CATAWBA NUCLEAR STATION

ENVIRONMENTAL PROTECTION PLAN

1987

AERIAL REMOTE SENSING

VEGETATIVE COMMUNITIES

CATAWBA NUCLEAR STATION VEGETATION MONITORING 1987

INTRODUCTION

The Catawba Nuclear Station Non-Radiological Environmental Protection Plan requires that the Catawba site be monitored for possible effects of cooling tower drift on vegetation due to operation of Catawba Units 1 and 2. This monitoring was to begin the first September following operation of Unit 1 and is to continue in alternate years for three monitoring periods following operation of Unit 2. Unit 1 generation began in January 1985. This report describes the results of the monitoring program for the period 1983 through 1987. The next scheduled monitoring report will be based on results of aerial photography scheduled for September 1989.

The Catawba Environmental Report (ER) indicated that the area within the NE and SW sectors approximately 950 feet from the center of the cooling tower yard would receive maximum drift deposition. Total dissolved solids (TDS) in the drift were projected to be in the range of 350 to 500 mg/l, based on the influent makeup water TDS of 60 mg/l and an operating range of 7 to 10 cycles of concentration.

Drift deposition rate calculations in the Catawba ER predicted total solids deposition rates of 2-3 kg/ha/month (2-3 lb/acre/month) based on 350 to 500 mg/l of TDS in drift. The Catawba FES suggests that thresholds for visible leaf damage in some sensitive plants fall in the range of 10 to 20 kg/ha/month (9 to 18 lb/acre/month). Since these thresholds exceeded the projected solids deposition rates by factors of approximately 5- to 10-fold, drift from the Catawba cooling towers was not expected to produce adverse impacts on site vegetation beyond the cooling tower yard or plant boundaries.

MATERIALS AND METHODS

The condition of Catawba Nuclear Station site vegetation has been monitored by color infrared aerial photography, supplemented by ground level visual inspection of site vegetation. Aerial photography was performed in September 1983 and 1984 (preoperational), in September 1985 (first operational growing season), in September 1986 (second operational growing season) and in September 1987 (third operational growing period). Ground level observations were made in spring and summer 1986 and in 1987 to supplement observations based on aerial photography. The conclusions in this report are based on inspections of the IR photographs and ground level observations to date.

Aerial IR photography was obtained on 6 September 1983, on 2 September 1984, on 14 September 1985, on 14 September 1986, and on 23 September 1987, using Kodak IR Type 2443 film at 1:6000 (1 in = 500 ft) scale. Vegetation shown in the photographs within a radius of approximately 1 km of the cooling tower yard was inspected for evidence of dead or damaged foliage which could be related to cooling tower operation, using information provided by Murtha (1972, 1984) as a guide.

RESULTS

Operation of the Catawba cooling towers began in January 1985, but significant levels of operation relative to drift production and possible effects on vegetation did not occur until March-April and June-August 1985 (Tables 1 and 2). The towers first operated at a load producing maximal one-unit evaporative water loss during July and August 1985. Therefore, vegetation in the vicinity of the towers experienced drift deposition over much of the 1985 growing season (April-August) and during the 1986 and 1987 growing seasons. Full scale operation of Unit 2 began in July-August and November-December 1986. Therefore, site vegetation has experienced drift deposition from full two-unit operation during the 1987 growing season.

Forested areas located within 1 km of the tower consist of mixed pine-hardwoods, loblolly pine plantations, mixed shortleaf-Virginia pine stands, and mixed hardwoods. These stands are described in Duke Power (1975).

Inspection of IR photographs obtained through September 1987 has not revealed any evidence of damage to vegetation in the vicinity of the cooling towers. Color variations apparent in the IR photographs are related to the differences in species composition among the various stands. The pine stands tend to present a darker magenta to bluish-magenta image due to shadowing caused by the elongated needles. Hardwood foliage is brighter magenta to purple-red due to the more extended reflective leaf surfaces (Murtha 1972). Variations in color images do not suggest the presence of living but physiologically damaged foliage (violet to bluish images). Color variations between stands of differing composition, and within stands of a given composition, are consistent in appearance between the 1983, 1984, 1985, 1986, and 1987 photographs. Therefore, the photographs do not suggest the presence of any progressive response of the vegetation to the influence of cooling tower drift as of September 1987.

