WOLF CREEK
NUCLEAR OPERATING CORPORATION

John A. Bailey
Vice President
Nuclear Operations

May 1, 1990
NO 90-0142

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-137
Washington, D. C. 20555

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

Gentlemen:

Enclosed is the Annual Environmental Operating Report which is being submitted pursuant to Wolf Creek Generating Station (WCGS) Facility Operating License NPF-42, Appendix B. This report covers the operation of Wolf Creek Generating Station for the period of January 1, 1989 to December 31, 1989.

Very truly yours,

John A. Bailey

John A. Bailey
Vice President
Nuclear Operations

JAB/jra

Enclosure

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Attachment to NO 90-0142

WCNOC EM 02-90

WOLF CREEK GENERATING STATION

ANNUAL ENVIRONMENTAL OPERATING REPORT

1989

ENVIRONMENTAL MANAGEMENT SECTION

WOLF CREEK NUCLEAR OPERATING CORPORATION

P.O. BOX 411

BURLINGTON, KS 66839

APRIL 1990

WOLF CREEK NUCLEAR OPERATING CORPORATION
WOLF CREEK GENERATING STATION

1989 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 1989 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 operated during 1989 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 pump 9.672 billion gallons per calendar year from the tailwaters of the John Redmond Reservoir (JRR) to Wolf Creek Cooling Lake (WCCL). During 1989, 2.914 billion gallons or 30 percent of the contracted allotment were pumped. Auxiliary raw water was pumped at a rate of approximately 1.3 million gallons per day which comprises about 12 percent of the total pumped. The remainder was transferred via the make-up pumps operated from March 20 through April 6 and from May 1 through May 18, 1989. The flows in the Neosho River that were measured by the United States Geological Survey at Burlington during these

pumping periods were consistent with those measured prior to and after pumping. This indicates that pumping activities during 1989 only withdrew water from JRR and did not reduce Neosho River flows downstream. Consequently, no changes to the river water quality or phytoplankton biomass attributable to the withdrawals were expected and, based on monitoring studies completed during the year, none have been witnessed.

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 to the CWS have averaged approximately 61 pounds per day. Compliance with the permit limits for daily maximum TRC and chlorination dose durations were 100 percent. Monitoring during 1989 detected a daily 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 during CWS chlorination were well below the evaluated levels and no fish mortalities attributable to chlorination were observed, permitted chlorine discharges during 1989 were not considered to have had appreciable effects on the cooling lake environment.

A different operational mode used during 1989 resulted in a second chlorine discharge route to the cooling lake. A portion of the Service Water System (SWS) flow was diverted to the Essential Service Water System (ESWS) and discharged to the Ultimate Heat Sink (UHS), which is part of the cooling lake. This was done to supply warming lines that prevent ice formation at the ESWS intake. This diverted flow was continuous and had no additional chlorine added over that normally dosed to the SWS. The KDHE approved this discharge and limited TRC concentration to 1.0 mg/l. This flow was monitored as a new NPDES outfall. When flows were discharged to this outfall, measured TRC concentrations ranged from 0.0 to 0.9 mg/l. This range is within the evaluated range of 0.68 to 1.08 mg/l TRC, which was judged to be acceptable (Section 5.5.2.2, FES/OLS).

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) states, "Cold shock effects on fish due to reactor shutdowns could cause significant mortality to aquatic species in the cooling lake". In 1989, one cold shock mortality event due to plant operation was observed. This event was judged not to be greater than cold shock impacts anticipated in licensing documents.

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, chiefly from stormwater runoff and infrequent blowdowns, water is sampled on the first day of each discharge and weekly thereafter until the end of each respective discharge. Effluent parameters measured include a flow rate estimate, temperature, pH, TDS, sulfate, and chloride concentration. Discharges are regulated to

maintain a zone of passage in the Neosho River for aquatic organisms at the Wolf Creek confluence. Consequently, the flows allowed from WCCL may range from zero to unrestricted, depending upon the water quality and temperature similarities with the Neosho River. A maximum of 90 ^{o}F is allowed in the Neosho River downstream of the mixing zone from Wolf Creek. In 1989, no NPDES violations at the WCCL discharge were observed. At no time did water quality criteria restrict WCCL discharge to the Neosho River. Based on monitoring studies completed, there have been no apparent deleterious effects to Neosho River water quality or phytoplankton biomass due to WCCL discharges.

