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WOLF CREEK GENERATING STATION

ANNUAL ENVIRONMENTAL OPERATING REPORT

1987

ENVIRONMENTAL MANAGEMENT GROUP

WOLF CREEK NUCLEAR OPERATING CORPORATION

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WOLF CREEK NUCLEAR OPERATING CORPORATION
WOLF CREEK GENERATING STATION

1987 ANNUAL ENVIRONMENTAL OPERATING REPORT

1.0 INTRODUCTION

Wolf Creek Generating Station (WCGS) has committed to minimizing the impact of facility operation on the environment. The 1987 Annual Environmental Operating Report is being submitted in accordance with the objectives of the Environmental Protection Plan (EPP) as required by Facility Operating License NPF-42. The report is to demonstrate that the plant is operating in an environmentally acceptable manner.

2.0 ENVIRONMENTAL MONITORING

2.1 AQUATIC [EPP Section 2.1]

2.1.1 Impacts of Water Withdrawal on the Neosho River

The owners have contracted with the Kansas Water Resources Board to remove 9.692 billion gallons per calendar year from the tailwaters of the John Redmond Reservoir (JRR) to Wolf Creek Cooling Lake (WCCL). During 1987, only 973,185,887 gallons or 10 percent of this allotment was used. Auxiliary raw water was pumped at a rate of approximately 1.3 million gallons per day which comprises 39 percent of the total pumped. The remainder was transferred via the make-up pumps operated from August 4 through August 11, 1987. Based on monitoring studies completed during the year, no changes attributable to these withdrawals have been witnessed in river water quality or populations of phytoplankton, macroinvertebrates or fishes.

2.1.2 Chlorine Discharges to Wolf Creek Cooling Lake

Total residual chlorine (TRC) was postulated in Section 4.2.6.1 of the Final Environmental Statement/Operating License Stage (FES/OLS) to range between 0.68 and 1.08 mg/l at the Circulating Water System (CWS) discharge. Three 30-minute doses per day at 411 pounds of chlorine per dose were projected to produce these concentrations. These chlorine doses were expected to cause periodic, appreciable mortality among aquatic organisms in a conservatively estimated 40 acres of the discharge area of WCCL (Section 5.5.2.2, FES/OLS).

Administered by the Kansas Department of Health and Environment (KDHE), the WCGS National Pollutant Discharge Elimination System (NPDES) permit allows TRC to be a maximum of 0.2 mg/l in the circulating water effluent. Chlorine dose duration is limited to two hours per day. In practice, WCGS has fallen well below the NPDES allowable limits. Actual chlorine dosages have averaged approximately 40 pounds per day to the CWS. Compliance with the daily TRC limits and chlorination dose durations were 100 percent during the year. Monitoring during 1987 detected an average TRC concentration of less than 0.1 mg/l, well below the 0.2 mg/l permitted level. In Section 5.5.2.2 of the FES/OLS, the proposed chlorination treatments were not expected to meaningfully affect the overall biological productivity of WCCL. Because the actual monitored values were well below the evaluated levels and no fish mortalities due to chlorination were observed, permitted chlorine discharges during 1987 were not considered to have had appreciable effects on the cooling lake environment.

Allowance in the NPDES permit was provided to enable WCGS to discharge chlorinated water from the Service Water System (SWS) when the CWS was not operating. During the 1987 refueling outage, this situation existed. The CWS was taken out of service on October 7 and remained off-line until November 25, 1987. The SWS comprises approximately eight percent of the normal CWS flow. The WCGS operational need for higher TRC concentrations in the normal SWS flow was not of environmental concern because of the immediate dilution of chlorine levels once the SWS flow was combined with CWS discharge. Without CWS flow, however, the SWS discharged without dilution to WCCL. The KDHE acknowledged the need for this operational mode and allowance in the NPDES permit was provided to enable WCGS to collect real-time data before permit TRC limits would be established. Average TRC measured at the SWS confluence with the CWS was 1.0 mg/l. Analysis of this flow path at the WCCL discharge revealed an average of 0.6 mg/l TRC. The average daily chlorine dose to SWS during this period was 549 pounds. Both the observed average TRC and actual dose rates were within the ranges evaluated in the FES/OLS (0.68 to 1.08 mg/l TRC at 1233 pounds/day), within which chlorination effects were judged to be acceptable.

2.1.3 Cold Shock

In the event of a rapid decline in plant power level during winter, fishes attracted to the WCGS heated discharge could experience mortality due to "cold shock", a quick reduction in body temperature. In reference to licensing document evaluations, the WCGS EPP Section 2.1 (c) stated, "Cold

shock effects on fish due to reactor shutdowns could cause significant mortality to aquatic species in the cooling lake". In 1987, no major cold shock mortality events due to plant shutdowns were observed.

2.1.4 Impingement and Entrainment

Impacts of entrainment and impingement were projected to be significant in the WCGS EPP. Condenser mortality for entrained organisms was expected to approach 100%. Because of this, sampling efforts to monitor entrainment impacts were not required by the Nuclear Regulatory Commission (NRC) and have not been implemented by WCGS. Through casual observations, fish impingement at the WCCL circulating water intake was considered minimal, thus no sampling efforts to monitor impingement impacts have been implemented.

2.1.5 Impacts of Wolf Creek Cooling Lake Discharges to the Neosho River

Cooling lake discharges into the Neosho River are regulated by NPDES permit limitations. Since discharges are sporadic, water is sampled on the first day of each discharge and weekly until the end of each respective discharge. Effluent parameters measured include a flow rate estimate, temperature, pH, TDS, sulfate, and chloride concentration. Wolf Creek additions to the Neosho River are regulated to maintain a zone of passage for aquatic organisms at the confluence. Consequently, the flows allowable from WCCL may range from zero to unrestricted, depending upon the similarity between Wolf Creek and Neosho River water quality and temperature. A maximum of 90 ^{o}F is allowed in the Neosho River downstream of the mixing zone from Wolf

Creek. In 1987, no NPDES violations at the WCCL dam (Outfall 004) were recorded. Based on monitoring studies completed, there have been no apparent deleterious effects to Neosho River water quality or phytoplankton, macroinvertebrate or fish populations due to WCGS operations.

