INSTRUCTIONS FOR ADDING REVISION 11 TO THE MIDLAND PLANT ENVIRONMENTAL REPORT

This Revision 11 to the Environmental Report (ER) of the Midland Plant consists of pages that are to be inserted into your copy of the ER.

Vertical bars in the margin indicate the location of the revisions in text and tables. Pages without bars are either unchanged pages furnished for continuity or contain minor spelling or editorial corrections which do not change the text content. The pages to be removed and inserted are as follows:

REMOVED	INSERT
Volume 1	
After Tab, LOEP-1 thru LOEP-11	After Tab, Letter and LOEP-1 thru LOEP-11
1-i thru 1-iii	1-i thru 1-iii
1.1-1 thru 1.1-32	1.1-1 thru 1.1-39
Tables 1.1-1 thru 1.1-14	Tables 1.1-1 thru 1.1-14
Figures 1.1-1 thru 1.1-3	Figures 1.1-1 thru 1.1-3
1.3-1/1.3-2	1.3-1/1.3-2
Tbl 1.3-1/1.3-2	Tbl 1.3-1/1.3-2
2-i/2-ii	2-i/2-ii
2-v/2-vi	2-v/2-vi
Tables 2.1-9/2.1-10	Tables 2.1-9/2.1-10
2.2-15 thru 2.2-21	2.2-15 thru 2.2-24
2.2R-1/2.2R-2	2.2R-1 thru 2.2R-3
2.5-5/2.5-6	2.5-5/2.5-6
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2.7-1/2.7-2	2.7-1/2.7-2
3-iii/3-iv	3-iii/3-iv
3.3-1/3.3-1a	3.3-1/3.3-1a
Tables 3.4-7/3.4-8	Tables 3.4-7/3.4-8
3.6-1/3.6-2	3.6-1/3.6-2
3.7-3 thru 3.7-5	3.7-3 thru 3.7-5
3.9-7/3.9-8	3.9-7 3.9-8
4.2-1 thru 4.2-8	4.2-1 thru 4.2-8
Table 4.2-1	Table 4.2-1
Table 5.8-1	Table 5.8-1

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REMOVED	INSERT
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6.2A-3-7/6.2A-3-8	6.2A-3-7/6.2A-3-8
6.3-9	6.3-9
6.4-1	6.4-1
Table 6.4-1	Tables 6.4-1/6.4-2
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8.2-1 thru 8.2-3	8.2-1 thru 8.2-4
--	Tables 8.2-1/8.2-2
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11-i/11-ii	11-i/11-ii
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11R-1	--
13.2-7 thru 13.2-12	13.2-7 thru 13.2-12
13.8-1	13.8-1
13.11-1	--
Q&R-i thru Q&R-iii	Q&R-i thru Q&R-iii
ARC 11-1	ARC 11-1
B-C 1a-1,2	B-C 1a-1,2
B-C 1b-1	B-C 1b-1
B-C 1c-1 thru B-C 1c-6	B-C 1c-1 thru B-C 1c-6
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SOC 12-1	SOC 12-1

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Revision 2 - June 1978	06/29/78	07/05/78
Revision 3 - November 1978	11/10/78	11/16/78
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Revision 8 - April 1979	04/30/79	05/03/79
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Tbl 3.5A-4	0	Tbl 3.6-3	8	Fig 3.9-6	0
Tbl 3.5A-5	0	Tbl 3.6-4	9	Fig 3.9-7	0
Tbl 3.5A-6	0	Tbl 3.6-5	0	Fig 3.9-8	0
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1 PURPOSE OF THE FACILITY AND ASSOCIATED TRANSMISSION

2 1.1 SYSTEM DEMAND AND RELIABILITY

In 1975, Consumers Power Company served 22.1 billion kWh to approximately 1.2
11 million electric customers in the Lower Peninsula of Michigan. By 1984, when
Midland Units 1 and 2 are expected to be in service, Consumers Power estimates
2 that it will have 1.4 million electric customers on its system and that they
11 will use 30.1 billion kWh.

Consumers Power is interconnected with several utility systems within the
State of Michigan as well as in neighboring states and the Province of
Ontario, Canada. The operation of its system is closely coordinated with that
of The Detroit Edison Company. In addition, it exchanges generation planning
data with Detroit Edison. Consumers Power, Detroit Edison and other systems
from several states are members of the East Central Area Reliability Agreement
group (ECAR). The purpose of ECAR is to further augment the reliability of
2 its member systems' bulk power supply through coordination of generation and
transmission planning and operation.

1.1.0 Consumers Power Company Energy Conservation Program

Consumers Power Company has been involved in diverse activities relating to energy conservation. These activities include both extensive work with customers as well as internal actions. The Company has been and is involved in many research activities and rate studies. Details of these activities follow.

1.1.0.1 Elimination of Sales Promotion Practices

In October 1970, the Company discontinued all efforts related to promotion of sales of electric energy. The Company also discontinued the merchandising of appliances on December 31, 1972.

2 1.1.0.2 Promotion of Conservation of Electric Energy

The Company has strongly encouraged builders and customers to install
substantial ceiling, wall and floor or slab insulation as well as storm
windows and storm doors in electric-heated dwellings. The Michigan Public
11 Service Commission (MPSC) has determined the Company's insulation program for
2 residential gas customers to be the most cost efficient in the State. As of
11 July 1, 1980, over 185,000 homes have had insulation installed since the
7 inception of the program in November 1973. In Case U-5331 dated July 31,
11 1978, the MPSC established minimum insulation standards required of new
customers to qualify for electric space heating service. They include R-35 in
7 ceilings, R-11 in sidewalls, R-19 in floors above unheated areas, and R-11 in
basement walls if used as living area.

The Company presently has before the MPSC an Expanded Gas Conservation Program
that would provide interest free financing to eligible customers who wish to
install ceiling insulation. This program, when approved, is expected to
11 significantly increase the number of dwellings insulated. Adding insulation
to gas heated homes reduces the need for electric energy to operate heat
system auxiliaries such as fan motors or pumps.

A Thermoscan flyover program was held in Jackson, Michigan in spring 1977.
2 This program demonstrates the relative heat loss by building coloration on an

aerial photograph. The photo was publicized in the media and displayed at the Jackson County Fair and Company offices to acquaint Jackson residents with their relative insulation needs.

Company personnel work with "Community Action" agency programs on home
insulation for the poor and elderly and similar energy conservation problems
of these people. The Company's Energy Management Services Department, which
currently includes approximately 160 energy management consultants and
2 additional General Office specialists, has assisted customers in energy
conservation practices. In June 1977, a separate section was created in the
General Office Energy Management Services Department which has complete
responsibility for energy conservation. Customer assistance has included
meetings with residential customers on efficient use of appliances, in-plant
visits with commercial and industrial customers, participation in a State-wide
and Regional Energy Conservation Expositions, and distribution of a quarterly
11 "Energy Newsletter" to a wide variety of commercial and industrial customers
as well as architects and engineers. In 1976, the Company began publishing a
quarterly newsletter designed specifically for builders. It provides timely
information on energy supply, application and conservation of interest to
2 residential homebuilders, land developers and other related businesses such as
banking and lending institutions and building material suppliers.

To assist in providing customers with information on energy conservation, the
Company has developed and made available a wide variety of brochures including
11 the following:

A Home Insulation Service Program

Why Insulate?

Saving Energy Is A Family Affair

The Electric Heat Pump

Selection and Use of Fireplaces and Woodburning Stoves

Solar Energy

Energy Use and Buyers Guide Room Air Conditioner

Energy Use and Buyers Guide Water Heaters

11 Energy Use and Buyers Guide Dishwasher

Energy Use and Buyers Guide Ranges

Energy Use and Buyers Guide Refrigerators & Freezers

Building Energy Efficient Homes

Saving Energy and Keeping Cool

How To Prepare Your Home For The Coming Heating Season

Since 1973 approximately 4,500,000 brochures have been distributed.

In November 1978, the Company implemented a $500,000 Residential Electric
7 Customer Information Program which includes mailing conservation information
to customers along with their bills for electric service. The first of four
mailings scheduled for 1979 was completed in February in which 1,150,000
copies of the booklet, "Saving Energy Is A Family Affair," were mailed. Three
11 additional mailings in 1979 covered air conditioning, preparation for the
heating season and the National Energy Watch Program. Also, as a part of this
program, the Company has appointed a solar energy specialist in each of its
operating regions to offer advice and assistance to customers on all forms of
7 solar energy.

To further promote conservation, in 1978 the Company participated in the National Energy Watch Program which is carried out in conjunction with the

Edison Electric Institute. The basic concept of this program is to publicly
7 recognize energy efficient homes in order to encourage both builders and
owners of existing homes to bring their dwellings up to desired energy
11 efficiency standards. As stated, one mailing in 1979 promoted participation
in this program.

In addition, energy conservation is promoted through newspapers, radio and television. A column is now offered to weekly newspapers called "Crossways" and discusses efficient use of energy and related issues.

2 Efforts to conserve energy in Company buildings show 29.4% savings in electric energy and 29.7% in gas energy in the first year of that program following the 1973 oil embargo. This conservation program is a continuing activity.

In 1976, the Company implemented a program for the conversion of its
incandescent streetlighting to more efficient light sources. The Company
offers incentives to its streetlighting customers to convert incandescent
luminaires to the more efficient mercury vapor and high pressure sodium types.
High pressure sodium units are now a standard for new installations with
mercury vapor available on request. New installations of incandescent
11 streetlighting are no longer allowed. High pressure sodium units offer an
energy savings of about 80 percent over incandescents. Mercury vapor
luminaires cut energy use about 60 percent when compared to incandescents.
Total incandescent units at the beginning of 1977 numbered nearly 45,000. As
a result of the conversion program this number has been reduced by one-half.
Total kWh sales for streetlighting peaked in 1977 at 166,653,000 kWh. In
1979, streetlighting sales were 160,828,000 kWh even though the total number
of luminaires on the Company's system grew from 124,072 to 130,665. The

Company encourages its customers to use more efficient lighting types in streetlighting applications.

As part of its conservation efforts the Company tests new products to
determine their potential to help conserve energy. In 1979 and 1980 the
11 Company tested the heat pump water heater, NASA motor controller and
hydrotherm pulse combustion boilers. As a result the Company recommends to
its customers the replacement of electric resistance water heaters with the
heat pump water heater to reduce energy requirements by up to 50%.

As stated in Section 1.1.1.2, Consumers Power has factored its energy conservation experience into its forecasts as well as further energy conservation savings which it anticipates.

1.1.0.3 Energy Conservation Studies

2 The Company was one of 12 utility companies in the nation that participated in
a national heat pump study sponsored by Electric Power Research Institute and
the Association of Edison Illuminating Companies. The Company had 10
customers with heat pumps extensively submetered to assess the costs and
benefits of the heat pump as compared with alternative heating and air-
conditioning systems. Results showed the operating costs of heat pumps in the
Company test to be approximately 30% more efficient than comparable resistance
7 electric heating. The national study showed better results in warmer
climates, which was expected.

2 1.1.0.4 Measuring the Effect of Energy Conservation

Measurements have been made on an annual basis of samples of residential space
heating customers concerning their energy conservation efforts since November
1973. Electric and gas residential space heating customers continue to
11 exhibit conservation efforts since the first few months following the Arab oil
embargo, but not at the same level experienced in the winter of 1973-1974.

A special study among industrial customers, ordered by the MPSC in Case U-4576, was made to determine the potential for reduced customer usage. Many had effected some conservation prior to the survey in early 1976, all of which has been reflected in the Company's Long-Range Forecast.

2 1.1.0.5 Conservation Efforts Through Rate Design

The Company in recent years has been ordered by the Commission to institute a
flat-type rate for residential customers (November 1973) and for small
11 commercial and industrial customers (January 1975). In April 1976, the MPSC
ordered inverted rates for residential customers except residential electric
heat during the heating season. The effects of this rate on customer usage
were studied. To measure the effect of the inverted rate design, customer
usage patterns were studied following both the 1975 rate increase when a flat-
2 type rate was applied before and after the rate increase, and the 1976 rate
increase when the flat-type rate was succeeded by the inverted rate. After
both rate increases, usage patterns declined slightly, but the results did not
indicate that the decrease following the imposition of the inverted rate was
any more significant than the decrease following the rate increase with no
change in rate design.

The inverted rate concept may influence the residential customer to reduce his
2 energy consumption level, but it probably will have little or no effect on
system demand on the day of the summer system peak demand. In June 1980, the
Governor signed into effect a bill which mandates the MPSC to implement a
lifeline rate within one year for residential customers. While the stated
11 purpose of this bill is to "provide for an adequate amount of electricity for
basic household needs at a lower cost" and to "provide an economic incentive
to conserve energy resources," it remains to be seen whether these objectives
will be met.

2 Time-of-day rates have been offered for years to large commercial and
11 industrial customers by disregarding off-peak demands in the determination of
the on-peak billing demand. Of the approximately 1,600 customers eligible for
this rate, only 11 customers have consciously shifted some load to off-peak
periods, accounting for a reduction of some 100,000 kW in demand, which is
already reflected in system demand. Based on a survey conducted by Consumers
Power in early 1976 (and discussed in Section 1.1.0.4) of its large primary
commercial and industrial customers, many of them indicated that there was
little likelihood that they would shift load from peak load periods. With the
cost of electric energy generally being less than 5% of their total product or
2 operating cost, there is little incentive to make the changes necessary to
shift load.

Consumers Power Company's annual load factor is among the highest of utility companies in the country. In addition, the Ludington Pumped Storage Plant provides a further improvement to the Company's load profile so that the benefits of shifting load from on-peak to off-peak may be substantially less

for Consumers Power Company compared with other, more typical utility
2 companies without pumped storage facilities.

11 In April 1976, the MPSC ordered time-of-day energy pricing for the energy
purchases of the primary commercial and industrial customers. The Company
attempted to determine the impact of this rate on the affected customers.
While modest improvements occurred in load factor and percent on-peak
consumption, there were so many other factors impinging on customers affected
2 by this rate that ascribing this improvement to the introduction of time-of-
day rates is of doubtful validity. In comparing the periods before and after
implementation of time-of-day rates, it should be noted that the on-peak
period covers a different number of hours and some differences in time periods
during the day. In addition, economic conditions improved from one period to
the next and the energy cost differential amounted to only 0.2 cent/kWh.
(This differential was increased to 0.3 cent/kWh in 1978.)

11

In April 1977, the MPSC approved an extensive experimental program for
measuring residential and small commercial and industrial customers' responses
2 to time-of-day pricing proposed by the Company. This program involves
approximately 210 residential customers and 265 small commercial and
7 industrial customers and is covering a 24-month period. During this time the
test customers were actually be billed on the special time-of-day rates. The
test included a subsample of large use farm customers and the installation and
11 testing of electric storage heat concepts in eight residential dwellings. At
the conclusion of these studies the sample customers' usage patterns were
compared with those of a control group billed on the standard rates. This has
provided some insight into how sensitive customers are to altering their

current pattern of electric usage for the purpose of saving on their utility
2 bill. This will also allow the Company to measure the benefits, if any, that
might be realized from this pricing mechanism against the costs of
implementation. Such cost/benefit analyses are currently underway. This test
program and the controlled load experiment discussed below cost some
11 $1,200,000 to complete. The Company will be submitting evidence and testimony
concerning the cost effectiveness of time-of-day rates for residential and
small commercial customers in the next filed rate case as mandated in the MPSC
Order in Case U-6490 issued May 2, 1980.

Incorporated in the above program is a controlled load experiment. This
2 involves an on-line experiment for controlling customer loads during peaks of
system electric demand. The experiment, conducted in the Jackson area,
demonstrated that water heating loads can be controlled for up to four hours
without customer dissatisfaction. The payback load is approximately twice the
load reduction. Average diversified water heating loads range from 0.5 to
0.75 kW during peak hours. The use of 15 minute per hour controls for central
air conditioning and space heating did not result in significant load
11 reductions due to the cyclic nature of these loads. However, modest
reductions in large commercial air-conditioning loads can be achieved when
outdoor temperatures exceed 76 degrees. The Company will be submitting
evidence and testimony concerning the cost effectiveness of interruptible air
conditioning and water heating rates for residential and small commercial
customers in the next filed rate case as mandated in MPSC Order in Case U-6490
issued May 2, 1980.

11 The MPSC ordered the Company and Detroit Edison as follows (Cases U-4576 and U-4570, respectively):

> Residential loads shall be analyzed with respect to price elasticity on average for applicants' service area. The analysis shall consider breakdowns for loads of less than 500 kWh per month, for loads of 500 to 1,000 kWh per month, and for loads in excess of 1,000 kWh per month. In addition, interstate comparisons of residential loads at different price
> 2 levels shall be submitted.

The two companies hired Economic Analysts, a division of Equitable Environmental Health, Inc from Park Ridge, Illinois as consultants.

There have been many studies in the past 15 to 20 years to determine the numerical magnitude of the elasticity coefficients. These studies have
11 resulted in a variety or short-run and long-run elasticities. There are numerous problems in applying the results of these studies to current conditions and to the Consumers Power system. The primary problems are: first, it is questionable to use aggregate data covering many utility areas, rather than specific systems; second, that the data included and the resulting elasticities were measured during periods of declining energy prices and thus indicated the amount of increase in energy consumption per decrease in price,
2 there being inadequate evidence to establish that once the customer's usage pattern has been set at a higher level, he would decrease consumption due to higher energy prices at the same rate at which consumption was increased; third, that elasticities have not been developed for customers at differing levels of electricity consumption; and finally, questions of how to measure the price variable.

The findings of the consultant, while developing short-run price coefficients which were in close agreement for the two companies and in the general range of values found in other studies, could not show that these price coefficients were true measures of price elasticity. Because of the declining block rate structure and little variation in price during the period under study, the consultants could not establish a measure of price elasticity.

Marginal Cost Pricing attempts to provide the customer with information 2 regarding his cost of the next unit of energy purchased. The customer cost would reflect the utility's cost of adding a new generating facility or purchasing high-cost power. One of the many problems is that utilities are governed by historical revenue constraints and once marginal cost rates are scaled back to fit this constraint, the resulting rate really is not priced at 11 marginal costs. The MPSC, in Order U-4840, stated that this method of pricing "...in a practical sense can accomplish little more in the way of providing correct price signals to the consumer than the current revenue requirement method."

Those advocates of marginal cost pricing anticipate that energy users faced with the higher marginal costs may reduce their energy consumption. However, on summer system peak demand days, which generally occur on the hottest weekday of the summer, customers are likely to run their air-conditioners and 2 other cooling loads with little regard for the price. The Company will in all probability experience what are commonly referred to as "needle peaks" that would be essentially of the same magnitude as peaks created under conventional embedded cost ratemaking philosophy.

In December 1974, the National Association of Regulatory Utility Commissioners (NARUC) at its annual convention passed Resolution 9 which called for the Edison Electric Institute (EEI) and the Electric Power Research Institute

(EPRI) to conduct a joint study "of the technology and cost of time-of-day metering and electronic methods of controlling peak-period usage of electricity and also a study of the feasibility and cost of shifting various types of usage from peak to off-peak periods."

2 The first phase of this project was funded by EPRI at approximately $1,000,000 and was directed by the Project Committee through a full-time executive director. The study representation came from investor-owned utilities, American Public Power Association, National Rural Electric Cooperative Association, National Association of Regulatory Utility Commissioners and others.

11

All of the task force findings have been published and a summary report was issued in early November 1977. There were four recommendations for the future as follows, with certain members of the Project Committee exhibiting disagreement in general and specific disagreement with Item d:

(a) Additional research is needed.

2 (b) Regulators and utility managers should evaluate the cost-effectiveness of time-differentiated rates and load controls.

(c) When an evaluation shows that benefits exceed costs, load management strategies normally should be implemented gradually.

(d) Rates should reflect marginal costs to the extent possible.

Most of the Project Committee rejected Item d on the basis that the research in the report did not support the recommendation. 2

A second phase of the study calling for a more in-depth study of certain phases of the issues has been completed and while no additional conclusions have been drawn, many of the issues being studied were mandated by the National Energy Act and more specifically PURPA (Public Utility Regulatory Policies Act). This legislation, passed in November 1978, covered every electric utility with retail sales in excess of 500 million kWh annually. It stipulated that each utility should study and/or implement certain ratemaking standards. These were:

(a) Cost of service based rates

(b) Prohibition of declining block rates except wehre cost justified

11 (c) Implement time-of-day rates where cost justified

(d) Implement seasonal rates where cost justified

(e) Implement interruptible rate

(f) Implement load management where cost effective

(g) Implement a lifeline rate unless determined through an evidentiary hearing that it should not be.

In addition to the above ratemaking standards each utility must meet certain standards related to master metering, automatic adjustment clauses, customer information termination of service and advertising. While Michigan and Consumers Power Company are already essentially in compliance with each of

11 these standards it will remain to be seen what transpires as a result of the
state ordered generic hearings dealing with each of these standards.

Customer reaction to changes in design of rates as well as changes in levels
of rates is an extremely complex subject and cannot be simplistically
2 resolved. Given a residential customer's mix of appliances, it is difficult
to change his patterns of use unless he perceives significant benefits. An
annual study at Consumers Power shows the average residential nonelectric
11 heating customer is currently using only 1.42 percent of his effective buying
7 income for his annual electricity purchases. This ratio has varied since 1961
11 from a low of 1.14 percent in 1968 and 1972 to a high of 1.55 percent in 1961.
This means that electricity is not a major cost item in his budget nor has it
2 increased significantly in relationship to his effective buying income over
the past 18 years.

11

The Company's study of time-of-day rates, which has just been completed,
should show the customer's propensity to voluntarily defer use of a portion of
his electric consumption to an off-peak period. However, there are many who
view with scepticism the ability of a customer to voluntarily defer loads such
as air conditioning, cooking, television, lighting and water heating. That
customer may defer some loads or may reduce his level of use but either of
2 these actions may have little or no effect on his use of electricity at the
time of the utility system peak demand.

1.1.0.6 Implications of Energy Conservation for Consumers Power Load Forecast

Consumers Power has been involved in many projects, which are discussed above,
to encourage energy conservation among its customers. Beginning in 1973,

there has been evidence that customers are responding to such programs. The
effect of those efforts has been incorporated in the Company's current long-
2 range forecast. Additional rate design incentives to conserve energy and
reduce peak loads have also been instituted during this period, including the
flat-rate concept for small commercial and industrial customers, time-of-day
11 pricing for residential space heating, large farms and large commercial and
industrial customers and, more recently, an inverted rate structure for
2 residential customers. Significant increases in overall rate levels have also
occurred during this period. Such stimuli have modified the increase in
11 consumption levels which has been reflected in the Company's forecasts.

Only through radical increases in rate levels, along with the application of
radically new rate structures which dramatically change historical price/usage
relationships, are further significant changes in usage patterns likely to
occur. The Michigan Public Service Commission is unlikely to permit radical
price increases and its concern with the effect that radical changes in rate
2 structures may have on the economy of the State, particularly its concern that
industry could be driven out of Michigan, will in all likelihood cause it to
take a cautious and moderate approach toward such changes. Consequently,
Consumers Power believes that consumption patterns are very unlikely to
deviate substantially from those currently projected and reflected in its
forecasts for the period through the early 1980s.

1.1.1 Load Characteristics

1.1.1.1 Load Analysis

2 Historical peak load data and forecasted peak loads are listed in Table 1.1-1 for the years 1966 through 1995. Data are shown for Consumers Power alone, combined with Detroit Edison, and for ECAR. Table 1.1-2 lists historical and projected energy requirements for the same period.

11

Figure 1.1-1 shows Consumers Power's load duration curve for the year 1978.
2 Current peak demand and energy forecasts support the extension of this data to
11 1983 and 1984 conditions without significant modification.

1.1.1.2 Demand Projections

The projections of peak demand and energy requirements appearing in Tables 1.1-1 and 1.1-2 are based upon forecasted energy sales to customers. Table 1.1-3 lists historical and projected sales to ultimate customers for the period 1966 through 1995.

1.1.1.2.1 Consumers Power Company Forecasting Policy and Procedures

General

The official forecasts of both future energy sales and peak demand for Consumers Power Company are approved and issued by the Energy Forecast Executive Review Committee (EFERC). The membership of the committee consists of the Company president as committee chairman and several other Company officers as committee members. The approved forecasts which are used in budget preparation and other planning activities are updated annually and on interim bases as required. The data are documented and distributed by means of a forecast data book and recorded in the minutes of the EFERC meetings. Any Company document or study utilizing future projections of energy sales or demand should reference the forecast currently in effect or should explicitly state that the official forecast was not utilized and what assumptions were. Long-term and short-term forecasts are prepared separately and treated independently because of their different end uses. The gas and electric forecasts are prepared and reviewed in a generally similar manner except that gas demand is currently not considered to exert any major constraints on the Company's operations. However, the long-term forecast must examine gas demand as well as any possible supply limitations.

Short-Term Forecast

Short-term forecasts for the next two years are prepared for gas sales and both electric sales and demand. The short-term forecast encompasses the upcoming budget year and the planning year beyond, and has as its starting point the current sales and demand data at the time the forecast is submitted for review. The yearly update of the short-term forecast is presented to the EFERC in August in order that the new short-term forecast can be incorporated in the detailed budget review and corporate revenue projections that follow.

The short-term forecast is divided into monthly segments and as such, includes monthly variations due to the seasonal effects as established by the average weather trends over the last 30 years. Also included would be any cyclic variations in the business cycle as predicted by whatever short-term economic projections are being utilized. In addition, the short-term forecast incorporates information obtained from the most recent planning projections from the Company's major customers.

The Customer Services Department has the responsibility for the preparation of the short-term forecast. The System Planning Department provides the load factor projections as input for converting the sales forecast data to peak demand.

Long-Term Forecast

The long-term forecast currently extends 15 years into the future on an official basis for the projections of electric and gas energy sales and electric peak demand. This forecast is extended further on an unofficial basis in order to support certain very long-range planning activities.

The long-term forecast is constructed by identifying the factors which determine the major trends in average, annual growth rate. These trends may be expressed over intervals of 5, 10, or 15 years depending on the assessment of major variations in future conditions. By employing a general trending approach, the long-term forecast does not include yearly fluctuations due to business cycle effects. In addition, since the time increment of the long-term forecast is years, no seasonal weather variations are included. The long-term forecast takes as its point of departure the Company's current send-out and demand data at the time the forecast is prepared and, therefore, there will be some overlap with the short-term forecast. Since each forecast has its own specific uses and techniques, the separate results for the overlap period are not expected to be identical. However, the comparison of this common data can be used as a rough, independent cross-check of consistency between the two forecast methodologies.

Preparation of the long-term forecast is the responsibility of the Energy Planning Department which obtains inputs and specific analyses from various
11 sources within and outside the Company as required. For example, projections of future system load factors are supplied by the Energy Control Department and general economic forecasts are provided by the Economic and Financial Planning Department. The long-term forecast is reviewed by the EFERC in January in order to provide a current long-term forecast for the initiation of the Company's yearly long-term planning update.

Interim Analyses

Because of the year-long interval between revisions of the Company's forecasts, events will occur in the interim which have a potential impact on
2 the forecast. Necessarily, various departments within the Company will undertake analyses of these events. These analyses are not published as new forecasts but only as situations which could potentially change the Company's forecasts. All such information is available to the members of the EFERC and to the departments having the responsibility for preparing the forecasts. If in the opinion of the EFERC or other members of the Company's top management the new developments are of a sufficient significance, a new forecast may be undertaken immediately. If not, the information from these interim analyses is retained for inclusion in the next annual forecast update.

2 1.1.1.2.2 Electric Sales Projections

The Company's current sales projections are developed in two separate departments using different though similar methodologies. Each is developed by major class of service and is in part the result of applying regression equations to forecasted economic and other factors which have been important in explaining historical levels of customer consumption. Some differences, however, do exist in methodology and the resulting projections due to a difference in purpose. Since the short-range forecast is to be used as a basis for the Company's planning of specific years, it reflects the most accurate monthly forecast available for these years. The long-range forecast consists of annual projections which are to be used as a strategic planning tool and as such reflects the most likely levels of consumption over a period of several years as a whole.

11 Briefly, the short-range projections are developed through the use of a reiterative multi-equation model which incorporates a forecast of economic activity as well as other variables such as price per kWh to the customer and weather indicators, with results from direct customer contacts. Normally this forecast is approved in August of each year extending out 29 months to the end of the planning year.