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. Other areas within the exclusion area have been mowed 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, 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 left undisturbed. Previously cultivated lands were allowed to advance through natural successional stages or native grass stands were reestablished. Land management activites 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, various lay-down storage yards, meteorological tower, support building borders, storage tank berms, switchyard, hazardous waste and waste oil storage areas, 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. These herbicides are registered by the Kansas Department of Agriculture. No environmental impacts from herbicide treatment of WCGS facilities were identified.

No herbicides were applied to the transmission right-of-ways associated with WCGS during 1989.

2.2.4 Waterfowl Disease Contingency Plan and Monitoring

A waterfowl disease contingency plan was maintained to provide guidance for station biologists in the event of

suspected or actual disease outbreaks. The contingency plan lists appropriate federal and state wildlife agency contacts to be made by WCGS in the event of such problems. 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 was to evaluate the impact of waste heat dissipation from WCCL on fog occurrence along U.S. 75 near New Strawn, Kansas. Upon conclusion of the 1987 data collection, it was determined that sufficient information was available to evaluate cooling lake fogging and all commitments relevant to fog monitoring had been satisfied. Because no problems were identified by these data, no formal fog monitoring program was conducted during 1989. Through casual observations, Environmental Management personnel did not observe any incidents of man-made fog along U.S. 75 during 1989. In addition, there were no reports of such incidents from individuals or local agencies responsible for traffic safety. Implementation of mitigative actions or further monitoring was not warranted.

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

1988/1989 annual wildlife study plan, specific objectives of the wildlife monitoring program were to assess waterfowl, waterbird, and bald eagle usage of WCCL. Because these annual monitoring programs target each migration season (autumn through early spring), this EPP reporting period overlaps with part of the 1989/1990 monitoring program. The objectives of this program were the same as for the 1988/1989 season. Wildlife monitoring results 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 the construction or establishment of terraces, waterways, and permanent vegetative covers. A summary of the 1989 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 in 1989 is presented. There were no changes in station design or operation nor were there tests or experiments that involved an unreviewed environmental question during 1989.

Evaluation 89-01: Substitution of Nalco Sure-Cool 1370 for Betz Powerline WCNO1 for Scale Control.

This evaluation dealt with changing condenser scale inhibitor chemicals. Betz Powerline WCNO1 was evaluated during 1988 in which no adverse environmental impacts were projected. Nalco Sure-Cool 1370 was substituted for Powerline during 1989 and varies from it in that it does not contain organic phosphonate. Both have pH of about 13 and both have very low toxicity. Injection rates and routes are identical. Based on these similarities, and the fact that Powerline produced no noticeable impacts, no environmental impacts from Nalco Sure-Cool 1370 were expected. The KDHE, responsible for water quality issues, approved this substitution.

Evaluation 89-02: Injection of Nalco 1383 into Circulating Water System

This was an environmental evaluation of a Plant Modification Request which called for continuous injection of Nalco 1383 into circulating water at rates between 100 and 120 ppb to control condenser scaling. Nalco 1383 is a solution of sodium phosphonate and polyacrylates which reduce scale formation in plant piping. Its pH is between 3.6 and 4.5 which will be unnoticeable once diluted with the cooling water. Toxicity data revealed no adverse effects to selected organisms at 1000 ppm, approximately 10,000 times the planned injection rate of 100 to 120 ppb. Based on

these factors, no environmental impacts from the use of Nalco 1383 were expected. KDHE approval was obtained prior to use of this chemical.