2.2 TERRESTRIAL [EPP Section 2.2]

2.2.1 Control of Vegetation in the Exclusion Zone

The composition and structure of vegetation in the 453 ha (1120 acre) exclusion zone were selectively controlled to be compatible with the function and security of station facilities. Most areas in the immediate vicinity of the power block have been planted and maintained in a lawn-type condition. Landscaping and grass establishment have not been entirely completed to date, however all areas have been mowed at least once annually for security and aesthetic purposes.

2.2.2 Vegetation Buffer Zone Surrounding Wolf Creek Cooling Lake

To create a 500 acre buffer zone around WCCL, all agricultural production activities were curtailed in 1980 below an approximate elevation of 1095' MSL, eight feet above WCCL normal operating surface water elevation (1087' MSL). This border ranges from approximately 200 to 400 feet adjacent to the lake shoreline. Previously grazed or hayed native tallgrass areas were allowed to return to a natural state. Cultivated lands were allowed to advance through natural successional stages. Land management activities specified in an annual land management plan included controlled burning and native tallgrass seeding to enhance and/or maintain the designated buffer zone with a naturally occurring biotic community.

2.2.3 Herbicide Use for Maintenance of Wolf Creek Generating Station Structures

A soil sterilant was applied on selected gravel areas of WCGS. These include the Protected Area Boundary, a lay-down storage yard, meteorology tower, support building borders, storage tank berms, switchyard, and on-site railroad beds. The herbicides applied consisted of 8 pounds of Karmex (EPA Reg. No. 352-247) and 4 to 6 pounds of Oust (EPA Reg. No. 352-401) per 100 gallons of water. Application rates ranged from 20-50 gallons per acre.

A weed and brush herbicide mixture was applied to selected problem areas within the transmission line right-of-ways associated with WCGS also during 1987. The Benton, LaCygne, and Rosehill 345 KV right-of-ways were treated. A wetting agent, a drift inhibitor, Garlon 3A (EPA Reg. No. 464-546), and Tordon 101 (EPA Reg. No. 464-306) were mixed in equal amounts to make a one percent solution of these chemicals with water.

All chemicals used were approved for use in Kansas. The applicator was a contractor commercially licensed by the Kansas Department of Agriculture. All label instructions were followed. No environmental problems were observed from herbicide treatment of WCGS facilities.

2.2.4 Waterfowl Disease Contingency Plan and Monitoring

A waterfowl disease contingency plan involving both state and federal personnel has been updated to provide more detailed guidance for station biologists in the event of

suspected or actual disease outbreaks. During routine wildlife monitoring and surveillance activities taking place over this reporting period, no avian mortality attributable to disease pathogens was identified.

2.2.5 Fog Monitoring Program [EPP Subsection 4.2.1]

Visibility monitoring was initiated in December 1983 and continued through 1987. The purpose of this study has been to evaluate the impact of waste heat dissipation from WCCL on fog occurrence along U.S. 75 near New Strawn, Kansas. A summary of fog monitoring activities is included in Attachment 1 of this report.

2.2.6 Wildlife Monitoring Program [EPP Subsection 4.2.2]

A wildlife monitoring program was initiated to monitor and assess wildlife populations or parameters most likely to be impacted by the operation of WCGS. As outlined in the 1986/1987 annual wildlife study plan, specific objectives of the wildlife monitoring program were to assess waterfowl, waterbird, and bald eagle usage of WCCL, to assess transmission line collision mortality of waterfowl using WCCL, to maintain a wildlife species list, and to develop an annual wildlife report. Wildlife monitoring activities are summarized in Attachment 1 of this report.

2.2.7 Land Management Program [EPP Subsection 4.2.3]

Land management activities on all company-owned lands except the 453 ha (1120 acre) WCGS exclusion area were designed to achieve balances between agricultural production and conservation values. An annual management

plan was formulated to address needs and propose accepted techniques for land maintenance, soil conservation, and wildlife management. These included construction or repair of livestock fences and ponds, and construction or establishment of terraces, waterways, and permanent vegetative cover. A summary of the 1987 Land Management Report appears in Attachment 1 of this report.

3.0 ENVIRONMENTAL PROTECTION PLAN REPORTING REQUIREMENTS

3.1 PLANT DESIGN OR OPERATING CHANGES [EPP Section 3.1]

Proposed plant design and operational changes which have the potential to affect the environment must receive an environmental evaluation prior to implementation. A summary of each Plant Modification Request or operating change which received an environmental evaluation prior to implementation in 1987 is presented. There were no changes in station design or operation nor were there tests or experiments which received evaluation that involved an unreviewed environmental question during 1987.

Evaluation 87-01 - Addition of Oil Drain Lines on Standby Diesel Generators

This evaluation covered the route change of waste drip oil from the standby diesel generators. The modification did not change the ultimate flow path through the oil/water separator, a NPDES permit monitored discharge. Since no changes would occur at the monitored NPDES outfall, it was concluded that this route change would not result in a significant increase in the evaluated level of environmental impact.

Evaluation 87-02 - Construction and Operation of the Wastewater Treatment Facility (includes 87-03 through 87-06).

This review is the final and overall evaluation for the Wastewater Treatment Facility (WTF). Specific evaluations (87-03 through 87-06) assessing environmental concerns with construction and operation of the WTF were completed during the design process. These evaluations revealed no significant environmental impacts. All of these culminate in this evaluation (87-02) of the actual environmental effects of long term operation of the WTF. Consequently these evaluations are not presented individually in this report.