Vegetation on areas within a 1-km radius of the cooling towers was inspected on the ground for evidence of drift damage in May and August, 1986. No evidence of drift damage to foliage was observed. Since the summer of 1986 was a period of extreme drought throughout the southeastern United States, some signs of accelerated leaf sensescence on broad-leaf species was evident in August. However, the vegetation within the postulated zone of influence of the cooling tower drift did not differ in this regard from that occurring on many sites elsewhere in the area. Mortality of some individual trees and shrubs might be expected due to drought effects. It was considered that additional responses to drought might become apparent during the 1987 observation period.

Inspection of the site in March 1987 revealed the presence of needle tip necrosis (browned or "scorched" needles) on loblolly pines along the north side of the cooling tower yard at a distance of approximately 200 feet from the nearest tower. Some browning of needles was also seen on loblolly pines to the east of the yard; again the trees nearest the cooling towers appeared to be most affected. These conditions were not seen in 1986. Although needle losses can be caused by ice storms or low temperatures, the location of the response suggested a possible relationship to the Catawba cooling towers. It was noted that vegetation did not experience full-scale drift exposure from two-unit operation until December 1986, after the 1986 aerial photographs were taken in September. It was speculated that increased icing of trees near the towers could have been responsible for these conditions.

The site was re-inspected in July and November, 1987 and in January 1988. No evidence of additional browning of needles on pines was noted. The trees most severely affected in March 1987 had produced new growth and appeared to be in good condition in July. Trees near the yard exhibited no greater prevalence of browned needles than trees in control areas to the east and west of the site. No unusual, "browned", or "scorched" foliage was seen on deciduous species in the area. Inspection of the site in January produced no evidence of icing on vegetation near the cooling tower following overnight temperatures near 20°F.

Lobolly and Virginia pines in the site area have sustained damage from infestation by the southern pine beetle in 1987 and 1988. Scattered dead trees which began to be noted in the area in summer 1987 are the result of beetle activity, based on field observations during 1987-1988. Silvery images indicating dead or defoliated trees are apparent on the September 1987 aerial photographs of the Catawba site. Pine beetle infestation have been seen at numerous other locations in the area, and do not appear to bear any specific relation to the Catawba site.

pmc2.cns

Table 1. Evaporative losses for Catawba Nuclear Station cooling towers, 1985 (millions of gallons, MG).

MONTH	UNIT 1, MG
January	26.64
February	32.58
March	247.09
April	215.71
May	0.19
June	160.87
July	459.48
August	548.03
September	563.83
October	240.42
November	108.54
December	427.60

Table 2. Evaporative losses for Catawba Nuclear Station cooling towers, 1986 (millions of gallons, MG).

MONTH	UNIT 1, MG	UNIT 2, MG
January	455.1	-
February	518.4	-
March	462.1	-
April	524.1	-
May	492.9	-
June	97.1	-
July	322.0	48.2
August	71.2	395.3
September	0.0	0.0
October	0.0	0.0
November	159.0	149.0
December	547.4	620.0

Table 3. Evaporative losses for Catawba Nuclear Station cooling towers, 1987 (millions of gallons, MG).

MONTH	UNIT 1, MG	UNIT 2, MG
January	407.3	539.6
February	512.5	441.4
March	294.0	468.9
April	530.1	359.5
May	502.0	575.3
June	550.2	627.2
July	435.5	600.8
August	502.5	179.5
September	554.6	471.9
October	13.2	665.8
November	1.8	501.7
December	6.6	317.6

References

Duke Power Company. 1975. Catawba Nuclear Station Terrestrial Studies (Submitted to U.S. Atomic Energy Commission Directorate of Licensing, January 31, 1975).

Murtha, P. A. 1972. A Guide to Air Photo Interpretation of Forest Damage in Canada. Canadian Forestry Service Publication No. 1292. Canadian Forestry Service, Ottawa. 62 pp.

Murtha, P. A. 1984. Vegetation Damage Detection and Assessment: The Photographic Approach. Pp. 337-354 in: Renewable Management Application of Remote Sensing. Proceedings of the RNRF Symposium on the Application of Remote Sensing to Resource Management, Seattle, Washington, American Society of Photogrammetry, Falls Church, VA.

OVERSIZE DOCUMENT PAGE PULLED

SEE APERTURE CARDS

NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 23

APERTURE CARD/HARD COPY AVAILABLE FROM RECORD SERVICES BRANCH, TIDC
FTS 492-8989