Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

November 10, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Response to Questions on Final
Environmental Statement (FES)
NRC Docket Nos. 50-237 and 50-249

Dear Mr. Denton:

In support of our request to convert the existing Provisional Operating License for Dresden Unit 2, your staff has raised several questions on the FES. Our response is in the form of several attachments to this letter.

If you have any questions on this matter, please contact this office.

One (1) signed original and forty (40) copies of this letter and the attachments are provided for your use.

Very truly yours,

B. Rybak

B. Rybak
Nuclear Licensing Administrator

lm

Attachments

cc: R. Gilbert - NRR
NRC Senior Resident Inspector - Dresden

7593N

C002
1/1

Dresden Unit 2 FTOL

Question 1

Has there been any monitoring of Rime ice formation on vegetation next to the spray canal/ponds? If yes, what are the results? REF: FES pg. 5-2.

Response

The monitoring programs have been primarily directed toward the occurrence, density and duration of steam fog rising from the surfaces of the cooling pond. However, a limited number of observations and measurements of rime ice formation on vegetation and on poles and fences have been made for amount of build up of rime ice and for distance of occurrence from the cooling pond and the spray canal.

These observations are found in the "Report on Meteorological Aspects of Operating the Cooling Lake and Sprays at Dresden Nuclear Power Station" which was prepared by Murray and Trettel Incorporated, August , 1973. The rime ice observations were summarized on 3 pages of the 80 page report (Attachment 2). The data from the Murray and Trettel report was used in the preparation of "Atmospheric Effects of Cooling Lakes," EPRI EA-1762, prepared by the Illinois Institute of Natural Resources, State Water Survey Division. Principal investigators, J. Vogel and F. Huff; April, 1981. This study was made for the Electric Power Research Institute and Section 3 of the report discusses icing in the vicinity of cooling ponds. Copies of the Section 3 pages are provided in the form of Attachment 3.

7593N

Dresden Unit 2 FTOL

Question 2

Have you corrected the problem of transmission lines affecting railroad signals? Also the problem of induced voltages and journal bearing failure? Provides results, if any. REF: FES pg. 5-5.

Response

If a problem is expected before a line is energized, modifications are made to the signal system. In this case, no problem was anticipated. All problems that arise with regard to railroad signal and communication systems after a line is energized are analyzed and corrected on a case by case basis in cooperation with the involved railroad. No problems have been identified since the lines were energized.

The investigation of induced voltages on inadequately grounded railroad cars was terminated when an unbonded car could not be found.

Journal bearing failure was a concern that was expressed in the early 1970's but investigations and research were never carried out by either the railroad industry or by the electric utility industry.

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Dresden Unit 2 FTOL

Question 3

Has there been any increase in plant diseases in the vicinity of the cooling ponds? REF: FES pg. 5-37.

Response

There has been no monitoring program to detect plant diseases at Dresden Station. There have been no observations or reports of any suspected increase in diseases from either tenants or neighboring property owners from operation of any of our cooling ponds at Collins, Powerton, Kincaid as well as Dresden Station.

3419E
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Dresden Unit 2 FTOL

Question 4

Have there been any detrimental effects from drift spray on vegetation?
REF: FES pg. 5-38.

Response

There have been no monitoring programs at Dresden Station to detect any detrimental affects from drift spray on vegetation. There have been no reports of any problems on either Commonwealth Edison property or on any neighboring property.

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Question 5

FES pg. 5-5 states you installed strobe lights and fog fences along the road. January 10, 1983 letter states you use fog fences, covered bridge and flashing lights. Have you eliminated the strobe lights? If so, why? Are the bridge and signs a better system?

Response

The strobe light was part of a fog detection and measurement system rather than a warning signal to motorists. The warning devices, signs with flashing lights, have remained essentially unchanged. The road cover over the bridges on County Line Road has been lengthened to a total length of 1500 feet. County Line Road is a local road serving the residential subdivision and individual homes along the Kankakee River north of the cooling pond. The combination of fog fences and road cover are effective, enabling motorists to use County Line Road under heavy fog conditions.

