7.1.1 System Description

Presently the sanitary waste treatment system at CPSES consists of two extended aeration treatment plants. Each unit has a design capacity of 30,000 gpd. The average flow rate treated by the waste system during this construction phase is approximately 34,000 gpd.

Upon completion of the construction phase at CPSES the sanitary waste system loading should be reduced. It is anticipated that during normal operation the average waste flow rate will be approximately 5000 gpd, 1 with peak flow rates of approximately 19,000 gpd during refueling Q64 outages. This loading is well below the combined capacity (60,000 gpd) of the existing sanitary waste treatment system.

With the reduced loading on the sanitary treatment system, it is anticipated that one of the extended aeration treatment plants will be removed from service.

During the operational phase of CPSES it is estimated that the BOD and total suspended solids concentrations in the total effluent will not exceed the daily maximum value of 45 mg/liter.

Basic equipment consists of the following components:

1. Aeration tanks for aeration and digestion of sewage.

2. Settling tanks (non-aerated) for dividing digested sewage into sludge and liquor.

3. Chlorination tank for digested liquor.

4. Blowers and chlorinating equipment.

5. Ash tank for holding of sludge pumped from settling tank till time of disposal.

6. Auxiliary hardware and controls.

3.7.1.2 System Operation

A daily visual inspection of the plant is made to check on performance of the system. This includes observing condition of the effluent, rolling action of the aeration chamber, color of aeration tanks, foaming or scum on the surface, floating debris, sludge return, appearance of the effluent and bubbling of the chlorinator. In addition, objectionable odors and unusual noises from the mechanical equipment are noted, if present, and investigated to determine the cause and remedial courses of action.

The standard for laboratory tests performed is the latest edition of "Standard Methods for Examination of Water and Waste Water." Tests are executed on site at the sewage treatment lab, with the exception of 5-day BOD, TSS and fecal coliform which are conducted by a certified independent laboratory. Tests performed include:

Daily: pH, Cl2 and flow rate (done on each working day)

Bi-weekly: relative stability and settleable solids

Monthly: 5-day BOD, TSS and fecal coliform

The above tests are required under the terms of the State permit for operation of the system. Other tests may be performed in the course of determining the cause of a problem. The results of all tests are recorded on forms and submitted to the Texas Department of Water Resources (TWDR), with copies maintained in files on the site. Inspections of the system and records are made at the site by the TDWR on a periodic basis. A detailed maintenance schedule is implemented to assure proper operation of the system.

3.7.13 Effects of System Operation

The Texas Water Quality Board requires the CPSES sewage plant effluent be treated to yield a 1.0 ppm residual chlorine level. The system is designed and operated to comply with this and other terms of the permit.

The impact of sewage chlorination upon the future aquatic ecosystem of Squaw Creek Reservoir is expected to be virtually non-existent as a result of the dilution of the estimated 5,000 gpd treated effluent during operation by the 2.2 million gpm circulating water flow. This discharge is diluted further by mixing with waters of the Squaw Creek Reservoir.

This mixing and dilution will reduce the chlorine concentration to levels far below the limits of detectability. No adverse effects upon aquatic biota are expected to occur under these conditions.

3.7.2 MISCELLANEOUS LIQUID WASTES

Building drains which may normally transport small quantities of radionuclides are routed as described in Section 3.5.2. Turbine Building drains are routed as discussed in Section 3.6. Diesel generator building drains are routed to the evaporation pond. They are not discharged to Squaw Creek Reservoir (SCR).

Steam generator blowdown is continuously routed through the Blowdown Processing System which depressurizes, cools, filters, and demineralizes the blowdown fluid for recycle as condensate. There are no releases from this system to the SCR. During periods of steam generator tube leakage, the resins will be drummed and disposed of as described in Section 3.5.4.

Laundry wastes are routed as discussed in Section 3.5.2. There are no releases of untreated laundry effluent.

3.7.3 NONRADIOACTIVE SOLID WASTES

Nonradioactive solid waste will be accumulated in waste receptacles at the plant. These wastes will be removed in bulk by a commercial carrier from the plant site to a landfill for which a TDWR permit has been obtained.

Sanitary waste treatment plant sludge will be pumped from the treatment plant by a commercial disposal service and trucked offsite. Frequency will be determined by plant operation.

Dissolved solids will precipitate in the evaporation pond as liquids evaporate. If required, the solids can be removed to an approved landfill by a commercial carrier.

3.7.4 GASEOUS EFFLUENTS

Products of combustion will be discharged to the atmosphere on infrequent occasions such as during the operation of plant emergency diesel generators and diesel-driven fire pumps. Both these diesels are tested periodically in accordance with manufacturer's specifications to insure proper functioning of the emergency systems. An estimate of the running time and the exhaust effluents is given in Table 3.7-1. The exhaust is untreated prior to release to the environment. The electric auxiliary steam boiler produces no gaseous effluent.

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5.1.4 ENVIRONMENTAL EFFECTS IN LAKE GRANBURY, LOWER SQUAW CREEK AND THE BRAZOS RIVER BELOW DeCORDOVA BEND DAM

As described in Section 3.4, Lake Granbury will serve as a source of make-up water for Squaw Creek Reservoir and ultimately receive discharges from SCR during certain periods of the year. Under average annual water use conditions, approximately 52,600 acre-feet of water would be withdrawn from Lake Granbury and approximately 26,400 acre-feet of water returned from SCR. This water will generally be higher in total dissolved solids than water in Lake Granbury. Aquatic biota within Lake Granbury, lower Squaw Creek and the Brazos River are not expected to be affected significantly by the above pumping activities.

Discharges from the Squaw Creek Reservoir will have an insignificant impact on the aquatic biota of Whitney Lake. There will be no routine direct releases of reservoir water to Squaw Creek or the Brazos River. Any releases that are made directly to Squaw Creek will be of short duration and would be made only to supplement the Lake Granbury pipeline flow so that a minimum of 1.5 cfs is maintained at the gaging station downstream of the Squaw Creek Reservoir. Discharge water will be routinely released into Lake Granbury where sufficient mixing will occur to bring dissolved oxygen (DO) and dissolved solids levels to ambient prior to release into the Brazos River and subsequently Whitney Lake. 1

A radiological study was performed for potential contamination of area waters. These levels have been calculated to be within acceptable limits. A detailed discussion of radiological impacts from routine operation is found in Section 5.2.

5.1.4.1 Impacts on Aquatic Biota

Potential impacts on phytoplankton, zooplankton and fish due to impingement or entrapment by the pump station operation on Lake Granbury are described fully in Sections 5.1.4.1 and 5.1.4.2 of the original ER.

5.1.4.2 Return Water Discharge Area

The build-up of dissolved solids in SCR, resulting from plant operation, will be controlled by recycling water from the reservoir and replacing it with water having a lower dissolved solids content from Lake Granbury. The return flow from SCR to Lake Granbury is estimated to be about 2200 acre-feet per month (37 cfs). The return water will enter Lake Granbury through a fixed horizontal discharge pipe at Elevation 670, approximately 23 feet below the surface (see Figure 3.4-11).

The water returned to Lake Granbury from SCR during plant operation is not expected to cause the quality of the receiving waters to violate the established water quality standards defined by the state. Since the return water will be discharged through a submerged horizontal pipe in the deep, less productive end of Lake Granbury, minimal impact on the aquatic ecosystem is expected even in the immediate plume area where temperature, dissolved oxygen, and solids differentials will be the greatest. The temperature differential will be minimized by withdrawing the return water from the cooler hypolimnetic layers of SCR.

The 2400 mg/l TDS of the return flow is well within the range tolerated by the fish populations of Texas reservoirs. For example, Lake Kemp, near Wichita Falls, Texas, maintains a viable fishery and a diverse faunal community while TDS levels have exceeded 3000 mg/l. On the basis of studies conducted by the Texas Parks and Wildlife Department in 1953 and 1954, the estimated standing crops of fishes in North Texas reservoirs are not suppressed by moderately high TDS levels. To the contrary, population estimates for Lake Diversion greatly exceeded the estimates for Lake Kickapoo during the study period (July 1953 through April 1954) when TDS ranges for the lakes were 1420 to 3500 mg/l and 154 to 217 mg/l, respectively. This phenomenon may be related to the macro- and micro-nutrient availability for the primary producer organisms forming the base of the food web.

The State of Texas operates warm water fish hatcheries to provide game fish for stocking Texas' waters. Two of these hatcheries are located where water supplies are high in TDS. One of these, the Possum Kingdom State Fish Hatchery, derives its water supply directly from Lake Possum Kingdom, while the other, the Dundee Fish Hatchery, operates with water from Diversion Reservoir. Successful spawning and growth of native game species has been experienced at both hatcheries in spite of TDS concentrations at times exceeding 3500 mg/l.

The low dissolved oxygen concentrations expected in the return water will be introduced at a depth in Lake Granbury already characterized by persistent low D.O. levels. Thus, virtually no change in the D.O. characteristics of receiving waters would occur except under conditions favoring a positively buoyant plume, in which case approximately 20,000 ft^2 is the maximum plume area that could occur before reaching the surface and mixing with aerated water.

A more detailed discussion of the temperature, dissolved oxygen and solids plume in the area of the return line discharge into Lake Granbury was presented on pages 5.1-24 through 5.1-27 and in Appendix E of the original ER.

As is normally the case with nuclear plants located on or near fresh water bodies, ingestion of invertebrates or aquatic plants harvested from Squaw Creek Reservoir or Lake Granbury does not present a potential exposure pathway to man.

Estimated annual doses from routine release of gaseous and liquid effluents for all viable pathways are presented in Section 5.2.4.

5.2.2 RADIOACTIVITY IN THE ENVIRONMENT

5.2.2.1 Radioactivity in Surface Waters

Concentrations of radioactive effluents in the waters of SCR, Lake 1
Granbury and Whitney Reservoir, which are under the radiological influence of CPSES, were calculated in accordance with methods set forth in Regulatory Guide 1.113 for "Reservoirs and Cooling Ponds." The specific rationale utilized is described below.

Released radionuclides will enter SCR and follow the flow pattern of the water bodies in the area as shown in Figure 3.3-1. Normally, only a small amount (approximately 1,500 acre-feet/per year) water will be 1
released from SCR into Squaw Creek. To control buildup of solids in SCR, approximately 24,900 acre-feet of water may eventually be pumped annually from the reservoir to nearby Lake Granbury. To keep the volume of Squaw Creek Reservoir constant, approximately 52,600 acre-feet of water may be pumped annually from Lake Granbury into the Squaw Creek Reservoir to replace evaporation losses (dependent upon local precipitation). It is anticipated that a minimum of 1.5 cfs of 1
this water will be diverted into Lower Squaw Creek to maintain stream flow. Replacement water to Lake Granbury is provided through local precipitation and by the Brazos River. After considering evaporation and diversion losses to Squaw Creek Reservoir, the remaining part will leave the lake via the DeCordova Bend Dam spillway and flow downstream to Whitney Reservoir.

In order to calculate radionuclide concentrations due to normal releases in the surface water bodies mentioned above, a mathematical model was developed in accordance with Regulatory Guide 1.113. A sketch of the model is presented in Figure 5.2-1. The flow in lakes and reservoirs was assumed to be plug flow. The reservoir volumes are assumed to be constant.

In this model:

$t_{1/2}$ is the half-life of the radionuclide element considered,

W is the rate of release of the radionuclide element (curie per unit time)

q_p is the circulating cooling water pumpage rate (volume per unit time)

V_s is the volume of Squaw Creek Reservoir

V_G is the volume of Lake Granbury

q_b is the pumpage rate to Lake Granbury

1 q_s is the release rate from Squaw Creek Reservoir

Q_L is the pumpage rate from Lake Granbury

Q_B is the annual average flow rate in Brazos River downstream from Lake Granbury

V_w is the volume of Whitney Reservoir

Q_{Bo} is the average annual flow rate of Brazos River downstream from Whitney Reservoir

Q_E is the average annual evaporation rate (ac-ft/yr) from Lake Granbury

C_1 is inflow concentration in Squaw Creek Reservoir

C_2 is concentration in Squaw Creek Reservoir

C_3 is concentration in Lake Granbury

C_4 is inflow concentration in Lake Granbury

C_5 is concentration in Whitney Reservoir

C_6 is inflow concentration into Whitney Reservoir.

Evaporation in Squaw Creek Reservoir is $(Q_L - q_b - q_s)$. Evaporation in 1
Lake Granbury is 58 inches per year (Climatic Atlas of the United States, U.S. Department of Commerce, June, 1969).

Constant average volume of Lake Granbury is assumed to be 83,000 acre-feet which is the average of the top gate capacity of 150,000 acre-feet and spillway crest capacity of 15,000 acre-feet. Corresponding surface area for 83,000 acre-feet is about 5,000 acres. This area yields about 24,000 acre-feet of evaporation losses which is assumed to be approximately equal to the blow-down rate (q_b) from Squaw Creek Reservoir (TWDB, Report 126). Annual evaporation in Whitney Reservoir is 54 inches and is equal to $(Q_B - Q_{Bo} + q_s)$. 1

By writing mass balance equation in place A,

$$C_1 \, (Q_L + q_p) = C_3 \, Q_L + \left(\frac{W}{q_p} + C_2\right) q_p \qquad (1)$$

Plug flow formula in Squaw Creek Reservoir (Regulatory Guide 1.113, 1976) is:

1 $$C_2 = C_1 \exp\left[\frac{-V_s \ln 2}{t_{1/2}\,(q_b+q_p+q_s)}\right] \qquad \text{(II)}$$

Mass balance equation in place B,

$$(Q_B + Q_L + Q_E - q_b)\,C_o + C_2 q_b = C_4\,(Q_B + Q_L + Q_E) \qquad \text{(III)}$$

$$C_o = 0 \text{ (fresh make-up water)}$$

Plug flow formula in Lake Granbury,

$$C_3 = C_4 \exp\left[\frac{-V_G \ln 2}{t_{1/2}\,(Q_B + Q_L)}\right] \qquad \text{(IV)}$$

Plug flow formula in Whitney Reservoir,

$$C_5 = C_6 \exp\left[\frac{-V_W \ln 2}{t_{1/2}\,Q_{Bo}}\right] \qquad \text{(V)}$$

$$Q_{Bo} = Q_B - \text{Evaporation from Lake Whitney}$$

Mass balance equation in place C,

1 $$C_6(Q_B+q_s) = C_2 q_s + C_3(Q_B) \qquad \text{(VI)}$$

The six unknowns (C_1, C_2, C_3, C_4, C_5, C_6) can be calculated from the six main equations presented above.

In the mathematical model above the following constants are used:

q_s = 1,500 ac-ft/yr
q_p = 3,550,000 ac-ft/yr
q_b = 24,900 ac-ft/yr
V_s = 151,000 ac-ft
V_G = 83,000 ac-ft 1
Q_B = 1,098,500 ac-ft/yr
V_w = 627,000 ac-ft
Q_{Bo} = 994,000 ac-ft/yr

Table 5.2-1 contains the predicted steady state radionuclide concentrations calculated by this mathematical model for Squaw Creek Reservoir, Lake Granbury and Whitney Reservoir.

5.2.2.2 <u>Radioactivity in Air</u>

Annual average dilution factors (χ/Q's) utilized in evaluating the releases of gaseous effluents were calculated according to the straight-line method set forth in Regulatory Guide 1.111, based on four years of onsite meteorological data acquired during the period May 15, 1972, through May 14, 1976. A detailed discussion of the applicable methodology appears in Section 6.1.3 with the results of the calculation of annual average χ/Q values listed in the Section 2.3 tables. Examination of the tables shows that the highest concentration of gaseous effluents all were expected to occur at the exclusion area boundary in the north-northwestern sector at 2083 meters, where a relative concentration of 3.3×10^{-6} sec/m^3 was calculated. Annual average χ/Q values are presented in Tables 2.3-16 through 2.3-29. The first seven of these tables provide data out to 50 miles. The remainder present data at special distances (such as to the nearest cow).

Expected annual gaseous release rates discussed in Section 3.5.3 were used with the maximum exclusion area boundary χ/Q of 3.3×10^{-6} sec/m^3 to estimate the maximum expected undecayed radioisotope air concentrations outside the restricted area. The release rates for two units and expected maximum offsite concentrations are listed in Table 5.2-2.

Concentrations in air and in environmental media for ingestion pathways are reported in Table 5.2-3 at offsite locations where maximum exposure from these pathways is anticipated to occur. These concentrations were calculated in accordance with the methods outlined in Appendix C of Regulatory Guide 1.109.

5.2.3 DOSE RATE ESTIMATES FOR BIOTA OTHER THAN MAN

The radioactive waste systems of the CPSES are designed to reduce radiation levels in liquid and gaseous effluents to as low as reasonably achievable limits. Man is the most radiosensitive living organism (NAS-NRC, 1972), and is the most important element in the consideration of radiological impact. It is recognized that biota other than man may receive an exposure from released radionuclides, though slight and insignificant.

Exposures resulting from gaseous releases will reach the other biota through pathways similar to those affecting man. The liquid radwaste system radioactive releases will only incrementally increase the total exposure to these organisms. All biota, including man, are constantly subjected to naturally occurring background radiation. Releases from CPSES will only approach a small fraction of this naturally occurring radiation exposure.

From considerations of the exposure pathways discussed in Section 5.2.1 and the distribution of facility-derived radioactivity dose rate estimates to local biota have been formulated through the use of the

GASPAR and LADTAP computer codes. These codes were based on the methodology presented in Regulatory Guide 1.109, which uses the standard ICRP model for computation of effective radionuclide decay energies and resultant dose factors.

Doses to aquatic flora and fauna can be calculated from a knowledge of the concentrations of radionuclides in Squaw Creek and Whitney Reservoirs and Lake Granbury. Based on radionuclide concentrations present (Table 5.2-1) and bio-accumulation factors in Table A-8 in Regulatory Guide 1.109, doses to fish and aquatic plants living in the Squaw Creek Reservoir area were calculated to be 1.65 mrad/yr and 4.76E-01 mrad/yr, respectively. Dose to fish and aquatic plants that reside in Lake Granbury were estimated to be 3.67E-02 mrad/yr and air inhalation, and meat consumption produce small contributions to the total dose, with irradiation from ground-plane deposition of radionuclides in the plume being the least important total body exposure pathway.

5.2.4.3 Direct Radiation from Facility

The total external dose rate and total population dose received by individuals outside the facility within 50 miles from direct radiation has been determined assuming a source with an effective radius of 216.25 feet. The buildings containing radiation sources are for the most part the Reactor Buildings, Safeguards Buildings, Auxiliary Building and Fuel Building. Therefore, a hemispherical source is assumed with an effective radius bounding the buildings containing the sources of radiation.

At the minimum exclusion boundary, which is approximately 4900 ft. southwest of Unit 1, and 5100 ft. southwest of Unit 2, the estimated total external dose received by individuals from direct radiation is approximately 3.25×10^{-3} mrem/yr. There are no critical nearby residences, schools, hospitals, or other publically used facilities within one mile of the nuclear units. 1

5.2.4.4 Annual Population Doses

Total-body (man-rem) and thyroid (thyroid-rem) doses to the population within 50 miles of the site for the year 2000 were calculated using CASPAR and LADTAP, the computer codes based on the methodology found in Appendix D of Regulatory Guide 1.109. The following sections discuss specific assumptions used for the liquid and gaseous pathway calculations. The results appear in Table 5.2-6.

The resultant doses from the CPSES will be only a very small pecentage of the 100 mrem/yr (Environmental Protection Agency, 1972) total-body dose from naturally occurring environmental background radiation anticipated in the State of Texas for individuals. The maximum potential individual doses from the CPSES will also be well below those doses received from ordinary and acceptable radiation exposures. For example, in 1970 it was estimated that the annual per capita abdominal radiation dose for exposed population to medical radiography was 153 mrem annually (Environmental Protection Agency, 1972). Doses from radium dial watches reported in 1963 were between 1.3 and 5.3 mrem/yr to the whole-body (Environmental Protection Agency, 1972).

Exposure of each of the 1.45 million people that are expected to be residing within a 50-mile radius of the plant in the year 2000 to the current 100 mrem annual whole-body naturally occurring environmental radiation level would result in a population dose of 1.45×10^5 man-rem. This contrasts with the year 2000 total-body man-rem dose from the Comanche Peak Steam Electric Station 3.77 man-rem. Thus, the contribution to the total man-rem commitment of the year 2000 population from the CPSES is a very small fraction of that which will conservatively be attributable to background radiation; the radiological impact of the plant on the area population is, therefore, expected to be negligible.

5.2.4.4.1 Liquid Pathways

Population doses were calculated for sport and commercial fishing, crop irrigation, and shoreline, swimming, and boating exposure pathways. As explained in Section 5.2.4.1, no municipal drinking water supplies are withdrawn from Squaw Creek and Whitney Reservoirs or Lake Granbury within a 50 mile radius of the CPSES.

The dose to the population from fish ingestion was based upon the following fish harvest for the three reservoirs based upon estimates for the year 2000:

TABLE 5.2-1

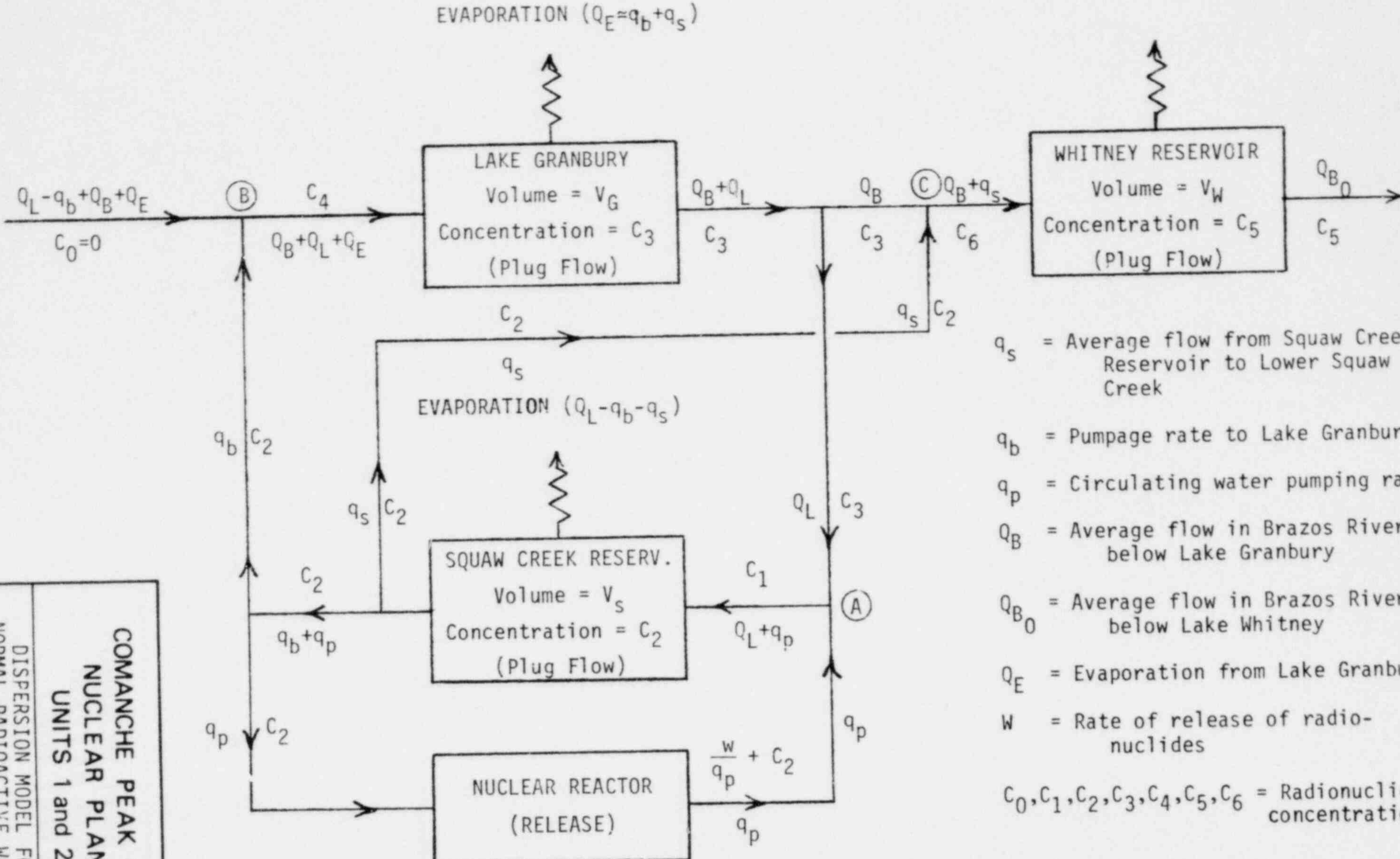
EXPECTED CONCENTRATIONS[a] OF RADIOACTIVE MATERIALS IN ENVIRONMENTAL MEDIA FROM LIQUID EFFLUENTS OF THE COMANCHE PEAK STEAM ELECTRIC STATION

Isotope	Annual[a] Release (Ci/yr)	Expected Long[b] Term Concentration of Squaw Creek Reservoir μ Ci/ml	Expected Long[b] Term Concentration of Lake Granbury μ Ci/ml	Expected Long[b] Term Concentration of Whitney Reservoir μ Ci/ml
Cr-51	7.0E-5	3.26E-14	3.79E-16	1.22E-18
Mn-54	5.0E-5	2.24E-13	4.72E-15	2.79E-15
Fe-55	6.0E-5	5.26E-13	1.16E-14	9.76E-15
Fe-59	4.0E-5	3.17E-14	4.74E-16	1.35E-17
Co-58	7.4E-4	9.49E-13	1.65E-14	1.77E-15
Co-60	3.6E-4	4.07E-12	9.02E-14	8.29E-14
Zr-95	5.0E-3	5.86E-14	9.93E-16	8.62E-17
Nb-95	7.0E-5	4.24E-14	5.65E-16	5.91E-18
Np-239	3.0E-5	7.07E-17	6.46E-22	1.36E-51
Br-83	4.0E-5	7.08E-61	-[c]	-[c]
SR-89	1.0E-5	9.25E-15	1.46E-16	6.71E-18
Mo-99	2.2E-3	1.08E-14	3.38E-19	3.45E-44
Tc-99m	2.1E-3	1.05E-31	1.09E-64	-[c]
Ru-106	8.0E-5	4.11E-13	8.77E-15	5.68E-14
Ag-110m	1.0E-5	3.91E-14	8.15E-16	4.34E-16
Te-127	1.0E-5	3.05E-27	3.65E-49	-[c]
Te-129m	5.0E-5	2.93E-14	3.84E-16	3.51E-18
I-130	1.5E-4	7.23E-23	2.24E-39	-[c]
I-131	8.6E-2	6.92E-12	1.60E-14	3.72E-23
Te-132	7.0E-4	6.11E-15	5.00E-19	2.29E-40
I-132	1.9E-3	1.46E-61	-[c]	-[c]
I-133	4.8E-2	5.52E-17	1.13E-27	-[c]
Cs-134	1.4E-3	1.10E-11	2.40E-13	1.94E-13
I-135	7.9E-3	4.26E-29	3.89E-59	-[c]
Cs-136	4.6E-4	8.03E-14	4.42E-16	2.04E-21
Cs-137	1.5E-3	2.20E-11	4.93E-13	4.83E-13
Ce-144	1.7E-4	7.26E-13	1.52E-14	8.70E-15
H-3	4.0E+1	5.39E-07	1.20E-08	1.16E-08

[a] per reactor

[b] 40 year maximum equilibrium concentration

[c] negligible concentration after 40 years



q_s = Average flow from Squaw Creek Reservoir to Lower Squaw Creek

q_b = Pumpage rate to Lake Granbury

q_p = Circulating water pumping rate

Q_B = Average flow in Brazos River below Lake Granbury

Q_{B_0} = Average flow in Brazos River below Lake Whitney

Q_E = Evaporation from Lake Granbury

W = Rate of release of radionuclides

$C_0, C_1, C_2, C_3, C_4, C_5, C_6$ = Radionuclide concentrations

AMENDMENT 1
SEPTEMBER 1980

COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

DISPERSION MODEL FOR
NORMAL RADIOACTIVE WATERS
RELEASES TO SURFACE WATER

FIGURE 5.2-1

Figure 2.4-6 used in the preceding calculations illustrates the effect pumpage has at a given time. It is readily seen that the greatest effect on the water level was within the first 90 to 180 days. After that period, the effect decreased with time. The hydrograph of the observation wells shows the greatest change occurred from March to September 1975 (180 days). The projected 40 year drawdown is only an additional 1.5 feet at a distance of 10,000 feet from the well. Monitoring of the on-site ground water levels will continue throughout the construction period.

