8/22/90

UTILITY American Electric Power Service Corporation

SITE Cook 1&2

ENCLOSURES answers to questions

attachments 1) Impact of the Donald C. Cook Nuclear Plant

2) 316(b)

3) Thermal Plume Measurements

4) Impact of Cooling Water Use

Aquatic Resources Questions

Enclosed are the Cook Nuclear Plant 316(a) and 316(b) demonstration, the supplemental 316(b) report, and the final aquatic impacts study report from the Great Lakes Research Division, University of Michigan.

Responses to Aquatic Resources Questions

1. Re: Post licensing modifications to alter impacts on aquatic life or mitigate impacts

   Response: Neither the design nor the operation of Cook Nuclear Plant have been modified in whole or in part to reduce or mitigate for impacts of plant construction or operation to aquatic resources of Lake Michigan, the cooling and service water source for the plant.

2. Re: Known impacts on aquatic resources or NPDES Permit enforcement actions

   Response: The pre- and post-operational aquatic ecological studies defined impacts from construction and operation of the Cook Nuclear Plant as being the result of the circulating cooling water discharge, the riprap scour beds around the intake and discharge structures, and the circulating water intake system. These impacts are described in response to other questions. No impacts, such as fish kills, have been associated with the construction or operation of Cook Plant. Several exceedances of NPDES Permit limits for temperature and chlorine have occurred during the operation of the plant. None of these exceedances have resulted in any environmental impacts or regulatory action by the Michigan pollution regulatory agency. However, on February 10, 1989, Cook Nuclear Plant did receive a "Notice of Non-Compliance and Order to Comply" with total suspended solids (TSS) effluent limits for internal Outfall 00F, a pre-filter backwash discharge. The TSS effluent limits could not be achieved due to the amount of TSS in the intake water. Cook Nuclear Plant complied with the "Order to Comply" by rerouting the discharge to an on-site absorption pond and so notified U.S. EPA Region V on March [illegible], 1989.

3. Re: Changes to the NPDES Permit during operation of the plant

Response: Cook Nuclear Plant has two discharge points to Lake Michigan; Outfalls 001 and 002 are the condenser cooling water discharges for Units 1 and 2, respectively. Cook Nuclear Plant has internal monitoring requirements for Outfalls 00A, 00B, and 00C, which are the Unit 1 Steam Generator Blowdown, Unit 2 Steam Generator Blowdown, and Heating Boiler Blowdown, respectively. Outfalls 00A, 00B, and 00C discharge to Lake Michigan via 001 and 002.

The initial NPDES Permit issued December 27, 1974, included Oil & Grease effluent limits for Outfalls 001, 002, and 003 (Outfall 003 is a deicing discharge comprised of effluent from 001, 002, or both 001 and 002 and is monitored at the discharge bay for Units 1 or 2, as applicable). Oil & Grease monitoring requirements were moved from 001, 002, and 003 to Outfalls 00A, 00B, and 00C when the permit was reissued on September 19, 1985, and were finally deleted altogether after one year of monitoring showed no likelihood of Oil & Grease being discharged.

A pH effluent limit for Outfalls 00A, 00B, and 00C established in the 1974 permit was deleted in the 1985 permit since pH adjustment is necessary to prevent fouling of the heater tubes and the flow from 00A, 00B, and 00C is insignificant compared to the flow from Outfalls 001 and 002; therefore, when co-mingled with the circulating water flow, no change in pH is detected.

Iron and copper effluent limits for Outfalls 00A, 00B, and 00C established in the 1974 permit were deleted in the 1985 permit since these discharges are considered low-volume wastes, and iron and copper effluent limits are not applicable.

4. Re: Trend analyses of discharge monitoring data and correlation with aquatic resources monitoring

Response: Aquatic ecological studies designed to determine the effects of construction and operation of the Cook Nuclear Plant on

Lake Michigan began in 1972 and were completed in 1982. Unit 1 was put into commercial operation in mid-1975 and Unit 2 in late 1978. The aquatic ecological studies identified the thermal component of the Cook Nuclear Plant discharges as having an impact on the aquatic biota. No impacts were detected from chemical discharges such as the intermittent chlorination. The thermal discharge effects are discussed in the response to Questions 5 and 7.

