# INSTRUCTIONS FOR UPDATING YOUR ER

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# BRAIDWOOD NUCLEAR GENERATING STATION - UNITS 1 & 2

## ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

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TABLE 2.1-1

DISTANCE FROM GASEOUS EFFLUENT RELEASE POINT TO NEAREST SITE BOUNDARY IN THE 16 MAJOR COMPASS DIRECTIONS

| DIRECTION | APPROXIMATE DISTANCE (ft) |
|---|---|
| N | 2,000 |
| NNE | 3,000 |
| NE | 2,600 |
| ENE | 2,300 |
| E | 3,400 |
| ESE | 8,900 |
| SE | 11,200 |
| SSE | 11,300 |
| S | 15,200 |
| SSW | 3,200 |
| SW | 2,050 |
| WSW | 1,750 |
| W | 1,700 |
| WNW | 1,650 |
| NW | 1,625 |
| NNW | 1,675 |

TABLE 2.1-2

1980 AND PROJECTED POPULATION DISTRIBUTIONS
WITHIN 10 MILES OF THE BRAIDWOOD STATION

| Sector Designation | 1980 RADIAL INTERVAL (miles) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 0-5 | 0-10 |
| N | 34 | 690 | 389 | 15 | 2 | 309 | 1,130 | 1,439 |
| NNE | 75 | 823 | 960 | 294 | 70 | 234 | 2,222 | 2,456 |
| NE | 0 | 107 | 103 | 0 | 480 | 4,735 | 690 | 5,425 |
| ENE | 4 | 12 | 22 | 22 | 291 | 1,980 | 351 | 2,331 |
| E | 0 | 0 | 13 | 28 | 22 | 1,027 | 63 | 1,090 |
| ESE | 0 | 0 | 17 | 18 | 50 | 236 | 85 | 321 |
| SE | 0 | 0 | 4 | 9 | 8 | 156 | 21 | 177 |
| SSE | 0 | 0 | 60 | 9 | 235 | 358 | 304 | 662 |
| S | 0 | 0 | 0 | 3 | 3 | 686 | 6 | 692 |
| SSW | 0 | 8 | 17 | 29 | 173 | 849 | 227 | 1,076 |
| SW | 402 | 296 | 214 | 19 | 89 | 1,384 | 1,020 | 2,404 |
| WSW | 82 | 218 | 188 | 37 | 26 | 163 | 551 | 714 |
| W | 0 | 34 | 179 | 3 | 11 | 794 | 227 | 1,021 |
| WNW | 8 | 0 | 8 | 37 | 13 | 251 | 66 | 317 |
| NW | 4 | 25 | 42 | 1,499 | 1,340 | 928 | 2,910 | 3,838 |
| NNW | 6 | 256 | 119 | 1,692 | 526 | 920 | 2,599 | 3,519 |
| Sum for Radial Interval | 615 | 2,469 | 2,335 | 3,714 | 3,339 | 15,010 | 12,472 | 27,482 |
| Cummulative Total to Outer Radius | 615 | 3,084 | 5,419 | 9,133 | 12,472 | 27,482 | 12,472 | 27,482 |
| Average Density (people/mi$^2$) in Radial Region | 196 | 262 | 149 | 169 | 118 | 64 | 159 | 87 |



Braidwood ER-OLS AMENDMENT 1
FEBRUARY 1983
AMENDMENT 2
JULY 1983
AMENDMENT 5
DECEMBER 1983

TABLE 2.1-2 (continued)

| Sector Designation | 1990 RADIAL INTERVAL (miles) 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 0-5 | 0-10 |
|---|---|---|---|---|---|---|---|---|
| N | 44 | 890 | 502 | 18 | 2 | 356 | 1,456 | 1,812 |
| NNE | 97 | 1,061 | 1,238 | 307 | 73 | 247 | 2,776 | 3,023 |
| NE | 0 | 138 | 133 | 0 | 501 | 5,037 | 772 | 5,809 |
| ENE | 5 | 15 | 26 | 25 | 327 | 2,084 | 398 | 2,482 |
| E | 0 | 0 | 15 | 31 | 25 | 1,105 | 71 | 1,176 |
| ESE | 0 | 0 | 20 | 20 | 56 | 269 | 96 | 365 |
| SE | 0 | 0 | 5 | 10 | 9 | 181 | 24 | 205 |
| SSE | 0 | 0 | 77 | 11 | 276 | 414 | 364 | 778 |
| S | 0 | 0 | 0 | 4 | 4 | 772 | 8 | 780 |
| SSW | 0 | 8 | 17 | 30 | 177 | 869 | 232 | 1,101 |
| SW | 478 | 304 | 220 | 20 | 94 | 1,473 | 1,116 | 2,589 |
| WSW | 104 | 224 | 193 | 38 | 28 | 167 | 587 | 754 |
| W | 0 | 35 | 184 | 3 | 12 | 857 | 234 | 1,091 |
| WNW | 8 | 0 | 8 | 38 | 14 | 297 | 68 | 365 |
| NW | 5 | 26 | 43 | 1,560 | 1,663 | 1,291 | 3,297 | 4,588 |
| NNW | 8 | 328 | 140 | 2,246 | 715 | 1,414 | 3,437 | 4,851 |
| Sum for Radial Interval | 749 | 3,029 | 2,821 | 4,361 | 3,976 | 16,833 | 14,936 | 31,769 |
| Cummulative Total to Outer Radius | 749 | 3,778 | 6,599 | 10,960 | 14,936 | 16,833 | 14,936 | 31,769 |
| Average Density (people/mi$^2$) in Radial Region | 238 | 321 | 180 | 198 | 141 | 71 | 190 | 101 |

TABLE 2.1-2 (continued)

| Sector Designation | 2000 RADIAL INTERVAL (miles) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 0-5 | 0-10 |
| N | 47 | 956 | 539 | 19 | 2 | 375 | 1,563 | 1,938 |
| NNE | 104 | 1,140 | 1,330 | 317 | 75 | 255 | 2,966 | 3,221 |
| NE | 0 | 148 | 143 | 0 | 517 | 5,219 | 808 | 6,027 |
| ENE | 6 | 17 | 28 | 26 | 343 | 2,154 | 420 | 2,574 |
| E | 0 | 0 | 16 | 33 | 26 | 1,148 | 75 | 1,223 |
| ESE | 0 | 0 | 22 | 21 | 59 | 283 | 102 | 385 |
| SE | 0 | 0 | 6 | 11 | 10 | 191 | 27 | 218 |
| SSE | 0 | 0 | 83 | 12 | 291 | 436 | 386 | 822 |
| S | 0 | 0 | 0 | 4 | 4 | 809 | 8 | 817 |
| SSW | 0 | 8 | 18 | 31 | 181 | 893 | 238 | 1,131 |
| SW | 506 | 313 | 226 | 20 | 97 | 1,527 | 1,162 | 2,689 |
| WSW | 111 | 230 | 199 | 39 | 29 | 171 | 608 | 779 |
| W | 0 | 36 | 189 | 3 | 12 | 891 | 240 | 1,131 |
| WNW | 8 | 0 | 8 | 39 | 15 | 314 | 70 | 384 |
| NW | 6 | 26 | 44 | 1,608 | 1,776 | 1,405 | 3,460 | 4,865 |
| NNW | 8 | 352 | 148 | 2,426 | 776 | 1,561 | 3,710 | 5,271 |
| Sum for Radial Interval | 796 | 3,226 | 2,999 | 4,609 | 4,213 | 17,632 | 15,843 | 33,475 |
| Cummulative Total to Outer Radius | 796 | 4,022 | 7,021 | 11,630 | 15,843 | 33,475 | 15,843 | 33,475 |
| Average Density (people/mi$^2$) in Radial Region | 253 | 342 | 191 | 210 | 149 | 75 | 202 | 107 |