5.6.3 OPERATIONAL PUMPAGE

As cited in Section 3.3, consumptive groundwater use for potable, sanitary, and other systems will be approximately 127 gpm on an annual average basis. This compares with a groundwater pumping rate during the first 3 years of construction of about 150 gpm as shown in the referenced tables.

An alternative means of fulfilling its operational requirements is the
surface Water Pre-Treatment System. It is designed to provide water in
sufficient quantity of suitable ground water quality by treating the
water from Squaw Creek Reservior. The water treatment facility when in 1
operation will take the supplement load of operational pumping of
ground water, then alleviating the drawdown problem.

Importation of water by tankers, in the quantity required, is also impractical. Based upon an annual average demand of 127 gpm (see Section 3.3), thirty-six 5,000-gallon tank truck deliveries per day would be required. Aside from the obvious difficulties in locating a convenient source of acceptable quality water, the logistics involved in conducting such an operation are considerable.

Based on available data and the judgement of groundwater consultants, it is the Applicant's position that the initial drawdown illustrated by Figs. 2.2-3 through 2.2-5 represent not only the drawdown in the water level due to the plant construction pumpage but also the regional pumpage as outlined in 2.4.2.4. It is also the Applicant's position that the 127 gpm average annual pumpage rate from plant operation will only cause that amount of further decline as shown by Figure 2.4-6 for the period of essentially three years to 40 years.

Therefore, while operational pumping in itself should not result in the creation of a serious drawdown problem, the Applicant recognizes that other regional pumping will have impacts which cannot be disregarded. The ground water level will be closely monitored throughout construction, and if drawdown should continue to a point at which the aquifer is being adversely affected beyond reasonable recovery, then alternative means of providing water for plant operation will be considered for adoption.

Table 5.7-1 (Sheet 1 of 5)

Summary of Environmental Considerations for Uranium Fuel Cycle[1]

(Normalized to Model LWR Annual Fuel Requirement [WASH-1248] or Reference Reactor Year [NUREG-0116])

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Natural Resource Use:		
Land (acres):		
Temporarily committed[2]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to 100 MWe coal-fired powerplant.
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to 95 MWe coal-fired powerplant.
Water (millions of gallons):		
Discharged to air	160	= 2 percent of model 1,000 MWe LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	< 4 percent of model 1,000 MWe LWR with once-through cooling.
Fossil fuel:		
Electrical energy (thousands of MW-hour)	323	< 5 percent of model 1,000 MWe LWR output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45 MWe coal-fired powerplant.

Table 5.7-1 (Sheet 2 of 5)

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Natural Resource Use: (cont'd.)		
Natural gas (millions of scf)	135	< 0.4 percent of model 1,000 MWe energy output.
Effluents - Chemical (MT):		
Gases (including entrainment): [3]		
SO_x	4,400	
NO_x [4]	1,190	Equivalent to emissions from 45 MWe coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1,154	
Other gases:		
F^-	.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards - below level that has effects on human health.
HCl	.014	
Liquids:		
$SO_4^=$	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional
NO_3^-	25.8	
Fluoride	12.9	
Ca++	5.4	
Cl^-	8.5	
Na^+	12.1	

Table 5.7-1 (Sheet 3 of 5)

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Effluents - Chemical (MT) (cont'd):		
NH_3	10.0	dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3 - 600 cfs. NO_3 - 20 cfs. Fluoride - 70 cfs.
Fe	.4	
Tailings solutions (thousands of MT)	240	From mills only - no significant effluents to environment.
Solids	91,000	Principally from mills - no significant effluents to environment.
Effluents - Radiological (curies):		
Gases (including entrainment):		
Rn-222	_____	Presently under reconsideration by the Commission.
Ra-226	.02	
Th-230	.02	
Uranium	.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	.14	Principally from fuel reprocessing plants.
I-129	1.3	
I-131	.83	
Fission products and transuranics	.203	

Table 5.7-1 (Sheet 4 of 5)

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Effluents - Radiological (curies) (cont'd.)		
Liquids:		
Uranium and daughters	2.1	Principally from milling - included in tailings liquor and returned to ground - no effluents; therefore, no effect on environment.
Ra-226	.0034	From UF_6 production.
Th-230	.0015	
Th-234	.01	From fuel fabrication plants - concentration 10 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products ..	5.9×10^{-6}	
Solids (buried on site):		
Other than high level (shallow)	11,300	9,100 Ci comes from low level reactor wastes and 1,500 Ci comes from reactor decontamination and decommissioning - buried at land burial facilities. 600 Ci comes from mills - included in tailings returned to ground ~ 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^7	Buried at Federal Repository.

Table 5.7-1 (Sheet 5 of 5)

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Effluents - Radiological (curies) (cont'd.)		
Effluents - thermal		
(billions of British thermal units)	4,063	< 5 percent of model 1,000 MWe LWR.
Transportation (person-rem):		
Exposure of workers and		
general public	2.5	
Occupational exposure (person-rem) .	22.6	From reprocessing and waste management.

[1]In some cases where no entry appears it is clear from the background documents that the matter was addressed and that, in effect, the Table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the Table. Table S-3 does not include health effects from the effluents described in the Table, or estimates of releases of Radon-222 from the uranium fuel cycle. These issues which are not addressed at all by the Table may be the subject of litigation in the individual licensing procedures.

Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248, April 1974; the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp. 1 to WASH-1248); and the "Discussion of Comments Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (Supp. 2 to WASH-1248). The contributions from reprocessing, waste management and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor which are considered in Table S-4 of § 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

[2]The contributions to temporarily committed land from reprocessing are not prorated over 30 years, since the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

[3]Estimated effluents based upon combustion of equivalent coal for power generation.

[4]1.2 percent from natural gas use and process.

5.8 DECOMMISSIONING AND DISMANTLING

The Comanche Peak Steam Electric Station (CPSES) has a design life of
40 years. Decommissioning of this facility will occur at the end of
its economic operating life. Decommissioning of CPSES is technically
feasible with present-day technology [1]. Although future technologies
available for decommissioning CPSES cannot be completely foreseen at
this time, it is possible to set forth a procedure, subject to change
by techniques and regulations in effect at the end of the plant's
operating life. In any event, the Applicant will retain sufficient
flexibility in its planning and operations to permit adaptation of 1
decommissioning procedures which have been proven acceptable.

5.8.1 METHODOLOGY AND COST

The following discussion of methodology and cost is based principally on Technology, Safety and Cost of Decommissioning a Reference Pressurized Water Reactor Power Station, NUREG/CR-0130, June 1978 [1] and NUREG/CR-0130 ADDENDUM, August 1979 [2]. The reference Pressurized Water Reactor (PWR) in the NUREG/CR-0130 study is the TROJAN Nuclear Plant. The TROJAN Plant is a Westinghouse reactor design similar to CPSES in most aspects including size. Therefore, a scaling factor such as the one in NUREG/CR-0130 addendum [2] is not used. There are differences noted between TROJAN and CPSES; for example, the containment buildings at CPSES are slightly larger than the TROJAN containment, but TROJAN has a cooling tower and CPSES does not. Also, both units at CPSES will likely be decommissioned together which suggests that estimating the cost to be twice that of the TROJAN cost is somewhat high. All things considered, the NUREG/CR-0130 study estimates are reasonable for this report.

5.8.1.1 Decommissioning Activities

The method of decommissioning described below is immediate dismantlement. Radioactive materials are removed and the station is disassembled and decontaminated during the four-year period following final cessation of power production operations. Upon completion, the property could be released for unrestricted use [1].

NUREG/CR-0130 divides the dismantlement of the facility into five general areas of effort:

1. Planning and Preparation - This phase is approximately 2 years (before final shutdown) of preparing a decommissioning plan to be approved by the Nuclear Regulatory Commission (NRC).

2. Decontamination - This is physically or chemically removing
1 radioactive contamination from equipment or systems.

3. Disassembly and Transport - This is the removal of potentially contaminated equipment and materials.

4. Demolition - This is taking down the buildings and structures. This step is optional because when all radioactive materials have been removed the NRC has no responsibility at the station.

5. Site Restoration - This is conditioning the site for future use.

For Comanche Peak, abandonment of the site and drainage of Squaw Creek Reservoir is not expected in the future for several reasons. First, because the agricultural productivity of the site area is relatively low (as documented by the original ER and subsequent hearings), there appears to be no justification in sacrificing what will then be an aquatic resource of significant value to the local area. Also, because the site is a good location for a power production facility, it is not 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.

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6.1 APPLICANT'S PREOPERATIONAL ENVIRONMENTAL PROGRAM

The preoperational environmental monitoring programs for the Comanche Peak project are described in Section 6.1 of the original Environmental Report (ER). These programs are divided generally into four broad areas of concern: surface water, ground water, air, and land use. Section 6.1.5 of the earlier ER addresses radiological monitoring as applied to these areas.

The proposed operational phase environmental monitoring program is discussed in Section 6.2 of the original ER. Since this program was designed prior to the start of project construction (and therefore prepared without benefit of information gained from monitoring and evaluating construction impacts) and several regulatory changes have 1
occurred, it is evident that a number of significant changes from that proposed operational program are now required. These changes are reflected in Section 6.2 of this operating license stage ER, which supercedes the program presented in Section 6.2 of the earlier report.

The following sections present a summary description of the construction phase monitoring programs that have been implemented to date, with particular emphasis on methodology and techniques employed. The results of these programs (i.e., data tables, figures, conclusions, and recommendations) are given in Section 2.2 of this ER and in the special documents referenced therein, such as Ubelaker (1974 and 1976), Summary of Aquatic, Terrestrial and Water Quality Monitoring During Comanche Peak Steam Electric Station Construction 1975 - 1979 1
(Monitoring Summary), and Annual Summary (1975 - 1979).

6.1.1 SURFACE WATERS

The surface waters of Squaw Creek (and, to a lesser degree, Lake Granbury) have been measurably affected by the construction of the Comanche Peak Steam Electric Station (CPSES) and associated facilities.

1 The construction phase monitoring programs have identified the characteristics of these waters and assessed the impacts of construction thereon.

6.1.1.1 Physical and Chemical Parameters

A stream gaging station was established by the U. S. Geological Survey in October 1973 on Squaw Creek at the bridge on State Highway 144. Stream height is measured by a type-A wire-weight gage, supplemented with digital and auxiliary graphic waterstage recorders operated by a bubble gage servo-manometer.

The methodology and results of water quality analyses for Squaw Creek are described in Section 4.0 of the monitoring summary documents
1 compiled annually. These analyses are performed on a monthly basis, with a certified independent testing laboratory conducting a supplemental chemical analysis of water samples on a quarterly basis. Parameters measured monthly include temperature, conductivity, turbidity, pH, dissolved oxygen, and alkalinity. Other water quality parameters evaluated quarterly are listed in Table 6.1-1. All quarterly water samples are packed in ice and transported to the testing laboratory within 24 hours after collection of the last sample. Sampling locations are shown in Figure 1.2-1 in Section 7 of the annual summary reports.

6.1.1.2 Ecological Parameters

1

At the writing of the original ER, only eight months of a 20 month aquatic environmental survey had been completed. Results of the eight months, along with the description of sampling locations, methods, and materials for the complete survey, were presented in Appendix D of the original ER. The unreported portion of this survey was initiated in January, 1974, and concluded December, 1974. The final report is contained in Ubelaker (1974). Table 6.1-2 presents a summary of events and parameters evaluated during this survey.

Additional studies that have been instigated since the submittal of the original ER include the CPSES Environmental Monitoring Program - Construction Phase, and a re-examination of Lake Granbury. Results of these studies are summarized in Section 2.2 of this ER. Greater detail can be found in Ubelaker (1976), and the monitoring summary documents. | 1

6.1.1.2.1 Squaw Creek

The aquatic portion of the Environmental Monitoring Program-Construction Phase was initiated in January, 1975. Six biological sampling locations established on Squaw Creek were selected so as to provide biological data to determine construction effects upon its fish, plankton, aquatic macrophytes, and benthic macroinvertebrate populations, and to substantiate the baseline survey results. More specifically, sampling locations were selected to evaluate the impacts of construction on:

1. areas in the direct impact zone which might be affected by increased turbidity and siltation;

2. areas to be inundated by the proposed reservoir.

The aquatic ecosystem near the CPSES site has been monitored to date during the following periods: winter (January 28 and 29, 1975), spring (April 1 and 2, 1975), summer (August 5, 1975), and winter (January 20-22, 1976). Spring and summer 1976 surveys were suspended due to the low water conditions which existed within the Squaw Creek drainage basin.

Surveys during 1977 were performed during winter (February 1, 1977) and summer (August 4, 1977). Surveys during 1978 were conducted on | 1

February 2, and on August 1. Winter and summer surveys for 1979 took
1 place on February 22 and August 7. Surveys for 1980 were conducted on February 12 and August 26. Winter surveys were selected to evaluate the aquatic community when water temperatures were low. The spring surveys were selected to coincide with the period of possible migration and spawning activities in Squaw Creek, and summer surveys chosen to evaluate the period of stress due to high water temperature and low flow. To determine ambient water conditions during sampling, in situ physical and chemical water quality measurements were recorded at each sampling location during each ecological survey.

Biological sampling location A_0 (see Figure 1.2-1 in Section 7 of the Annual Summaries), the uppermost of the six Squaw Creek sampling locations, consisted of a riffle with several deep to shallow pools. Bottom substrate varied from sand to gravel. Depths ranged from 0.1 meter (m) (0.3 ft) in the riffle to 3.7 m (12.0 ft) in the deepest pool, although the average pool depth was approximately 1.8 m (5.9 ft). Overhanging bank vegetation provided the only available fish cover in the area. This section was used for fish collection and in situ water quality sampling only.

Sampling location A_1, approximately 300 m (984 ft) downstream from A_0, consisted of a series of pools and riffles over a bedrock substrata. Sands and fine gravel appeared along the streambank in some areas. Depths ranged from 0.1 m (0.3 ft) in the riffles to 2.5 m (8 ft) in pools, and overhanging bank vegetation and large rocks provided limited cover for fish in the area. This location served as a fish collection and in situ water quality station only. The primary impact encountered at A_0 and A_1 was a change from stream habitat to lake habitat.

Sampling location A_2, approximately 2 kilometers (km) (1.7 mi) downstream of location A_1 and approximately 0.5 km (0.3 mi) upstream of the proposed dam site, was composed of two natural pools divided by a narrow gravel riffle. Pool depths ranged from 0.6 to 1.2m (2 to 4 ft) while riffle depths averaged 0.1 m (0.3 ft). Substrate in the upper pool was bedrock, while gravel was the primary substrate type in the riffle and lower pools, with rocks and exposed roots providing some cover for fish. Siltation and the change to a lacustrine (lake-like) habitat were the primary impacts affecting aquatic organisms at location A_2. None of the above stations currently exists due to inundation by Squaw Creek Reservoir.

Sampling location A_3, which still exists, is adjacent to the low-water bridge which crosses Squaw Creek immediately downstream from the construction area. The habitat consists of two pools separated by the bridge with gravel riffle occurring downstream from these pools. Substrate varies from mud and organic detritus, which typifies the upper pool to a gravel-rock substrate in the lower pool. Depths range from 0.1 m (0.3 ft) in the riffles to 2.0 m (6.5 ft) in the pools. Aquatic vegetation, large rocks, and overhanging bank vegetation serve as potential cover for fish. Location A_3 is in the direct impact zone of upstream construction and should reflect any impacts of turbidity and siltation.

Also currently existing, sampling location A_4 is under the State Highway 144 bridge over Squaw Creek. It consists of a series of large pools connected by a gravel riffle. Bottom substrate in the upper pool is gravel with a sand-mud-detritus complex in the nearshore backwater areas. The lower pool substrate is predominantly bedrock with some gravel and leaf litter along the edges. Depths range from 2.0 m (6.5 ft) in the upper pool to 0.2 m (0.6 ft) in the riffle. Overhanging vegetation and large rocks provide fish cover. The greatest impact at this location is expected to be the downstream movement of fish and benthos due to turbidity and siltation occurring upstream.

Sampling location A_5 was located 91.4 m (110 yd) downstream from the dam site in the area of greatest construction activity. This station was discontinued as a feasible sampling location at the end of 1975 due to construction of the service spillway discharge canal which is routed through the vicinity of station A_5. It consisted of a series of small pools connected by gravel riffle. The substrate was predominatly gravel; however, due to construction in the immediate area, a layer of fine silt 15.4 to 20.5 cm (6 to 8 in.) deep has collected in the pools.

In situ water quality measurements were taken concurrently with biological samples at A_0, A_1, A_2, A_3, A_4, and A_5 using a Yellow Springs Instruments (YSI) Model 57 dissolved oxygen meter, YSI model 33 SCT (salinity, conductivity, and temperature) meter, and a Secchi disk. The dissolved oxygen meter and SCT meter were calibrated prior to their use according to procedures outlined in their respective operation manuals. Turbidity analyses were conducted in the laboratory using a HACH Model 2100A turbidimeter.

Duplicate phytoplankton samples were collected at locations A_2, A_3, A_4 in winter and spring, 1975, and at A_2 through A_5 in summer at mid-depth, using a 2.1 liter Alpha bottle water sampler (modified Van Dorn). Triplicate phytoplankton samples were collected at location A_2, A_3, A_4 in winter, 1976. Similar collection techniques were employed during the period 1977 - 1980 and are discussed in more detail in the annual summary documents for those years. Samples were placed into containers containing sufficient Merthiolate perservative to give a minimum final concentration of 35 milligrams per liter (mg/l), and the samples were preserved for subsequent laboratory analysis. Analyses of phytoplankton samples were conducted according to methods outlined by the U. S. Environmental Protection Agency (EPA) (Weber, 1973). Samples were thoroughly mixed by inversion, and one-liter aliquots were placed into plexiglass settling columns. Ten milliters (ml) of Rodhe Acidic Lugol's iodine solution were then added to facilitate settling and to further fix the sample. After settling for five days, the supernatant was siphoned to a settled volume of 50 ml.

One ml of each duplicate concentrate was then placed in a Sedgwick-Rafter (S-R) counting cell and enumerated by viewing 25 Whipple disk fields microscopically at 100X to 300X. Samples that were too concentrated to count accurately were diluted with distilled water.

The following field count conversion for the Whipple disk was used to compute the concentration of organisms per liter:

$$\text{Organisms per liter} = \frac{C \times 1000\ mm^3 \times K}{A \times D \times F}$$

where:
C = number of organisms counted
K = volume of concentrate (50 ml)
A = area Whipple disk (0.1218 mm^2)
D = depth S-R cell (1 mm)
F = number of fields counted (25)

Taxonomic identification of organisms were made following Smith (1950), Prescott (1951, 1970), and Patrick and Reimer (1966).

The aquatic macrophytes were evaluated at six sampling locations which were previously established on Squaw Creek to conduct surveys on various aquatic elements, such as fish, benthos and plankton. The study consisted of examining each of the aquatic sampling locations to determine the composition of aquatic macrophytes. Each species was evaluated on a qualitative basis according to its abundance at the sampling location.

Production samples were collected within four-1/4m^2 (50 x 50 cm) quadrats at each sampling location. Five quadrats were sampled during the spring survey, but due to the sparseness of the vegetation the sample size was reduced to four quadrats during the summer survey. The vegetation was clipped at the base and placed in plastic bags. After transporting to the laboratory, the samples were placed in wire screens and allowed to drain the excess water. The samples were then placed in paper bags and weighed to determine the wet weight. After determining the wet weight, the plants were dried at 70^o C (158^{o}F) for 96 hours and oven-dried weights were recorded. Mid-depth zooplankton samples were collected in Squaw Creek and preserved with Rodhe Acidic Lugol's 1
solution (conc. 1 ml/100 ml of sample) (Edmondson, 1959).

Each sample was scanned under a 10-50X Wild M5 stereomicroscope, and all zooplankters were removed and enumerated. Identification was completed utilizing a 100X compound microscope (AO 50) in accordance with Edmondson (1959). Total counts were made due to the low numbers of organisms. Community composition and structure of benthic macroninvertebrates were determined through the use of both a square
1 foot box sampler for riffle habitats and an Ekman dredge for pool habitats.

Duplicate Ekman samples were collected at randomly selected locations in pool habitats and washed in the field through a #30 mesh bucket sieve. Triplicate box samples were collected in randomly selected locations in riffle areas. Expended effort per box sample was held to three minutes per sample to maintain uniformity of collection. Both Ekman and box samples were preserved in 70 percent ethanol containing rose bengal as a staining agent to aid in sorting and identification.

Using a wild M5 stereo-dissecting scope, benthic animals were sorted, enumerated, and identified; identifications to lowest applicable levels were then made using that scope and a 100X compound scope (AO 50).

Definitive taxonomic keys used were Pennak (1953) and Edmondson (1959). Supplementary keys utilized included Ross (1944), Burks (1953), Brown (1972), and Klemm (1972).

Because samples were sufficiently large to create extreme difficulties in sorting, 1/2 or 1/4 sample size aliquots were taken, and identifications and enumerations were made on these aliquots. Appropriate computations were made to convert the results into organisms per unit area.

Fish were collected from pool and riffle habitats at each location on Squaw Creek. Three capture devices were employed: 1) small mesh seines; 2) a backpack electroshocker; and 3) minnow traps. Two types of seines were used, depending upon stream width and depth: 1) a 7.62 m x 1.22 m x 0.32 cm mesh (25 ft x 4 ft x 1/7 in); and 2) a 9.14 m x 1.82 m x 0.32 cm mesh (30 ft x 6 ft x 1/7 in) bag seine. Approximately 50-meter day and night seine hauls were made at each location during each survey.

Stream water depths ranged from 2.54 cm (1 in) to 2 m (78.6 in). Daylight seine hauls were held to two hauls per location to insure a representative sample of equal effort per location. One seine haul per location was made in pool areas during night seining.

Electroshocking was intended to serve as a seining efficiency check at each location and was used to sample fish populations residing in areas difficult to seine, such as undercut banks, deep water, and around large rocks and brush. Shocking was performed using a 110 volt AC custom-made shocker with an effective electrical field of 182.9 cm (6 ft) in diameter. Electroshocking was conducted for a 15-minute period at each location during daylight hours, but was not employed as a technique after February of 1977 since increased conductivity in Squaw Creek rendered the equipment ineffective.

Fish collected during the fishery surveys were identified to species in the field, when possible, and enumerated. Identifications were made using Knapp (1953), Trautman (1957), Hubbs (1964), Cross (1967), Eddy (1969), and Miller and Robison (1973). An identification number was assigned to each fish except when large numbers of forage fish were collected (i.e., Gambusia). Specimens were selected from the sample which represented maximum and minimum weights and lengths. The total number of individuals, total weight of the sample, and breakdown by sex were then recorded for the sample. Total length (in millimeters) and weight (in grams) were recorded for all fish collected. Sex determinations and gonadal conditions also were made.

Food web relationships were investigated for the winter, spring, and summer surveys by removing stomachs from selected species of forage, game, and rough fish. Stomachs were preserved in 5 percent buffered formalin and stored in Whirl-pak bags for later analyses. Individuals within each species collected were grouped by 20-mm intervals according to their respective lengths. A maximum of five individuals within each group was then selected for stomach analyses. This procedure was followed for each location. At locations where samples contained less than five individuals within the particular size group for that species being collected, all specimens were processed as described below. A program using a maximum of three stomachs per 20-mm group per species was initiated for the January samples.

Preserved stomach samples were drained in the laboratory and the contents of each stomach sorted and identified to family, where possible, using keys by Pennak (1953), Hubbs (1964), and Eddy (1969). The number of individuals per family was counted and stomach content data tabulated; the number of individuals was then averaged by dividing the number of stomachs examined for each fish species, and the results recorded. As a result, the data in final form attempts to illustrate the relative importance of certain food organisms to individual fish species and to the fish population as a whole.

Fish collected during each survey were checked for external parasites at time of capture. Obvious internal parasites were removed and preserved during gonadal condition checks and stomach extrication. Parasites were removed from larger fish in the field and preserved in 10 percent buffered formalin. Parasites were left on smaller fish and were removed in the laboratory. Each fish's parasites were preserved separately and labeled with the host species, date, location, and general condition of the fish. Identification to the generic level was accomplished when possible using Pennak (1953), Edmondson (1959) and Hoffman (1970) as taxonomic guides.

Individuals of each fish species collected were preserved in a 10 percent formalin solution buffered with sodium borate, stored in glass jars, and retained as voucher specimens.

6.1.1.2.2 Lake Granbury

A survey was initiated in June, 1975, to re-examine the vicinity of the makeup water pump station on Lake Granbury. The objectives of this survey were to (1) examine diurnal vertical migration of insect larvae and (2) to examine populations of fish fry. Accomplishment of these objectives provided additional data to determine impacts resulting from the construction and operation of the makeup water pumping station on Lake Granbury. Table 6.1-3 provides a summary of events and parameters investigated during this survey. The study area was located approximately two and one-half miles from DeCordova Dam in the vicinity of the proposed pipeline intake structure (see Figure 3.4-12). This area will be under the greatest influence of water intake for the Squaw Creek Reservoir.

The first sampling station (1) was located approximately 10.9 meters (36 ft) from the shore in waters ranging from 2.0 to 2.4 meters (6.5 to 1.9 ft) in depth. This site is characterized by a substrate of sand and light gravel mixed with organic debris. The samples from this location were collected immediately beyond a zone of emergent aquatic macrophytes. Temperature, conductivity, dissolved oxygen, and pH profiles indicated a constant mixing of water at this location.

The second location (2) was located approximately 24 meters (80 ft) from shore in an area containing numerous dead trees and stumps. The depth ranged from 11.5 to 12.2 meters (37.7 to 40.0 ft), and the substrata contains sand and silt. No aquatic macrophytes were observed.

The third location (3) was located 53.3 meters (175 ft) from shore beyond the standing tree line. The substrate is the former river bank, and consists of a sand base overlayed by silt. Substrate at this location is probably typical of the channel bottom, for depth changes only irregularly across the mid-channel.

