ML230A

May 6, 1982

MEMORANDUM FOR: C. Siess, Chairman
Ad Hoc Subcommittee on Midland Plant Units 1 & 2

FROM: D. Fischer, Reactor Engineer

SUBJECT: AD HOC SUBCOMMITTEE ON MIDLAND PLANT UNITS 1 & 2
APRIL 29, 1982

Attached is the proposed meeting summary you prepared. Copies are being distributed to the other ACRS members and Subcommittee consultants for their information and comment. Corrections and additions will be included in the minutes of the meeting.

Attachment:
As stated

cc: ACRS Members
ACRS Technical Staff
E. Case, NRR
E. Goodwin, NRR
H. Denton, NRR
D. Eisenhut, D/DL
R. Vollmer, NRR
R. Tedesco, AD/DL
J. Knight, AD/CSE
E. Adensam, LB-4
D. Hood, LB-4
R. Hernan, LB-4

FILE: MIDLAND UNITS 1 & 2

OFFICE	ACRS	DFISCHER/bgs	5-6-82				
SURNAME							
DATE							

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NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

May 6, 1982

MEMORANDUM FOR: C. Siess, Chairman
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FROM: D. Fischer, Reactor Engineer D. Fischer

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MEMORANDUM FOR: ACRS Members

FROM: C. P. Siess

SUBJECT: REPORT OF AD HOC SUBCOMMITTEE ON FOUNDATION PROBLEMS AND REMEDIAL ACTIONS AT MIDLAND PLANT UNITS 1 AND 2

The Ad Hoc Subcommittee met in Washington, D.C. on 29 April 1982. Those in attendance were:

C. P. Siess, ACRS Member
W. M. Mathis, ACRS Member
R. J. Scavuzzo, Consultant
J. D. Osterberg, Consultant
Z. Zudans, Consultant

Presentations were made by the NRC Staff and the Consumers Power Company, Applicant.

The meeting was requested by the NRC Staff to discuss with the ACRS proposed remedial actions for soils-related structural settlement problems at the Midland site. The nature, scope, and status of the Staff's review of two to three year were highlighted. The NRC Staff has requested comments from the ACRS on the adequacy of the Staff requirements, and review of the remedial actions being taken or proposed by the Applicant.

Problem

Plant grade is at El. 634 feet. Good foundation material, of unquestioned capability is found at El. 595 to 600 feet. The containment buildings and a large portion of the auxiliary building are founded on the good material. The remaining Category 1 structures are founded on compacted fill material about 25 to 30 feet thick. This fill, consisting of both granular and cohesive materials, was inadequately compacted. It is extremely variable in density and ranges from reasonably good to extremely poor foundation material.

The deficiency of the fill was discovered in July 1979 when the settlement of the partially completed diesel generator building reached about 7 to 8 inches, more than twice the expected settlement.

Potential Consequences

The potential consequences of the inadequately compacted fill material are:

a. Excessive settlement of structures founded on it.

b. Excessive settlement of piping, electrical ducts, and tanks buried in it.

c. Liquefaction during a seismic event of those portions of the fill consisting of granular materials.

Affected Structures and Components

a. Diesel Generator Building

b. Auxiliary Building

   Control tower

   Electrical penetration areas

   Feedwater isolation valve pits.

c. Service Water Pump Structure

d. Borated Water Storage Tank

e. Underground Utilities

   Service water piping

   Borated water piping

   Diesel fuel piping and storage tanks

   Control room pressurization lines and tanks

   Electrical duct banks

Remedial Actions

The remedial actions are of several kinds, as described in very general terms below:

a. Underpinning to extend the foundation to the original soil. This is being done for the Service Water Pump Structure and portions of the Auxiliary Building (i.e. the Control Tower, the Electrical Penetration Areas and the Feedwater Isolation Valve Pits.)

b. Surcharge to accelerate settlement and thus reduce future settlements. This is being done for the Diesel Generator Building and the Borated Water Storage Tank.

c. Rebedding and/or replacing portions of the buried piping.

d. Permanent dewatering of a major portion of the site to reduce the probability of liquefaction of the fill material due to an earthquake.

e. Extensive monitoring of all affected structures and components, including those for which no remedial action is deemed necessary.

Seismic Considerations

The Midland Plant was designed for a SSE characterized by a zero-period acceleration of 0.12 g and a "modified" Housner spectrum. The modification consisted of increasing the acceleration in the regions between about 1.5 and 5 Hz.

More recently, Site Specific Response Spectra (SSRS) have been developed for the Midland Plant site. The SSRS being used to reevaluate seismic margins, and for the design of underpinning, yield accelerations up to twice those for the original spectra at frequencies above about 5 Hz. In this range, they correspond fairly closely to R.G. 1.60 spectra anchored at a zero-period acceleration of 0.12 g. For frequencies below 3 to 5 Hz the SSRS accelerations are less than those for either the original design spectra or the R.G. 1.60 spectra.

Some of the new construction (underpinning) was designed before the SSRS were decided upon. For the seismic response analysis of these structures, spectra corresponding to 1.5 times the "FSAR Spectra" were used. The Applicant has stated that these spectra envelope the SSRS.

With regard to liquefaction, it was stated that the "loose granular backfill supporting Seismic Category 1 facilities is safe against liquefaction for earthquakes that produce a peak ground surface acceleration of 0.19 g or less provided the groundwater elevation in the backfill is maintained at or below El. 610 ft." The permanent dewatering system will maintain the groundwater level at El. 595 ft. to provide margin to permit repair or replacement of the dewatering system if it should fail.

The seismic input criteria and the SSRS were not reviewed by the Ad Hoc Subcommittee at this meeting. We recommend that this be consfdered by the Midland Plant Subcommittee, especially with respect to the need for and criteria for dewatering to reduce the probability of liquefaction.

Findings

The NRC Staff's approach to the remedial measures is essentially to require that the corrected plant should comply with all regulations and licensing requirements; that is, that it should be as good as it would have been if it had been designed and constructed in accordance with all commitments in the FSAR. Within this framework, the NRC Staff has made a thorough review. We found essentially no aspects of the remedial actions that had not been considered by the Applicant or the Staff. The Staff's approach is typically conservative, in some cases perhaps overly so. The Staff's requirements for monitoring are elaborate and appropriately thorough.

Where the Staff had reason to believe that it did not have adequate expertise or experience in some of the specialized areas involved in evaluating the problem and the remedial measures, it has engaged consultants. Although there is some question whether the Staff and its consultants have the expertise and experience to judge the ability of the structures to serve their required functions with remedial measures short of those required to bring them into full compliance with the original criteria, requirements, and commitments, there is no question that they are adequately competent to achieve compliance with the licensing requirements.

We are reasonable confident, subject to resolution of the question of seismic input as it relates to soil liquefaction, that the remedial measures, if completed to the satisfaction of the NRC Staff, will restore the affected structures to an acceptable condition. We consider the monitoring programs to be important and believe that the NRC Staff's requirements are appropriate.

Overall, we find the Staff's approach and requirements to be adequate to insure no undue risk to the health and safety of the public. There was some feeling in the Subcommittee of "overkill" in some of the Staff's requirements. This, however, was probably the result of the Staff's attention to licensing criteria as opposed to an evaluation of the modification's contribution to risk or consequences.

Recommendations

We recommend:

1. That the Midland Plant Subcommittee review the adequacy of the seismic input criteria and the SSRS and its relation to the proposed permanent site dewatering as a means of reducing the probability of liquefaction due to an earthquake.

2. That, subject to a finding by the Midland Plant Subcommittee regarding the adequacy of the seismic input criteria, the ACRS recognize the adequacy of the NRC Staff's efforts as outlined in this report and consider the proposed remedial measures as a matter that can and should be resolved in a manner satisfactory to the NRC Staff.