5. Re: Summary of the types and numbers of aquatic organisms entrained or impinged with seasonal and annual patterns

Response: Entrainment and impingement sampling was conducted at Cook Nuclear Plant from January 1, 1975 through December 31, 1982. The details of these studies have been described in various reports published by the University of Michigan, Great Lakes Research Division. A summary of the entrainment and impingement study results are presented in various chapters of the final study report (Rossmann 1986). Entrainment samples were collected for phytoplankton, zooplankton, macroinvertebrates, and ichthyoplankton.

Phytoplankton entrainment sampling was conducted from 1975 through 1982. Samples were collected from the plant intake forebay and discharge forebay. Samples were analyzed for chlorophyll *a*, *b*, and *c*; phaeophytin *a*; and phaeophytin *a*/chlorophyll *a* ratio. Samples were also collected for cell identification and enumeration. One series of tests were conducted to estimate primary production using the carbon-14 uptake method. Phytoplankton were lumped into major groups: coccoid blue-green; filamentous blue-green; coccoid green; filamentous green; flagellate; pennate diatom; centric diatom; desmid; and other for most long-term and overall analyses. All counted cells were usually identified at least to genus. The cell count; species composition and diversity; chlorophyll *a*, *b*, and *c*; phaeophytin *a*; and phaeophytin *a*/chlorophyll *a* ratio all indicated that there was no power plant-related effects resulting from entrainment. The carbon-14 uptake tests showed primary production

was reduced after plant entrainment by between 16% to 76%. The ecological significance of this reduction could not be determined. Chlorophyll content of the cells was not decreased, so potential for cell recovery existed (Rossmann 1986 - pages 87-168).

Zooplankton were sampled for determination of the number per unit volume, species, and survival rate upon plant passage. Two replicate samples were collected once each month. Replicate samples were pumped for one minute at dawn, noon, dusk, and midnight. Samples were drawn from the intake and discharge bays of both units.

From 1975 through 1982, billions of zooplankton each month passed through the plant. Monthly estimates for two-unit operation ranged from about 250 to 1000 x 10^9 from January through April and in some years May up to 5,000 to 20,709 x 10^9 between the months of June through December. The average concentration of zooplankton between 1979 and 1982 was 23,915/m^3 and ranged from 1,614/m^3 to 96,730/m^3. Species composition and abundance was very similar to composition and abundance measured on samples collected from the lake. Table 1 shows the species list for zooplankton collected from Southeastern Lake Michigan during the aquatic ecological surveys (Rossmann 1986 - page 176).

Mortality rates for entrained zooplankton varied from species to species. The calanoid copepods, especially immature animals, showed the highest mortality rates, up to 9.56% higher in the discharge compared to the intake. Diaptomus, Eurytemora, Limnocalanus, and Daphnia genera show the highest rates. Other zooplankton species show no statistical significant difference between the intake and discharge samples.

Over the study period, zooplankton abundance decreased. The decrease was observed at the control stations as well as the treatment stations. No seasonal or annual changes in zooplankton populations were attributable to the construction or operation of

the Cook Nuclear Plant except for the area within the thermal plume (Rossmann 1986 - pages 169-205). The zooplankton tended to concentrate near the surface within the thermal plume and the bottom within the first few hundred meters from the discharge jets were devoid of epibenthic zooplankton.

Macroinvertebrates are entrained and impinged at Cook Nuclear Plant. Both types of impact were evaluated during the aquatic ecological study -- 1973 through 1982 (Rossmann 1986 - pages 207-283). Entrainment samples were collected from two locations in the intake forebay and one sample from the discharge bay. These samples were collected over a 24-hour period, divided into four equal parts: dawn to noon; noon to dusk; dusk to midnight; and midnight to dawn. Samples were collected weekly from June through August and twice monthly from September through May.

Impinged macroinvertebrates were collected daily from early 1975 through early 1976 and every fourth day from then through 1978. Samples were collected on 614 days in all. All samples were obtained by sorting crayfish, the only macroinvertebrate impinged, from the debris and fish collected in the screen wash basket.

Estimated annual impingement rates ranged from 7,625 in 1978 to 16,151 in 1975. The impingement rate decreased during the study period. The downward trend is believed to stabilize. The significance of the crayfish entrainment rate is not known. The riprap around the intake structure provides the habitat for the crayfish. Without the riprap, there would be no crayfish in that portion of Lake Michigan.

Estimates of annual entrainment rates of invertebrates were made for Pontoporeia hoyi, Gammarus spp., Hyalella azteca, Mysis relicta, and Asellus spp. All other species entrained were collected too infrequently or in too low numbers to conduct statistical analyses.