Evaluation 89-03: Application of Aquatic Herbicides to Control American Lotus in Wolf Creek Cooling Lake

This was an evaluation to determine the possible impacts to the cooling lake biota from using herbicides to control developing American lotus (Nelumbo lutea). Control of approximately nine acres were desired before extensive establishment around the lake occurred which would make control difficult and expensive. Four different chemicals were used. Weedtrine II, a granular 2,4-D formulation for aquatic application, was used in areas inaccessible by land. The remaining three were tank mixed and applied from shore. They were Esteron 99C (a liquid 2,4-D), Rodeo (a glyphosphate herbicide), and Cide-Kick II (a nonphosphate surfactant). Available toxicity data on these herbicides revealed little to no adverse effects to common biota in the cooling lake at the concentrations to be applied. Depletion of dissolved oxygen from decaying plants was not considered a problem because the area covered by the lotus comprised only 0.2 percent of the total surface area of the cooling lake. Based on these factors, no adverse environmental impacts were probable.

Evaluation 89-04: Replacing Vitaclean A & B Film Cleaning Chemicals with No Chrome.

Environmental concerns with discharging waste No Chrome film cleaning chemicals through the NPDES permitted sewage treatment facility were evaluated. The No Chrome product was determined to be nonhazardous and would have no environmental impacts. Although not originally a component of No Chrome, silver was picked up

during the cleaning process and therefore became a constituent of the waste. In this waste, silver was found to be well below the maximum concentration at which it would be classified as hazardous. Intentions were to process the waste No Chrome through a silver recovery unit before discharging, but this proved to be ineffective. Consequently, the KDHE did not approve discharge to the sewage treatment plant and the preferred alternative was to dispose of it as nonhazardous solid waste.

Evaluation 89-05: Piping Installation Between the Discharge of the Oily Waste Interceptor Pumps to the High TDS and Low TDS Collector Tanks.

This was an evaluation of treatment by-passes made possible by piping additions which may effect the water quality at an NPDES regulated discharge. Regulatory guidelines are for influents to the Lime Sludge Pond (LSP) to be greater than pH 6 and lower than 9. As long as plant effluents enter the LSP via the Wastewater Treatment Facility (WTF), neutralization to within this range will have occurred. The proposed piping addition would allow Turbine Building drains to flow to the LSP in the event of a WTF outage without being checked to assure that the pH would be between the 6 to 9 range. The piping addition was considered acceptable based on plant environmental requirements provided that procedural and/or mechanical safeguards were implemented which ensure that effluents during a WTF outage to the LSP are within the 6-9 pH range. Given these conditions, no adverse environmental impacts were expected.

Evaluation 89-06: Diversion of Service Water System (SWS) Flows Through the Essential Service Water System (ESWS) During Summer Lake Conditions.

This evaluation looked at the possible impacts of heated and chlorinated SWS discharges to the Ultimate Heat Sink (UHS) discharge in the cooling lake. Based on engineering projections, the temperature increase at the UHS discharge (approximately 20 feet under the lake surface) would be raised 15°F. This was expected to cool to 4.5°F above ambient by the time it reached the surface and to 2.7°F higher than ambient once dispersed to four acres. This indicated that little area would be thermally influenced and that the increased temperatures would quickly be within the variability of natural temperature fluctuations governed by the weather. Projected chlorine levels (0.6 mg/l TRC) were lower than the NPDES permitted level (1.0 mg/l TRC) and the level evaluated in licensing documents (0.68 to 1.08 mg/l TRC) which impacts were considered acceptable. Based on these main factors, no significant environmental impacts were considered probable.

Evaluation 89-07: Disposal of Liquid Scintillation Cocktail to the Sewage Treatment Plant

This evaluation has been postponed pending further assessment of the operational need for this discharge.

Evaluation 89-08: Procedure Changes Involving Resin Changeout.

This was an evaluation of new procedures governing the changeout of resins in ion exchangers. Waste resins from these procedures had not previously been addressed. The used resins were determined to be nonhazardous solid waste with their disposal being regulated by a solid waste disposal authorization from the Kansas Department of Health and Environment. No adverse environmental impacts were expected.

Evaluation 89-09: Extension of the Plant's Domestic Sewage System.

This evaluation covered the environmental and regulatory concerns with constructing a new main extension to the sewage system. The addition would not tax the Sewage Treatment Plant (STP) beyond its design capabilities. No significant changes to the NPDES monitored STP effluents were probable. KDHE approval was obtained prior to this main extension and no environmental or regulatory impacts were expected.