Projections shown on Table 1.1-3 reflect the current short-range forecast for the current and following years and the long range thereafter.

Since this report is most concerned with years beyond which the short-range forecast has been developed, the remaining discussion in this section focuses on the long-range methodology.

7 The EFERC has reviewed and approved a revised long-term forecast of electric energy sales and peak demand as of December 1979. This update supersedes the previous long-term forecast approved by the EFERC in December of 1978. The new forecast projects a 15-year 1979-1994 average annual compound rate of growth (AAR) of 2.75%.

11

Peak demand for the years 1980 through 1994 was calculated assuming a load factor of 68.5% and a system efficiency of 91.5%.

2 A range of uncertainties was developed for the new forecast. Expressed as a
percentage of the 1979 sales, the high range (having a 15% probability of
occurrence) shows a 107% increase by 1994, while the low range (also having a
11 15% probability of occurrence) exhibits a 4% decrease from current levels over
the same period. The expected value for 1994, which has a 70% probability of
occurrence, was projected to increase by 50% from the 1979 level.

7 The forecast represents a downward revision from historic growth rates. It
was prepared by combining regression analysis of the past sales data with
specific investigations of certain "forward looking" items which were
2 identified as likely to influence future sales. The future state of the
economy was the most important determinant of future energy sales, but
considerable impact was exerted by the projected price of energy and the
7 multiple factors predicted to be the outcome of the National Energy Policy.

2 Sales Forecast Methodology

11 The current sales forecast was developed utilizing a methodology which
combines regression analysis with specific investigations of factors which
could influence future sales but are not present in the past data. The
independent variables in the regression analysis were, in large measure,
economic variables which were projected by the use of a separate economic
forecast. The forecast was also characterized by preparing a separate
2 forecast for each sales category and, where appropriate, breaking down certain
of the more important categories into more detail. Where possible, data from
direct customer contact was employed. An uncertainty range for the forecast
was built up by developing the uncertainties associated with the individual
forecast components. This was done by means of encoding techniques which were
used to develop subjective probabilities from the various contributors to the
forecast.

11 The starting point of the December 1979 forecast was a detailed regression
analysis which attempts to capture the significant causal factors from the
2 past 10-15 years of electric sales data. Many possible independent variables
and model forms were tested until the final models, as presented in Table
1.1-4, were selected based on statistical evaluation and inspection for
7 logical consistency. The independent variables in the various models are
generally comprised of economic parameters and the price of energy. The
projections of the economic parameters were obtained from a national economic
2 forecast which was, in large part, based on the econometric models utilized by
Data Resources Incorporated (DRI), one of the major national economic
consulting firms. The use of national economic projections instead of local

11 data was selected for three reasons. First, the Michigan economy, which
includes the economy of Consumers Power Company's service area, is highly
influenced by the automotive industry and has historically followed national
2 trends. Secondly, there is currently no long-term "bottom up" projection of
the Michigan economy available. There are some generalized regional models
based on adjusted national trends, but this is essentially what the regression
11 analysis achieves. Third, the quality of historic national economic data is
much better than the quality and consistency of local economic data. The
2 projections for the cost of electricity and gas for use in the regression
models were developed from the 15-year corporate planning analysis prepared in
11 1979 using the Consumers Power Company planning model.

The impact of future factors or "forward-looking" items was developed from
individual analyses which were directly applied as adjustments to the
regression model results. Because of the overlapping of many of the factors
relating to the general categories of conservation and the National Energy
Policy, care was taken to avoid, to the extent possible, double counting of
2 the same effect. Specific investigations or factors were developed for
appliance efficiency improvements, cogeneration, industrial and commercial
conservation and conversions to alternate fuels, electric vehicles and solar
energy utilization.

Where possible, the forecast employed data directly obtained from various
11 customer samples. Foremost in this category was a major study conducted by
the SRI International (SRI) in 1977 of the energy end use of the Company's
2 major industrial and commercial customers. This study resulted in an
assessment by SRI of the potential in these two sales sectors for additional

conservation and conversion to and from alternate energy sources. The major
2 new finding from the SRI study in relation to electric sales is that there is
only a modest potential in the next 10 years for switching from gas or other
11 fossil fuels into electricity. An in-house update of this SRI study was
conducted in 1979 and is also used in the forecast. In addition, there were
several direct interviews by Consumers Power Company personnel with our
2 customers or other Michigan sources in regard to various aspects of the
forecast. These included discussions with Dow on their electricity usage
11 projections, General Motors on their economic and sales forecasts and views on
electric vehicles, DRI on their economic forecast, various sources (GM, Ford,
2 EPRI and DOE) on the general status of electric vehicles, a major heating
11 equipment distributor on market projections for the heat pump, and several
industrial customers on their cogeneration potential.

The range of uncertainty developed as part of the forecast utilized the
technique of probability encoding. In this method the information source or
knowledgeable person is interviewed about possible swings in the future value
2 of the variable under study. The result of the interview is a cumulative
probability distribution for that variable. With similar information for the
major forecast inputs, the data can be statistically combined and a
probability range established for the dependent variable, ie, the sales
forecast.

11

2 The results are discussed in the following sections:

Residential Sales

The forecast of residential sales is divided into two parts: Residential
2 space heating sales and residential domestic sales. To develop the forecast,
three regression models were prepared: models for average usage in each
category and a single model for residential customer gain. The independent
variables include an appliance index and a measure of people per household in
11 the domestic usage model, a measure of disposable income in the space heating
usage model, the price of electricity in both usage models, and housing stock
and population in the customer model.

The two average use models each contain a price term which is a downward force
on the growth rate and, as such, represents the general conservation trend
currently being experienced. Depending on the mathematical form of the
2 specific model, some form of implied price elasticity can be derived from the
regression models and comparison with published data shows at least general
agreement with what is defined as "short-term" elasticity in the literature.
However, the price coefficients are derived quantities from the regression
11 analysis, not input parameters. As such they represent something other than
2 pure price elasticity effects, particularly in a regression model utilizing
only a few independent variables. For example, it can reasonably be argued
11 that the price term in the residential models represents, at least in part,
2 all aspects of conservation of electricity through reduced usage, whether from
patriotic, peer pressure, media influence or strictly economic motives.

7

The results produced by the regression models were modified to reflect future
2 factors not present in the past sales data. Domestic average use was adjusted
to reflect projected improvements in appliance efficiency. This adjustment
and a factor to reflect the increasing use of the heat pump were applied to
7 the space-heating category. Finally, adjustments to the total residential
2 sales were made to reflect the advent of solar heating and cooling and the
electric vehicle in the latter part of the forecast period.

11 A relatively significant downward adjustment in average usage results from the
7 projection of improvements in appliance efficiency. Based on the National
2 Energy Act, mandatory appliance efficiency standards will be implemented and
11 are assumed to be in effect starting in the mid-1980s. Calculations were made
based on predictions of what the improvements in efficiency would be,
2 projected appliance saturations, and a calculation of the percentage
penetration each year into the general appliance population by the new, more
efficient appliances. The resultant impact on overall average use per
11 domestic customer amounted to about 6% by the latter part of the forecast
2 period.

4

In addition to the adjustment for appliance efficiency improvements, an
additional downward adjustment to reflect the increased use of the heat pump
was applied to the space-heating average use category. Based on current
2 improvements in heat pump technology and the relative improvement in the
economics of the heat pump, vis-a-vis other home heating alternatives when
examined on a life cycle heating cost basis, it was concluded that the heat
pump would make inroads into the home heating market. Therefore, even though

the number of electric space-heating customers was projected to increase over
2 the forecast period, the average use of electricity for space heating was
decreasing based on the projected mix of heat pumps and resistance heating
4 customers.

2 An adjustment to total residential sales to reflect the impact of solar
11 heating and cooling was made. This assessment predicted about a 7% drop in
residential sales, mainly in the area of water heating, by 1994.

7

2 A second adjustment to total residential sales was the potential impact of the
commercialization of electric vehicles. Based on a survey of current activity
in this area, it was concluded that the electric vehicle is expected to
increase residential electric sales by about 9% by 1994.

11

The expected value for the growth in residential sales over the next 15 years
is 2.5% per year in the current forecast. This is a considerable reduction
7 from pre-embargo trends in this sales sector and reflects the downward
2 pressure from increasing energy costs, improvements in appliance efficiency,
general conservation in domestic usage, improvements in space-heating
11 efficiency due to the heat pump, and the impacts of solar energy and the
electric vehicle.

7

Commercial Sales

The approach used to project commercial sales was to establish a base forecast
2 using a regression model (refer to Table 1.1-4) and to apply analyses of the
potential impact of specific "forward-looking" items to this base forecast.
The economic variables used in the regression model were disposable income per
11 capita, the real price of electricity and the real price of gas. Disposable
2 income per capita was by far the most significant variable. The specific
forward-looking items for which adjustments were made were solar energy and
11 the electric vehicle. The results of the 1977 SRI energy end use study of the
Company's industrial and commercial customers and the internal 1979 update
7 were used to project conservation. Since the regression model contained a
11 price of electricity term, it was necessary to reconcile the SRI projections
of expected conservation with those inferred from the model analysis. Incre-
2 mental conservation was reflected by adjusting the expected value of the SRI
probability curve downward to avoid double counting the conservation already
reflected in the model. This approach led us to conclude that the model is
adequately reflecting the expected level of future commercial conservation.

The projection of the impact of solar energy, amounting to about a 260 million
11 kWh reduction by 1994, is an adjustment to the commercial sales forecast. In
addition, the electric vehicles were assumed to add about 130 million kWh to
1994 commercial sales.

The regression models, economic forecast and the Company's 1979 projections of
2 future electric and gas prices result in a growth rate in commercial sales of
11 2.8%/year between 1979-1994. The forward-looking items have the net effect of
reducing this 1979-1994 average annual growth rate slightly to 2.7%.

11

Industrial Sales

2 The approach used to project future industrial sales was to develop a
regression model base forecast (refer to Table 1.1-4) and then to modify the
base forecast for specific forward-looking items. Separate regression models
7 were developed for both GM sales and for industrial sales to other than Dow
2 and GM. Sales to Dow were forecast by direct consultation with Dow.

Industrial sales to GM accounts are projected as a function of GM auto
11 production, motor vehicle real gross capital stock, and the price of
7 electricity.

The regression model used to forecast industrial sales excluding GM and Dow is
2 based on GNP and the price of electricity as the independent variables. The
forecast was much more sensitive to variations in GNP than to changes in the
7 price of electricity.

2 Based only on the Dow communications and the regression model projections,
total industrial sales would be projected to grow at a 1979-1994 AAR of 3.2%.

11 Several forward-looking items are believed to be significant to the industrial
sales forecast. These were: conservation, conversion, cogeneration and self-generation, solar energy and electric vehicles. Conservation and price
2 elasticity were also reflected through the inclusion of a price term in the

2 regression models. Therefore, the industrial conservation estimate from the SRI study and the 1979 update of the study was modified to avoid double counting. The SRI and Consumers Power 1979 update estimates of conversions were used essentially as defined in the SRI report and the Consumers Power construction and conversion analysis report. The electric vehicle impact was estimated to be relatively small, about 130 million kWh by 1994. The solar impact is also relatively small, about 100 million kWh by 1994.

11 Cogeneration and self-generation were estimated by a 1979 Consumers Power Company study and a 1979 external analysis. The expected impact of additional cogeneration and self-generation is to reduce 1994 potential industrial sales by 480 million kWh.

The expected value of 1994 sales forecast for industrial sales, combining the regression model results with forward-looking items, translates to a 3.0% AAR.

2 <u>Other Sales</u>

<u>Streetlighting</u> - The December 1979 forecast of streetlighting sales was
2 developed based on the current program to convert the existing incandescent
7 and fluorescent luminaires to high-pressure sodium. This results in declining
11 annual sales through 1991, even though the total system luminaires are assumed
to increase.

7

<u>Sales to Other Utilities</u> - Sales to other utilities were projected in December
11 of 1979 to grow at about the same rate as Consumers Power Company sales

11 through 1982. Beyond 1982, an AAR of about 75% of the Consumers Power rate is
2 assumed to reflect the possible construction of generating facilities by
7 groups of our wholesale customers.

2 Interdepartmental - Interdepartmental sales are assumed to hold constant at
11 about 75 million kWh level for all years after 1979.

1.1.1.2.3 Generation Requirements and Peak Load Projections

Consumers Power's peak load projections are developed from its sales
forecasts. Since the sales forecasts measure energy requirements at the point
of sale and energy losses take place between the generation facilities and the
point of sale, the sales forecasts must be divided by an efficiency factor to
determine the amount of generation necessary to meet the sales forecasts. The
efficiency factor is a ratio of sales to generation calculated on the basis of
historical trends, modified to reflect known or expected factors that will
2 influence efficiency. Application of the efficiency factor results in an
estimate of the total generation requirement in kWh necessary to meet the
annual sales forecast. The expected peak load is calculated by dividing the
average demand (ie, the total generation requirement divided by the hours in
the year) by the estimated annual load factor for the year. The annual load
factor is a ratio of average demand to peak demand.

Annual load factors are developed from historical relationships of load factors based on summer maximum demands and winter maximum demands. In projecting future load factors, consideration is given to the impact of such things as energy conservation, pricing of energy, availability of gas with the

resultant effect on the use of electricity for heating, load management and
2 general economic conditions. Since some of these factors tend to improve load
factor and others tend to decrease load factor, the load factor for future
11 years has been projected at a constant 68.5%, realizing that in any given year
the actual load factor can deviate from the projected load factor in either
2 direction.

Monthly Peak Loads

11 Table 1.1-5 lists Consumers Power's actual monthly peak load data through the
most recent month for which data are available. Table 1.1-6 lists forecast
monthly peak loads for the same period and the percentage deviation of the
forecasted load from actual. Tables 1.1-7 and 1.1-8 list similar data on
monthly energy sales for the same period.

Response to FPC Order 496

Consumers Power's response to FPC Order 496 is included as Exhibit B to the
2 Environmental Report Supplement.

1.1.1.3 Power Exchanges

Consumers Power does not include power exchanges with other utilities as a part of its load. Such exchanges are reflected in the capacity availability figures and are treated under Section 1.1.2.

1.1.2 System Capacity

Table 1.1-9 summarizes Consumers Power's projected installed capability over
11 annual peak load for 1971 through 1986. Also shown are the most recently

available data for the combined Consumers Power-Detroit Edison system and for
2 ECAR. Not included in the tables, but an important factor in capability
assessment, are estimated deratings to the capabilities shown due to higher
cooling medium temperatures in summer. These are listed below for 1983 and
11 1984 when the Midland units are projected to be placed in service.

		Derating - MW	
2		1983	1984
	Consumers Power	225	266
11	Consumers Power-Detroit Edison	375	422
	ECAR	1852	1943

Also shown in Table 1.1-[illegible] are actual and projected capacity sales at time of
peak. Shown separately is the lease of capacity to the Commonwealth Edison
Company from the Ludington Pumped Storage Plant, which is jointly owned by
2 Consumers Power and Detroit Edison. Included in the installed capability
listed is the anticipated net ownership from Consumers Power's Campbell Unit 3
11 and from Detroit Edison's Enrico Fermi Unit 2. Purchase of portions of these
units is anticipated by rural electric cooperatives and municipal systems
within the State of Michigan. Capacity from these units not immediately
2 needed by the purchasing systems is expected to be sold back as unit power and
is also shown. The details of the expected transactions and purchases are:

4	Capacity Sold - % of Plant					
	1981	1982	1983	1984	1985	1986
2 Cooperatives:						
Campbell 3	3.16	3.16	3.16	3.16	3.16	3.16
11 Campbell 3 Sell Back to CP	2.62	2.33	2.04	1.74	1.45	1.16
E Fermi 2	0	20.00	20.00	20.00	20.00	20.00
E Fermi Sell Back to DE	0	16.29	14.46	12.63	10.89	9.06
2 Municipals:						
Campbell 3	4.80	4.80	4.80	4.80	4.80	4.80
11 Campbell Sell Back to CP	2.92	2.70	2.35	1.77	2.82	2.72

Table 1.1-10 lists the composition of Consumers Power's generating system for
2 the initial year reported in Table 1.1-9 (1971). Table 1.1-11 lists changes
in capability, unit additions, and long-term transactions in chronological
11 order through 1986. Data are given for both Consumers Power and Detroit
2 Edison.

11 The composition of Consumers Power's generating system for 1984, including the
2 expected range of unit capacity factors, is shown in Table 1.1-12.

11

1.1.3 Reserve Margins

Consumers Power determines installed generating capacity requirements and
2 reserve margins based on a generation planning reliability design guide which
recognizes that Consumers Power, being a part of the integrated regional
system, will as a minimum plan to install equitable generating capacity such
11 that a loss of load expectation (LOLE) index of 1 day/10 years is maintained.
2 Included in these assessments are consideration of peak load levels throughout
the year, generating unit maintenance, and reductions in unit capacity due to

hot weather, statistical treatment of random unit outages, and mutual assistance within the integrated regional system.

1.1.3.1 Maintenance

For probability assessment purposes, generating unit maintenance is assumed
scheduled so as to levelize the risk of outage over the entire year. To do
2 this, scheduled maintenance on units is preferentially grouped to the extent
possible, in periods of the year when the level of loads is lower (ie, autumn
and spring).

1.1.3.2 Loss of Load Probability Methods

Application of the generation planning reliability design guide requires that
a loss of load probability (LOLP) method be applied to an integrated regional
11 system of companies. The actual determination of the LOLE index for the
integrated system is completed with the use of computer simulations. For the
purposes of this computation, the year is modeled by monthly intervals.
2 Within each month maintenance is considered constant. Based on projected
generating unit maintenance requirements and peak loads for each month, a
schedule of unit outages is developed. Then, for each month, a normal
capacity outage distribution is determined using standard techniques. The
projected weekday peak loads are convolved with the normal capacity outage
11 distribution to yield a capacity surplus or deficiency and its probability of
occurrence.

This simulation is first performed for a system with a peak load equal to the eastern United Stated and Ontario Hydro (called the integrated regional system) but with a load shape and generating unit characteristics and mix

which is equivalent to the combined systems of the East Central Area
Reliability system and Ontario Hydro. Generation capacity is then adjusted
until a 1 day/10 years LOLE is obtained. This simulation indicates the
aggregate generation capacity requirements of the utilities in the eastern
United States and Ontario Hydro. An additional simulation is then performed
in order to allocate the capacity requirement to each utility. The philosophy
is that each utility must supply an equitable capacity contribution to the
integrated regional system (IRS). Given any reliability goal for the IRS,
11 Consumers Power Company should, therefore, receive support (measured by
negative days) from the IRS members equal to the support received by an
Average Integrated Regional System (AIRS). The AIRS for Consumers may be
defined as one whose peak demand is equal to Consumers' peak demand and whose
load shape and generating units characteristics and mix is equivalent to the
IRS. Consumers Power Company required generating capacity is then determined
by adjusting Consumers Power's reserve to maintain the negative day count of
an AIRS to support the established 1 day/10 years LOLE index.

2 Consumers Power's generating unit capacities for purposes of reliability
11 studies are as shown in Table 1.1-9. Unit availability and maintenance
2 projections for the first year of service of Midland units are shown in Table
1.1-13. The monthly load model for Consumers Power for the same year is shown
in Table 1.1-14. The systems in ECAR are modeled from information taken from
11 reports entitled "Regional Reliability Council Coordinated Bulk Power Supply
Program" ERA-411, April 1, 1980 and "Appraisal of ECAR-WIDE Installed Reserves
for the Period 1979-1988", 79-GRP-57. Ontario Hydro's unit information was
obtained from a report by the Resources Planning Department, System Planning

Division of OH entitled "January 1980 Forecast of Reliability Indices For Use in Corporate Planning Studies".

Results of the analysis for a AIRS load of 5150 MW appear in Figure 1.1-2.
This figure presents the relationship between the required negative days for
an AIRS and the supported LOLE index for the IRS. As can be seen, for an LOLE
11 index of 1 day/10 years Consumers Power would be required to install capacity
so that external support would be requested for no more than 46 days/year.
Figure 1.1-3 translates this negative day requirement into a capcity
requirement at 23% unit unavailability. The graph indicates a reserve level
of 25.5% would be necessary.

1.1.3.3 Capacity Support

Whenever capacity is added to a system, the amount of reserves in megawatts
2 needed to cover outages increases. In terms of percent of peak load, however,
the generation reserves required remain nearly constant. This is due to the
fact that the capacity is not added until load has increased to the point
11 where it is needed. The impact of the addition of a generating unit or units
to a system is always to enhance its reliability.

With respect to its interconnections, Consumers Power's policy is to provide
2 sufficient transmission capability so that, under credible contingencies, the
full amount of capacity support needed from outside sources can be imported.

1.1.3.4 Reserve Responsibility

ECAR has established the following objectives:

(a) Assure an abundant supply of electric energy to meet present and future needs.

(b) Achieve maximum reliability and continuity of service.

(c) Accomplish the first two objectives while protecting and preserving the environment.

2 Under the terms of Consumers Power's coordination agreement with Detroit Edison, Consumers Power is not obligated to maintain a particular reserve level; instead it has agreed to provide an adequate amount of reserve to meet operating reserves. It is Consumers Power's judgment that its reliability assessment methodology adequately meets both of these requirements.

1.1.4 External Supporting Studies

Based on an "Appraisal of ECAR-Wide Installed Reserves for the Period 1980-1989", Report No 80-GRP-57, reserve levels will be less than desired if the average generating unit unavailability continues at the current level and if the load and capacity conditions reported in the 1980 ECAR response to DOE/ERA materialize. 11

For the years 1983 and 1984, assuming a 30% unavailability for existing units, ECAR's system of companies will operate at an LOLP index of approximately 25 day/year. It should be noted that this study assumed all units presently scheduled for operation by 1983 and 1984 are in service. Delays in the in-service dates of these units would change the LOLP index.

TABLE 1.1-1
SUMMER AND WINTER PEAK DEMANDS 1966-1995
(MW)

Year	Consumers Power		Combined Consumers Power - Detroit Edison		ECAR	
	Summer	Winter	Summer	Winter	Summer	Winter
1966	2,522	2,660	6,530	7,099	-	-
1967	2,673	2,941	7,080	7,280	-	33,651
1968	2,979	3,180	7,808	7,833	36,564	35,890
1969	3,184	3,377	8,320	8,435	37,918	39,248
1970	3,343	3,458	8,751	8,494	40,020	41,021
1971	3,604	3,711	9,573	9,010	43,825	41,985
1972	3,808	4,080	9,743	9,709	46,769	45,365
1973	4,394	4,105	11,265	9,630	51,932	46,140
1974	4,109	4,033	10,709	9,417	49,648	46,529
1975	4,134	4,194	10,454	10,019	50,338	51,269
1976	4,185	4,282	10,798	10,207	53,178	53,289
1977	4,542	4,281	11,923	10,339	62,306	59,136
1978	4,588	4,436	11,756	10,657	62,454	63,297
1979	4,479	4,343	11,224	10,027	62,182	59,263
1980	4,560	4,470	11,665	10,334	64,628	66,476
1981	4,560	4,450	11,942	10,495	68,176	70,390
1982	5,220	5,080	12,753	11,237	71,752	73,264
1983	5,380	5,230	13,284	11,671	74,649	76,338
1984	5,490	5,330	13,702	12,014	77,404	79,414
1985	5,640	5,460	14,176	12,380	80,246	82,534
1986	5,800	5,610	14,663	12,762	83,177	85,655
1987	5,970	5,750	15,143	13,108	86,056	88,704
1988	6,140	5,910	15,615	13,507	89,012	92,234
1989	6,240	5,990	16,032	13,815	92,042	95,621
1990	6,340	6,080	16,448	14,127	NA	99,500
1991	6,530	6,240	16,908	14,484	NA	103,000
1992	6,720	6,420	17,368	14,836	NA	107,000
1993	6,920	6,610	17,857	15,246	NA	110,800
1994	7,130	6,790	18,371	15,621	NA	114,700
1995	7,330	6,970	18,880	16,020	NA	118,700

Notes: Data prior to Summer 1980 are actual for Consumers Power and Detroit Edison.

2 ECAR was organized in January 1967.

ECAR data are based on report entitled "Regional Reliability Council Coordinated Bulk Power Supply Program", ERA-411, April 1, 1980, Volume I.

4

NA = Not Available.

TABLE 1.1-2
ENERGY REQUIREMENTS 1966-1995
(GWh)

Year	Consumers Power	Combined Consumers Power - Detroit Edison	ECAR
1966	15,891	40,595	NA
1967	16,665	42,276	205,679
1968	18,111	46,286	223,567
1969	19,435	49,738	240,049
1970	20,095	51,253	250,863
1971	21,509	54,571	263,715
1972	23,330	58,946	285,368
1973	25,212	63,047	308,819
1974	24,626	60,620	305,601
1975	24,282	59,316	308,153
1976	25,995	64,041	331,800
1977	26,830	66,066	365,526
1978	27,493	67,423	369,108
1979	27,906	67,499	379,018
1980	27,386	65,228	384,200
1981	27,338	67,042	406,400
1982	31,310	71,876	427,600
1983	32,280	74,686	444,500
1984	32,940	77,114	461,400
1985	33,860	79,516	478,900
1986	34,830	82,070	496,100
1987	35,800	84,483	513,400
1988	36,860	87,286	532,000
1989	37,440	89,250	550,000
1990	38,040	91,329	NA
1991	39,170	93,774	NA
1992	40,340	96,236	NA
1993	41,550	98,761	NA
1994	42,800	101,296	NA
1995	43,980	104,030	NA

Notes: Data prior to Winter 1980 are actual for Consumers Power and Detroit Edison.

ECAR data are based on report entitled "Regional Reliability Council Coordinated Bulk Power Supply Program", ERA-411, April 1, 1980, Volume I.