The following measurements were taken at each location: temperature, pH, dissolved oxygen, and conductivity. Temperature readings were precalibrated with an YSI thermistor, conductivity was precalibrated with standard solutions, and dissolved oxygen was precalibrated at atmospheric pressure to 8.25 parts per million (ppm). Measurements were taken at 6:00 p.m., midnight, and 6:00 a.m. at one meter depth intervals using a Hydrolab II electronic surveyor (Hydrolab Instruments, Austin, Texas). Because readings at 6:00 a.m. and 6:00 p.m. showed no differences from the midnight readings, additional readings were not taken hourly.

Plankton samples were collected at one hour intervals from 6:00 p.m. to 6:00 a.m. A two-liter Kemmerer sampler attached to marked lines was used to collect plankton from the surface, intermediate, and bottom levels. The water samples from these depths were passed through a standard Wisconsin plankton bucket, washed, and preserved in 70 percent isopropyl alcohol and one percent gylcerin.

Benthic samples were collected using a double-weighted Petersen dredge (0.9 m square meter surface area). Substrate obtained in the dredge was washed through fine (#20) brass screens, then macrobenthic organisms were handpicked from the screens and preserved in 70 percent ethanol and one percent glycerin solutions.

Identification of zooplankton was accomplished by placing one milliliter samples into a Sedgewick-Rafter chamber and identified using standard techniques (Pennak, 1953). Large species of phytoplankton were also noted and identified in the counting chambers during examination of the zooplankton sample. Macrobenthic samples were given a final cleansing, cleared with lactophenol when necessary, and identified using standard techniques (Usinger 1956). Plankton concentrations were reported as organisms per liter, and macrobenthic forms were reported as organisms per square meter.

To determine if various fish larvae were utilizing this area of Lake Granbury as feeding or developing beds, twenty plastic "Sears" minnow traps were set. Two traps were positioned at three depths: bottom, middle, and top at each site. Two sites were selected on the opposite side of the lake in dense, aquatic emergent macrophyte beds to compare this area with other areas believed to be spawning beds. The water here is shallow, less than 2 meters (4 ft), and the bottom is sandy, overlayed by dense silt and decaying vegetation. Traps were positioned at each site.

Traps were baited with "Gravy Train" dog food and positioned in the evening and retrieved the following morning. Fish were transferred to jars containing one percent formalin and 24 hours later transferred to 70 percent ethanol for storage and identification. See Ubelaker (1976) for data.

6.1.2 GROUND WATER

6.1.2.1 Physical and Chemical Parameters

Ground water is monitored on a monthly basis to detect fluctuations in tne static level of four observation wells. The locations of these wells are shown by Figure 1.2-1 of the annual summary documents, and
1 were selected to provide data of a broad spatial nature, and to monitor both the Glen Rose Formation around the reservoir and the Twin Mountains Formation on a regional scale.

Table 6.1-1 lists the parameters monitored, sampling frequency, and detection limits of measuring equipment. Water levels, of course, are measured in situ on a monthly schedule, while chemical analyses are performed by an independent testing laboratory on a quarterly basis.

6.1.2.1 Models

The model used for prediction of ground water movements in the Twin Mountains Formation is based upon a confined homogeneous aquifer. The Paluxy Formation is not in contact with and does not underlie the reservoir, and is therefore not monitored. The Glen Rose Formation is, at the site, essentially impermeable, but is treated as an unconfined aquifer for analytical purposes.

6.1.3 AIR

6.1.3.1 Meteorology

The pre-operational onsite meteorological program includes an onsite meteorological station designed to measure the parameters needed to evaluate the dispersive characteristics of the site (for both routine and accidental releases of radionuclides). A baseline study of the local meteorology is presented in Section 2.3 of this report. A total where:

$\chi/Q(i,D)$ = dilution factor (seconds/meter^3) at distance D, in affected direction sector i

i = wind direction sector index

p = Pasquill stability class index

$\sigma_y(p,D)$ = hourly average horizontal dispersion coefficient of the plume (meters) for a given Pasquill class, at distance D

$\sigma_z(p,D)$ = hourly average vertical dispersion coefficient of the plume (meters) for a given Pasquill class, at distance D

c = building wake shape factor (taken as 0.5)

A = estimated cross-sectional area of the reactor containment structure (3200 meters^2)

$\bar{u}(i)$ = hourly average wind speed (meters/second) affecting direction sector i

D = distance from reactor containment structure to point of concern or receptor

Ground reflection is assumed at all points; this doubles the concentrations which are to be expected in the free atmosphere. The effect of the wake term (cA) on χ/Q is limited to a factor of 3 or less.

6.1.3.2.1.2 Diffusion Model for Periods Longer than 8 Hours

For releases beyond the first eight hours, the dilution factors are estimated from an equation which recognizes the tendency for winds to meander throughout a direction sector during longer time periods, i.e.:

$$\chi/Q(i,D) = \frac{1}{B\ \ D}\frac{\sqrt{2}}{\sqrt{\pi}}\frac{1}{\bar{u}(i)\ \sigma_z(p,D)} \qquad (6.1.3\text{-}7)$$

where:

/Q(i,D) = dilution factor (seconds/meter^3) at distance D, in affected direction sector i

i = wind direction sector index

p = Pasquill stability class index

z(p,D) = hourly average vertical dispersion coefficient of the plume (meters) for a given Pasquill class, at distance D

B = horizontal plume spread factor (taken as $\pi/8$ radians)

$\bar{u}$(i) = hourly average wind speed (meters/second) affecting direction sector i

D = distance from reactor containment structure to low population zone (meters)

1.111, March, 1976. The curves presented in that guide were used (Figure 3 for ground release plume depletion and Figure 7 for ground release plume deposition). Decay was calculated as follows: 1

$$\chi/Q \text{ decay} = \chi/Q \exp(-\lambda t) \qquad (6.1.3\text{-}9)$$

where:

t = time (hours) = $\dfrac{\text{distance (m)}}{\text{wind speed (m/hour)}}$

λ = disintegration constant in hours, or decay factor = $0.693/T_r$

T_r = half-life of particular isotope (hours)

6.1.4 LAND

6.1.4.1 Geology and Soils

Soil analyses were conducted as part of the construction phase terrestrial monitoring program, the details of which are contained in Appendix C of the original ER, and in Section 6.1.4.3 of the present ER.

The geological characteristics of the site are given in Section 2.5. A more extensive discussion of the site geology is presented in Section 2.5 of the Final Safety Analysis Report.

6.1.4.2 Land Use and Demographic Survey

Field surveys were conducted during the summer of 1976 to obtain current data for use in updating the original ER estimates of population distribution and land use in the vicinity of the CPSES site (as required in Sections 2.1.3 and 2.1.4). In view of the extraordinary growth that has occurred in Hood and Somervell counties since 1973, it was determined that a detailed survey of current land use (within five miles of the site) and a comprehensive enumeration of housing units throughout Hood and Somervell counties would be the best approach to development of reliable estimates of current population and population distribution in the area. The land use and housing surveys are described in more detail below along with discussion of the specific data and methods utilized in preparing the revised estimates of population distribution.

It should be noted here in connection with both the land use and demographic surveys that boundary lines of CPSES sector-areas (formed by the compass sector lines and concentric circles) are not identical with the boundary lines shown in the original ER, because the actual locations of the Unit 1 and 2 Containment Buildings differ slightly from those given in the original ER. While the centerline location differs only slightly (Unit 1 is approximately 305 feet north of the location given in the original ER) the difference causes a shift in the boundary lines of the sector areas, resulting in slight revisions to the present population estimates for particular sector areas (especially in settled areas) as compared with the earlier estimates for the same areas. The centerline location of the Unit 1 Containment structure, as specified in Section 2.1.1, has been used as the point of origin for the 16 sector lines and the concentric circles (drawn at various radii out to 50 miles) forming the sector-areas for which population estimates are provided in Section 2.1.3.

visitors levels off. The procedure for estimating monthly, uaily, and peak period daily use are the same as followed in estimating 1976 daytime use of Lake Granbury.

Potential daytime transient recreational visitor use of Squaw Creek Reservoir was distributed by sector-area, taking into account the fact that certain areas of the reservoir would be closed to public recreational use. It was assumed that the daytime visitor use of a recreational park situated somewhere on the northeast shore of the reservoir would occur as follows:

Season	Percent of Visitors Engaged in Boating
Winter	95
Summer	25

The above indicates that winter season use of the park would be very limited except for boating.

6.1.4.3 Ecological Parameters

The terrestrial ecological portion of the Construction Phase Environmental Monitoring Program was initiated in May, 1975. A permanent sampling transect was established within each of three basic habitat types within the CPSES site - grassy slopes, juniper woodland, and lower riparian. The monitoring program was established to sample birds and terrestrial invertebrates every other year and herpetofauna every year through 1981. Table 6.1-9 provides a summary of the terrestrial sampling to date, including methodology and schedule.

The objective of these studies was to evaluate the impact of construction activities on these faunal elements. Therefore, transects were established in proximity of construction activities but would not

be subjected to vegetation removal. The lower riparian habitat has been
1 lost as a result of filling of Squaw Creek Reservoir. The sampling locations are identified on Figure 1.2-1 of the Annual Summaries.

Bird surveys were conducted using the strip census method (Kendeigh 1956, Emlen, 1971). Transects were established to sample a total area of 10.4ha (25.7a), which is considered the most efficient for determining density (Graber and Graber, 1963). Length and width varied by habitat depending on the screening effect of the vegetation. The high, median, low, and mean numbers for each strip were recorded and estimates of relative abundance calculated. Species diversity and equitability also were calculated for each habitat type.

The bobwhite (*Colinus virginianus*) and the mourning dove (*Zenoida macroura*) are important resident gamebird species occurring in the area of the CPSES site. Ten bobwhite and seven mourning dove specimens were collected in July, 1975, in areas outside but representative of the sample areas to prevent bias of census. Forage content analysis provided information on feeding habits of these species on the CPSES site.

Crop analyses were conducted using a modification of the technique described by Korschgen (1969). Identification of seeds was made using photographs published by USDA (undated), Lay (1959) and Jackson (undated).

Herpetofauna are most active with increasing temperatures in spring, so, therefore, the yearly herpetofaunal surveys were conducted during the period of greatest activity. Several techniques were utilized at the CPSES site to better define the distribution, diversity, and composition of herpetofauna. Each terrestrial sampling location was thoroughly searched for herpetofauna. Rocks, logs, and boards were overturned and possible den sites in limestone outcrops were explored.

Road surveys were conducted after rains and at night to provide additional information. Most sections of Squaw Creek and other selected areas on the site deemed suitable habitat were extensively surveyed in an attempt to collect and identify as many species of herpetofauna as possible.

Capture methods varied depending on the target species. Frogs, toads, and some lizards were captured using nets. Snakes were normally captured with snake tongs. Den sites in the limestone outcropping were sprayed with gasoline to drive out animals that may have been present but not readily visible.

Voucher specimens were obtained for all species collected and are maintained in the Houston laboratory of Dames & Moore. Other specimens were marked using techniques described by Woodbury (1953) and released.

Terrestrial invertebrates were typically sampled in early summer, which is considered to be the period of maximum diversity. Standard entomological sweep nets were used (38 cm in diameter; 65 cm in handle length) on bushes and trees. Past experience in sampling insects on the Texas Coastal Prairie has shown 500 sweeps can adequately sample the insect fauna of a typical habitat. However, it also is true that insect diversity and abundance is a function of foliage density so this number of sweeps must be modified for any particular habitat according to vegetation density. Therefore, 500 sweeps were utilized as a baseline and the number of sweeps necessary in each of the three study areas was computed based upon the herbaceous plant density in each area. This allowed comparison between areas on an equal biomass basis. Variations in herbaceous density are reflected by the number of sweeps taken in each area. Each sample was taken as a replicate sample for purposes of analysis. The number of sweeps in the trees was the same.

The volume swept in each habitat type was computed as:

$$V = \pi r^2 h = 3.14(19)^2(130)/1000 = 147. m^3.$$

Because the sampling scheme was established on an equal biomass basis, this volume was essentially the same in each area and was used to compute densities of insects for each habitat.

The sweep was divided where samples were collected in both trees and grassland, and a beating net was used to sample both trees and large bushes. The number of tree sweeps in each area was set at 200 because it was estimated that a similar amount of biomass would be sampled in each area. The computed volume covered by each tree sweep was 0.092 m^3. Each vegetation type was sampled by the same investigator to standardize the effort expended in each habitat and to compensate for individual variation in sweeping. All samples were collected within a relatively brief time frame to ensure that climatic conditions would be uniform in all areas.

All sweep samples were immediately placed into individual plastic bags containing ethyl acetate, and replicates from each area were kept separately (each sample constituted a replicate). The insects were separated from the vegetation by hand sorting and identified to family and probable morpho-species. References used for keying insects are listed. Identification was facilitated by using the reference insect collections from the University of Houston Coastal Center and the Allens Creek nuclear generating site monitoring program. Once a reference collection had been established for the CPSES site, individuals from each area were tallied. The reference collection is maintained in the Houston laboratory of Dames & Moore.

unweighted arithmetic averages which give the best fit to the original data was used for this study (Sokal and Michener, 1958; Farris, 1969; Whittker and Gauch, 1973). Basically, this technique joins groups which are mutually closest (highest similarity value) and successively reduces the similarity matrix as areas are joined in a cluster. A principal component analysis reduces the dimensionality of the similarity matrix by displaying common axes of variation interrelating the collection areas.

The results of the terrestrial ecological investigations are summarized in Section 2.2.1. Additional detailed information can be found in the annual summaries documents for 1975 through 1979. 1

6.1.5 RADIOLOGICAL MONITORING

The environmental radiological monitoring program for CPSES is designed to: 1) analyze selected samples in important anticipated pathways for the qualification and quantification of radionuclides released to the surrounding environment and 2) to establish correlations between levels of environmental radioactivity and radioactive effluent from plant operation. This program utilizes the concepts of control-indicator and preoperational-operational intercomparisons in order to establish the adequacy of source control and to realistically verify the assessment of environmental levels and resultant human radiation dose as demonstrated by both the in-plant effluent monitoring program and the environmental monitoring program. Significant upgrading of program scope and sensitivity has occurred as a result of the review of more comprehensive site-specific baseline environmental and land use data which had been unavailable at the construction permit stage.

The sample types, criteria for selection, collection frequencies, locations, and analyses which are performed are presented in par. 3/4.12.1 of the Standard Radiological Technical Specification, NUREG 0472. Site related dispersion characteristics, demography, hydrology, land use, 1 anticipated source terms, and critical pathways have been considered in the selection of s mple media, sampling and analysis frequencies, sample locations, and types of analyses (see Chapters 2 and 5). Detailed examination of possible critical pathways and site related specific dose estimates are presented in Section 5.2. The results of this analysis assure that reasonably conceivable pathways to man and the environment are monitored with frequencies justified on the basis of potential dose. Locations are selected on the basis of site-specific characteristics. Anticipated maximum lower limits of detection for the analyses are presented in Table 6.1-11.

The radio ogical monitoring program implemented in the preoperational phase assures that the minimum amount of baseline data acquired describes the samples of interest for those time periods reflected in Table 6.1-12. Preoperational sampling and sample measurements indicate the existent fluctuating background levels of radioactivity due to naturally occurring and manmade radionuclides. The methodology and frequency of sampling and analyses will be reviewed and optimized (as necessary) during the preoperational phase to obtain a realistic qualitative and quantitative estimate of the radiological environment. Experience gained through the use of analytical procedures and quality control reviews provides the basis for appropriate analytical modifications. Annual reviews of site specific existent exposure pathways provide a basis for the evaluation of possible changes in sampling and sample site selections.

The operational phase of the radiological monitoring program will be an extension of the preoperational phase. Raw data is analyzed and presented in a format similar to Table 6.1-13. These summaries include certain median values (with corresponding error estimate) and ranges for observed environmental concentration estimates. The preoperational median (with error estimate) and range values establish general preoperational baseline concentrations which provide one basis for evaluation of possible long-term changes in the radiological environment. The similarly developed data for "paired" control and

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 Standardlized 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

The objectives of the operational meteorological monitoring program are to satisfy the requirements of Regulatory Guide 1.23 (Safety Guide 23) and to achieve the following:

1. to provide real-time meteorological information to be used in making decisions concerning routine plant operations,

2. to provide real-time meteorological information from which initial estimates of the radiological consequences of an accidental release of radioactive gases into the atmosphere can be made, and

3. to provide the meteorological summaries from which the concentrations of radionuclides due to atmospheric releases during normal plant operations can be estimated.

To accomplish the above objectives, the existing meteorological recording equipment will be modified to transmit meteorological data to the Control Room by addition of a Weather Measure Modular Signal Conditioning Unit. This unit provides 4-20 madc signals which can be transmitted up to 2000 feet. In the Control Room, a new modular signal conditioning card frame assembly will convert the 4-20 madc signals into 1-5 Vdc signals which will then be recorded on strip chart recorders. The analog signals from the tower will also be displayed digitally in the Control Room. The display panel will consist of three Mestronix 2-pen recorders for analog recording, a wind direction meter, and the Weather Measure card frame assembly for digital display of wind speed, wind direction, and delta temperature.

The meterological parameters monitored will be the following:

1. Wind speed, 10 and 60 meters
2. Wind direction, 10 and 60 meters
3. Delta temperature, 10 to 30, and 10 to 60 meters
4. Ambient temperature, 10 meters
5. Dewpoint, 10 meters
6. Precipitation

The bimonthly magnetic tapes will not be processed, but will be stored for future reference. The meterological station will remain in continuous operation, except during that period when equipment/instrument modifications are required to convert to the Operational Meterological Program.

The signals from the tower will be recorded once per minute by the radiation monitoring system mini-computer where they will be averaged each hour and stored in the computer. A time-history of the meteorological data will be available in analog form (strip charts) and from the hourly averaged digital data.

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 short period dose calculations on demand. For long period dose calculations a file of onsite meteorological data will be maintained in the computer. These data will be periodically confirmed and updated using onsite data. As a backup to the short period dose calculation, a set of overlays will be available to Control Room personnel. These overlays will permit a quick evaluation of plume relative concentrations downwind as a function of wind speed and T. The operational program will be conducted in accordance with the requirements specified in Regulatory Guides 1.21, 1.23, and 4.1.

The analog signals for the wind speed, wind direction and delta temperatures will be transmitted from the weather station and displayed and recorded in the Control Room. Appropriate data will be input to the digital radiation monitoring system's minicomputer to aid in accomplishing the above objectives.

T between 10 and 30 meters is substituted for T between 10 and 60 meters, with the difference in height increments accounted for appropriately. That is, T in $^{o}C/20m$ is converted to $^{o}C/100m$ for classification of atmospheric stability in accordance with Table 2 of Regulatory Guide 1.23.

The final step in the data reduction program is the listing, in sequential order, of the concurrent, hourly-averaged values of the weather elements observed at the site. The data record provides the input data for all types of meteorological analyses needed to define the site atmospheric dispersive qualities.

The dates and times of significant instrument c age, the cause thereof and the corrective action taken are shown by Table 6.1-14.

6.2.5 ECOLOGICAL MONITORING

6.2.5.1 Aquatic Programs

6.2.5.1.1 Biological Monitoring

1. General Fisheries Survey

Under the laws of the State of Texas, the Texas Parks and Wildlife Department (TPWD) has authority for the monitoring and management of the fish resources in reservoirs. This agency has a sophisticated program to accomplish these objectives and exercises regulatory power over fish management schemes. The State has performed this task on all major Texas reservoirs and stream systems for many years and is in an excellent position to provide data required in order to adequately assess the effects of plant operation on aquatic resources. The extensiveness of their current fisheries management program is detailed in their publication entitled "A Manual of Survey and Management Techniques for Reservoir and Stream Management," published by the Inland Fisheries Branch of the TPWD under a federal grant through the Dingell-Johnson Act (50 CFR Part 80).

2. Impingement

Fish impinged on the traveling screens will be sampled for one 24-hour period on a weekly basis. Impingement studies will begin 60 days after the start of Unit 1 commercial operation of the plant and continue for a period of one year. When feasible, all fish will be collected from a representative sample of the screens, weighed, measured, and identified. If large numbers of fish are impinged, subsampling will be performed to estimate the total numbers impinged for each species. A determination of long-term impacts of impingement on important fish populations in 1

Squaw Creek Reservoir will be made from this information, and relevant information from other cooling reservoirs. After performance of this survey for a period of one year, the program
1 shall be terminated. Also see response to question 350.9.

3. Lower Squaw Creek

Lower Squaw Creek baseline and construction monitoring programs were designed to detect changes resulting from construction and release of water down Squaw Creek from Lake Granbury. Plant operation should have no impact on Lower Squaw Creek beyond those effects resulting from impoundment and release of Lake Granbury water. Because impoundment began February 1977, sufficient
1 construction monitoring has taken place to determine effects on Lower Squaw Creek. Therefore, sampling of Lower Squaw Creek will be terminated when any construction activity which could have an impact has been completed.

6.2.5.1.2 Physical and Chemical Parameters

See Section 6.2.6

6.2.5.2 <u>Terrestrial Programs</u>

6.2.5.2.1 Soils

Pre-operational and construction monitoring indicated no abnormally high readings for pesticides and heavy metals. There is no reason to believe plant operation will affect pesticide or heavy metal concentrations in the soil. Therefore, such monitoring will be
1 terminated when any construction activities which could have an impact has been completed.

6.2.5.2.2 Biological Monitoring

Some terrestrial animals were displaced by construction activities. Other than displacement no other adverse impacts were noted. Plant operation will not result in further habitat removal; therefore, no additional displacement should occur. On that basis, terrestrial biological monitoring will be continued following completion of construction activities which could result in adverse impacts on such biota. 1

6.2.6 WATER QUALITY SURVEILLANCE

6.2.6.1 Surface Waters

6.2.6.1.1 Squaw Creek Reservoir

Squaw Creek Reservoir will be monitored for the following parameters at the frequency indicated:

Monthly -	Temperature
	Conductivity
	Turbidity
	pH
	Total alkalinity
	Total dissolved solids
Quarterly -	ammonia
	nitrate
	nitrite
	total Kjeldahl nitrogen
	orthophosphate
	total phosphate
	copper

Other water quality parameters monitored during construction have not indicated problematic quantities and will not be affected by CPSES operation. Some parameters included for operational monitoring will not be directly affected by plant operation but are variables which contribute to or indicate the productivity of the reservoir (e.g., nitrate, orthophosphate).

Copper is the only heavy metal which will be measured during operational monitoring because it is the only heavy metal which may be contributed by power plant operation (condenser tube erosion). As established by correspondence with NRC staff, only those pesticides utilized during construction or operation will be monitored. To date, no pesticides have been used.

In addition to monthly temperature measurements, two programs will be undertaken to assess the cooling capabilities and plume extent under summer load conditions.

Monitoring for thermal performance of SCR comprises two programs. The first program includes late spring, summer and early fall biweekly monitoring of temperature and dissolved oxygen at designated stations (Figure 6.2-1) within SCR. The second program consists of annual thermal plume surveys accomplished in one afternoon under summer load conditions to delineate the horizontal and vertical thermal distribution with relation to the circulating water discharge. This program would occur annually beginning one year preoperational and continue through two summers following commercial operation of Unit 2. The first program supplies data for analyzing reservoir performance throughout the hottest part of the year. The second study provides data on the reservoir-wide thermal regime under summer load conditions and will enable comparison with preoperational thermal modeling.

Tentative station sites include:

1. Circulating water discharge to SCR
2. Buoy line at circulating water intake
3. SCR dam at diversion water structure
4. Makeup water discharge into SCR
5. Upper SCR

6.2.6.1.2 Lower Squaw Creek

Lower Squaw Creek water quality monitoring will continue until the completion of biological monitoring programs except those required by the NPDES permit and the state water quality permit. Plant operation should have no additional effect on Squaw Creek water quality. 1

6.2.6.1.3 Lake Granbury

The effect of withdrawal from and return of water to Lake Granbury is discussed in Section 5.1. Blowdown parameters will be monitored as required by the EPA NPDES permit.

6.2.6.2 Groundwater

Monitoring of physical and chemical groundwater parameters were performed during construction phase program described in Section 6.1.2. 1
This monitoring program will be discontinued when sufficient data is collected to establish that CPSES has no adverse effect upon the water quality of the aquifer.

6.3 RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

The Texas Parks and Wildlife Department presently maintains a continuing surveillance of fish populations and basic water quality parameters (such as D.O. and temperature profiles) in Lake Granbury, Lake Whitney and other water bodies in the area. It is expected that this agency will monitor Squaw Creek Reservoir upon completion of filling operations. 1

The USGS maintains several stream flow monitoring stations at various locations in the region surrounding the CPSES site area. Data from some of these stations is presented in Section 2.4.

6.4 PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING DATA

The preoperational radiological monitoring program for the Comanche Peak Steam Electric Station began in January, 1978. A discussion of the program methodology is presented in Section 6.1.5. 1

CPSES

ENVIRONMENTAL TECHNICAL SPECIFICATIONS

(PROPOSED)

The information previously in this section was removed to facilitate compliance with standard Radiological Effluent Technical Specifications, NUREG - 0472 and NRC procedure for establishing non-radiological environmental technical specifications. The requirements for CPSES environmental technical specifications will be implemented in accordance with NRC regulations. 1

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1. The accidental release of materials stored onsite will not affect the safe operation of the plant.

2. The environmental effect of any significant quantity of materials will be confined to the site.

The former is discussed in Section 2.2 of the Applicant's Safety Analysis Report and the latter is discussed below.

7.2.2.1 Flammable Materials

There are four 102,000 gallon diesel fuel oil storage tanks located underground onsite. These tanks are located and designed such that any fire would remain localized. The effects of any such fire in the diesel fuel oil storage tanks would be confined to the site.

Hydrogen gas is the only potentially explosive chemical stored onsite in any significant quantity. There are two bulk hydrogen storage tanks located outdoors. This outdoor location will prevent any explosive concentration of hydrogen from accumulating as a result of leaks. The effects of a hydrogen tank rupture will not extend to the site boundary.

7.2.2.2 Toxic Materials

Chlorine gas cylinders are stored in Chlorination Buildings located near the Circulating Water and Service Water Intake Structures. There are 24 chlorine gas cylinders (1 ton capacity each) in the Circulating Water Chlorination Building and six chlorine gas cylinders in the Service Water Chlorination Building. Under normal conditions, the leakage from the storage cylinders will be inconsequential. However, as a safety measure, leak detectors and masks are provided in the chlorine storage and injection areas.

Hypothetical chlorine releases from both buildings were analyzed utilizing the approach outlined in Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators against Accidental Chlorine Release." Based on concentrations of chlorine calculated at the Control Room air intake, it was determined that an accidental release would not result in dangerous concentrations at the site boundary.

7.2.3 NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

The effects of potential accidents in the vicinity of the CPSES site from industrial, transportation and military installations are evaluated in the Final Safety Analysis Report, Section 2.2. The events identified and evaluated in the FSAR are:

1 1. Gas pipeline and gas well accidents,

2. Accidental release of chlorine, and

3. Crude oil pipeline rupture.

These events are based on current and projected hazards within a five mile radius of CPSES.