3. That the EDO be informed at this time that the ACRS has found the Staff's approach to be acceptable, subject to the further review mentioned in item 1 above.

cc: ACRS Staff

MIDLAND PLANT UNITS 1 & 2
OPERATING LICENSE REVIEW
APRIL 29, 1982

- PROJECT STATUS REPORT -

PURPOSE:

The purpose of this meeting is to discuss remedial action being taken by Consumers Power Company regarding the Midland soils and structural settlement issues.

BACKGROUND:

Pertinent facts concerning the Midland Project include:

Location:

The Midland site is located partially within the city of Midland, Midland County, Michigan. The city of Midland is approximately 105 miles NNW of Detroit and about half way up Michigan's lower peninsula on the Lake Huron (east) side. The facility is located along the south shore of the Tittabawassee River and south of the city of Midland. The site is adjacent to the Dow Chemical Company's (Dow) main industrial complex in Midland (located on the north side of the Tittabawassee River and due north of the plant). Within 10 miles of the plant, the 1970 estimated population was 72,706, within 5 miles, there were 48,501 residents. Circulating water for the two units is obtained from a cooling pond. The cooling pond receives make-up water from the Tittabawassee River. A map of the Midland plant site is included as Attachment 1.

Plant:

Unit 1 and Unit 2 each consist of a Babcock & Wilcox pressurized water reactor, a turbine generator, and associated auxiliaries. The two units have a combined capability of approximately 1,300 MWe and 4 million lb/hr of process steam. The process steam will be supplied to Dow and the electricity to the utility's customers. The containment for the nuclear steam supply system (NSSS) is a post-tensioned, reinforced concrete structure with a steel liner to provide leak tightness. The containment which was designed and constructed by Bechtel Power Corporation has a design pressure of 70 psig. The requested power level per unit is 2,452 MWt [NSSS output = 2452 MWt + 16 MWt (Reactor Coolant Pump heat input)]. The Unit 1 turbine generator (GE) is rated for operating at the NSSS rated output with a corresponding electrical output of 504.8 MWe. Process steam is provided to Dow by using extraction steam from the high pressure turbine under normal operation, and main steam from the main steam header. About 4 million lb/hr of process steam can be provided to Dow at the Unit 1 turbine generator rated level of 504.8 MWe. The Unit 2 turbine generator (GE) is rated for operation at NSSS rated output with a corresponding electrical output of 852 MWe. Each unit will use two B&W once-through steam generators. The reactor cores will

be loaded with 177 fuel assemblies (15x15). The core will have an average thermal output of 5.47 kw/ft (based on cold BOL data). The SSE is 0.12 g horizontal, 0.8 g vertical. The OBE is 0.06 g horizontal, 0.05 g vertical. A comparison of Midland features with those of similar plant designs is included as Attachment 2.

ADDITIONAL CONSIDERATIONS:

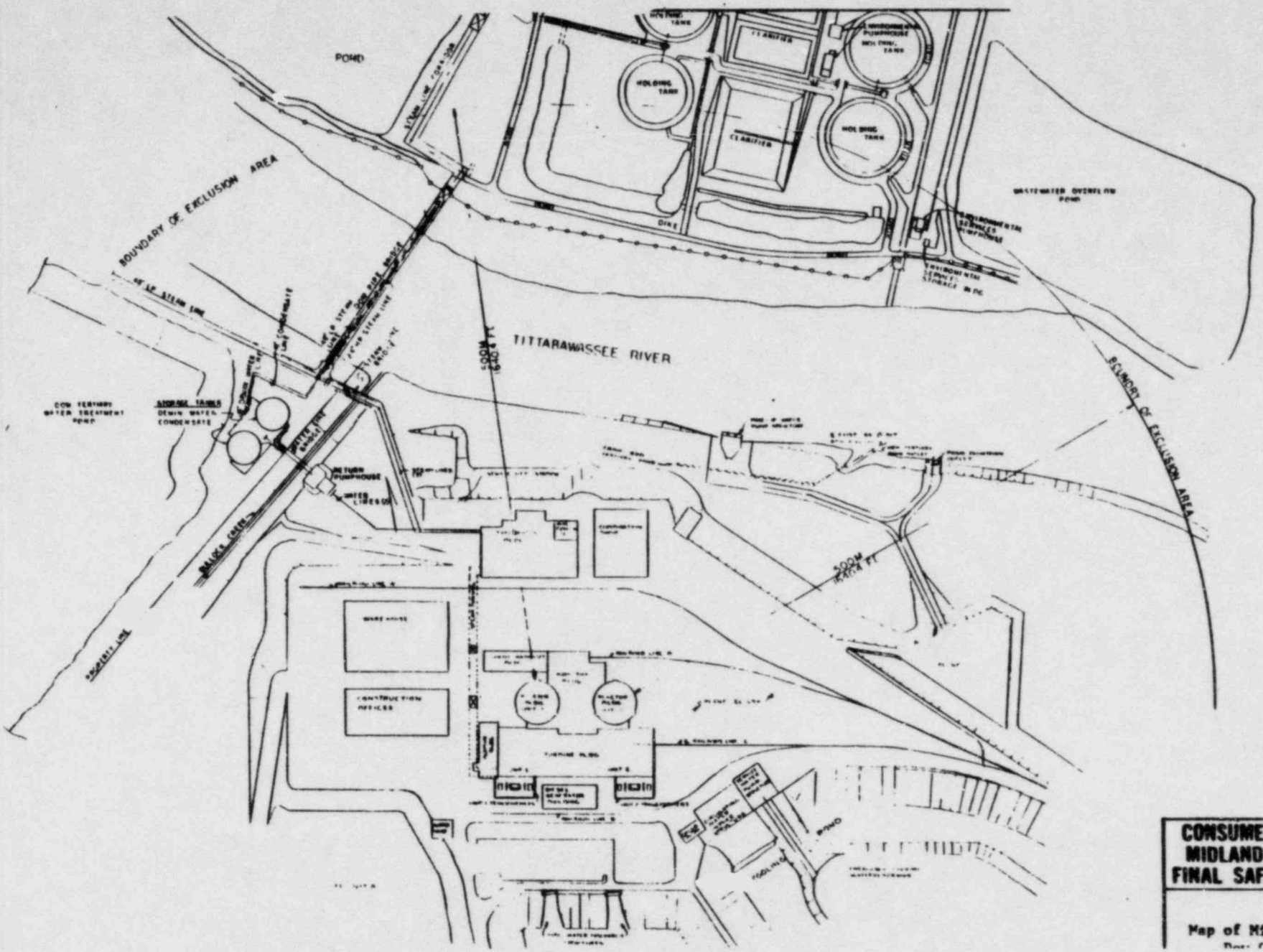
Midland Units 1 & 2 have a nominal finish grade elevation of +634 ft. The design high water level due to probable maximum flood, including wave run up effects is +635.5 ft. The design water level of the Tittabawassee River, cooling pond, and ultimate heat sink are +588 ft, +618 ft, and +604 ft, respectively.

ACRS REVIEW:

The ACRS reviewed Midland for a CP license in June 1970. A copy of the CP letter and supplement thereto is included as Attachments 3 & 4, respectively. The ACRS Midland Plant Subcommittee plans to review the application of Consumers Power Company for an OL on May 20&21, 1982 in Midland, MI. The full ACRS is tentatively scheduled to review the OL application during its June 1982 meeting.