4

2 NA = Not Available.

TABLE 1.1-3

MAIN SYSTEM ENERGY SALES 1966-1995
CONSUMERS POWER
(GWh)

Year	Annual Sales
1966	14,405
1967	15,097
1968	16,415
1969	17,667
1970	18,154
1971	19,632
1972	21,133
1973	22,995
1974	22,507
1975	22,145
1976	23,794
1977	24,551
1978	25,234
1979	25,707
1980	25,058
1981	25,014
1982	28,650
1983	29,540
1984	30,140
1985	30,980
1986	31,870
1987	32,760
1988	33,730
1989	34,260
1990	34,810
1991	35,840
1992	36,910
1993	38,020
1994	39,160
1995	40,240

TABLE 1.1-4

REGRESSION MODELS USED FOR MAIN SYSTEM ELECTRIC SALES PROJECTIONS
4 (By Major Customers)

CONSUMERS POWER

Residential Domestic Average Use (RDU)

RDU = 13232.3 + 3984.17 * appliance index per household * people per household
(12.17) (32.78)
-1115.00 * ln (real price of electricity)
(-8.332)
11 -557.498 * ln (lagged real price of electricity)
(-8.332)
R^2 = .9889
DW = 1.6101

4 Residential Space Heating Average Use (RSHU)

ln (RSHU) = 3.81793 + 0.538710 * ln (lagged RSHU) -0.231046 * ln (current elec price/
(4.009) (5.065)
11 current disposable income per capita)
R^2 = .8921
DW = 2.0469

4 Residential Customer Gain

Res Cust Gain = -14,863.6 + 800.149 change of MS adult population
(-3.713) (6.118)
+ 7868.72 * housing demand proxy
(4.812)
11 + 7234.56 * change in national housing stock
(4.538)
R^2 = .8442 Note: Housing Demand Proxy = 1 for 61 to
DW = 2.1711 73 and 0 for 74 to 94

4 Commercial Sales (COM)

COM = -66904.2 + 8095.03 * ln (real disposable income per capita) + 1527.80 * ln
(-21.66) (16.90) (5.390)
(real price of gas) -1565.79 * ln (real price of elec) -1043.86 * ln (lagged
11 (-6.231) (-6.231)
price of elec) -521.931 * ln (2-yr lagged real price of elec)
(-6.231)
R^2 = .9963
DW = 2.0999

4 Industrial Other Sales (INDO)

INDO = -844.716 + 5.77816 * real GNP -0.311796 * real price of electricity
(-5.920) (41.35) (-5.817)
-0.207864 * lagged real price of electricity - 0.103932 * 2-yr
(-5.817) (5.817)
11 lagged real price of elec
R^2 = .9926
DW = 1.8998

4 GMSales

ΔGW Sales = 0.282854 * Δ GM vehicle production + 47.3045 * ln (real gross capital stock -
(12.69) (6.123)
11 motor vehicle) -0.811099 * Δ real price of electricity
(3.779)
R^2 = .9513
DW = 2.1657

3 Notes: Values in parentheses are T statistics.

7 R^2: Coefficient of Determination
DW: Durbon-Watson Statistic
GNP: Gross National Product
3 *: Multiplication
7 MS: Main System

TABLE 1.1-5

11 ## ACTUAL MONTHLY PEAK LOADS
1972 THROUGH 1979
(MW)

CONSUMERS POWER

Month	1972	1973	1974	1975	1976	1977	1978	1979	1980
January		4010	3903	3889	4058	4196	4281	4436	4224
February		3931	3797	3848	3938	4023	4176	4329	4140
March		3718	3746	3629	3938	3833	3918	4210	4087
April		3783	3688	3576	3697	3761	3862	4063	
May		3573	3641	3743	3737	4127	4204	4196	
June		4005	3753	4016	4124	4193	4306	4292	
11 July		3908	4109	3995	4160	4542	4556	4479	
August		4394	4077	4134	4185	4133	4546	4452	
September		4289	3884	3683	3979	4059	4588	4218	
October	3704	3965	3840	3751	3937	3945	4076	4091	
November	3829	4105	4033	3951	4231	4151	4326	4161	
December	4080	3949	4020	4194	4282	4268	4390	4343	

TABLE 1.1-6

4 FORECAST OF MONTHLY PEAK LOADS AND PERCENT DEVIATION FROM ACTUAL
10 1972 THROUGH 1979

CONSUMERS POWER

4	Month	1972			1973			1974			1975			1976			1977			1978		
		MW	% Dev		MW	% Dev		MW	% Dev		MW	% Dev		MW	% Dev		MW	% Dev		MW	% Dev	
	January				3890	(3.0)		3920	0.4		3980	2.3		4170	2.8		4196	0.0		4440	3.7	
	February				3850	(2.1)		3870	1.9		3940	2.4	e	4110	4.4		4061	0.9		4320	3.4	
	March				3700	(0.5)		3710	(1.0)	c	3770	3.9		3990	1.3		3902	1.8		4210	7.5	
	April				3620	(4.3)		3650	(1.0)		3700	3.5		3880	4.9		3990	6.1		4130	6.9	
	May				3590	0.5		3570	(2.0)		3630	(3.0)		3850	3.0	g	3970	(3.8)		4160	(1.0)	i
10	June				4110	2.6	b	4330	15.4		4140	3.1		4180	1.4		4250	1.4	h	4470	3.8	
	July				4130	5.7		4330	5.4		4290	7.4	f	4380	5.3		4510	(0.7)		4740	4.0	
	August				4130	(6.0)		4330	6.2		4290	3.8		4380	4.7		4510	9.1		4740	4.3	
	September				3870	(9.8)		4050	4.3	d	4080	10.8		4300	8.1		4330	6.7		4500	(1.9)	
	October	3620	(2.3)		3910	(1.4)		3950	2.9		3980	6.1		4180	6.2		4240	7.5		4450	9.2	
	November	3810	(0.5)	a	4110	0.1		4140	2.7		4170	5.5		4340	2.6		4450	7.2		4670	8.0	
	December	3990	(2.2)		4310	9.1		4330	7.7		4360	4.0		4380	2.3	h	4540	6.4		4750	8.2	

	Month	1979			1980		
		MW	% Dev		MW	% Dev	
	January	4440	0.1		4550	7.7	
	February	4330	0.0		4430	7.0	k
	March	4210	0.0		4270	4.5	
	April	4110	1.2				
	May	4260	1.5				
11	June	4550	6.0	j			
	July	4740	5.8				
	August	4740	6.5				
	September	4390	4.1				
	October	4330	5.8				
	November	4550	9.3				
	December	4630	6.6				

Notes: Positive deviation indicates that forecast was higher than actual.

Date Forecast Made:
a - January 1972
b - January 1973
c - January 1974
d - May 1974
e - December 1974
f - March 1975
g - November 1975
h - September 1976
i - August 1977
j - December 1978
k - August 1979

TABLE 1.1-7

11 ## ACTUAL MONTHLY ELECTRIC SALES[a]
1972 THROUGH 1979

CONSUMERS POWER
(GWh)

Month	1972	1973	1974	1975	1976	1977	1978	1979	1980
January		1891	1885	1886	1971	2099	2122	2245	2141
February		1970	1884	1899	2053	2141	2173	2296	2127
March		1931	1841	1781	1899	1998	2056	2207	2103
April		1859	1819	1841	1881	1939	1991	2112	
May		1821	1782	1658	1905	1886	1896	2041	
June		1849	1801	1774	1886	2016	2033	2104	
July		1920	1859	1867	1970	2061	2061	2115	
August		1879	1952	1914	1904	2046	2082	2093	
September		2025	1932	1905	2021	2016	2189	2119	
October	1774	1900	1895	1800	1916	1999	2095	2039	
November	1907	1996	1910	1888	2127	2143	2194	2154	
December	1935	1954	1948	1959	2189	2227	2314	2182	

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11 [a] Sales exclude adjustment for unbilled sales.

TABLE 1.1-8

FORECAST OF MONTHLY ELECTRIC SALES AND PERCENT DEVIATION FROM ACTUAL 1972 THROUGH 1979

CONSUMERS POWER

	1972		1973		1974		1975		1976		1977		1978		1979		1980	
Month	GWh	% Dev	GWh	% Dev	GWh	% Dev	GWh	% Dev	GWh	% Dev	GWh	% Dev	GWh	% Dev	GWh	% Dev	GWh	% Dev
January			1880	(0.6)	2001	6.2	1964	4.1	1963	(0.4)	2044	(2.6)	2105	(0.8)	2175	(3.1)	2232	4.3
February			1959	(0.6)	2082	10.5	2042	7.5	2000	(2.6)	2116	(1.2)	2186	0.6	2210	(3.8)	2284	7.4
March			1883	(2.5)	2018	9.6	1968	10.5	1930	1.6	2020	1.1	2120	1.6	2130	(3.5)	2198	4.5
April			1868	0.5	1985	9.1	1931	6.4	1916	1.9	2003	3.3	2107	5.8	2094	(0.8)		
May			1797	(1.3)	1925	8.0	1888	13.9	1860	(2.4)	1899	0.7	2003	5.7	2039	(0.1)		
June			1836	(0.7)	1956	8.6	1909	7.6	1889	0.2	1957	(2.9)	2080	2.3	2081	(1.1)		
July			1817	(5.4)	1995	7.3	1933	3.5	1937	(1.7)	2003	(2.8)	2105	2.1	2141	1.2		
August			1887	0.4	2036	4.3	1970	2.9	1926	1.2	1976	(3.4)	2082	0.0	2122	1.4		
September			1922	(5.1)	2048	6.0	2027	6.4	1992	(1.4)	2051	1.8	2223	1.5	2190	3.3		
October	1797	1.3	1906	0.3	2057	8.6	2022	12.4	1959	2.3	1997	(0.1)	2083	(0.6)	2104	3.2		
November	1825	(4.3)	1951	(2.3)	2106	10.3	2104	11.4	2066	(2.9)	2093	(2.3)	2167	(1.2)	2237	3.9		
December	1880	(2.9)	2003	2.5	2142	10.0	2123	8.3	2077	(5.1)	2165	(2.8)	2252	(2.7)	2301	5.4		

Notes: Positive deviation indicates that forecast was higher than actual.
Monthly gigawatthour forecasts are made in August of the preceding year.

TABLE 1.1-9

CAPABILITY AT ANNUAL PEAK
(Seasonal Deratings Not Included)
(MW)

		Consumers Power				Consumers Power-Detroit Edison				ECAR		
	Year	Installed Capability	Ludington Lease	Purchases (Sales)	Net Capability	Installed Capability	Ludington Lease	Purchases (Sales)	Net Capability	Installed Capability	Net Interchange	Net Capability
	1971	3,828	-	766	4,594	10,617	-	185	10,802	51,359	148	51,507
	1972	4,153	-	481	4,634	11,166	-	764	11,930	57,138	(653)	56,485
	1973	5,230	(255)	(71)	4,904	14,294	0)	1,069	15,063	63,776	(154)	63,622
	1974	5,364	(76)	60	5,348	14,711	0)	312	14,873	67,753	624	68,377
2	1975	5,742	(306)	(28)	5,408	14,817	50)	1,207	15,574	74,188	(1,537)	72,651
	1976	5,742	(318)	20	5,444	14,940	(624)	520	14,836	75,713	(1,380)	74,333
	1977	5,721	(318)	270	5,673	14,483	(624)	620	14,479	79,326	(1,775)	77,551
	1978	6,488	(318)	20	6,190	15,540	(624)	620	15,536	86,012	(1,183)	84,829
	1979	6,240	(318)	220	6,142	15,384	(624)	420	15,180	90,328	(197)	90,131
	1980	6,146	(318)	245	6,073	14,649	(624)	720	14,745	92,679	(105)	92,574
	1981	6,894	(318)	64	6,640	16,429	(624)	64	15,899	95,043	(276)	94,767
	1982	6,894	(318)	60	6,636	17,303	(624)	238	16,917	99,316	(278)	99,038
11	1983	7,101	(318)	55	6,838	17,510	(624)	213	17,099	102,309	(39)	102,270
	1984	8,430	(159)	48	8,319	19,503	(312)	186	19,377	108,181	(48)	108,133
	1985	7,932	(159)	54	7,827	19,669	(312)	173	19,530	111,729	(33)	111,696
	1986	7,932	(159)	51	7,824	19,669	(312)	150	19,507	115,415	(339)	115,076

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2 (a) Consumers Power has been winter peaking generally, but experienced summer peaks in 1973 and 1974. Data for 1978-1984 are for summer critical load season.

11 (b) ECAR data is based on report entitled regional reliability council coordinated bulk supply Program, ERA-411, April 1, 1980, Volume I.

TABLE 1.1-10 1 of 2

GENERATING CAPABILITY AT TIME OF PEAK-1971
CONSUMERS POWER

Unit	MW	Type	Function
Campbell 1	275	Coal-Steam	Base Load
Campbell 2	372	Coal-Steam	Base Load
Cobb 1	68	Coal-Steam	Base Load
Cobb 2	68	Coal-Steam	Base Load
Cobb 3	68	Coal-Steam	Base Load
Cobb 4	162	Coal-Steam	Base Load
Cobb 5	165	Coal-Steam	Base Load
Elm Street	32	Coal-Steam	Intermediate
Kalamazoo	23	Coal-Steam	Intermediate
Karn 1	275	Coal-Steam	Base Load
Karn 2	275	Coal Steam	Base Load
2 Morrow 1	41	Oil-Steam	Intermediate
Morrow 2	41	Oil-Steam	Intermediate
Morrow 3	60	Oil-Steam	Intermediate
Morrow 4	68	Oil-Steam	Intermediate
Saginaw River 3	34)	Coal-Steam	Intermediate
Saginaw River 4	46)(a)	Coal-Steam	Intermediate
Saginaw River 5	41)	Coal-Steam	Intermediate
Weadock 1	42)	Oil-Steam	Intermediate
Weadock 2	42)	Oil-Steam	Intermediate
Weadock 3	62)	Oil-Steam	Intermediate
Weadock 4	62)(b)	Oil-Steam	Intermediate
Weadock 5	72)	Oil-Steam	Intermediate
Weadock 6	72)	Oil-Steam	Intermediate
Weadock 7	162	Coal-Steam	Base Load
Weadock 8	165	Coal-Steam	Base Load
Wealthy Street	23	Coal-Steam	Intermediate
Whiting 1	106	Coal-Steam	Base Load
Whiting 2	106	Coal-Steam	Base Load
Whiting 3	133	Coal-Steam	Base Load

TABLE 1.1-10 2 of 2

Unit	MW	Type	Function
Big Rock	71	Nuclear	Base Load
2 Hydro	$134^{(c)}$	Run of River Hydro	Intermediate
Diesels and Peakers	$523^{(d)}$	Internal Combustion & Combustion Turbine	Peaking
TOTAL	3828		

Notes:
(a) Saginaw River 3-5 were boiler limited at 80 MW.
(b) Weadock 1-6 were boiler limited at 332 MW.
(c) 35 hydro units ranging from 0.4 MW to 10.8 MW.
(d) 20 combustion turbines ranging from 20 MW to 44 MW plus one diesel of 1 MW.

11 TABLE 1.1-11 1 of 5

HISTORICAL AND PROJECTED CAPABILITY CHANGES AND LONG-TERM TRANSACTIONS
CONSUMERS POWER - DETROIT EDISON

Year	Date	Item	MW Change
1971	As of Dec 31	Total Installed Capability (1972 ECAR Response (dated 4/78) to FPC Docket R-362, Order 383-2)	10,866
		CP Purchase: Dow Chemical Co-Ludington	4
		CP Purchase: Wolverine Power Corp	11
		DE Purchase: Ford Motor Co	45
		Ontario Hydro Diversity	(200)
1972	Feb 1	Saginaw River Plant Retired (CP-Coal)	(80)
	Feb 13	OH Diversity Ends	200
	Mar 7	Palisades Initial Rating (CP-Nuclear)	80
	Apr 1	Conners Creek Plant	(12)
	Apr 7	Palisades Uprate	315
	May 1	DECo System Rerate	(3)
	May 29	OH Diversity Begins	200
	Sept 17	OH Diversity Ends	(200)
	Oct 30	OH Diversity Begins	(300)
	Nov 1	Palisades Uprate	10
	Dec 16	Palisades Uprate	93
	Dec 22	Palisades Uprate	87
	Dec 31	Allegan Diesel Retired (CP)	(1)
	Dec 31	Kalamazoo Retired (CP-Coal)	(23)
	Dec 31	Wealthy St Retired (CP-Coal)	(23)
	Dec 31	Conners Creek Plant	(17)
	Dec 31	Marysville Plant	(134)
1973	Jan 18	Ludington 1 (CP/DE)	325
	Jan 19	Monroe 2	770
	Feb 6	Trenton Channel Retirement	(47)
	Feb 18	OH Diversity Ends	300
	Feb 26	Trenton Channel Retirement	(27)
	Mar 19	Ludington 2 (CP/DE)	325
	Mar 31	Palisades Uprate (CP-Nuclear)	70
	Apr 5	Monroe 3	470
	Apr 7	Palisades Uprate (CP)	39
	Apr 13	Palisades Uprate (CP)	6
	May 1	Ludington 3 (CP/DE)	325
	May 28	OH Diversity Begins	100
	June 1	Dow Ludington	5
	June 11	Ludington 4 (CP/DE)	300

11 TABLE 1.1-11 2 of 5

Year	Date	Item	MW Change
1973	June 18	Ludington 4 Uprate (CP/DE)	25
	July 3	Monroe 3 Uprate	80
	July 5	Monroe 3 Uprate	70
	July 14	Monroe 3 Uprate	80
	Aug 7	Ludington 5 (CP/DE)	325
	Aug 7	Lease of 1/3 of Ludington Capability to CE Begins	(541)
	Aug 31	Elm St Plant (CP-Coal)	(32)
	Sept 16	OH Diversity Ends	(100)
	Sept 30	Conners Creek Plant	(66)
	Sept 30	Trenton Channel Plant	(142)
	Oct 1	Sale to TECo Begins	(200)
	Oct 1	Ludington 6 (CP/DE)	325
	Oct 1	Lease of 1/3 of Additional Ludington Capability to CE	(108)
	Nov 1	DECo System Rerate	(372)
1974	May 1	DECo System Rerate	(46)
	May 8	Monroe 4	750
	Oct 1	Palisades-Cooling Tower Rerate (CP)	(14)
	Oct 1	Trenton Channel 2 & 4 Retired	(108)
	Oct 1	Trenton Channel 7 & 8 Rerated	(44)
	Oct 6	Sale to TECo Terminated	200
	Nov 1	DECo System Rerate	47
	Nov 1	DE Purchase From Ford Motor Co No Longer Counted	(45)
1975	Jan 26	Karn 3 Initial Rating (CP-Oil)	450
	May 1	CPCo System Rerate	(107)
	May 1	DECo System Rerate	22
	May 1	Karn 3 Derate (CP)	(50)
	July 1	Marysville Plant Derate	(44)
	July 16	Karn 3 Uprate (CP)	100
	Aug 1	DECo System Rerate	(146)
	Oct 20	Wyandotte South Returned to Customer	(15)
	Nov 1	Delray Plant Rerate	30
1976	Jan 1	Purchase of Gavin Unit Power Begins (CP)	250
	Mar 31	Purchase of Gavin Unit Power Terminated (CP)	(250)
	Apr 1	Purchase of Gavin Unit Power Begins (CP/DE)	500
	May 1	DECo System Rerate	112
	Sept 30	Purchase of Gavin Unit Power Terminated (CP/DE)	(500)
	Nov 1	DECo System Rerate	73
1977	Jan 1	Big Rock Derate (CP)	(10)
	Jan 1	Palisades (CP)	(11)
	Jan 1	River Rouge & St Clair Rerate (DE)	(434)
	Mar 1	Trenton Channel Rerate (DE)	5

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TABLE 1.1-11 3 of 5

	Year	Date	Item	MW Change
	1977	May 1	Conners Creek & Delray Rerate (DE)	(80)
		Sept 6	Wyandotte North Returned to Customer (DE)	(23)
		Sept 30	Karn 4 (CP-Oil)	620
		Nov 1	DE System Rerate	312
		Dec 1	Palisades Uprate (CP)	55
		Dec 1	Morrow Uprate (CP)	10
	1978	Jan 1	Karn 4 Derate (CP)	(120)
		Feb 1	Campbell 1 Derate (CP)	(4)
		Apr 1	Karn 1 Derate (CP)	(3)
		Apr 1	Karn 2 Derate (CP)	(3)
		Apr 1- Sept 30	Unit Pwr (DE)	200
		Apr 1- Oct 31	Unit Pwr (DE)	200
		May 1	Karn 3 Uprate (CP)	100
		May 1	Karn 4 Uprate (CP)	100
		May 1	Palisades Uprate (CP)	10
		May 1	Big Rock Uprate (CP)	2
11		May 12 - Sept 17	Short Term (DE)	200
		Nov 1	Derate St Clair 5-7 (DE)	(155)
	1979	Jan 1	Campbell 2 Derate (CP)	(20)
		Jan 1	Fermi 1 Economy Reserve (DE)	(161)
7		Jan 1	Delray LP Economy Reserve (DE)	(151)
		Apr 1	Morrow 1-4 Economy Reserve (CP)	(76)
		Apr 1	Weadock 1-6 Economy Reserve (CP)	(131)
11		Apr 1	Whiting 1 (CP)	(21)
		May 1	Trenton Ch 9 (DE)	(40)
		May 21- Sept 16	Short Term (DE)	200
10		June 4- Oct 28	Short Term (CP)	200
		July 5	Greenwood 1 (DE)	780
		Oct 1	CP System Rerate	(107)
		Nov 1	Greenwood 1 Uprate (DE)	50
		Dec 1	Greenwood 1 Uprate (DE)	75
	1980	Jan 1	Greenwood 1 Uprate (DE)	35
		Jan 1	Karn 4 Uprate (CP)	13
11		Jan 1	Conners Creek LP Economy Reserve (DE)	(175)
		Feb 1	River Rouge 1 Economy Reserve (DE)	(206)
		Feb 1	St CLair 5 Economy Reserve (DE)	(250)
		Apr 1	Delay 16 Economy Reserve (DE)	(69)
		May 1	DE System Rerate	(101)
		May 1 Oct 31	Short Term (DE)	200
		May 5- Aug 31	Short Term (DE)	100
		May 5-	Limited Term (CP)	50

TABLE 1.1-11 4 of 5

Year	Date	Item	MW Change
1980	Sept 4		
	May 5- Sept 14	Short Term (CP)	175
	May 5- Sept 14	Short Term (DE)	175
	Oct	Campbell (CP-Coal)	791
	Oct	Sale of Campbell 3	(63)
	Oct	Buy Back of Excess Campbell 3	47
1981	Jan 1	Campbell 2 Uprate (CP)	20
	Jan 1	Greenwood 1 Uprate (DE)	20
	Jan 1	Buy Back Campbell 3 Changed to 44 MW	(3)
	Jan 1	DE Units Returned From Economy Reverse	1,012
1982	Jan	Buy Back Campbell 3 Changed to 40 MW	(4)
	Mar	Fermi 2 (DE)	1,093
	Mar	Sale of Fermi 2	(219)
	Mar	Buy Back of Excess Fermi 2	178
1983	Jan	Morrow 1-2 and Weadock 1-3 Returned from Economy Reserve	207
	Jan	Buy Back Campbell 3 Changed to 35 MW	(5)
	Jan	Buy Back Fermi 2 Changed to 158 MW	(20)
	Aug 7	Lease of 1/6 of Ludington Capability to CE Ends	312
	Dec	Midland 2 (CP)	807
1984	Jan	Buy Back Campbell 3 Changed to 28 MW	(7)
	Jan	Buy Back Fermi 2 Changed to 138 MW	(20)
	Mar	Belle River 1 (DE)	664
	July	Midland 1 (CP)	522
1985	Jan	Buy Back Campbell 3 Changed to 34 MW	6
	Jan	Buy Back Fermi 2 Changed to 119 MW	(19)
	Jan	Morrow 1-4 and Weadock 1-6 Placed on Economy Reserve	(510)
	Mar	Belle River 2 (DE)	664
	June	Wood Demo (CP)	12

11 TABLE 1.1-11 5 of 5

	Year	Date	Item	MW Change
	1986	Jan	Buy Back Campbell 3 Changed to 31 MW	(3)
11		Jan	Buy Back Fermi 2 Changed to 99 MW	(20)

11 Consumers Power owns 51% of the Ludington Pumped Storage Plant and Detroit Edison owns 49%.

TABLE 1.1-12

CAPACITY FACTORS OF UNITS
PROJECTED FOR SERVICE IN 1984 11

CONSUMERS POWER 2

Unit	MW	Type	Function	Range of Capacity Factor
Campbell 1	253	Coal-Steam	Base Load	65-80
Campbell 2	349	Coal-Steam	Base Load	65-80
Campbell 3 (a)	728	Coal-Steam	Base Load	65-75
Cobb 1-3	180	Coal-Steam	Base Load	50-65
Cobb 4	151	Coal-Steam	Base Load	65-80
Cobb 5	152	Coal-Steam	Base Load	65-80
Karn 1	255	Coal-Steam	Base Load	65-80
Karn 2	257	Coal-Steam	Base Load	65-80
Karn 3	638	Oil-Steam	Intermediate	5-30
Karn 4	613	Oil-Steam	Intermediate	5-30
Midland 1 (a)	522	Nuclear	Base Load	60-75
Midland 2 (a)	807	Nuclear	Base Load	60-75
Morrow 1-4	190 (b)	Oil-Steam	Intermediate	5-30
Palisades	740	Nuclear	Base Load	60-75
Weadock 1-6	320 (b)	Oil-Steam	Intermediate	20-40
Weadock 7	155	Coal-Steam	Base Load	65-80
Weadock 8	155	Coal-Steam	Base Load	65-80
Whiting 1	95	Coal-Steam	Base Load	65-80
Whiting 2	95	Coal-Steam	Base Load	65-80
Whiting 3	120	Coal-Steam	Base Load	65-80
Big Rock	63	Nuclear	Base Load	60-75
Hydro	134 (c)	Run of River Hydro	Intermediate	25-35
Ludington 1-6	955 (d)	P Storage Hydro	Peaking	15-20
Peakers	504 (e)	Jet or Comb Turbine	Peaking	5-20

(a) Units not existing in 1976 but projected for operation by 1984.
(b) Boiler limitation.
(c) 35 units ranging from 0.4 MW to 10.8 MW.
(d) 6 units of 312 MW each. Consumers Power Company share 51%.
(e) 20 turbines ranging from 19 MW to 42 MW.

TABLE 1.1-13

GENERATING UNIT
AVAILABILITIES AND MAINTENANCE
11 1984

CONSUMERS POWER

	Unit(s)	Availability %	Periodic Maintenance Weeks
	Campbell 1	68.0	10
	Campbell 2	76.8	3
	Campbell 3	79.4	4
	Cobb 1-3	83.2	4
	Cobb 4	83.4	3
	Cobb 5	85.1	3
	Karn 1	74.0	4
	Karn 2	79.0	3
	Karn 3	76.2	4
	Karn 4	74.3	4
11	Morrow 1-4	84.3	3
	Weadock 1-6	78.0	4
	Weadock 7	76.8	3
	Weadock 8	77.6	3
	Whiting 1	79.7	6
	Whiting 2	90.1	2
	Whiting 3	86.4	2
	Big Rock	84.9	6
	Palisades	62.2	9
	Midland 1	34.8	2
	Midland 2	54.0	9
4	Hydro	95.5	1
	Comb Turbines	81.0	3
10	Ludington Pumped Storage	94.0	2

POOR ORIGINAL

TABLE 1.1-14

MONTHLY LOAD MODEL USED
IN RELIABILITY ASSESSMENTS
CONSUMERS POWER

Daily Peaks - Per Unit of Monthly Peak

Mo.	Monthly Peak (Fraction of Yearly Peak)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	.936	1.0000	0.9969	0.9899	0.9784	0.9770	0.9733	0.9716	0.9674	0.9667	0.9660	0.9635	0.9597	0.9571	0.9569	0.9557	0.9489	0.9482	0.9419	0.9323	0.7594	0.7519	0.7316		
Feb	.912	1.0000	0.9875	0.9817	0.9805	0.9731	0.9707	0.9678	0.9674	0.9674	0.9652	0.9635	0.9563	0.9540	0.9528	0.9489	0.9453	0.9417	0.9393	0.9202	0.9187				
Mar	.879	1.0000	0.9916	0.9880	0.9799	0.9720	0.9704	0.9699	0.9669	0.9659	0.9631	0.9628	0.9618	0.9608	0.9529	0.9501	0.9458	0.9435	0.9430	0.9338	0.9310	0.9226	0.9221	0.7677	
11 Apr	.857	1.0000	0.9840	0.9758	0.9758	0.9673	0.9642	0.9634	0.9632	0.9601	0.9601	0.9557	0.9544	0.9526	0.9508	0.9385	0.9320	0.9297	0.9277	0.9251	0.9220				
May	.896	1.0000	0.9395	0.9263	0.9049	0.9040	0.9008	0.8992	0.8963	0.8927	0.8917	0.8838	0.8807	0.8804	0.8795	0.8778	0.8756	0.8752	0.8725	0.8713	0.8708	0.8701	0.8627	0.7211	
June	.940	1.0000	0.9835	0.9680	0.9410	0.9317	0.9278	0.9271	0.9222	0.9058	0.8972	0.8861	0.8829	0.8746	0.8730	0.8725	0.8679	0.8662	0.8591	0.8584	0.8521	0.8459	0.8318		
10 July	1.000	1.0000	0.9527	0.9503	0.9453	0.9280	0.9049	0.8911	0.8898	0.8848	0.8725	0.8642	0.8625	0.8535	0.8500	0.8295	0.8212	0.8181	0.8124	0.7984	0.5801	0.5293			
11 Aug	.972	1.0000	0.9855	0.9443	0.9410	0.9320	0.9290	0.9091	0.9013	0.9002	0.8978	0.8960	0.8949	0.8919	0.8794	0.8724	0.8685	0.8668	0.8648	0.8635	0.8596	0.8593	0.8554	0.8026	
10 Sept	.936	1.0000	0.9800	0.9685	0.9568	0.9275	0.9193	0.9071	0.8978	0.8971	0.8830	0.8817	0.8624	0.8559	0.8537	0.8472	0.8449	0.8405	0.8403	0.8362	0.8351	0.6206			
11 Oct	.901	1.0000	1.0000	0.9985	0.9916	0.9902	0.9872	0.9850	0.9833	0.9823	0.9799	0.9787	0.9782	0.9779	0.9765	0.9750	0.9750	0.9721	0.9711	0.9696	0.9662	0.9545	0.9508	0.7368	
10 Nov	.955	1.0000	0.9928	0.9912	0.9884	0.9875	0.9752	0.9713	0.9581	0.9551	0.9510	0.9500	0.9408	0.9380	0.9348	0.9285	0.9258	0.9235	0.9200	0.9142	0.8969	0.7305	0.6933		
11 Dec	.965	1.0000	0.9981	0.9963	0.9952	0.9931	0.9842	0.9828	0.9783	0.9778	0.9716	0.9703	0.9687	0.9648	0.9609	0.9363	0.9230	0.8130	0.8071	0.7831	0.7820	0.6005			