3419E
BBB:ds

Question 6

Beginning on FES pg. 2-30, there is a description of Goose Lake Nature Preserve. Has anyone conducted studies to determine if important changes have occurred in this preserve? What might be the cause of these changes, if any?

Response

Goose Lake Nature Preserve has evolved into Goose Lake Prairie State Park and has been expanded in size. No studies have been made by either Commonwealth Edison or the Illinois Department of Conservation relating to changes that might be associated with the operation of Dresden Station. The important changes in the park have been those caused by the effort to reestablish a prairie environment.

When asked about any related effects of Dresden Station, Mr. J. Nyhoff, Superintendent of the park, stated that he was very sure that the operation of Dresden Station had not had any effect on any aspect of the park.[1]

Source:

1. Nyhoff, J., 1983. Goose Lake Prairie State Park, Telephone Conversation on October 28, 1983 with B. Barickman, Commonwealth Edison.

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Dresden Unit 2 FTOL

Question 7

Have you been using herbicides to control vegetation in the four miles of R.O.W.? If yes, what was used and how was it applied? Will you continue to use herbicides in the future?

Response

The herbicide, Banvel 520, has been used on the four miles of transmission R.O.W. It was used in an oil-water solution and application was by the selective basal method. Present plans call for continued use of herbicides on this R.O.W. about once every four years.

No herbicides have been used on the railroad spur.

All herbicides used in vegetation control programs are transported, handled and applied in accordance with the restrictions stated on the registered container label.

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BBB:ds

ATTACHMENT
2

REPORT
ON METEOROLOGICAL ASPECTS OF OPERATING THE COOLING LAKE AND SPRAYS AT DRESDEN NUCLEAR POWER STATION

Report No. 1001-5

prepared for

COMMONWEALTH EDISON COMPANY
Chicago, Illinois 60690

by

MURRAY AND TRETTEL, INCORPORATED
Certified Consulting Meteorologists
Northfield, Illinois 60093

1 August 1973

6.5 Rime Ice Deposition Down-wind of the Sprays

Rime, a milky granular deposit of ice having a density of 0.2 to 0.3 gm/cm^3, forms when super-cooled water droplets impinge upon an exposed surface. Rime ice frequently accumulated on the edges of the canals during the 1 January 1973 through 31 March winter periods. The fence posts located about 60-80 feet east of the warm canal once had nine (9) to ten (10) inches of rime ice accumulate on them during one period of several days when the air temperature was near zero and the wind was west to northwest at 10 to 20 mph.

On only three (3) occasions clear ice formed - the remainder were rime ice depositions.

Six (6) times rime ice was deposited on grassy surfaces at a distance from the sprays of 150 feet or more (cf. Table 9).

The maximum distance occured twice - 425 feet.

TABLE 9

Greatest Inland Distance of Rime Icing

at

Dresden Nuclear Power Station Sprays

	150'	200'	250'	300'	425'
Amount deposited	1/16"	1/16"	1/8"	1/4"	3/16" and 1/8"

Under some conditions, soft rime ice was observed coating the trees just west of Dresden Road (about 250 to 300 feet east of the sprays). The amount deposited ranged from 3/8 to 1 1/2 inches (cf. Table 10). Only the heaviest observed deposition was logged per day.

TABLE 10

Soft Rime Ice Deposition on Trees

250-300 feet East of Sprays

	3/8"	1/2"	3/4"	1 1/2"
No. of occurrences	1	2	3	1

7.5 Rime Ice Deposition on Vertical Objects Down-wind of Lake

Rime, a milky granular deposit of ice having a density of 0.2 to 0.3 gm/cm^3, was observed on 11 days on vegetation along East Lake (Cottage) Road, approximately 125 feet east of the lake. The accumulations measured are listed in Table 17

TABLE 17

Frequency of Rime Ice Along Cottage Road

Amount	Trace	1/8"	3/16"	5/16"	3/8"	3/4"	3"	3 1/2"
No. of Occurrences:	1	2	2	2	1	1	1	1

On two of the days indicated above rime ice was also noted on trees along Lorenzo Road, within approximately 300 feet of the lake.

A deposition of rime 200 feet east of pool 1 occurred once when nothing similar was observed elsewhere around the lake. Exact measurements from the above three (3) occurrences were not available, but each is believed to have been less than 1/2 to 3/4 inches.