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8.1 BENEFITS

8.1.1 DIRECT BENEFITS - VALUE OF DELIVERED PRODUCTS

Comanche Peak Steam Electric Station (CPSES) will provide a reliable source of 2300 megawatts (MW) of electric power generating capacity to help meet the total energy requirements of the electric utility subsidiaries of the Texas Utilities Company System (TUCS) and the systems to which a 10 percent interest has been sold. Using conservative projections, during the first year of commercial operation, 1982, Unit 1 will operate at a capacity factor (CF) of about 29 percent, producing some 2.9 billion kilowatt-hours (KWH) of energy.
Unit 2 is scheduled to come on line for commercial operation in January 1
1984, operating at a capacity factor of about 35 percent and producing about 3.4 billion KWH in its first year of operation. Estimated output of the two units in the first five years of commercial operation of CPSES is as follows:

Year	Unit 1 (1150 MWe) KWH (billions)	Unit 1 (1150 MWe) CF (percent)	Unit 2 (1150 MWe) KWH (billions)	Unit 2 (1150 MWe) CF (percent)	TOTAL CPSES KWH (billions)	
1982	2.9	29	-	-	2.9	
1983	5.7	57	0.8	7	6.5	
1984	7.1	70	3.4	35	10.5	
1985	7.1	70	5.6	55	12.7	
1986	7.1	70	7.1	70	14.2	1

The installed capacity (2300 MW) and the projected total output of CPSES in the year 1984 (10.5 billion KWH) will represent significant percentages of total system capacity and output for TU and neighboring areas to which the 10 percent interest has been sold. For example, in 1984 CPSES will represent about 10 percent of total installed capacity

in the system; in that same year CPSES output of 10.5 billion KWH will
1 account for about 15 percent of total TU sales. It is at once evident that CPSES will be an important facility in the system. It is thus useful to consider the overall requirements for additional system capacity when assessing the general benefits of the CPSES.

Section 1.1 contains a detailed discussion of the projected demand for power and of critical factors relating to power supply, capacity resources of the system, and the required reserve margin. Section 1.3 considers the consequences of delay in construction of CPSES with
1 respect to overall demand for energy. Thus, in broadest terms, the major benefit of CPSES is that its on-line operation (along with other new plants) will enable regional demand for power and energy to be met.

8.1.1.1 Energy Sales

The valuation of CPSES energy production can be indicated by the amount users pay for electrical energy. There is no practical way to distinguish the value of the output of CPSES from that of any other TU plant. The output from CPSES can, however, be accounted for as a proportionate share of system revenue from total energy sales. The projected levels of TU system energy sales are shown in Table 1.1-10. These figures represent total energy production, less line losses, internal use, etc.. Therefore, these data indicate actual sales revenue produced. Sales for the period have been estimated by using the forecasting techniques described in Section 1. In 1984,
1 total sales are projected to be 71,338,000 MWH as compared with actual sales of 54,125,440 MWH in 1979.

8.1.1.2 CPSES Energy Sales and Revenue Projection

In paragraph 8.1.1.1 above, projected energy sales for the entire TU
1 system are shown to be 71,338,000 MWH in 1984, representing a gross revenue of $2.293 billion, assuming an average gross yield of 3.214

cents per KWH based on 1979 data. In 1982 the energy production of Unit 1 of CPSES will amount to 2.9 billion KWH, with energy sales revenue attributable to CPSES being some $93.2 million, allowing seven percent of production for non-revenue producing uses, distribution losses, and so on. In 1984, when Unit 2 goes into commercial service, total CPSES energy production will increase to 10,500,000 MWH and sales revenue attributable to the two units will increase to $337 million. 1

Table 8.1-1 shows projected annual energy production and annual sales revenue of CPSES over the period 1982-2013, providing for a 30-year economic life for each unit. Total sales revenue over the 30-year life of the two units is $13.37 billion using the assumptions stated above.

8.1.1.3 Present Value of CPSES Production

The projected revenue attributable to CPSES sales of electricity over the 30-year life of the two PWR units has a 1982 present value of $4.035 billion. This valuation is based on an annual discount rate of 10 percent and on the production and revenue data presented in Table 8.1-1. 1 Q34

8.1.1.4 Value to Users

As suggested earlier, it is not practical to identify particular users of the output of CPSES or to give strict definition to the service area of this individual plant within the TU system and that of the other owners. However, it should be noted that the plant site is well located to provide efficient distribution to the Dallas-Fort Worth metropolitan area, the focus of increasing demand within the TUCS. It is also useful to note the percentage distribution of demand among major categories of users, as shown in the following tabulation. 1

Category of Use	Historical and Projected Percentage Distribution of Demand		
	1961	1971	1981
Residential	27%	32%	40%
Commercial	29	25	20
Industrial	33	34	32
Public	4	3	3
Other	7	6	5
TOTAL	100%	100%	100%

Residential and industrial uses are dominant, together accounting for approximately two-thirds of demand. It is observed that, for these two classes of use, peak daily demand occurs at different times and that, currently through 1980, a portion of the industrial use is provided on
1 an interruptible basis.

8.1.1.5 Other Revenue

Revenues from sales of electrical energy constitute the only direct benefits from CPSES. There are no planned sales of waste heat or steam for usage by entities outside the TU system.

8.1.2 INDIRECT BENEFITS

Indirect, or external, benefits accrue mainly to project personnel and residents living in the general vicinity of the site. The principal indirect benefits are increased local employment and wage incomes, increased local business activity, increased tax revenues, and, over the longer term, expanded community services and public facilities (such as development of Squaw Creek Reservoir).

8.1.2.1 Income

Construction and operation of CPSES will contribute importantly to regional income in the counties most directly affected by the plant. The increase in, or contribution to, disposable income in the local area will be a significant economic benefit. The major source of the increase in disposable income in the project impact area will be project payrolls - construction payrolls over the period extending from 1974 into 1984 and operating work force payrolls beginning late in 1977 (for training and in anticipation of initiation of Unit 1 on-line commercial operations in 1982). Other increases in local income attributable to the project derive from local procurements of project materials and services. Local procurements are not significant relative to total project procurements, but may be of considerable beneficial consequences to the smaller counties and communities in the local or primary impact area. 1

For purposes of considering the potentially significant economic and social benefits of the CPSES project, the local impact area has been delineated to include (1) Somervell and Hood counties (in which the project site is situated) and (2) Johnson, Bosque, Erath, and Parker counties (all four of which are directly peripheral or adjacent to Somervell and Hood counties).

All of these must be classified as predominantly rural counties. The broader region extending beyond the local impact area, within which some project workers will reside (commuting longer distances) and from which some procurements will be made, includes Tarrant and Dallas counties (which include the major metropolitan populations of Fort Worth and Dallas), Hill County, and McLennan County (which includes Waco, a large metropolitan area). An outline map of the local or primary impact area and the broader region (as defined in this section) is provided as Figure 8.1-1 of the original ER. The population of these counties and of the principal community in each is shown below the map for convenience of reference.

8.1.2.1.1 Construction Phase

Section 8.1.2 of the original ER contains a detailed discussion of the contribution to local income from construction and operation of the CPSES. Included are benefits from both project payrolls and procurements.

While the methods and assumptions presented in the original ER are basically still valid, certain quantitative information requires updating in the light of new data collected during the construction phase of the project.

8.1.2.1.1.1 Local Procurements

The total expenditures for construction and preparation for operation
1 of the CPSES are projected at $2.235 billion. A detailed breakdown of
these costs is presented in Table 8.2-1.

Procurements for project construction expenditures during the period October 1973 through July 1977 are shown in Tables 8.1-2 through 8.1-6. The data in these tables is based upon a tabulation of purchase orders and petty cash disbursements issued by Texas Utilities Generating Company and the project general contractor.

These expenditures amounted to approximately $1.57 million during this period of time. Assuming that future outlays will follow the same
1 pattern, it is anticipated that total construction procurements in the
local six-county area will amount to approximately $6 million. This represents less than one percent of total expected project costs.

On the basis of the foregoing cost figures, it is evident that local suppliers and the local economy are able to supply only a small proportion of the project's construction materials and equipment requirements. Most of these items - sand, gravel, cement, reinforcing steel, lumber, fuels, earth moving equipment, and the like, are provided by suppliers in the Dallas-Fort Worth area. Major plant components such as the Nuclear Steam Supply System and turbine-generator sets, as well as other major items, come from outside the local region.

8.1.2.1.1.2 Local Income from Project Payrolls

For the local and regional economy, the major source of project income is the project payroll (of both prime and subcontractors). A major determinant of the geographic incidence of project income is the residential distribution of the construction workers.

The number of workers residing in the local six-county impact area is shown in Tables 8.1-7 through 8.1-12. The cumulative buildup of the work force, from the arrival of the first onsite security personnel in June of 1974 through the end of August 1977, is depicted in these tables. Additionally, the number of workers shown residing in each of the local counties is divided into locally-hired and relocated individuals (the latter consisting of those persons moving into the county from outside of the six-county area for the purpose of employment on the CPSES project).

Examination of these tables reveals that the majority of the workers who live in the local area are concentrated in Hood and Somervell (the two counties containing Squaw Creek Reservoir and the CPSES site) and Johnson counties. This bears out the predictions made in Table 8.1-7 of the original ER, although the total number of workers is considerably greater than was originally forecasted. This can be seen from Table 8.1-13, which compares the original ER projections with the actual residential distribution of the peak work force onsite which occurred in January of 1977. The cumulative buildup of the total construction work force without regard to worker residence is shown in Table 8.1-14. Table 8.1-15 shows the expected size of the work force during the remainder of the construction period (through 1982) allocated among the various residential counties in accordance with prior experience.

Based upon contractor payroll figures and the data contained in Tables 8.1-7 through 8.1-12, plus Tables 8.1-14 and 8.1-15, a reasonably accurate estimate of past and present project payroll disbursements in the six-county local area can be derived. The results of these calculations are shown in Table 8.1-16. As this table indicates, the communities in the local impact area will derive a significant stream of income directly from wage payments to workers on the project. Such local spending becomes even more significant when the effects of the multiplier principle are taken into consideration during successive rounds of induced spending.

8.1.2.1.2 Income - Operation Phase

The operation of CPSES will contribute a continuing stream of income to the local economy of the surrounding area. Such income will derive primarily from the wages of the permanent operating staff of the plant. The staffing schedule and gross payroll estimated for the operating work force are shown in Table 8.1-17. It is assumed that most, if not all, of the operating staff will reside within the six-county local area, with the majority of these personnel settling in Hood, Johnson, and Somervell counties (in order of decreasing numbers). In addition to contributing directly to disposable income, project operating payrolls will serve to induce additional income in the local area.

The income of the operating work force was estimated at $1,029,924 in the original ER for the year 1982, based upon a staff of 67 full-time employees. As reflected in Table 8.1-17, this figure is now estimated at $4,771,000 for the same year based upon 187 personnel.

From Section 8.1.2.3.3, it can be seen that taxable purchases by the operating personnel residing in the local area (Hood and Somervell counties) will amount to about $357,000 annually. In the aggregate, it is felt that this will comprise a significant addition to local business activity.

8.1.2.2 Employment

8.1.2.2.1 Construction Phase

A critical requirement in assessing economic and community service impacts of construction is the residential distribution of workers and the number of workers who will move into the project area. As discussed in Section 8.1.2 above, and as presented in Tables 8.1-7 through 8.1-13, and 8.1-15, the number and location of past and present construction workers is well known, and can be estimated for the future work force with acceptable accuracy. The employment figures in Table 8.1-13 show that some 37 percent of the peak work force (occurring in January of 1977) resided in Somervell and Hood counties.

A considerable amount of demographic data has been collected and analyzed to determine the characteristics of the construction work force. A questionnaire is prepared for each worker assigned to the project site in order to obtain this data for further processing. Figure 8.1-1 illustrates the form used to collect the information. From these forms, a series of data tables are generated and an updated report on all statistics is issued on a monthly basis.
Tables 8.1-18, 8.1-19, and 8.1-20 present data pertaining to the age, race, sex, and marital status characteristics of the project work force, for the month ending August 1977 (the latest month for which data was available for incorporation into this report). From these tables, it can be seen that the average worker is 30 years of age, white, married, and (based upon analysis of other data) has just under two dependents, excluding himself.

Further analysis of the tables reveals that about 60 percent of the workers residing in the six-county local impact area were native residents of the area at the time they began working on the project (as opposed to workers relocating into the area from elsewhere for the sole purpose of obtaining employment at the CPSES site). Allowing for attrition which occurred during the period June 1974 through August 1977, it is estimated that about 5,500 local residents have been hired at one time or another. The value of this income contribution to the local economy is obvious when one considers the effect of the multiplier principle.

8.1.2.2.2 Operating Phase

The projected employment schedule and payroll of the CPSES operating staff are shown in Table 8.1-17. The size of the staff required in
1 January 1983 has been set at minimum of 187 full-time personnel. This figure was derived on the basis of detailed consideration of all normal operating functions.

In the original ER it was estimated that in the year 1982 a total of 67 direct and 117 induced employment positions would be attributable to the operation of CPSES. Based upon a revised operating work force level of 187 personnel, a nearly three-fold increase could be experienced in this area. As a result, some 210 additional jobs may be induced in the local economy above the original projections. These estimates are based upon consideration of the numbers of local and relocated workers which studies indicated had moved into the project area, and the average employment levels discussed in Section 8.1.4.

8.1.2.3 Taxes

The CPSES will have a direct and significant impact on the local tax base of Somervell County and, to a much lesser extent, Hood County. The power plant and supporting facilities are located in Somervell

County, but the cooling impoundment (Squaw Creek Reservoir) is located in both Somervell and Hood counties. It is not known at this time what the transmission lines will contribute to the local tax base; however, the overwhelming portion of the tax contribution or liability relates to the valuation of the CPSES as a unit.

8.1.2.3.1 Local Taxing Authorities and Present Tax Rates

For tax purposes, the site selected for the CPSES comes under the jurisdiction of Somervell, and, to some extent, Hood counties, the school districts of the two counties, and the State of Texas. Property taxes will be assessed by the following local taxing jurisdications within Hood and Somervell counties:

County of Hood (County, Hospital District, Library, Farm Road)
Granbury Independent School District
County of Somervell
Glen Rose Independent School District

Each jurisdiction determines only the use of its own revenues. Texas law forbids one taxing jurisdiction from transferring tax revenues to another. Accordingly, should a taxing jurisdiction not including the plant within its boundaries experience indirect costs attributable to plant activities (for example, as may result from relocated CPSES construction workers taking up residence in incorporated areas of Hood or Somervell counties and thus requiring the extension of municipal services) there is no provision for the county governments to divert tax revenues paid to them by the CPSES facilities to the unincorporated areas of the counties.

The CPSES construction effort will have significant indirect impacts on the cities of Glen Rose and, to a lesser extent, Granbury, but neither community has taxing authority with respect to the plant. Texas law does, however, permit counties to provide various services within incorporated city limits, including those relating to streets, waste disposal, water and sewage treatment, and hospitals. Such arrangements have historically been arranged on a case-by-case basis.

Within any of the local taxing jurisdications listed above, decisions as to utilization of tax revenues are governed in part by statute, including, for example, specific levies for various operating and debt servicing funds, and in part by current general fund requirements. County government is administered in each case by four elected commissioners and an elected county judge, who is also president of the commissioners' court (and, thus, chief administrative officer of the county). School boards oversee the activities of the independent school districts with administrative responsibilities delegated to district superintendents. There are no other special tax jurisdictions (e.g., flood control, pest control, etc.) in either Hood or Somervell county. Current property tax rates per $100 valuation for the counties, school districts, and the state are as follows:

Type of	Somervell County		Hood County *	
Jurisdiction	Valuation	Rate	Valuation	Rate*
County	20%	$1.10	20%	$1.85
School Districts	25%	$1.60	35%	$1.45
State	20%	$0.10	20%	$0.10

* Hood County tax includes Hospital District $0.54, Library $0.06, and Farm Roads $0.30.

The following table shows the taxable value of the CPSES property located within the various taxing jurisdictions for the year ending 1977.

County	Taxable Value ($)
Hood	3,407,600
Somervell	97,610,500

School Districts

Glen Rose	97,484,720
Granbury	1,625,114
Tolar	564,564

Total taxes paid to all taxing authorities for 1977 are as follows:

Agency	Taxes Paid
Somervell County	$214,743.11
Hood County	6,201.83
Glen Rose School District	389,938.88
Granbury School District	8,250.06
Tolar School District	3,384.00
Hood County Hospital District	3,680.21
Hood County Library	408.91
Farm to Market Road Fund	2,044.56
State of Texas	19,743.17
TOTAL	$648,394.73

8.1.2.3.2 Current Tax Valuation of Somervell and Hood Counties

The 1974 and current (1977) tax valuations of the two counties containing the CPSES site are as follows:

	1974 Valuation	1977 Valuation	Increase %
Somervell County	$ 5,356,364	$25,418,980	474.6
Hood County	$30,940,814	$54,121,970	174.9
Total assessed valuation (20%)	$36,297,178	$79,540,950	219.1

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8.1.2.3.3 CPSES Tax Valuation and Tax Liabilities

If valuation were assessed at 20 percent (for county and state tax purposes), the CPSES would have a tax valuation of approximately $280 million when completed. Without further adjustment to this valuation, this would mean that CPSES would have a tax valuation more than three times as great as the present valuation of Somervell and Hood counties combined, and nearly 8 times the combined valuation in 1974, when construction began. The tax rates for Hood and Somervell counties are comparatively high at present; and it might well be that, with the extraordinary increase in the local tax base attributable to the CPSES, rates and assessment ratio may be lowered.

Communities in both Somervell and Hood counties have experienced increases in demand for all types of public and community services during the construction period. The original ER noted that this situation might pose short-term financial burdens on the communities but no significant impacts over the longer term have yet been noted.

The increase in the local tax base and tax revenues (however the rates are set) resulting from development of the site should offset any potential community financing problems.

As shown in Section 8.1.2.1.1.1, local plant purchases during construction represent an extremely small percentage of project expenditures. During operation, such purchases in the local area for plant required equipment and supplies will be even smaller. Therefore, their contribution to local income and tax revenues can be considered negligible (particularly when compared with workers purchases during the operation phase of the project).

An estimate of state and local taxes generated by worker spending during plant operation can be made as follows:

Total Number of workers	187 (from Table 8.1-17)
Number Residing in local counties (Hood and Somervell)	70
Average Annual Salary	$25,513 (based on Table 8.1-17)
Income Distribution	
Housing & Utilities	$5,102 (20%)
Food	$7,656 (30%)
Savings	$2,551 (10%)
Taxes	$5,102 (20%)
Taxable Purchases	$5,102 (20%)

Based upon a four percent state sales tax and a one percent local sales tax, it can be seen that an average worker will spend some $255 annually in general sales taxes. The total contribution of all local plant workers is thus:

$14,280 state sales tax revenues
$ 3,570 local sales tax revenues
$17,850 total taxes

It appears that few of the construction workers moving into the local area have bought or built permanent homes. Many have moved away after completing their construction employment on CPSES to obtain further work. During their residence in Hood and Somervell counties, many of the relocated workers have chosen to live in trailers or rented houses. Whatever their choices of housing, the construction workers have contributed to the tax base through property taxes, although the payments will be indirect in most cases, being included in rents. No data are available on assessed valuations of trailer or mobile home spaces in Somervell and Hood counties, nor is there a basis for estimating the numbers that will live in trailers versus rented houses or apartments, and there is thus no basis for estimating their contribution to the tax base.

It is assumed that most of the CPSES operating personnel will buy or build permanent homes in the area. If an average value of $30,000 per home is assumed and tax levies are based on 20 percent of assessed vauation (with a composite tax rate of $2.80 per $100 assessed valuation), the 70 operating personnel estimated to chose to reside in Hood and Somervell counties would pay property taxes totaling about $12,000 per year. Distribution of operating personnel by county was based on estimates using data for construction workers.

On the basis of the foregoing, it is evident that the residential property tax base in Somervell and Hood counties will not be increased by the relocation of CPSES workers from other areas. Of far greater consequence, however, is the tax valuation of the CPSES facility itself, the local taxes on which will far outweigh those from all other sources.

The potential impact of the expected large increase in the tax base will be seen most directly [illegible]ges [illegible]he quality and adequacy of community services. The increase in [illegible] base, as such, should not be a major cause of significant changes in land use. Of greater consequence is the fact that the increase in local tax base attributable to CPSES will enable local governmental agencies to better accomodate themselves to the greatly increased budgets basic to adequate provision of the community services necessitated by population growth in the unincorporated areas of the counties, recognizing that, in the main, such growth is not attributable to CPSES. Section 8.1.4.4 of the original ER presents a more detailed discussion of the impacts of increased tax bases upon the quality of such local amenities.

8.1.2.4 Environmental Benefits

8.1.2.4.1 Ecological Surveys

A number of ecological surveys have been performed in the region of the CPSES during the past six years. Appendices C and D of the original ER presented the final reports concerning the terrestrial and aquatic baseline ecological inventories. The scope of these studies range from a comprehensive survey of the aquatic ecosystem of nearby Lake Granbury (from which makeup water required to fill Squaw Creek Reservoir is obtained) to analyses of the mammal, invertebrate, reptilian, avian, and floral communities of the CPSES area.

In addition, a considerable amount of testing and monitoring has been performed to document the effects of construction activities upon the local environment. Impacts on the groundwater quality and level and surface water quality have been determined and analyzed. The methods and techniques employed in these surveys are described in Section 6.1, and the data obtained are discussed in Section 2.2 of this report.

As a result of these surveys, there has been an increased awareness of and concern for environmental protection during the construction and operation of the CPSES. A new wealth of knowledge has been obtained which, in all likelihood, would never have come into being otherwise.

8.1.2.4.2 Creation of Aquatic Habitat

As discussed in Section 9.2 of the original ER, several potential means of plant cooling were evaluated. The most economically feasible, efficient, and environmentally acceptable method was determined to be through the creation of a cooling reservoir. Filling of the Squaw Creek Reservoir was begun in February 1977 and was completed in May 1979. 1

It is expected that the reservoir will be made available for public recreational usage. The establishment of an aquatic community to support such activities (through stocking of the reservoir) will result in a positive addition to environmental resources in the area.

8.1.2.5 Improvement to Area Facilities

During the early phases of project construction, an extensive volume of vehicle traffic to and from the CPSES plant site resulted in significant wear to local roadways. A contract was issued to the Texas Highway Department to provide for upgrading of Farm Roads 201 and 51. These roads are shown on Figure 2.1-2. The flow of traffic in this vicinity has been noticeably improved.

As mentioned previously, the creation of the Squaw Creek Reservoir (SCR) will result in the availability of a valuable aquatic resource. Although there are other recreational reservoirs located within a short commuting distance from the CPSES (see also Section 2.1), SCR will enhance the sport and recreational opportunities for area residents.

8.1.2.6 Public Education

As described in Section 12.4, a local information office was established in Glen Rose to provide area residents with details pertaining to the CPSES project in particular, and to nuclear issues in general. To further educate the public, a visitor's overlook will be constructed which will provide a vantage point for observing construction of plant facilities and viewing the completed station and reservoir.

During the performance of the baseline ecological studies, an archeological survey of the CPSES area was also conducted in 1972. This survey documented the historical significance of the site and was presented in Appendix A of the original ER. As a result of this survey (and other archeological studies described in Section 2.6 of this report), a significant body of knowledge concerning the early period of settlement in the Hood and Somervell counties region has been accumulated. This information, based in part upon detailed interviews with long-time native residents, not only serves to provide historical information today, but also assures that such knowledge will be preserved for future generations. The great majority of this historical data would have been lost beyond recovery had it not been for this detailed survey.

8.1.3 SUMMARY OF BENEFITS

A summary description of the benefits of the CPSES project is presented in Table 8.1-21, and in Section 11.1.

TABLE 8.1-1

PROJECTED ENERGY PRODUCTION AND SALES REVENUE OF CPSES

	Energy Production (000 MWH)					
Year	Unit 1[1]	Unit 2[1]	Total	Sales Revenue ($000)[2]	10% Present Worth Factor	1982 Present Value ($000)
1982	2,900	---	2,900	93,206	1.0000	93,206
1983	5,700	800	6,500	208,910	0.9091	189,920
1984	7,100	3,400	10,500	337,470	0.8264	278,885
1985	7,100	5,600	12,700	408,178	0.7513	306,664
1986	7,100	7,100	14,200	456,388	0.6830	311,713
1987	7,100	7,100	14,200	456,388	0.6209	283,371
1988	7,100	7,100	14,200	456,388	0.5645	257,631
1989	7,100	7,100	14,200	456,388	0.5132	234,218
1990	7,100	7,100	14,200	456,388	0.4665	212,905
1991	7,100	7,100	14,200	456,388	0.4241	193,554
1992	7,100	7,100	14,200	456,388	0.3855	175,938
1993	7,100	7,100	14,200	456,388	0.3505	159,964
1994	7,100	7,100	14,200	456,388	0.3186	145,405
1995	7,100	7,100	14,200	456,388	0.2897	132,216
1996	7,100	7,100	14,200	456,388	0.2633	120,167
1997	7,100	7,100	14,200	456,388	0.2394	109,259
1998	7,100	7,100	14,200	456,388	0.2176	99,310
1999	7,100	7,100	14,200	456,388	0.1978	90,274
2000	7,100	7,100	14,200	456,388	0.1799	82,104
2001	7,100	7,100	14,200	456,388	0.1635	74,619
2002	7,100	7,100	14,200	456,388	0.1486	67,819
2003	7,100	7,100	14,200	456,388	0.1351	61,658
2004	7,100	7,100	14,200	456,388	0.1228	56,044
2005	7,100	7,100	14,200	456,388	0.1117	50,979
2006	7,100	7,100	14,200	456,388	0.1015	46,323
2007	7,100	7,100	14,200	456,388	0.0923	42,125
2008	7,100	7,100	14,200	456,388	0.0839	38,291
2009	7,100	7,100	14,200	456,388	0.0763	34,822
2010	7,100	7,100	14,200	456,388	0.0693	31,628
2011	7,100	7,100	14,200	456,388	0.0630	28,752
2012	---	7,100	7,100	228,194	0.0573	13,076
2013	---	7,100	7,100	228,194	0.0521	11,889
Total sales revenue (1982-2013)				13,370,240		-------
Present value of sales revenue (1982)[3]						4,034,723
Annualized Present Value (30 years)						428,084

1. Capacity factors for each unit is assumed to be approximately 30%, 55% and 70% during first, second and third through thirtieth years of service life respectively.
2. Revenue is equal to 93% of total production at 3.214¢ per KWH. From 1961-71, distribution losses and non-revenue producing uses for the TU system decreased from 10% to 7% of total energy production.
3. Discount rate used is 10%.

8.2 COSTS

Construction and operation of the Comanche Peak Steam Electric Station (CPSES) involves the expenditure of considerable sums in the acquisition and preparation of the project site, construction and emplacement of steam and power generating, cooling and transmission facilities and related structures, and in operations of the plant, including procurement and disposition of nuclear fuel. The major elements of the internal costs to be borne by the Applicant in undertaking construction and operation of the CPSES will be indicated first. Following this, the external social and economic costs of the project (which will be borne by the communities and residents of the area surrounding the project site) will be considered. A summary statement of project direct and indirect costs is presented in Section 11.2.