SOILS ISSUES:

The April 29, 1982 ACRS Midland Plant Subcommittee meeting in Washington, DC is to discuss remedial actions being taken by Consumers Power Company regarding the Midland soils and structural settlement issues. The meeting is being conducted at the request of the NRC Staff (NRR). The NRC Staff and Consumers Power Compnay will provide information on these issues to the Subcommittee so that the ACRS might better comment on the merit of proposed and implemented fixes. A summary of the soils-related issues at the Midland Nuclear Plant is included in the attached reference material. I encourage you to read this executive summary first (transmitted by Consumers Power Company letter to H. Denton dated April 19, 1982). A list of other correspondences summarizing the soils-related issues at Midland is included as Attachment 5. The documents listed on Attachment 5 are appended to this meeting status report. A chronology regarding plant fill deficiencies was compiled by the NRC Staff's Project Manager for Midland. This chronology is included as Attachment 6. In view of the large volume of material being forwarded to you by this status report, I have arranged to have extra copies available at the meeting for your use.



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

Map of Midland Plants of the
Dow Chemical Company

TABLE 1.3-1

COMPARISON OF MIDLAND FEATURES WITH SIMILAR DESIGNS(1)

System	Midland	Rancho Seco	Oconee	Turkey Point	
Reactor and Reactor Coolant System (ref Chapters 4 and 5)					
Rated heat output (core), MWt	2,452	2,772	2,568	2,200	
Maximum overpower, %	12	12	14	12	
Reactor coolant pressure (operating), psia	2,200	2,200	2,200	2,250	11 32
Power distribution factors					
Heat generated in fuel and cladding, %	97.3	97.3	97.3	97.4	
$F_{\Delta h}$ (nuclear)	1.78	1.78	1.78	1.77	
DNB ratio at rated conditions	2.50	1.75(W-3)	2.0	1.81	
DNB ratio at design overpower	2.07	1.39(W-3)	1.55	-	32
Coolant flow					
Total flowrate, lb/hr x 10^6	131.3	137.8	131.3	101.5	16
Effective flow area for heat transfer, ft^2	48.9	49.17	49.19	41.8	32
Average velocity along fuel rods, ft/s	15.5	16.5	15.73	14.3	
Coolant temperature					
Nominal inlet (vessel)	555.2	556.5	556	546.2	
Nominal outlet (vessel)	602.8	607.7	604.7	602.1	
Nominal outlet (core)	605.9	---	605.5	604.5	32
Maximum fuel temperature, °F	3,980	4,400(hotspot)	4,250	4,400(overpower)	
Heat transfer at 100% power					
Active heat transfer surface area, ft^2	49,130	49,734	49,734	42,460	
Average heat flux, Btu/hr/ft^2	166,000	185,090	171,470	171,600	32
Average thermal output, kW/ft	5.47	6.10	5.65	5.5	
Core mechanical design parameters					
Fuel assemblies	177	177	177	157	
Design	CRA canless	CRA canless	CRA canless	RCC canless	

ATTACHMENT 2

TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point	
Rod pitch, in.	0.568	0.568	0.568	0.563	
Overall dimensions, in.	8.587 sq	8.536 sq	8.536 sq	8.426 sq	
Number of grids per assembly	8	8	8	7	
Fuel rods					
Number	36,816	36,816	36,816	32,028	
Outside diameter, in.	0.430	0.430	0.430	0.422	
Clad thickness, in.	0.0265	0.0265	0.0265	0.0243	
Clad material	Zircaloy-4	Zircaloy-4	Zircaloy-4	Zircaloy	
Fuel pellets					
Material	UO_2, sintered	UO_2, sintered	UO_2, sintered	UO_2, sintered	
Density, % of theoretical	95.0	92.5	93.5	94,93,92	33
Diameter, in.	0.3686	0.370	0.370	0.3659,0.3659,0.3649	33
Control rod assemblies (CRA)					
Neutron absorber	5%Cd-15%In-80%Ag	5%Cd-15%In-80%Ag	5%Cd-15%In-80%Ag	5%Cd-15%In-80%Ag	
Cladding material	304SS-cold worked	304SS-cold worked	304SS-cold worked	304SS-cold worked	
Clad thickness, in.	0.021	0.021	0.021	0.019	
Number of assemblies	61	61	61	53	
Number of control rods per assembly	16	16	16	20	
Burnable poison rod assemblies (BPRA)	68	68	68	68	
Nuclear Design Data					
Structural characteristics					
Fuel weight as UO_2, lb	93.1 metric tons	204,820	207,486	176,000	
Core diameter, in. (equivalent)	128.9	128.9	128.9	119.5	
Core height, in. (active fuel)	141.8	144	144	144	33
Performance characteristics					
Loading technique	3 region	3 region	3 region	3 region	
Fuel discharge burnup, MWd/mtU					
average first cycle	13,746	14,250	14,250	13,000	32
equilibrium core average	27,789	---	---	24,500	

TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point
Control characteristics				
Effective multiplication (BOL)				
Cold, zero power, clean, no burnable poison	1.24	1.252	1.248	1.180
Hot, zero power, clean, no burnable poison	1.19	1.19	1.198	1.138
Hot, rated power, equilibrium Xe, with burnable poison	1.11	1.12	1.134	1.077
Boron concentrations				
To shutdown with rods inserted, clean, cold/hot, ppm	1,143/641	1,099/605	992/493	780/510
Boron worth, hot, %(Δk/k)/ppm	1/96	1/100	1/100	7.3/---
Boron worth, cold, %(Δk/k)/ppm	1/74	1/75	1/75	5.6/---
Principal design parameters of the reactor coolant system				
System heat output, MWt	2,468	2,772	2,584	2,200
Operating pressure, psig	2,185	2,185	2,185	2,235
Reactor inlet temperature, °F	555.2	556.5	558	546.2
Reactor outlet temperature, °F	602.8	607.7	604	602.1
Number of loops	2	2	2	3
Design pressure, psig	2,500	2,500	2,500	2,485
Design temperature, °F	650	650	650	650
Hydro test pressure (cold), psig	3,125	3,125	3,125	3,107
Principal design parameters of reactor vessel				
Material	SA-533 Gr B, 18-8SS clad	SA-533, Gr B 18-8SS clad	SA-533, Gr B, 18-8SS clad	SA-302 Gr B, low alloy steel, internally clad with SS
Design pressure, psig	2,500	2,500	2,500	2,485
Design temperature, °F	650	650	650	650
Operating pressure, psig	2,185	2,185	2,185	2,235
Inside diameter of shell, in.	171	171	171	155.5
Overall height of vessel and closure head (over CRD nozzles), ft-in.	40/8-7/8	40/8-3/4	40/8-3/4	41/6

TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point
Minimum clad thickness, in.	1/8	1/8	1/8	5/32
Principal design parameters of the steam generators				
Number of units per reactor	2	2	2	3
Type	Vertical, once-through, integral superheater, straight-tube	Vertical, once-through, integral superheater, straight-tube	Vertical, once-through, integral superheater, straight-tube	Vertical U-tube, integral moisture separator
Tubeside design pressure, psig	2,500	2,500	2,500	2,485
Tubeside design temperature, °F	650	650	650	650
Shell side design pressure, psig	1,050	1,050	1,050	1,085
Shell side design temperature, °F	600	600	600	556
Operating pressure				
Tubeside, psig	2,185	2,185	2,185	2,235
Shell side, psig	910	910	910	1,020
Hydrostatic test pressure, cold, tubeside, psig	3,125	3,125	3,125	3,107
Principal design parameters of reactor coolant pumps				
Number of pumps	4	4	4	3
Type	Vertical, single stage	Vertical, single stage	Vertical, single stage	Vertical, single stage
Design pressure, psig	2,500	2,500	2,500	2,485
Design temperature, °F	650	650	650	650
Design capacity, gpm	88,000	92,400	88,000	89,500
Design total developed head, ft	327	362	396	260
Hydrostatic test pressure (cold), psig	3,125	---	---	3,107
Motor type	ac, induction, single speed	ac, induction, single speed	ac, induction, single speed	ac, induction, single speed
Motor rating, hp	9,000	10,000	9,000	6,000
Reactor coolant piping				
Hot leg (id.) in.	36	36	36	29
Cold leg (id.) in.	28	28	28	27-1/2

TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point	
Engineered Safety Features (ref Chapter 6)					
Safety injection system					
Number of high head pumps	3	3	3	4 (shared)	
Capacity each, gpm/ft	250/6,000	300/5,850	250/5,900	300/2,700	15
Number of low head pumps	2	2	2	2	
Capacity each, gpm/ft	3,000/370	3,000/350	3,000/350	3,750/240	
Containment coolers					
Type	Fan coolers	Fan coolers	Fan coolers	Fan coolers	
Number of units	4	4	3	3	
Capacity, Btu/hr each, at accident	50×10^6	60×10^6	80×10^6	60×10^6	
Core flooding system					
Number of tanks	2	2	2	3	
Total water volume, each ft^3	1,040	1,040	1,040	1,200 (total volume) 775 water vol min	
Containment spray					
Number of pumps	2	2	2	2	
Capacity, each, gpm	1,300	1,500	1,500	1,450	13
Spray additive for iodine removal	N_2H_4	NaOH	None	None	
Emergency power					
Type	Diesel	Diesel	Various	Diesel	
Quantity	2/5,250kW each continuous	2/2,600kW each continuous	7 sources of significant capacity	2/2,500kW each continuous	
Power Conversion System (ref Chapter 10)(1)					
Turbine-generator	Unit 2	Unit 1			
Gross generator output, MW	852	504.8,(2) 595.2(3)	850	847	728	1
Cylinders, high-pressure, low-pressure	1 hp, 2 lp	1 hp, 1 lp	1 hp, 2 lp	1 hp, 3 lp	1 hp, 3 lp	

TABLE 1.3-1 (continued)

System	Midland		Rancho Seco	Oconee	Turkey Point
Steam conditions at throttle valve					
Flow, 10^6 lb/hr	9.77	9.62	10.77	11.17	8.97
Pressure, psia	900	900	900	900	745
Temperature, °F	566.4	566.4	595	568.8	510
Moisture content, %	0	0	0	0	0.25
Steam flow to Dow Chemical					
Pressure, psig hp/lp	-/-	632/198[4]	-	-	-
Flow, lb/hr hp/lp	-/-	400,000/3.65x10^6[2]	-	-	-
	-/-	6.84x10^5/1.8x10^6[3]			
Turbine cycle arrangement					
Steam reheat stages, no.	2	2	2	2	1
Feedwater heating stages, no.	5	5	6	6	6
Strings of feedwater heaters, no.	2	2	2	2	2
Heaters in condenser necks, number	2	2	0	1	2
Heater drain system	Deaerator cycle	Deaerator cycle	Cascade	Pumped forward	Pumped forward
Number of condensate pumps	2	2	3	3	2
Number of condensate booster pumps	2	2	0	3	0
Number of main feedwater pumps	2	2	2	2	2
Number of auxiliary feedwater pumps	2 1-turbine 1-motor	2 1-turbine 1-motor	2 1-turbine 1-motor	1 with interties to other 2 units - turbine driven	3-turbine
Capacity, each, gpm	885	885	840	7-1/2% full feedwater capacity	600

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TABLE 1.3-1 (continued)

System	Midland		Rancho Seco	Oconee	Turkey Point
Main steam turbine bypass capacity, %	15%	15%	15%	25%	40%
Final feedwater temperature °F at mgl	430	430	471	460	436
Condenser					
Type	Dual pressure	Single pressure	Dual pressure	-	Single pressure
Condenser shells	2	1	2	-	2
Design pressure Hg abs hp/lp	4.07/2.77	2.83	2.5 average	-	2.5
Total condenser duty, Btu/hrx10[9]	5.51	2.14	6.24	-	5.02
Circulating water system	Cooling pond	Cooling pond	Cooling tower (hyperbolic)	Once through Lake Keowee	Once through Biscayne Bay
Circulating water pumps	2/Unit 2	2/Unit 1	4/Unit	4/Unit	2/Unit
Flow, gpm x 10[5]/unit	2.64	3.90	4.47	7.08	3.12
Ultimate heat sink	Cooling pond	Cooling pond	Spray pond	Lake Keowee	Biscayne Bay
Service water pumps, no.	2/Unit 2 (Plus one common spare for Units 1&2)	2/Unit 1	2/Unit	3 shared	3 shared
Flow, gpm/each pump	21,000	21,000	16,000	15,000	16,000
Radioactive Waste Management Systems (ref Chapter 11)					
Liquid radwaste treatment	Degasified, filtered, demineralized, evaporated		Degasified, filtered, demineralized, evaporated	Degasified, evaporated	Degasified, demineralized evaporated

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TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point
Evaporators, waste capacity, gpm	30	30	10 approx	20
Quantity	1	1	1	1
Demineralizers, waste capacity, gpm	150	150	None	1,000 gal. batch @ 2 gpm
Quantity	2	2	-	1
Gaseous radwaste treatment	Holdup tanks for decay, charcoal, and HEPA filters	Holdup tanks for decay, charcoal, and HEPA filters	Holdup tanks for decay, prefilter, absolute, and charcoal filters	Holdup tanks for decay, monitored, released to atmosphere
Holdup Tanks				
Quantity	6	4	2	6
Capacity, cubic ft (each)	390	490	1,100	525
Solid radwaste treatment				
Containers	55 gallon drum	55 gallon drum	55 gallon drum	55 gallon drum
Containment (ref Subsection 6.2.1				
Type	Steel lined, pre-stressed, post-tensioned concrete cylinder with curved dome roof	Steel lined, pre-stressed, post-tensioned concrete cylinder with curved dome roof	Steel lined, prestressed, post-tensioned concrete cylinder with curved dome roof	Steel lined, prestressed, post-tensioned concrete cylinder with curved dome roof
Leak rate, %/day	0.1	0.1	0.25	0.25
Design pressure, psig	70	59	59	49.9
Free volume, $ft^3 x10^6$	1.67	1.98	1.91	1.55
Cylinder inner diameter, ft	116	130	116	116
Inside height, ft	193	185	208-1/2	189

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TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point
Structural Design Requirements (ref Section 3.8)				
Operating basis earthquake (horiz g)	.06	0.13	0.05	0.05
Safe shutdown earthquake (horiz g)	.12	0.25	0.10	0.15
Vertical seismic ground motion (% of horizontal)	67	68	-	66
Maximum sustained wind, mph	85	90	95	145
Tornadoes, mph	360 max	-	300	225
Electrical Systems (ref Chapter 8)[4]				
Number of offsite circuits	2	5	12	(4 from 2 nuc units, 3 from fossil fuel)
Number of auxiliary power sources	2-startup transformers (shared) 2-unit aux transformers	2-startup transformers 1-unit aux transformer	1-startup transformer 1-unit aux transformer	1-startup transformer 1-unit aux transformer
Number of preferred power to ESF buses	2	2	-	2
Number of 4.16kV ESF buses/unit (4kV)	2	2	3	2
Number of Class 1E 125Vdc systems supplying buses/unit	2	4	2	2
Number of Class 1E 120Vac preferred buses/unit	4	4	4	4
Sharing of standby power	none	none	none	none
Fuel Handling Equipment and Facilities (ref Section 9.1)				
Reactor building crane				
Type	polar	polar	polar	polar
Capacity, tons	190 main, 25 aux	180	-	135 main, 35 aux

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TABLE 1.3-1 (continued)

System	Midland	Rancho Seco	Oconee	Turkey Point	
Transfer tubes/unit					
Number	1	2	2	1	
Capacity	dual	dual	dual	single	
Spent fuel storage					
Capacity (number of fuel assemblies)	1,049	242	336	217	15
New fuel storage					
Type					
Wet or dry storage	Dry	Dry	Wet	Wet	
Capacity/unit	66	20	168 (new & spent)	53	32
Cask handling crane					
Type	Double girder bridge	Gantry crane	Double girder bridge	Double girder bridge and trolley	
Capacity, tons	125 main, 15 aux	185 main, 35 aux cask weight = 100	100	105 main, 15 auxiliary	