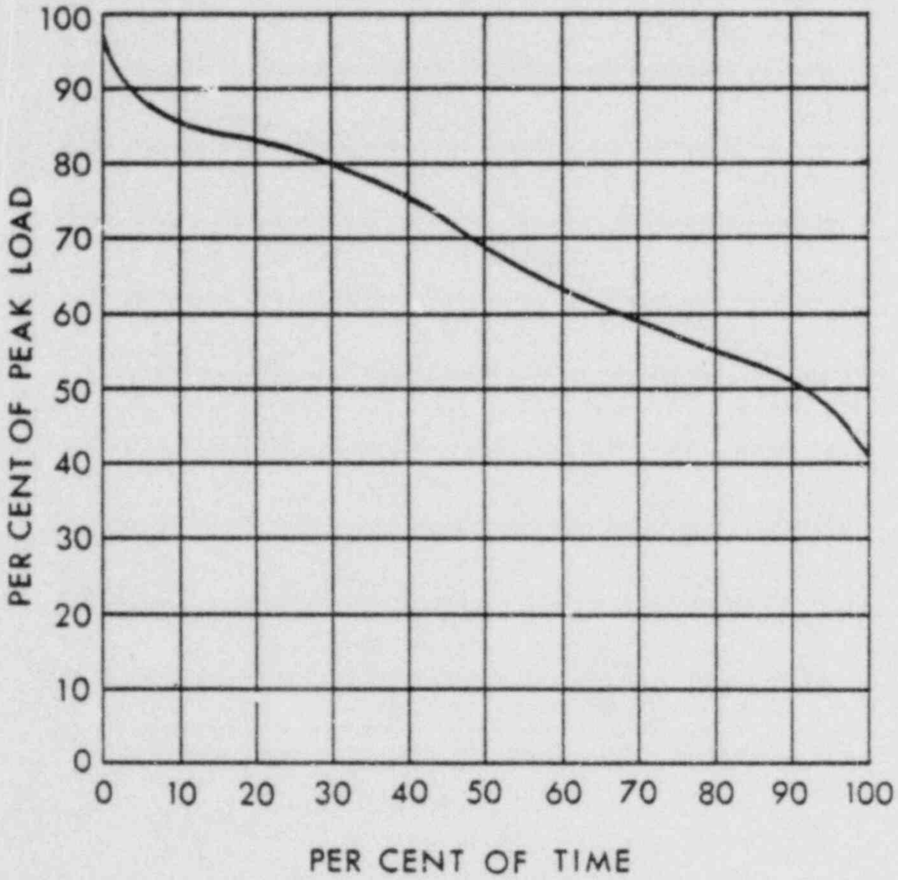


FIGURE 1.1-1

MAIN SYSTEM 1978
LOAD DURATION CURVE
CONSUMERS POWER

MIDLAND PLANT UNITS 1 & 2
CONSUMERS POWER COMPANY

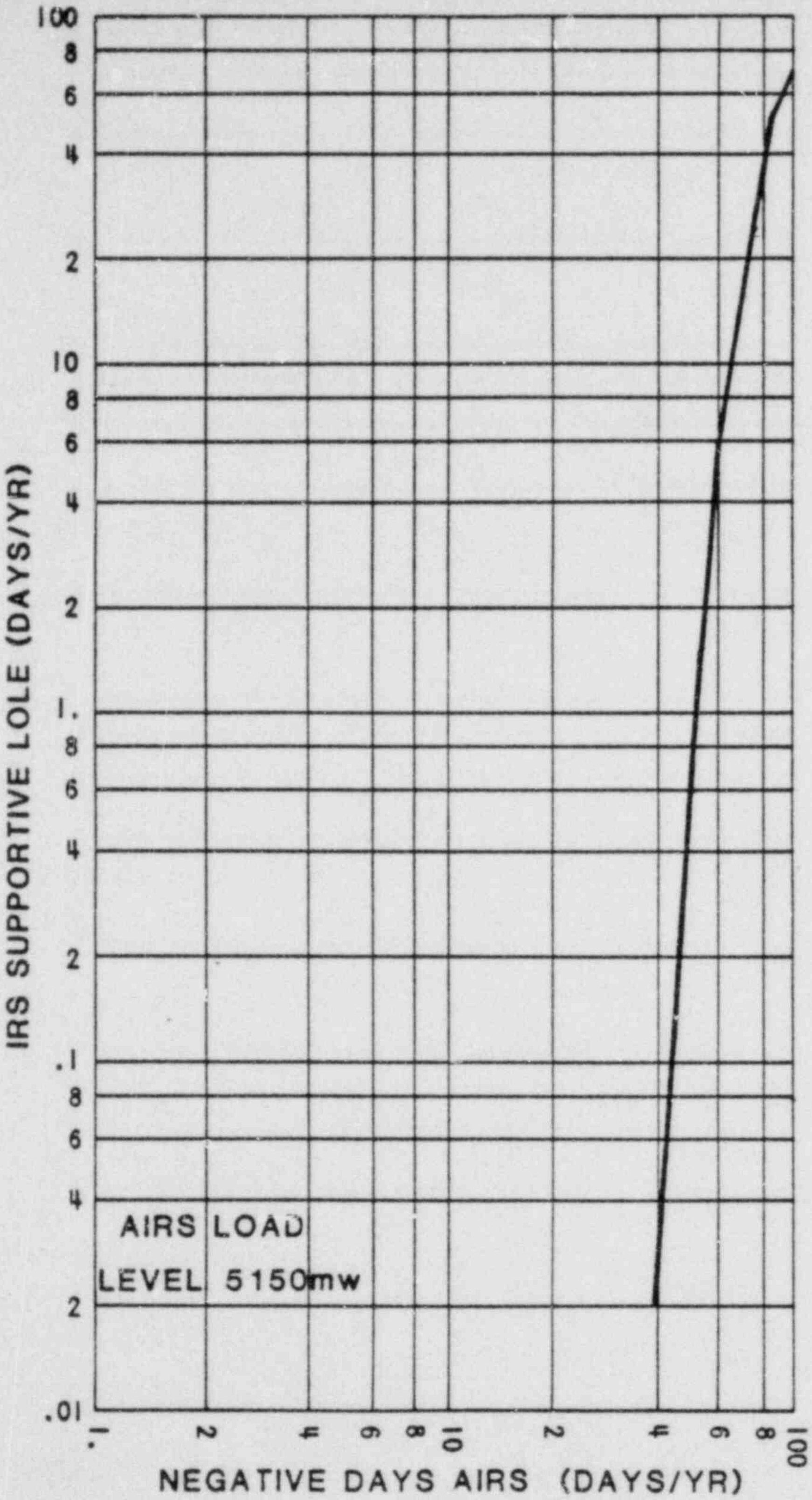
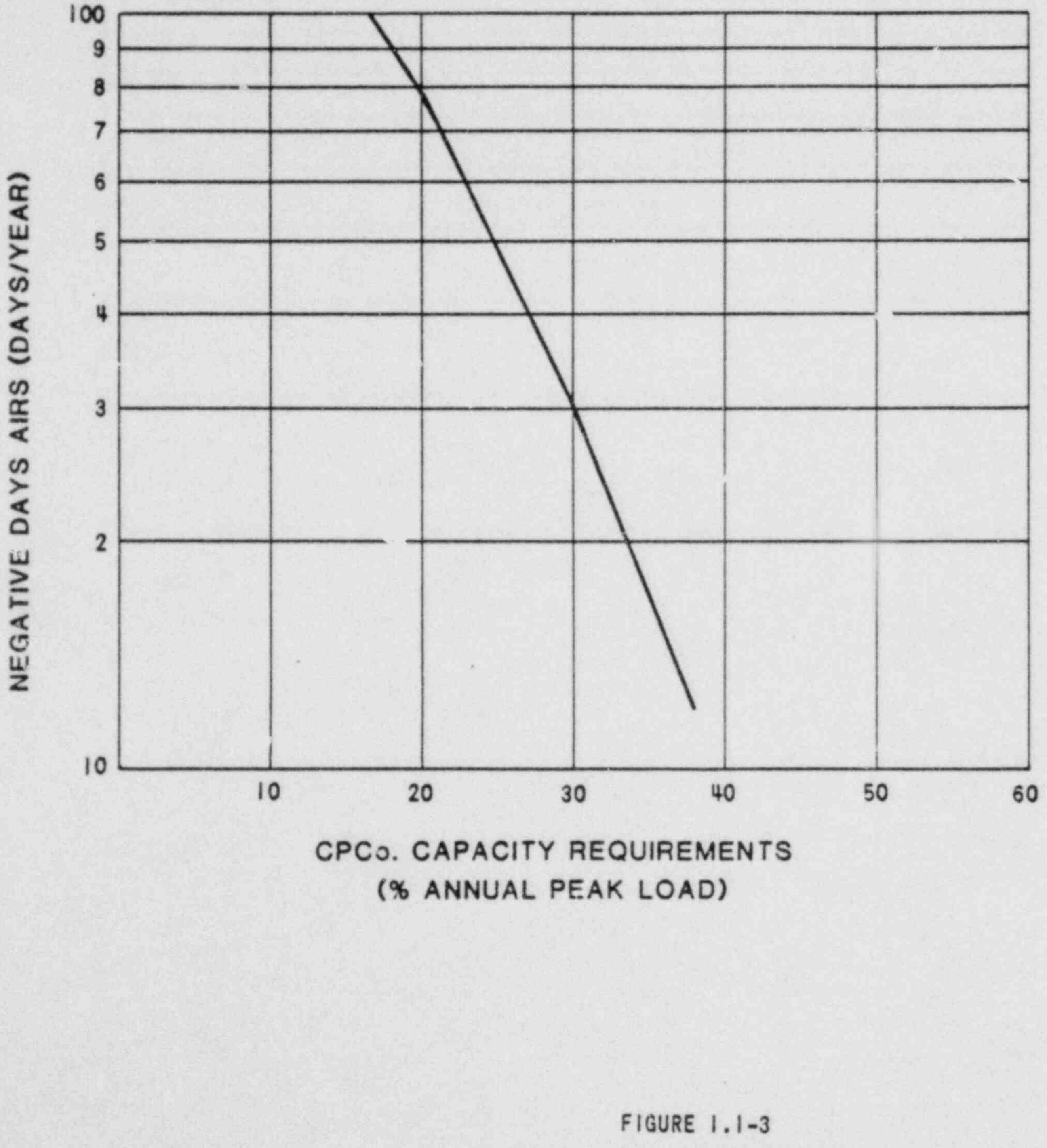


FIGURE 1.1-2

IRS SUPPORTIVE LOLE
VS
AIRS NEGATIVE DAYS

MIDLAND PLANT UNITS 1 & 2
CONSUMERS POWER COMPANY



(BASED ON PROJECTED CONDITIONS
WITH 23%UNIT UNAVAILABILITY)

FIGURE 1.1-3

AIRS NEGATIVE DAYS
CPCo. PER CENT RESERVES

MIDLAND PLANT UNITS 1 & 2
CONSUMERS POWER COMPANY

1.3 CONSEQUENCES OF DELAY

2 The effect of a delay in the in-service dates of the Midland Plant Units 1 and
4 2 would have adverse consequences on the reliability of the Consumers Power
system as well as the groups of which it is a member. Assuming a one-, two-
2 or three-year delay in the commercial operation dates of the Midland Plant
results in the following reserve percentages for the Consumers Power system:

			1-Year	2-Year	3-Year
4	Year	No Delay	Delay	Delay	Delay
	1984	46.7	23.2	23.2	23.2
11	1985	34.1	34.1	20.3	20.3
	1986	30.3	30.3	30.3	16.9

2 Similar data for the Consumers Power-Detroit Edison system are:

			1-Year	2-Year	3-Year
4	Year	No Delay	Delay	Delay	Delay
	1984	38.3	28.9	28.9	28.9
11	1985	34.8	34.8	29.3	29.3
	1986	30.2	30.2	30.2	24.9

2 Tables 1.3-1 and 1.3-2 detail the development of the above data.

11 In the 1984 through 1986 period considered, ECAR's indicated reserves (including interruptible load) and the estimated effect of the above delays on those reserves are:

	Year	No Delay	1-Year Delay	2-Year Delay	3-Year Delay
11	1984	33.4	31.8	31.8	31.8
	1985	35.1	35.1	34.2	34.2
	1986	34.7	34.7	34.7	33.8

2

11 Based on an "Appraisal of ECAR-wide Installed Reserves for the Period 1980-
1989" Report #80-GRP-57, the delay of the Midland units would worsen an
4 already "less than desired" situation. This report projects that additional
11 capacity of 7,000 MW or more, above that already projected, would be required
by the early 1980s and thereafter to supply the projected load requirements in
a reliable manner.

TABLE 1.3-1

EFFECT OF MIDLAND DELAY ON RESERVES[a]

CONSUMERS POWER COMPANY
(Summer; in MW)

Year		As Scheduled	Delay 1 Year	Delay[b] 2 Years	Delay[c] 3 Years
1984	Cap	8025	6737	6737	6737
	Purch	28	28	28	28
	Net Cap	8053	6765	6765	6765
	Load	5490	5490	5490	5490
	Res	2563	2563	2563	2563
	% Res	46.7	23.2	23.2	23.2
1983	Cap	7527	7527	6749	6749
	Purch	34	34	34	34
	Net Cap	7561	7561	6783	6783
	Load	5640	5640	5640	5640
	Res	1921	1921	1143	1143
	% Res	34.1	34.1	20.3	20.3
1984	Cap	7527	7527	7527	6749
	Purch	31	31	31	31
	Net Cap	7558	7558	7558	6780
	Load	5800	5800	5800	5800
	Res	1758	1758	1758	980
	% Res	30.3	30.3	30.3	16.9

---

4 (a) Assumes 1.5 x 10^6 lb/h steam flow to The Dow Chemical Company.

11 (b) Economy Reserve Weadock 1-6 and Morrow 1-4 delayed until December 1985.

(c) Economy Reserve Weadock 1-6 and Morrow 1-4 delayed until December 1986.

TABLE 1.3-2

EFFECT OF MIDLAND DELAY ON RESERVES(a)

CONSUMERS POWER COMPANY-DETROIT EDISON
(Summer; in MW)

Year		As Scheduled	Delay 1 Year	Delay(b) 2 Years	Delay(c) 3 Years
1984	Cap	18790	17502	17502	17502
	Purch	166	166	166	166
	Net Cap	18956	17668	17668	17668
	Load	13702	13702	13702	13702
	Res	5254	3966	3966	3966
	% Res	38.3	28.9	28.9	28.9
1985	Cap	18956	18956	18178	18178
	Purch	153	153	153	153
	Net Cap	19109	19109	18331	18331
	Load	14176	14176	14176	14176
	Res	4933	4933	4155	4155
	% Res	34.8	34.8	29.3	29.3
1986	Cap	18956	18956	18956	18178
	Purch	130	130	130	130
	Net Cap	19086	19086	19086	18308
	Load	14663	14663	14663	14663
	Res	4423	4423	4423	3645
	% Res	30.2	30.2	30.2	24.9

---

4 (a) Assumes 1.5 x 10^6 lb/h steam flow to The Dow Chemical Company.

11 (b) Economy Reserve Weadock 1-6 and Morrow 1-4 delayed until December 1985.

(c) Economy Reserve Weadock 1-6 and Morrow 1-4 delayed until December 1986.

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TABLE 2.1-9

TOTAL ESTIMATED POPULATION DISTRIBUTION INCLUDING DAILY INCREASES WITHIN 0-10 MILES[a,b,c]

ANNULI TOTALS	1970	1980	1990	2000	2010	2020
0-1 Mile	2,154	2,297	2,361	2,394	2,479	2,544
1-2	17,407	18,462	18,984	19,491	20,021	20,543
2-3	30,113	31,922	32,828	33,723	34,628	35,405
3-4	18,000	19,077	19,604	20,156	20,698	21,232
4-5	11,310	11,978	12,310	12,640	12,971	13,295
5-10	24,205	25,432	25,906	26,542	27,100	27,599
Cumulative						
0-1 Mile	2,154	2,297	2,361	2,394	2,479	2,544
0-2	19,561	20,759	21,345	21,885	22,500	23,087
0-3	49,674	52,681	54,173	55,608	57,128	58,492
0-4	67,674	71,758	73,777	75,764	77,826	79,724
0-5	78,984	83,736	86,087	88,404	90,797	93,019
0-10	103,189	109,168	111,993	114,946	117,897	120,618

NOTE: Projections of population assume that this area will retain its respective percentage of 1970 census population of the counties involved as shown on Table 2.1-1.

Total daily population includes resident population as shown on Table 2.1-2 and Figures 2.1-3 through 2.1-8 plus the daily business loading from Table 2.1-8.

(a) Electric Distribution Map(1).

(b) United States Census of Population(3).

(c) Population Projections of the Counties of Michigan(4).

TABLE 2.1-10

NEAREST RESIDENT/GARDEN(a), MILK ANIMAL(b) AND MEAT ANIMAL(c) TO MIDLAND NUCLEAR UNITS 1 & 2

11 SURVEY OF AUGUST, 1979

SECTOR	NEAREST LOCATION				
	RESIDENT/GARDEN	MILK ANIMAL		MEAT ANIMAL	
	(feet)	(feet)	(type)	(feet)	(type)
N	8,000	>26,400	----	>26,400	----
NNE	7,400	>26,400	----	>26,400	----
NE	6,800	25,300	Cow	25,900	Beef
ENE	12,300	>26,400	----	19,200	Beef
E	9,100	>26,400	----	18,500	Beef
ESE	9,600	>26,400	----	20,600	Beef
SE	9,100	21,000	Cow	21,000	Hog
SSE	13,200	>26,400	----	>26,400	----
S	6,600	>26,400	----	>26,400	----
SSW	6,800	25,000	Goat	25,000	Beef
SW	5,400	>26,400	----	19,100	Beef
WSW	4,200	14,200	Goat	22,200	Hog
W	4,600	18,900	Goat	>26,400	----
WNW	7,400	22,200	Goat	22 300	Hog
NW	11,100	>26,400	----	>26,400	----
NNW	9,800	>26,400	----	>26,400	----

---

1 (a) The nearest vegetable garden (500 ft^2) is assumed to be located at the nearest residence.

(b) Milk cows and milk goats.

(c) Beef cattle (including young feeder stock) and hogs.

Above the Dow Dam, the presence of a diverse and well-balanced macroinvertebrate community indicated clean water conditions. Below the dam, the areas that received The Dow Chemical Company and general wastewater treatment plant discharges had severely degraded water quality conditions. Macroinvertebrates were limited to midges and sludgeworms. Some recovery was observed from the Freeland Station downstream.

The MWRC(14) 1974 survey yielded data indicating a substantial recovery and biological recuperation at the Smith's Crossing and Freeland Stations and a pronounced improvement below the Midland wastewater treatment plant since 1971. Figure 2.2-4 shows these differences as reflected by biotic index values(14).

11 | 2.2.2.4 Consumers Power Company's Pilot Investigations

Consumers Power Company, Department of Environmental Services, contracted the
11 | Department of Biology of Central Michigan University during 1977 and 1978 to survey the biological communities of the Tittabawassee River near Midland and examine various methodologies for future monitoring of these communities. The biological communities investigated were: primary producers (phytoplankton, periphyton, chlorophyll, autotrophic index), macroinvertebrates (including zooplankton), and fish (fish-larvae, juvenile and adult). The 1977 effort is
11 | included as Appendix 2.2C while 1978 data is available in the report, Survey and Evaluation of the Water Quality, Tittabawassee River, Near Midland, Michigan, 1978-1979, prepared by Central Michigan University, April 1979.

2.2.2.5 Summary of Consumers Power Company's Preoperational Monitoring During 1979

During 1979, Lawler, Matusky and Skelly Engineers were contracted by Consumers Power Company, Department of Environmental Services, to assess the 1977-1978 pilot investigation data and develop an experimental design for long-term ecological monitoring in the Tittabawassee River. Lawler, Matusky and Skelly Engineers accomplished these tasks through preparation of the reports: Assessment of 1977-78 Data(14b) and Experimental Design of the Long-Term Ecological Monitoring Program of the Tittabawassee River Near the Midland Nuclear Plant(14c). The State of Michigan Water Resources Commission approved the experimental design for long-term monitoring in October 1979. The initial preoperational year of ecological monitoring using the approved experimental design, as described in Section 6.1.1, was conducted by Lawler, Matusky and Skelly during 1979 and is available in the report, Aquatic Assessment of the Tittabawassee River in the Vicinity of Midland, Michigan(14d). A summary of this preoperational data is presented below. Refer to Figure 6.1.1a to identify transect and sampling station locations. 11

2.2.2.5.1 Phytoplankton

Whole water phytoplankton samples were collected four times during 1979 on 8 May, 19 June, 10 August, and 12 October at two river stations. The community was composed mainly of three groups: diatoms, green algae, and blue-green algae.

Total phytoplankton abundance fluctuated over time and generally followed a classical pattern of abundance for the latitude of the area sampled. No consistent differences in abundance between stations were detected. Biovolume information was included in the report as an aid in determining the relative photosynthetic potential of each dominant taxon.

2.2.2.5.2 Periphyton

The periphyton community in the Midland vicinity of the Tittabawassee River is composed primarily of diatoms (Chrysophyta), green algae (Chlorophyta), blue-green algae (Cyanophyta), and Euglenophyta. Statistical analyses were conducted using the abundance data to detect possible differences between sampling dates, transects, and stations.

A statistical rationale for reducing the number of transects to be sampled in future studies at the Midland Plant site was developed. The technique involved a comparison of the complete data set using the 15-station design vs the minimal two-station design to determine how reduction of the sampling strategy would affect the conclusions. The results showed that the only 11 conclusions lost by the 87% reduction of the data are the significant seasonality of Chlorophyta and Euglenophyta and the station differences of the latter. The seasonality is expected and therefore the reduction is not a major loss to the analysis. In addition, Euglenophyta never account for more than 10% of the organisms at any station on any date so detectability of such station differences does not justify the 13 additional stations.

2.2.2.5.3 Zooplankton

Three taxonomic groups dominated the Tittabawassee River microzooplankton: rotifers, cladocerans, and copepods. The community structure of river microzooplankton depends on the following factors: the reproductive strategy of the various taxa, feeding behavior, competition, predation, and the capacity of populations to increase. The observations serve as a valuable data base for future comparisons. Bosmina coregoni was the most abundant cladoceran species identified in the Tittabawassee River.

Temporal and spatial trends in distribution and abundance were examined visually and statistically through the use of analysis of variance (ANOVA). Seasonality was confirmed in every analysis with a Bonferroni comparison, but spatial heterogeneity was not readily apparent, although Station A_2, in midstream above the Midland Plant intake, tended to have higher densities of microzooplankton. Community analysis revealed that Station D_2, below the Midland Plant intake, had consistently higher diversity (Shannon-Weaver) than A_2, but the small sample size involved may be an incomplete representation of the community structure.

2.2.2.5.4 Macroinvertebrates

11 Macroinvertebrates were collected by Ponar grab samples and artificial substrates in the Midland vicinity of the Tittabawassee River. The results of the Ponar grab samples show that the benthic community is not well established and is most likely sustained by continued colonization from upstream population epicenters. The June 1979 benthic invertebrate data covered five transects of three stations each for a total of 15 collection sites. To determine significant differences among replicates, transects, or stations, the data were analyzed statistically using split plot and whole plot analysis of variance following log transformation of the data.

Significant differences were found only for ephemeropterans, and were among transects. Examination of the June data for each station reveals that a major influence of this transect heterogeneity was the absence of ephemeropterans at one transect. For the total benthos and individual groups, mean abundances were available. Considering that reported abundance values included all macroinvertebrates retained in the Ponar grab, it would seem that, as suggested by the sediment analysis, the benthos community in the river is depauperate.

The number of taxa identified in artificial substrate collections was not much higher than that of the Ponar grab samplers, although the taxa occurred in greater densities. Thus, a more diverse and abundant community of macroinvertebrates was able to develop on the samplers during the approximate six-week immersion periods.

Macroinvertebrates collected on artificial substrates were evaluated for seasonal differences in abundance. The tests revealed that there were significant date differences for all groups tested; one of the major changes in abundance over time involved low densities in October, primarily at Station 11 D_2 downstream of the plant intake. It would appear that, given identical substrates, the two areas (A_2 upstream and D_2 downstream) were able to support similar densities of the dominant macroinvertebrate groups. This is probably related, in part, to colonization from upstream populations so that the two sets of artificial substrate samplers were exposed to the same stock of drifting organisms.

Shannon diversity indices were computed at the taxonomic level of genus. In May and June, the diversity at A_2 was somewhat higher than at D_2. Although this cannot be accounted for in terms of number of genera, the evenness index and abundances show that there was a more even distribution of organisms among the genera. In August and October, diversity was higher at D_2 than at A_2, partly as a result of the increased evenness index at Station D_2.

The groups of macroinvertebrates (total benthos, Chironomidae, Oligochaeta) examined were consistently more abundant in artificial substrate samples than in Ponar grab samples. This difference was most pronounced for oligochaetes, which suggests that the unstable sandy river bottom was unfavorable for these infaunal taxa. This was tentatively attributed to bottom sediment particle size distribution and low organic content, but the possibility of toxic substances is not ruled out.

2.2.2.5.5 Ichthyoplankton

The families Cyprinidae, Centrarchidae, and Percidae were represented by the largest number of species captured in the Tittabawassee River with five, four, and three species collected, respectively. The larval data for cyprinids, centrarchids, emerald shiner, yellow perch, black crappie and white sucker were statistically analyzed by an analysis of variance. Factors which were tested included date sampled, time period of sampling, collection gear, and station location.

The results of the analysis of variance performed on Cyprinidae showed significant differences in abundance due to date sampled, gear, and station. Centrarchid abundance was significantly different by date, period sampled (day or night), gear used, and a gear x period interaction. Analysis of black crappie data revealed a significant effect on catch due to date and period sampled. Emerald shiner and white sucker abundances showed no significant effect due to main factors or interactions. Yellow perch data analysis showed significant effects on catch due to gear, station, and a period by station interaction. The nonsignificance of the period and date of the above species may be a result of the low statistical power of the test because capture occurred on only a few dates.

2.2.2.5.6 Fisheries

A total of 11,704 fishes representing 11 families and 41 species were collected by electrofishing, seining, and trap netting from the Tittabawassee River in the vicinity of the Consumers Power Midland Plant in 1979.

The fish community is dominated by warmwater species, primarily of the families Cyprinidae and Centrarchidae. Electrofishing was the most successful collection technique, followed by seining and trap netting. Eight selected species of interest were analyzed by a log transformed split plot analysis of variance for each collection gear to define changes at the species level over space and time.

11 An analysis of community structure was performed using four measures of diversity: the number of taxa, the number of individuals, the evenness of distribution of individuals among the taxa, and a Shannon-Weaver diversity statistic (H'). Species diversity between transects, sampling dates, and gear types showed no consistent trends. However, electrofishing samples had generally higher diversity values than other gear types and September and October collections tended to have higher diversity values. It would appear that electroshocking is the most overall effective collection device, but trap netting and seining captured species not collected by electroshocking. The use of the Shannon-Weaver information statistic in defining aquatic community structure was discussed.

2.2.2.5.7 Water Quality

Comparison of water quality program results with the State of Michigan Water Quality Standards were not made because the standards were undergoing revisions. In general, water quality was sufficient to support biological communities.

Two trends are evident in the water quality data. The first is the influence that Lingle Drain exerts on Station D_3 (immediately downstream of Lingle Drain), especially during low flow periods when Station D_3 is isolated from the rest of the river by a large sandbar. There is no indication that this sandbar will disappear in the future; therefore, the influence of Lingle Drain on Station D_3 can be expected to recur as long as the sandbar is present. The second trend is the influence or Dow discharge (downstream of the plant intake) on sampling stations (Transects B, C, and D). Flow characteristics of the river seem to determine which stations are affected. During periods of 11 low flow, shoreline and midstream sampling stations are influenced by Dow's discharge. However, as flow increases, the "plume" appears to hug the shoreline and does not influence midstream areas.