8.2.1 INTERNAL PROJECT COSTS

The internal costs to be incurred in construction and operation of the CPSES fall into two major categories: construction costs (including an allowance for funds used during construction) and operating costs. Decommissioning costs are also considered. The principal cost elements making up these cost categories are discussed below.

8.2.1.1 Construction Costs

Construction costs of CPSES will total an estimated $2,235 million over the period 1972 through 1984. This amount includes anticipated escalation in labor and materials costs over the period as well as an allowance for the funds used during the period of construction. 1 Q36
Allowance for funds used during construction (AFUDC) will amount to an estimated $394 million, when calculated at 5% per annum compounded monthly. (AFUDC is not calculated at this rate among all of the Owners. For the purposes of this cost estimate, however, a rate of 5%

was applied to total projected cash expenditures each month. This represents the weighted average of the various owners' AFUDC rates.)

The two components making up total construction cost (including AFUDC cost and allowance for contingencies) are:

1
Q36

	(Thousands)
Cost of Plant, Supporting Facilities and Preparation for Operations	\$2,235,000
Cost of Transmission Facilities	\$ 4,417
Total	\$2,239,417

A summary breakdown of these estimates of construction costs is given in Table 8.2-1.

The cost of construction of transmission facilities required by CPSES has been included in the breakdown of investment costs shown in Table 8.2-1, although these costs are not normally considered by the Applicant to be a part of the estimate of power plant construction costs.

8.2.1.2 Operating Costs

An annual representative operating cost of CPSES has been estimated. Costs provided for in this estimate of annual operating cost include only those expenses generally included as power production expenses. This includes operating and maintenance expense of the station; it does not include distribution expense or any allowance for system costs or expense such as operation of customer accounts, sales expenses, or administrative and general expenses.

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:

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

1 Q33

Fuel cost is based upon 1980 market values of the various fuel cycle conponents. 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 (1980 dollars). See Section 5.8 for details of this estimate. 1 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 \$5,300 million. This estimate is comprised of the following components:

	(Millions)
Fixed Charges	\$ 3,172
Operating, Maintenance and Fuel Costs	\$ 2,078
Allowance for Decommissioning	\$ 50
Total (lifetime cost)	\$5,300

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:

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

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 $$(\$4,222 \text{ million}) \times (0.7513) = \$3,172 \text{ million}$$

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)

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

$$= (\$90,928,000) \times \left[\frac{(1.08)^n - 1}{.08}\right] \times \left[\frac{(1.1)^n - 1}{0.1(1.1)^n}\right]$$ 1 Q37

The results of this analysis show a present value of the operations, maintenance and fuel cost of $2,078 million as shown in Table 8.2-3.

An estimate of the representative unit cost of electrical generation is shown in Table 8.2-2.

8.2.2 EXTERNAL PROJECT COSTS

Construction and operation of CPSES will affect the communities in the surrounding region in a variety of ways. Some of these effects will be transitory, while others will be of relatively long duration. Also, some effects will beneficial to the people in the project area (discussed previously). The principal factor underlying such changes in local community characteristics will be the population influx in the area as construction workers from other parts of the state and elsewhere take residence in the vicinity of the project for varying periods of time during the construction phase.

8.2.2.1 Potential Housing Development Problems

A total of 1,114 CPSES workers had moved into Somervell and Hood counties by the end of 1976. Many of the construction workers who move into the area reside in mobile homes or trailers. This is due in part to the relative scarcity of houses and apartments for rent in Hood and Somervell counties at the beginning at construction. Some trailer park facilities are available in both Hood and Somervell counties, but the initiation of CPSES resulted in the establishment of more trailer parks.

Trailer (or mobile home) parks developed without regard for appropriate standards of density, sanitation, utility system capacities, and aesthetic considerations could have a long-term adverse impact on the local communities. This could be mitigated by having the nearby communities provide sufficiently strict zoning regulations for this form of housing development to eliminate the risk of haphazard and uncoordinated development of an undesirable nature.

Less risk is attached to the possibility that permanent housing will be developed in a haphazard manner to meet worker needs, although prohibitions against substandard housing and worker camps may be required. In any event, the total number of permanent personnel expected to be utilized by CPSES is too small to constitute an important demand for additional local housing. The more likely possibility is that the housing selected by the permanent CPSES workers settling in the area will generally serve to upgrade housing values because of the higher than average incomes of these employees.

8.2.2.2 Impacts of Construction Buildup and Project Completion

Although the magnitude of the increase in income and employment in the local impact areas occasioned by the development of CPSES is very large, the impact of these changes is fairly well dispersed throughout the six counties. On the basis of estimated residential locations, however, 37 percent of the total payroll income and employment generated by construction activities on CPSES accrues to Somervell and Hood counties.

Because these two counties are small in population and in economic activity, there is some risk that the proximity of a large number of construction workers may overstimulate expansion of such activities as retail sales, mobile home park development, and various other consumer services. In such a situation the decline in induced income and employment as CPSES construction work diminishes may impose hardships on local residents if not compensated for by other factors. However, careful planning by civic leaders and businessmen can help forestall the adverse impacts of such changes on the local economy.

In the case of Hood County, there is reason for optimism because the vitality behind the development of the recreational and residential potential of Lake Granbury has served to diversify the local economy. Regarding Somervell County, the opportunity is at hand for local business to supply a greater share of local consumer requirements. As presented in Table 8.1-5 of the original ER, in 1971 Somervell County retail sales were equivalent to only 38.6 percent of county disposable income, whereas sales-to-income ratios for most of the other counties in the local impact area were well in excess of 50 percent.

The demand for consumer goods attributable to CPSES workers appears to have stimulated Somervell County businesses to expand to levels permitting them to offer a broad range of goods and services and capture a greater share of overall local residents' spending. Such increased local patronage could serve to offset some of the decline in construction worker business that will take place as the facility approaches completion.

An additional factor of importance to the local economies of Somervell and Hood counties is the stabilizing effect of the additional tax revenues that will accrue to the county governments from local taxes on the CPSES facility. Such resources will be greatly in excess of like funds hitherto collected and could form the basis for the development of income- and employment-generating activities in the area.

8.2.2.3 Loss of Agricultural Land and Production

The CPSES site in Hood and Somervell counties is situated in a sparsely populated area in which low-intensity farming was the predominant land use. Removal of this rural land from present agricultural use has resulted in only an insignificant decrease in agricultural production in the two counties and an even less significant decrease in agricultural production within the six-county impact area. Also, only a few people were displaced by construction of the power plant, reservoir, and such ancillary facilities as rail and road connections, transmission lines, and pipelines. (See Sections 2.1.4 and 4.3.) Section 8.2.2.4 of the original ER contains a comprehensive discussion of land use/productivity in the site area.

8.2.2.4 Change in Water Availability and Quality

The changes that Squaw Creek has undergone in connection with the CPSES project have had a negligible effect on local water availability and quality. A more significant concern is the potential impact of Squaw Creek Reservoir on Lake Granbury and downstream users of Brazos River water. Lower Squaw Creek itself is a minor tributary of the Brazos River system, joining the Paluxy River just above its confluence with the Brazos River. Normally, Squaw Creek carries surface water intermittently during seasons of precipitation. At other times, the creekbed is dry, although subsurface water passes along the underground channel to the Brazos floodplain. However, the Applicant has committed to maintain a continuous flow of 1.5 cfs in Squaw Creek below the reservoir.

Present local dependence on Squaw Creek surface water is minor. Farmers and ranchers of the CPSES area satisfy domestic farm and livestock needs by drawing on the subsurface water through small wells. Reports indicate that the water table has not dropped significantly in the Squaw Creek area (see Section 5.6); thus, water use is not heavy. A prominent ridge separates Squaw Creek from Glen Rose, and the creek does not contribute to Glen Rose's water supply.

With respect to the potential impact of CPSES on Lake Granbury water availability and quality, the most important considerations are the pumping of up to 52,600 acre-feet of water per year from Lake Granbury to Squaw Creek Reservoir in order to provide estimated makeup to the reservoir to replace natural and forced evaporative losses, and the holding of total dissolved solids within acceptable limits. Because Lake Granbury was created by the Brazos River Authority to impound water for commercial and industrial purposes, the use of this water is in accord with their water use plan, and was approved by the Authority. Approximately 26,400 acre-feet of water per year may be returned to Lake Granbury from Squaw Creek Reservoir. This water characteristically will have a higher concentration of dissolved solids.

8.2.2.5 Potential Aesthetic Impacts

The Comanche Peak Steam Electric Station and Squaw Creek Reservoir are located in a remote, sparsely populated portion of Somervell and Hood counties. The power plant will be visible in the distance to the general public only along a limited segment of State Highway 144 (the main route between Glen Rose and Granbury) and from Farm Road 201 to the west of the site. The closest view of the plant from State Highway 144 is approximately three miles distant; the intervening area is occupied by rolling countryside (scrub forest and open grazing land) and Squaw Creek Reservoir. The plant is readily visible at a distance of three-quarters to one mile from the relatively infrequently traveled Farm Road 201.

From both viewpoints along the roads mentioned above, transmission lines will be a part of the foreground scenery. The lines will be partially obscured from view by motorists on State Highway 144 by rolling ground (looking toward the power plant) except in the immediate area where the lines cross the highway.

The area where the presence of the transmission lines will have the most significant impact on the general view of the landscape will be in the vicinity of Lake Granbury. Even here, however, care will be taken to concentrate all lines in one corridor and, in effect, come into the DeCordova plant site through the "back door" to the lake relative to the location of residential and recreational developments on Lake Granbury. Transmission line routing is described in detail and illustrated in Section 3.9. The plant and the reservoir will not adversely affect any widely-known scenic landscape or the quality of life of any local concentration of population.

8.2.2.6 Impact on Archaeological Sites

The Institute for the Study of Earth and Man of Southern Methodist University was engaged to undertake an archaeological investigation of the Squaw Creek Watershed. The purpose was to provide a basis for evaluating the potential impact of the construction of Comanche Peak Steam Electric Station on archaeological resources within the general region. Further, the objective was to allow time for exploration and preservation of any important remains that would otherwise be lost.

The investigations revealed that some historic and prehistoric remains would be directly or indirectly affected by the construction of the reservoir. A few sites or buildings of local historical interests are located in close promimity to the reservoir site, but remain untouched and preserved.

The construction of the Squaw Creek Reservoir and Comanche Peak Steam Electric Station has had no adverse impact of any consequence on archaeological resources in the region. Indeed, the investigations already performed have made a contribution to available knowledge on local historical and archaeological resources in the Squaw Creek area. The full report prepared by Southern Methodist University was reproduced and included as Appendix A to the original ER.

8.2.3 SUMMARY STATEMENT OF COSTS

A summary description of the costs of the CPSES project is presented in Section 11.2.

TABLE 8.2-1

BREAKDOWN OF CONSTRUCTION COSTS

(Thousands of Dollars)

	Unit 1	Unit 2	Total
Direct Costs			
Land and Relocations	11800	-	11800
Structures and Site Facilities	21385	100817	314667
Reactor Plant Equipment	239438	190328	429766
Turbine Plant Equipment (w/o Heat Rejection)	60291	62988	123279
Heat Rejection System	15445	3650	19095
Electric Plant Equipment	79952	48012	127964
Transmission Plant Equipment (switchyard)	10113	4309	14422
Miscellaneous Plant Equipment	16476	3762	20238
Spare Parts Allowance	7000	-	7000
Contingency Allowance	90000	60000	150000
Total Direct Costs	744365	473866	1218231
Indirect Costs			
Construction Facilities, Equipment, and Services	225281	150187	375468
Engineering and Construction Management	148381	98920	247301
Allowance for Funds Used During Construction[a]	256100	137900	394000
Escalation[b]	-	-	-
Total Indirect Costs	629762	387007	1016769
Total Construction Costs	1374127	860873	2235000

[a] AFUDC based upon 5.3% compounded monthly. Actual AFUDC equivalent rates vary among the owners depending upon rate authority decisions and jurisdiction.

[b] Escalation is included in above breakdown estimate at 12% per year for labor and 16% per year for material from January 1, 1981.

TABLE 8.2-2 (Sheet 1 of 2)

ESTIMATE OF REPRESENTATIVE UNIT COSTS OF ELECTRICAL GENERATION[a]

Fixed Costs[b]	Mills/Kilowatt-Hour
Cost of Money[c]	26.7
Depreciation[d]	5.2
Interim Replacements[e]	0.0
Insurance	0.2
Ad Valorem Taxes	0.2
Fuel Cycle Costs[f]	
U_3O_8 (yellowcake)	2.1
Conversion and Enrichment	2.1
Conversion and Fabrication of Fuel Elements	0.5
Storage Shipment and Disposal	0.7
Cost of Money on Fuel Inventory[g]	0.0
Credit for Plutonium	0.0
Cost of Operation and Maintenance[b]	1.5
Decommissioning Cost[b,h]	0.9
Total	40.1

[a] As shown below, this estimate is conservative. Average or "levelized" unit cost of electrical generation should be somewhat lower. Calculations are for power delivered to the transmission system. Values are expressed, where applicable, in 1980 dollars.

[b] Based upon 1161 MWe at a 70% capacity factor for each unit. This represents 14,238 million kilowatt-hours per year.

[c] Based upon the initial year of expected full plant capacity operation (70% capacity factor). Levelized cost would be somewhat less.

TABLE 8.2-2 (Sheet 2 of 2)

[d] Based upon 3.33% per year straight line depreciation.

[e] There are no capital improvements identified which would increase capital costs. It is expected, however, based upon system historical data, that some improvements will be made, but they should not significantly affect total unit cost of generation.

[f] Based upon 1980 market prices on fuel cycle component costs. Some overhead charges associated with fuel activities are included in the operating and maintenance costs.

[g] The cost of money for fuel inventories has not been established. It will not, however, significantly affect total unit cost of electrical generation.

[h] Based on an annual revenue requirement of $13,475,000.

TABLE 8.2-3

CALCULATION OF PRESENT WORTH OF OPERATIONS

Year	8% Compound Sum Factor	10% Present Worth Factor	Product
1	1.0800	0.9091	0.9818
2	1.1664	0.8264	0.9639
3	1.2597	0.7513	0.9464
4	1.3605	0.6830	0.9292
5	1.4693	0.6209	0.9123
6	1.5869	0.5645	0.8958
7	1.7138	0.5132	0.8795
8	1.8509	0.4665	0.8634
9	1.9990	0.4241	0.8478
10	2.1589	0.3855	0.8322
11	2.3316	0.3505	0.8172
12	2.5182	0.3186	0.8023
13	2.7196	0.2897	0.7879
14	2.9372	0.2633	0.7734
15	3.1722	0.2394	0.7594
16	3.4259	0.2176	0.7455
17	3.7000	0.1978	0.7319
18	3.9960	0.1799	0.7189
19	4.3157	0.1635	0.7056
20	4.6610	0.1486	0.6926
21	5.0338	0.1351	0.6801
22	5.4365	0.1228	0.6676
23	5.8715	0.1117	0.6558
24	6.3412	0.1015	0.6436
25	6.8485	0.0923	0.6321
26	7.3964	0.0839	0.6206
27	7.9881	0.0763	0.6095
28	8.6271	0.0693	0.5979
29	9.3173	0.0630	0.5870
30	10.0627	0.0573	0.5766
Total			22.8578

(22.8578) X ($90,928,000) = $2,078,414,038

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11.0 SUMMARY BENEFIT-COST ANALYSIS

In earlier sections the facility has been described in detail, and expected environmental and economic impacts or effects of construction and operation of the facility have been identified and analyzed. The objective of this section is to bring together in the format of a benefit-cost summary, the results of these extensive investigations of the potential effects of CPSES. This overview of benefits and costs of the project provides summary documentation for the Applicant's findings and judgment that the costs of construction and operation of the station (including monetary costs, community, economic and social impacts, and environmental effects) are, in the aggregate, acceptable and indeed outweighed by the benefits that will accrue to the population in the Applicant's service area. These findings take into account the need to convert to solid fuels, anticipated increases in demand for electric power to keep pace with economic growth of the region, the location and the characteristics of the site and the local impact area, and the nature and extent of environmental effects resulting from the construction and operation of the facility as proposed by the Applicant. 1

Section 11.1 reviews project benefits as described in detail in Sections 1.1 and 8.1. Section 11.2 includes consideration of three major categories of cost: (1) power generating costs (described in detail in Section 8.2), (2) community economic and social costs (described in Sections 4.0, 5.0, and 8.2), and (3) environmental costs (analyzed and described in Chapters Four and Five).

11.1 BENEFITS

In analyzing the economic and social effects of the construction and operation of the CPSES, both direct and indirect benefits have been recognized and evaluated. As defined in this report, direct benefits relate specifically to the value of electric power delivered by the station; indirect benefits include all other benefits that may result from the construction and operation of the facility including employment opportunities, increases in local income, support for local business, and increases in the local tax base.

11.1.1 DIRECT BENEFITS

The principal direct benefit of CPSES will be to allow TUCS to continue with the orderly transition away from the use of natural gas as a primary boiler fuel. The CPSES facility will represent about ten
1 percent of total installed capacity in the Applicant's system in 1984. As discussed in Section 1.3, the capacity of CPSES (or equivalent additional generating capacity) is required in order to continue a systematic transition towards increased use of the more abundant lignite, coal, and nuclear fuels. The latest dates that the CPSES units can be placed in service without adversely affecting the schedule
1 for this fuel conversion program are 1982 for Unit 1 and 1984 for Unit 2 (see Section 1.1.4).

A comprehensive plan has been developed for the additional power resources required by projected future energy demands and fuel
1 availability constraints. This plan calls for implementing the use of all energy resources (including nuclear) to best advantage, considering questions of fuel supply, availability of water resources and suitable sites, comparative economics, and potential environmental effects. The CPSES is thus part of an integrated power generation and fuel conservation program, and without its inclusion in this multiple-resource program, the Applicant would be unable to meet the above objectives.

As indicated in Table 8.1-1, which summarizes the project revenues, the eventual annual output of CPSES is estimated at 14.2 billion kilowatt
1 hours. On the basis of the average revenue of 3.214 cents per kilowatt-hour, the value of this output is estimated at $456 million.

This does not take into account inflationary trends and the possibility of future need for upward adjustments in rate schedules.

There is no practical way to distinguish the value of the output of CPSES from that of any other plant and no practical way to identify particular users of the output of CPSES. It is noteworthy, however, that the trend in percentage distribution of demand among various types of users (direct beneficiaries) shows that residential demand is increasing in relative importance (increasing from 32 percent in 1971 to an estimated 40 percent in 1981). Residential and industrial users together accounted for two-thirds of total demand in 1971; by 1981 these two categories of use will account for nearly three-fourths of total energy demand. It should be noted that peak demand for these two categories occurs at different times, therefore the requirements for installation of additional power generating capacity to serve total increases in demand cannot be attributed to any single class of use.

11.1.2 INDIRECT BENEFITS

Implementation of the proposed CPSES requires a relatively large construction work force on the site for about ten years, and a much 1
smaller permanent work force to operate the facility. Employment opportunities and the disposable income generated (both by temporary and by permanent employees) constitute a significant indirect benefit of CPSES. Increases in the local tax base and tax revenues that will be derived by Somervell and Hood counties are also recognized as an important indirect benefits of the project.

11.1.2.1 Construction Employment

The construction effort at CPSES began October 1974 and will extend through 1984. Unit 1 is scheduled for commercial operation in 1982 and Unit 2 in 1984. A sizeable construction work force will be employed at 1
the site for several years (see Tables 8.1-14 and 8.1-15).

With the requirement for a large construction force over an extended period a substantial number of workers have moved into the area from locations even more distant than Dallas and Fort Worth. At the time of the peak (to date) work force in January 1977, about 25 percent of the construction workers came from within the Dallas-Fort Worth metropolitan area. The residential distribution of construction workers within the six-county local impact area is shown by Tables 8.1-7 through 8.1-13.

11.1.2.2 Operating Force Employment

The size of the permanent operating work force is small by comparison with the construction force. It is expected that an operating staff of 187 permanent employees will be adequate to operate both units of the CPSES. Most of the operating staff will live in the six-county local impact area surrounding the site.

11.1.2.3 Induced Employment

Construction and operating force employee spending will create a significant number of additional jobs in the local impact area, including occupations in retail and wholesale services, professional services, public services and housing-related activities. When the multiplier effect is taken into account, it follows that construction employment has generated many additional jobs in the local six county area during the years of greatest construction activity (Section 8.1.2.2). From 1981 on, local spending by the CPSES operating work force should support many additional service-type jobs in the six-county impact area.

Suitable sites for power plants are limited, particularly in the case of nuclear power plants, considering cooling water requirements, and concern for potential environmental effects. This is implicitly recognized in long-range planning policies described in Section 1.1. Recognition of these facts and the character of a long-range power plant development program are thus important to consider in weighing the total costs (including environmental effects) of the CPSES.

11.2.1 INTERNAL POWER GENERATING COSTS

The internal costs required by CPSES include two major categories: construction costs and operating costs. An allowance for decommissioning has also been estimated.

11.2.1.1 Construction Costs

The total construction cost of CPSES is estimated at approximately $2,235 million, including allowances for funds used during construction, escalation, and contingencies. A more detailed breakdown is shown by Table 8.2-1. 1

11.2.1.2 Operating Costs

Estimated annual operating costs include operating and maintenance (O&M) expenses, but do not include such costs as distribution expenses, operation of customer accounts, or administrative and general expenses. The major component of O&M costs is for fuel. On the basis of 1980 dollars and a 70 percent annual load factor, the open market value of annual fuel cycle costs will be approximately $70 million. Other O&M costs, such as direct labor, technical support, material, quality assurance, license fees, and taxes (excluding ad valorem taxes and insurance) are expected to amount to about $21 million annually. 1

11.2.1.3 Decommissioning Costs

Decommissioning of CPSES is estimated to cost $50 million per unit in
1 1980 dollars. Further details pertaining to decommissioning and
related costs are presented in Section 5.8.

11.2.1.4 Power Generating Costs

As discussed in Section 8.2.1.4, it is estimated that the 1980 present
1 value of the power generating costs over the first 30 years of plant
life is $5,300 million. This includes fixed charges, O&M and fuel
costs, and assumed decommissioning allowances.

11.2.2 EXTERNAL COSTS

External costs of plant construction and operation were discussed in Section 8.2.2, and the principal findings are summarized below. In most cases, no monetary values were determined for the potential external adverse effects that were identified; accordingly, qualitative statements indicating the relative magnitude and significance of the effects are made.

It will be recalled that the analysis focused on project impacts likely to be experienced in the local impact area (comprised of the six counties surrounding the site -- Somervell, Hood, Parker, Johnson, Bosque, and Erath). Since the project site lies within both Somervell and Hood Counties, the major part of the external social and economic costs to be generated by the project are expected to be borne by residents of these two counties.

The construction and operation of CPSES will affect the communities in the six county local impact area in a number of ways, most of which are beneficial (and have been discussed as indirect benefits) and some of which are unfavorable and should be considered in the context of a discussion of project costs. Most of these external costs are temporary, but some will be of longer duration. To a large extent, potentially unfavorable economic and social impacts on the local area are directly attributable to the influx of construction workers (and their families) into the small communities near the project site.

Somervell and Hood counties will experience the most significant impacts. These two counties are sparsely populated and essentially rural in character. The communities in these counties are small and the inflow of workers will have a notable impact. Glen Rose, located about 5 miles south of the site, is the county seat of Somervell County. This community had an estimated 1976 population of 2,790. Granbury, located about 10 miles from the site, is the county seat of Hood County, and had an estimated 1976 population of 3,526.

Adjacent counties which have been included in the six-county local impact area, will also experience some economic and social impacts (and benefits) from the construction of CPSES, but the effects in these other counties and communities will be of far less significance than in Somervell and Hood counties. The other counties are somewhat more densely populated and contain larger communities, therefore, a relatively wider dispersal of workers and families among the communities in these counties will take place as compared to the relative concentrations of workers in Somervell and Hood counties.

11.2.2.1 Community Service Costs

The inflow of construction workers and families taking relatively long-term construction jobs on CPSES has increased the resident population of nearby communities and the demand for public services (including utility services, fire and police protection, traffic control, and school facilities). The towns of Glen Rose and Granbury have experienced the most significant increases in demands for public services relative to their size and available resources. Certain areas outside established towns may experience rapid housing development and create a demand for provision of community services by county agencies (particularly in the Lake Granbury area). Refer to Section 8.1 for details of the number of workers that have moved into the local area and on community impacts.

11.2.2.2 Housing Availability

The construction of CPSES has had a strong impact on local housing availability. Numerous trailer parks have been constructed along the principal roadways in the Somervell and Hood County areas to meet the needs of the large construction work force. In addition, the nominal amount of locally available rental housing is presently in high demand, which has resulted in much higher than previous rental price levels and a growing scarcity of such property.

Personnel who will be residing in the local area for an extended period of time (such as supervisory, professional and managerial construction and operating personnel) have in many instances purchased or built homes in outlying areas of the counties. The risks of a haphazard and uncoordinated housing development boom have not been too great as yet, but careful consideration of this matter should be given by local authorities to insure that minimum codes and standards are met for density, sanitation, aesthetics, etc.

11.2.2.3 Local Business Activity

There have been favorable impacts or benefits accruing to local business (retail and service establishments) during construction but there are also some risks of adverse effects from overexpansion of business relative to long-term sustainable levels of business after construction of CPSES is complete. Potentially adverse impacts of overexpansion of business can be mitigated by foresighted local planning. Perhaps investment of some tax revenues in modest industrial development programs could stimulate further diversification of local economic activity and long-range employment opportunities.

11.2.2.4 Displacement of Local Population

As indicated earlier (see Sections 2.1.4 and 4.1), the CPSES site is located in a relatively remote and rural, sparsely-populated portion of Somervell and Hood counties. Only eight rural households were physically displaced by the project. The plant site is not in close proximity to any concentration of population.

11.2.2.5 Loss of Agricultural Land and Population

The predominant use of the CPSES site at present was for cattle grazing. Removal of this rangeland and limited croplands from previous agricultural uses has resulted in a negligible reduction in total agricultural output of Somervell and Hood counties. Without reference to other possible future changes in land use in these counties (from totally unrelated development), it is clear that this small loss of agricultural production could be readily replaced or made up by production elsewhere in the larger region, depending on the nature of demand. See Sections 4.1, 4.3 and 8.2.2.3 for further detail.

11.2.2.6 Water Availability and Quality

The construction and operation of CPSES will have a negligible impact on availability of potable water and water for agricultural uses in the area around the site. The diversion of the flow of Squaw Creek during the construction of the dam for the cooling reservoir had no economic impact beyond that related directly to the loss of agricultural land in the water-shed. Water flow in the lower reaches of Squaw Creek (below the dam) will not be decreased during construction. When CPSES is in operation, water will be maintained downstream of the dam as required by the terms of appropriate permits. (See also Section 12.1). Long term changes in the quality of water in lower Squaw Creek (and of water entering the Paluxy and Brazos Rivers) as the result of the operation of CPSES will be of minimal consequence.

During operation of Squaw Creek Reservoir as a cooling pond for the CPSES, an average of approximately 52,600 acre feet of water per year may be diverted from Lake Granbury to the reservoir to make up for evaporative losses. An estimated 26,400 acre feet per year may be returned from the reservoir to Lake Granbury to maintain water quality in SCR within desirable limits.