TABLE 2.1-2 (continued)

| Sector Designation | 2010 RADIAL INTERVAL (miles) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 0-5 | 0-10 |
| N | 48 | 983 | 554 | 20 | 2 | 386 | 1,607 | 1,993 |
| NNE | 107 | 1,173 | 1,368 | 326 | 77 | 262 | 3,051 | 3,313 |
| NE | 0 | 152 | 147 | 0 | 532 | 5,368 | 831 | 6,199 |
| ENE | 6 | 17 | 29 | 27 | 352 | 2,216 | 431 | 2,647 |
| E | 0 | 0 | 17 | 34 | 27 | 1,180 | 78 | 1,258 |
| ESE | 0 | 0 | 22 | 22 | 61 | 291 | 105 | 396 |
| SE | 0 | 0 | 6 | 11 | 10 | 197 | 27 | 224 |
| SSE | 0 | 0 | 86 | 12 | 299 | 448 | 397 | 845 |
| S | 0 | 0 | 0 | 4 | 4 | 832 | 8 | 840 |
| SSW | 0 | 9 | 18 | 31 | 186 | 919 | 244 | 1,163 |
| SW | 520 | 322 | 233 | 21 | 100 | 1,570 | 1,196 | 2,766 |
| WSW | 114 | 237 | 204 | 40 | 30 | 176 | 625 | 801 |
| W | 0 | 37 | 195 | 3 | 13 | 917 | 248 | 1,165 |
| WNW | 9 | 0 | 9 | 40 | 15 | 323 | 73 | 396 |
| NW | 6 | 27 | 46 | 1,654 | 1,826 | 1,445 | 3,559 | 5,004 |
| NNW | 9 | 362 | 153 | 2,495 | 798 | 1,605 | 3,817 | 5,422 |
| Sum for Radial Interval | 819 | 3,319 | 3,087 | 4,740 | 4,332 | 18,135 | 16,297 | 34,432 |
| Cummulative Total to Outer Radius | 819 | 4,138 | 7,225 | 11,965 | 16,297 | 18,135 | 16,297 | 34,432 |
| Average Density (people/mi$^2$) in Radial Region | 261 | 352 | 197 | 216 | 153 | 77 | 207 | 110 |

TABLE 2.1-2 (continued)

| Sector Designation | 2020 RADIAL INTERVAL (miles) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 0-5 | 0-10 |
| N | 50 | 1,011 | 570 | 20 | 2 | 397 | 1,653 | 2,050 |
| NNE | 110 | 1,206 | 1,407 | 336 | 80 | 270 | 3,139 | 3,409 |
| NE | 0 | 157 | 151 | 0 | 547 | 5,520 | 855 | 6,375 |
| ENE | 6 | 18 | 30 | 27 | 363 | 2,279 | 444 | 2,723 |
| E | 0 | 0 | 17 | 35 | 27 | 1,214 | 79 | 1,293 |
| ESE | 0 | 0 | 23 | 22 | 62 | 299 | 107 | 406 |
| SE | 0 | 0 | 6 | 11 | 10 | 202 | 27 | 229 |
| SSE | 0 | 0 | 88 | 12 | 308 | 461 | 408 | 869 |
| S | 0 | 0 | 0 | 4 | 4 | 856 | 8 | 864 |
| SSW | 0 | 9 | 19 | 32 | 192 | 945 | 252 | 1,197 |
| SW | 535 | 331 | 239 | 21 | 103 | 1,615 | 1,229 | 2,844 |
| WSW | 117 | 244 | 210 | 42 | 31 | 181 | 644 | 825 |
| W | 0 | 38 | 200 | 4 | 13 | 943 | 255 | 1,198 |
| WNW | 9 | 0 | 9 | 42 | 16 | 332 | 76 | 408 |
| NW | 6 | 28 | 47 | 1,701 | 1,878 | 1,486 | 3,660 | 5,146 |
| NNW | 9 | 372 | 157 | 2,566 | 820 | 1,651 | 3,924 | 5,575 |
| Sum for Radial Interval | 842 | 3,414 | 3,173 | 4,875 | 4,456 | 18,651 | 16,760 | 35,411 |
| Cummulative Total to Outer Radius | 842 | 4,256 | 7,429 | 12,304 | 16,760 | 18,651 | 16,760 | 35,411 |
| Average Density (people/mi$^2$) in Radial Region | 268 | 362 | 202 | 222 | 158 | 79 | 213 | 113 |

TABLE 2.1-9

1980 AND PROJECTED POPULATION DISTRIBUTIONS BETWEEN 0 AND 10 MILES OF THE BRAIDWOOD STATION INCLUDING PEAK DAILY TRANSIENT POPULATION

| SECTOR DESIGNATION | 1980 | 1990 | 2000 | 2010 | 2020 |
|---|---|---|---|---|---|
| N[a] | 3,840 (1,439 + 2,401*) | 4,213 (1,812 + 2,401*) | 4,339 (1,938 + 2,401*) | 4,394 (1,993 + 2,401*) | 4,451 (2,050 + 2,401*) |
| NNE[b] | 5,876 (2,456 + 3,420*) | 6,443 (3,023 + 3,420*) | 6,641 (3,221 + 3,420*) | 6,733 (3,313 + 3,420*) | 6,829 (3,409 + 3,420*) |
| NE[c] | 7,055 (5,425 + 1,630*) | 7,439 (5,809 + 1,630*) | 7,657 (6,027 + 1,630*) | 7,829 (6,199 + 1,630*) | 8,005 (6,375 + 1,630*) |
| ENE | 2,331 | 2,482 | 2,574 | 2,647 | 2,723 |
| E[d] | 26,090 (1,090 + 25,000*) | 26,176 (1,176 + 25,000*) | 26,223 (1,223 + 25,000*) | 26,258 (1,258 + 25,000*) | 26,293 (1,293 + 25,000*) |
| ESE | 321 | 365 | 385 | 396 | 406 |
| SE | 177 | 205 | 218 | 224 | 229 |
| SSE[e] | 1,662 (662 + 1,000*) | 1,778 (778 + 1,000*) | 1,822 (822 + 1,000*) | 1,845 (845 + 1,000*) | 1,869 (869 + 1,000*) |
| S[f] | 1,852 (692 + 1,160*) | 1,940 (780 + 1,160*) | 1,977 (817 + 1,160*) | 2,000 (840 + 1,160*) | 2,024 (864 + 1,160*) |
| SSW[g] | 3,176 (1,076 + 2,100*) | 3,201 (1,101 + 2,100*) | 3,231 (1,131 + 2,100*) | 3,263 (1,163 + 2,100*) | 3,297 (1,197 + 2,100*) |
| SW[h] | 2,904 (2,404 + 500*) | 3,089 (2,589 + 500*) | 3,189 (2,689 + 500*) | 3,266 (2,766 + 500*) | 3,344 (2,844 + 500*) |
| WSW | 714 | 754 | 779 | 801 | 825 |
| W | 1,021 | 1,091 | 1,131 | 1,165 | 1,198 |
| WNW | 317 | 365 | 384 | 396 | 408 |
| NW[i] | 4,838 (3,838 + 1,000*) | 5,588 (4,588 + 1,000*) | 5,865 (4,865 + 1,000*) | 6,004 (5,004 + 1,000*) | 6,146 (5,146 + 1,000*) |
| NNW[j] | 15,725 (3,519 + 12,206*) | 17,057 (4,851 + 12,206*) | 17,477 (5,271 + 12,206*) | 17,628 (5,422 + 12,206*) | 17,781 (5,575 + 12,206*) |
| Sum for 0-10 Mile Interval | 77,899 (27,482 + 50,417*) | 82,186 (31,769 + 50,417*) | 83,892 (33,475 + 50,417*) | 84,849 (34,432 + 50,417*) | 85,828 (35,411 + 50,417*) |
| Average Density Persons/mi$^2$) in 0-10 Mile Interval | 248 | 262 | 267 | 270 | 273 |

Note: Asterisk (*) indicates transient population part of total.

[a]Sector includes Des Plaines Conservation Area, Illinois Michigan Canal State Trail, McKinley Woods and Area 1 Outdoor Club.

[b]Sector includes Wilmington Recreation Area Club and Fossil Rock Recreation Club.