In this evaluation it was determined that total dissolved solids (TDS) addition to WCCL would be of greatest concern. This parameter with the WTF in service would be increased by five percent over the levels predicted in the WCGS Environmental Report (Operating License State) [ER(OLS)]. When the ER(OLS) evaluated this, it was planned that sulfuric acid would be used to control condenser scaling. This system has not been put into service and is not likely to ever be used to the extent originally planned. Consequently, the WTF system without the sulfuric acid additions will comprise only about 10 percent of the TDS inputs which were designed and evaluated to enter WCCL.

Effluent pH safeguards and discharge pollutant levels were also considered. Discharges from the WTF will be tested twice for pH compliance prior to being released. The WTF effluent was also not expected to show any new or unusually high levels of pollutants that are environmentally dangerous. Past priority pollutant scans have not shown elevated pollutant levels, and WTF effluents are simply rerouting and treating past WCGS effluents.

Based on the small contribution that the WTF effluents are expected to make to TDS, the operational requirements of a back-up pH check prior to WTF release, and the lack of any dangerous pollutant increases, the environmental effects of the WTF system and its effluents were not expected to be significantly greater than those previously evaluated and permitted.

Evaluation 87-07 - Auxiliary Boiler Minimum Load Requirement Vent to Atmosphere.

This evaluation involves a modification completed to allow excess steam from the Auxiliary Boiler to be vented to the atmosphere if required. No radiological concerns are involved with this evaluation. These intermittent steam releases were evaluated with respect to noise disturbances to the environment. Based on the remoteness of WCGS and the infrequency of releases, no increase in previously evaluated impacts were expected.

Evaluation 87-08 - Oily Waste Interceptor Reroute through High TDS Tank

This evaluation covered the by-passing of NPDES Outfall 002 effluent from the oily waste interceptor to the high TDS tank for pH neutralization before being released to its normal Outfall 002 discharge point. This rerouting would allow for greater NPDES pH compliance at this outfall and thus result in a positive net environmental effect. No adverse environmental impacts were anticipated.

Evaluation 87-09 - Aquatic Weed Harvest and Weed Disposal on WCCL

Development of submersed macrophytes of the genus Potamogeton have created operational impingement problems. Mechanical removal of problem weed beds was considered by WCGS management to be most

feasible, economically and environmentally. This evaluation covered the effects on WCCL of the entrapment and removal with the weeds of WCCL fishes. It was calculated that 1/6 of the pondweed present in WCCL would be removed. In addition, a mortality estimate was achieved by counting the fishes in a one cubic-yard subsample. An estimate of 2700 fish, almost all young-of-the-year bluegill, would be trapped during one season of harvest. These losses will not noticeably impact the cooling lake fishery. This conclusion was based on the high natural mortality typically experienced by young bluegill, their tendency for multiple spawns, their ability to avoid capture more easily with increasing size, and the delayed pondweed harvest anticipated in future seasons.

Evaluation 87-10 - Erosion Repair and Stream Crossing Maintenance of WCGS Railroad Spur

This evaluation covers the repair and maintenance of the railroad easement. Some repairs involved lands outside easement boundaries and as such have not been previously evaluated. All repairs were less than one acre in size. All disturbed soil was reseeded with a quick growing cover grass to reduce initial storm erosion. Native grasses were planted to "takeover" and provide a natural cover typical of a bluestem prairie referenced in the FES/OLS. On stream crossings, mechanical removal of problem trees was employed. No herbicides were used. Given the small size of the repairs, the restoration practices in these areas, the methods of controlling problem trees, and the actual long term benefits of the habitat diversity created by the maintenance of the railroad, no adverse environmental effects were expected.

Evaluation 87-11 - Temporary Modification to Defeat a Low Dilution Water Flow Switch

This evaluation covers a temporary modification to bypass a low dilution water flow switch to allow a Radwaste discharge to NPDES Outfall 003a when CWS is not running. It was assumed in this evaluation that discharge rates to Outfall 003a could be controlled to adequately dilute with SWS flow and thus remove the chance of violating pH limitations at the outfall. This is normally no problem when discharged when CWS is operating. No increases in chemical constituents regulated at this outfall were expected given the dilution considerations. No adverse environmental impacts were expected.

Evaluation 87-12 - Water Removal from Duct Bank Manholes

Increases of water flow through NPDES Outfall 002 were evaluated. Removing excess storm water seepage via a new sump pump from the duct bank manholes was not expected to cause environmental impacts. This conclusion is based on the relatively low volume expected, the short duration of each pumping event, and the seasonal infrequency of storm events.

3.2 NON-ROUTINE ENVIRONMENTAL REPORTS

3.2.1 Submitted Non-Routine Reports

No non-routine environmental reports involving significant impact were submitted to the NRC during 1987.

3.2.2 Unusual or Important Environmental Event Evaluations

No unusual or important environmental events reportable under specifications in the EPP were identified during 1987.

3.3 ENVIRONMENTAL NONCOMPLIANCES [EPP Subsection 5.4.1]

At WCGS in 1987, environmental noncompliances were recorded along with the events surrounding them. Noteworthy noncompliances included minor oil spill and fish kill events, deviations from NPDES permit criteria, fog monitoring delays, hazardous waste discharges, and late or mishandled ecological samples and evaluations. These noncompliances were evaluated and determined not to be reportable pursuant to EPP Section 5.4.1.