Considering that the two instances of rime deposition at Lorenzo Road occurred coincidentally with rime deposition at Cottage Road and that rime was only observed during the winter months of December, January and February, the overall frequency of downwind rime icing at distances of 100 feet or greater was found to be 6.6 percent (12 days out of 181). Based on this frequency, one may expect to observe rime deposition beyond 100 feet downwind on 6 days per year.

ATTACHMENT

3

Atmospheric Effects of Cooling Lakes

EA-1762
Research Project 578

Final Report, April 1981

Prepared by

ILLINOIS INSTITUTE OF NATURAL RESOURCES
State Water Survey Division
605 East Springfield
Champaign, Illinois 61820

Principal Investigators
J. Vogel
F. Huff

Prepared for

Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, California 94304

EPRI Project Manager
C. Hakkarinen

Environmental Physics & Chemistry Program
Energy Analysis and Environment Division

Section 3

ICING

INTRODUCTION

During the colder part of the year, when steam fog forms and moves away from the lake, ice may coat structures and vegetation. The icing can take two forms, glaze or rime. According to the Glossary of Meteorology (1), glaze is "a coating of ice, generally clear and smooth but usually containing some air pockets, formed on exposed objects by the freezing of a film of supercooled water deposited by rain, drizzle, fog, or possibly condensed from supercooled water vapor." Such icing is formed by large water droplets, has a density of 0.8 to 0.9 g/cm^3, and occurs with the air temperature between -7^0C (19^0F) to -1^0C (30^0F). Glaze forms a hard, continuous sheet and can cause structural damage if the accumulation is great enough. Rime is defined in reference (1) as "a white or milky and opaque granular deposit of ice formed by the rapid freezing of supercooled water drops as they impinge upon an exposed object." Rime is favored by the formation of small water droplets, has a density between 0.3 to 0.8 g/cm^3, and usually occurs when the air temperature is less than -7^0C (19^0F). Rime icing is friable (easily crumbled), poses little or no problems to vegetation or structures, and is less dense than glaze.

The average diameter of droplets formed by steam fog was determined to be 7.5 to 15 microns at the Four Corners power plant in New Mexico(2). Such droplets are considerably smaller than drizzle drops, the smallest precipitation-sized drop. Thus, rime rather than glaze icing can be expected to occur around a cooling lake.

BALDWIN COOLING LAKE

Icing observations at Baldwin Lake were made by the observer with the same routine used for steam fog observations. Generally, observations were made in the first few hours after sunrise and were continued until the icing stopped or darkness approached. Vegetation, visibility posts, instrumentation, and a trailer situated at site 14 (Figure 1-2) were used to estimate the accumulation of rime. The horizontal extent of the icing was estimated by the observer. The primary periods for such observations were the winters of 1976-1977 and 1977-1978.

Frequency of Icing and Synoptic Types

During the observational period at Baldwin, 33 icing events were noted. The earliest date was 26 November and the latest was 4 March. Thus, icing is primarily a winter phenomenon. Only one icing observation was made on a day with natural fog. That is, icing was almost exclusively restricted to initiation days. However, only 45% of all winter initiation days had icing associated with them. In only 20 of the 33 events was icing occurring at the time of the observation, and only those observations will be discussed. Because the sun was usually shining after the other 13 events, any icing deposition could have been partially dissipated and not be representative. In addition, since the exact timing of the icing is unknown, the weather observations at the time of these observations may not be truly representative of the condition during which rime formed. In only two events where icing was not actively occurring was an accumulation of 0.65 cm (0.25 in) or greater observed.

Rime accumulations in excess of 2.5 cm (1 in) were observed twice, and the greatest accumulation was 7.6 cm (3 in). Most icing events (65%) had accumulations between 1.3 and 2.5 cm (0.5 to 1 in) and were confined to within 100 m (300 ft) of the cooling lake (Table 3-1). Only two events were observed to extend more than 200 m (0.1 mi). During each of the two winter periods, about 1.2 cm (0.5 in) of icing accumulated on the east berm road immediately adjacent to the cooling lake. The largest rime depositions were observed to occur adjacent to the cooling lake, and the accumulation decreased rapidly with distance from the lake.