[c]Sector includes Braidwood Dunes and Savanna Nature Preserve, Forsythe Woods, Braidwood Recreation Club and Will County Sportsmen's Club.

[d]Sector includes Kankakee River State Park.

[e]Sector includes South Wilmington Sportsmen's Club.

[f]Sector includes Ponderosa Sportsman's Club, Sun Recreation Club and Shannon Shores.

[g]Sector includes South Wilmington Firemen Beach and Park Club.

[h]Sector includes Chicago Beagle Club.

[i]Sector includes Rainbow Council Scout Reservation.

[j]Sector includes Goose Lake Prairie State Park, CECo Employees Recreation Association, Inc., Coal City Area Club, Dresden Lakes Sports Club and Goose Lake Club.

TABLE 2.1-10

1978 FARM STATISTICS

| APPROXIMATE LAND AREA | WILL COUNTY | GRUNDY COUNTY | KANKAKEE COUNTY | ILLINOIS |
|---|---|---|---|---|
| Total Land (acres) | 542,080 | 276,480 | 433,920 | 35,682,560 |
| Percentage in Farms | 67.2 | 83.8 | 91.3 | 83.3 |
| Land in Farms (acres) | 364,072 | 231,729 | 396,141 | 29,730,739 |
| Number of Farms | 1,382 | 675 | 1,251 | 109,924 |
| Average Size of Farms (acres) | 263 | 343 | 317 | 270 |
| LAND AREA IN FARMS BY USE | | | | |
| Cropland Harvested (acres) | 312,994 | 200,048 | 350,669 | 22,822,821 |
| Cropland Pastured (acres | 6,990 | 4,105 | 4,209 | 1,516,614 |
| Cropland Not Harvested and Not Pastured (acres) | 13,282 | 7,647 | 13,546 | 1,021,157 |
| Woodland Including Woodland Pasture (acres) | 6,962 | 6,963 | 7,003 | 2,015,291 |
| Other Lands (roads, homes, etc.) (acres) | 23,844 | 12,966 | 20,714 | 2,354,856 |

Source: U.S. Bureau of the Census (1981).





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estimates indicated the presence of relatively large numbers of fish at mid-stream above Transect 3. This mid-stream concentration of fish may have, in part, accounted for the low fish numbers encountered in the near-shore regions of the river.

Population estimates based on the total number of fish captured and recaptured were relatively low when compared with the total number of fish collected during the survey. Although the total number of fish marked and recaptured using this technique does not necessarily have to be large (Ricker 1958), the obvious lack of sufficient numbers of marked and recaptured fish made the results less reliable.

2.2.1.11.4 Select Species

Age, growth, food habits, parasites, and condition factors of rock bass, longear sunfish, smallmouth bass, largemouth bass, and white crappie from the Kankakee River and Horse Creek were studied in 1974. The growth rates of these fish varied from fair to good when compared with those of other fish populations described in literature. Also, except in the case of white crappie, they had relatively higher condition factors (see Table 2.2-49). Annual increments in length varied from year to year. The majority of fish seemed to be growing well in 1974.

Select fish species of the Kankakee River and Horse Creek fed on a wide assortment of aquatic invertebrates and, in several cases, on minnows and other fish (see Figures 2.2-24 through 2.2-27). Aquatic invertebrates were available in the study area throughout the study period. Some invertebrate species were fed upon selectively. In several cases, the changing feeding habits of fish with the season was largely attributed to the seasonal fluctuation of the benthic community.

Fish collected from the Kankakee River and Horse Creek were subject to parasitic infections. The degree of infection varied among species. Parasitic effects were not severe, as indicated by the growth patterns and condition factors (see Table 2.2-50). In several cases fish were shown to host more than one species of parasite at one time. The parasitic organisms encountered in the study area were mostly trematodes (flukes).

2.2.1.11.5 Eggs and Larvae

Fish eggs are commonly classified as being buoyant, semi-buoyant, or demersal (on the bottom) (Ricker 1971). The collection of eggs and larvae during the survey was done using surface and bottom plankton net tows and bottom pumping. These collection methods were used so that the three types of eggs would be represented in the sampling. Eggs collected by plankton nets are most likely buoyant or semi-buoyant, and those collected by bottom pumping are primarily demersal. A limiting or complicating factor in the assessment of fish eggs and larvae in any area is that eggs and larvae may be concentrated in spawning

areas rather than widely distributed. The collection of adequate numbers of demersal eggs using traditional collecting methods was difficult, and the movement of fish between different bodies of water (such as the Kankakee River and Horse Creek) made it almost impossible to define population boundaries during breeding periods.

Fish eggs and larvae were collected during the first sampling period (May 2, 1974) at Transect 3, which indicates that spring spawning had already occurred by this time (see Table 2.2-51). Larvae were collected at Transect 3 as late as June 27, 1974. Thus, the spring spawning period started before May 2 and extended beyond mid-June 1974. Larvae collected during the first part of the sampling probably belonged to early spring spawners, whereas eggs and larvae collected in the latter part of the survey were from early summer spawners.

It is known that different fish species have different temperatures that induce spawning. For example, the spawning temperatures for rock bass, longear sunfish, and smallmouth bass have been reported to be $20^{o}$ to $21^{o}C$, $24^{o}$ to $30^{o}C$, and $13^{o}$ to $21^{o}C$, respectively (Scott and Crossman 1973). It was, therefore, not unusual that fish eggs and larvae were collected throughout the sampling period.

Bottom plankton tows and bottom pumping produced a small number of eggs (15) and larvae (54); none were collected using surface plankton tows. The number of eggs and larvae collected per cubic meter of water at each sampling location is presented in Table 2.2-51. Although some larvae were collected at each transect, no eggs were obtained from Transects 2 and 5 during the entire sampling period (see Table 2.2-51).

More eggs and larvae were collected from Horse Creek (Transect 4) during May 1974 than at all the Kankakee River transects (Transects 2, 3 and 5) combined, which suggests that spawning was more intensive in Horse Creek in May 1974 than in the Kankakee River at this time. Conditions in Horse Creek appear to be more ecologically favorable for early spawning than the Kankakee River conditions. Horse Creek is shallow (mean depth of 4.6 feet), having relatively warm water (ranging between $2.8^{o}$ and $24.2^{o}C$ during March through June) and low flow. Fish movements between the creek and the river were suggested from the observations made during the 1974 through 1975 study. Both the creek and some areas of the river appear to provide nursery grounds for eggs and larvae.

## 2.2.2 Terrestrial Environment

### 2.2.2.1 Introduction

The 4454 acres of the Braidwood site included 1213 acres of agricultural land, 237 acres of open woodlands, and 3004 acres of strip-mine spoil. The ecology of

each of these areas is quite distinct. The unmined areas are affected by past agricultural practices and soil types. The mined areas are affected by the acidity and texture of the surface material, slope, ridge heights, and the amount of time elasped since mining occurred. The type of reclamation practiced also affects strip-mined areas.

The flora and fauna observed during the baseline survey and their interactions were summarized by indicating their relative positions within a generalized food web for the Braidwood site (see Figure 2.2-28). This food web schematic considered the site as a whole without distinguishing between the various habitats sampled. It indicates general relationships between vegetation, herbivores, omnivores, insectivores, and carnivores found on the site. Species grouped within boxes are generally similar in food preference, but a broad range of nutrient options may be represented. Although human beings are not included, it should be recognized that they are not only an omnivore in the web, but that they also influence the web by their effects on the habitat of the individual species.

Initial ecological studies at the Braidwood site began in the fall of 1972 and continued on a seasonal basis during the winter, spring, and summer of 1973. The results and projections of the construction inpact concluded from these studies for the fall, winter, and spring surveys are included in Subsections 2.7.1 and 4.1.5 of the Braidwood Station Environmental Report - Construction Permit Stage (ER-CPS). The impact was assessed in the ER-CPS and the Braidwood Final Environmental Statement (FES). The summer 1973 survey confirmed the minimal environmental impact as described in both the ER-CPS and FES.