ATTACHMENT 1

SUMMARY OF

ENVIRONMENTAL INVESTIGATIONS

AT WOLF CREEK GENERATING STATION, 1987

Wolf Creek Nuclear Operating Corporation

Environmental Management

Burlington, Kansas

1. 1987 LAND MANAGEMENT REPORT

This report assessed the implementation of the 1987 Land Management Plan for WCGS. Unanticipated activities are also presented. This land management plan only includes the mostly agricultural lands around the WCCL. Management of landscaped property associated with the power block area, switchyard, and other plant support buildings was not part of the program. Four main objectives were targeted:

1. to reduce soil loss on agricultural and "old-field" areas

2. maintain or increase agricultural production while enhancing wildlife benefits

3. establish, improve, and/or maintain the native grass areas

4. improve wildlife potential on non-agricultural lands

To achieve these goals, various methods were employed. These activities included controlled burning, native grass seeding, and construction of waterways, terraces, and fences. Some objectives were achieved via stipulations in agricultural leases. Company lands were managed for agricultural benefits, enhancement of wildlife, conservation of soil, and native plant resource improvement during 1987.

2. 1987 EA, ENGINEERING, SCIENCE, AND TECHNOLOGY ENVIRONMENTAL MONITORING REPORT

Environmental monitoring completed by EA, Engineering, Science, and Technology Inc., a consultant, included studies on the Neosho River, WCCL, and adjacent lands. Objectives accomplished by these studies were:

1. documentation of concentrations of general water quality parameters, aquatic nutrients, organically-derived materials and certain trace metals in the Neosho River and WCCL

2. determination of general groundwater quality in the vicinity of the WCCL

3. characterization of the Neosho River and WCCL benthic communities

4. determination of phytoplankton productivity of the Neosho River and WCCL

5. determination of zooplankton biomass in WCCL

6. characterization of the Neosho River fishery

Water quality studies in the Neosho River near WCCL have been conducted since 1973. Seasonal mean concentrations of water quality parameters during 1987 were within previously established ranges for the study area. Water quality among river locations was similar though slight natural differences between the JRR tailwaters (Location 1) and the lower river (Locations 4 and 10) were apparent. Seasonal differences observed during 1987 and previous years reflect changes in discharge rates from JRR and runoff due to local precipitation and snowmelt events. Since filling of WCCL began in 1981, flows from Wolf Creek into the Neosho River have been limited to seepage, releases for testing of blowdown procedures, and runoff events. There have been no apparent deleterious effects to water quality in the Neosho River due to operation of WCGS based on available water quality monitoring data.

Water quality studies of WCCL began when the lake was initially filled during 1981. Water quality was greatly influenced by makeup water being pumped from the Neosho River during that year. Since 1982 makeup water has generally been added during routine use of the auxiliary raw water pumps and

quarterly testing of the makeup water pumps. Therefore, WCCL water quality has been generally independent from influence of the Neosho River. Concentrations of water quality parameters were very similar among locations in the cooling lake, with the shallow upstream site (Location 2) slightly different in water quality than near the main dam (Location 6) and the station intake (Location 8). Concentrations of dissolved and suspended constituents continued to show declining trends since operation of WCGS began, indicating an improvement in overall water quality. Surface water temperature in the cooling lake during spring and summer periods has been warmer than in preoperation years (particularly Location 2) as is expected due to plant operation. There appears to be a slight trend of increasing concentrations of iron and sulfate in the cooling lake; however, this trend does not appear to indicate adverse impact from plant operations but rather natural changes in impounded water.

Groundwater data collected near WCGS since 1973 have shown that quality of well water varied widely among wells. Data collected during 1987 indicated water quality parameters from the monitoring wells were within concentration ranges observed in previous studies with few exceptions; some dissolved constituents (Cl, Mg, and Fe) were lower in one or more wells in 1987 than in previous years. Well water at the monitoring sites has typically been very hard with high levels of dissolved constituents. Water quality in the wells tend to reflect shallow perched water resulting from precipitation and runoff. These observations have not changed since dam closure of WCCL or after WCGS has begun operation.

Macroinvertebrate studies of the Neosho River at JRR tailwaters as well as upstream and downstream of the confluence with Wolf Creek have been conducted since 1973. Aquatic oligochaetes, mayflies, stoneflies, net-spinning caddisflies, and midge flies have been dominant organisms. No long-term patterns, empirical, or statistical differences have been found that suggested any alterations attributable to the construction and/or

operation of WCCL and WCGS. The data have been highly variable which has been attributed to fluctuating river flows that undoubtedly affect organism abundances but also greatly influence sampling efficiencies.

The macroinvertebrate monitoring program on the Neosho River was reimplemented in 1985 to coincide with startup of WCGS after the program was discontinued in 1982. High, variable flows in 1985 resulted in low sample recovery and benthic densities that approached the lowest recorded since monitoring was initiated in 1973. Species richness and abundance improved substantially in 1986 as flows were comparatively stable and low. In 1987, the number of taxa encountered remained stable, and mean annual ponar density exhibited continued improvement. The potential for WCGS to impact the Neosho River macroinvertebrate community has been minimal based on low diversion rates from JRR tailwaters and the lack of substantial discharge from WCCL.

Benthic macroinvertebrates in WCCL have been sampled bimonthly since 1981 when the cooling lake was initially filled. The benthic fauna of WCCL is fairly typical of lakes in general and midwestern reservoirs in particular. Quantitative dissimilarities in the faunas from the three sampling sites reflected differences in respective depths, substrate composition, and organic matter content. The data have exhibited high annual variation from 1981 through 1987 that likely reflects various ecological, climatic, and limnological factors. Operation of WCGS caused no apparent changes in the macroinvertebrate community during the initial two years of operation.

Although mean annual benthic macroinvertebrate densities in 1987 (170 organisms/m^2) were at a low for the seven-year study, densities declined annually through 1984 after peaking in 1982 (1,521/m^2). Mean annual densities increased slightly in 1985 (332/m^2), the first year of station operation, but have since continued to decline. Downlake densities at the deepwater (17-22 m) location near the main dam were primarily responsible for the annual trend. At the organism level, primarily oligochaetes and

chironomids influenced the trend as both groups declined annually after peaking in 1982 except for tubificids which recovered in 1985 and then declined to relatively low densities in 1986 and 1987. The 1985 recovery was due almost exclusively to mean annual tubificid densities at Location 6, which were the second highest recorded for the WCCL study. Apparent changes in WCCL benthos reflect normal responses of pioneer organisms to newly-filled reservoirs and could be expected independent of WCGS operation.