This return water will generally have somewhat higher temperatures and concentrations of solids, and lower dissolved oxygen levels than Lake Granbury waters, but the size of the return flow relative to the volume of water in Lake Granbury and the flow of the Brazos River is such that overall effects on the quality of water in Lake Granbury will be of negligible consequence. Changes in the availability and quality of water available from Lake Granbury as the result of the construction and operation of CPSES will have no significant economic impact on present or anticipated future users of the Lake Granbury resource. Refer to Sections 4.3, 5.7 and 8.2.2.4 for additional details.

11.2.2.7 Aesthetic Impacts

The location and design of the Comanche Peak Steam Electric Station is such that it has had no adverse aesthetic impacts. The plant and the reservoir do not impact on any widely-known scenic landscape nor on the quality of life of any segement of the local population. The most noticeable aesthetic impact would derive from the transimission lines connecting the CPSES with the DeCordova Bend Switchyard on Lake Granbury. The transmission lines will cross State Highway 144, where they will be partially obscured from the view of passing motorists by the gently rolling nature of the topography. Transmission line routing has been selected to minimize potential visual impacts and viewing by the general public. See details concerning aesthetic impacts and transmission line routing in Sections 3.9, 4.2 and 8.2.2.5.

11.2.2.8 Historical and Archaeological Sites

A detailed survey of potential archaeological and historical sites in the general vicinity of CPSES has been made. The investigations revealed some historic and prehistoric remains within the boundaries of the plant site, but the construction of Squaw Creek Reservoir and the power generating station have had no impact of serious consequence on the historical and archaeological resources available in the general region (see Section 12.1.2). The investigations made have made a significant contribution to knowledge available on local historical and archaeological resources in the region. The report on this archaeological investigation was included in Appendix A of the original ER.

11.2.3 ENVIRONMENTAL COSTS

Major efforts were made by the Applicant in the preparation of this Environmental Report to identify, quantify (where feasible), and evaluate the possible environmental effects of construction and operation of CPSES. From the outset, known and possibly adverse effects were considered, and taken into account in overall planning and in the selection of design alternatives for the plant and supporting facilities.

Specific effects and changes in the physical environment frequently can be identified clearly and their impacts further traced and evaluated. In some cases, however, it is difficult to identify and characterize such changes and effects, and it is especially difficult to identify and evaluate complex indirect environmental effects and subtle (but nevertheless significant) biological or ecological changes, both positive and negative.

11.2.3.1 Long Term Ecological Effects

The construction and operation of CPSES will have measurable impacts on the terrestrial and aquatic biological communities in and around the site. Relatively severe changes have occurred due to site preparation and construction in the immediate area of the power plant, the dam and reservoir, and along the rights-of-way of the pipelines, rail line, access road, and (to some extent) the transmission lines. Biological changes in such areas have been described and analyzed with the objective of identifying the localized, temporary effects as well as long term effects that may or may not be subject to amelioration. The considerations have been detailed in earlier sections (see Sections 2.2 and 4.1). Table 11.2-2 of the original ER provided a summary listing of specific environmental effects and costs related to the construction and operation of CPSES.

11.2.3.2 Effects of CPSES on Natural Surface Water Bodies

The natural surface water bodies included in this assesment are Lake Granbury, Squaw Creek, portions of the Brazos and Paluxy Rivers, and Squaw Creek Reservoir.

11.2.3.2.1 Water Quality

Water quality effects have been detailed in Sections 4.1 and 5.1. The water quality parameters expected to undergo changes included temperature, total dissolved solids concentrations, dissolved oxygen, and turbidity.

The major effects will be confined to the cooling reservoir; only slight, localized changes are expected to occur in Lake Granbury. Except for the temporary minor increase in suspended solids that periodically occurred in Squaw Creek during the construction period, there was no impact of any significance on the water quality of the Paluxy and Brazos rivers.

The presence of radionuclides in the cooling water discharge from CPSES will be carefully controlled so that concentrations in SCR during the operating life of the plant will always be well within the accepted numerical guides for Appendix I of 10 CFR Part 50. Therefore, the amount of radionuclides that would be discharged either through the return water pipeline to Lake Granbury or by means of an emergency spill into lower Squaw Creek would be insignificant (See Section 5.2).

The only chemicals discharged into Squaw Creek Reservoir by the CPSES will be the chlorine used for biocide treatment of the circulating water, which will rapidly dissipate in the thermal plume region without any significant adverse effects on the biological communities.

11.2.3.2.2 Fish

The construction and filling of Squaw Creek Reservoir for plant cooling adds approximately 3,272 acres of potentially productive aquatic habitat in the Hood-Somervell County area. The degree to which this potential is realized will be determined in part by the reservoir water quality. Changes in water quality as a result of plant operation and its effects on fish and other aquatic organisms will be most pronounced in SCR, less so in Lake Granbury, lower Squaw Creek, the Brazos and Paluxy rivers--the effects decreasing in that order. Although a small percent of the total standing crop in the cooling reservoir is potentially subject to loss through operation of the cooling system, this does not constitute a serious or irretrievable loss to the ecosystem. In practice, such losses should not be significant because of the low intake velocities predicted for the cooling reservoir intake design. Fish losses through the diversion water intake in Lake Granbury are likewise predicted to be very low and will not have a significant effect on the fishery.

11.2.3.2.3 Plankton

The expected loss of plankton resulting from operation of the cooling system, i.e., passage through the condensers, is detailed in Section 5.1. Although the losses appear to be large, the overall effects will be minor, and the nutrients not lost from the system, but assimilated by the rapidly multiplying plankton biomass.

Some plankton is transferred from Lake Granbury to the cooling reservoir through the diversion water system, while other amounts of plankton will be transferred from the cooling reservoir to Lake Granbury via the return water system. In summation, they are not considered to be of great significance.

11.2.3.2.4 Aquatic Wildlife

Those species of aquatic wildlife with preference for stream type habitat have been displaced along the portion of upper Squaw Creek inundated by the cooling reservoir. However, this loss has been compensated to an extent by the creation of a lake-type habitat which may be favored by other species. The aquatic wildlife in Lake Granbury, lower Squaw Creek, the Brazos and Paluxy Rivers are not expected to be affected by operation of the CPSES facility.

11.2.3.2.5 Consumptive Use of Water

The expected annual consumptive use of water by the CPSES will not impair any existing or anticipated allocation of water for industrial, municipal, or agricultural uses. Recreational uses of existing natural water bodies will not be adversely affected as a direct or indirect result of the rate of water consumption by CPSES. Water lost through evaporation in the cooling system represents the short-term commitment of a renewable resource component of the hydrologic cycle, but is not considered a long-term or irretrievable loss.

11.2.3.3 Effects of CPSES on Ground Water

A detailed discussion of these effects is contained in Section 5.6. All waste discharge systems of the facility are designed to avoid ground water contamination. The flow of Squaw Creek and ground water resources in the lower reaches of the Squaw Creek watershed are not presently utilized for potable water or for irrigation.

11.2.3.4 Effects of CPSES on Air Quality

The creation of dust and smoke problems during the construction phase of the project have been minimized. See Section 4.5 for more detail.

No air quality problems are anticipated for the operational phase of the project. Gaseous radioactive releases will be strictly controlled in accordance with numerical guides for Appendix I, 10 CFR Part 50. Conservative estimates of the maximum individual total body and thyroid doses, as well as population doses have been calculated in Section 5.2. Neither man, nor biota other than man, is expected to be adversely affected by the extremely slight increases in the background radiation characteristics of the general area of the site that will occur during the operational life of the plant.

Slight increases in low level fogging may occur as a result of the thermal discharge into SCR. The only major highway that may be affected in the immediate vicinity of the reservoir is State Highway 144. Results of the study presented in Section 5.1 of the original ER indicated that any increase in intensity and duration of fog would be so slight as to have no significant adverse impact on the local area surrounding CPSES.

11.2.3.5 Effects of CPSES on Land

The CPSES site includes a total of 7,669 acres, of which approximately 3,700 acres will be occupied by the power plant, the dam and reservoir, and related facilities. Except for the rail and road access routes, pipeline right-of-way, and transmission line right-of-way, the remainder of the acreage within the site will be largely undisturbed by construction and operation of the facility (see details in Sections 4.1, 4.2, and 5.1).

The loss of agricultural production resulting from the development of the facility has amounted to only an insignificant percent of the total value of agricultural production in Somervell and Hood Counties. The land area directly occupied by the plant, the dam and reservoir, and related facilities has resulted in the elimination of a considerable area of riparian vegetation.

Such displacement of wildlife does not involve an irreversible or irretrievable commitment of local biological resources in the CPSES area. The original Squaw Creek area represented about five percent of the riparian habitat in Hood and Somervell Counties, and wildlife displacements from the site may have caused some increased competitive pressures on nearby riparian areas. The operation of CPSES should not impact adversely on wildlife. In fact, some wildlife will probably return to the site or the vicinity when construction is completed.

As noted previously, the aquatic environment of Squaw Creek has changed from a free-flowing stream to a lake-type environment. With this change and the very slight changes in the water quality of lower Squaw Creek, it is evident that the aquatic biota of the Squaw Creek watershed have undergone significant changes with the construction of CPSES and the filling of SCR; however, this will not have a significant or major long-term impact on aquatic resources and species represented in the local area.

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12.0 ENVIRONMENTAL APPROVALS AND CONSULTATIONS

The design, construction, and operation of the Comanche Peak Steam Electric Station (CPSES) are subject to the review and/or approval of numerous local, State, and Federal agencies. This Chapter provides a summary of contacts made with such regulatory bodies and the status of activities required to obtain necessary permits. Chapter 12 of the original Environmental Report (ER) contains additional information regarding such contacts which occurred during the preconstruction phase of the project.

12.1 AGENCY CONTACTS

12.1.1 FEDERAL AGENCIES

12.1.1.1 U.S. Nuclear Regulatory Commission

The Nuclear Regulatory Commission (NRC), under authority of the Atomic Energy Act of 1954, as amended, has regulatory authority over the design, construction, and operation of the CPSES. Particular emphasis is placed on the nuclear aspects which might affect the health and safety of the general public.

The original Environmental Report was prepared as part of an application for a construction permit and was submitted to NRC in June of 1973. The permit was issued in December of 1974. This current Environmental Report constitutes a portion of the application for an operating license for the two units comprising the CPSES. It has been prepared and submitted in compliance with 10 CFR Part 50, Appendix D, for review and analysis by NRC. Informal discussions have also been held with NRC representatives during the construction phase of the CPSES regarding the development of design and construction activities.

12.1.1.2 Environmental Protection Agency

Under the provisions of the Federal Water Pollution Control Act of 1972 (FWPCA), a National Pollutant Discharge Elimination System (NPDES) permit is required for the CPSES. TUGCO anticipates that the regional office of the U.S. Environmental Protection Agency will issue this permit to the Applicant in the near future. Additional discussion of the terms of the proposed NPDES permit is presented in Section 6.2 and in the proposed Environmental Technical Specifications.

12.1.1.3 Other Federal Agencies

As stated in Section 12.1 of the original ER, relevant aspects of the CPSES have been discussed with other Federal agencies, including the U.S. Army Corps of Engineers, the Federal Aviation Administration, the U.S. Geological Survey, and the Soil Conservation Service. Such discussions will continue to be conducted with these and other concerned Federal agencies as may be required during subsequent stages of this project.

12.1.1.4 Floodplain Management

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A review of the 100-year water levels at CPSES has been performed. The 100-year flood and reservoir level were determined using the same analysis procedure as was used in the PMF analysis except the 100-year precipitation was substituted for the PMP. For details of this PMF analysis see Section 2.4.3 of the Final Safety Analysis Report (FSAR) and the discussion of compliance with Regulatory Guide 1.59 in Section 1A(B) of the FSAR. The 100-year flood had a maximum water level of elevation 780.8 in Squaw Creek Reservoir, a peak inflow of 42,910 cubic feet per second and a peak outflow of 4,786 cubic feet per second. The flow from the 24.6 square mile Squaw Creek drainage area above the reservoir headwaters during the 100-year flood event was 13,560 cubic feet per second. A separate flood routing to determine the water level in the Safe Shutdown Impoundment during this 100-year flood was not performed. Since the difference in water level between the two reservoirs was 1.7 feet during the PMF, the difference in water level during the 100-year flood will be less than 1.7 feet.

The structures in the plant site are above the reservoir level reached during the PMF so they are above the levels reached during the 100-year flood. The maximum flow and water levels in Squaw Creek below the dam will be reduced by Squaw Creek Reservoir. The 100-year flood flow at the dam prior to the construction of the dam would have been greater than the 13,560 cubic feet per second flow that was computed for Squaw Creek at the headwaters of the reservoir. The outflow from the reservoir during the 100-year flood will be 4,786 cubic feet per second. The Applicant has purchased the land in fee or has obtained flood easements on all property upstream of the reservoir that is below elevation 790.0. Since the water level in Squaw Creek Reservoir during the 100-year flood is elevation 780.8, 9.2 feet below the property acquisition level, no flooding will occur on property not controlled by the Applicant.

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The Makeup Pump Station located on Lake Granbury will be subject to flooding from the Brazos River inflows into Lake Granbury. Based on frequency data and discharge rating curves in the National Dam Safety Program, Phase I Inspection Report on DeCordova Bend Dam, which forms Lake Granbury, the reservoir level during the 100-year flood will be elevation 693.0 or conservation water level. The floor of the pump station is elevation 700.0. Therefore, the Makeup Pump Station will not be affected by the 100-year flood at Lake Granbury.

In conclusion, the facilities constructed at the Comanche Peak Steam Electric Station will not be affected by the 100-year flood, nor will they adversely affect the 100-year flood level on property not owned by the Applicant.

12.1.2 STATE AGENCIES

12.1.2.1 Permitting Activities

The following permits relating to the construction and operation of the CPSES have been obtained from the State of Texas:

1. A permit for the construction of Squaw Creek Dam and Reservoir and for the consumptive use of water in connection with the operation of CPSES was issued to the Applicant on June 26, 1973, by the Texas Water Rights Commission (now the Texas Water Commission), pursuant to the provisions of Chapter 5 of the Texas Water Code.

2. A permit for discharges into and from Squaw Creek Reservoir was issued on February 27, 1974, by the Texas Water Quality Board (now the Texas Department of Water Resources), pursuant to the provisions of Chapter 21 of the Texas Water Code.

3. TUGCO ·ill obtain the certificate from the Texas Department of Water Resources required pursuant to Section 401 of the FWPCA of 1972.

4. Certificates of Public Convenience and Necessity have been issued by the Public Utilities Commission of the State of Texas for the construction of CPSES and associated transmission lines pursuant to the provisions of Article 1446c, Revised Civil Statutes of Texas (the Public Utility Regulatory Act).

12.1.2.2 Non-Permitting Activities

The Applicant has coordinated the development of an emergency plan with such State agencies as the Texas Department of Health and the Texas Department of Public Safety. This plan outlines procedures for protection of the public health and safety in the event of incidents requiring such measures.

In addition, the following State agencies were contacted during the design and construction phases of the project in order to assure their awareness of design and operational aspects which may enter into their respective areas of interest:

1. Texas Air Control Board
2. Texas Highway Department
3. Texas Parks and Wildlife Department
4. Texas State Historical Survey Committee
5. Texas Soil and Water Conservation Board
6. Texas Railroad Commission
7. Texas Water Development Board
8. Texas Department of Agriculture
9. Texas Industrial Commission
10. Texas Archeological Research Laboratory
11. Texas Forest Service
12. State of Texas General Land Office
13. The Bureau of Economic Geology of the University of Texas at Austin.

As required by Section 2.6 of Regulatory Guide 4.2, contact was made with the appropriate State of Texas agency to determine that the CPSES project would not adversely affect properties potentially eligible for nomination to the National Register of Historic Places. Evidence of this contact is reflected in a Texas Historical Commission letter which is appended to this section.

12.1.3 LOCAL AGENCIES

As with any project of this magnitude and impact, there will be numerous occasions when contacts will be made with officials of local and area agencies as well as the general public. The Brazos River Authority and the county judges and commissioners within whose jurisdiction the CPSES site is located have been briefed as to the scope and schedule of the project plans and have indicated their willingness to be of whatever assistance appropriate. Of special significance concerning coordination with local entities is the emergency plan referred to previously.

12.2 REGULATIONS AND DIRECTIVES

Although the Public Utilities Commission of the State of Texas has published no regulations governing the design, routing, and construction of transmission systems, it does issue Certificates of Convenience and Necessity which permit such construction.

12.3 WATER QUALITY CERTIFICATION

The water quality of adjacent states will not be affected by the operation of the CPSES, as the Brazos River is confined to Central Texas and discharges directly into the Gulf of Mexico at a location approximately 130 miles from Louisiana, the nearest neighboring state.

12.4 PUBLIC INFORMATION AND MEETINGS

In July of 1972 a public information office was established by Texas Electric Service Company (as a co-owner of the CPSES project) in Glen Rose. Letters were sent to all residents of Somervell County informing them of the establishment of the information office. This office was established first to inform local residents of plans for construction of the CPSES and the features of nuclear power in general. In addition, a series of articles and advertisements have been placed in local newspapers outlining details of the project and discussing nuclear issues. A secondary objective of this action is to establish a basis for assuring local residents that the influx of construction forces would not impact unfavorably on local schools, businesses, and city and county governments.

In an effort to keep the general public continually informed as to project and related nuclear developments, speakers groups have been organized by the CPSES co-owners (Dallas Power & Light Company, Texas Power & Light Company, and Texas Electric Service Company). These speakers receive frequent training to keep them informed of current events and issues pertaining to nuclear power and CPSES.

On a periodic basis, these speakers make presentations to civic clubs, city, county, and school groups, professional organizations, environmental groups, home demonstration clubs, and other interested groups throughout the service area of the three operating companies listed above. Particular emphasis is placed on meeting with such groups in towns and communities around the plant site, including Glen Rose, Granbury, Tolar, Walnut Springs, Rainbow, Iredell, Hico, Clifton, and Meridian.

On one occasion, several key Somervell County citizens were taken to the Arkansas Nuclear One site near Russellville, Arkansas, to meet with their counterparts and discuss impacts on the local area caused by construction of a nuclear facility. These officials included the county judge, school superintendent, postmaster, Chamber of Commerce president, newspaper publisher, and regional Soil Conservation Service representative.

Later on, an additional six Sommervell County residents, including the Mayor of Glen Rose, the Somervell County Judge-elect, the school superintendent, a banker, a local rancher, and the local Soil Conservation Service representative were taken to the Arkansas Nuclear One plant site for similar discussions with local officials and a tour of the plant.

The information office in Glen Rose continues to provide information to local residents and continues to monitor social and economic impact on the area around the plant site so that problems are minimized and, when possible, avoided.

TABLE 12.1-1 (Sheet 1 of 2)

STEAM ELECTRIC STATIONS
PERMITS - REQUIREMENTS AND STATUS

COMANCHE PEAK

REQUIREMENT	APPLIED	RECEIVED	COMMENTS
A. Water Control			
(1) TWRC - Construction permit for dam and reservoir on Squaw Creek	2/13/73	No. 2871 6/26/73	Authorizes construction of Squaw Creek reservoir, the impoundment of 151,500 acre feet the consumptive use of 23,180 acre feet/yr. and the use of flood water for initial filling. As amended on 8/20/77, the permit authorized diversion of 48,300 acre feet annually from Lake Granbury.
(2) TWQB - Discharge	9/10/73	No. 01854 2/27/74 Expires: 4/22/84	Revision and Renewal of Permit granted on 4/2/79. Revision includes permission to make low-level discharges from Squaw Creek Reservoir into Squaw Creek. EPA and TDWR notified of installation of R.O. Unit 6/25/80.
(3) EPA-NPDES Permit for Station discharge	3/14/75	No. TX0065854 12/16/78 Permit Expires 1/15/84	Revised EPA permit was issued to public notice on June 23, 1978, with requirements for a chlorine minimization study. Minimization study approved by EPA on 6/8/79. Thermal limitations indicate a problem under worst case weather conditions for station operation at full load. TUGCO comments on proposed NPDES permit submitted to EPA on 7/17/78. Permit issued 12/16/78 with effective date 1/16/79 for 5 years. Permit Expires Jan. 15, 1984.
B. Air Control			
(1) FAA-Aviation Clearance	11/9/76	11/30/76 No. 76-SW-1433-OE	Clearance issued.

TABLE 12.1-1 (Sheet 2 of 2)

STEAM ELECTRIC STATIONS
PERMITS - REQUIREMENTS AND STATUS

COMANCHE PEAK

REQUIREMENT	APPLIED	RECEIVED	COMMENTS
(2) NRC Construction Permit	6/5/73	12/19/74 No. CPPR-126 No. CPPR-127	Permit amendments obtained to date are: 1. Requirement for operational chlorine minimization study. Applied for on 6/30/78. Received amendment on 12/8/78. 2. Extension of 250 gpm groundwater pumping limit for one year. Received 11/16/79. 3. Addition of Brazos Electric Power Cooperative and Texas Municipal Power Agency as part owners of project. Received on 12/18/79.
(3) Diesel Generator	2/6/80	2/17/80 X-1382	Required no construction or operating permit. Used for emergency shutdown only.

THE SITE

Q1. Provide an updated schedule for the completion of Units 1 and 2, such as fuel loading, startup for commerical power dates, etc.

R1. The fuel load date for Unit 1 is December 1981 and the fuel load date for Unit 2 is the third quarter 1983. The dates for commercial operation are six months after the respective fuel load dates. For more information see revised Chapter 1.

THE SITE

Q2. Provide an updated list of other agency reviews and approvals, including a list of all licenses and approvals CPSES will require prior to startup of Units 1 and 2.

R2. See new Table 12.1-1 which reflects the status of permits and approvals required for the CPSES project, as of June 25, 1980.

AIR QUALITY

Q3. Provide an updated summary of existing air quality information applicable to the site.

R3. A copy of the TEXAS AIR CONTROL BOARD 1979 Annual Data Summaries was provided by letter dated September 12, 1980.

AIR QUALITY

Q4. Provide a copy of the letter from the Texas Utilities Services, Inc. to the Executive Director, Texas Air Control Board, dated 6 February 1980 and their reply dated 12 February 1980.

R4. A copy of the letters requested above were provided by letter dated September 12, 1980.

AIR QUALITY

Q5. Discuss the methods to be utilized to control fugitive dust during plant operation.

R5. "Rule 104" is the numbered provision of Regulation I - Control of Air Pollution from Visible Emissions and Particulate Matter of the Texas Air Control Board as adopted on January 26, 1972, filed with the Secretary of State on February 4, 1972 and effective March 5, 1972. The numbering system 131.03.04.001-.005 is the numbers assigned to the provisions of Rule 104 in the Regulation filed with the Secretary of State on February 27, 1976. Rule 104 is presented here for reference

PARTICULATE MATTER FROM MATERIALS HANDLING, CONSTRUCTION, AND ROADS, STREETS, AND ALLEYS
131.03.04.001-.005

.001. Geographic Areas of Application

Rules 131.03.04.002-.005 shall apply only to sources in areas designated as nonattainment for total suspended particulate in accordance with Section 107 of the Federal Clean Air Act of 1977 to the extent needed to provide for the attainment of the National Ambient Air Quality Standards.

.002. Fines Handling

No person may cause, suffer, allow or permit any material except for abrasive material for snow and ice control, to be handled, transported, or stored without taking at least the following precautions to prevent particulate matter from becoming airborne:

(a) Through (b) no change.

(c) Covering at all times, when in motion, of open-bodied trucks, trailers, or railroad cars transporting materials which can create airborne particulate matter in areas where the general public has access. Suitable wetting may be used as an alternative to covering in all areas except the city of El Paso.

.003. Construction and Demolition

N person may cause, suffer, allow or permit a structure, road, street or alley, to be constructed, altered, repaired or demolished without taking at least the following precautions to prevent particulate mater from becoming airborne:

(a) Use of water or of suitable oil or chemicals for control of dust in the domilition of structures, in construction operations, in work performed on a road, street, or alley, or in the clearing of land;

(b) Use of adequate methods to minimize airborne particulate matter during sandblasting of structures or similar operations.

.004. Roads

No person may cause, suffer, allow or permit any public, industrial, commercial, or private road, street, or alley to be used without taking at least the following precautions to prevent particulate matter from becoming airborne:

(a) Application of asphalt, water, or suitable oil or chemicals on unpaved surfaces having more than 100 vehicles traversals daily, averaged on an annual basis, or more than 200 vehicles traversals daily, averaged on a monthly basis, whichever is the more stringent.

(b) Removal from paved surfaces, as necessary, of soil or other materials, except for sand applied for the specific purpose of snow or ice control.

.005. Parking Lots

No person may allow any vehicular parking surface having more than 20 parkings daily, averaged on a monthly basis, to be used unless dust is controlled by the appropriate application of asphalt, water, or suitable oil or chemicals. Parking surfaces having five spaces or less and parking surfaces at a property designed for and used exclusively as a private residence housing and not more than three families are exempt from this rule.

Rule 104.1 states that rules 104.3 through 104.5 apply only to sources in nonattainment areas. The CPSES site is in an attainment area. However, rule 104 is used here to discuss methods utilized to control fugitive dust during plant operation.

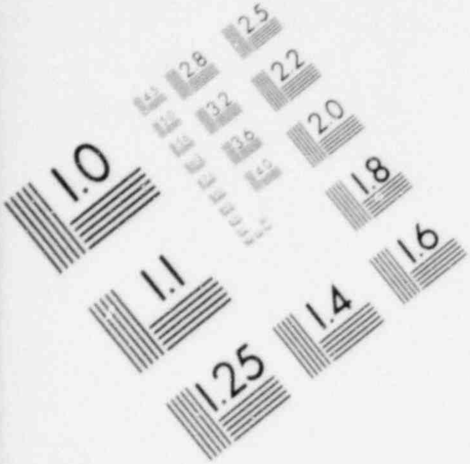
It is not anticipated that any large quantities of materials that can become airborne will be transported to support the operation of CPSES. In any event rule 104.2 will be complied with.

With respect to Rule 104.3, construction and demolition do not apply to operation.

Roads are covered by Rule 104.4. All roads to be used during the operation of CPSES having more than 100 vehicle traversals daily are paved.

Rule 104.5 is for parking lots; the parking lot at the CPSES administration building to be used by the plant operations personnel is paved.

In addition to the above, the top soil removed from the construction area has been saved to be used in landscaping. This landscaping will be done when the construction is complete. This landscaping should reduce dust at the site.