Diel variability in entrainment was strong in most of these five taxa. P. hoyi and M. relicta entrainment rates were highest in the dusk-to-midnight and midnight-to-dawn samples. P. hoyi entrainment rates were about four times higher, and M. relicta entrainment rates were nearly eight times higher at night then in the daytime. Asellus spp. were entrained only slightl· more frequently at night compared to day samples. Gammarus spp. and H. azteca were entrained slightly more frequently in the daytime compared to the night.

There were strong seasonal variations in the annual pattern of benthic invertebrate entrainment rates. Fall and winter were months of highest entrainment rates. P. hoyi and M. relicta entrainment rates were highest in December and January, with smaller peaks in August and September. Most benthic invertebrates were entrained in a similar seasonal pattern.

P. hoyi and M. relicta entrainment represented 17.4% of the estimated annual benthic invertebrates entrainment, as measured by number per cubic meter of water entrained. Entrained benthic invertebrate concentrations ranged from 0.0484 P. hoyi/m^3, 0.0253 M. relicta/m^3, to 0.5591 total benthos/m^3 on an annual average basis.

The annual entrainment losses of P. hoyi were compared to the lake bottom population densities near Cook Nuclear Plant as a means of assessing impact. In the study area near the plant, P. hoyi densities were an average of 2,209 organisms/m^2. At that average density, 0.09 km^2 of lake bottom would produce the 1.97×10^8 individuals estimated to be entrained each year. This loss was not considered ecologically significant (Rossmann 1986 - page 225).

Fish impingement and entrainment at Cook Nuclear Plant was studied from late 1974 through December 1982. Entrainment samples for ichthyoplankton were collected. Samples were collected twice per month except in June, July, and August when samples were collected

once to twice a week to coincide with peak fish spawning activity. Three sampling locations in the intake forebay and one from the discharge bay were sampled for 24 hours, using a diaphragm pump. Samples were divided into four parts -- dawn to noon, noon to dusk, dusk to midnight, and midnight to dawn (Rossmann 1986 - pages 285-351).

Samples were processed to determine species, size frequency distribution, and concentration (number per m^3 of water filtered). Larval fish keys were available or were developed as part of this study to allow for the identification nearly all larvae collected. Eggs could not be identified with certainty; however, reasonable assumptions were made based upon size and other physical characteristics and time of collection correlations with known species spawning activity (Rossmann 1986 - pages 289-290).

Nearly 750 million fish larvae were estimated entrained through the Cook Nuclear Plant. Ninety percent of the larvae were alewife (74.34%), spottail shiner (9.00%), rainbow smelt (4.79%), and yellow perch (1.79%). About 7.5% of the larvae were in too poor condition to identify even to Family. Less than 0.1% could not be identified and less than 0.67% could be identified to genus only, sculpins, minnows, coregonines, and darters. The remaining 1.94% were made up of these nine species: trout-perch; Johnny darter; slimy sculpin; mottled sculpin; common carp; ninespine stickleback; quillback; burbot; and deepwater sculpin (Rossman 1986 - page 297). Table 2 is a summary of the entrainment for 1975 through 1982.

Fish impinged on the intake traveling screens were collected every day and preserved for analyses. During 1975, all fish collected were identified to species, measured, weighed, and examined for sex, gonad condition, presence of food, disease or parasites, and physical damage. In 1976, these measurements and examinations were made on fish collected every fourth day, and all other days impingement was bulk weighed. The ratio of the monthly total of every fourth day weight to total fish weight was used to estimate

the species, composition of the impingement samples that were bulk weighed only, i.e., $E_w = (S_w/P_w)\ T_w$

where: E_w = estimated monthly weight of impinged fish of a given species

S_w = monthly total weight of every fourth day impingement samples of a given species

P_w = monthly total weight of all every fourth day impinged fish

T_w = total monthly weight of all impinged fish

Alewives were the most frequently impinged fish. Annual estimated impingement rate showed alewives made up between 39% and 89% of the total fish impinged. The most frequently impinged fish, as measured by estimated annual average impingement rate: alewife (68%); spottail shiner (10%); yellow perch (9%); trout-perch (5%); rainbow smelt (4%); and slimy sculpin (2%).

Annually, these same species were impinged at about this same relative composition, with a few slight trends. Yellow perch increased in percent composition; trout-perch and slimy sculpin decreased. Yellow perch increased in abundance lake-wide during the study period, and their predation on trout-perch was believed to cause the trout-perch decline. Slimy sculpins colonized the riprap only; thus, their small population size was susceptible to impingement losses.