Table 3-1

FREQUENCY OF BALDWIN RIME ICE ACCUMULATION AND HORIZONTAL EXTENT

Horizontal Extent (m)	Accumulation (cm)				
	<.65	.65-1.2	1.3-2.5	>2.5	Total
<15	0	2	4	0	6
15-100	1	1	6	0	8
101-200	0	1	2	1	4
>200	0	0	1	1	2
Total	1	4	13	2	20

All but one of the 33 events were synoptically classed as cold air mass weather types. The sole exception was classed as a cold front that passed Baldwin 24 hours prior to the icing incident. Thus, Baldwin was essentially embedded in the cold air during all icing events.

Wind

Before rime can form, steam fog must be blown beyond the confines of the cooling lake. The horizontal extent of rime icing depends upon wind speed and the horizontal extent of the steam fog. The frequency of wind speeds and icing is given in Table 3-2. Wind speeds from calm to greater than 24 km/h (15 mi/h) were noted. The horizontal extent of all events with winds of 5 km/h (3 mi/h) or less did not exceed 15 m (50 ft). Half of the icing events had wind speeds of 6 to 15 km/h (4 to 9 mi/h). No apparent relation between wind speed and the horizontal extent of the rime existed, nor was there a significant relation between the horizontal wind speed and the icing accumulation.

Table 3-2

FREQUENCY OF WIND SPEED AND HORIZONTAL EXTENT OF ICING AT BALDWIN

Horizontal Extent (m)	Wind Speed (km/h) 0-5	6-15	16-24	>24	Total
<15	3	2	1	0	6
15-100	0	5	1	2	8
101-200	0	1	1	2	4
>200	0	2	0	0	2
Total	3	10	3	4	20

Most of the icing events (65%) were associated with winds from the west-southwest through northwest (Table 3-3). Of the five riming events with horizontal extent greater than 150 m (500 ft), two were associated with winds from the north-northwest to northeast. Only three icing occurrences were observed with winds from an east or south component. Thus, most icing was associated with active cold air advection.

Most of the area around the lake is typified by relatively flat land. The region immediately south of the cooling lake is about the same elevation as the lake

Table 3-3

FREQUENCY OF WIND DIRECTION AND HORIZONTAL EXTENT OF ICING AT BALDWIN

Horizontal Extent (m)	Wind Direction* NNW-NE	ENE-SE	SSE-SW	WSW-NW	Calm	Total
<15	0	0	1	4	1	6
15-100	1	1	1	5	0	8
101-200	1	0	0	3	0	4
>200	1	0	0	1	0	2
Total	3	1	2	13	1	20

itself, but the region east of the lake is 3 to 6 m (10 to 20 ft) below the top of the dike. Thus, steam fog advected south (north-northwest to northeast winds) flowed directly from the lake, and would be deposited as rime directly on surface vegetation. Steam fog which moved eastward was elevated to a certain extent; although it restricted visibility at eye level, surface vegetation and other features were not readily coated with rime because of the increased mixing with the ambient atmosphere. All three icing events with north-northwest to northeast winds extended at least 60 m (200 ft) inland, whereas only 3 of the 13 events with winds from the west-southwest to northwest had similar horizontal extents. The wind speeds and other meteorological parameters for these icings were similar. Thus, it appears that minor differences in terrain immediately around the lake influenced the horizontal extent of icing at Baldwin.

Temperature and Humidity

The air temperature is critical to the formation of rime on surfaces (1-4). All Baldwin icing events were observed to occur with air temperatures of -7°C (19°F) or below (Table 3-4). Most riming (85%) was observed with temperatures below -10°C (14°F), and the heavier accumulations were associated with the colder temperatures.