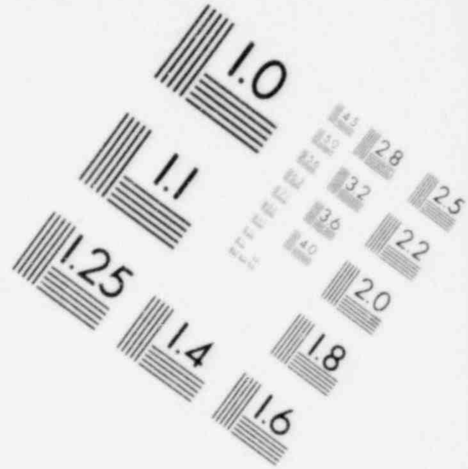
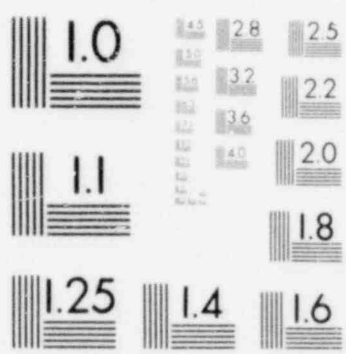
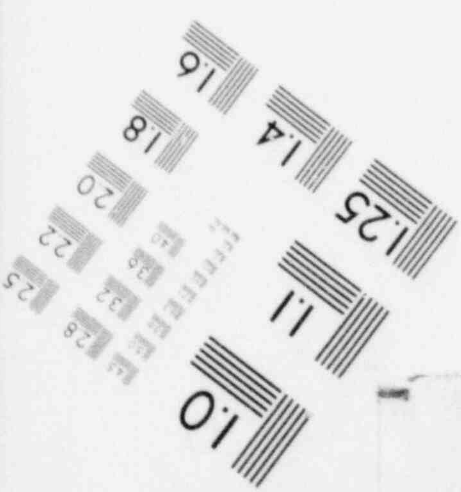


IMAGE EVALUATION TEST TARGET (MT-3)



6″

MICROCOPY RESOLUTION TEST CHART



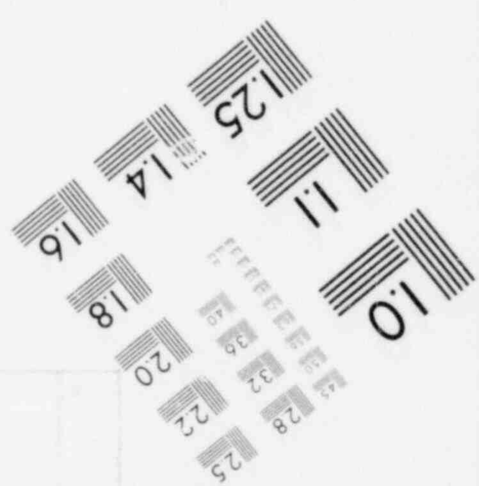


IMAGE EVALUATION
TEST TARGET (MT-3)

6″

MICROCOPY RESOLUTION TEST CHART

METEOROLOGY

Q6. The discussion of tornadoes in Section 2.3.2.4.2 is disjointed, with one type of analysis presented for the 1955 to 1967 data and another for the 1968 to 1977 data. Provide a single analysis of tornadoes in the area for all of the data.

R6. See revised Section 2.3.2.4.2.

METEOROLOGY

Q7. The hurricane and wind storm descriptions in Section 2.3.2.4 are based on data prior to 1961 and 1967, respectively. Provide discussions of these storm types which include but are not limited to more recent data.

R7. See revised Section 2.3.2.4.4.

METEOROLOGY

Q8. The monthly and annual distribution of thunderstorms are not presented in Table 2.3-8 as stated in Section 2.3.2.4.1. Provide this information.

R8. This reference table has been included as Table 2.3-30. It is the same as FSAR Table 2.3-2. See revised Section 2.3.2.4.1 and new Table 2.3-30.

METEOROLOGY

Q9. The X/Q values presented in Section 2.3 and referred to in Section 5.2.2.2 were calculated according to the model described in Section 6.1.3.2.2. No reference for this section is given in the 1975 Annual Summary as indicated in Section 6.1.6.1. Provide clarification of this reference and, if Revision 1 of Reg. Guide 1.111 was not used, provide X/Q values calculated according to the guidance in Reg. Guide 1.111, Rev. 1 or a justification for the model used.

R9. As indicated by the title, Section 6.1.6.1 refers to only ecological references. No meteorological references were intended.

Average annual dispersion calculations at the CPSES were made in 1976 in accordance with NRC Regulatory Guide 1.111, March 1976. The NRC subsequently published revised depletion and deposition curves in an errata sheet dated January 1977, and later in Regulatory Guide 1.111, Revision 1 of July 1977. A copy of this errata sheet is included as Figure Q9-1. As noted in Figure Q9-1, in the region where the highest individual doses are usually calculated (i.e., 1-10 km), the relative concentrations (χ/Q) including depletion would only be about 10 percent higher than before and the relative deposition values (D/Q) would be about 30 percent lower. Since D/Q is usually controlling, application of the new curves to plants evaluated and in compliance with Appendix I was not reqired by the NRC at that time. Therefore, recalculation of χ/Q and D/Q values using the revised depletion and deposition curves in Revision I of Regulatory Guide 1.111 is not warranted.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

January 1977

ERRATA

Regulatory Guide 1.111, March 1976

"Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors"

A computer programming error that affected the depletion and deposition curves in Figures 3 through 10 of Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," has been discovered.

The corrected figures transmitted herewith should be used in future assessments of potential annual radiation doses to the public resulting from routine releases of radioactive materials in gaseous effluents. A comparison of the revised depletion and deposition curves to the original ones has shown that, in the region where highest individual doses are usually calculated (i.e., 1-10 km), the relative concentrations (X/Q), including depletion, will be about 10% higher than before and the relative deposition values (D/Q) will be about 30% lower. Therefore, since D/Q is usually controlling, application of the new curves to plants that have already been evaluated and found to be in compliance with Appendix I will not be required because there would be no change in the conclusion of acceptability.

SEPTEMBER 1980

COMANCHE PEAK S.E.S. NUCLEAR PLANT UNITS 1 and 2
R.G. 1.111, 3/76, ERRATA
FIGURE Q9-1

METEOROLOGY

Q10. Identify the amount of wind speed, wind direction, and vertical temperature difference data that was reconstructed from the other tower levels when lower level data was missing. Provide individual frequency distributions of the reconstructed data by parameter. Define the procedures used for the reconstructed data including any adjustment algorithms.

R10. This requested information has been provided in response to FSAR question 372.29 on January 31, 1979.

METEOROLOGY

Q11. Discuss the calibration and maintenance procedures to be used for the operation meteorological monitoring program, and compare them with the procedures used for the pre-operational program.

R11. The general calibration and maintenance procedures to be used for the operational meteorological monitoring program will be the same as the preoperational program which meets the requirements of R.G. 1.23. These procedures call for the calibration of the weather instruments and recorders at six-month intervals. This includes close visual inspection of all instrument sensors for wear, electronic component calibration, ambient temperature and dewpoint comparisons using mercury thermometers and calibration of recorders. Normal maintenance includes two operational inspections per week and any adjustments that may be needed. The Applicant is presently performing an engineering evaluation of the operational meteorological monitoring program to update the present system to meet anticipated regulatory requirements. When this evaluation is complete the Applicant will purchase state of the art equipment that will meet acceptable system accuracies specified in R.G. 1.23.

METEOROLOGY

Q12. Demonstrate that acceptable system accuracies for meteorological measurement as specified in Reg. Guide 1.23 will be maintained after the modifications for the operational meteorological measurements program are made.

R12. See response to Q11.

HAZARDS

Q13. As published in the Federal Register (Vol. 45, No. 116, June 13, 1980, Pages 40101 - 40104) the Nuclear Regulatory Commission (NRC) has revised its policy regarding accident considerations in National Environmental Policy Act (NEPA) reviews. Information regarding the site as well as events arising from causes external to the plant which are considered possible contributors to the risk associated with the plant are to be discussed. Reference to safety evaluations is acceptable provided the Environmental Report contains a complete overview with references to specific sections of the FSAR. Accordingly, please provide the information requested in each part below:

(a) Please identify the type of material carried in all pipe lines within 2 miles of site boundary. Provide a basis for your statement. Please include a statement as to the type of material which these pipe lines may carry by design limitations and/or current regulations. Indicate whether liquified natural or liquified petroleum gas is carried or planned to be carried in these lines.

(b) Your response to FSAR question 312.1 (dated July 27, 1978) which addressed 120.24 acres within the exclusion area indicated (1) control of this area will be acquired with the purchase of the land and (2) the entire area lies outside the minimum exclusion area boundary. Figure 2.1-2c of the FSAR (Dated July 31, 1979) shows that ingress and egress rights for mineral interests are still outstanding within the exclusion area. Please discuss the status of your efforts regarding acquisition of the mineral rights and control of ingress and egress within the exclusion area.

R13. (a) See new Section 7.2.3 for information regarding events arising from causes external to the plant. This information covers the four pipelines which pass within five miles of CPSES. Only natural gas and crude oil are transported by these pipelines. The nature and age of these pipelines make it highly unlikely that any change in use could be economically made; therefore, the Applicant does not project any change in the type of material carried.

The pipeline company owners will be contacted to verify this position.

(b) See revised ER(OLS) Section 2.1. Also see the revised FSAR Section 2.1 and response to Q312.1 which will be provided in FSAR Amendment 12.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q14. Provide information of load management or time-of-use studies to determine if better management could delay the need for the plant. Present in summary form the relevant issues, the conservation steps you have taken to delay the need for power beyond that year, and the future conservation steps you contemplate which may have that effect.

R14. The three electric utility subsidiaries, DPL, TESCO, and TPL, deal directly with the customers. They provide their own load analyses, load management, various studies and load projections. A discussion of forecasting loads for each subsidiary is included in 1.1.1.2.1 Methodology, and the various energy conservation steps are covered in 1.1.1.2.2.

TUCS data is simply the consolidation of that information supplied by the three electric utility subsidiaries, DPL, TESCO, and TPL. See response to Q39 with reference to conservation and little or no load growth. The same savings are realized through the operation of CPSES, with or without system load growth.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q15. Identify (and give a short explanation of) any developing federal or state or local government or regulatory policy, laws or actions existing or pending which you believe may substantially affect your fuel supply.

R15. Under Fuel Use Act of 1978 (Public Law 95-619).

(a) EXISTING electric power plants may not use natural gas after Jan. 1, 1990 without specific exemption from DOE; and

(b) NEW electric power plants may not use natural gas or petroleum as primary energy source, and must be constructed with capability to burn coal or alternate fuels.

Under Environmental Coordination Act of 1974 (Public Law 93-319).

(a) EXISTING electric power plants may be prohibited from burning natural gas or petroleum, to meet certain requirements.

(b) Administrator may require NEW electric power plants to be designed and constructed to use coal.

The Fuel Use Act of 1978, by prohibiting the use of natural gas and petroleum as primary energy sources for electric power plants after Jan. 1, 1990, could limit or make useless some 10,000 MW of generating capability on TUCS. Thereby, increasing capital investment and operating costs; and reducing system reliability by retiring all gas/oil units. For reference, see "Fuel Supply" in Chapter 1.3.1.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q16. Will your system be more reliable with C.P.S.E.S. than without it? If so, explain how the increased reliability comes about.

R16. A more reliable service is seen on TUCS through an assured fuel supply of nuclear energy, which replaces the prohibited-use, higher cost gas/oil, and supplements the limited lignite resources. For example; CPSES would enhance system reliability greatly when gas-fired units are curtailed during extremely cold winters and natural gas is not available for boiler use.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q17. In the first year that both units are running, would CPSES replace any baseload plant on your system which can be operated and maintained more inexpensively than CPSES?

R17. No, with both units at Comanche Peak in servi[illegible], TUCS plans to use less natural gas and oil, so that a substanial saving in fuel cost will result. The units which will be curtailed in opertion will be the smaller, less efficient gas-fired units. For example, units of less than 50 MW capability comprise a t[illegible]al on TUCS at this time of approximately 225 MW. System average natural gas cost in 1983 is estimated to be approximately $3.20 per million BTU, while nuclear energy is estimated to be approximately $0.65 per million BTU. Each Kwh provided by Comanche Peak will thus effect a fuel cost saving of $2.55 per million BTU, or approximately 25 mills per Kwh. Most of these smaller gas-fired units are scheduled for retirement during the next five to ten years.

ESTIMATED COST TO DELIVER ONE KWH BY ALTERNATE GENERATING UNITS FOR SERVICE IN 1985

	GAS/OIL	LIGNITE	NUCLEAR
Investment Cost ($/KW)	104.00	565.00	972.00
Fixed Charges ($/KW)	20.80	113.00	194.40
Capacity Factor (%)	20	50-60	70
KWH per KW	1752	4380-5256	6132
Fixed Charges(Mills/KWH)	11.9	25.8-21.5	31.7
Fuel Cost (Mills/KWH)	55.0	11.2-11.2	6.2
O.& M. Cost (Mills/KWH)	2.5	4.7-4.7	1.3
TOTAL COST (Mills/KWH)	69.4	41.7-37.4	39.2

The calculations shown above clearly show tht it is in the best interest of customers to be supplied with base energy generated at [illegible] cents/KWH by CPSES rather than by Gas/Oil units at 6.9 cents/KWH. The older base/intermediate load lignite units will generate energy at approximately 4 cents per KWH.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q18. Provide copies of "List of Schedules" in form 1 and form 12 reports filed with the FPC for 1979.

R18. FPC Form 1 "List of Schedules" and data on "Steam-Electric Generating Plants," pages 432, 432a, 436, and 437 are included for DPL, TESCO, and TPL for the year 1979. TUCS does not file a consolidated FPC Form 1.
FPC Form 12 Schedules 1, 3, and 5 are included for DPL, TESCO, and TPL for 1979. An abbreviated FPC Form 12 for TUCS is consolidated for DPL, TESCO, and TPL; and a copy of the 1979 report is included.

A copy of the above information indicated as "included" was transmitted by letter dated Septemer 12, 1980.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q19. For Schedule 432a, Form 1, please further provide the breakdown of Kilowatt hours generated (line 12), fuel costs (line 21), and production costs other than fuel (line 34 minus line 21) for each of the fuel types for each of the plants (when there is more than one fuel type)?

R19. Schedule 432a was transmitted by letter dated September 12, 1980.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q20. Please provide the anticipated loading order of units by type of fuel for each of the seasons of the year.

R20. Priority loading of Units by types of fuel for all seasons of the year (year-round) are:

1st	NUCLEAR	Base Load	Most Economical
2nd	LIGNITE	Base Load	Intermediate
3rd	GAS/OIL	Cycle/Peaking	Highest Cost Fuel

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q21. (ER Section 1). Indicated the dates when electrical generation will be fully available from each unit.

R21. Unit-1 is scheduled for commercial operation in 1982 and 70% annual capacity factor operation in 1984. Likewise, Unit-2 is scheduled for commercial operation in 1984 and should reach 70% annual capacity factor operation in 1986.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q22. Provide sample demand and energy projection methodology used by DP and L in summary form. E.G., a least squares projection (Sec. 1.1.1.2.1)

R22. Sample "Least Squares Exponential Trend" projection has been forwarded by letter dated September 12, 1980.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q23. Provide the most recent summary documents from Edison Electric Institute, DPL, TUGCO, TESCO, TPL, TUCS, TIS and ERCOT in which the assumptions, methods and conclusions for, and estimates of, need for power in the relevant regions are calculated. If unavailable, explain why. (Sec. 1.1.1.2.1)

R23. Copies of the latest ERCOT and EEI reports were forwarded by letter dated September 12, 1980.

Data for DPL, TESCO, and TPL, the three electric utility subsidiaries in TUCS, is included in the ERCOT report. ERCOT data is consolidated information on the Texas Interconnected System and is included as regional data in the EEI National Summary. TUGCO serves principally as a generating company for DPL, TESCO, and TPL of their jointly-owned stations and therefore has no equivalent reports.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q24. Discuss the bases for the conclusion (page 1.1-16) that the addition of a nuclear plant provides the proper mix of energy sources for the TUCS area. (Sec. 1.1.2)

R24. The present fuel sources for TUCS are lignite and natural gas, with oil as an emergency standby for gas. Lignite is the most economical-with eight units, 5,300 MW installed during the 1970's--and will be agressively pursued during the 1980's. But proven lignite reserves are limited to serve approximately 9,200 MW. Natural gas and oil are expensive, in short supply, and restricted for use in power plants by Fuel Use Act of 1978. Nuclear energy provides diversification in an alternative, essential fuel supply, which is expected to be competitive with lignite and more plentiful in supply than gas and oil.

Also, see revised Section 1.3.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, AND BENEFIT COST

Q25. (ER Section 1). Explain what you mean by "statistical theory of extreme values" and "exponential smoothing," and give a short example of how you used each in the need for power calculation.

R25. Reference is made to paper entitled, "Statistical Theory of Extreme Values and Some Pratical Applications" by Emil J. Gumber, U.S. Department of Commerce, National Bureau of Standards, Applied Mathematical Series, 1954.

"Exponential Smoothing" is covered in most textbooks relating to mathematical projections. One reference is: "Statistical Techniques in Business" by Robert Mason; Publisher: Richard D. Erwin; Homewood, Illinois.

Short example of "Least Squares Exponential Trend", Y=A+B---X forwarded by letter dated September 12, 1980.

See response to Q22.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q26. (ER Sections 1 and 11). If the reserve margin with Comanche Peak turns out to be substantially in excess of 15% over a good portion of the plant life, will TUCS members close down or reduce usage of less efficient plants? If so, state which plants and show the calculations for any saving of money or energy which would occur. If no such saving would occur, state the reasons why Comanche Peak would be operated. Assume 70% load factor and give the year in which 70% will be achieved.

R26. Reference is made to response to Q17 with emphasis on the fact that; the units which will be curtailed in operation will be the smaller, less efficient, gas-fired units.

ESTIMATED FUEL COST SAVINGS:

Gas - \$3.20 per million BTU

Nuclear - \$0.65 per million BTU

Savings - \$2.55 per million BTU

Additional savings are realized through base-loading CPSES with its least expensive fuel, and thereby reducing the use of the most costly gas/oil fuels.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q27. (ER Section 1). Indicate the reasons that 10% of Comanche Peak is being sold. Is it correct that this sale will not materially change any conclusion concerning your system?

R27. Condition 3.D (2)(a) of the Comanche Peak Construction Permits states in part that "The Applicants shall afford an opportunity to participate in the Comanche Peak Steam Electric Station, Units 1 and 2 for the term of the instant license, or any extension or renewal thereof, to any entity(ies) in the North Texas Area making a timely request therefore, through a reasonable ownership interest in such Unit(s). . .". To comply with this antitrust condition the Texas Municipal Power Agency and Brazos Electric Power Cooperative Inc. were sold 6.2 and 3.8 percent respectively.

It is correct that this sale does not materially change any conclusions concerning TUCS.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q28. Page 1.3-1 claims the best interest of customers, from the cost standpoint, is to place Comanche Peak in service on schedule. show the calculation which proves Comanche Peak will lower KWh cost to customers on schedule. If a different calculation supports your point for Section 1.2.2, show it.

R28. Reference is made to the tabulation in response to Q17 which shows the estimated bus bar costs of generating one KWH from the three types of fuel available on TUCS in 1985. Emphasis concludes that it is in the best interest of TUCS customers, from cost standpoint, to be served energy generated by Comanche Peak at 3.92 cents/KWH rather than costlier gas/oil at 6.94 cents/KWH.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q29. Expand the discussion of Section 1.3.3 to show exactly what the shortage of non-nuclear fuel would be if Comanche Peak did not operate. Explain in detail any difficulties envisioned in obtaining oil and gas as fuels and explain the evidence for it.

R29. The tabulations in Table Q29-1; (1) With nuclear and (2) Without nuclear, show what the shortage of non-nuclear fuel would be if Comanche Peak did not operate.
Difficlties in obtaining natural gas and oil for future use by TUCS fall into three main areas:

(1) Economic Because of diminishing supplies and rising cost of Natural Gas and Oil.
(2) Regulations such as Fuel Use Act of 1978, which prohibit or limit their use as fuel for electric power plants.
(3) Assured Fuel Supply for long-term use by various types of duties--base load, intermediate, cycling, etc.--for specific generating units.

Also see responses to Q15, Q24, and Q30.

TABLE Q29-1

ENERGY REQUIREMENTS WITH AND WITHOUT CPSES[a]

(1) WITH NUCLEAR - ENERGY REQUIREMENTS IN MILLIONS KWH

FUEL TYPE	1982	1983	1984	1985	1986
NUCLEAR	2,649	5,795	9,640	11,657	12,728
LIGNITE	35,141	34,791	35,638	42,270	45,151
PURCHASES	42	42	42	42	42
GAS/OIL	29,132	29,537	28,362	23,304	23,073
TOTAL	66,964	70,165	73,682	77,273	80,994
GAS/OIL IN 10^{12}BTU					
AVAILABLE	371	367	355	343	334
REQUIRED	318	322	309	254	251
SURPLUS	53	45	46	89	83

(2) WITHOUT NUCLEAR - ENERGY REQUIREMENTS IN MILLIONS KWH

FUEL TYPE	1982	1983	1984	1985	1986
NUCLEAR	0	0	0	0	0
LIGNITE (70% C.F.)	36,531	36,531	40,075	48,028	48,028
PURCHASES	42	42	42	42	42
GAS/OIL	30,391	33,592	33,565	29,203	32,924
TOTAL	66,964	70,165	73,682	77,273	80,994
GAS/OIL IN 10^{12}BTU					
AVAILABLE	371	367	355	343	334
REQUIRED	331	366	366	318	359
SURPLUS (SHORTAGE)	40	1	(11)	25	(25)

[a]The following tabulations;(1) WITH Nuclear and (2) WITHOUT Nuclear show what the shortage of non-nuclear fuel would be if CPSES did not operate.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q30. Indicate the number of barrels of oil or therms of gas that would be saved by normal operation of CPSES per year assuming normal operation of Units 1 and 2. Include the basis for the above calculation.

R30. The following nuclear generation in million of KWH by Comanche Peak during the first five years of operation:

1982	1983	1984	1985	1986
2,649	5,795	9,640	11,657	12,728

Is Equivalent to natural gas requirement in Billions of CF at 1,000 BTU/CF and 10,900 BTU/KWH, of:

1982	1983	1984	1985	1986
29	63	105	127	139

or equivalent to an oil requirement in millions of barrels at 6,000,000 BTU/Barrel of:

1982	1983	1984	1985	1986
4.8	10.5	17.5	21.2	23.2

With reference to response to Q29, a shortage of non-nuclear fuel is shown without CPSES operating and all lignite units operating at 70% capacity factor level.

	1984	1986
Billion of CF Gas	11	25
(or) Millions of Barrels Oil	1.83	4.17

Also see Section 1.3.1.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q31. (ER Section 5.7 and 5.8). Reconcile the claim of 30 year economic life for the plant (page 5.7-6) and at least 40 year operating life (page 5.8-1).

R31. References to a 40 year plant operating life are referring to the fact that the engineered design life of the plant is 40 years. A 30 year economic life is referring to our practice of depreciating a plant over a 30 period. The 40 year life is an engineering practice and the 30 year life is an accounting practice. Revised Section 5.8 recognizes tht the plant is designed to operate at least 40 years but the plant will likely be decommissioned as economics dictates.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q32. Provide an updated discussion of decommissioning costs and include bases for assumption used.

R32. See revised Section 5.8.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q33. (ER Section 8). Update all numbers in Chapter 8 which are outdated and apply to operation (i.e. no need to update construction information).

R33. See revised Chapter 8.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q34. Show the calculation of present value for CPSES as stated Section 8.1.1.3, and state why you use the discount rate you do.

R34. See revised Section 8.1.1.3. The discount rate of 10% is used because the Applicant assumes that the discount rate will be 2% above the long-term inflation rate. Our experience indicates that a long-term inflation rate of 8% is historically justified.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q35. (ER Chapters 1, 8 and 11). What proportion of TU sales are on an interruptible basis, and are any uses in addition to industrial on an interruptible basis?

R35. Between 4 and 6% of total sales on TUCS have been interruptible during the past 10 years, with no interruptible sales anticipated or being scheduled after March, 1981. The interruptible service to a large industrial customer becomes firm under new contract arrangements, upon the commerical operation of new lignite-fired generator by April 1, 1981.

Also, see revised Section 1.1.1.2.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q36. Update the discussion of 8.2.1.1 and provide the bases for use of the percentage value for AFUDC.

R36. See revised Section 8.2.1.1.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q37. Show the calculation for fixed charge and operating, maintenance and fuel costs (page 8.2-4). How was 3.67% arrived at as the depreciation rate, 18% as the fixed charge rate, and how did you use it in calculating fixed charges?

R37. See revised Section 8.2.1.4 and new Table 8.2-3.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q38. (ER Section 11). Identify and estimate the value of the most valuable crop which could be grown or grazed on site if the plant did not operate.

R38. As discussed in Section 11.2.3.5, the loss of agricultural production as result of CPSES is insignificant. Below is an estimate of the lease income value of the approximately 7600 acres at the site.

SITE LEASE INCOME VALVE

Land Use	Acreage	Dollars/Acre	Annual Income
Crops (mostly hay production, with some milo and small acreage of peanuts)	1000	$10.00	$10,000.00
Improved Pasture (primarily coastal bermuda)	1000	5.00	5,000.00
Native Pasture	5600	2.50	14,000.00
		Total	$29,000.00

NEED FOR PR̄ ECT, ALTERNATIVES TO OPERATION, BENEFIT COST

Q39. (ER Section 1, 8 and 11). Estimate total system production costs and energy production in KWh with and without the CPSES units in each of the first 5 years they both operate at full capacity assuming zero load growth between now and then, and for the case of your projected load growth between now and then. Give costs in millions of dollars and mills per KWh. List the assumptions and show the basic calculations. If you were able to achieve 70% capacity factor in the early years due to trouble-free operation, how would that affect the production cost comparison.

R39. Total TUCS estimated production costs are shown in Table Q39-1 for CPSES for the first five years of commercial operation for the station. After both units are operating at 70% annual capacity factor (1986), TUCS realizes savings of $577,340,000 or about 7.1 mills per KWH. Likewise, earlier achieving of 70% CPSES operation would simply result in additional savings earlier than seen on the attached tabulations. Further, it should be noted that the same savings occur through the operation of CPSES, with or without load growth.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COSTS

Q40. (ER Section 1, 8 and 11). If CPSES is not licensed, give the source of the needed energy from the next best alternative.

R40. The only available, short-range (1982-1986) alternative fuel source on TUCS for the required energy is natural gas or oil. Lead time for adding generating capacity is 8 to 10 years.

NEED FOR PROJECT, ALTERNATIVES TO OPERATION, BENEFIT COSTS

Q41. (ER Section 1). Indicate any change in service area, regional relationships, new forecasts of system production costs, base load, temperature sensitive load and peak load, system capability, reserves and reserve margin since FES-cp and also OL application.

R41. TPL purchased the electric facilities in Commerce, Texas in November, 1979; and, thereby gained some 1,200 customers and nine employees. The sale of this city-owned system was approved by Texas Public Utility Commission after the citizens of Commerce and the City Commission had voted their approval. No other change in service area since FES and OL applications.

Updated costs, loads, capabilities and reserves are included throughout the report. Temperature sensitive load and peak load studies are included in the Appendix 1.1B.

See revised Chapter 1 and revised Appendix 1.1B.

SOCIO-ECONOMICS

Q42. Indicate, if available, how many workers will be present at CPSES during operation that:

1) will be hired locally

2) be retained from construction work force

and/or

3) hired from outside Somervell and Hood counties.

Approximate percentage estimates are sufficient.

R42. TUGCO estimates the operational Staffing to be comprised of the following:

1. 10% will be hired locally
2. 10% will be retained from construction work force

   and

3. 80% will be hired from outside Somervell and Hood counties.