Seasonally, impingement rates and species composition changed in conjunction with changes in fish behavior. Spring and summer impingement peaks in June and July are associated with shoreward migration of alewives and other species to spawn. Secondary peaks occurred each year in either spring (April or May) or fall (September or November). The spring peak is caused by the

shoreward migration of fish seeking the warmer shore water temperatures. Fall peaks are caused by the young-of-year fish reaching a size large enough to be impinged on the traveling screens rather than entrained through the plant.

Causes of changes of impingement rate for individual species or all fish, in general, include changes in circulating water system flow volume (large increases in some species were attributed to the change from one-unit to two-unit operation, which resulted in 137% increase in water volume), the spring thermal bar (alewives and other species concentrated shoreward of the thermal bar and were more susceptible to impingement, year-class strength (alewife, spottail shiners, yellow perch, and rainbow smelt all had high impingement years caused by a particularly successful spawn), upwellings (cold water brings cool-adapted species, like bloater and rainbow smelt, near the intake structures), and storms (a large storm caused extremely high alewife impingement in 1980).

6. Re: Describe changes in aquatic habitat and resulting changes to aquatic biota in the vicinity of the plant since the Operating License was issued

Response: No alterations to aquatic habitat have been made in the vicinity of Cook Plant since the Operating License was issued. Changes to the aquatic habitat resulting from construction and operation are described in response to Questions 4 and 7.

7. Re: Describe other nearby water uses and how plant impacts have altered those uses

Response: Nearby water uses in Lake Michigan near the Cook Nuclear Plant include power and sail boating, swimming, sport fishing, and drinking water source. Only sport fishing has a significant potential for impacts from construction and operation of the plant. Boating is not affected because there is no obstruction or impairment to boating associated with the submerged intakes and

discharges. Swimming at public and private beaches north and south of the plant are not impacted in any way by the plant. Drinking water supplies are not affected since no harmful chemicals in harmful amounts are discharged to Lake Michigan from Cook Plant.

Sport fishing has the potential to be impacted by the construction and operation of Cook Plant in positive and negative ways. Positive impacts include the concentrating effect the warm water discharge has on some species during certain times of the year and the habitat provided by the riprap scour beds around the intake and discharge structures. Negative impacts include the loss of sport fish and forage species due to impingement and entrainment and the avoidance of the thermal plume by some fish during some times of the year. Annually, Cook Plant impinges between 500 and 1000 salmonid species (coho and chinook salmon and lake, rainbow, and brown trout). These are highly prized sport fish. This rate of impingement was not considered a significant impact on the sport fishery by either the University of Michigan, Great Lakes Research Center (who conducted the study), or the Michigan Department of Natural Resources. The large number of alewives, which are an important component of the coho and chinook salmon diet, were believed by the Michigan DNR to have a negative impact on the growth rate of the prey species. The actual total contribution of Cook Plant to the cropping of the annual production of the alewife population in the entire lake was calculated at a few one hundredths of a percent.

Field catch data from the standard series sampling using trawls, gillnets, and seining conducted from 1973 through 1982 showed that 22 of the 59 species of fish collected were affected by Cook Plant operation and construction. Impacts resulted from (1) attraction to the scour bed riprap, (2) attraction to riprap, structures, and current, (3) avoidance of plant area caused by construction activity, dredging, and discharges, and (4) avoidance of discharges or reduced abundance due to impingement and entrainment mortality. Spottail shiner, trout-perch, and yellow perch were less abundant

at the Cook Plant stations than the control station. Trout-perch populations were probably reduced by yellow perch predation and power plant entrainment. Spottail shiner and yellow perch may have been impacted by impingement, although the yellow perch results were ambiguous. Trawl data and two years of gillnet data were significant with fewer fish at the Cook Plant station. Gillnet data for other plant operation showed significantly more perch at Cook Plant than at the control station. Warm water and food availability appeared to attract brown trout, common carp, and gizzard shad. Johnny darters, lake trout, and slimy sculpins were attracted to the riprap Longnose and common suckers appeared to avoid the construction area (Rossmann 1986 - pages 309-318). Immediate and noticeable impacts to the sport fishery from these impacts were limited to the increased sport fishing activity around the riprap and intake and discharge structures. Yellow perch, which were strongly attracted to the riprap for food, spawning habitat, and refuge from storm activity, was the fish most frequently sought by fishermen.