2.2.2.5.8 Bottom Sediments

Comparison of the data indicates that silver, arsenic, beryllium, cadmium, and nickel were found in low concentrations at all stations except A_1 upstream of the plant and generally decreased in value between June and October. Copper, zinc, and total organic carbon (TOC) concentrations increased between sampling dates while lead values remained fairly constant between June and October. One parameter, manganese, exhibited wide variations between sampling dates. The October manganese concentrations are abnormally high and should be interpreted cautiously, although no procedural or computational errors were detected during the investigation.

The particle size distribution data indicate that the bottom sediments were composed mainly of larger fractions, medium sand to gravel, with medium sand dominating 73% of all samples and silt and clay comprising less than 10%, by weight, of most samples. These larger grain sizes necessarily reduce the available area for absorption by the various ions. This helps explain the low values of certain parameters and reinforces the caution with which the manganese levels should be viewed. Seasonal redistribution of sediment composition was noted, but deeper water stations exhibited fewer seasonal changes than the shallower stations. Organic content has been shown to be inversely related to grain size, thus the observed low TOC recorded in the river sediments is consistent with the coarse grained substrate found there.

11 2.2.2.5.9 Impingement

Impingement of fishes occurred during a three-day period in March 1979 when 255×10^6 gal of water was pumped from the Tittabawassee River into the Midland Plant cooling pond. The flow in the river at this time was moderately high.

A three-day compilation of data cannot be extrapolated to make any prediction concerning the annual impingement rate. However, it can be postulated from these data that yearling yellow perch will probably dominate future impingement collections taken during similar time periods and that the total number of fish impinged will likely be low in a two-pump mode of operation when river flows are moderately high.

2.2.2.5.10 Fish Migration

The impingement of high numbers of young-of-the-year yellow perch during the fall 1978 portion of the filling of the Midland Plant cooling pond raised questions regarding the origin of the yellow perch involved. More precisely, information was required to determine whether this was a one-year phenomenon resulting from the 1978 Sanford Lake drawdown or an expected annual occurrence. In addition, the study attempted to determine if the yellow perch were the progeny of a residential population or the result of the influx of young-of-the-year individuals from other spawning areas such as Sanford Lake or Saginaw Bay. The conclusions of the study suggest that high impingement rates of yellow perch can be expected during the fall season. 11

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Dow Chemical Company has monitored surface elevations over the mined zones since 1958. To the present no measurable subsidence has been observed at any location monitored(2). The possibility of subsidence due to salt mining has been investigated(2,3) and it is concluded that it will not be significant to the Midland Plant. A subsurface subsidence monitoring program has been implemented at the Plant site to measure any unexpected localized subsidence occurring beneath the Plant site (Section 6.1.4.1.3).

Figure 2.5-6 shows the locations of all exploratory, abandoned, and productive oil wells in the vicinity of the Plant. The Larkin field, 5 miles (24 km) north of the Plant, covers about 20 acres (8.1 ha) and is the closest area from which oil was produced. This field was abandoned in 1945, however, some 11 additional activity has taken place recently (1970-1975) but the outcome has been dry holes. It consisted of only two wells which pumped a total of about 7,000 barrels(4).

The most extensive oil producing field in the Plant vicinity is the Porter oil field, about 10 miles (16 km) southwest of the Plant. The latest available information in 1975 states that nearly 100,000 barrels were extracted from the 129 active wells in this field's 6,690 acres (27 km^2)(4).

Wildcat wells shown in Figure 2.5-6, near the Plant, indicate that no potential oil reserves are known beneath or near the Plant site.

Coal deposits of commercial quantity and thickness are present in 10 eastern Michigan counties with some lesser reserves in a few other eastern counties. Coal production in the State has been exclusively from the Saginaw Formation and mainly where the coal seams are less than 200 feet (61 m) from the surface(5). Coal mining has been decreasing almost continually within

Michigan since 1907. Presently, a single small surface coal mine is in operation in the State, located about 60 miles (97 km) south of the Plant. Figure 2.5-7 shows the locations of known commercial coal reserves in the Plant vicinity. No reserves are present beneath the Plant.

The unloading associated with the retreat of glacial ice is apparently responsible for crustal uplift in the northeastern United States and Canada. Correlations of glacial lake shorelines, in conjunction with radiocarbon dating, indicate that rebound began at a fairly rapid rate with the greatest adjustment occurring from 8,000 to 4,500 years ago. Since that time, uplift has been slight. Recent studies(6) indicate that Michigan is experiencing a vertical movement upward ranging from 1 foot (30 cm) per 100 years in the northern portion of the State to static conditions in the southern portion. In the Plant area at a rate of rise of 0.25 foot (7.5 cm) per 100 years is estimated.

Minor crustal movement in the form of rebound is occurring in the Plant area at a decreasing rate. Crustal uplift is occurring at such a slow rate and over such a broad area that it will have no effect on the Midland Plant.

TABLE 2.5-1

STATUS OF SALT, BRINE, AND DISPOSAL WELLS WITHIN ONE MILE OF THE MIDLAND PLANT[a]

	Well Number[b]	Total Salt Extracted (10^3 tons)	Current Status	Comments
			Salt Wells	
	9	372	Plugged in 1972	No production since 1964
	10	325	Plugged in 1968	No production since 1961
	11	450	Standby since 1971	
	14	523	Standby since 1970	
	15	555	Plugged in 1973	No production since 1969
11	16	375	Plugged in 1979	No production since 1969
	17	607	Plugged in 1973	No production since 1970
	19	274	Plugged in 1973	No production since 1968
	20	354	Plugged in 1973	No production since 1967
			Brine Wells	
	1	-	Plugged in 1973	No production since 1970
11	3	-	Plugged in 1977	No production since 1970
	5	-	Plugged in 1977	No production since 1971
	28	-	Operating	
			Disposal Wells	
11	1	-	Plugged in 1979	No production since 1972
	7	494	Operating	Originally drilled for use as a salt well; no salt has been extracted since 1970; now used as a disposal well in gallery with Well 18.
	8	-	Operating	Originally drilled for use as a salt well; no salt has been extracted since 1972; now used as a disposal well in gallery with Well 7.
	18	426	Operating	

(a) Status of wells based on latest available data received from Dow Chemical
11 Company in February 1980.

(b) See Figure 2.5-5.

VOL. 2

On August 29, 1978 Consumers Power Company representatives and the State
3 Archeologist toured the Midland Plant site. A survey of the Tittabawassee
River floodplain (including the route of the proposed blowdown discharge line)
was initiated in October 1978. Two previously identified archeological
significant sites which contain historic and prehistoric artifacts were
6 identified during the survey and are discussed in the report, <u>Archeological
and Historical Investigations of the Floodplain Area, Midland Plant Site,
Midland, Michigan</u>. This report describing the results was submitted to the
Nuclear Regulatory Commission on February 8, 1979.

2.6.3 <u>Transmission Line Right-of-Way Archeological Features</u>

Appendix 2.6C a copy of the archeological survey of the transmission line
3 right-of-way associated with the Midland Plant. A detailed plan for the
mitigation or avoidance of the identified archeological sites that could be
disturbed by the construction and operation of the Plant's associated
4 transmission facilities is presented in Section 4.2.2.

In 1979, the nine archeological sites that could not be avoided during
transmission line construction were mitigated by recovery of materials to
preserve the sites on paper. The recovered cultural material of the sites and
recorded details of its context are preserved for future study. Site 20SA318
11 is an Early Archaic (seventh or eighth millenium BC, based on projectile
points), low intensity campsite which could have been recurrently occupied
during the cold season. Hunting, butchering, wood and plant processing and
cooking were probable activities. Similarly, site 20SA108 is an Early Archaic
low intensity campsite which could have been recurrently occupied during the
warm season (based on different patterns of lithic technology and fire cracked

rock use). Similar activities probably occurred at this site. The only other possible Early Archaic site is 20SA337 which was perhaps a kill and butchering station for large game and was used for a very short duration. Insufficient data were recovered from 20MD394 to date the occupation, but the consultant speculates that an Archaic component was destroyed by sand removal. Site 20SA325 is of Late Archaic age (about 1900 BC) and was probably a warm season camp. A Woodland component, probably early Late Woodland, is (AD 600-800) also present. Nearby site 20SA326 may represent a contemporary single episode Late Archaic occupation. A well known local site, 20MD116, also represents a warm season encampment of the early Late Archaic. This site additionally has a pre-Civil War historic component (domestic household). Site 20SA322 is 11 predominantly a Late Archaic site with a minor Late Woodland component (occupied 1500 BC - AD 1000). The site was likely used for brief encampments during the warm season. The last site, 20SA329, is totally historic and was probably a rural farm homestead from about 1880-1920.

The University of Michigan, Museum of Anthropology, report on this archeological mitigation (Report of Archaeological Mitigation and Avoidance on a Consumers Power Company Right of Way in Saginaw and Midland Counties, Michigan, February 18, 1980) has been provided to the Nuclear Regulatory Commission.

The mitigation of these nine sites on the transmission line right-of-way has preserved these cultural resources on paper, as in the University's report, in the site file and field notes, and in the curated cultural material recovered during field work. These materials preserve the sites for future generations of students and for further study as changing theoretical interests require.

Additionally, an archeological survey was conducted in May 1979 on the tie line right of way from the Midland Plant to the Tittabawassee Substation. This survey area is not owned by Consumers Power Company and no construction activity for these tie lines has taken place. One prehistoric and two historic sites were found. The two historic sites appear to be of modern or recent age and the archeological consultant did not recommend mitigation for either of these sites. The prehistoric site represented a small, probably diffuse, prehistoric site likely occupied for a rather short time for specialized purposes, possibly hunting. Six pieces of fire-cracked rock and seven chert spalls were recovered. Even though it was impossible to estimate its period of occupation or importance, the archeological consultant recommended avoidance or mitigation. However, when the site was revisited in July 1979, the portion of the sandy ridge containing the site had been destroyed by removal of the soil. Consequently, mitigation or avoidance is no longer a consideration for this prehistoric archeological site.

Six copies of the consultant's report, Report of a Preliminary Archaeological Survey of a Transmission Right of Way from the Midland Plant to the Tittabawassee Substation for Consumers Power Company, by Museum of Anthropology, University of Michigan, July 1979, were provided to the NRC on November 29, 1979.

2.7 NOISE

A noise survey was conducted on May 23 and 24, 1973 to provide baseline environmental noise levels surrounding the area of the Midland Plant. Another survey will be performed in the year preceeding commercial operation to 11 document changes in ambient levels that may have occurred in the intervening years due to construction of the Plant and due to changes in industrial operations on adjacent land. This survey in will be more comprehensive in that it will include permanent magnetic tape recordings of samples obtained.

11 Methodology used in the 1973 survey as well as that to be used in the future ambient survey is detailed in Section 6.1.3. A Plant map of the site showing the 13 test points sampled in 1973 is presented in Figure 2.7-1. "A" weighted and/or octave band measurements were taken at three different times over a 24-hour period: 1630-1920 hours, 2100-2300 hours, and 0300-0500 hours. Extraneous noise sources were identified when possible and noted along with local weather conditions. Measurements were confined to the immediate area of the Plant and its property lines due to the industrial nature of the area.

Figure 2.7-2 summarizes the "A" weighted noise levels during each measurement period. A graphical comparison of octave band levels at two points for the 1630- to 1920-hour period is presented in Figure 2.7-3. Test Point 11 was on the south property line of the site over one mile (1600 meters) from Test Point 2 near the Plant location. Increased levels at Test Point 2 were due to noise sources at The Dow Chemical Company complex to the north.

Data sheets containing all measurements are presented as Figures 2.7-4 through 2.7-6.

Background noise level without traffic or other intermittent sources might be considered moderate. The level averages approximately 44 dBA during the daytime to approximately 48 dBA during the 0300- to 0500-hour measurement period.

CHAPTER 3

LIST OF TABLES

3.3 PLANT WATER USE

The sources, uses, and discharges of water for Midland Units 1 and 2 are shown on Figure 3.3-1 and quantified in Tables 3.3-1 and 3.3-2.

Ground water is not intended or planned to be utilized as a source of water during Plant operation.

3.3.1 Process Water

All water for use as process water is provided as follows:

a. The Dow Chemical Company provides feedwater to the evaporators in the process steam system. The steam thus produced is returned to The Dow Chemical Company for use in their process systems.

b. Makeup for the Midland Plant demineralizer system will be taken from
either of two sources. The Dow Chemical Company demineralized water
10 supplied by Dow as a portion of the makeup supply to the evaporators
can be used as makeup to the demineralizer system or the Plant has the
option of using the Midland Muncipal Water District supply. Normally,
11 the Plant will use the Midland municipal water as the preferred supply
with Dow demineralized water as backup.

2 It is estimated that on an annual basis the water use rate from the city water
8 system will average approximately 50 million gallons per year over the life of
2 the Plant.

Treatment and discharge of process wastewater is discussed in Section 3.5 and Section 3.6.

3.3.2 Cooling and Condensing Water

Water for use as cooling and condensing water is withdrawn from the Tittabawassee River and pumped to the 880-acre (356 ha) recirculating cooling pond. The makeup pumps are capable of withdrawing water from the

TABLE 3.4-7

MAKEUP WATER APPROACH VELOCITIES FOR VARIOUS WITHDRAWAL RATES

6	River Flow (cfs)	Withdrawal for Makeup (cfs)	Recirculation (cfs)	Total[(a)] Pumping (cfs)	No of Pumps Operating	Water Surface Elevation at Intake (ft (msl))	Average Approach Velocity[(d)] (ft/s)
10	350	0	67 (b)	67	1	588.8	0.42
6	390	40	40 (c)	80	1	589.0	0.24
	700	80	0	80	1	589.4	0.50
10	744	134	22 (c)	156	2	589.5	0.73
	1000	158	0	158	2	590.0	0.79
11	1565 (e)	226	0	226	3	590.8	1.00

---

10 (a) Pump output for makeup and recirculation to makeup pump inlet is a function of the river water surface elevation. Maximum pump output is 270 cfs at a water surface elevation of 608.0 ft.

(b) Recirculation to the blowdown line is for radwaste dilution only. Pump output for radwaste dilution is 67 cfs and is not a function of the river water surface elevation. Radwaste dilution may also be provided by cooling pond blowdown where available.

6 (c) Recirculation to makeup pump inlet.

(d) Calculated one foot in front of screen face.

10 (e) For river flows exceeding 1565 cfs, the average approach velocity will be less than 1 ft/s.

1 ft = 0.3048 m
1 ft/s = 30.5 cm/s

TABLE 3.4-8

MAXIMUM AND MINIMUM TEMPERATURES DURING HOURLY SIMULATIONS FOR 40-DAY PERIOD (°F)

	Equilibrium Temperature[a]		Condenser Inlet Temperature[b]	
	Max	Min	Max	Min
Hourly	113.2	35.9	97.7	87.6
Daily Average	80.2	59.9	97.0	88.3
2 6-Day Average	75.1	65.7	95.1	90.4
Period Average (40 days)	71.0		89.9	
Average - last 30 days	72.5		92.0	

(a) Equilibrium temperature is the temperature of a water body at which there is no net heat transfer across the water surface. Equilibrium temperature is determined solely by meteorological conditions.

(b) Figures represent last 30 days of simulation period to allow for adjustment to assumed initial conditions. The heat load in Btu/hr was 7.61 x 10^9.

3.6 CHEMICAL AND BIOCIDE WASTES

Chemical and biocide usage and discharge in wastewater streams are discussed below. The interrelationship and water usage of Plant water systems are presented in Section 3.3. Radwaste systems are discussed in Section 3.5. Sanitary and laundry wastes are discussed in Section 3.7. The effects of Plant chemical and biocide discharges on the Tittabawassee River are discussed in Section 5.3.

3.6.1 Low Volume Wastewater

Makeup for the Midland Plant demineralizer system will be taken from either of
10 two sources. The Dow Chemical Company demineralized water supplied by Dow as
a portion of the makeup supply to the evaporators can be used as makeup to the
demineralizer system or the Plant has the option of using the Midland
Municipal Water District supply. Normally, the Plant will use the Midland
11 municipal water as the preferred supply with Dow demineralized water as
backup. Since the Dow Chemical Company water is demineralized, the Midland
municipal water represents a worst case basis for waste characterization and
is used throughout this Environmental Report. Midland municipal water quality
is shown in Table 3.6-1.

3.6.1.1 Plant Makeup Water Treatment System

Midland municipal water is pumped from the makeup water system storage tank through activated carbon filters for residual chlorine removal and then through either one of two ion exchange trains. Each train consists of a strong acid cation vessel, a strong base anion vessel and a strong acid/strong base mixed bed vessel.

The activated carbon filter removes residual chlorine from the Midland municipal water. No significant accumulation of suspended solids is expected since the Midland municipal water is clarified and filtered prior to delivery to the Plant. The activated carbon filters are backwashed as necessary to condition the bed. This creates a maximum of 4,700 gallons (17.8 kl) of 8 backwash water per day assuming each filter is backwashed once per day. This backwash water is routed to the evaporator building neutralization sump.

Each makeup demineralizer train is designed to produce 253,350 gallons (959 kl) of demineralized water between regenerations. During normal operation one train is in service, and the other train is either in regeneration or on standby. Both trains, however, may be used during periods of high water demand.

The cation resins are regenerated with a sulfuric acid solution and the anion resins with a sodium hydroxide solution. All backwash, rinse, and chemical regenerant wastes from the makeup demineralizers are routed to the makeup evaporator neutralizing sump where the pH is adjusted as required to a range within 6.5 and 9.5 by addition of sulfuric acid or sodium hydroxide. Waste characteristics and volumes for the carbon filters and ion exchange trains are shown in Table 3.6-2.

3.6.1.2 Condensate Polishers

The high purity water required for operation of the once-through steam generators is maintained by the use of ammonia, hydrazine and full flow condensate polishing ion exchangers. The condensate polishers remove corrosion products and other impurities from the steam generator feedwater.

3.7.2 Liquid Effluents

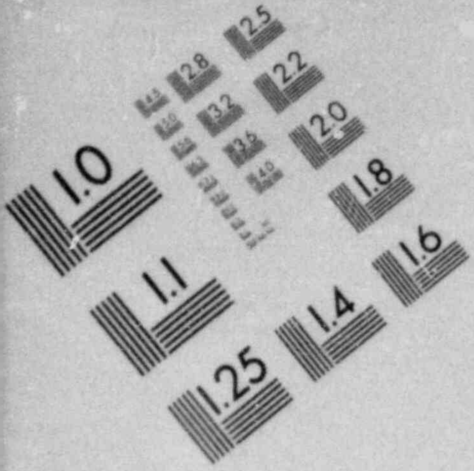
3.7.2.1 Laundry Waste

The laundry waste consists of personnel decontamination solutions, emergency shower water, and liquid waste generated from washing clothing which is potentially contaminated with radioactive particulates. This waste contains detergents and is not processed through demineralizers or evaporators, but is filtered for gross solids removal and collected in the laundry drain tank where the radioactivity level is monitored. Under normal conditions, laundry waste does not require treatment for radioactive contamination. From this drain tank the waste is filtered again for fine solids removal and released through the discharge structure to the Tittabawassee River. If the radioactivity level exceeds discharge limits, the waste will be diverted to the liquid waste system evaporator for processing as discussed in Section 3.5.2.

The quantity of laundry waste for the Midland Plant is estimated at a daily output of between 450 and 600 gallons. A non-phosphate synthetic detergent is used that allows the Plant to meet the NPDES Permit requirements for discharges to the Tittabawassee River.

3.7.2.2 Storm Drainage

The storm drainage system collects precipitation runoff from most of the building roofs and areaways, paved and unpaved surfaces of the power block area, and conveys the water to the cooling pond. The drainage from the evaporator building, combination shop, and part of the service water cooling



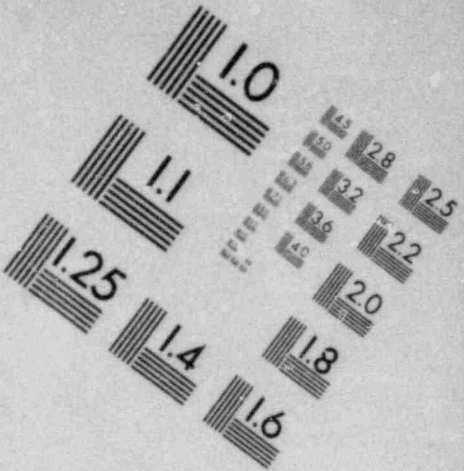
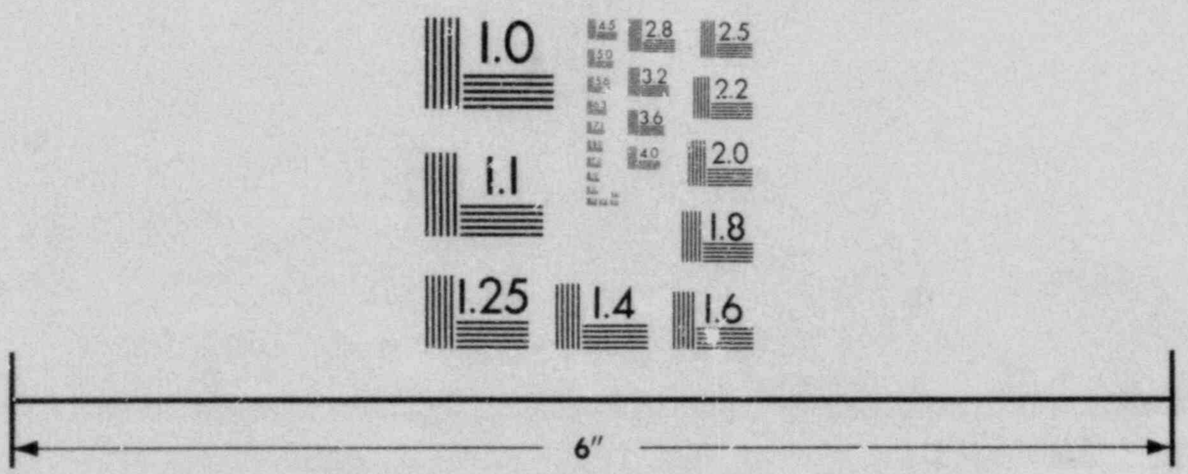
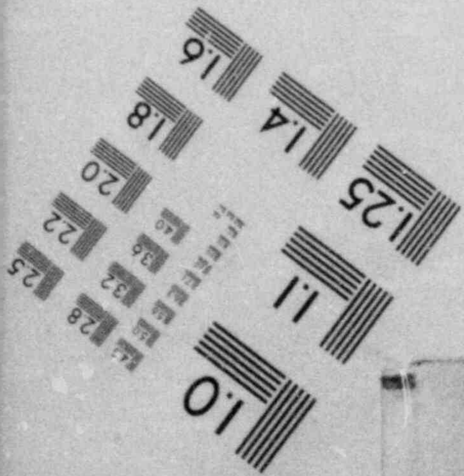
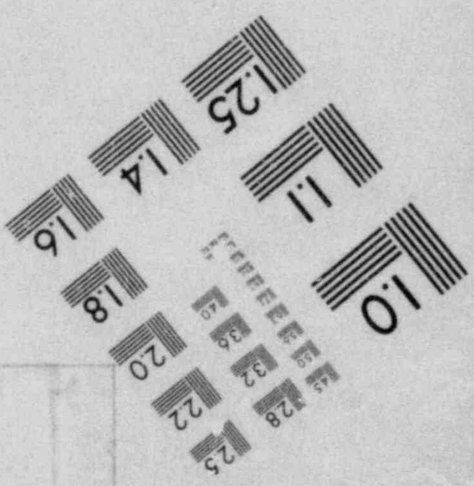


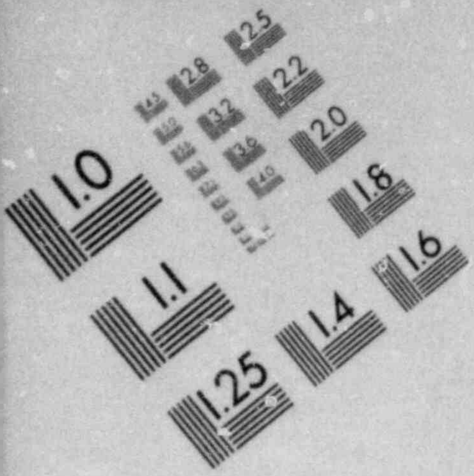
IMAGE EVALUATION
TEST TARGET (MT-3)



MICROCOPY RESOLUTION TEST CHART







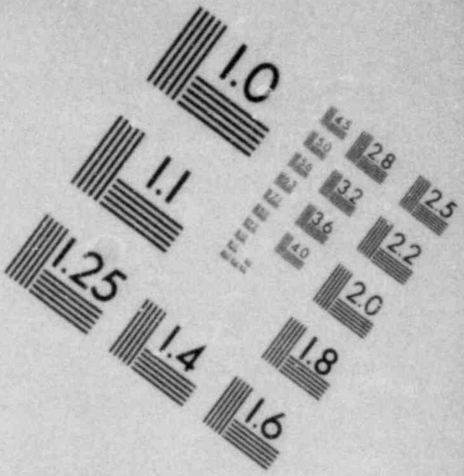
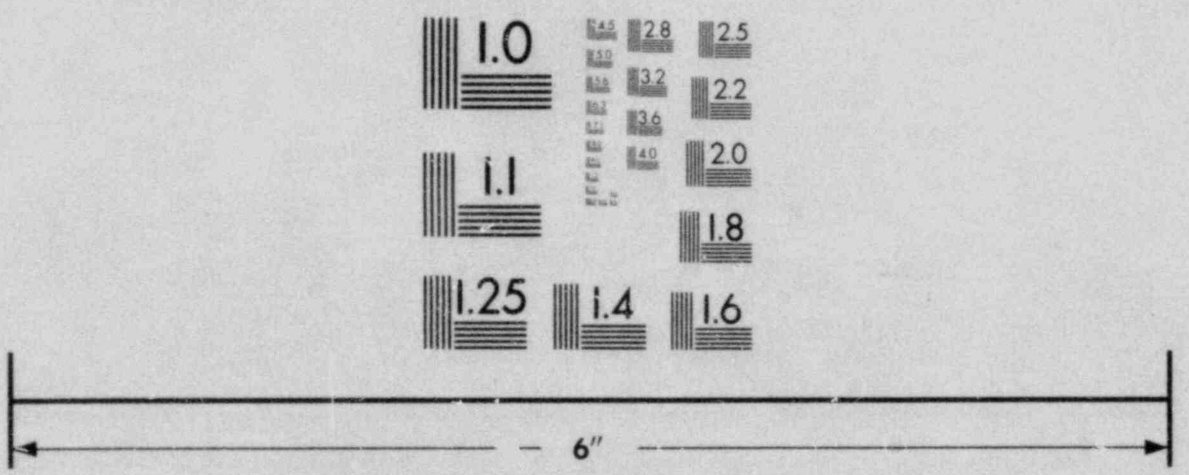


IMAGE EVALUATION
TEST TARGET (MT-3)



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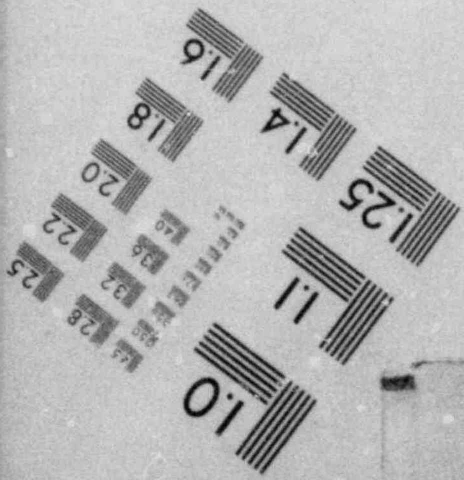

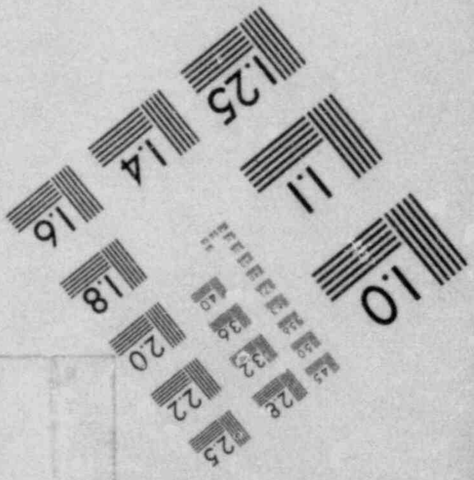

tower area is discharged directly into the Tittabawassee River via drainage ditches.