Phytoplankton chlorophyll a concentrations and carbon fixation rates in the Neosho River from the tailwaters of JRR to below the confluence with Wolf Creek have been monitored since 1973. Flow in the study area is controlled by releases from JRR. During periods of moderate to high flows, chlorophyll concentrations and fixation rates immediately upstream and downstream of the confluence with the creek were very similar to those observed in the tailwaters. During low flow conditions, values for both parameters immediately upstream of Wolf Creek were often different (usually but not always higher) than those observed at the other locations. In 1987, both the average annual chlorophyll concentration (27.38 mg/m^3) and carbon fixation rate (29.86 mg $C/m^3/hr$) were within the respective ranges (3.81-63.38 mg Chl a/m^3, 12.18-238.22 mg $C/m^3/hr$) observed for previous annual averages. The 1987 results reflected a return to more normal conditions after the high phytoplankton values resulting from the generally low river flow of 1986. There has been no indication that adverse effects on the phytoplankton of the Neosho River have occurred as a result of the construction and operation of WCGS.

Phytoplankton chlorophyll a concentrations and carbon fixation rates (surface samples) as well as zooplankton biomass (vertical tows) in the WCGS cooling lake have been monitored bimonthly since initial lake filling in 1981. Average annual chlorophyll a concentrations declined by approximately 30 percent from 1981 to 1982, remained fairly stable from 1982 through 1984, and returned to near 1981 levels in 1985 and 1986. The annual value in 1987 declined by approximately 35 percent to 6.6 mg/m^3 and was below the previous range (7.5-11.0 mg/m^3) of annual values. Temporally, phytoplankton standing

crop has been generally greatest in late summer or early autumn, and spatially, it has generally been least in the downlake deep water location near the dam. However, exceptions to these general patterns have been observed, and chlorophyll concentrations were unusually high in October and December 1985 and April 1986. Carbon fixation rates have been strongly influenced by phytoplankton standing crop as well as natural variations in ambient conditions (e.g. temperature), and as a result fixation rates have revealed few consistent spatial or temporal trends. Unlike 1986 when unusually high fixation rates were common, the annual mean rate in 1987 (9.1 mg $C/m^3/hr$) was slightly below the previously observed range of annual values (11.7-64.4 mg $C/m^3/hr$).

Average annual zooplankton biomass, both dry and ash-free dry weights, declined from 1981 through 1984, although dry weight biomass appeared to stabilize in 1983 and 1984. Ash-free dry weight increased from (40 mg/m^3) in 1984 to 67 mg/m^3 in 1985 and 92 mg/m^3 in 1986, and then declined to 53 mg/m^3 in 1987. Dry weight peaked in 1985 (234 mg/m^3) and has since progressively declined in 1986 (154 mg/m^3) and 1987 (123 mg/m^3). Average annual dry weight in 1987 was less than that obvserved during lake filling in 1981 but greater than the 66 mg/m^3 minimum of 1984. Few consistent spatial and temporal trends have been observed for zooplankton biomass, but there has been a tendency for greater biomass in the up-lake shallower water and for greater biomass in late winter or early spring from 1981-1985 with spring and fall peaks in 1985 and 1986. A spring peak also occurred in 1987, but zooplankton sampling was discontinued before the normal period of the fall peak.

Annual trends in phytoplankton and zooplankton through 1984 were considered representative of a new lake that was initially filled with eutrophic water and then gradually assumed its own character. Increases in plankton apparent in 1985 and 1986 were considered primarily a response to natural factors although operational effects of the thermal discharge and altered lake circulation patterns associated with WCGS start-up may have been

contributing factors. Plankton declines to normal levels during WCGS operation in 1987 support the conclusion that station operation is not adversely affecting plankton production. Based on average annual chlorophyll a concentrations, the WCGS cooling lake remains in the mesotrophic classification.

The fish community in the Neosho River at the JRR tailwaters, and above and below the confluence with Wolf Creek has been monitored since 1973. The study was curtailed in 1981 and discontinued from 1982-1984 before reinstatement in 1985 to coincide with startup of WCGS. Potential operational effects of WCGS on the fishery were limited to diversion of water from JRR tailwaters for raw water and/or makeup water for WCCL and the effect discharges from WCCL would have downstream of the confluence with Wolf Creek. Maximum diversion of river water occurred from August 2 to 11, 1987, when use of two make-up water pumps diverted 100 cfs which was equivalent to 41 percent of the mean daily discharge from JRR during that period. Maximum diversion of river water based on mean monthly flows also occurred in August 1987 (3.1 percent) and was higher than previous maxima observed in June 1986 (0.4 percent). Closure of the WCCL dam eliminated flood stage flows in Wolf Creek and generally improved the water quality.

Trends in electrofishing and seining data between locations upstream and downstream of the Wolf Creek confluence suggested changes in Wolf Creek due to WCCL and operation of WCGS had no effects on the Neosho River fishery. Overall, few long-term trends were apparent and annual differences were related to natural variability, releases from JRR, and river flows which influenced gear efficiency. Changes in electrofishing gear that occurred in 1981 contributed to lower catches during the operational study. Catch data did not reflect potential influences of commercial fishing in 1980, impingement losses at the WCGS makeup water screenhouse in 1981, or a documented fish kill in August in 1986.

3. OCCURRENCE AND ABUNDANCE OF ASIATIC CLAMS (*Corbicula fluminea*)

The Asiatic clam (*Corbicula fluminea*) has been reported to cause biofouling problems in power plant cooling systems. The first report of *Corbicula* near WCGS was August 1986 when immature clams were collected at long-term monitoring sites located on the Neosho River upstream and downstream of the confluence with Wolf Creek. To compliment the on-going ecological monitoring program, a discrete survey was conducted during the fall of 1987 to identify the distribution of *Corbicula* in the vicinity of WCGS. This late summer effort will be continued annually. This report presents the findings of this survey and combines it with information gathered during the ecological monitoring studies.