8. Re: Describe other sources of impacts on aquatic resources that could contribute to cumulative impacts

Response: Cook Nuclear Plant is located on the southwestern shore of Lake Michigan, well away from other major sources of water pollution that could contribute to cumulative effects. Nearby cities are relatively small and have adequate sewage treatment facilities. The St. Joseph River, which enters the lake about 20 miles north of the plant, has good water quality. Water quality problems from the St. Joseph River are diluted by the lake before reaching the plant. Land is developed for industry, private residents, and agriculture in Berrien County. However, non-point source runoff appears to be, at worst, a small problem.

9. Re: Provide copies of Section 316(a) and 316(b) Demonstration Reports

Response: Enclosed are:

ETA. 1980. Summary Report Comparing the D. C. Cook Thermal Plume Measurements with Model Predictions. Tech. Report from ETA Engineering, Inc. Chicago. 49 pp.

This report compares the thermal plume mapping by ETA Engineering with the thermal plume modeling conducted for the Operating License application. The field-measured thermal plumes verified predictions made of the thermal plume. Field plumes tended to be about half the volume of predicted plumes but good agreement for plume areas.

Anon. 1979. Supplemental Report Demonstrating Compliance with Section 316(b) of the Clean Water Act. Volumes I and II. Indiana Michigan Power Company submittal to Michigan Water Resources Commission. (129 pp., Vol. I) (Appendices A & B, Vol. II).

This report to the Michigan Water Resources Commission Staff is a supplement to the 316(a)/316(b) report submitted to the Commission Staff on January 1, 1977. Additional data on fish impingement and ichthyoplankton entrainment is included in this report. The most significant portion of this report is the economic and engineering feasibility of modifications to the existing intake structures at Cook Plant to reduce fish impingement and entrainment.

Anon. 1977. Report on the Impact of Cooling Water Use at the Donald C. Cook Nuclear Plant. Indiana Michigan Power Company submittal to Michigan Water Resources Commission. 194 pp.

This report is the Indiana Michigan Power Company 316(a) and 316(b) report to the Michigan Water Resources Commission for the Cook Nuclear Plant.

References

Rossmann, R. (ed). 1986. Southeastern Nearshore Lake Michigan: Impact of the Donald C. Cook Nuclear Plant. Great Lakes Research Division Publication 22, University of Michigan, Ann Arbor. 432 pp.

TABLE I. Zooplankton taxa found in the D. C. Cook Nuclear Plant area (southeastern Lake Michigan) from 1972 to 1982.

CYCLOPOIDA
Cyclops bicuspidatus thomasi
Cyclops vernalis
Ergasilus sp.
Eucyclops agilis
Eucyclops prionophorus
Eucyclops speratus
Mesocyclops edax
Paracyclops fimbriatus poppei
Tropocyclops prasinus mexicanus

CALANOIDA
Diaptomus ashlandi
Diaptomus minutus
Diaptomus oregonensis
*Diaptomus reighardi**
Diaptomus sicilis
Epischura lacustris
Eurytemora affinis
Limnocalanus macrurus
Senecella calanoides

HARPATICOIDA
Bryocamptus spp.
Canthocamptus spp.

ROTIFERA**
Asplanchna herrichi
Asplanchna priodonta

CLADOCERA
Alona affinis
Alona guttata
Alona quadrangularis
Alona rectangula
Bosmina longirostris
Camptocercus rectirostris
Ceriodaphnia quadrangula
Chydorus sphaericus
Daphnia galeata mendotae
Daphnia longiremus
Daphnia parvula
Daphnia pulicaria
Daphnia retrocurva
Diaphanosoma spp.
Disparalona rostrata
Eubosmina coregoni
Eurycercus lamellatus
Holopedium gibberum
Ilyocryptus acutifrons
Ilyocryptus sordidus
Ilyocryptus spinifer
Latona setifera
Leptodora kindtii
Leydigia quadrangularis
Macrothrix laticornis
Pleuroxus denticulatus
Pleuroxus procurvis
Polyphemus pediculus
Scapholeberis kingi
Sida crystallina
Simocephalus serratulae
Simocephalus vetulus

MALACOSTRACA
Mysis relicta

*Only one specimen observed.
***Asplanchna* is the only rotifer genus routinely enumerated in these collections.

stations, to 60 mg/m^3 at approximately 30 m, and decreasing to 30 mg/m^3 at the deepest station (Fig. 4b).