Precipitation falling on areas which may be contaminated by oil is collected and treated in the oily waste system (refer to Section 3.6).

3.7.2.3 Sanitary Waste

The sanitary waste collection system provides for sewage collection and the
11 conveyance of these wastes and the blowdown and continuous sample flow from
the process steam evaporators to The Dow Chemical Company Waste Treatment
Plant. The system consists of a gravity sewer which collects the effluent
11 from all building sanitary plumbing systems. The sewage, evaporator blowdown
and continuous sample flow are pumped by a sewage lift station to Dow via
force main.

Administrative control, design, and restricted access to contaminated areas are provided to prevent radioactive materials from entering the domestic sanitary waste water collection system.

The maximum expected load during Plant operation is based on a population of 300 at 50 gallons per capita per day or 15,000 gallons per day.

The Dow treatment facility consists of storage equalization, and tertiary treatment under continuous licensed supervision. The tertiary treatment includes preliminary treatment through trickling filters followed by two-stage activated sludge and final sedimentation.

3.7.2.4 Laboratory Wastes

All laboratory waste drainages are routed as follows:

a. The dirty radwaste system collects laboratory and other wastes which contain potentially radioactive substances.

b. The detergent radwaste system collects laboratory and other wastes which can contain detergent and radioactive substances.

c. The turbine building laboratory wastes are routed to the turbine building neutralizing sump. 11

d. The evaporator building laboratory wastes are routed to the evaporator building neutralizing sump.

The dirty radwaste and detergent radwaste systems are discussed in Section 3.5.2. Neutralizing sumps are discussed in Section 3.6.

3.7.3 Solid Waste

Solid waste includes trash, garbage, and other solid materials, such as materials from the trash racks and water screens in the water intake structures. These solid wastes are removed to a sanitary landfill by a licensed waste disposal company as discussed in Section 5.6.3. The estimated quantities of such wastes are presented in Table 5.6-2.

prebuilt tower line, is 2.7 miles (4.35 km) long. The environmental effects of this line are discussed in detail in Section 4.2 of the Environmental Report Supplement (ERS)(12). These line routes are shown on Figure 3.9-2.

3.9.4.3 Midland 1 and 2 to Tittabawassee 345 kV Lines

Two 345 kV bus tie lines originate at the south turbine building wall of the Midland Plant and extend across the north pond area with structures located adjacent to the dikes (Figure 3.9-2). Single circuit towers shown on Figure 3.9-8 will be utilized for these lines. The lines parallel an existing 138 kV tower line on 100-foot (30.5-m) centers along the toe of the dike to a point southerly of the railroad bridge. The lines cross the Tittabawassee River and South Saginaw Road along the south side of Salzburg Road. Vegetation along the riverbank was not disturbed. A small woodlot between the river and the dike was cleared. The area under the lines between South Saginaw Road and the railroad is used for industrial settling ponds. The remainder of the route along the northeasterly side of the railroad right-of-way is undeveloped industrial land which is covered by sapling and shrub vegetation. The area adjacent to the lines will be partially cleared for construction work. Both 11 lines will be 2.3 miles (3.7 km) long. The environmental effects of this line are discussed in the Applicant's Supplemental Environmental Report (ASER)(13) and the Final Environmental Statement (FES)(14).

3.9.4.4 Tittabawassee to Kenowa/Thetford 345 kV Line

The Tittabawassee-Kenowa/Thetford 345 kV line was also addressed briefly in the ASER(13) and the FES(14). A more detailed analysis follows.

The Tittabawassee to Kenowa/Thetford line is located in an existing corridor that was purchased prior to 1972. Double circuit towers, shown on Figure 3.9-9, were utilized. The corridor, excluding the wider, 1 mile (1.6 km) long exit at Tittabawassee, will accommodate two 345 kV tower lines. The first 8.0 miles (12.9 km) south from the Tittabawassee exit also accommodates two 138 kV tower lines and the next 7.6 miles (12.2 km) accommodates one 138 kV tower line. A 138 kV line was built in the north 8.0 miles (12.9 km) of the corridor in 1972. The 345 kV line is located 100 feet (30.5 m) east of the existing 138 kV line. The relative location of lines and the width of the corridor are indicated on Figures 3.9-2 and 3.9-3A through 3.9-3H.

The transmission line crosses numerous drains and creeks in addition to the Tittabawassee River and both forks of the Bad River. The Tittabawassee flood plain in the area of the proposed river crossing is approximately 0.5 mile (0.8 km) wide. Two structures are located in the low area northerly of the river with one of the towers placed within 200 feet (61 m) of the riverbank to provide clearance enough to allow riverbank vegetation to remain undisturbed. The tower on the southerly side of the crossing is placed at the top of an embankment to allow all except the largest trees to remain. Other river and creek banks are left undisturbed except for the removal of larger trees. The majority of the land along the route is cultivated. Wooded areas are generally a composite of immature trees, saplings and shrubs. Nearly 60% of the route lies along property lines. The alignment was adjusted in several locations to avoid the removal of residences. The 345 kV line utilizes 333

4.2 TRANSMISSION FACILITIES CONSTRUCTION

Transmission lines associated with the Midland Nuclear Plant construction consist of two 345 kV lines running 2.3 miles (3.7 km) to Tittabawassee Substation and one 345 kV line running 27.5 miles (44.2 km) from Tittabawassee Substation to interconnect with the existing Kenowa-Thetford 345 kV line. The line route between the Plant and the substation crosses flat land identified as industrial or wasteland. The 27.5-mile (44.2 km) section of line running south out of the substation crosses farmlands mixed with occasional woodlots.

Another line associated with the project is a 138 kV start-up line running south along the east side of the cooling pond and east along the north side of Gordonville Road. This line crosses the Tittabawassee River and Saginaw Road approximately 1 mile (1.6 km) south of the 345 kV line crossings and then continues northeast into Tittabawassee Substation. The clearing at the river is for construction access with a majority of the right-of-way selectively cleared to preserve low growing species. There is an ample amount of roadside trees along Saginaw Road to obstruct views to the line at the crossing location.

Routing of the 138 kV start-up line and the two 345 kV lines judiciously utilizes existing vegetation. An insignificant amount of clearing is required between the Midland Plant and Tittabawassee Substation. The Tittabawassee to Kenowa-Thetford 345 kV line requires clearing only 110.9 acres (45 ha) of scattered fencerows and woodlots at a width of 142 feet (43.3 m). Additional trees outside the cleared right-of-way which endanger the line are selectively removed.

The most visually sensitive area affected by new transmission lines is the northern one-third of the Tittabawassee to Kenowa-Thetford right-of-way(1). In this area, the flat terrain is nearly lacking of arborescent vegetation. Agriculture in this area is practiced up to roadsides and ditch banks. The predominance of row crops also has eliminated fencerows and the vegetation that usually is present along fencerows. Although the transmission towers are exposed for long distances, the rural nature of the surrounding area reduces the effects of this exposure.

The remaining portion of the Tittabawassee to Kenowa-Thetford 345 kV line route has a moderate sensitivity. In some areas the line will be screened by existing woodlots and stream valleys.

Design, routing, construction and maintenance of these transmission lines is done in accordance with Environmental Criteria for Electric Transmission Systems(2) developed by the US Departments of Interior and Agriculture, and Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities(3) published by the Federal Power Commission. In addition, the Applicant has engaged landscape architects to develop guidelines(4) for minimizing impact of transmission lines and facilities on aesthetic values. These criteria have been applied in design of the transmission lines from the Midland Plant to the substation, and from the substation to the Kenowa-Thetford line.

11 Approval of the Corps of Engineers was obtained for erecting the transmission lines across the Tittabawassee River, Bad River and Beaver Creek.

4.2.1 Clearing Techniques and Changes to Physical and Biological Processes

Construction clearing practices of selective cutting, keeping the width of the cleared strip to a minimum, clearing to a variable width within spans and preservation of existing small trees and shrubs are followed when possible to reduce visual impact. Merchantable timber is salvaged and slash windrowed or disposed of. Windrowing provides habitat for many species of birds and mammals and is the method accepted by the Michigan Department of Natural Resources.

Construction activities along the transmission line route will require removal of all trees and brush to at least 45 feet (13.6 m) on either side of the
4 tower center line. Additional trees tall enough to endanger the reliability of the operating line will be removed up to 115 feet (34.7 m) from the tower center line. Clearing activities began on September 10, 1979 on the southern end of the right-of-way. This date coincided with completion of field work for the ecological survey on this segment of the right-of-way. The ecological survey for the entire right-of-way, which was completed on September 14, 1979,
10 revealed no threatened or endangered species or other significant impediments to construction. Clearing activities were completed by November 15, 1979. Clearing crews were transported in small pickup trucks. Small crawler type tractors windrowed brush along the right-of-way.

In wooded areas that required clearing, the physical structure of the forest was well as the biotic succession was reduced to herbaceous ground cover. These conditions are the results of clearing the corridor, grading where required for a construction road in the right-of-way, grading and excavating for tower bases, construction of towers, and heavy equipment moving across the terrain.

The cleared wooded areas are changed structurally and compositionally from
areas supporting at least three vegetative strata and wildlife nesting areas
to areas of one or two vegetative strata. While floral and faunal species
requiring a forest habitat in this stage of succession have been negatively
10 impacted, floral and faunal species favoring earlier successional stages will
be benefitted. Important game species such as deer, rabbits, and grouse
should benefit from the erection and maintenance of this right-of-way.
Topographical and hydrological changes are minimal due to the little relief in
this area. Hence, disruption of drainage patterns or topographical features
by line construction has a negligible effect on biological processes.

4.2.2 Erecting Towers and Stringing Conductors

Construction of towers and stringing conductors cause minor disruption to the
environment. At each tower, work activities travel across the shortest and
most practical access roads. Work activites which impact the right-of-way for
4 the Tittabawassee to Kenowa/Thetford transmission line follow based, on the
current construction schedule.

11 Shipments of tower anchor steel were delivered to railhead storage sites by
10 November 1979. Contractor's equipment will be set up and excavation for tower
11 foundations is scheduled to begin in August 1982. Heavy tracked equipment or
truck-mounted power augers will be required to bore four-foot diameter holes
10 to depths from 10 feet (3 m) to 20 feet (6 m) depending on soil conditions. A
30-foot (9 m) long, trailer-mounted, vibra-hammer, towed by a truck or tractor
4 will be required to drive caissons for the foundation at each of the four

tower legs. A stump-free access road to each tangent tower site will be
required for the front-end dump, 12-1/2 yard concrete trucks to supply
concrete for the pier type foundations. A tracked front-end loader and a soil
4 compactor will be used at each angle tower to excavate and cover the 12-15
foot square (3.7-4.6 m) reinforced concrete pads for the four tower anchors.
A 15-man crew transported by light trucks will be used at each tower site.
With allowance for inclement weather and unusual access problems, foundation
10 work will progress ahead of tower erection crews to a scheduled completion
date of August 1983.

11 Tower steel delivery is scheduled to begin by August 1982 by 10-ton multi-
wheeled trucks from the railhead to the tower sites and will continue as
10 required, except for the period when spring load restrictions are placed on
roads. Approximately 2,200 tons of tower steel or an average of 15 tons per
4 tower will be required. Sorting and partial assembly of tower steel will be
10 done by a 15-man crew. A 70-ton, self-propelled, tracked crane, supported by
a 12-man crew, is scheduled for delivery to start erection of towers on
11 completed foundations by November 1982. Tower erection is scheduled for
completion by May 1983.

Conductor reels are usually placed at four-mile intervals with tensioner
equipment located at the midpoint between them. Conductor stringing
operations start approximately one month after tower erection starts. A light
4 caterpillar tractor will be used to pull the lead line along the approximate
tower center line between the conductor reels and the tensioner. Conductors
are tension strung so that they do not touch the ground. Two reels of
10 conductor per phase are pulled from each direction and joined with splices
4 before the equipment is moved to the next station where the process is

repeated. The heavy equipment along with the caterpillar tractors used for
4 transportation and anchorage are located as near to roadways as practical.
Wire installation is scheduled to begin in January 1983 and for completion by
11 July 1983.

Project completion is scheduled for August 1, 1983. Two weeks are allowed for
10 testing of substation equipment prior to the service date. Site cleanup,
11 grounding and fence restoration will be completed before October 1, 1983.

The Tittabawassee to Kenowa/Thetford 345 kV line route crosses 14 agricultural drainage ditches and 5 streams(1). Most of the drainage ditches are small and lack arborescent vegetation; therefore, transmission line construction does not create much impact. Construction equipment generally uses existing roads and culverts in crossing ditches to prevent erosion and siltation.

All stream and river crossings will be accomplished in accordance with
10 specifications that are conditions for permit approvals by the Michigan
Department of Natural Resources under the Inland Lakes and Streams Act, Act
346 of Public Acts of 1972 and by the Corps of Engineers under Section 404 of
11 the Federal Water Pollution Control Act (PL 92-500 as amended).

The 25 archeological/historic sites reported (Appendix 2.6C) along the
Tittabawassee to Kenowa/Thetford 345 kV transmission line route can, in
general, be avoided and left intact on the right-of-way. An avoidance and
4 mitigation plan was finalized at a Consumers Power meeting with Dr Doreen
Ozker, Archeologist for the Great Lakes Museum of Anthropology, University of
Michigan, and Dr John Halsey, State Archeologist, on November 29, 1978. This
plan is summarized on Table 4.2-1.

11 Five of the archeological sites were removed from consideration because prior
4 sand removal and grading by others had destroyed the archeological materials
11 or because they were not archeological sites in the ROW. Eleven of the archeological sites can be avoided because their locations are such that they
4 can be posted to direct construction activities around them. Tower locations will be adjusted to span the archeological sites.

10 Nine of the archeological sites required mitigation because they conflicted
4 with line construction plans for structure location or access along the right-
10 of-way. Phase I field reconnaissance of all these archeological sites was conducted in the spring of 1979. This phase of archeological mitigation
11 involved plowing, surface collection of artifacts and shovel probing to determine whether the site was significant enough to require detailed Phase II mitigation. Phase I reconnaissance was generally restricted to the part of
10 the right-of-way impacted by construction activities. If the results were negative, that area was then cleared for unrestricted construction activity. Phase II excavation, conducted in the spring of 1979, involved plotting the concentrations of artifacts recovered in Phase I, analysis of their significance, division of the site into a grid for controlled surface collection, and further excavation to the archeological horizon in areas that
11 were productive in Phase I. Phase III analysis involved documentation, interpretation and reporting of the results of the mitigation activities. As indicated in Section 2.6.3, a report has been provided to the NRC on the findings of this analysis.

4 The Herber Site, 20SA318, located south of Ring Road in the southwest one-
10 quarter of Section 15, Brant Township, Saginaw County, involved Phase I, II
4 and III activities. The Big Mapleton Site, 20MD116, located in the floodplain

10 north of the Tittabawassee River in the southwest one-quarter of Section 1,
11 Ingersoll Township, Midland County, also required the same treatment. Phase
II excavation also occurred at other sites after the Phase I field
reconnaissance. Following archeological fieldwork completed in July 1979,
10 sites listed for mitigation were clear for unrestricted construction activity,
pending the September completion of the concurrent ecological study discussed
in Section 4.2.1.

4.2.3 Access and Service Roads

During construction, access to the right-of-way generally is along established
10 farm lanes and temporary drives near the line. New access roads to the right-
of-way are constructed only when absolutely necessary. New roads and
temporary drives are returned to their original use upon completion of
construction.

4.2.4 Erosion Due to Transmission Line Construction

Soil erosion is controlled in compliance with Michigan Soil Erosion and Sedimentation Control Act(5). Temporary measures are implemented during construction to eliminate soil erosion associated with construction activities and the use of heavy equipment. Upon completion of construction, disturbed areas are regraded and permanent erosion control measures are administered to preserve the water quality of the watershed.

Construction activities on agricultural lands subject these areas to some wind erosion. Agriculture is extensively practiced close to roads, ditches and streams, leaving vast areas devoid of windbreaks and shelterbelts. During construction, this condition exists for one growing season. Following construction, the land again is available for agricultural practices. If

TABLE 4.2-1

AVOIDANCE AND MITIGATION ARCHEOLOGICAL SITES ON TITTABAWASSEE TO KENOWA/THETFORD TRANSMISSION LINE RIGHT-OF-WAY

	Michigan Archaeological Site Number(a)	Activity	1979 Mitigation Phase(b)
11			
	20SA207	Omit(c)	-
4	20SA321	Avoid, use west 1/3 of ROW	-
	20SA320	Avoid, use sides of ROW to avoid knoll	-
	20SA337	Mitigate	I, II, III
11	20SA108	Mitigate	I, II, III
	20SA322	Mitigate	I, II, III
	20SA323	Avoid, use west 1/3 of ROW	-
4	20SA318	Mitigate	I, II, III
	20SA324	Omit(d)	-
11	20SA325	Mitigate	I, II, III
	20SA326	Mitigate	I, II
	20SA327	Avoid, use east 1/2 of ROW	-
4	20SA328	Avoid, use west 1/2 of ROW	-
11	20SA329	Mitigate	I, III
	20SA330	Omit(c)	-
4	20SA319	Avoid, use west 1/2 of ROW	-
	20SA331	Avoid, use west side of ROW	-
11	20SA332	Omit(e)	-
	20SA333	Avoid, use west 1/2 of ROW	-
4	20MD391	Avoid, use east 1/3 of ROW	-
	20MD392	Avoid, use east 1/2 of ROW	-
5	20MD393	Avoid, use west 1/2 of ROW	-
	20MD116	Mitigate	I, II, III
11	20MD394	Mitigate	I, II, III
	20MD395	Omit(c)	-

4

(a) Refer to Appendix 2.6C.

(b) I = Reconnaissance; II = Excavation; III = Analysis; refer to Section 4.2.2.

(c) Original site was previously destroyed by mining.

11 (d) Site is on a tree easement rather than the ROW.

(e) On reconsideration this is not an archeological site.

TABLE 5.8-1

6 ESTIMATED DECOMMISSIONING[a] AND RESTORATION COSTS
11 (Millions of 1984 Dollars)

6 Activity	Estimate
Mobilization, Demobilization and Temporary Facilities	$ 4.8
Supplies, Power, Contractor Services, Nuclear Insurance	23.6
Equipment	5.4
11 Staff Labor	33.2
Demolition Services	54.9
Disposal (Radioactive Waste)	46.6
Overheads	16.3
Subtotal Decommissioning	$184.8
6 Reboiler, Diesel-Generator, Administration, Service Water and Circulating Water Structures Demolition	8.9
11 Site Specific Restoration	41.9
Rounding	(0.6)
6 11 Total Decommissioning, Demolition and Site Restoration	$235.0

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6 [a] Prompt removal/dismantling based on Battelle Pacific Northwest Study[1a] and Atomic Industrial Forum Study[2].

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6.1.3.3 Preoperational Noise Survey

During May of 1973, an environmental sound survey was conducted in the area of the Midland Plant and surrounding property. The survey provided baseline environmental noise levels for the area surrounding the Plant prior to construction such that the noise impact of construction and operation could be determined. The baseline data collected in this survey are presented in Section 2.7.

11 Another survey will be conducted in the year prior to commercial operation, when most Plant construction is complete, following the same procedures and techniques as used in the 1973 survey. At that time, any additional ambient noise sources, such as those from The Dow Chemical Company complex, the major source of noise in the 1973 survey, can be identified.

6.1.3.3.1 Instrumentation

The following equipment was used in the May 1973 ambient sound level survey of the Midland Plant site:

- a. General Radio Model 1558-BP Octave Band Analyzer
- b. General Radio Model 1560-P6 1-Inch Ceramic Microphone
- c. General Radio Model 1560 - P40 Microphone Preamplifier
- d. General Radio Model 1562A Microphone Calibrator
- e. Bruel and Kjaer Windscreen

The Octave Band Analyzer (sound level meter) used conforms to ANSI Standard S1.4-1971(7) for a Class II sound level meter which complies with ANSI

Standard S1.13-1971(8) , Section 5.4.1, concerning instrument accuracy for field environment use.

11 In future environmental noise surveys at the Midland Plant site, the following general equipment specifications will be adhered to:

a. Sound Level Meter - conforms to ANSI Standard S1.4-1971(7) for a Class I Precision Sound Level Meter.

b. Octave Filter Set - conforms to ANSI Standard S1.11-1966 (R1971)(9) for octave, half octave, and third octave filters. The filter set can be a part of the Precision Sound Level Meter.

c. Microphone - conforms to ANSI Standard S1.4-1971(7) and satisfies the requirements of the Class I Precision Sound Level Meter. A windscreen was used to minimize the effect of wind noise.

d. Calibrator - capable of calibrating the sound level meter used.

Other general equipment will be required:

e. Tape Recorder - will be used when a nonrepeatable, short duration noise is to be measured. Tape recorder will meet specifications set forth in ANSI Standard S1.13-1971(8) .

f. Temperature, humidity and wind speed measuring equipment. Barometric pressure will be obtained from the nearest airport.

g. Measuring Tape or Measuring Wheel - for determining distances to locate data collection points.

6.1.3.3.2 Calibration

The system was calibrated prior to each measurement period to ensure consistent and accurate measurements. Battery condition was monitored and 11 batteries replaced when necessary. These procedures will be followed in all future sound level surveys at the site.

6.1.3.3.3 Methodology of Data Collection

During the May 1973 environmental sound survey, "A" weighted and/or octave band measurements were taken at 13 locations in the area of the Midland Plant structures and the perimeter of the Plant property boundary. Measurements were taken at the nearest residence as well as along the access roads to the Plant. Measurements were taken during three different time intervals over a 24-hour period; (1) the first period (1630 to 1930 hr) encompassed the highest ambient noise time period in the general vicinity of the Plant due to the elevated levels of traffic noise on adjacent roads; (2) the second period (2100 to 2300 hr) was chosen as typical of those hours when the majority of persons residing near the Plant would be active within their homes and levels of ambient sources other than the Midland Plant would be minimal; (3) the third period (0300 to 0500 hr) represented the extreme condition when virtually all community noise should be at its lowest value. The number and location of sampling points and the sampling periods were chosen to provide an accurate measure of existing ambient levels. Sound level measurements were taken with the sound level meter in the slow-response position. Each measurement represents a 15-second average of the sound level meter indication. During each measurement, weather data and general traffic conditions were observed and recorded. A B&K Windscreen was always used on the microphone. However, no data were collected when the wind velocity exceeded 10 mph.

11 Essentially the same procedure will be followed in the ambient survey performed just prior to commercial operation with the exception that a number of measurement points will be added to the existing 13, in the area north of the Plant extending into The Dow Chemical Company complex, and beyond the Plant property lines to the south and west to include the residential areas nearest to the Plant.

In addition, the amount of data taken at each measurement point will be expanded by recording a sample of the ambient sound level and subsequently analyzing this sample on a real-time analyzer. Not only will this provide a permanent record of the data, but will allow more meaningful comparisons to be made between data points and between preoperational and postoperational levels. Due to the industrial nature of the area directly north and east of the Midland Plant, it is also expected that the noise impact of the Midland Plant will be difficult to quantify without a spectral analysis of the sound levels at these points. The recording and real-time analysis of these measurements will greatly enhance the accuracy and reliability of the data.

1 6.1.4 Land

6.1.4.1 Geology and Soils

Numerous site exploration programs have been completed since the initial investigation began in 1956. The primary purposes of these studies were to determine the site glacial and bedrock geology conditions, evaluate the foundation conditions, and determine the environmental impact of Plant construction and operation on the geology and soils in the Plant area. The major conclusions of these investigations are presented in Section 2.5. These programs are summarized in the following sections.

6.1.4.1.1 Exploration Programs

Power Block Area Borings

A total of 117 borings ranging up to 432 feet in depth and 22 probes were performed in the power block area between 1956 and 1974. Two of the borings passed through the glacial deposits and penetrated into rock. Boring 1 was drilled about 10 feet into rock, and Boring 1A was drilled about 75 feet into rock.

Twenty-two probes ranging in depth from 10 to 45 feet were also performed in this area by truck-mounted rotary continuous flight auger equipment. The soil cuttings from the augers were used to identify soil types for the log of the soil profile.

Dike Perimeter Area Borings

A total of 167 borings are attributable to exploratory work for the dike system. Sixty-one of the borings were done for site exploration and the rest were subsequently drilled in conjunction with dike construction. The borings ranged in depth from 3.5 to 70 feet.

Borrow Area Borings

A total of 90 borings were made in the borrow area inside the dike system. Twenty-one of the borings were made in the area that is now the emergency cooling water pond. These borings range in depth from 10 to 15 feet.

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Forty-nine borings were drilled at various locations within the cooling pond area to determine a source of borrow material. They ranged in depth from 5 to 60 feet.

Borings for Structures Outside Power Block Area

Additional exploration was conducted for three structures away from the main Plant area. Nine exploratory borings were drilled at the railroad bridge site and one in the embankment area. These ranged in depth between 25 and 70 feet. A total of eight borings with depths ranging from 60 to 75 feet were made in the vicinity of the Bullock Creek bridge. Sixteen borings ranging in depth between 9 and 60 feet were made in the vicinity of the spillway through the east leg of the dike.

6.1.4.1.2 Soil and Rock Sampling Methods

No preoperational studies have been conducted to determine the impact of construction activities on productivity of soils; however, the surface soil types that are found on the site have been discussed in the Ecological Survey of the Midland Site(10).

Physical properties of the glacial surficial materials were determined. Both disturbed and undisturbed soil samples were taken. The disturbed samples were of three types: those from the standard penetration test sampler, bulk samples from auger cuttings, and wash samples from the rotary wash drilling process. The undisturbed samples were obtained by using Dames and Moore soil samplers or coring methods.

The rock cores were taken by an NX size core barrel with a diamond bit.

6.1.4.1.3 Subsidence Monitoring Program

The subsidence benchmark program is designed to monitor any subsidence of the
2 ground surface which could occur adjacent to the Plant due to salt mining.
The program is considered as precautionary because no actual subsidence is
anticipated as a result of the salt mining.

Two studies, one of which includes 10 years of ground surface monitoring data,
prepared by independent engineering consulting firms and referenced in Section
2.5 of this report, conclude there will be no surficial effects due to salt
removal from the rock strata located over 4,100 feet beneath the ground
surface. Since the issuance of these reports, a number of previously active
wells used in the subsidence analysis have either been plugged or are now
inactive. In fact, within a one-mile radius of the power block area, there
11 are no active salt solution mining wells (see Table 2.5-1 and Figure 2.5-5).
One brine removal well is still in service but it is over 2,000 feet southwest
of the containment buildings.

The subsidence monitoring system consists of 25 shallow benchmarks anchored in
2 till at a depth of 15 to 60 feet (4.5 to 18 m) below the ground surface and 2
deep benchmarks anchored in rock 320 and 413 feet (98 and 126 m) below the
ground. Figure 6.1-8 shows the location and design of these benchmarks.

2

First order surveys will be made at least annually for the operational life of the Plant to detect any subsidence near the Plant.

6.1.4.2 Land-Use and Demographic Surveys

Land-use information and data were obtained by the Applicant's staff from field surveys of the area surrounding the Midland Plant site, and from the Environmental Inventory(11).

Recent aerial photographs were used to locate the nearest residence in each of the 16 sectors. Consumers Power Company's Electrical Service Distribution maps were used to verify these residences. The nearest vegetable gardens were assumed to be located at the nearest residences. Field surveys of the area within 5 miles of the Midland Plant consisted of driving all the public roads to physically locate the milking cows, milking goats and also to verify the nearest residences.

Methods for collection and analysis of demographic data are discussed in Section 2.1.2.

6.1.4.3 Ecological Parameters

The 1971 terrestrial ecological survey(10) that was conducted by Michigan State University personnel is the only terrestrial ecological survey that has been completed on the Midland Plant site. The report described and discussed 3 relationships between the vegetation and wildlife that existed on the site prior to and after preliminary Plant site preparation activities. Most of the vegetation and wildlife habitat on the 1235-acre Plant site have been either eliminated or altered as a result of construction activities.