To augment the initial (1972 through 1973) baseline study, a program was designed for the 1974 through 1975 period. The results and conclusions presented in the 1974 through 1975 Final Terrestrial Monitoring Report further support the impact assessment presented in both the ER-CPS and the FES. The information obtained during these 2 years of baseline monitoring is summarized in the following subsections.

2.2.2.2 Objectives of the 1972 through 1973 Baseline Survey

The major objectives of the terrestrial baseline study (1972 through 1973) were as follows:

a. to record and describe "important" species of flora and fauna in the site area during all four seasons of the year;

b. to provide baseline data that could be used to develop a monitoring program for detecting impacts of plant construction and operation on the environment;

c. to delineate the different types of habitats near the Braidwood site environs;

d. to determine the ecological relationships between the biotic and abiotic parameters present; and

e. To offer recommendations concerning effects of construction on any "unique or unusual" plants or animals found within zones of direct impact.

2.2.2.3 Objectives of the 1974 through 1975 Baseline Survey

The six major study objectives of the terrestrial baseline study (1974 through 1975) were the following:

a. to document existing biota in recently purchased areas that were not evaluated during baseline surveys;

b. to evaluate the biotic components of areas that will be subject to construction activity for station and switchyard facilities;

c. to observe annual fluctuation in the biological density represented within the site;

d. to expand the biological data base for predicting impacts associated within the site;

e. to provide background data for the initiation of a specific program to evaluate the impact of site development on migratory water fowl; and

f. to identify significant parameters to be measured or monitored in later studies to provide continuing estimates of real and potential impacts.

2.2.2.4 Summary of the 1972 through 1973 Baseline Survey

The following results were based on the field baseline studies conducted from the fall of 1972 through the summer of 1973 in the environs of the Braidwood site.

a. The 4454 acre Braidwood site included 1213 acres of agricultural land, 237 acres of open woodlands, and 3004 acres of strip-mine spoil. | 1 | 5

b. The climax community for the site was primarily tall grass prairie with some areas of deciduous forest. There are now, however, no climax communities remaining within the site boundaries, and all of the unmanaged natural communities are in some stage of succession toward climax. Plant diversity was

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| Chapter 12.0 - Environmental Approvals and Consultation | 2 |
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## 3.7 SANITARY AND OTHER WASTE SYSTEMS

### 3.7.1 Sanitary Wastes

The sanitary wastes from the Braidwood Nuclear Generating Station - Units 1 & 2 (Braidwood Station) are collected by a sewer system and discharged into a packaged sewage treatment plant located at the station. The treatment plant is designed to handle a maximum of 15,000 gallons per day. The treated effluent is combined with the cooling pond blowdown and discharged to the Kankakee River. The effluent contains a residual of up to 1 mg/liter free chlorine, and after mixing with the cooling pond blowdown, the residual chlorine content is negligible. Water from onsite wells is used for the sanitary system during construction. During station operation, water from the Kankakee River will be used for the sanitary system.

The sewage treatment unit for permanent plant service operates as an extended aeration system for 553 operating personnel at approximately 25 gallons per person per day. The effluent from the unit is given tertiary treatment (consisting of filtration and recirculation in a packaged unit) and then is chlorinated before discharge. During construction, factory-installed modifications allowed the package unit to operate as a contact stabilization system designed for 1,500 construction personnel at 15 gallons per person per day, or a total of 22,500 gallons for the 8-hour work day. | 2

The environmental effect of the treated sewage is discussed in Section 4.1 and 5.5

### 3.7.2 Other Waste Systems

The station maintains four diesel generators to provide emergency electrical power during a loss of offsite power. The station also has two diesel-driven auxiliary feedwater pumps, one miscellaneous equipment diesel, and one diesel-driven fire pump. These engines exhaust directly to the atmosphere through muffler systems. The use of these systems other than for routine testing is not anticipated during normal operation. These diesels are tested by starting each one once a month and running it for one hour. | 5

Two No. 2 fuel oil-fired auxiliary steam boilers, each rated at about 75 x $10^6$ Btu, are used to supply steam for initial plant

startup and for those infrequent occasions when both nuclear units are shut down. These boilers are supplied with low-sulfur distillate oil to meet Illinois state emission standards for control of gaseous sulfur dioxide emissions. When firing distillate oil, these standards limit $SO_2$ emission to 0.3 lb per million Btu heat input. In addition, the oil used has a low ash content so that the emission of particulate matter from the stack is within the Illinois state emission standard of 0.1 lb per million Btu heat input. The emission standard on the visual scale is 30% opacity, which is achieved when firing the low-ash distillate oil. Table 3.7-1 lists the state emission standards for the new distillate oil-fired units of less than $250 \times 10^6$ Btu. These are the only standards currently applicable to the auxiliary steam boilers.

During normal operation, one boiler is expected to operate an average of about 2 weeks per year at 80% capacity.

Trash from the plant is disposed of offsite by an independent contractor. Laundry wastes and wastes from chemical laboratory drains are processed through the radwaste system, which is described in Section 3.5 Solid, nonradioactive chemical wastes are disposed of offsite by an independent contractor.

# CHAPTER 4.0 - ENVIRONMENTAL EFFECTS OF SITE PREPARATION, STATION CONSTRUCTION, AND TRANSMISSION FACILITIES CONSTRUCTION

## 4.1 SITE PREPARATION AND PLANT CONSTRUCTION

### 4.1.1 Construction Schedule

A Nuclear Regulatory Commission (NRC) construction permit for the Braidwood Nuclear Generating Station - Units 1 and 2 (Braidwood Station) was issued on December 31, 1975. An extension to the construction license was issued November 15, 1982. As of April 1, 1983, 51% of the estimated $3.1 billion project cost had been expended. Completion dates for Units 1 and 2 have been set for October 1985 and October 1986, respectively. The specific conditions for environmental protection attached to the contruction permits are listed in Section 4.5.

The effects of site preparation and construction activities on land and water use are described in the following subsections.

### 4.1.2 Land Use

The Braidwood site consists of approximately 4454 acres with the south portion containing the pond, dikes, etc., being 3898 acres and the 556 acre plant area which is north of the pond area and contains the principal plant facilties.

All the land within the pond area was considered to be disturbed by construction of Braidwood Station or was previously disturbed by strip mining. Prior to construction this area was made up of 3004 acres of strip-mine spoil, 777 acres of agricultural land and 117 acres of woods.

The 556 acres of the plant area consisted of 436 acres of agricultural land and 120 acres of woods. During construction of the station facilities, approximately 256 acres of land was disturbed, 221 acres of which were agricultural land and 35 acres were woods. After construction is complete, the permanent facilities including the main plant buildings, switch yard, parking areas, roads, etc., will occupy approximately 125 acres, of which 90 acres was agricultural land and 35 acres was wooded. The remaining 131 acres which was construction disturbed agricultural land and the approximately 300 acres that were not disturbed will be either planted for wildlife habitat

or allowed to continue in a natural state. Of the undisturbed land, 215 acres were agricultural land and 85 acres woods. Dedication of the site to nonagricultural uses during the operating life of the site will reduce the total amount of agricultural land by 1213 acres. This acreage represents only a small portion (about 0.1%) of the 913,500 acres of farmland in the 5

immediate area (Grundy, Kankakee, and Will counties). Some land biota will be displaced from the Braidwood Station site into the surrounding area where selective competition will take place for already occupied niches. New habitats attractive to aquatic biota such as frogs, turtles, and some water fowl will be formed.

The Braidwood Station site is served by both highway and rail transportation facilities. Interstate 55 is less than 2 miles west-northwest, and Illinois State Routes 53 and 129 are less than a mile northwest of the station. The Illinois Central Gulf Railroad, which runs parallel with and between Routes 53 and 129, is used to provide spur track access from the site to the main line.

The initial site preparation work has two stages. The first stage consists of stripping, excavating, and backfilling the areas occupied by structures and roadways. The second consists of developing the site with all necessary facilities to support construction, such as offices, railroad tracks, warehouses, wells, sanitary facilities, and power lines. The actual station construction began while these activities were in progress.