During June, *Bosmina longirostris* was often the most abundant taxon, followed by nauplii and immature *Cyclops* spp. and *Diaptomus* spp. copepodites (Evans et al. 1978, 1982, 1986b). Differences in inshore and offshore taxa abundance were often evident, with *B. longirostris* more abundant inshore, and immature copepodites abundant offshore. During some years the rotifer, *Asplanchna* spp., was a major component of the June plankton (Evans et al. 1978, 1982, 1986b). Total zooplankton occurred in unusually high concentrations at the discharge (90,000/m^3) in June

TABLE 2. Estimates (in millions) of annual entrainment losses of fish larvae and fish eggs at the D. C. Cook Nuclear Plant, southeastern Lake Michigan, 1975 to 1982. Calculations use actual reported flow rates of the circulating water system.

Taxon	Year of Estimate								Total	% Total
	1975	1976	1977	1978	1979	1980	1981	1982		
Alewife	63.708	53.7550	27.3888	31.098	125.6180	49.35	111.54	92.425	554.8828	74.34
Spottail shiner	3.41	0.9361	2.760	1.681	1.8228	21.06	7.257	28.2297	67.1566	9.00
Rainbow smelt	1.3608	0.4145	0.1795	0.3496	0.3726	11.954	2.6265	18.5233	35.7808	4.79
Yellow perch	0.17554	0.03807	1.3224	3.0655	0.3840	0.8971	2.506	4.9700	13.3586	1.79
Trout-perch	1.079	0.2509	0.1456	0.0194	0.6288	0.4858	0.5394	1.3749	4.5238	0.61
Johnny darter	0.0440	0.210	0.707	0.772	0.8105		0.153	0.7046	3.4011	0.46
Slimy sculpin	0.2431	0.06092	0.0256	0.130		0.553	1.002	0.4887	2.5033	0.34
Mottled sculpin	0.152	0.146	0.0483		0.131		0.143	0.4870	1.1073	0.15
Common carp		0.0912	0.0235	0.175	0.3603	0.0513	0.187		0.8883	0.12
Ninespine stickleback				0.124		0.379	0.156	0.0112	0.6702	0.09
Quillback			0.0628				0.534		0.5968	0.08
Burbot		0.0202		0.102				0.3428	0.4650	0.06
Deepwater sculpin				0.178	0.0141				0.1921	0.03
Unidentified sculpins	0.1899	0.0892	0.0918	0.175	0.0905	0.667	0.5953	0.5744	2.4731	0.33
Unidentified minnows			0.1248		0.8138	0.2846	0.1714	1.0280	2.4226	0.32
Unidentified coregonines			0.0850						0.0850	0.01
Unidentified darters			0.0276						0.0276	<0.01
Poor condition	6.555	2.8642	0.4274	3.352	5.9935	6.4765	11.859	17.9458	55.4734	7.43
Unidentified larvae	0.1693	0.0349	0.0887	0.100					0.3929	0.05
Total larvae	77.08664	58.91119	33.5088	41.3215	137.0399	92.1583	139.2696	167.1054	746.4013	
Total eggs	743.1879	2,269.4543	1,320.301	5,840.8138	1,392.5408	3,334.692	995.94	7,005.26	22,902.1898	
Total Cook Plant Flow (millions of m^3)	1,298.	1,292.	1,138.	2,370.	2,476.	2,830.	2,753.	2,749.		

cook

Socioeconomic Questions for All Utilities

1. To understand the importance of the plant and the degree of its socioeconomic impacts on the local region, estimate the number of permanent workers onsite for the most recent year for which data are available.

Response:

1177 people.

2. To understand the importance of the plant to the local region, and how that has changed over time, estimate the average number of permanent workers onsite, in five-year increments starting with the issuance of the plant's Operating License. If possible, provide this information for each unit at a plant site.

Response:

1977 average number of permanent workers was 287

1980 average number of permanent workers was 373

1985 average number of permanent workers was 555

1990 average number of permanent workers was 626

3. To understand the potential impact of continued operation for an additional 20 years beyond the original license term, please provide for the following three cases:

   A. a typical planned outage;

   B. an ISI outage; and

   C. the largest single outage (in terms of the numbers of workers involved) that has occurred to date

   an estimate of additional workers involved (for the entire outage and for each principal task), length of outage, months and year in which work occurred, and cost. Also estimate occupational doses received by permanent and temporary workers during each principal task.

Response:

See chart on next page.