6.2A-1 DEFINITIONS

11 | annually - See frequency.

atmospheric ΔT - A normalized measure of atmospheric stability obtained from the vertical temperature gradient between two levels (eg, 10m and 60m). The corresponding values between the magnitude of temperature gradient and type of stability are given in Regulatory Guide 1.23.

batch release - The discharge of fluid wastes of a discrete volume.

calendar quarter - Periods of three consecutive months beginning with January, April, July, and October.

calibration - The process whereby a position on the scale of an instrument is identified with the magnitude of the signal actuating that instrument.

check - A qualitative determination of acceptable operability by observation of instrument behavior during normal operation.

commercial operation - When the unit is declared commercial by Consumers Power Company.

composite sample - A sample made up of several grab samples collected and mixed to represent the average over a period of time.

confirmed measurement - A measurement that has been verified by re-analysis of the original, analysis of a duplicate, or analysis of a new sample.

continuous - As applied to monitors, samplers and indicators, does not prevent the devices from periodically being taken out of service for calibration or maintenance.

continuous release - The discharge of fluid waste of a nondiscrete volume, eg, from a volume or system that has an input flow during the continuous release.

cooling pond - The approximately 880-acre impoundment (operating capacity of about 12,600 acre feet) for the dissipation of waste heat, storage of emergency service water and storage of some limited process wastes until discharge to the river.

11 daily - See frequency.

daily average concentration - Arithmetic average of two or more quantities totaled over a calendar day; arithmetic average of all daily determinations of concentration made during a calendar month.

dbh - Diameter at breast height.

drift - Small droplets of the cooling water and dissolved salts that are carried aloft by convection and wind.

$\bar{E}$ - Average beta or gamma energy per disintegration of a radionuclide mixture.

emergency service water intake channel and reservoir - That depressed portion of the cooling pond which provides cooling water for the ultimate heat sink following an analyzed accident requiring operation of Plant emergency systems.

frequency - Required intervals are defined as:

Annually - At least once per 12 months.

Daily - At least once per 24 hours.

Monthly - At least once per 31 days.

11 Quarterly - At least once per 92 days.

Semiannually - At least once per 6 months.

Weekly - At least once per 7 days.

Interval extensions are allowable if the extension does not exceed the specified interval by more than 25% and if any three consecutive intervals do not exceed 325% of the specified interval.

functional test - Injection of a simulated signal into the instrument to verify that it is operable, including any alarm and/or trip initiated action.

grab sample - Sample taken to be a near-instantaneous representation of a well-mixed flow or uniform body of material. Sampling occurs over a distribution that is small in comparison to the total distributed quantity.

habitat - The environment which a plant or animal natively occupies.

herbaceous vegetation - The low-growing plants that occupy the lower stratum in natural plant communities such as grasses and forbs.

$_i$ - (subscript) - Refers to individual radionuclide.

initial criticality - The first attainment of a self-sustaining fission reaction within the reactor core.

K - The total body dose factor due to gamma emissions (rem/yr per Ci/s) obtained from the product of the gamma-body dose factor for exposure to a semi-infinite cloud (Table B-1, Regulatory Guide 1.109)(1) and the most limiting χ/Q value. For K_s, χ/Q_s equals 2.72E-06 s/m^3 and for K_v, χ/Q_v equals 2.51E-05 s/m^3.

L - The skin dose factor due to beta emissions (rem/yr per Ci/s) calculated using the following formula:

$$L_i = 1.0E{+}09\ \chi/Q\ (DFS_i + 1.1\ DF\gamma_i)$$

where

χ/Q_s = 2.72E-06 s/m^3

χ/Q_v = 2.51E-05 s/m^3

DFS_i = beta skin dose factor (mrem/m^3 per pCi/yr) from Table B-1, Regulatory Guide 1.109 (1)

1.1 = average ratio of tissue to air energy absorption coefficients

$DF\gamma_i$ = gamma air dose factor (mrad/m^3 per pCi/yr) from Table B-1, Regulatory Guide 1.109(1)

1.0E+09 = units conversion from mrem/pCi to rem/Ci

LCO - Limiting Condition for Operation.

lower limit of detection (LLD) - The smallest amount of sample radioactivity that would yield a net count (above system background) for which there is a 95% confidence that radioactivity is present. LLDs are calculated assuming a single gamma-emitting isotope is present in the sample. Therefore, LLDs are objectives only and are not rigid sensitivity limits for multicomponent gamma spectrometry.

11 monthly - See frequency.

mosses - Low-growing primitive plants that lack true roots, stems, leaves and vascular systems.

MPC - maximum permissible concentration values specified in 10 CFR 20, Appendix B, Table II.

noble gases - The following radionuclides are considered noble gases:

Ar-41
Kr-83m
Kr-85m
Kr-85
Kr-88
Xe-131m
Xe-133m
Xe-133
Xe-135m
Xe-135

normal operation - Operation to perform the intended function without an associated abnormal condition such as an alarm, a nonroutine valve lineup or other off-standard condition.

NPDES Permit - National Pollutant Discharge Elimination System Permit issued by the State of Michigan to Consumers Power Company. This permit authorizes Consumers Power Company to discharge, from the Midland Plant, into the waters of the State of Michigan.

phytosociology - The branch of ecology devoted to the consideration of vegetational arrangement or pattern.

Plant - The total Midland Plant Units 1 and 2 including all structures, the cooling pond and all associated land within the site boundary.

Q - Average annual release rate in curies per second.

11 quarterly - See frequency.

$_s$ - (subscript) - stack or elevated.

11 semiannually - See frequency.

significant gamma emitter - radionuclide emitting electromagnetic radiation of nuclear origin with an energy greater than 0.1 MeV, a gamma intensity greater than 10% and a physical half-life greater than one day but including the following radionuclides:

Ar-41
Kr-85
Kr-85m
Kr-87
Kr-88
Xe-133
Xe-135
Xe-135m
Xe-138
I-131
I-133
I-135
Cs-134
Cs-137
Co-58
Co-60
Fe-59
Zn-65
Mn-54
Cr-51
Zr-Nb-65
Mo-99
Tc-99m
Ba-La-140
Ce-141

site - Midland Nuclear Plant Units 1 and 2 and all associated property and structures.

$_v$ - (subscript) - vent or ground level.

vegetation composition - The makeup of plant species in an area or sampling plot.

vegetation structure - An expression of vegetative life forms of an area in relation to their spatial organization.

11 | weekly - See frequency.

X/Q - Ratio of the concentration at the receptor (curies per cubic meter) to the radioactivity release rate (curies per second). The term denotes the degree of dispersion of the radioactivity as it is transported from the source to the receptor. Open terrain correction factors are included when used to calculate K.

d. Instrumentation meets the following general specifications:

  1. Sound Level Meter - Conforms to ANSI Standard S1.4-1971(3) for a Class I Precision Sound Level Meter.

  2. Octave Filter Set - Conforms to ANSI Standard S1.11-1966(R1971)(4) for octave, half octave and third octave filters. The filter set can be a part of the sound level meter.

  3. Microphone - Conforms to ANSI Standard S1.4-1971(3) and satisfies the requirements of the Class I sound level meter. A windscreen is used to minimize the effect of wind noise.

  4. Calibrator - Capable of calibrating the sound level meter used.

  5. Tape Recorder - Meets specifications set forth in ANSI Standard S1.13-1971(5).

e. Meteorological and Plant operating conditions are documented during the surveillance periods.

Reporting Requirements

a. Results of the operational noise survey are presented in the Annual Report according to Section 6.2A-5.6.1 of the Environmental Technical Specifications.

b. Deviations from the schedule in Table 6.2A-3-4 are described in the Annual Report.

Bases

This operational noise survey is for verification of the predicted noise impact of those features of the Midland Plant considered to produce significant noise levels.

Although several noise criteria have been published by various agencies (6,7,8), they are not particularly adaptable to sampling techniques as outlined in this survey program. Each criteria differs sufficiently from the others to prevent a common level criteria to be established. Most methods are based on annoyance limits and are, therefore, very subjective. Noise levels that are considered safety hazards (9) greatly exceed any community noise level resulting from operation of the Midland Plant.

The winter and summer seasons chosen for the survey represent the best and worst case conditions, respectively, due to higher sensitivity of the general population to outdoor noises during the summer months and vice versa.

11| As many test points as possible coincide with those used in the preoperational ambient survey such that meaningful comparisons can be made to determine what environmental impact is attributed to Plant operation. In addition, instrumentation used is, as much as practical, the same as that used in the preoperational ambient survey. 11|

6.2A-3.1.2 Biotic Surveillance

6.2A-3.1.2.1 Aquatic Surveys

Biotic aspects of aquatic environments are surveyed in accordance with the NPDES Permit which specifies effluent and instream monitoring requirements

Section 2.6.1. These investigations are also part of the archeological
5 background of the report noted above.

6.3.7 Noise Programs

At the present time, the only other party conducting any sound level surveys
in the vicinity of the Midland Plant is The Dow Chemical Company. Using field
measurement techniques, these surveys are done occasionally around the
perimeter of The Dow Chemical complex by the environmental quality control
group and are intended for informational purposes only. Past surveys by Dow
Chemical did not include the southern property along the Tittabawassee River.
Therefore, no data have been obtained for the areas immediately adjacent to
the Midland Plant. The nearest data point is on Saginaw Road approximately
4,000 feet (1,219 m) east of the Midland Plant. This point and others are
11 within the area that Consumers Power Company personnel will survey prior to
commercial operation of the Midland Plant. All survey data will be made
available to both companies and correlation will be done upon completion of
11 the preoperational ambient survey which is described in detail in
Section 6.1.3.1.

6.3.8 Radiological Programs

There are no public agencies, currently known to the Applicant, conducting any radiological environmental monitoring programs in the vicinity of the Plant. The Michigan Department of Public Health does plan to conduct an environmental monitoring program in the vicinity of the Plant similar to those currently conducted by that agency at operating reactors within the State(12,13). However, no definite date has been established for initiation of this program.

6.4 PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING DATA

11 A limited amount of radiological data are available on raw Lake Huron water (Whitestone Point) and Midland municipal water. Samples are composites of daily (Monday through Friday) grab samples. Analyses were performed by three independent laboratories over a one-year period. Gross beta and tritium results are provided in Table 6.4-1. Monthly composites of the weekly samples were analyzed for gamma emitting isotopes. Within the detection limits (approximately 10 pCi/l) no gamma activity was observed in any of the samples. 11

The preoperational environmental radiological monitoring program as described in Section 6.1.5 started in November 1978. The schedule for all phases of the preoperational program is presented in Table 6.1-8. The first full calendar year of data are presented in Table 6.4-2. 11

TABLE 6.4-1

SUMMARY OF LABORATORY RESULTS

GROSS BETA ANALYSIS

Laboratory	Sample Location	Collection Period	Results (pCi/l) No of Samples	Max	Min	Mean	Error (2 σ)
A	Treated City Water	7/76 - 3/77	31	7	1	2.7	2.8
	Raw Lake Water	7/76 - 3/77	31	9	1	3.0	3.5
B	Treated City Water	7/76 - 4/77	37	2.4	0.3	1.7	1.1
	Raw Lake Water	7/76 - 4/77	38	3.9	1.0	1.7	0.6
C	Treated City Water	2/77 - 6/77	24	2.3	1.1	1.7	0.5
	Raw Lake Water	2/77 - 6/77	17	2.7	1.3	2.1	0.7

TRITIUM ANALYSIS

Laboratory	Sample Location	Collection Period	Results (pCi/l) No of Samples	Max	Min	Mean	Error (2 σ)
A	Treated City Water	7/76 - 3/77	31	700	110	393	303
	Raw Lake Water	7/76 - 3/77	31	700	170	413	284
B	Treated City Water	7/76 - 1/77	10	369	184	340	130
	Raw Lake Water	7/76 - 1/77	10	424	232	310	110
C	Treated City Water	2/77 - 7/77	23	360	<150	250	110
	Raw Lake Water	2/77 - 7/77	23	360	<150	270	98

(a) Mean of all samples with samples indicating less than detectable activity presumed at detection limit.

TABLE 6.4-2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY - MIDLAND PLANT
January 1, 1979 to December 31, 1979

Medium or Pathway Samples (Unit of Measurement)	Analysis and Total Number of Analyses Performed		Lower Limit of Detection	All Indicator Location Mean$^{(b)}$ Range$^{(b)}$	Location With Highest Annual Mean Name Distance and Direction	Location With Highest Annual Mean Mean$^{(b)}$ Range$^{(b)}$	All Control Location Mean$^{(b)}$ Range$^{(b)}$
Surface Water pCi/1)	Gross Beta	30	1.0	5.1 (23/24) (2.0-13.0)	River Discharge 1190 Feet NE	11.0 (1/1) (11.0-11.0)	5.7 (6/6) (3.0-12.0)
	Gross Alpha	11	1.0	2.3 (4/9) (1.0-3.0)	#1 Discharge 650 Feet SSE Freeland Road Bridge 11 Miles SE	3.0 (1/1) (3.0-3.0) 3.0 (1/2) (3.0-3.0)	2.0 (1/2) (2.0-2.0)
	Tritium (Qtr)$^{(c)}$	12	100.0	201 (9/10) (110-280)	Cooling Pond - CW Intake 650 Feet SE	270 (2/2) (260-280)	140 (2/2) (90-190)
	I-131$^{(c)}$	30	1.0	<LLD	-	-	<LLD
	Fe-59; Zn-65$^{(c)}$	30	30.0	<LLD	-	-	<LLD
	Mn-54; Co-58-60; Zr-Nb-95; Ba-La-140	30	15.0	<LLD	-	-	<LLD
	Cs-134-137$^{(c)}$	30	10.0	<LLD	-	-	<LLD
Groundwater (pCi/1)	Gross Beta	18	1.0	44.7 (18/18) (3.0-170.0)	East Dike/Wells 6, 7 & 8 4800 Feet SE	86.2 (6/6) (14.0-170.0)	None
	Gross Alpha	12	1.0	4.4 (5/12) (2.0-8.0)	West Dike/Wells 16, 17 & 18 4600 Feet SE	4.7 (3/3) (2.0-8.0)	None
	Tritium $^{(c)}$	4	100.0	340 (2/4) (300-380)	East Dike/Wells 6, 7 & 8 4800 Feet SE	340 (2/2) (300-380)	None
	I-131$^{(c)}$	18	1.0	<LLD	-	-	None
	Fe-59; Zn-65$^{(c)}$	18	30.0	<LLD	-	-	None
	Mn-54; Co-58-60 Zr-Nb-95; Ba-La-140$^{(c)}$	18	15.0	<LLD	-	-	None
	Cs-134-137$^{(c)}$	18	10.0	<LLD	-	-	None
Gamma Dose$^{(d,e)}$ (mR/Month)	TLD (Monthly)	74	1	6.3 (59/59) (3.8-30.2)	Pole - SE Dow Fence 2400 Feet ENE	10.4 (5/5) (4.9-30.2)	5.2 (10/10) (3.7-6.2)
(mR/Quarter)	TLD (Quarterly)	59	1	13.3 (47/47) (10.3-17.3)	Dow Chemical 1750 Feet NE	15.1 (4/4) (14.4-16.8)	12.3 (8/8) (11.0-15.0)
Crops (pCi/g Wet)	Gross Beta	34	1.0	1.4 (20/34) (1.0-2.0)	G-10 12,700 Feet N G-11 11,540 Feet NNE	2.0 (1/2) (2.0-2.0) 2.0 (1/2) (2.0-2.0)	None
	I-131$^{(c)}$	38	0.06	<LLD	-	-	None
	Cs-134-137$^{(c)}$	38	0.08	<LLD	-	-	None
	Sr-89 $^{(c)}$	38	0.025	<LLD	-	-	None
	Sr-90	38	0.005	0.098 (34/38) (0.006-0.31)	G-6 11,700 Feet ENE	0.174 (3/4) (0.086-0.31)	None
Sediment (pCi/g Dry)	Gross Beta	8	1.0	2.0 (3/8) (1.0-4.0)	Freeland Road Bridge 11 Miles SE	4.0 (1/2) (4.0-4.0)	None
	Cs-134-137$^{(c)}$	8	0.15	<LLD	-	-	None
	Sr-89	8	0.025	<LLD	-	-	None
	Sr-90	8	0.005	<LLD	-	-	None
Fish (pCi/g Wet)	Gross Beta	13	1.0	1.5 (10/13) (1.0-2.8)	Railroad Bridge - River 3950 Feet ESE	1.93 (3/4) (1.0-2.8)	None
	Fe-59; Zn-65$^{(c)}$	13	0.26	<LLD	-	-	None
	Mn-54; Cs-134 Co-58-60$^{(c)}$	13	0.13	<LLD	-	-	None
	Cs-137$^{(c)}$	13	0.13	0.14 (6/13) (0.06-0.19)	Railroad Bridge - River 3950 Feet ESE River Discharge 1100 Feet NE	0.19 (1/4) (0.19-0.19) 0.19 (1/2) (0.19-0.19)	None
	Sr-89	13	0.025	<LLD	-	-	None
	Sr-90	13	0.005	<LLD	-	-	None

(a) Nominal lower limit of detection (LLD) as defined in HASL-300, Pages D-08-01, 02 and 03.

(b) Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in paratheses.

(c) Proposed Technical Specifications requirement.

(d) Includes transit dose which averages approximately 2.5 mR per round trip.

(e) Additional Data: Community TLD (monthly) - Mean and Range of 4.8 (5/5) and (7.7-5.5) - 2.5 miles N.
Community TLD (quarterly) - Mean and Range of 11.0 (4/4) and (10.0-11.8).

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8 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

8.1 BENEFITS FROM THE FACILITY

8.1.1 Expected Annual Average Generation

The Midland Station is designed as a dual-purpose plant to provide electrical energy to the customers of Consumers Power and process steam to The Dow Chemical Company. The electrical energy output will vary from 1,263 MW (net) at design up to 1,344 MW (net) depending on the process steam outflow to Dow. As such, the estimated net average annual generation will range from 7.7 billion to 8.2 billion kilowatthours, based on a 70 percent capacity factor.

8.1.2 Expected Use of Generated Electricity

Because the output of Midland Units 1 and 2 is transmitted by the total power network of Consumers Power's transmission and distribution system, it must be assumed that the sales to a particular customer class are in the same proportion as that customer class proportion of total system usage. The sales forecast for each customer class is listed for the period 1984 through 1988 and for 1993 in Table 8.1-1.

The average electric customer rate is estimated to be 7.5 cents per kilowatthour which includes generation, transmission and distribution costs for all of Consumers Power customers in 1984. Over Midland's plant life, electric customers' rates are estimated to increase at an average annual rate of 8.24 percent per year. The levelized annual revenues received from Midland's generation based on a design net rating of 1263 MW at a 70 percent capacity factor are estimated to be $1.3 billion per year in 1984 dollars. The present

11 worth revenues in 1984 dollars are estimated to be $10.8 billion over the 34-
year life of the plant.

8.1.3 Process Steam Sales

Process steam sales to The Dow Chemical Company will generate revenues for the
11 35-year period of the current contract. Based on the expected hours of
process steam availability, 38,839 billion Btus per year will be converted to
process steam for sale to Dow. The Midland Plant Units 1 and 2 will supply
from 1.4 to 4.05 million pounds per hour of process steam which equals 14,121
3 to 40,962 billion Btus per year at a 100% capacity factor.

The steam sales provisions of the 1978 Dow-Consumers general agreement are proprietary information.

8.1.4 Income and Property Taxes

7 Income and property taxes expected to flow to Federal, State, and local
11 governments because of the Midland Plant are estimated to be $166 million per
7 year. The present worth of this payment stream over the 34-year economic life
11 is $1,382 million. The effect on taxes of decommissioning and restoration are
not reflected in these data.

8.1.5 Direct Socioeconomic Benefits

The operation of the Midland Plant provides certain direct and indirect economic benefits to the Midland region. A portion of the direct benefits originates with the operating personnel employed at the Plant. Present plans

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11 call for about 550 operating personnel to be employed at the Midland Plant. The presentation of the direct benefits associated with the operating personnel is based on a study(5) prepared for the US Chamber of Commerce. This study measures the impact of 100 manufacturing and nonmanufacturing employees entering a region. Using this information, the following effects are projected for the Midland region:

1,350 more people
380 more families
440 more schoolchildren

11 and the following resultant benefits (1984 dollars) are projected for the Midland region:

$7,973,000 more annual personal income[a]
$3,612,000 more annual retail sales
$4,398,000 more bank deposits

The increased number of families will not create any major lasting impact on housing or real estate values in the area. The additional schoolchildren should be easily absorbed within the region without the need for new facilities. The increased personal income will help to provide indirect benefits within the region.

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11 (a) Total annual salary for Midland Plant staff in 1984 is estimated to be approximately $16,000,000 in 1984 dollars. The retail sales and bank deposits may be correspondingly higher.

4 The projected annual employment schedule of the Midland Plant staff for
commercial operation is:

2

End of Year	Total Employment
1981	309
1982	445
1983-to end of 40-year Plant life	550

11 It is estimated that approximately 85% or 468 of the projected 550 operating
personnel will be newcomers to the Midland area. Of these newcomers, it is
projected that approximately 70% or 327 will establish residence within the
City of Midland or in the immediate surrounding townships. The remaining
141 newcomers are expected to be randomly located in outlying townships at
2 distances up to approximately 40 miles.

4 Locally contracted services and merchandise (ie, consumables) will result in
11 expenditures of not more than $6 million (in 1984 dollars) in the three
4 counties of Midland, Saginaw and Bay. This is exclusive of all wages for
Midland Plant Operations personnel.

8.1.6 Indirect Socioeconomic Benefits

Indirect benefits are derived as a consequence of the Plant employees spending their earnings. Through their consumption of housing services, retail goods and the like, the direct employees will create the demand for secondary jobs.

To assess the indirect employment benefits, a regional employment multiplier may be implemented. A multiplier of 1 would indicate no secondary employment effects and usually applies to a sparsely populated rural area. Values of 3.0 or more apply to heavily urbanized environs (6). Although a regional multiplier for Midland is not known, a value of 2 would be a conservative 11 estimate. This would imply that a minimum of 470 service jobs would result from the operation of the Plant. Many of these jobs would be filled by local personnel which would favorably contribute to the Midland social and economic environment.

8.1.7 Environmental Benefits

The environmental studies described in Chapter 6 will result in increased knowledge of the environment in the following areas:

a. Monitoring of the ecological and water quality rehabilitation of the Tittabawassee River;

b. Effects of attracting waterfowl to an artificial water body which 7 potentially remains ice-free the year round during Plant operation;

c. Cooling pond induced fog occurrence;

d. Icing effects on trees.

The ice-free pond may attract a resident population of waterfowl, shore birds and marsh birds. Any increase in the number of these birds would improve the natural and aesthetic amenities of this generally industrialized area.

The heated discharge from cooling pond blowdown to the Tittabawassee River may improve sport fishing in the river during the colder months of the year.

The river intake structure, riprap along the river shore, and river channelization near the intake structure will provide improved shelter and feeding habitat for fishes in the vicinity.

In addition, the atmospheric emissions from the existing fossil-fueled units of Dow Chemical Company will be greatly reduced and eventually cease.

TABLE 8.1-1

SALES FORECAST

Class	Percent of Sales by Class by Year					
	1984	1985	1986	1987	1988	1993
Residential	29.7	29.6	29.6	29.5	29.4	29.7
Commercial	22.8	22.8	22.7	22.7	22.6	23.0
Industrial	43.5	43.6	43.8	44.0	44.2	43.6
Streetlighting	0.5	0.5	0.5	0.4	0.4	0.4
Other	3.5	3.5	3.4	3.4	3.4	3.3

11 This breakdown is based on the following projection of long-term growth rates by class of service:

	Percent by Year
Residential	2.5
Commercial	2.7
Industrial	3.0
Streetlighting	-1.3
Other	1.9
Total	2.75

8.1R REFERENCES

11

7

5. US Chamber of Commerce, "What New Jobs Mean to a Community," Booklet 2928 (1973), US Chamber of Commerce, p 10.

6. Harry M Bridgeman, "Assessing the Economic and Social Impacts of Major Development Projects," Dames & Moore Engineering Bulletin, July 1976, p 6.

8.2 COSTS ASSOCIATED WITH THE FACILITY

All of the costs listed in this section are reported in 1984 dollars in accordance with the following construction completion schedule:

		Unit 1	Unit 2
11	Construction Completion (a)	8/83	3/83
	Fuel Load	12/83	7/83
	Commercial Operation	7/84	12/83

The present worth of each of the costs in 1984 is calculated using a discount rate of 11.75 percent and a 34-year economic life.

Estimated levelized annual costs of electric energy production from the Midland Plant are shown in Table 8.2-1.

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11 (a) Where construction completion is defined as the last system turnover to Consumers Power Company.

8.2.1 Capital Costs of Facility Construction

The capital cost of constructing Midland Units 1 and 2, including the costs of the approximately 1,235-acre site, is estimated to be $3.1 billion as shown in 11 Table 8.2-2. This amount includes anticipated escalation in labor and material costs over the period of construction as well as interest on investment over the same period.

8.2.2 Capital Costs of Transmission Facilities

The cost of constructing the transmission lines and substation facilities necessary to connect the Midland Units 1 and 2 into the Michigan Bulk Power system is estimated to be $19.5 million. This amount includes anticipated escalation in labor and material over the period of construction as well as interest on investment over the same period.

8.2.3 Fuel Costs

Fuel costs associated with the production of electrical and steam energy over the 34-year economic life of the Plant will not vary with the process steam outflow to The Dow Chemical Company. Based on two power only units, the levelized annual cost is currently estimated to be approximately 18.4 mills per kilowatthour. The present worth in 1984 dollars of cost of fuel associated with the production of electrical energy is estimated to be $1,103.0 million.

8.2.4 Operating and Maintenance Costs

The uniform annual equivalent operating and maintenance costs, including annual license fees but excluding nuclear insurance, are estimated to be $136.3 million, equalling a present worth of $1,133.7 million in 1984 dollars. Nuclear insurance is estimated to be $12.1 million in 1984, equalling a present worth of $195.1 million.

8.2.5 Costs of Decommissioning and Dismantling

Decommissioning and dismantling the main power structure, which is an NRC requirement, is estimated to cost $235.0 million in 1984 dollars. Of this

11 total, removal of the pond and intake structures, and relandscaping of the Plant site which are local requirements, are estimated to cost $41.9 million.

3 Section 5.8 is a discussion and cost breakdown for decommissioning and dismantling the Midland Plant.

8.2.6 Cost of Income and Property Taxes

7 Income and property taxes expected to flow to Federal, State and local governments because of the Midland Plant are estimated to be $166 million per year. The present worth of this payment stream is $1,382 million. The effect on taxes of decommissioning and restoration are not reflected in these data.

8.2.7 Socioeconomic Costs

Additional municipal services would be required to support the Plant operating personnel who live in the area; however, the property taxes incurred by the Midland Plant will more than offset the increase in service costs.

Public service impacts attributable to the immigration of newcomers due to operation of the Plant are expected to be minimal. For example, the 380 additional schoolchildren would represent approximately 4.0% of the total projected Midland school 1982-83 enrollment of 9,506 if all were to be enrolled in Midland schools.

11 Regarding traffic services, the vehicles introduced by Midland Plant staff personnel who are newcomers would represent 1% of all registered vehicles in the Midland area. This figure is based on an average of 1.7 vehicles per staff member (790 vehicles) and the 1978-79 registration of 64,000 vehicles total.

8.2.8 Environmental Costs

Only minor environmental costs are associated with the operation of the Midland Plant:

a. Preemption of 1,235 (500 ha) acres of land from other uses during the life of the Plant;

b. An increase in local fogging and icing;

c. Entrainment of planktonic organisms (phytoplankton, zooplankton, ichthyoplankton, and invertebrates) from approximately 5% of the river flow during the initial filling of the cooling pond and intermittent makeup pumping;

d. Possible impingement losses of some resident and migrant fish species during intermittent makeup pumping;

e. Temperatures elevated above normal river temperature fluctuations during blowdown.

TABLE 8.2-1

ESTIMATED GENERATING COSTS FOR THE MIDLAND PLANT

(Levelized Annual Mills/kWh Equated to 1984 Dollars)

Fixed Charges	
Cost of Money	39.0
Depreciation(a)	0.9
Taxes(a)	17.8
Nuclear Fuel Cycle Costs	
Fuel Depletion Charge	12.2
Fabrication Depletion Charge	2.6
Fuel Carrying Charge	2.5
Spent Fuel Storage Charge	1.1 11
Cost of Operation and Maintenance	
Fixed Component	14.1
Variable Component	0.0
Cost of Insurance	
Property Insurance	2.2
Liability Insurance	0.2
Total	92.6

(a)The effect of decommissioning and restoration are not reflected in these data.