Table 3-5 presents the frequency of rime with the associated saturation deficits and water-air temperature differences. All but one of the icing events had water-

Table 3-4

FREQUENCY OF OCCURRENCE OF RIME ICING AND TEMPERATURE

Air Temperature (^oC)	Accumulation (cm)				
	<.65	.65-1.2	1.3-2.5	>2.5	Total
-19 to -15	0	2	4	1	7
-14 to -10	0	1	8	1	10
-9 to -7	1	1	1	0	3
Total	1	4	13	2	20

Table 3-5

FREQUENCY OF RIME ICING AND WATER-AIR TEMPERATURE DIFFERENCE AND SATURATION DEFICIT

Water-Air Temperature Difference (^oC)	Saturation Deficit (g/kg)			
	≤.25	.26-.50	.51-.75	Total
15-19	1	0	0	1
20-24	4	5	1	10
25-29	1	3	2	6
≥30	1	2	0	3
Total	7	10	3	20

air temperature differences in excess of 19^oC (34^oF), and 17 of the 20 events had saturation deficits of 0.5 g/kg or less. This distribution suggests that icing is associated with dense steam fog events. Indeed, all but three of the active icing events were associated with dense steam fog events, and all occurred with visibilities of 1.6 km (1 mi) or less. During the winters of 1976-1977 and 1977-1978, 25 initiation fogs with visibilities of 1.6 km or less were observed; 16 or 64% of these were associated with icing. Of the nine remaining events, five exhibited no horizontal movement off the cooling lake and no rime was deposited. Two had winds of less than 5 km/h (3 mi/h), and the remaining two had temperatures near the -7^oC (19^oF) cutoff. Thus, the Baldwin study indicates that there is a potential for icing in any steam fog with a visibility of less than 1.6 km (1 mi) and an air temperature of -7^oC (19^oF) or less. Although three rimes had wind speeds of less than 4 km/h (2.5 mi/h), analyses indicate some air movement is necessary for the deposition of rime.

OTHER ICING MEASUREMENTS

Other icing observations have been made by Murray and Trettel, Inc. (5) and Currier et al. (2, 3) in Illinois and at the Four Corners power plant in New Mexico. Observations over two winter periods (1971-1972 and 1972-1973) at Dresden cooling lake by Murray and Trettel showed only 12 rime icing observations having horizontal extents of 30 m (100 ft) or greater, and only three were detected at 60 m (200 ft) or more from the lake. Only two of the rime icing events had accumulations in excess of 2.5 cm (1 in). Most occurrences were east of the cooling lake, which indicates that the winds were from the west for most icing events at Dresden.

Many other rime events with accumulations of up to 10 cm (4 in) were noted on the bridge which bisects the cooling lake just east of the warmest section. All icing events were observed during winter. No glaze icing due to steam fog was observed at Dresden.

Currier et al. (2, 3) made several observations of icing near Coffeen cooling lake in west central Illinois and at Four Corners cooling lake near Fruitland, New Mexico. Little or no horizontal extent was noted. They obtained some measurements of the accretion rate of rime, and, in general, they determined that the colder the ambient air temperatures, the more rapid the ice accumulation. All icing situations at Coffeen and Four Corners occurred with air temperature of -5.5°C (21°F) or less, water-air temperature differences of 22°C (40°F) or more, and saturation deficits of 0.6 g/km or less.

Other rime icing observations were reported at Dresden cooling lake during the winter of 1976-1977 (6). The general operation of Dresden cooling lake and spray canals changed from supplementary cooling in 1973 to a closed water system in the winter of 1976-1977. Previously, the water in the cooling lake was pumped from the Kankakee River and released into the Illinois River after cooling. At the present time, only make-up water is added from the Kankakee River and the water is continuously cycled. As a result, water temperatures during the winter of 1976-1977 seldom dipped below 20 to 25°C (68 to 77°F) (6). These water temperatures were at least 10 to 15°C (18 to 27°F) warmer than the winters of 1971-1972 and 1972-1973. During these two winters the average temperature at O'Hare Airport, 75 km (47 mi) north, was -3.4 and -2.8°C (25.8 and 26.9°F), respectively. During the winter of 1976-1977 the average air temperature at O'Hare Airport was -7.2°C (19°F), at least 3.8°C (6.8°F) cooler than the two earlier winters which were near normal. These cooler temperatures coupled with the warmer water temperatures should have produced more dense steam fog than in the earlier years. The dramatic rime ice accumulations, observed in 1976-1977 by Shannon and Everett (6) on instrument shelters and on instrumentation located on a raft in the center of pond 1 (Figure 1-4), were produced by the extreme differences in water and air temperatures. Such icing accumulations were not observed at Dresden or Baldwin cooling lakes during the four winter observational periods reported here. The horizontal extent of icing with the 1976-1977 extreme water-air temperature differences should be greater than those reported either at Dresden earlier or at Baldwin. However, no measurements were reported of the horizontal extent and accumulation of these riming events.