To accommodate the construction force, an onsite parking area was constructed, and a sewage treatment facility was provided. After construction is completed, this parking area will be graded and seeded.

Existing roads on the station site are used as much as possible for construction activities. The only new roads are those within the construction area proper and a service road created for work on the river structures. A township roadway that entered Commonwealth Edison Company (CECo) property was closed with approval of the highway commissioner of Reed Township. The abandoned roadway has no public access or use and is completely controlled by CECo. No county, state, federal, or interstate highway has been rerouted as a result of Braidwood Station construction.

The designated construction areas, access ways, and laydown areas were cleared to permit construction of the permanent station structures and facilities. In order to minimize erosion, a construction drainage system was incorporated into the site development plan. Temporary gravel roads and permanent roads were installed with site grading and drainage facilities to permit all-weather use of the site for movement and storage of materials and equipment during construction.

Areas only temporarily disturbed by construction were stabilized by native vegetation. In all instances, erosion control measures around the construction area were planned and scheduled as part of construction operation. To the extent possible, mechanical disturbances during the construction of any of the associated facilities were limited to the immediate construction site. In construction laydown areas, temporary diversions were constructed

## 4.3 RESOURCES COMMITTED

The construction of the Braidwood Nuclear Generating Station - Units 1 & 2 (Braidwood Station) involves permanent and temporary uses of land, water and material resources. This section describes the resources committed during plant construction.

### 4.3.1 Land Resources

In the development of the 4454-acre site, 256 acres have been affected by actual plant building activities including 35 acres of woods and 90 acres of agricultural land that will be changed from current land use during the life of the plant. 1

The pond area is approximately 3898 acres and has affected 777 acres of agricultural land, 117 acres of woods and 3004 acres of strip-mine spoil. Approximately 300 acres of the site was not affected by site construction. The expected impact of site construction is described in Section 4.1. 1 5

The construction of permanent facilities on the site eliminates some wildlife habitat, which results in shifts of wildlife populations to other areas. Those portions of the site not occupied by the permanent facilities or landscaped for aesthetic purposes will be allowed to return to a natural state.

There are some unavoidable animal deaths due to construction activities (e.g., the coverage of nests and dens), particularly in the cooling pond area. During pond filling, small mammals living on the pond site and not able to relocate to a safe area will be lost. Once the filling is completed, however, the pond will provide habitat for both nesting and migrating waterfowl.

The land that will be traversed by the transmission lines for the Braidwood Station is mainly farmland. Except for areas occupied by the tower foundations, there will be no commitment of farmland resources during the proposed period of transmission line use. Any farmland disturbed by construction activities will be restored.

### 4.3.2 Water Resources

No permanent effect on water resources is expected at the Braidwood Station. The construction of the river intake and discharge structures will permanently alter approximately 250 feet of shoreline on the southern bank of the Kankakee River. No other permanent aquatic disruptions are expected during the construction of the Braidwood Station.

### 4.3.3 Materials Used

The materials used for the Braidwood Station are of two types: those used for the construction of buildings; and fuel. Construction materials include structural and reinforcing steel, portland cement, electrical cables, paints, coverings, and fixtures. Although these will be permanently committed during the lifetime of the plant, some of them can be at least partially reclaimed if the plant is eventually dismantled. The highly contaminated items will not be reusable. The discussion of fuel consumption and of other resources committed during plant operation is included in Section 5.7. The decommissioning and dismantling of the plant is described in Section 5.8.

## 5.7 RESOURCES COMMITTED

Resource commitments due to operation of the Braidwood Nuclear Generating Station - Units 1 & 2 (Braidwood Station) fall into two categories: resources committed during the active lifetime of the plant and resources consumed (i.e., committed irretrievably) during plant operation. Resources committed during plant construction are described in Section 4.3.

### 5.7.1 Resources Committed During Plant Lifetime

Section 2.2 describes the present ecological characteristics of the Braidwood Station site area. The expected impact of plant construction on the surrounding ecological community is described in Section 4.1. The expected ecological impact due to plant operation is presented in this section. Although changes in the local terrestrial ecology attributable to the presence of Braidwood Station could be interpreted as being commitments of resources, a distinction should be made between such consequences as the displacement of animal populations and the destruction of animal habitats; i.e., natural vegetation. Plant operation should not reduce further the wildlife habitat altered by plant construction and, therefore, should not displace any more animal populations. Ecological monitoring will identify and document changes in the quantity and quality of the chemical and thermal discharges and the resultant effects on the biotic community in the Kankakee River (see Section 6.2).

Resources committed during plant life cannot reasonably be considered as irretrievable long-term net losses. Preconstruction surveys (see Section 2.2) indicated that there are no known threatened or endangered species of plants or animals indigenous to the Braidwood Station area. Since no undue or extreme environmental disturbance is expected to result from plant operation, it is anticipated that natural flora and fauna could reestablish themselves after the plant is decommissioned if the area is allowed to revert to a natural state.

The use of land for the Braidwood Station is also a resource commitment. Subsection 4.3.1 describes the land that is removed from natural and agricultural production by plant construction. During plant operation, 4454 acres will be occupied by plant facilities, the cooling pond, and the exclusion area. The cooling pond provides a habitat for waterfowl, shore birds, and semi-aquatic mammals. Portions of this land not occupied | 2

or disturbed during construction will be allowed to return to their natural state in order to provide habitat for terrestrial wildlife. The 1213 acres of land that will be unavailable to agriculture represents about 0.1% of the total agricultural land in Will, Grundy, and Kankakee Counties. About one-fourth of the land could be reclaimed after the plant is decommissioned without removal of any facilities. 5

Makeup water is expected to be withdrawn from the Kankakee River at an average annual rate of 90.8 cfs (see Table 3.3-1). An additional 9.3 cfs of rainfall will be added to the Braidwood pond (see Table 3.3-1). An average of 56.8 cfs of water is expected to be lost through evaporation and seepage from the cooling pond. Although most of this water is eventually returned to the earth as precipitation, it is an immediate loss to the local area. In addition, an annual average blowdown of 43.2 cfs is eventually returned to the Kankakee River (see Table 3.3-1).

### 5.7.2 Irretrievable commitments of Resources

The environmental effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level and high-level wastes are within the scope of the NRC report entitled "Environmental Survey of the Uranium Fuel Cycle" (see Table 5.7-1).

The operation of the Braidwood Station will involve the consumption of a certain amount of uranium ore that represents a fraction of the current reserves and resources of the United States. The radioactive materials inventory appears in Section 3.8. During the expected lifetime of the plant, the estimated annual use will be 64,450 pounds of $UO_2$ or 56,810 pounds of U.

## 6.1.5 Radiological Monitoring

The preoperational radiological monitoring program planned for the Braidwood Station was described in the Environmental Report - Construction Permit Stage (ER-CPS). The monitoring program currently planned incorporates some changes in sample collection and analysis that were made to obtain more useful data. The area to be monitored is essentially the same as that described in the ER-CPS (see ER-CPS Subsection 6.1.5).

CECo started its preoperational radiological monitoring program in the summer of 1983. The preoperational monitoring program will provide measurements of natural background and other radiation sources, such as fallout, that are external to Braidwood Station. This program will continue until the plant loads nuclear fuel and the operational-phase monitoring program begins. Details of the proposed monitoring program are discussed in this subsection. 1 2 5

### 6.1.5.1 Sampling Media, Locations, and Frequency

Table 6.1-10 presents the salient features of the preoperational radiological sampling program being used at the Braidwood Station. The media to be sampled include the most important dose pathways. Air sampling stations and surface and well water sampling sites used in the program are shown in Figure 6.1-7. Air sampling sites were selected on the basis of population and site meteorological conditions. Environmental samples will be collected at these locations with the frequencies specified in the technical specifications. 2 5

Before the observation period, traveling screens will be manually operated to remove debris, and a clean trash basket will be set into place. At the end of each 24-hour period, the traveling screens will again be manually operated to remove all debris, including impinged fish. Fish will be enumerated from this collection.