SOCIO-ECONOMICS

Q43. Estimate to the extent feasible how many construction force workers of CPSES, who presently live in Somervell or Hood counties, will choose to remain as residents of these counties after construction is complete.

R43. No survey has been performed to determine where former employees will choose to reside at the completion of the project. However, Table 8.1-3 contains the most recent information on numbers of local hires from the two counties and workers that relocated to these counties to work at CPSES. It would be reasonable to expect most of the 619 local hires to remain in this area at the completion of construction.

SOCIO-ECONOMICS

Q44. Update taxes paid by CPSES to local and State government and discuss the factors which influence the projection of tax payments over the life of the plant.

R44. Below is an update of taxes paid for 1979 on Comanche Peak and the new factors which influence the projection of taxes over the life of the plant.

Agency	1979 Property Taxes Paid
Somervell County	$ 536,368.48
Hood County	5,992.48
Glen Rose School District	1,124,570.08
Granbury School District	9,379.34
Tolar School District	3,081.42
Hood County Hospital District	3,514.44
Hood County Library	390.49
Farm to Market Road Fund	1,952.47
State of Texas	67,696.88
TOTAL	$1,752.876.08

The Texas Legislature passed Senate Bill 621 in 1978. Among other things it provides for a single appraisal district for each county, reappraisal of all properties by 1982 and a .0001 percent assessment for state taxes only. This will practicaly eliminate state property taxes. The Bill calls for major administrative changes but probably will not have a significant effect on property tax projections over the life of the plant.

SOCIO-ECONOMICS

Q45. Provide a map of land owners by category [public (by jurisdiction), private, TEC] who have access or are located within a quarter of a mile of the Squaw Creek reservoir. Document, if available, any formal decisions regarding the use and control of the reservoir for recreational purposes or other land use/ownership decisions.

R45. No private land owners have direct access to Squaw Creek Reservoir and all property located within a quarter of a mile of Squaw Creek Reservoir is privately owned with the exception of state and county roads.

Copies of correspondence between the Applicant and the State of Texas with respect to recreational development of Squaw Creek Reservoir between November 15, 1980 and July 3, 1980 was provided to NRC by letter dated September 12, 1980. This correspondence documents the formal decisions regarding recreational development of Squaw Creek Reservoir.

See response to question 69.

CULTURAL RESOURCES

Q46. With reference to ER Section 2.6.3.1 and 2.6.3.2, indicate how it can be assured that cultural resource sites are not present at or near these locations without looking. Provide detailed information on surveys made in the nearby area (i.e., within 25 miles) for similar topographic settings with the same geological history.

R46. Archaeological sites in the uplands of Hood and Somervell Counties, Texas are generally restricted to upland deposits of gravel (Uvalde gravels) and sand fields. There are no gravel fields in the area of these locations nor are there any sand fields. Because of the absence of these geologic features as well as the low density of archaeological sites along Squaw Creek (see Skinner and Humphreys 1973, Appendix A of the original ER) and the absence of sites in minor tributaries of the Paluxy River to the southwest, we are confident that cultural resources are not present at these locations.

CULTURAL RESOURCES

Q47. (ER Section 2.6). Provide a detailed description of the settlement-subsistence system for all cultural phases known in the nearby area and a correlation of site-type, cultural-phase, and environmental setting over time.

R47. The requested information is included in a manuscript transmitted to NRC by letter dated September 12, 1980. This manuscript deals with the settlement of the Central Brazos River Basin and will be published in Plains Anthropologist in 1981. The major occupation of Squaw Creek was during the Late Archaic which agrees directly with the cultural/environmental interpetation offered in this article.

CULTURAL RESOURCES

Q48. (ER Section 2.6). Describe the natural resources, or locations on the plant properties of cultural or religious importance to Native Americans living in/or utilizing the nearby area, if any. Provide a detailed description of the structure, function and current condition of all of the cultural resource sites that have been located on the plant properties.

R48. There are no sites in the plant site which are claimed by any living groups of Native Americans. These cultural resources within the project area are described in two reports (Skinner and Humphreys 1973, Gallagher and Bearden 1976). Most of the prehistoric sites were studied during the initial comprehensive survey and the Hopewell School Site was excavated to mitigate its loss in 1974. The May House (see pp. 14-17 of Skinner and Humphreys 1973, Appendix A of the Original ER) has not been impacted by construction of the dam or lake. The house is no longer occupied but is not showing any appreciable deterioration. The majority of the remaining site locations are currently underwater.

CULTURAL RESOURCES

Q49. (ER Section 3.6). Provide a detailed description of the research design developed for site identification and all methods utilized in the field reconnaissance. Describe the kinds of strategies utilized in areas with different topographic and vegetational settings.

R49. The research design which guided the study was based primarily upon earlier work at DeCordova Bend Reservoir (Lake Granbury-Skinner 1971, 1969) and at Lake Whitney in 1971 (Skinner and Gallagher 1974). Survey was done by crews which swept across the land with an average spread of 30-50 m between individuals. Much of the land was in pasture or had been planted and ground exposure was fairly good. Exposure was particularly good because the weather was so dry that vegetation had burned off. Besides good surface exposure the sediment was shallow on the slopes and in the uplands where soil was usually less than 20 cm thick. Consequently shovel testing or augering was not needed to locate sites.

CULTURAL RESOURCES

Q50. Provide a detailed description of the criterion used to evaluate the sites according to the four levels of data need presented on pages 2.6-4 and 2.6-5. What levels of data have been collected from the sites that still remain on the plant properties?

R50. Except for excavation of the Hopewell School Site which was conducted in 1974, mitigation of site loss consisted of controlled surface collection (Sites 41SV40) and collection of surface artifacts at the remaining archaeological sites. The prehistoric sites located on the plant site have been thoroughly explored and their loss mitigated during the 1972 and 1974 investigations. The only data that might be collected would be Historic American Building Survey (HABS) drawings of the May House. A decision to do this depends upon discussions between the Applicant and the Texas Historical Commission.

CULTURAL RESOURCES

Q51. (ER Section 4.1). Discuss the specific plans for reducing aesthetic impacts of CPSES site and along the associated transmission corridors.

R51. Plans for reducing adverse aesthetic impacts will consist primarily of landscaping and revegetation of the main plant island vicinity. Topsoil in sufficient quantities to accomplish this has been stockpiled on site for later use. Specific details regarding this activity have not been developed at this time, but it is expected that appropriate soil conditioners and fertilizers will be used if required to establish native grasses which will be compatible with the surrounding area.

Transmission line corridors will not receive any special treatment, but will be allowed to revert to their pre-construction condition. Herbicides will not be used to clear growth along the rights-of-way unless essential to remove growth from the power lines. It is anticipated that there will be a very remote likelihood of having to resort to this type of treatment due to the sparseness of any heavy concentration of vegetation in this rural area.

HYDROLOGY

Q52. ER-OL, Figure 3.4-10. Please provide a more legible figure showing the profile of the equalization channel (safe shutdown spillway for mini dam).

R52. A full size drawing of the portion of Figure 3.4-10 showing the equalization channel profile was provided at the August 3, 1980 site visit.

HYDROLOGY

Q53. ER-OL, page 3.4-5, Section 3.4.2.2. Please indicate the service water temperature rise and perform the thermal plume analysis for SSI during the normal operation of the station.

R53. A copy of a report entitled HYDROTHERMAL SIMULATIONS OF COMANCHE PEAK SAFE SHUTDOWN INPOUNDMENT, May 1980 was provided at the August 4, 1980 meeting. This report is the basis for AMENDMENT 10 to the ultimate heat sink analysis in FSAR Section 9.2.5. The information requested is included in the May 1980 report and FSAR Section 9.2.5.

HYDROLOGY

Q54. ER-OL, page 3.4-5. Please discuss the effects on the water temperature in the SSI due to the possible thermal wedge intrusion of the Panther Branch Arm of the SCR through equalization channel.

R54. For reasons discussed below, the effect on SSI temperature due to thermal wedge intrusion is inconsequential.

The equalization channel was analized for a density wedge due to warmer water from Panther Branch arm intruding over the cooler outflow of the SSI. The analysis assumed a high pool elevation of 775 and channel invert of 700, and a net flow out of the SSI of 13,000 gpm. The analysis showed that for these conditions, the density wedge may just reach the SSI end of the equalization channel as a thin layer of warm water.

The normal operating practice is to keep the reservoir level about two feet lower than the maximum 775. The lower level reduces the channel cross-section which increases the SSI outflow velocity, and decreases the depth and hence horizontal pressure gradient due to density at the mouth of the canal. These result in a reduction of wedge length into the equalization channel.

The heat carried into the SSI by a density wedge in the equalization channel from the warmer Panther Branch would have to be mixed into the SSI to cause any effects on the water temperature in the SSI. Since the wedge extends into the channel and not the SSI at high water level, mixing of the wedge heat would be with the SSI overflow after leaving the SSI, and the SSI temperatures would not be affected.

For extreme conditions of low flows out of the SSI, when a wedge may extend into the impoundment, the effect on temperatures is dictated by the amount of heat convected into the SSI by the wedge. The convective circulation in the wedge would not extend below the equalization channel invert and is very limited at transporting heat into the SSI. This heat would be a small fraction of the service water heat and would be dissipated to the atmosphere.

The difference in temperature between Panther Branch arm and the SSI is lower than that determined from the condenser cooling water discharge temperature. The condenser cooling water discharge mixes rapidly in Panther Branch arm as it flows toward Squaw Creek Reservoir. A portion of this water mixes up another arm toward the equalization channel and is cooler than the condenser discharge temperature due to mixing and cooling. A lower Panther Branch temperature at the end of the equalization channel further reduces the potential effect of a density wedge on SSI temperature.

HYDROLOGY

Q55. ER-OL, page 3.4-5, Section 3.4.3.1. The circulating water system as presented in ER-CP has been modified at several locations including but not limited to the discharge tunnel and the discharge channel. However, the data presented in Table 3.4-5 in the ER-OL do not reflect these modifications. The position numbers given in the table do not correspond to the numbers shown on Figure 3.4-14 in the ER-OL. Several number mentioned on page 3.4-5 in the ER-OL describing the discharge channel design are also different from the numbers shown on Figure 3.4-5 in the ER-OL. Please clarify these discrepancies.

R55. See revised Section 3.4.3.1, revised Table 3.4-5 and revised Figures 3.4-5 and 3.4-14.

HYDROLOGY

Q56. ER-OL, page 3.4-5, Section 3.4.3.1. Please provide a schematic diagram showing the design details of the discharge tunnels and also describe the material used for constructing the discharge channel floor.

R56. See revised Section 3.4.3.1 and revised Figure 3.4-5.

WATER QUALITY

Q57. (ER Section 3.6.2.3)-Provide the thickness of the clay liner in the evaporation pond and the permeability through the liner in mm/sec. Estimate the permeability increase of the liner due to leaching of the chemicals discharged to the evaporation pond and provide the basis for the estimate.

R57. The evaporation ponds clay liner has a minimum thickness of 3 feet. There were no direct measurements of permeability recorded. Quality control records indicate that the clay has a mean plasticity index of 25.8 and a mean liquid limit of 41.9.

The Applicants investigation has revealed no indication that the clay liner will be adversely affected by any of the chemicals listed (see response to Q58) to be discharged to the evaporation ponds. In the event any chemicals other than those listed are to be discharded to the evaporation pond the Applicant will investigate their effect on the liner.

WATER QUALITY

Q58. (ER Section 3.6.2.3)-Provide an updated list of chemicals discharged to the evaporation pond following determination of RCRA compliance. For any contaminants, previously identified as being routed to the evaporation which cannot be disposed of in that manner, describe the agreed upon method of treatment and disposal. Include method of treatment and disposal. In the treatment description, include the concentrations of these contaminants in waste streams, treasted effluent, and receiving body, and frequency of discharges.

R58. Revised Table 3.6-3 includes a list of the chemicals which will be discharged to the evaporation ponds. The Applicant's RECRA compliance review has not identified any material that was to be discharged to the evaporation ponds that cannot be disposed of in that manner.

WATER QUALITY

Q59. Discuss ultimate fate of treated waste from the CPSES' evaporation ponds. Indicate anticipated frequency of material removal from the evaporation ponds. (ER-OL, Sec. 3.7; Sec. 5.4, p. 5.4-1; Sec. 6.2.2, p. 6.2-1).

R59. Presently TUGCO has no plans for removing the waste material from the evaporation ponds. The ultimate fate of the waste material will be determined as a part of plant decommissioning. If interim removal of waste material is required, TUGCO will contract with a liscensed commercial contractor for removal, transportation and treatment/disposal in accordance with RCRA requirements.

WATER QUALITY

Q60. (ER Section 3.6.2.4)-Describe possible pathways of hydrazine release from the secondary cooling water system into the environment. Estimate the amount released in each pathway and concentration in the receiving body. Identify any mitigating measures for each pathway.

R60. There is no pathway for the release of hydrazine to the environment. Any leakage/spills of hydrazine containing material will drain to the turbine building sumps which will be routed to the evaporation ponds. Table 3.6-3 estimates the amounts of hydrazine released to these evaporation ponds.

WATER QUALITY

Q61. Specify the organic corrosion inhibitor listed in Table 3.6-1 of the OL-ER, and if available, the EPA registration number.

R61. No organic corrosion inhibitor will be used as indicated by Table 3.6-1. The corrosion inhibitor used will be Calgon's CS. The composition is 72% sodium nitrite and 28% Borax.

See revised Table 3.6-1.

WATER QUALITY

Q62. (ER Section 3.6)-Estimate the amount of copper released to Squaw Creek Reservoir as a result of corrosion/erosion. Provide the basis for the estimate.

R62. The exact amount of copper that will be released to Squaw Creek Reservoir is not known. In order to make an estimate though a search was made for any published work that addressed this type of question.

The investigation turned up a study performed by S.F. Hager and J.M. Popplewell who presented their work entitled "Copper Ion Pickup in Recirculating Cooling Tower Systems" to the Cooling Tower Institute Meeting in Houston, Texas on January 30 - February 1, 1977. Their study showed that for the plants that they monitored the copper release rate was greatest when a new plant first starts up (1 mil per year) and then decreased to a steady state (less than 0.1 mils per year) after approximately a month. For Comanche Peak SES that would mean an initial release rate of copper of approximately 32,900,000 grams per year decreasing after a month to less than 3,290,000 grams per year.

It should be emphasized that the plants studied by Hager and Popplewell differ from Comanche Peak SES in that they ed recirculating cooling systems with cooling towers ead of once through cooling. Also the water at Comanche Peak SES is probably less corrosive since it is not sea water as at the plants studied and its Langelier and Ryznar Indexes indicate optimum conditions against corrosion.

WATER QUALITY

Q63. (ER Section 3.6)-The following chemicals, cyclohexylamine, sodium phosphate, lithium hydroxide, and detergents, are identified in the CP-ER, but not in the OL-ER. If these chemicals will be used during operation, identify source of use and amount consumed, frequency of discharge, concentrations in system water and waste streams, release point, and estimate increase in concentration in the receiving body.

R63. Of the chemicals listed above, only lithium hydroxide will be used during operation. It will be used in the reactor coolant system for pH control and will not be released by any waste streams. Any detergents that may be used in the laundry system will be processed as discussed in Section 3.5.2.2.4.

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 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.

AQUATIC ECOLOGY

Q65. Discuss plans to monitor SCR during operation of the CPSES until such time as the reservoir becomes part of a public recreational area.

R65. There are no plans on the part of the Applicant at this time to monitor and manage the aquatic resources of Squaw Creek Reservoir. The right and responsibility for this function is the sole jurisdiction of the State of Texas. In the event that the Texas Parks and Wildlife Department elects to delegate the authority for reservoir management to the Applicant, a suitable program will be developed for review by the appropriate agencies.

AQUATIC ECOLOGY

Q66. Lake Granbury is reported to be "brackish" because of its high salinity. In view of this condition, show what changes are to be expected in Lake Granbury salinity as a result of a return flow from SCR. ER-OL, pp. 5.1-4; Appendix "D" of Original ER; Aquatic - p. 299.

R66. A detailed discussion of the expected impacts on Lake Granbury due to the return flow from SCR was presented in Appendix E of the Original ER. Included is a report covering a comprehensive modeling study prepared by Water Resources Engineers entitled An Analysis of the Effects of the Squaw Creek Reservoir Blowdown Plumes on Lake Granbury, November, 1973, which illustrates the behavior of temperature, dissolved oxygen, and dissolved solids plumes in Lake Granbury.

AQUATIC ECOLOGY

Q67. Provide the level of concentration of chlorine (TRC) that will be released via the CPSES effluent into the Squaw Creek Reservoir (SCR), according to the latest information. ER-OL Sec. 3.6; 3.7; 5.1.3.3, on p. 5.1-7, 6.2.2; Environ. Tech. Spec. Sec. 4.1.

R67. The Applicant has completed the development of plans for an operational program to determine the minimum effective level of chlorination required. This study program will go into effect during the first year of operation and the details and procedures have been approved by the Environmental Protection Agency. A copy of this program has been furnished to NRC. By letter dated June 11, 1979, Mr. Ronald Ballard of NRC acknowledged receipt, from Region IV EPA, of the CPSES chlorine minimization plan and transmitted NRC's comments. In addition, it should be emphasized that chlorine concentrations will be restricted in any event to the limitations set forth in the NPDES permit.

AQUATIC ECOLOGY

Q68. Describe the extremes of temperature and salinity to be expected in the SCR and Lake Granbury as a result of operation of CPSES, (e.g., low and high flow, low/high temperature, low/high salinity and combinations thereof superimposed on extremes of power plant operation). Orginal ER-5.1, 5.2.

R68. A comprehensive analysis of the expected behavior of temperature, dissolved oxygen and dissolved oxygen plumes in both Squaw Creek Reservoir and Lake Granbury was presented in Appendix E of the Original ER. Included therein are the following reports:

1. A Technical Assessment of the Impact of the Comanche Peak Steam Electric Station on the Proposed Squaw Creek Reservoir, Water Resources Engineers, November 1973.

2. An Analysis of the Effects of the Squaw Creek Reservoir Blowdown Plumes on Lake Granbury, Water Resources Engineers, November 1973.

AQUATIC ECOLOGY

Q69. Describe the access, if any, that the public will have to Squaw Creek Reservoir for recreational purposes. Indicate the limitations on recreational activities.

R69. Plans for recreational use of Squaw Creek Reservoir have not been finalized at this time. It is anticipated that a portion of the property along the eastern shoreline of the reservoir will be made available to a governmental or regulatory agency for development into a public recreational facility. The extent of such activities will be determined at that time by the agency involved and such usage will be limited to the portions of the reservoir not restricted by buoy lines. Details concerning recreational activities will be made available when they have been finalized.

TERRESTRIAL ECOLOGY - LAND USE

Q70. Land use is mainly discussed in Section 3.9-5 to 3.9-9 of the ER-OL but it did not mention any cooperative agreements with land owners and land use restrictions on right-of-way associated with CPSES. Please provide a description of right-of-way agreement.

R70. The standard easement, a copy of which was provided by letter dated September 12, 1980, provides for a continuing use of land for ranching and general agricultural purposes. Buildings and other improvements that would interfere with the safe operation of the transmission line are not allowed, and trees that may interfere have been removed or trimmed. These provisions have been implemented and the land uses as noted above are continuing. Over 83% of the ROW was used for crops and ranching prior to construction of the lines, and this operation is continuing at this time. Separate agreements were not necessary as this is allowed under the terms of the easement.

TERRESTRIAL ECOLOGY - LAND USE

Q71. Provide information on management of undeveloped parts of the site and transmission corridors during the lifetime of the plant.

R71. The Applicant has no plans to develop any undeveloped parts of the site and transmission corridors during the lifetime of the plant. The only exception is the development of a park for recreational use. See response to question 69. The management of transmission corridors is discussed in the responses to questions 70 and 73. Except as noted above, the undeveloped parts of the site and transmission corridors will be left in or allowed to return to the natural state.

TERRESTRIAL ECOLOGY - LAND USE

Q72. (ER Section 3.9) Describe any additional transmission lines not described in the ER-OL directly associated with CPSES that will be constructed during lifetime of the plant. ER-OL 4.2-5.

R72. All transmission lines directly associated with CPSES that will be (or have been) constructed during the lifetime of the plant are discussed in Section 3.9.

It is planned that an additional tie to the existing transmission system to the Southwest will be made from the CPSES switchyard in 1983 or later as system loads require a transmission reinforcement. Such a tie would involve a transmission line from Comanche Peak Switchyard to Comanche Switching Station. This additional tie is not considered to be part of the Comanche Peak project. It is planned for system requirements and will be connected at the CPSES switchyard because it is a convenient location.

TERRESTRIAL ECOLOGY - LAND USE

Q73. (ER Section 3.9.1.3) Indicate which herbicides are/will be used along transmission line right-of-way. Provide the EPA registration number of the herbicides, and any restrictions for using them. Indicate who will be responsible for the application of the herbicides and their qualification requirements. Indicate how, and how often and when (what time of year) they are to be applied. Indicate which pesticides are/will be used on site and along right-of-way. Identify state regulations and/or permits requirements for use of the herbicides and pesticides to be applied. ER-OL 4.2-10.

R73. Section 3.9.3 indicates that herbicides may be used along transmission right-of-way. Our use of herbicides is confined to direct individual application to a specific tree as it becomes a problem in the safe operation of our lines. In this manner we now use TORDON 101R EPA #464-510. There are no restrictions for the use of this herbicide, and no state permits are required. GUARDSMAN 2413 EPA #1706-125-AA-550 is now used inside fenced areas of switching station yards. We do not use pesticides on the yard or on the right-of-way.

The Texas Electric Service Company Fort Worth Transmission Division is responsible for the application of these chemicals.

TERRESTRIAL ECOLOGY - LAND USE

Q74. (ER Section 3.9) Describe the measures that have been or will be undertaken to insure that the transmission lines do not interfere with irrigation and crop dusting activities.

R74. The routing of the lines is such that only 16% of the ROW acreage is utilized as cropland, and on a substantial portion of this the lines pass along the edge of small fields or the terrain is such that it is not generally suitable for irrigation. Thus, transmission line interference with irrigation and crop dusting is minimized by its location and the surrounding terrain.

TERRESTRIAL ECOLOGY - LAND USE

Q75. (ER Section 4.1) Give details for monitoring and mitigating erosion problems during lifetime of plant. Describe the extent to which native vegetation has been seeded. Provide documentation on the success of seeding these grasses. Provide a replanting schedule (if available). ER-OL Section 3.3, 3.4, 4.0.

R75. As site construction is completed the topsoil saved during the clearing phase of construction will be respread on appropriate areas of the site pennisula to provide suitable habitat for revegatation. The topsoil will be distributed at the proper time and placed so as to minimize the potential for erasion. In addition a landscaping and planting program will follow the distribution of the topsoil as soon as practicable in order to minimize wind and water erasion.

TUGCO will confer with individuals such as the local county agricultural agents or other horticulture specialist to plan for the landscaping of the CPSES site. Emphasis will be placed on planting vegetation that is best suited for the existing soil and climate conditions. Native species will be preferred.

Since the majority of site reclamation will be accomplished at a future date, records for seeding of grasses exist for only minor areas such as grasses that were planted around the evaporation ponds and grasses planted along the service water discharge channel.

Future planting activities will be documented and records filed. After landscaping and planting is complete, aerial photographs will be made of the site area to document the success of the reclamation project.

TERRESTRIAL ECOLOGY - LAND USE

Q76. (ER Section 4.2) Describe the safety measures which were undertaken to ensure that metal structures such as fences, barns, buildings, etc. near the activated transmission lines are adequately grounded to preclude electrical shock hazards.

R76. Computer studies validated by actual field measurements show that objects off the right-of-way would generally be of such a distance from the lines that there would be no shock hazard. Structures near the right-of-way and fences on or near the right-of-way have been checked and their ground resistance measured where there is any question as to safety. Any structure that would appear to be a hazard has been grounded with a driven ground rod.

TERRESTRIAL ECOLOGY - LAND USE

Q77. (ER Section 4.2) Indicate the status, percent completion, and construction schedule of the transmission lines associated with CPSES. Describe any special construction techniques (e.g. at long over-water crossing, stream bed crossing, pipeline crossings) to be used for the transmission line and indicate where their use will be necessary.

R77. Construction of the transmission lines involved in this project is complete. Design, construction, and clearing techniques that minimize the lines' impact on the area were used--such as limited clearing, no permanent private access roads, maximum ruling span design, parallel construction with existing lines where applicable, and selected routing to miss populated areas.

TERRESTRIAL ECOLOGY - LAND USE

Q78. Please provide the following references from Section 2.5.7 of the ER:

Shubert, D. H., 1969, Increased Seismicity in Texas: Texas Journal of Science, Vol. 21, pp. 37-41.

Sellards, E.H., 1935, Balcones Zones of Faulting and Folding: The University of Texas Bulletin No. 3201.

R78. Copies of the requested references were transmitted by letter dated September 12, 1980. The Sellards, 1935 reference was incorrectly listed as U.T. Bulletin No. 3201. This should be Bulletin No. 3401. Section 2.5 has been corrected.

TERRESTRIAL ECOLOGY - LAND USE

Q79. Please provide an update of the record of seismic activity within a 250m radius of CPSES. Indicate the magnitude, frequency and location of the epicenter of the events that have occurred since the drafting of Figure 2.5-1 in the ER.

R79. The Applicant has requested the above information from the Earthquake Information Center, National Oceanographic and Atmospheric Administration, Denver, Colorado.

Q350.1 The record from the CP stage indicates no involvement of endangered species of plants or animals with this project, however, staff is unable to rely exclusively on that record for the OL review since new regulations and new listings have been published in the interim. Thus, you should update your analysis of endangered species in sufficient detail to enable the staff to determine whether the actions which remain to be taken on this project could affect listed species. This action does not necessarily involve a large scale effort, however, early resolution is advised since formal NRC consultation with Fish and Wildlife Service would be mandatory under new regulations if a possible effect were found.

R350.1 Applicable notices and regulations are regularly reviewed to determine whether listed endangered species might be affected by project activities. See Section 2.2.2.6. To update endangered species information, the Applicant had the report in Appendix 2.2A prepared. 1

Q371.01 On a suitable map, provide delineations of the one percent chance floodplains for all watercourses altered or affected by construction and operation of the plant and/or appurtenant structures. Identify and describe the location of all facilities within the one percent chance floodplains. Include a floodplain delineation for conditions prior to initiation of plant construction and one for conditions expected when the plant is in operation. Additionally, if expected conditions during construction would result in greater flooding of neighboring land than during the operational phase, provide similar information for the construction period. Also, provide water surface and thalweg profiles and all cross sections used to compute flood depths.

Provide details of your methods of analyses. Include your assumptions of and bases for pertinent parameters such as length and slope of drainage basins, times of concentration, infiltration rates, rainfall amounts and distribution, Manning's "n" values and any other assumptions or parameters used to determine the floodplains.

In some circumstances, floodplain delineation by others may be acceptable. Specifically, if studies by the U. S. Department of Housing and Urban Development, Federal Insurance Administration or the Corps of Engineers are available for the site area, the details of analyses requested above need not be supplied; provide instead the reports from which you obtained the floodplain information.

R371.01 See revised Section 12.1.1.4.