TABLE 8.2-2

COST INFORMATION FOR NUCLEAR POWER GENERATION METHOD

1. Interest During Construction		8.5%/Year, 1980
		10%/Year, 1981 and 1982
		10.5%/Year, 1983 and Beyond
2. Length of Construction Workweek		40 Hours/Week
3. Estimated Site Labor Requirement		20.4 Manhour/kWe
4. Escalation Rates	Site Labor	10.0%/Year in 80-81 and 8.0%/Year Thereafter
	Materials	10.0%/Year in 80-81 and 8.0%/Year Thereafter
	Composite	10.0%/Year in 80-81 and 8.0%/Year Thereafter

5. Power Station Cost ($1,000)

11

Direct Costs	Unit 1	Unit 2
a. Land and Landrights	$ 0*	$ 5,883
b. Structures and Site Facilities	143,698	206,586
c. Reactor Plant Equipment	140,955	231,296
d. Turbine Plant Equipment, Not Including Heat Rejection	61,671	75,380
e. Heat Rejection System	8,972	12,538
f. Electric Plant Equipment	42,659	94,444
g. Miscellaneous Equipment	33,075	11,198
h. Spare Parts Allowance	0*	4,000
i. Contingency Allowance	0*	80,000
j. Trended Costs Since Last Forecast (1/80)	0*	35,108
Subtotal	$431,030	$ 756,433
Indirect Costs		
a. Construction Facilities, Equipment and Services	0*	369,127
b. Trended Costs Since Last Forecast (1/80)	0*	33,892
c. Engineering and Construction Management Services	0*	272,401
d. Other Costs	0*	352,117
e. Interest During Construction (@ Rates Above)	0*	885,000
Escalation		
Escalation During Construction	Included Above	
Total Cost		
Total Station Costs, @ Start of Commercial Operation	$431,030	$2,668,970

*Included With Unit 2

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11 SUMMARY COST-BENEFIT ANALYSIS

The primary costs and benefits of the Midland Plant Units 1 and 2 are summarized in Table 11-1.

11

Table 11-2 outlines the socioeconomic and environmental costs and benefits associated with the Midland Plant.

TABLE 11-1

SUMMARY OF COSTS AND BENEFITS

	Steam Outflow @ 4.05×10^6 Lb/Hr
Direct Benefits (Annual)	
Energy Generated (at 70% Capacity Factor) Kilowatthours	7.7×10^9
Capacity, Kilowatts	$1,263 \times 10^3$
Proportional Distribution of Electrical Energy (Expected Annual Delivery in Kilowatthours 1984)	
Industrial	3.3×10^9
Commercial	1.8×10^9
Residential	2.3×10^9
Streetlighting	0.1×10^9
Other	0.2×10^9
Energy to Steam Sold From the Facility, Btu x 10^6	$38,839 \times 10^3$
Expected Average Annual Delivery of Other Beneficial Products	0
Revenues From Delivered Benefits, $/Yr	
Electrical Energy Sold	1.3×10^9
Steam Sold	Proprietary
Other Products	0
Indirect Benefits (Annual)	
Taxes, $/Year	
Local	62.0×10^6
State	3.4×10^6
Federal	100.8×10^6
Direct Benefits (Present Worth in Millions of Dollars)	
11 Revenues	
Electrical Energy Sold	10,843
Steam Sold (35-Year Period)	Proprietary
Indirect Benefits (Present Worth in Millions of Dollars)	
Taxes	
Local	515.6
State	28.3
Federal	838.2
Total Direct and Indirect Benefits	12,225.1
Primary Internal Costs (Present Worth in Millions of Dollars)	
Capital Investment	3,100.0
Transmission Facilities	19.5
Fuel	1,103.0
Operating, Maintenance and Insurance	1,328.8
Decommissioning and Dismantling	235.0
Income and Property Taxes	1,382.1
Total	7168.4

NOTE: All dollars are in 1984 dollars.

TABLE 11-2

SUMMARY

SOCIOECONOMIC AND ENVIRONMENTAL BENEFITS AND COSTS OF MIDLAND PLANT OPERATION

Benefits	
Socioeconomic	
Consumables	$6,000,000
Annual Personal Income	7,973,000(a)
Annual Retail Sales	3,612,000
Bank Deposits	4,398,000
Environmental	
Knowledge of the Environment as a Result of Research and Monitoring	Increase
Waterfowl Population	Possible Increase
River Sport Fishing	Possible Improvement
Fish Shelter and Feeding Habitat	Increase
Atmospheric Emissions From Dow Fossil-Fueled Units	Reduction
Costs	
11 Socioeconomic	
Municipal Services Required	Increase(b)
Environmental	
Land Use	Loss of 1,235 Acres From Other Uses
Fogging and Icing	Increase
Plankton	Small Entrainment Loss During Makeup Periods
Resident and Migrant Fish	Some Impingement Loss During Makeup Periods
River Temperatures	Increase Above Ambient During Blowdown Periods

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(a)Total annual salary for Midland Plant staff in 1984 is estimated to be approximately $16,000,000 in 1984 dollars. The retail sales and bank deposits may be correspondingly higher.

(b)Property taxes incurred by the Midland Plant will more than offset the increase in service costs.

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ARCHAEOLOGY

QUESTION 11

Provide a detailed plan for the mitigation or avoidance of sites that will be disturbed by the construction and operation of the plant site and the transmission corridor.

RESPONSE

3

4 Dr John Halsey, State Archaeologist, and Dr Doreen Ozker, Archaeologist for the Great Lakes Museum of Anthropology, University of Michigan, met with Consumers Power staff on November 29, 1978; the plan for the avoidance and mitigation of archaeological sites on the transmission line right-of-way was finalized at this meeting. Refer to revised ER Sections 3.9.4.4 and 4.2.2.

11 Six copies of the following report were provided under separate cover to the Nuclear Regulatory Commission on September 15, 1980:

Ozker, Doreen, and David W Taggart, Report of Archaeological Mitigation and Avoidance on a Consumers Power Company Right of Way in Saginaw and Midland Counties, Michigan, Great Lakes Division, Museum of Anthropology, University of Michigan, February 18, 1980.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 1a

If Midland did not operate in the first year of planned operation, and Consumers Power Company had to find replacement energy from the sources in the table below, what is your best estimate of the numbers for the following table (1978 dollars)?

	High Sulfur Coal	Low Sulfur Coal	Oil	Gas Turbine	Nuclear	Hydro	Purchased
1) Fuel Costs (Mills/kWh)							
2) Operating and Maintenance Cost (Mills/kWh)							
3) Other Cost (Mills/kWh)							
4) Total Operating Cost (#1+2+3) (Mills/kWh)							
5) Percent of Replacement Energy Generated							

RESPONSE

11 Replacement energy costs in 1983 dollars are:

	Low Sulfur Coal[a]	Oil	Gas Turbine	Nuclear	Hydro	Purchased
1) Fuel Costs (Mills/kWh)	28	94	72	-	-	-
2) Operating and Maintenance Cost (Mills/kWh)	2	2	6	-	-	-
3) Other Cost (Mills/kWh)	-	-	-	-	-	-
4) Total Operating Cost (#1+2+3) (Mills/kWh)	30	96	78	-	-	44
5) Percent of Replacement Energy Generated	17	2	2	0	0	79

11 [a] Includes small percentage of high sulfur coal.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 1b

Assuming Midland is operating in fiscal 1981, give the following costs: 1) fuel, 2) operating and maintenance, 3) other, 4) total. If Midland nuclear costs are different than the nuclear costs in Question #1a, please explain. Use 1978 dollars.

RESPONSE

2 Since the project involves two units and both units are assumed to operate in
11 1984, the costs of operation will be given for that year. The costs in 1984
2 dollars are estimated as follows:

		($ x 10^6)	Mills/kWh
Fuel	=	$ 56.0	9.2
O&M	=	47.6	7.9
Fixed Charges	=	410.3	67.7
Total		$513.9	84.8

Includes electric costs only.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 1c

2 Give the dollar amount lost per year of delay by not operating Midland and using replacement energy and a rough breakdown of those costs.

RESPONSE

The amounts lost per year of delay in $ million in the year incurred are:

1-Year Delay	1983	1984	1985	1986	1987
Δ Replacement Power	44	212	11	60	17
Δ Midland Fuel (Electric Only)	(9)	(45)	7	(5)	(2)
Δ Midland O&M (Total Plant & Overheads)	(3)	(47)	(13)	0	0
Δ Insurance (Total Plant)	(1)	(9)	(2)	0	0
Net Difference	31	111	(19)	55	(15)
11 2-Year Delay					
Δ Replacement Power	44	257	242	44	90
Δ Midland Fuel (Electric Only)	(9)	(56)	(41)	2	(8)
Δ Midland O&M (Total Plant Overhead)	(3)	(50)	(64)	(14)	0
Δ Insurance (Total Plant)	(1)	(10)	(12)	(2)	0
Net Difference	31	141	125	30	82

2 The following tables illustrate the breakdown of replacement power costs in the year incurred.

11 1983

	Low Sulfur Coal[(a)]	Oil	Gas Turbine	Nuclear	Hydro	Purchased
1) Fuel Costs (Mills/kWh)	28	94	72	-	-	-
2) Operating and Maintenance Cost (Mills/kWh)	2	2	6	-	-	-
11 3) Other Cost (Mills/kWh)	-	-	-	-	-	-
4) Total Operating Cost (#1+2+3) (Mills/kWh)	30	96	78	-	-	44
5) Percent of Replacement Energy Generated	17	2	2	0	0	79

(a) Includes small percentage of high sulfur coal.

11 1984

	Low Sulfur Coal[a]	Oil	Gas Turbine	Nuclear	Hydro	Purchased
1) Fuel Costs (Mills/kWh)	31	118	86	-	-	-
2) Operating and Maintenance Cost (Mills/kWh)	2	2	6	-	-	-
3) Other Cost (Mills/kWh)	-	-	-	-	-	-
11 4) Total Operating Cost (#1+2+3) (Mills/kWh)	33	120	92	-	-	42
5) Percent of Replacement Energy Generated	19	1	1	0	0	79

(a) Includes small percentage of high sulfur coal.

11

1985

		Low Sulfur Coal[a]	Oil	Gas Turbine	Nuclear	Hydro	Purchased
	1) Fuel Costs (Mills/kWh)	35	95	100	-	-	-
	2) Operating and Maintenance Cost (Mills/kWh)	2	2	6	-	-	-
	3) Other Cost (Mills/kWh)	-	-	-	-	-	-
11	4) Total Operating Cost (#1+2+3) (Mills/kWh)	37	97	106	-	-	53
	5) Percent of Replacement Energy Generated	29	5	0	-	-1	67

[a] Includes small percentage of high sulfur coal.

11 1986

	Low Sulfur Coal[a]	Oil	Gas Turbine	Nuclear	Hydro	Purchased
1) Fuel Costs (Mills/kWh)	39	103	135	-	-	-
2) Operating and Maintenance Cost (Mills/kWh)	2	2	7	-	-	-
3) Other Cost (Mills/kWh)	-	-	-	-	-	-
11 4) Total Operating Cost (#1+2+3) (Mills/kWh)	41	105	142	-	-	56
5) Percent of Replacement Energy Generated	33	3	0	0	-1	65

---

[a] Includes small percentage of high sulfur coal.

11 1987

	Low Sulfur Coal[a]	Oil	Gas Turbine	Nuclear	Hydro	Purchased
1) Fuel Costs (Mills/kWh)	45	114	162	-	-	-
2) Operating and Maintenance Cost (Mills/kWh)	2	2	7	-	-	-
3) Other Cost (Mills/kWh)	-	-	-	-	-	-
11 4) Total Operating Cost (#1+2+3) (Mills/kWh)	47	116	169	-	-	72
5) Percent of Replacement Energy Generated	19	10	1	-	-2	72

[a] Includes small percentage of high sulfur coal.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 2

Assume CPS does operate but does not sell any electricity to Dow Chemical in the 1980's. Under this scenario, answer questions 1a., 1b. and 1c.

2 RESPONSE

Dow Chemical Company is presently a customer of Consumers Power Company and has, in fact, contracted to purchase power from the Company in the future. Making the unrealistic and purely hypothetical assumption that these purchases would not occur, the replacement power cost components identified in the
11 responses to Questions 1a and 1c might be reduced by 4%. Note that the response to Question 1b would be unchanged.

The distribution of sources identified in the response to Question 1a would shift slightly, reflecting more generation from lower cost resources. For example, a 3% increase in the proportion of low sulfur coal generation, and
2 equal decrease in oil generation would result in the above noted decrease in overall cost of replacement power from Consumers Power Company's units.

The table supplied in response to Question 1c would appear as follows:

2

AMOUNT LOST PER YEAR OF DELAY
ASSUMING NO DOW PURCHASE
($ Million in the Year Incurred)

	1-Year Delay	1983	1984	1985	1986	1987
	Δ Replacement Power	47	198	(11)	62	12
	Δ Midland Fuel (Electric Only)	(9)	(45)	7	(5)	(2)
11	Δ Midland O&M (Total Plant & Overheads)	(3)	(47)	(13)	0	0
	Δ Insurance (Total Plant)	(1)	(9)	(2)	0	0
	Net Difference	34	97	(19)	57	10
2	2-Year Delay					
	Δ Replacement Power	47	240	236	43	84
	Δ Midland Fuel (Electric Only)	(9)	(56)	(41)	2	(8)
11	Δ Midland O&M (Total Plant & Overheads)	(3)	(50)	(64)	(14)	0
	Δ Insurance (Total Plant)	(1)	(10)	(12)	(2)	0
	Net Difference	34	124	119	39	76

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 3

Staff wishes to determine what fraction of the capital costs of Midland should be considered not sunk. Should an OL be delayed 1 to 5 years or not granted then, excepting fuel and operation and maintenance, can any of the costs of Midland be recovered? If yes, please explain in what way and the amounts of money involved. For example, if the plant never ran how much less than $83.5 million (ERS, Amendment 1, p. 8.2-2) would decommissioning costs be?

RESPONSE

Sections 5.8 and 8.2.5 of the ER(OLS) have been revised to present the dis-
11 cussion on costs of decommissioning and dismantling, which are now estimated
in 1984 dollars to be $235 million.

A review was made of this estimate to determine the costs of removal if the
Plant were never to be operated. It is assumed that fuel loading does not
2 take place, therefore, there are no contaminated elements. Based on the
reevaluation under the described conditions, the costs of removal would be
$145 million. Since the equipment is assumed to be clean (uncontaminated), a
salvage value has been attached of $31 million. Hence, if the site is
11 restored before fuel loading occurs, the net loss due to restoration is
estimated to be $114 million in 1984.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 8

Please provide the forced outage rates for each size of units, or alternatively, provide forced outage rate data for each unit (by type and size for the system). 2

RESPONSE

Following is a list of the ROR (random outage rates) projected for the period 11 1984-85. ROR is defined as:

$$ROR = \frac{F + U}{T - P}$$

2 where: T = Installed Capability x Time, (MW x Time)

F = Forced Outage (Actual) x Time, (MW x Time)

P = Period Outages (Actual) x Time, (MW x Time)

U = Unforeseen Outages (Actual) x Time, (MW x Time)

Coal	Size(MW)	1984 ROR	1985 ROR
Campbell 1	253	15.3	13.0
Campbell 2	349	18.0	16.0
Campbell 3	791	13.5	15.0
Cobb 1-3	180	9.9	10.0
Cobb 4	151	11.0	12.0
Cobb 5	152	9.2	13.0
Karn 1	255	19.4	19.0

			1984	1985
11 2	Coal	Size(MW)	ROR	ROR
	Karn 2	257	15.6	16.0
	Weadock 7	155	23.0	20.0
11	Weadock 8	155	17.2	16.0
	Whiting 1	95	9.4	7.4
	Whiting 2	95	5.7	5.7
	Whiting 3	120	9.6	10.0
2	Oil			
	Karn 3	638	18.0	15.0
	Karn 4	613	20.0	16.0
11	Morrow 1-4	114	10.0	0.0
	Weadock 1-6	189	15.0	0.0
2	Nuclear			
	Big Rock	63	3.4	3.3
	Palisades	740	24.2	25.4
11	Midland 1	522	30.9	31.2
	Midland 2	807	34.7	42.1
2	Peakers			
11	(20 Units)	504	14.0	16.2
2	Ludington Pumped Storage[(a)]			
11	(6 Units)	954	3.0	3.0
2	Hydro			
11	(35 Units)	133.6	1.7	1.7

---

2 (a) Reflects CP Co 51% share.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 9b

Please provide the anticipated loading order of units available to CPS for each of the seasons of the year. 2

RESPONSE

Units are dispatched on an economic priority basis regardless of season. The anticipated loading of steam-electric and combustion-turbine units available to Consumers Power Company in 1984 is:

PAL
BIG R
MID 1
MID 2
CAMP2
CAMP1
COBB5
COBB4
KARN2
KARN1
WHIT3
WHIT1
WHIT2
CAMP3
WEAD7 11
WEAD8
COBB3
COBB2
COBB1
KARN4
KARN3
TH5-9
WEADA
GAYLD
TH1-4
MORRA
MORRB
MORR2
MORR1
WEAD1
WEAD2

WEAD3
STRAT
MORR3
MORR4
11 WEAD4
WEAD6
WEAD5
WHITA
CAMPA

2 Hydroelectric units are typically dispatched run-of-river with regard to regulations established for their operation. Pumped-storage units are dispatched on an economic and energy-related criteria. Therefore, exact loading cannot be depicted.

BENEFIT-COST ANALYSES AND NEED FOR POWER

QUESTION 11

Explain the interval by interval load model and the meaning of Table 1.1-11.

RESPONSE

The phrase "interval by interval load model" as used in the ERS has been replaced by the more descriptive phrase "monthly load model" in added ER 2 Section 1.1.3.2 which updates the information in the ERS. The purpose of both is to describe the daily, peak hour load scaling factors that are used to obtain a daily, peak hour load for years in the future. These scaling factors are based on historical loads modified by projected differences.

ER Table 1.1-14 indicates the factors that when applied to projected seasonal peak load will yield the peak hour load for each weekday of the year under consideration.

11

The scope of this study shall require the identification and elaboration of major soil series and quantitative and qualitative assessment of the natural biota.

B. Data Requirements - Midland Nuclear Plant - Tittabawassee Substation
Gary Road Substation 345 kV Transmission Right-of-Way

1. Soils and Topography

The Consultant shall:

(a) Map soil series traversed by the corridor.

(b) Identify soils of economic importance.

4 (c) Discuss the suitability of various soil types for various practices (eg, agriculture, forestry, recreation).

(d) Include topographical summary for the corridor.

2. Vegetation

The Consultant shall:

(a) Describe, identify, and map major community types within the existing right-of-way.

(b) Use standard plot and/or plotless methods to quantitatively describe the vegetation of a representative sample of all natural compartments traversed by the proposed transmission line.

TABLE END 1-1 1 of 2

POOR ORIGINAL

ENDANGERED AND THREATENED FLORA AND FAUNA OF THE SAGINAW, MIDLAND AND BAY COUNTIES AREA

PLANTS(a)

Saginaw County	Midland County	Bay County
Carex platyphylla (Carey) Threatened - Michigan Sedge Habitat: Rich deciduous woods and rocky slopes. Late April - June.	*Cypripedium arietinum* (R. Br.) Rare - Michigan; Threatened - US Ram's head lady-slipper Habitat: Damp, mossy woods; bogs. Late May - June.	*Habenaria ciliaris* Threatened - Michigan Orange fringed orchid Habitat: Bogs or swamp sandy soil in woods, thickets, etc.
Habenaria flava (L.) Rare - Michigan; Threatened - US Tubercled orchid Habitat: Swampy woods, bottomlands. June - September.	*Carex seorsa* (Howe) Threatened - Michigan Sedge Habitat: Wet woods; swamps. April - early July.	*Habenaria leucophaea* (Nutt.) Threatened - Michigan, US Prairie fringed orchid Habitat: Wet prairie; open (tamarack) swamps; bogs. Mid-June - August.
Habenaria leucophaea (Nutt.) Threatened - Michigan, US Prairie fringed orchid Habitat: Wet prairie; open (tamarack) swamps; bogs. Mid-June - August.	*Sisyrinchium atlanticum* (Bickn.) Threatened - Michigan Blue-eyed grass Habitat: Damp-dry meadows; marshes; low woods. May - July.	*Beckmannia syzigachne* (Steudel.) Fern Threatened - Michigan Slough grass Habitat: Wet areas.
Trillium viride (Beck.) Threatened - Michigan Trillium Habitat: Rich woods. April - May.	*Diarrhena americana* (Beauv.) Threatened - Michigan Habitat: Shaded riverbanks and woods. July - September.	*Stipa comata* (Trin. & Rupr.) Threatened - Michigan Feathergrass, speargrass Habitat: Dry soil.
	Lindernia anagallidea (Michaux.) Threatened - Michigan False pimpernel Habitat: Damp shores, sands. June - October.	*Asclepias hirtella* (Pennell) Woodson Threatened - Michigan Milkweed Habitat: Open areas, prairies, fields, waste ground.

ANIMALS

MAMMALS	BIRDS		REPTILES AND AMPHIBIANS
Synaptomys cooperi (Baird) Threatened - Michigan Southern bog lemming Habitat: Moist, grassy areas; heavy grass cover.(b)	*Falco peregrinus* (Tunstall) Endangered - Michigan, US Peregrine falcon Habitat: Migrates south along beaches, hunts over wooded areas, open country and coastal areas; feeds on birds; migrant only.	*Haliaeetus leucocephalus* (L.) Threatened - Michigan, US Bald eagle Habitat: Seldom found far from water (eg, lakes, large rivers, coastal areas). Large trees are used for nesting, food staple is fish. Feeding habitat may be found on or near Plant site. Nests in Saginaw County.	*Elaphe obsoleta* (Say) Threatened - Michigan Black rat snake Habitat: Habitat varies from rocky, timbered hillsides to flat farmlands and coastal plains. Woodlots and agricultural lands in the study area could provide habitat for this species.(b)
Microtus pinetorum (LeConte) Threatened - Removed proposed 1979 Michigan list Pine vole Habitat: Grassy areas at edges of woodlands; deciduous forests	*Dendroica kirtlandii* (Baird) Endangered - Michigan, US Kirtland's warbler Habitat: Very specific nesting requirements which	*Circus cyaneus* (L.) Threatened - Michigan Marsh hawk Habitat: Marshes, grassy swales and open fields are required for	

with thick layer of duff; orchards.(b)

jack pine on Grayling sand. Suitable nesting habitat is not found at the Midland site. May possibly see this bird as a migrant, but unlikely.

Phalacrocorax auritus (Lesson)
Endangered - Proposed 1979 Michigan list

Double-crested cormorant

Habitat: Inhabits areas with large bodies of water, where it feeds primarily on fish and crustaceans. Has been seen at Plant site.

Sterna hirundo (L.)
Endangered - Proposed 1979 Michigan list

Common tern

Habitat: Abundant coastally and over large inland lakes. (May be found at Midland site.)(b)

Accipiter cooperi (Bonaparte)
Threatened - Michigan

Cooper's hawk

Habitat: Perches in dense, leafy crowns, hunts birds and small mamals in open farmland. Favors scattered woodlots interspersed with open farmland for nesting. Has been seen near the Midland site.

Buteo lineatus (Gmelin)
Threatened - Michigan

Red-shouldered hawk

Habitat: Nests and feeds in and around swamps, river bottoms, and other wet woodlands, and is common in farming country in small woodlots, which provide acceptable (but not preferred) nest sites. Midland Plant area could provide nesting sites and food sources. Nests in Saginaw County.

frogs, snakes, crayfish, large insects and some small birds. Low meadows and marshy areas are suitable for nesting sites, where shrubs and tall weedy growth afford concealment. Seen in migration on the transmission right-of-way.

Pandion haliaetus (L.)
Threatened - Michigan

Osprey

Habitat: Nests in areas with extensive bodies of clear water with elevated nest sites. Food staple is fish. No suitable nesting sites appear to exist in the study area. Observed during 1971 ecological survey.

Lanius ludovicianus (L.)
Threatened - Michigan

Loggerhead shrike

Habitat: Inhabits open country with woody growth for nesting sites and lookout perches (eg, hedgerows, scattered trees, fence and utility poles and wires). Food consists of insects, some mice and birds. General habitat requirements are met throughout the Midland Plant area.(b)

Hydroprogne caspia (Pallas)
Threatened - Proposed 1979 Michigan list

Caspian tern

Habitat: Found both coastally and inland. Robs other sea birds, eats eggs, fish is main diet. Could be found near cooling pond.(b)

(a) Occurrence based on historical records for the tri-county area.
(b) May be found in the tri-county area on the basis of habitat requirements.

ENDANGERED SPECIES

QUESTION 6

Please supply the interim biological survey report (November 15, 1978) referenced in the Scope Statement (Endangered Species Question 1, Revision 4, December 1978).

5 RESPONSE

Six copies of INTERIM REPORT, Terrestrial Ecological Survey - Midland Nuclear Plant - Tittabawassee Substation - Gary Road Substation 345 kV Transmission ROW, prepared for Consumers Power Company by Asplundh Environmental Services and S & R Environmental Consulting, November 15, 1978, were provided to the Nuclear Regulatory Commission under separate cover on January 10, 1979. Six 11 copies of the final report, completed November 10, 1979, were provided to the Nuclear Regulatory Commission on September 15, 1980.

HYDROLOGY, WATER USE AND WATER QUALITY

QUESTION 4

3 Provide an estimate of the maximum amount of city water to be used on an annual basis at MNP, both directly and indirectly from DOW. What percentage of the total city water provided to the community would this be?

RESPONSE

The City of Midland Water Department provided the following information on the city water system:

10	Design Capacity	Avg Annual Use	Peak Use (Summer)
Present capacity of City water system (MGD)			
(a) City Filtered (Potable) Water	20	9	20
(b) Raw Huron Water Supplied to Dow	17	12	15
11 1982 capacity of City water system (MGD)			
(a) City Filtered (Potable) Water	31	11	24
(b) City Filtered (Industrial) Water	17	13	16
Total	48	24	40
Contracts with CP Co (MGD)	1.0 max		
10	(720 gpm)		
1981 Contracts with Dow (MGD)	17 max	-	-

(a) Separate system (nonfiltered). Should not be totaled with potable water capacity or use. 11

(b) The Dow Chemical Company currently uses about 13 MGD of which about 3
10 MGD is used for makeup to the process steam system. These quantities
11 are not expected to change significantly in the next few years.

Based on this information, Midland Plant Units 1 & 2 will use the following percentages of City water on a daily basis: 3

11	Domestic use and makeup demineralizers	- Avg 0.3% of 1982 Design Capacity
		- Max 1.7% of 1982 Design Capacity
	Makeup by Dow to process steam system	- Avg 4.6% of 1982 Design Capacity
		- Max 9.7% of 1982 Design Capacity

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10 (a) Based on 40% makeup to process steam feedwater. Makeup water is <u>not</u> used by the Midland Plant. All feedwater supplied by Dow is returned to Dow either as process steam or evaporator blowdown; ie, Dow supplies the fluid transfer medium required for the Midland Plant to supply heat energy to Dow.

(b) 1982 reserved flow rate of 1.9×10^6 lb/hr.

(c) Design flow rate of 4.05×10^6 lb/hr.

SOCIOECONOMICS

QUESTION 12

Provide an estimate of property and income tax payable to local and state jurisdictions during the operating life of the Midland Plant (update Page 8-1 of Enclosure 1 in the April 1, 1977 letter to William H Regan, if necessary). The estimates should indicate these taxes, in 1978 dollars, for each operating year along with the total taxes paid during the operating life of the plant.

RESPONSE

3

The estimates of State and local taxes applicable to the Midland Plant are
provided by employing those components of a fixed charge rate based on the
4 Consumers Power currently authorized rate of return. Since these estimates
are levelized annual values, they should not be used for planning purposes.
They are not site specific, rather, they are system average estimates.

a. Michigan Single Business Tax
11 1984 Levelized Annual Payment = $3.4 million

4 b. Property Taxes
11 1984 Levelized Annual Payment = $62.0 million

4 c. No special district taxes

11 Refer to revised ER(OLS) Sections 8.1.4, 8.2.6 and 11.