During the special *Corbicula* survey, 51 discrete sampling efforts were completed of which included 23 efforts in WCCL, three in Wolf Creek, and 14 below and 11 above JRR in the Neosho River. Only four specimens were collected, three downstream of the Burlington low-water dam and one near the U.S. 75 bridge. These locations are on the Neosho River below the JRR dam. No *Corbicula* were found at the WCCL makeup pumps located near the JRR spillway, nor were any found upstream of JRR. Similarly, searches on WCCL yielded no evidence of *Corbicula*.

At standardized monitoring locations in the Neosho River upstream and downstream of the Wolf Creek confluence, established *Corbicula* populations apparently have developed. During the WCGS Ecological Monitoring Program, four were collected in 1986 and 46 during 1987 at these locations. Disarticulated shells were readily found along the river banks. As during the special survey, none were located in WCCL.

The apparent lack of *Corbicula* upstream of JRR minimizes the potential that it will become established in WCCL. It is generally accepted that other than man mediated dispersion, downstream drift of the planktonic larval stage is the main factor affecting range extensions. Therefore, before

Corbicula could be introduced in WCCL via makeup water, it would have to occur upstream in JRR. Although Corbicula has been found in most substrates, suggested preferred substrates are not present in the Neosho River immediately below or in JRR. This condition should further decrease the likelihood of Corbicula pioneering into WCCL. Thus far, monitoring in the vicinity of WCGS has shown Corbicula far below nuisance levels. Success of establishment in WCCL is limited but the potential for introduction exists provided the river population remains established. Future annual surveys should monitor population trends and document local range extensions near WCGS.

4. FISHERY MONITORING ACTIVITIES
1987

Fishery monitoring surveys were conducted on WCCL near WCGS, Coffey County, Kansas from April through October 1987. These resulted in the collection of 4,037 fish representing 11 families and 30 species. Data collected were used to describe the fishery which was subsequently evaluated based on the goal of increased plant reliability through reduced gizzard shad impingement. Plant operations began in October 1985 and have shown no adverse impact on the fishery thus far. As of 1987, bluegills, gizzard shad and green sunfish, three prey species, occupied the top three abundance positions with 23.5%, 21.4% and 10.6%, respectively, of the total fish caught in the standardized effort. Next in abundance came predators with largemouth bass, white crappie, black crappie, white bass, walleye, smallmouth bass and wipers ranging from 7.2% to 2.5%. When the total biomass of all fishes captured in the standardized effort is considered, the common carp reached the top place at 17.3% in 1987 after continuing its trend of slow increase. Largemouth bass dropped by more than 1/3 from 1986 to 1987 going from first (18.8%) to third (11.9%). Wipers remained steady at 13.8% in 1987. Walleye (9.4%), white crappie (8.9%), channel catfish (7.1%), white bass (6.4%), black crappie (5.7%) and smallmouth buffalo (5.2%) occupied positions 4 through 9, respectively, in percent biomass. Gizzard shad biomass was tenth highest and was 3.6% of the total in 1987.

Growth and body condition data using Proportional and Relative Stock Density (PSD, RSD), relative weight (Wr) and condition factor (K_{TL}) continue to show large average sizes, slowing growth and low to moderate condition for Wolf Creek predators. Wiper growth continues but at more modest rates than in its earliest years. Growth of WCCL's initial largemouth bass year classes also has slowed greatly. Growth of crappies, white bass, and walleyes continues at moderate rates. For all Wolf Creek predators, average sizes are large and the proportion of mature fish (quality size and larger) versus smaller, immature fish (stock size) is also large, leading to very high PSD's. At the same time, condition of these predators is lower than the averages from other Kansas impoundments. In contrast, both gizzard shad PSD and Wr values are close to the top of reservoirs surveyed in Kansas. While these qualities in shad have been shown to be optimal for production of a good prey base, few YOY gizzard shad in WCCL remain through their first winter. Little or no survival of the last three year classes of gizzard shad indicate that the combination of predation pressure and winterkill are adequate to control expansion of the WCCL shad population. Thus, no impingement problems have been experienced thus far. The sportfish/roughfish ratio in Wolf Creek is very high when compared with other reservoirs in the midsection of the U.S. The unusually low number of gizzard shad and equally unusually high number of predators in WCCL mean predator condition is low but more importantly, so are impingment rates.

5. FOG MONITORING ACTIVITIES

The fog monitoring study was initiated in December 1983. The purpose of the study was to assess the impact of waste heat dissipation from WCCL operations on the occurrence of fog along U.S. Route 75 in New Strawn, Kansas. Visibility was monitored continuously at New Strawn with an instrument that utilizes a light scattering measurement technique. Monitoring was scheduled throughout the year except for the months of June, July, and August. A total of 6,984 hours of preoperational phase visibility data was

collected prior to commencement of full power operations at WCGS on June 4, 1985. This database was used to represent baseline conditions of "natural" fog occurrence in the site vicinity.

Operational phase monitoring was conducted through May 1986. A total of 4,775 hours of operational data was collected during periods when WCGS was operating at or near full power. Although completion of visibility monitoring at the conclusion of this initial year of commercial operations fulfilled all WCGS commitments relevant to the fog study, the 1986 Annual Environmental Operating report expressed the intentions of the Environmental Management Group to conduct additional visibility monitoring during the period from September 1987 through February 1988. The reasons for conducting additional monitoring included (1) increasing the size of the operational phase database, particularly for the autumn months where data was lacking and (2) changing the methodology such that the effect of fog enhancement due to cooling lake operations could be more thoroughly evaluated. Fog enhancement is the process where existing natural fog is made more dense by the addition of moisture from the warm surface of the cooling lake. Unfortunately, a series of instrument malfunctions delayed the scheduled start of monitoring to the point where it became obvious that little or no additional data could be collected during the 1987-88 monitoring season. This represented the second consecutive winter season that monitoring could not be conducted due to instrument malfunctions. Because sufficient data was available to evaluate cooling lake fogging and all commitments relevant to the fog study had been satisfied, it was decided that the benefits to be gained from collecting additional data were outweighed by the delay that this effort would entail. Consequently, the additional monitoring was cancelled and a summary report of the entire fog study was completed in March 1988.