SUMMARY AND CONCLUSIONS

Only rime icing was observed during each of two winters of observations at Dresden and Baldwin cooling lakes in Illinois. Rime has a low density, is friable (easily crumbled), and poses little danger to structures or vegetation. No glaze icing due to steam fog was noted during these four winters. The absence of glaze icing (formed by large water droplets) supports the droplet diameter measurements of 7.5 to 15 microns made in steam fog by Currier *et al*. (2, 3).

Rime icing in Illinois (and most of the Midwest) is primarily a winter phenomenon, as shown by the observations at Baldwin and Dresden. Air temperatures of -7^{o}C (19^{o}F) or less are required for rime ice formation. Riming occurred at Baldwin as early as 26 November and as late as 4 March; however, these occurrences were associated with unusually cold air masses for southern Illinois on these dates. The icing season will be extended in other regions where the temperature drops to -7^{o}C (19^{o}F) and below earlier in the fall and continues at such temperatures later in the spring.

Only limited observations of the horizontal extent of icing were available from the Dresden observations. However, on 12 occasions rime with accumulations of up to 9 cm (3.5 in) was observed 40 m (125 ft) or more from the boundaries of the cooling lake. Of the 20 active rime events at Baldwin, the greatest horizontal extent was 0.8 km (0.5 mi). Most of the icing events (90%) were observed within 200 m (650 ft) of the cooling lake. The greatest accumulation of rime at Baldwin was 7.6 cm (3 in), and most (90%) of the rime accumulations were 2.5 cm (1 in) or less. Also, it was noted that the horizontal extent of icing was greater south rather than east of Baldwin, even though there were more icing events to the east.

However, the area south of the cooling lake is flat and nearly level with the lake surface, whereas the area east of the lake is 3 to 6 m (10 to 20 ft) lower than the lake surface. This would indicate that rime is not as readily deposited at ground level if the region beyond the lake boundary is depressed even slightly relative to the lake level.

For rime icing to occur beyond the confines of a cooling lake, the Baldwin, Coffeen, and Four Corners observations indicate that the following atmospheric conditions must be present: 1) an air temperature of -7°C (19°F) or less, 2) a saturation deficit of 0.5 g/kg or less, 3) a water-air temperature difference of 19°C (34°F) or greater, and 4) winds of at least 1 to 3 km/h (1 to 2 mi/h). These criteria are similar to the atmospheric conditions required for the more intense steam fog events at Baldwin. All of the active icing events observed at Baldwin were associated with steam fogs with visibilities of 1.6 km (1 mi) or less.

REFERENCES

1. Ralph E. Huschke. Glossary of Meteorology. Boston, MA: American Meteorological Society, 1959.

2. E. L. Currier, J. B. Knox, and T. V. Crawford. "Cooling Pond Steam Fog." Journal of Air Pollution Control Association. Vol. 24, 1974, pp. 860-864.

3. E. L. Currier, J. B. Knox, and T. V. Crawford. The Environmental Effects of the Midland Cooling Pond Summary Report. San Francisco, CA: Bechtel Company, April 1972.

4. F. A. Huff and J. L. Vogel. Atmospheric Effects from Waste Heat Transfer Associated with Cooling Lakes. Urbana, IL: Illinois State Water Survey, 1973.

5. Murray and Trettel, Inc. Report on Meteorological Aspects of Operating the Cooling Lake and Sprays at Dresden Nuclear Power Station. Chicago, IL: August 1973, 1001-5.

6. J. D. Shannon and R. G. Everett. "Effect of the Severe Winter upon a Cooling Pond Fog Study." Bulletin of the American Meteorological Society. Vol. 59, 1978, pp. 60-61.