(1) Midland data given for Unit 2, unless Unit 1 data given in addition. All data for other plants given on per unit basis.
(2) Design steam flow to Dow at rated reactor power. High-pressure process steam flow may exceed 400,000 lb/hr, up to a maximum of 800,000 lb/hr, when low-pressure process steam production is less than 3,650,000 lb/hr. 32
(3) Based on maximum calculated electrical production at 2,468MWt with a minimum corresponding steam flow to Dow.
(4) Represents total incoming and outgoing circuits.
(5) Data on plants other than Midland not maintained current after August 1977. 32

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

June 18, 1970

Honorable Glenn T. Seaborg
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: REPORT ON MIDIAND PLANT UNITS 1 & 2

Dear Dr. Seaborg:

During its 122nd meeting, June 11-13, 1970, the Advisory Committee on Reactor Safeguards completed its review of the application by the Consumers Power Company for a permit to construct the Midland Plant Units 1 and 2. During this review, the project also was considered at Subcommittee meetings held on January 22, 1969, at the plant site, on April 24, 1970, at Chicago, Illinois, on February 4, 1969, March 24, 1970, and June 10, 1970, at Washington, D. C. and at the ACRS meetings of February 6, 1969, April 9, and May 8, 1970, in Washington, D. C. In the course of these meetings, the Committee had the benefit of discussions with representatives and consultants of the Consumers Power Company, Babcock and Wilcox Company, Bechtel Corporation, Dow Chemical Company, and the AEC Regulatory Staff. The Committee also had the benefit of the documents listed.

The Midland Plant site is on the south bank of the Tittabawassee River adjacent to the southern city limits of Midland, Michigan. The main industrial complex of the Dow Chemical Company lies within the city limits directly across the river from the site and provides an area of controlled access about two miles wide between the reactor site and the Midland business and residential districts. The exclusion area of the plant site has a radius of 0.31 miles and includes a small segment of the Dow plant; no Dow employees are permanently assigned in this segment, and the applicant has the right to remove any persons from this segment if conditions warrant. The low population zone has a radius of 1.0 miles and contains 38 permanent residents and about 2,000 industrial workers, mainly employees of Dow Chemical Company. The number of permanent residents within five miles of the plant site was estimated to be 41,000 in 1968, mainly in the city of Midland and its environs.

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The applicant has established criteria for, and has begun the formulation of a comprehensive emergency evacuation plan. This plan is being coordinated with the well-established plan of the Dow Chemical Company for emergency evacuation of the Midland chemical plant and portions of the City of Midland in case of major emergencies at the chemical plant. Close coordination with appropriate municipal and state authorities is also being established.

The Midland units will each include a two-loop pressurized water reactor designed for initial core power levels up to 2452 MWt. The nuclear steam supply systems and the emergency core cooling systems of these units are essentially identical with those for the previously reviewed Oconee Units 1, 2 and 3 and Rancho Seco Unit 1 (ACRS reports of July 11, 1967 and July 19, 1968, respectively). The combined electrical output of the two units will be 1300 MW. In addition, 4,050,000 lbs per hour of secondary steam will be exported to the adjacent Dow plant to supply thermal energy for chemical processing operations.

The prestressed, post-tensioned concrete reactor containment buildings are similar to those approved for the Oconee Units 1, 2 and 3. The design will include penetrations, which can be pressurized, and isolation valve seal water systems to reduce leakage. Channels will be welded over the seam welds of the containment liner plates to permit leak testing of the seam welds.

Cooling water for the Midland reactors is supplied from a diked pond with a capacity of 12,600 acre-feet. Make-up water is taken from the Tittabawassee River. The cooling water supply is sufficient for 100 days of full power operation without make-up during periods of low river flow. In the unlikely event of a gross leak through the dikes of the cooling pond, a supplemental source of water will be available. The supplemental source is provided within the main pond by excavating a 24 acre area to a depth of six feet below the bottom of the main pond. This source can supply shut-down cooling capability for 30 days without make-up.

The applicant will conduct an on-site meteorological monitoring program to verify the applicability of the meteorological models used for accident evaluation and routine release limits as well as to determine any meteorological effect of the cooling pond. This program should be completed during construction.

Midland is the first duel purpose reactor plant to be licensed for construction. The export steam originates from the secondary side of the steam generators and may contain traces of radioactive leakage from the primary system. The demineralized condensate from 60 to 75 percent of the export steam is returned by Dow to the feed water supply of the reactor plant. The condensate from the remaining steam is either chemically contaminated or cannot practically be returned to the nuclear plant. It is collected in the Dow waste treatment system for dilution and processing with other streams before eventual discharge to the river. Thus, the unreturned portion of the condensate represents an effluent from the reactor plant to which the requirements of 10 CFR Part 20 must apply.

This matter may be considered in two parts: (1) the steps taken by the applicant to ensure that any radioactivity in the export steam is within the limits set by 10 CFR Part 20 and as low as practicable and (2) the measures taken by the Dow Chemical Company to ensure that the export steam can be used in chemical operations without product contamination and that the unreturned steam condensate is properly managed for safe disposal. In connection with item (1), the applicant proposes to monitor and control radioactivity in the export steam. A representative, continuous sample of the export steam will be condensed for monitoring and laboratory analysis. The gamma activity of this flowing sample will be continuously monitored by on-line analyzers and an alarm actuated if the activity exceeds an appropriate limiting value. The alarm will serve to indicate any change in the integrity of the steam generators or fuel cladding. Samples of this condensate stream will be analyzed at appropriate intervals by sensitive low-level beta counting for determination of gross beta activity and concentration of selected radionuclides. The applicant agrees to limit, by maintaining high integrity of the steam generators and fuel cladding, the yearly average gross beta activity in the export steam to one-tenth or less of the limits specified by 10 CFR Part 20 for the selected radionuclides. The yearly average will include any periods of short duration when the concentrations may approach but not exceed the 10 CFR Part 20 limits. The applicant states that in his judgment it is practical to operate the plant within these limits. If these limits are exceeded, corrective measures will be taken in the plant or the delivery of export steam to Dow will be terminated. He also agrees to demonstrate the analytical equipment and procedures in development programs to be carried forward and completed during construction of the Midland Plant. In connection with item (2), Dow has stated that they will apply for a 10 CFR Part 30 Materials License to receive, possess, and use the export (secondary) steam as a source of thermal and mechanical energy. No export steam or condensate will be intentionally introduced into any product. Isolation of the export steam from contact with products will be accomplished by the use of heat exchange devices which will provide suitable physical barriers. Programs will be established to provide for detection of leaks in the heat exchange devices by analyses, monitors, and other means; for repair of leaks when detected; and for appropriate administrative control of the programs.

Dow has stated that accumulation of radioactivity from the export steam and release of radioactive materials in the effluent will be in accordance with 10 CFR Part 20. The unreturned condensate will represent less than 10% of the total liquid effluent disposed of through the Dow waste treatment plant and the annual average concentration in the total effluent is expected to be less than 1% of the 10 CFR Part 20 limits.

The Committee believes that the criteria proposed by the applicant and Dow for the control of radioactivity in the export steam are necessary and adequate. The detailed procedures for implementation should be developed during construction in a manner satisfactory to the Regulatory Staff. The Committee wishes to be kept informed.

To minimize the likelihood of subsidence at the site, the applicant and Dow have agreed to prohibit future salt mining operations within one-half mile from the center of the reactor plant. No new wells will be drilled within this distance and all existing wells will be abandoned and plugged. The Committee believes these arrangements are satisfactory.