Visibility data were analyzed for this study primarily through the use of several indices which could reasonably be expected to provide an indication of increased fogging due to WCCL operations. While the final analysis

showed that these indices were not in total agreement, the results were in sufficient agreement to confidently conclude that there was no appreciable increase in fogging at the monitoring site that was attributable to WCGS operations. The results also suggested that the magnitude of normal year-to-year fluctuations in the frequency of natural fog is probably far greater than any changes in fog frequency due to cooling lake effects.

The frequency of "natural" fog recorded during the preoperational phase was determined to be 4.0 percent. Against this benchmark, fog frequency declined to 3.1 percent during WCGS operations. Since it was expected that cooling lake induced fogging would be most prevalent during the winter months, a seasonal breakdown of fog frequency was also performed. This analysis showed that the frequency of fog occurrence during the operational phase winter of 1985-86 declined to 4.3 percent compared to a value of 6.9 percent for the preoperational phase winter of 1984-85. These results were considered highly representative of the respective winter seasons since the availability of visibility data was above 95 percent during both winters.

The frequency with which southeasterly winds occurred in conjunction with fog events was considered to be a more reliable indicator of the influence of cooling lake operations than fog frequency. This is because the monitoring site was located northwest of the WCCL discharge cove, making southeasterly winds a prerequisite for the transport of cooling lake induced fog to the monitoring site. Southeasterly winds occurred during 25 percent of all fog-hours recorded during the preoperational phase, but during only 13.5 percent of all operational phase fog-hours. This trend was most pronounced when comparing the preoperational and operational phase winters, where the decline was from 30.0 percent to 7.6 percent. This is convincing evidence that cooling lake operations did not appreciably affect fogging at the monitoring site during WCGS operations.

The only index utilized in this study that suggested some influence of cooling lake operations was the frequency of dense fog relative to total fog. Dense fog was analyzed separately from other fog events because it has

the most detrimental effect with respect to driving impairment. The frequency of dense fog relative to total fog increased from 24.7 percent during preoperations to 28.6 percent during operations. However, the importance of this increase was diminished by the fact that the frequency of critical southeasterly winds during occurrences of dense fog decreased to 26 percent during plant operations compared to a preoperational baseline value of 38 percent. Therefore, the increase in dense fog frequency at the monitoring site was most likely due to natural fluctuations.

The results of analyses for the persistence of fog episodes and the visibility class distribution of fog-hours were inconclusive. An average fog episode during the operational phase was shorter than a preoperational phase fog episode, but the magnitude of the decrease was insufficient to determine whether a trend was present. Similarly, a decrease was noted for average visibility of operational phase fog-hours, but the magnitude of this decline was not significant.

Rather than rely solely on the aforementioned indices to detect the presence of man-made fog from the cooling lake, a search of the data base was conducted for individual fog episodes potentially of cooling lake origin which may have gone undetected by the other analyses. Only eight days during the entire operational phase were identified as having this potential. However, all fog occurring on each of those days was judged to be of natural origin. This judgement was based on a review of local visibility observations made by site personnel as well as regional observations by the National Weather Service.

While this study has concluded that cooling lake operations did not cause an appreciable increase in fogging at the monitoring site in New Strawn, it did not conclude that man-made fog from WCCL will never pose a problem along Route 75. First, it must be considered that weather conditions during the operational phase of the study may not have been conducive for the initiation of steam fog or the subsequent transport of this fog to the monitoring

site. An increased frequency of southeasterly winds coinciding with favorable conditions for fog development may, in future years, cause fogging to become more frequent at the former monitoring site. Secondly, although the location chosen for monitoring was predicted to have the highest potential to experience fogging events resulting from cooling lake operations, there may have been undetected episodes of cooling lake induced fog along other portions of Route 75. Such an event was actually observed in February 1986 following the completion of operational phase monitoring. Although this event was viewed as an isolated incident, additional documentation and evaluation would be warranted if such events are found to occur frequently.

6. WILDLIFE MONITORING ACTIVITIES
September 1986 through April 1987

Avian density and diversity observed during operation of WCGS were similar to preoperational studies. An annual operational average of 131 different species were observed. This average represents an 11 percent decrease from the three year preoperational average of 147 species. During 1986-1987 monitoring, three new species were observed, bringing the total number of bird species observed in the vicinity of WCGS to 230 since monitoring began. Establishment of WCCL has resulted in an increase in species diversity observed in the local area. Annual species diversities have increased approximately 50 percent above those observed prior to lake filling. This was expected as the lake provided numerous waterbird habitats while upland areas supported similar bird populations present prior to lake filling. Detectable differences due to station operation were not found.

During the 1986-1987 monitoring, 47 water-related species were observed on the cooling lake during waterfowl and waterbird surveys. Large numbers utilized WCCL during migration and a general increase over preoperational totals was observed. Most species observed used JRR to a greater extent than WCCL.

Threatened or endangered species observed since 1973 included the white-faced ibis, bald eagle, peregrine falcon, prairie falcon, and interior least tern. Bald eagles were common winter residents using WCCL primarily as a feeding and loafing site. The prairie falcon was removed and the white-faced ibis was added to the Kansas threatened list as of May 1987. These species migrate through or infrequently visit the area and can be expected to be observed in the future.