Fish Eggs and Larvae:

Fish egg and larvae data will be collected at one river transect upstream of the Braidwood Station intake and in the intake forebay to contrast intake with river numbers. Sampling will be conducted for one full spawning period after Braidwood Unit 2 is declared commercially operational by CECo.

6.2.1.1.2 Temperature

When CECo has declared both Braidwood Units 1 and 2 to be in commercial operation with licenses to operate at full power output, plume studies will be conducted at 3-month intervals that will terminate when four plume studies representing the four seasonal river conditions have been completed.

6.2.1.1.3 Water Chemistry

Water chemistry samples will be taken upstream of the river screen house, in the outfall of the Braidwood Station blowdown structure, and downstream from the blowdown structure. Samples will be taken quarterly. Table 6.2-1 shows the water quality parameters that will be measured during the Braidwood Station operational-phase program.

6.2.2 Terrestrial Monitoring Program

A terrestrial monitoring program designed to detect any effects of pond filling was submitted to the NRC staff in July, 1978. Staff approval was received in August, 1979 and the program was initiated in 1979 and has been continued through 1983. A description of the program is contained in Section 6.1.4.3.3 and a summary of the conclusions for the years 1979 through 1982 is contained in Section 4.1.4.1.1. No off-site effects have been observed that could be attributable either to the filling of the pond or to the presence of the pond. Since the operation-phase effects of Braidwood Station were focused on the filling of the cooling pond, and the present monitoring program indicates that there are no discernable effects of this action, it is proposed that the program be terminated and no operation-phase terrestrial monitoring program is required. 5

### 6.2.3 Radiological Monitoring Program

The monitoring program described in Table 6.1-10 will continue until fuel loading of the Braidwood Station begins. Thereafter, the monitoring program used will be similar to that put forth in Table 6.2-2. 5

### 6.2.4 Meteorological Monitoring Program

The meteorological measurement program currently used at the Braidwood Station site is described in Subsection 6.1.3.1.1. It is proposed that this program continue through the operational phase of the Braidwood Station. Any change in plans will be reported in a supplement to this Environmental Report.

TABLE 6.2-1

## BRAIDWOOD STATION OPERATIONAL PHASE

## WATER QUALITY MONITORING PARAMETERS

### BACTERIAL PARAMETERS

Fecal Streptococci
Total Coliforms
Fecal Coliforms

### WATER CHEMISTRY PARAMETERS

Temperature
pH
Dissolved Oxygen (DO) and Percent Saturation
Total Dissolved Solids (TDS)
Total Suspended Solids (TSS)
Specific Conductance
Ammonia Nitrogen ($NH_3$ - N)
Nitrate Nitrogen ($NO_3$ - N)
Nitrite Nitrogen ($NO_2$ - N)
Oil and Grease
Total Hardness
Total Alkalinity
Chlorides ($Cl^-$)
Potassium (K)
Biochemical Oxygen Demand (BOD)
Residual Chlorine ($Cl_2$)
Chemical Oxygen Demand (COD)
Magnesium (Mg)
Sodium (Na)
Ortho-phosphates (O - $PO_4$)
Total Phosphates (T - $PO_4$)
Sulfates ($SO_4$)
Calcium (Ca)
Iron (Fe) - Total
Iron (Fe) - Dissolved
Copper (Cu)

AMENDMENT 4
OCTOBER 1983
AMENDMENT 5
DECEMBER 1983

# TABLE 6.2-2

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM IN THE OFF-SITE DOSE CALCULATION MANUAL FORMAT

| EXPOSURE PATHWAY AND/OR SAMPLE | NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1] | SAMPLING AND COLLECTION FREQUENCY | TYPE AND FREQUENCY OF ANALYSIS | |
|---|---|---|---|---|
| 1. Direct Radiation[2] | Forty monitoring stations:<br>Near Field:<br>Godley<br>Braidwood<br>Custer Park<br>Far Field:<br>Gardner<br>Essex<br>County Line Road<br>Coal City<br>Wilmington<br>Site boundary - ring of 16.<br>About 5 mile radius - ring of 16. | Continuous monitoring. Collected quarterly. | TLD Gamma dose. Analyzed quarterly. | 4 |
| 2. Airborne | | | | 4 |
| Radioiodine and Particulates | Samples from seven locations:<br>Godley<br>Braidwood<br>Custer Park<br>Gardner<br>Essex<br>County Line Road<br>Streator (control-least prevalent wind direction) | Continuous sampler operation with sample collection weekly, or more frequently if required by by dust loading. | Radioiodine Cannister: I-131 analysis weekly.<br>Particulate Sampler: Gross beta radioactivity<br>Analysis following filter change[3]; Gamma isotopic analysis[4] of composite (by location) quarterly. | 5 |
| 3. Waterborne | | | | |
| a. Surface Water[5] | Kankakee River<br>One sample upstream of discharge.<br>One sample downstream of discharge. | Weekly collection, composited monthly and quarterly. | Gamma isotopic analysis[4] monthly. Composite for tritium analysis quarterly. | |
| b. Ground Water | Samples from Braidwood Town Hall well. | Quarterly. | Gamma isotopic[4] and tritium analysis quarterly. | |
| c. Sediment from shoreline | One sample from downstream area with existing or potential recreational value. | Semiannually. | Gamma isotopic analysis[4] semiannually. | |
| 4. Ingestion | | | | 4 |
| a. Milk | Samples from three dairies within 8 km, the nearest ones to the plant, if possib e.<br>One sample from milking animals at a control location, 15-30 km distant and in the least prevalent wind direction. | Semimonthly when animals are on pasture, monthly at other times. | Gamma isotopic[4] and I-131 analysis semimonthly when animals are on pasture; monthly at other times. | |
| b. Fish and Invertebrates | Representative samples of commercially and recreationally important species in vicinity of plant discharge area.<br>Representative samples of commercially and recreationally important species in areas not influenced by plant discharge. | Three times per year (spring, summer and fall). | Gamma isotopic analysis[4] on edible portions. | |
| c. Food Products | Representative samples of the principal classes of food products from any area within 10 miles of the plant[7]. | At time of harvest[6]. | Gamma isotopic analysis[4] on edible portion. | |

# TABLE 6.2-2 (continued)

## TABLE NOTATIONS

(1) Specific parameters of distance and direction sector from the centerline of one unit, and additional description where pertinent, shall be provided for each and every sample location in a table and figure(s) in the Offsite Dose Calculation Manual (ODCM).

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Specification 6.7.1.6. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In lieu of any Licensee Event Report required by Specification 6.7.1 and pursuant to Specification 6.7.1.12, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in a Special Report to the Commission within 30 days and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

(2) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition, to integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors this table, a thermluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The forty stations is not an absolute number. The number of direct radiation monitoring stations may be reduced according to geographical limitations; e.g., at an ocean site, some sectors will be over water so that the number of dosimeters may be reduced accordingly. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.

(3) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

(4) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(5) The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area beyond but near the mixing zone.

(6) If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

(7) Additional broad leaf vegetation sampling will not be done since milk sampling will be done as part of this program.

## 6.4 PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING DATA

The preoperational radiological monitoring program for the Braidwood Nuclear Generating Station - Units 1 and 2 began in the summer of 1983. When 12 months of monitoring data, including data from a crop harvest and a complete growing season, are available, they will be submitted. 1 2 5

# CHAPTER 8.0 - ECONOMIC AND SOCIAL EFFECTS OF STATION OPERATION

The Braidwood Nuclear Generating Station - Units 1 & 2 (Braidwood Station) will create a total of 553 permanent new jobs at the station site and an estimated annual payroll of $14.6 million (in 1982 dollars) when the station goes commercial in 1986. 1

The total agricultural land affected by the construction and operation of the Braidwood Station is 1213 acres. The construction of the cooling pond required the diversion of 777 acres of agricultural land. About 77% of the remaining area required for pond construction, or 3004 acres, consisted of strip-mine spoil. The total affected agricultural land (1213 acres) is about 0.1% of the total agricultural land in the three-county agricultural region formed by Grundy, Kankakee, and Will Counties (see Section 4.1). 5

Permanent new residents attracted as a result of the Braidwood Station project will be dispersed throughout the surrounding communities (see Section 8.4), so that there will be little effect on local services. The increased tax revenue attributable to the Braidwood Station project from property taxes is estimated to be $9.3 million in 1986 (see Section 8.2). Local taxing districts should receive more tax dollars than required to provide the additional services for the new residents. 1

It is not possible to determine the benefit to the local economy from the purchase of local goods and services for operation of the station. The average 1983 budget for contract payments for Commonwealth Edison's three operating nuclear stations, each with two operable units, is $17.3 million. These costs include refueling, maintenance and waste disposal. The procurement of materials and services is based on a competetive bid system, and therefore no estimate can be made as to which suppliers will provide the materials and service, the corresponding monetary value, or the county in which the supplier is located. 1

There are no historical sites located on the Braidwood site.