A large volume of liquid chlorine is maintained in a refrigerated storage vessel about one mile from the Midland plant control room. The applicant is continuing his study of the consequences of a major accidental release of chlorine from this vessel. He has included in his criteria for the design of the control room the objective of finding a practical method of maintaining the concentration of chlorine in the control room atmosphere below the eight hour threshold limiting value (TLV) of 1 ppm for the most serious conceivable chlorine accident. The Committee believes that adequate air purification facilities should be provided in the control room ventilation system to reduce chlorine concentration to the eight hour TLV of 1 ppm so that operators can work without respiratory equipment during an extended chlorine emergency. This matter should be resolved during construction in a manner satisfactory to the Regulatory Staff.

The reactor vessel cavity will be designed to withstand mechanical forces and pressure transients comparable to those considered in the design of the Zion and Indian Point-3 plants.

The applicant has stated that he will provide additional evidence obtained by improved multi-node analytical techniques to assure that the emergency core cooling system is capable of limiting core temperatures to the limits established at present. He will also make appropriate plant changes if the further analysis demonstrates that such changes are required. This matter should be resolved during construction in a manner satisfactory to the Regulatory Staff. The Committee wishes to be kept informed.

The safety injection system for the Midland plant is actuated by either low reactor pressure or high containment pressure signals. However, of these two, the reactor is tripped only by the low reactor pressure signal. The Committee believes that provision also should be made to trip the reactor by the high containment pressure signal.

The applicant plans to develop more detailed criteria for the installation of protection and emergency power systems together with appropriate procedures to maintain the physical and electrical independence of the redundant portions of these system . The Committee believes that these criteria and procedures should be reviewed and approved by the Staff prior to actual installation.

The applicant considers the possibility of melting and subsequent disintegration of a portion of a fuel assembly because of flow starvation, gross enrichment error, or from other causes to be remote. However, the resulting effects in terms of local high temperature or pressure and possible initiation of failure in adjacent fuel elements are not well known. Appropriate studies should be made to show that such an incident will not lead to unacceptable conditions.

The Committee believes that consideration should be given to the utilization of instrumentation for prompt detection of gross failure of a fuel element.

The Committee has commented in previous reports on the development of systems to control the buildup of hydrogen in the containment which might follow in the unlikely event of a major accident. The applicant proposes to make use of a technique of purging through filters after a suitable time delay subsequent to the accident. However, the Committee recommends that the primary protection in this regard should utilize a hydrogen control method which keeps the hydrogen concentration within safe limits by means other than purging. The capability for purging should also be provided. The hydrogen control system and provisions for containment atmosphere mixing and sampling should have redundancy and instrumentation suitable for an engineered safety feature. The Committee wishes to be kept informed of the resolution of this matter.

The Committee recommends that the applicant accelerate the study of means of preventing common failure modes from negating scram action and of design features to make tolerable the consequences of failure to scram during anticipated transients. The applicant stated that the engineering design would maintain flexibility with regard to relief capacity of the primary system and to a diverse means of reducing reactivity. This matter should be resolved in a manner satisfactory to the Regulatory Staff during construction. The Committee wishes to be kept informed.

Other problems related to large water reactors have been identified by the Regulatory Staff and the ACRS and cited in previous ACRS reports. The Committee believes that resolution of these items should apply equally to the Midland Plant Units 1 & 2.

The Committee believes that the above items can be resolved during construction and that, if due consideration is given to these items, the

nuclear units proposed for the Midland Plant can be constructed with reasonable assurance that they can be operated without undue risk to the health and safety of the public.

Sincerely yours,

/s/
Joseph M. Hendrie
Chairman

References

1) Amendments 1 - 12 to License Application

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

September 23, 1970

Honorable Glenn T. Seaborg
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: SUPPLEMENTAL REPORT ON MIDLAND PLANT UNITS 1 AND 2

Dear Dr. Seaborg:

At its 125th meeting, September 17-19, 1970, the Advisory Committee on Reactor Safeguards completed its review of amendments to the application by the Consumers Power Company to construct the Midland Plant Units 1 and 2. This project was the subject of a report to you dated June 18, 1970. The review was reopened in consideration of additional submittals by the applicant proposing an increase in the design pressure of the containment structure and the addition of a system of reboilers for the generation of steam to be exported to the Dow Chemical Company. These changes were considered at a Subcommittee meeting held in Washington, D. C. on September 14, 1970. The Committee had the benefit of discussion with representatives and consultants of the Consumers Power Company, Babcock and Wilcox Company, Bechtel Corporation, Dow Chemical Company, and the AEC Regulatory Staff. The Committee also had the benefit of the documents listed.

The applicant has revised downward his estimate of the free volume and internal surface area of the containment structure and has revised upward to 60 psig the calculated peak containment pressure reached in the unlikely event of a loss of coolant accident. The containment design pressure has been raised to 67 psig to provide a suitable margin above the peak accident pressure, and an increased number of prestressing tendons will be provided in the containment structure to accommodate the increased pressure. No changes in the structural design criteria are proposed. The Committee believes these changes are satisfactory.

In the earlier design the export steam was taken from the secondary side of the main steam generators and might contain traces of radioactive leakage from the primary system. The applicant now proposes to use this steam in a system of shell and tube reboilers to generate tertiary steam for export to the Dow Chemical Company. Secondary steam condensate from the reboilers is returned to the turbine condenser hot well while feed water for the tertiary side of the reboilers is supplied by condensate from the tertiary steam which is supplemented as required by

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ATTACHMENT 4

demineralized water from Lake Huron. Blowdown from the reboilers is normally routed to the Dow waste treatment system for disposal to the river but may be sent to the radwaste system of the nuclear plant if secondary to tertiary leakage is detected.

The applicant proposes to install monitoring and analytical facilities to determine the levels of radioactivity in the export steam as described in the June 18, 1970, letter; these include an on-line analyzer for gamma activity and sensitive low level beta counting equipment for analysis of samples of the condensed steam. The applicant expects that the tertiary steam delivered to Dow will contain no more radioactivity than the treated make-up water from Lake Huron. Recycling tertiary steam condensate may result in some slight concentration of naturally occurring radioactivity in the reboiler system but is not expected to effect the validity of the comparison between steam and make-up water radioactivity as a sensitive indication of leakage in the reboilers. If detectable leakage occurs, corrective action will be taken in the plant or delivery of export steam will be terminated.

The applicant agrees to demonstrate the analytical equipment and procedures in development programs to be carried forward during construction of the Midland Plant.

The Committee believes that the proposed system of reboilers will provide substantial additional assurance that leakage of primary system radioactivity into the export steam can be maintained at an extremely low and insignificant level and that the export steam can be maintained essentially at natural background levels. The detailed procedures for monitoring and control of the reboiler system should be developed during construction in a manner satisfactory to the Regulatory Staff. The Committee wishes to be kept informed.

The Committee believes that the above items can be resolved during construction and if due consideration is given to these items and to the items referred to in its June 18, 1970 report, the nuclear units proposed for the Midland Plant can be constructed with reasonable assurance that they can be operated without undue risk to the health and safety of the public.

Sincerely yours,

Joseph M. Hendrie

Joseph M. Hendrie
Chairman

References

1) Amendments 14-18 to the License Application

DOCUMENTS SUMMARIZING THE SOILS-RELATED ISSUES AT MIDLAND

1. Summary of Soils-Related Issues at the Midland Nuclear Plant.

2. Selected Consumers Power Company submittals related to Midland's Auxiliary Building and Feedwater Isolation Valve Pit.