Bald eagle usage on WCCL declined since plant operations while remaining consistent on JRR. Operational usage on WCCL declined, it was assumed, because larger numbers of a more vulnerable and preferred food resources (primarily gizzard shad) were available on JRR than WCCL. Bald eagle usage during severe winter periods with WCGS operating could not be characterized because no harsh winters have occurred.

Waterbird usage was similar between the two lakes. American coots used WCCL to a much greater extent than JRR. Pondweed development was thought to be the primary reason for this. Double-crested cormorants used both lakes similarly. It was apparent that JRR provided easier foraging habitat while WCCL supplied roosting and nesting sites.

Of the ducks observed on both reservoirs, fluctuating water levels on JRR appeared to greatly influence the distribution between the lakes of early fall migrants. During periods of little fluctuation on JRR, WCCL with its aquatic macrophyte growth appeared to attract these ducks, especially during the 1984-1985 preoperational study. Continued use of these weed beds was not evident during operational studies. With high water levels on JRR, this influence was over-shadowed by the attractiveness of JRR. The operation of WCGS greatly influenced the duck distribution between the two lakes during late winter. The heated effluent kept most of WCCL ice-free, providing previously unavailable late winter habitat. This, in combination with seclusion and close, abundant food supplies, appeared to keep ducks on WCCL longer than during preoperational seasons. Spring ducks were attracted to JRR almost exclusively over WCCL as during preoperational seasons.

Goose distribution between the two reservoirs was similar to preoperational seasons. The increasing trend evidenced during previous years was continued during the 1986-1987 operational year to the point where more Canada geese were observed on WCCL than on JRR.

During operational monitoring, it was shown that mallards, snow geese, and, to a lesser extent, Canada geese increased on WCCL during winter periods when ice formation on JRR was present. Although the ice-free condition was probably a major factor, it was evident that wind protection, hunter refuge, and/or high food availability also contributed. The area where these factors were most prevalent on WCCL was preferred by mallards and snow geese. Large waterfowl concentrations may cause problems with crop depredations and disease outbreaks. However, these concentrations, it is felt, have not reached levels high enough to cause wide-spread crop depredation problems. Given similar usage patterns in the future, mallards and snow geese may be expected to have the greatest potential for causing depredation problems at WCCL. This is because these species occur in the largest numbers and have consistently crowded in areas of WCCL at times when late-harvested crops are most vulnerable. Canada geese, although using the same crop types and at peak numbers during the same time periods, at this time should not pose as great a threat because they have tended to occur in smaller concentrations around the cooling lake. Although waterfowl disease outbreaks have not been observed, potential areas of concern will be similar as for crop depredation events because of the consistent use of the same areas.

Results of collision surveys revealed similar mortality rates to those previously documented. Ten species were identified during the study. No threatened or endangered species were found during these surveys. No significant relationships were found between the number of collision mortalities and the total use of the area by live birds. It was concluded that collisions with transmission facilities associated with WCCL during station operation did not cause sufficient avian mortality to be considered problematic.

Twenty-five mammalian and 12 herptile species were documented of which one mammal was not previously reported. No threatened or endangered species were observed.

An increase in avian species diversity due to lake filling was identified by preoperational studies. Plant operation has not altered this. The major operational effect identified was the increase of wintering waterfowl likely caused by ice-free water on WCCL. However, no identifiable problems were observed as a result of this. No significant increases in avian collisions with transmission lines due to station operation were observed and this continues to have little impact.

October through December 1987

This synopsis provides a summary of wildlife data collected from October through December 1987 as part of the 1987/1988 Operational Wildlife Monitoring Program. These data are not presented in the report summarized above. Waterfowl and waterbird counts and transmission line collision surveys were continued. Special attention was given to both state and federally listed threatened and endangered wildlife species occurring in the vicinity of WCGS.

A total of 35 waterfowl and waterbird species were observed during 13 ground counts during fall and early winter of 1987. The most abundant species were the mallard, American coot, and Franklin's gull making up 57, 20, and nine percent of the total, respectively. This is similar to past monitoring seasons, however, since no surveys were completed during September, 1987 as in past years, the percentage rankings changed favoring later migrating waterfowl, especially mallards. Apparent factors influencing usage of WCCL continue to include relatively clear water, seclusion, wind protected coves, concentrations of aquatic weed growth, and availability of agricultural fields. Heated effluents influenced waterfowl usage very little to none at all as WCGS was not operating due to a refueling outage throughout most of

this time period. No identifiable crop depredation or disease problems were present among waterfowl concentration on WCCL during the fall and early winter of 1987.

Transmission line collision surveys were completed in November and December, 1987. Sixteen mortalities representing five different species were found. No mortality of threatened or endangered species were observed. All specimens positively identified were waterbirds associated with WCCL habitat. None of the collision events observed during the fall and early winter of 1987 were considered detrimental to the populations using WCCL.

The bald eagle was the only threatened or endangered species observed using WCCL. As during past studies, the eagles were common winter residents first appearing during late November, 1987. The cooling lake was used as a feeding and loafing site primarily, however not to the extent observed on JRR. No changes in bald eagle usage of WCCL during the fall and early winter of 1987 were identified.

WOLF CREEK
NUCLEAR OPERATING CORPORATION

Bart D. Withers
President and
Chief Executive Officer

April 26, 1988

WM 88-0105

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Subject: Docket No. 50-482: Annual Environmental Operating Report

Gentlemen:

Attached is the Annual Environmental Operating Report which is being submitted pursuant to Wolf Creek Generating Station Facility Operating License NPF-42, Appendix B. This report covers the operation of Wolf Creek Generating Station for the period of January 1, 1987 to December 31, 1987.

Very truly yours,

BDWithers

Bart D. Withers
President and
Chief Executive Officer

BDW/jad

Attachment

cc: B. L. Bartlett (NRC), w/a
R. D. Martin (NRC), w/a
P. W. O'Connor (NRC), 2 w/a

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