# CHAPTER 11.0 - SUMMARY COST-BENEFIT ANALYSIS

Information on the summary cost-benefit analysis for the Braidwood Nuclear Generating Station - Units 1 & 2 (Braidwood Station) is presented in Table 11.0-1.

TABLE 11.0-1

SUMMARY OF COST-BENEFIT ANALYSIS OF THE BRAIDWOOD STATION

| CONDITIONS AND CHARACTERISTICS | PRESENT BRAIDWOOD STATION ENVIRONMENT | NUCLEAR POWER STATION WITH ASSOCIATED COOLING POND | |
|---|---|---|---|
| Total Anticipated Capital Investment | | $3.1 billion | 2 |
| Economy of the Braidwood Station Region | Resource-based economy especially oriented toward agriculture and mining | Annual permanent employee payroll: $14.6 million<br><br>Annual local taxes on station: $9.3 million estimated for 1986 when the second unit becomes commercial<br><br>Taxes (local, state, federal) over 30-year period $1,482.4 million | 1 |
| Economy of the Commonwealth Edison Company Service Area | Extremely diverse economy, highly industrialized in Chicago metropolitan area and some outlying centers (Joliet, Rockford), and primarily agriculturally oriented in non-metropolitan areas | Annual value of power produced under present schedules: $836 million | |
| Physical and Chemical | Lands: The present land use in the area is primarily strip-mine spoil with some cultivated land | Approximately 4454 acres of land have been acquired for use by the proposed station and cooling pond. Of this acreage, about 300 acres will form the exclusion area. Cropland and residential land in the exclusion area will be changed because no crops will be grown and house and farm buildings have been removed. The actual station structure will occupy 125 acres. Loss | 5<br><br>5 |

TABLE 11.0-1 (Cont'd)

SUMMARY OF COST-BENEFIT ANALYSIS OF THE BRAIDWOOD STATION

| CONDITIONS AND CHARACTERISTICS | PRESENT BRAIDWOOD STATION ENVIRONMENT | NUCLEAR POWER STATION WITH ASSOCIATED COOLING POND | |
|---|---|---|---|
| | | of wildlife habitat is expected to be small. Construction of the cooling pond required the diversion of 777 acres of agricultural land. Of the remaining area required for pond construction, the major portion, 3004 acres, consisted of strip-mine spoil | 5 5 |
| | Water: Kankakee River near site: average flow = 3952 cfs | Water consumed through evaporation and seepage loss: approximately 57 cfs | 2 |
| | Temperature ranges:<br>Summer 16.5° to 30.0°C<br>Spring and Fall 0.5° to 26.5°C<br>Winter 0.0° to 9.5°C | The concentration of radionuclides in the discharge will be much less than the maximum permissible concentration (MPC) of 10 CFR 20 and will meet the design objectives of 10 CFR 50, Appendix I. | |
| | Quality is good, with little effect due to domestic and industrial discharge | Thermal discharge to river is expected to be negligible and in compliance with thermal mixing zone regulations. | |
| | | Chemical discharge into the Kankakee River due to operation of the station is not considered significant. | |
| | | The only discharge to the groundwater (approximately 5 cfs) will be associated with seepage from the cooling pond. | |

QUESTION ER470.3

The applicant should update Section 6.2.3 of the Environmental Report to include tables equivalent to tables presented in USNRC Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program, Revision 1," November 1979 (attached). The licensee should also indicate when the pre-operational radiological monitoring program will begin.

RESPONSE

Section 6.1.5, Radiological Monitoring, contains a description of the program from its start, Summer of 1983, continuing through the loading of fuel into the first Braidwood unit. 5

Tables 6.1-10 and 6.1-11, "Preoperational Radiological Sampling Program" and "Detection Capabilities for Environmental Sample Analysis," respectively, have been amended to incorporate some of the features of the NRC Branch Technical Position (BTP) referred to in the question. Table 6.1-11 is the equivalent of Table 2 in the BTP.

Table 6.2-2, "Standard Radiological Monitoring Program" has been amended to reflect the features of the BTP in the Off-Site Dose Calculation Manual format. Tables QER470.3-1 and QER470.3-2 are equivalent to Tables 1 and 4 of the BTP and are in the Radiological Environmental Technical Specifications format. The equivalent to Table 3 of the BTP, "Environmental Radiological Monitoring Program Annual Summary," will be developed at a later date. 4 5

TABLE QER470.3-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
RADIOLOGICAL ENVIRONMENTAL TECHNICAL SPECIFICATIONS FORMAT

| EXPOSURE PATHWAY AND/OR SAMPLE | NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS(1) | SAMPLING AND COLLECTION FREQUENCY | TYPE AND FREQUENCY OF ANALYSIS | |
|---|---|---|---|---|
| 1. Direct Radiation(2) | Forty routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows:<br><br>An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY;<br><br>An outer ring of stations, one in each meteorological sector in the 6- to 8-km range from the site; and<br><br>The balance of the stations to be placed in special interest areas such as population centers, at the air sampling sites. | Continuous monitoring collected quarterly. | TLD gamma dose analyzed quarterly. | 5 |
| 2. Airborne | | | | |
| Radioiodine and Particulates | Samples from seven locations:<br><br>Five samples from close to the three SITE BOUNDARY locations, in different sectors, of the | Continuous sampler operation with sample collection weekly, or more frequently if required by by dust loading. | Radioiodine Cannister: I-131 analysis weekly.<br><br>Particulate Sampler: Gross beta radioactivity | 5 |



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TABLE QER470.3-1 (Continued)

| EXPOSURE PATHWAY AND/OR SAMPLE | NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS(1) | SAMPLING AND COLLECTION FREQUENCY | TYPE AND FREQUENCY OF ANALYSIS | |
|---|---|---|---|---|
| Radioiodine and Particulates (continued) | highest calculated annual average ground level D/Q;<br><br>One sample from the vicinity of a community having the highest calculated annual average ground-level D/Q; and<br><br>One sample from a control location, as for example 10-30 km distant and in the least prevalent wind direction. | | analysis following filter change(3); Gamma isotopic analysis(4) of composite (by location) quarterly. | 5 |
| 3. Waterborne | | | | |
| a. Surface water(5) | One sample upstream.<br>One sample downstream. | Weekly collection, composited monthly. | Gamma isotopic analysis(4) monthly. Composite for tritium analysis quarterly. | 5 |
| b. Groundwater | Samples from one off-site source. | Quarterly. | Gamma isotopic(4) and tritium analysis quarterly. | 5 |
| c. Sediment from shoreline | One sample from downstream area with existing or potential recreational value. | Semiannually. | Gamma isotopic analysis(4) semiannually. | |