NUMARC Question 3 Response

	Case A Typical Planned Outage	Case B[1],[3] An ISI Outage	Case C[2] Largest Single Outage Workforce
3.1 Outage Workers (Equiv. Man-Years)			
3.1.1 refueling task workers	4.5	4.5	5.8
3.1.2 routine maintenance workers	63.4	111.2	111.2
3.1.3 major plant modification or refurbishment workers	2.9	39.6	39.6
3.1.4 total, entire outage workers	158.8	290.4	728.8
3.2 Outage Details			
3.2.1 length, days	81	325	325
3.2.2 month/year start - finish	3/89-7/89	4/88-3/89	4/88-3/89
3.2.3 cost, k$	9,110	26,758	139,758
3.3 Occupational Dose (man-rem)			
3.3.1 refueling task workers	25	25	30
3.3.2 routine maintenance workers	35	210	215
3.3.3 major plant modifications or refurbishment workers	95	40	430
3.3.4 total, entire outage workers	260	345	745

NOTES:

(1): Manpower estimates for both Case B and Case C are based upon the 1988-1989 Unit 2 Outage. This outage combined a refueling, 10-year in-service inspection (ISI) and steam generators replacement project; and was our largest work force outage.

(2): Case C includes a longer refueling time, 35 days versus 28 days for Case B.

(3) Occupational dose in Case B is based upon the 1985 Unit-1 ISI outage.

4. To understand the plant's fiscal importance to specific jurisdictions, for 1980, 1985, and the latest year for which data are available, estimate the entire plant's taxable assessed value and the amount of taxes paid to the state and to each local taxing jurisdiction.

Response:

	Assessed Value	Taxes Paid
1980	$365,600,700	$ 7,028,240.32
1985	474,155,300	10,810,094.11
1989	519,990,300	12,638,325.77

includes nuclear fuel, excludes Visitor Center.

Socioeconomic Questions for Case Study Sites

Taxes

These questions are asked to validate information obtained from local government sources or to obtain information if local governments fail to provide it.

1. What types of local taxes must be paid on the plant and property?

Response:

Property taxes on real and personal property.

2. To what jurisdictions are these taxes paid?

Response:

Lake Township, Berrien County, Michigan.

3. What types of state taxes must be paid on the plant and property?

Response:

None.

4. For each tax type, please estimate the total amount the utility paid to each relevant state and local jurisdiction in 1980, 1985 and 1989 (or the most recent year for which data are available).

Response:

The total amount paid for real and personal property taxes is supplied in the reply to question 4 above.

5. Have major plant modifications or refurbishment affected the plant's taxable assessed value?

Response:

Yes. Cook Plant Training Center and Steam Generator (Unit 2).

6. Would an extended outage for major plant modifications or refurbishment result in a temporary cessation or reduction of tax payments to state and/or local governments?

Response:

A reduction in property tax assessment would be sought.

7. Would tax payments cease in the event of plant decommissioning?

Response:

No. Salvage value.

Cook

Waste Management Questions

A. Spent fuel

1. Which of the following current techniques for at-reactor storage are you using and how?

   A. Re-racking of spent fuel.

   B. Control rod repositioning.

   C. Above ground dry storage.

   D. Longer fuel burnup.

   E. Other (please identify).

Response:

   A. Reracking of spent fuel - The spent fuel pool at the Cook Nuclear Plant was reracked in 1979 to increase the pool storage capacity from 500 to 2050.

   B. Control rod repositioning - This does not apply to spent fuel storage.

   C. Above ground dry storage - This option has not been pursued yet.

   D. Longer fuel burnup - Higher fuel assembly discharge burnups have been pursued to optimize the fuel cycle.

   E. Other - none.

2. Do you plan on continuing the use of these current techniques for at-reactor storage of spent fuel during the remaining time of your operating license or do you expect to change or modify them in some way?

Response:

We plan to rerack the pool in the 1993-94 time frame. This should yield sufficient storage capacity until 2009. After this, dry storage will be pursued if necessary.

3. Which of the following techniques for at-reactor storage do you anticipate using until off-site spent fuel storage becomes available and how?

   A. Re-racking of spent fuel.

   B. Control rod repositioning.

   C. Above ground dry storage.

   D. Longer fuel burnup.

   E. Other (please identify).

Response:

As stated in Question A.2, the pool will be reracked in the 1993-94 time frame and dry storage will be pursued if necessary.

4. Will the techniques described above be adequate for continued at-reactor storage of spent fuel for the operating lifetime of the plant, including a 20-year period of license renewal, or are you developing other plans.

Response:

Dry storage can be added in modular forms. If there are no plant site space limitations, this would give adequate onsite spent fuel storage capacity for the 20-year period of license renewal.