3. Selected Consumers Power Company submittals related to Midland's Borated Water Storage Tank.

4. Selected Consumers Power Company submittals related to Midland's Diesel Generator Building.

5. Selected Consumers Power Company submittals related to Midland's Permenant Plant Dewatering.

6. Selected Consumers Power Company submittals related to Midland's Service Water Pump Structure.

7. Selected Consumers Power Company submittals related to Midland's Underground Utilities.

8. Selected NRC Documents Related to Midland's Soils and Structural Settlement Issues.

ATTACHMENT 5

UPDATE COPY

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
09/07/78	Applicant's verbal report to Region III of abnormal settlement of Diesel Generator Building (DGB)
09/29/78	First 50.55(e) interim report on DGB settlement issued
11/01/78	Region III requests NRR review support on soils compaction adequacy
11/07/78	Second 50.55(e) interim report on DBG settlement issued
11/24-27/78	Investigation by Region III on DBG settlement, documented by inspection report 50-329/78-12; 50-330/78-12
12/03-04/78	Meeting and site tour on DGB settlement
12/14/78	Special Prehearing Conference on OL issues
12/21/78	Third 50.55(e) interim report on DGB settlement issued
12/21/78	50.55(e) notification that applicant has selected preload as corrective action for DGB
01/05/79	Supplement to third 50.55(e) interim report on DGB settlement
01/26/79	Start of surcharge placement for DGB
— 02/23/79	OL Prehearing Conference Order - accepts W. Marshall contention 2 and M. Sinclair contention 24 on soils
02/23/79	Meeting with Region III on soils QA
02/23/79	Fourth 50.55(e) interim report on DGB settlement
03/05/79	Meeting with Region III and NRR on Region III investigation
03/06/79	Site visit
03/21/79	Staff issues first set of 50.54(f) questions regarding plant fill (Questions 1-22)
03/22/79	Region III issues investigation report on soils 50-329/78-20; 50-330/78-20
03/28/79	Accident occurs at Three Mile Island, Unit 2
✓ 04/24/79	Applicant's initial response to 50.54(f) requests regarding plant fill
✓ 04/30/79	Revision 5 to 50.55(e) interim report on DGB settlement

ATTACHMENT 6

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
05/31/79	Revision 1 to Applicant's resonse to 50.54(f) requests regarding plant fill
06/07/79	Site visit by staff to observe test pits in plant fill
06/25/79	Revision 6 to 50.55(e) interim report on DGB settlement
07/09/79	Revision 2 to Applicant's response to 50.54(f) requests regarding plant fill
✓ 07/18/79	Meeting on results of DGB preload program, site investigation, proposed fixes including caissons, underpinning and dewatering (Summary: Applicant's 50.54(e) report dated August 10,1979)
07/19/79	Meeting on site geology
09/05/79	Revision 7 to 50.55(e) interim report on DGB settlement
09/05/79	Meeting on draft 50.54(f) question 23 regarding ~~mils~~ soils QA
09/11/79	Staff issues 50.54(f) question 23 regarding ~~mils~~ soils QA
✓ 09/13/79	Revision 3 to response to 50.54(f) requests regarding plant fill
✓ 10/16/79	Staff announces that U.S. Army Corps of Engineering to assist with geotechnical engineering review
11/02/79	Revision 8 to 50.55(e) interim report on DGB settlement
✓ 11/13/79	Revision 4 to response to 50.54(f) requests regarding plant fill
11/14/79	Initial site visit by Corps of Engineering
11/19/79	Staff issues supplemental 50.54(f) questions 24-35
12/06/79	NRC issues order requiring modification of construction permits prior to proceeding with soils remedial activities
12/19/79	Applicant files Amendment 72 requesting modifications of CP's and requesting staff approval of proposed soils remedial Activities
12/26/79	Applicant requests hearing on NRC's 12/06/79 order

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCES
01/16/80	Meeting on 50.54(f) responses and proposed remedial activities on plant fill (Summary issued 02/04/80)
02/07/80	Applicant's notice of termination of 50.55(e) reporting on DGB Settlement
02/11/80	Submittal of documents referenced by Amendment 72
02/26/80	NRC announces that Naval Surface Weapons Center to assist in structural engineering review
02/27-28/80	Meeting and site tour regarding plant fill deficiences and remedial actions
02/28/80	Revision 5 to responses to 50.54(f) requests regarding plant fill
02/29/80	NRC announces that Energy Technology Engineering Center to assist in Mechnanical Engineering review
04/01/80	Staff requests additional reports, drawings and other information on plant fill deficiencies and fixes
06/30/80	Staff requests additional soils exploration, sampling, and laboratory tests (Questions 36-38)
07/07/80	Staff provides guidelines for future audit on seismic and structural design calculations
07/31/80	Meeting to discuss soils remedial actions and staff request for additional borings and tests
08/04/80	Staff letter forwarded Corps of Engineering request for information and soils testing (Questiosn 39-48)
08/27/80	Staff requests information on site dewatering (Questions 49-53)
08/28/80	Site tour for NRC management and consultants
08/29/80	Meeting to hear applicant's appeal of staff request for additional borings and tests (Question 37)
10/07/80 - ~~02/20/81~~ 3/81	Oral depositions of staff, applicant, Bechtel and consultants during discovery for soils (OM, OL) hearing

NAME

CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES

10/14/80	Staff position letter providing acceptable alternatives for determining seismic input
10/20/80	Staff letter expressing concerns for underground piping stressess
11/10/80	Staff letter denying applicant's appeal of staff position regarding request for additional soils exploration, sampling and lab tests
11/14/80	Applicant replies to underground pipe stress concerns
11/21/80	Amendment 85 submitted responding to Questions 39-44, 46-53
11/24/80	Meeting on systematic appraisal of licensee performance (SALP)
01/27/81	Site visit to observe BWST concrete foundation cracking
01/28-29/81	Special Prehearing Conference on plant fill issues
02/20/81	50.55(e) report 81-03 on cracking in BWST foundations (subsequent interim reports issued 4/3/81, 6/12/81, 6/26/81, 7/21/81, 8/28/81, 10/26/81, 11/13/81, 11/24/81, 12/11/81, and 1/18/82)
03/02/81	Parts I and III of applicant's report on site specific response spectra
03/23/81	Applicant's letter announcing underpinning of service water pump structure will be based upon a perimeter wall concept, rather than piles
04/20-24/81	Design audit of seismic Category I structures and seismic calculations (Summary issued March 2, 1982)
04/27/81	Special Prehearing Conference on plant fill issues
05/05-07/81	Meeting on Underground pipes, Amendment 85, solid pier concept for Auxiliary Building underpinning, and Borated Water Storage Tank foundations
05/13/81	Part II report by applicant on site specific response spectra
06/17/81	Addendum to Part I report on site specific response spectra (original ground surface)

7/7-18/81 OM,L hearing on QA ~~matter~~ iss.; related E. soils areas

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
06/19/81	Preliminary results of soils boring and testing program for cooling pond dikes
06/30/81	Meeting on seismic margin review criteria
07/15/81	Telephone conference discussion on BWST surcharge (Summary issued July 29, 1981)
07/27/81	Report on final results of soil boring and testing program for perimeter and baffle dike area
07/27/81	Transmittal of update of site settlement measurements and piezometer data
08/04-13/81	OM, OL hearing on Stamiris' contentions
08/11/81	Applicant's report on basis for rejection of 1966 Parkfield Earthquake Accelerograms for site specific response spectra
08/26/81	Transmittal of technical report and drawings on SWPS underpinning
09/08/81	Meeting on seismic input parameters
09/11/81	Applicants letter with updated settlement plots for several structures on fill
09/16/81	Meeting on site specific response spectra
09/17/81	Meeting on SWPS remedial actions (Summary 11/23/81)
09/22/81	Transmittal of Part I of report on soil borings and tests For Auxiliary Building
09/24/81	Telephone conversation in which staff requests additional information on soil concerns for Diesel Generator Building
09/25/81	Staff concurrence on surcharging valve pits for BWSTs
09/25/81	Transmittal of applicant's proposed seismic margin review criteria
09/30/81	Transmittal of technical report and drawings on Auxiliary Building and dynamic models for Auxiliary Building and SWPS

	DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
	09/30/81	Meeting on DGB soil borings and testing results
	10/01/81	Meeting on Auxiliary Building underpinning (Summary 2/5/82)
—	10/02/81	Meeting on seismic models for Auxiliary Building and SWPS (Summary 1/25/82)
✓	10/02/81	Transmittal of DGB concrete crack analysis
—	10/06-07/81	Meeting on underground pipes and DGB settlement measurements (Two summaries issued 2/5/82)
	10/13-16/81	Hearing on seismic issues
✓	10/19/81	Responses to open items from structural design audit of April 20-24, 1981
✓	10/21/81	Applicant's letter responding to verbal requests of 9/24/81 regarding DGB
	10/26/81	Parts 1 and 2 of Woodward-Clyde report "Test Results, Auxiliary Building, Soil Boring and Testing Program"
	10/26/81	Amendment 97 (Revision 12 to Responses to NRC Requests Regarding Plant Fill and settlement update report)
	10/28/81	BWSTs filled with water
✓	10/28/81	Request for staff concurrence for construction of access shafts and freezewall in preparation for underpinning of Auxiliary Building
	10/30/81	Telephone conversation in which staff requests additional information on remedial action for Auxiliary Building
✓	11/04/81	Meeting on Auxiliary Building and response to October 30 requests (summary issued 12/31/81)
✓	11/06/81	Response to staff requests on Sept. 17, 1981, on SWPS underpinning
✓	11/06/81	Test Results of soil boring and testing for SWPS
—	11/10/81	Transmittal of results of soil borings and tests for BWSTs
	11/12/81	Meeting on soils remedial action schedules (summary issued 11/23/81)

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
11/13/81	"Design Report for the BWST Foundation Analysis"
11/16/81	Transmittal of letter "Response to NRC Request for Additional Information Pertaining to the Proposed Underpinning of the Auxiliary Building and FWIV Pits". Includes alteration to the FWIP underpinning configuration
11/17/81	Meeting on construction schedules for remedial underpinning for Auxiliary Building & SWPS
11/24/81	Staff concurrence for construction of vertical access shafts and freeze wall in preparation for underpinning the Auxiliary Building and Feedwater Isolation Valve Pits
11/24/81	Staff visit to observe underpinning of structures near the Philadelphia subway tunnel
11/24/81	Transmittal of results (Part II of Woodward-Clyde report) of soil boring and testing program for Auxiliary Building
11/24/81	Staff given copy of report "Seismic Safety Margin Evaluation Workshop" (Summary March 16, 1982)
11/24/81	BWST Foundation OL Design Calculations plus enclosure 1: "Design Report for the BWST Foundation Analysis" (55(e) Report 81-03 #9)
12/01-04/81	Hearing - Auxiliary Building Underpinning
12/03/81	Underpinning of the Auxiliary Building - Calculational Results (supplements September 30, 1981, letter)
12/10/81	Meeting on Cracks in Auxiliary Building, SWPS & DGB
12/14-18/81	Hearing on Seismic Models and [illegible] and QA Organization
12/15/81	CPCo letter on Undergro[illegible]th several related enclosures
12/30/81	Staff issues proposed findings of fact and conclusions of law (QA)
01/04/82	Staff receives advanced copy of Applicant's draft Testimony (12/31/81) on Service Water [illegible] Structure
01/06/82	Applicant's letter on effects of Auxiliary Building Freeze Wall on Utilities and Structures

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
01/07/82	General Quality Plan for Underpinning & Quality Plans and Q-list activities for SWPS and Auxiliary Building Underpinning
01/11/82	Meeting on Cracks (Summary March 16, 1982)
01/12/82	Meeting in Glen Ellen on QA Organization change and General Quality Plan on Underpinning (Summary January 29, 1982)
01/13/82	Meeting on BWST (Summary February 8, 1982)
01/18/82	BWST Foundation OY Design Calculations including SMA report on tank stresses (same letter also dated January 11, 1982)
01/18-19/82	Audit Meeting Prior to Excavation beneath FIVP & TB (Phase II of Underpinning Construction) (Summaries March 10, 1982, and March 16, 1982)
01/20/82	Meeting on Freeze Wall effects (Ann Arbor) (Summaries March 10 and 16, 1982)
01/21-22/82	Meeting on Underground Pipes
01/25/82	Applicant's letter - Evaluation Report for the FIVPs
01/26/82	Applicant's letter - Quality Assurance Organization change
01/26/82	Telecon discussion on surcharge results for BWST foundations
01/28/82	Applicant's letter to ASLB on QA Organization (1/26/82 letter) and Audit reports regarding qualifications of Bechtel electrical inspection
01/29/82	Evaluation Report for Auxiliary Buidling Control Tower & EP Areas on cracks
02/02/82	Hearing on QA Organizational change
02/02-05/82	Audit meeting prior to Excavation Beneath Auxiliary Building and Auxiliary Building Cracks
02/04/82	Applicant's letter on Augering method for soldier pile holes for access shaft of the Auxiliary Building
02/16/82	Applicant's letter with enclosure on Evaluation Report for concrete cracks in the Diesel Generator Building

DATE	CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES
02/16-19/82	Hearing on BWST and Underground Pipe
02/23-26/82	Meetings on DGB, SWPS, BWST Surcharge Removal, Dewatering Recharge Test results (17 days of data) and Additional Settlements for Auxiliary Building Monitoring (Summary March 12, 1982)
02/25/82	Staff receives advanced copy of Applicant's draft testimony (1-8-82) on structural reanalysis of DGB, excluding Appendix C
02/26/82	Staff letter of concurrence for removal of surcharge from BWST valve pits
03/02/82	Applicant's letter with report responding to request for Additional Information, "Service Water Pump Structure Three-Dimensional, Finite-Element Models" (This is an appendix to SWPS Technical Report dated 8/25/81)
03/02/82	Applicant's letter with report "Evaluation of Cracking in Service Water Pump Structure at Midland Plant"
03/03/82	Meeting on Dewatering Criteria (Summary March 16, 1982)
03/04/82	Meeting on hearing schedules
03/10/82	Applicant's letter on settlement of Underground Diesel Fuel Oil Tanker due to Seismic Shakedown
03/10/82	Applicant's letter on protection of excavation face for the Auxiliary Building underpinning access shaft
03/10/82	Meeting on QA for underpinning (Summary March 12, 1982)
03/12/82	NRC notified of loose sands beneath SW piping (Summary March 16, 1982)
03/16/82	Meeting with Director, NRR on schedules
03/16/82	Applicant's letter providing additional information on buried piping, with enclosures on future monitoring program and replacement of 26" and 36" SW piping
03/16-19/82	Audit on SWPS Underpinning
03/18/82	Applicant's letter regarding surcharge removal for the BWST valve pits

CHRONOLOGY REGARDING PLANT FILL DEFICIENCIES

DATE	
03/23/82	Applicant's letter forwarding Woodward-Clyde Consultant's report, "Test Results, Retaining Walls, Soil Boring and Testing Program, Midland Plant-Units 1 and 2," dated November 6, 1981.
03/22/82	Staff letter compiling information requested for completion of staff review of Phase 2 Underpinning for Auxiliary Building
03/26/82	Staff letter of concurrence to grout cracks in the existing concrete foundations of the BWSTs
03/29/82	Applicant's letter forwarding Dames and Moore's "Report, Soil Dynamic Modulus Study, Midland Units 1 and 2" dated March 5, 1982
03/30/82	Meeting with Region III on QA implementation for installation of underpinning instrumentation
4/1/82	Meeting with Director of NRR on schedules for completion of Midland plant reviews