TABLE QER470.3-1 (Continued)

| EXPOSURE PATHWAY AND/OR SAMPLE | NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS(1) | SAMPLING AND COLLECTION FREQUENCY | TYPE AND FREQUENCY OF ANALYSIS |
|---|---|---|---|
| 4. Ingestion | | | |
| a. Milk | Samples from three dairies within 8 km, the nearest ones to the plant, if possible. | Semimonthly when animals are on pasture, monthly at other times. | Gamma isotopic(4) and I-131 analysis semimonthly when animals are on pasture; monthly at other times. |
| | One sample from milking animals at a control location, 15-30 km distant and in the least prevalent wind direction. | | |
| b. Fish and Invertebrates | Representative samples of commercially and recreationally important species in vicinity of plant discharge area. | Three times per year (spring, summer and fall). | Gamma isotopic analysis(4) on edible portions. |
| | Representative samples of commercially and recreationally important species in areas not influenced by plant discharge. | | |
| c. Food Products | Representative samples of the principal classes of food products from any area within 10 miles of the plant. | At time of harvest(6). | Gamma isotopic analysis(4) on edible portion. |



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TABLE QER470.3-1 (Continued)

| EXPOSURE PATHWAY AND/OR SAMPLE | NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS(1) | SAMPLING AND COLLECTION FREQUENCY | TYPE AND FREQUENCY OF ANALYSIS |
|---|---|---|---|
| c. Food Products (continued) | Samples of three different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground-level D/Q if milk sampling is not performed. | Monthly when available. | Gamma isotopic(4) and I-131 analysis. |
| | One sample of each of the similar broad leaf vegetation grown 15-30 km distant in the least prevalent wind direction if milk sampling is not performed. | Monthly when available. | Gamma isotopic(4) and I-131 analysis. |

TABLE QER470.3-1 (Continued)

TABLE NOTATIONS

(1) Specific parameters of distance and direction sector from the centerline of one unit, and additional description where pertinent, shall be provided for each and every sample location in Table QER470.3-1 in a table and figure(s) in the Offsite Dose Calculation Manual (ODCM).

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Specification 6.7.1.6. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In lieu of any Licensee Event Report required by Specification 6.7.1 and pursuant to Specification 6.7.1.12, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in a Special Report to the Commission within 30 days and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

2. One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition, to integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors this table, a thermluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The forty stations is not an absolute number. The number of direct radiation monitoring stations may be reduced according to geographical limitations; e.g., at an ocean site, some sectors will be over water so that the number of dosimeters may be reduced accordingly. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.

QUESTION E290.8

Chapter five does not address environmental effects of station operation on land use and terrestrial ecology. Please provide a current evaluation.

RESPONSE

The primary environmental effects of station operation on land use and terrestrial ecology occurred at the time of construction of the station and the construction and the filling of the cooling pond.

These effects were conversion of land use from strip mine spoil and farmland to station facilities and cooling pond. The principal effects on terrestrial ecology were conversion of terrestrial habitat to aquatic habitat and consequent dislocation of resident terrestrial populations. As the area from the pond to the site perimeter has been revegetated, this land is providing habitat for terrestrial species. Additional habitat will be available as the interior dikes and islands revegetate and other areas disturbed by construction are revegetated. Approximately 1792 acres are available for wildlife habitat (total site acreage of 4454 minus water surface area of 2537 acres and 125 acres containing plant facilities). Of the 3241 acres of land available for wildlife habitat before construction, 237 acres were woodlands and 3004 acres were strip mined areas consisting mostly of ponds and bare spoil banks. In addition, there were 1213 acres of farmland, portions of which were fallow at times.

Before construction there were 796 acres of prime farmland on this site. During construction, 688 of these acres were disturbed, 652 of which were permanently disturbed. There are now 144 acres that are prime farmland, none of which will be cultivated for the life of the station. 5

Table QE290.8-1 provides a breakdown of the site land use allocations for the construction permit, preconstruction; and operational stages.

Section 5.7.1 states that the 1213 acres of agricultural land that was removed from production represents about 0.1% of the farmland in Will, Grundy, and Kankakee Counties. About one-fourth of this agricultural land could be put back into

production after the plant is decommissioned without the removal of any facilities. 5

The results of the 1979 to 1982 terrestrial monitoring program which are summarized in Section 4.1.4.1.1 of the ER supports the current evaluation that no terrestrial ecological effects have occurred outside the station boundary and none are expected to occur.

Section 5.1.4 contains a discussion of the increase in humidity within a few hundred meters of the shoreline of the cooling pond and the potential for the occurrence of additional fogging and icing on the surrounding area.

TABLE QE290.8-1

BRAIDWOOD SITE LAND USE

| BASIC DATA | OPERATION PHASE | BEFORE CONSTRUCTION | CP INFORMATION |
|---|---|---|---|
| Plant Area | 556 | 556 | 556 |
| Pond Area | 3898 | 3898 | 3764 |
| Site Area | 4454 | 4454 | 4320 |
| Pond Surface | 2537 | — | 2640 |
| Plant Facilities | 125 | — | 125 |
| **LAND USE ALLOCATIONS** | | | |
| Plant Area | | | |
| Disturbed Agricultural | 221 | — | — |
| Disturbed Woods | 35 | — | — |
| | 256 | — | — |
| Undisturbed Agricultural | 215 | 436 | 436 |
| Undisturbed Woods | 85 | 120 | 120 |
| | 300 | 556 | 556 |
| TOTAL | 556 | 556 | 556 |
| Pond Area | | | |
| Disturbed (by Const) | | | |
| Strip Mine | 3004 | — | — |
| Agricultural | 777 | — | — |
| Woods | 117 | — | — |
| | 3898 | — | — |
| Undisturbed | | | |
| Strip Mine | — | 3004 | 2838 |
| Agricultural | — | 777 | 809 |
| Woods | — | 117 | 117 |
| | — | 3898 | 3764 |
| GRAND TOTAL | 4454 | 4454 | 4320 |

SUMMARY LAND USE

| | OPERATION PHASE | BEFORE CONSTRUCTION |
|---|---|---|
| Plant facilities | 125 | — |
| Woods | 85 | 237 |
| Agricultural (incl. fallow) | 346 | 1213 |
| Pond | | |
| Water | 2537 | — |
| Other (dikes, islands, etc.) | 1361 | — |
| Strip Mine | — | 3004 |
| TOTAL | 4454 | 4454 |

PRIME FARMLAND CONSIDERATION

| | Plant Area | Pond Area | Total Site |
|---|---|---|---|
| Prime Farmland Allocation | | | |
| Disturbed | | | |
| Permanently | 54 | 598 | 652 |
| Temporary | 36 | — | 36 |
| Undisturbed | 108 | — | 108 |
| Total (before construction) | 198 | 598 | 796 |

This section contains an oral request from the NRC staff for additional information followed by the response to the question. In addition, Amendment 5 consists of voluntary revisions to the following parts of the Braidwood Station Environmental Report - Operating License Stage:

| | |
|---|---|
| Section 2.1.2 | Population Distribution |
| Section 2.1.3 | Uses of Adjacent Lands and Waters |
| Section 2.2.2 | Terrestrial Environment |
| Section 4.1.2 | Site Preparation and Plant Construction, Land Use |
| Section 4.3.1 | Resources Committed, Land Resources |
| Section 5.7.1 | Resources Committed During Plant Lifetime |
| Section 6.2.2 | Terrestrial Monitoring Program |
| Section 6.2.3 | Radiological Monitoring Program |
| Section 6.4 | Preoperational Environmental Radiological Monitoring Data |
| Chapter 8 | Economic and Social Effects of Station Operation |
| Chapter 11 | Summary Cost-Benefit Analysis |
| AMENDMENT 2 | Revised response to QER470.3 |
| AMENDMENT 3 | Revised response to QE 290.8 |

ORAL QUESTION

Are there sufficient numbers of migratory waterfowl using the Kankakee River in the areas of the transmission line crossing and the river intake-discharge structures to constitute a concern?

RESPONSE

The Kankakee River, in the areas of the transmission line and the intake-discharge structures is not heavily used by migratory waterfowl due to the strong currents and the rocky-gravelly substrates. There should be no reason for concern for any effects on migratory waterfowl.

Sources:

Perkins, A., 1983, Illinois Natural History Survey, Telephone Conversation on October 19 with B. B. Barickman, CECo, Environmental Affairs.

Thornburg, D., 1983, Illinois Department of Conservation, Telephone Conversation on October 20 with B. B. Barickman, CECo, Environmental Affairs.