5. Do you anticipate the need to acquire additional land for the storage of spent-fuel for the operating lifetime of the plant, including a 20-year period of license renewal?

Response:

No future land purchases are anticipated.

6. Do you anticipate any additional construction activity onsite, or immediately adjacent to the power plant site, associated with the continued at-reactor storage of spent fuel for the operating lifetime of the plant, including a 20-year period of license renewal? (yes/no)

Response:

Yes, if dry storage is used, a dry storage facility would need to be constructed.

7. If you answered yes to question 6, briefly describe this construction activity (e.g., expansion of fuel storage pool, building above ground dry storage facilities).

Response:

A dry storage facility would need to be constructed.

B. Low-level radioactive waste management

1. Under the current scheme for LLRW disposal (i.e., LLRW Policy Amendments Act of 1985 and regional compacts) is there currently or will sufficient capacity for wastes generated during the license renewal period be available to your plant(s)? If so, what is the basis for this conclusion?

Response:

It is unknown whether disposal will be available for wastes generated during the license renewal period. Under the present circumstances, it is unclear whether disposal will be available before 1996. Also, during the license renewal period, it is anticipated that the second Midwest disposal facility will be sited and begin operation. If the present is an indication of the future, there will be considerable problems and most likely a period when disposal will be unavailable. The availability of future waste disposal space cannot be determined.

2. If for any reason your plant(s) is/are denied access to a licensed disposal site for a short period of time, what plans do you have for continued LLRW disposal?

Response:

Starting on January 1, 1993, access to a disposal site will be lost. To store wastes for a limited period, storage space is being developed, and will be available prior to losing access to the disposal site.

3. In a couple of pages, please describe the specific methods of LLRW management currently utilized by your plant. What percentage of your <u>current</u> LLRW (by volume) is managed by:

   A. Waste compaction? __________

   B. Waste segregation (through special controls or segregation at radiation checkpoint? __________

C. Decontamination of wastes? __________

D. Sorting of waste prior to shipment? __________

E. Other (please identify) __________

Response:

Low level waste is managed using a variety of techniques. The wastes are minimized onsite by controlling the materials that enter the auxiliary building, by controlling contaminated areas, by controlling the coolant chemistry and by using organic resins for waste water cleanup as opposed to evaporation. Wastes are divided into two general categories: dry active waste and other. The dry active wastes (DAW) are typically paper, plastic, wood and metal trash. The other wastes are typically resins and filters. About 90% of the wastes are DAW and they are all processed prior to shipment to the burial site. An offsite vendor is used to process the waste. The vendor uses a variety of processes and procedures to reduce the amount of waste shipped to the burial site. These procedures include sorting of the wastes, decontamination for free release, and finally waste compaction. The other wastes, the resins and the filters are processed onsite. The resins are dewatered and sent to the burial site in high integrity containers (HICs).

A.	Waste compaction	-	85%
B.	Waste segregation	-	85%
C.	Decontamination	-	85%
D.	Sorting	-	85%
E.	Other (Dewatering)	-	15%

4. In a couple of pages, please describe the anticipated plans for LLRW management to be utilized by your plant(s) during the remainder of the operating license and through the license renewal term. What percentage of your anticipated waste (by volume) will be managed by:

A. Waste compaction? __________

B. Waste segregation (through special controls or segregation at radiation checkpoints? __________

C. Decontamination of wastes? __________

D. Sorting of waste prior to shipment? __________

E. Other (please identify) __________

Response:

The answer is the same as number 3 above. Trends and availability of new technologies will be followed and may be used. New products or processes such as incineration or solidification of resins with specialized products may be pursued.

5. Do you anticipate the need to acquire additional land for the storage of LLRW for the operating lifetime of the plant, including a 20-year period of license renewal? If so, how much land? When would this acquisition occur? Where? (if answer is "yes", 3-4 sentences.)

Response:

No future land purchases are anticipated to help manage radioactive wastes.

6. To provide information on the timing of future low-level waste streams, if you answered yes to question #5, over what periods of time are these activities contemplated?

Response:

Not applicable.

7. Do you anticipate any additional construction activity onsite, or immediately adjacent to the power plant site, associated with temporary LLRW storage for the operating lifetime of the plant, including a 20-year period of license renewal? (yes/no)

Response:

Yes.

8. If you answered yes to question 7, briefly describe this construction activity (e.g., storage areas for steam generator components or other materials exposed to reactor environment).