Evaluation 89-10: Trial Chemical Treatment of the Service Water System (SWS) and Essential Service Water System (ESWS).

Chemical treatment trials to find preferred ways to control unacceptably high corrosion rates in the SWS and ESWS were evaluated. Four tests using Betz proprietary chemicals were recommended. Based on the toxicity data available for the chemicals, no mortality to the most sensitive organisms tested would result from the doses to be used in the SWS and ESWS systems. Treatment durations and frequency of only 15 minutes once per month further reduced any possible effects. No significant risk of environmental impacts was apparent.

3.2 NON-ROUTINE ENVIRONMENTAL REPORTS

3.2.1 Submitted Non-Routine Reports

There were no non-routine environmental reports involving significant impact submitted to the NRC during 1989.

3.2.2 Unusual or Important Environmental Event Evaluations

No unusual or important environmental events reportable under specifications in the EPP were identified during 1989.

3.3 ENVIRONMENTAL NONCOMPLIANCES [EPP Subsection 5.4.1]

At WCGS in 1989, nonradiological environmental noncompliances or noteworthy events were recorded along with the details surrounding them. These included such things as deviations from study plan schedules, a late balance calibration, nonsignificant bird collision events, disposal of film processing chemicals to the sewage treatment plant, sack deterioration of stored herbicide, and documentation of a fish kill event. These noncompliances were evaluated and determined not to be reportable pursuant to EPP criteria.

ATTACHMENT 1

SUMMARY OF
ENVIRONMENTAL INVESTIGATIONS
AT WOLF CREEK GENERATING STATION, 1989

Wolf Creek Nuclear Operating Corporation

Environmental Management

Burlington, Kansas

CONTENTS

1. 1989 LAND MANAGEMENT ACTIVITIES

This report is on the implementation of the 1989 Land Management Plan for Wolf Creek Generating Station (WCGS). Unanticipated activities are also presented. This land management program involves for the most part, agricultural lands around the cooling lake. Landscaped property associated with the power block area, switchyard, and other plant support buildings was not part of this program. Activities presented were designed in part to satisfy Sections 2.2(b) and 4.2.3 of the Environmental Protection Plan, Appendix B of the Facility Operating License. Other general objectives of this plan were to:

a. reduce soil loss on agricultural and "old field" areas
b. maintain or increase agricultural production while enhancing wildlife benefits
c. establish, improve, and/or maintain the native grass areas
d. improve wildlife potential on non-agricultural lands

Company lands are composed of primarily range, cropland, and woodland habitats. These lands were used for various purposes depending on the location and capability of each area. Most were leased for grazing, haying, and crop production. Some were inaccessible, unfenced, or were deemed unsuitable for these purposes. Other areas were left unused to preserve lake shoreline stability, fulfill regulatory requirements, or reserved for their wildlife value.

Grasslands

Grasslands at WCGS consist of grazed rangeland, hay meadows and odd areas left idle primarily for their wildlife value. Also, by not renting the odd

areas, the licensing commitment to maintain a 500 acre buffer zone around the cooling lake in a "natural occurring biotic community" was satisfied.

Grasslands leased to local farmers included grazed rangeland totaling 1518 acres and approximately 452 acres of hay meadow. Grazing lease options included grazing season length, rotation programs, and stocking rates. Hay lease requirements included cutting and bale removal dates.

Controlled burning on WCGS grasslands was used to discourage woody invasion, decrease less desirable cool season grasses and weeds, and increase prairie vigor and production. Approximately 1557 acres were planned to be burned in 1989. Of these, 951 acres were burned. An additional 45 acres, which were not planned to be burned, were done to facilitate neighbor efforts. As a result of on-site judgement, 606 acres were not burned as planned. The dry spring conditions would have made control of some burns difficult with available manpower, so these were cancelled. Unfavorable wind conditions prevented others.

Kansas law requires landowners to control noxious weeds on their property to prevent infestation of neighbor properties. Two species, musk thistle and Johnson grass, have appeared on WCGS grasslands. Musk thistle was sprayed with Tordon 22K during the fall of 1988 by the Coffey County Noxious Weed Department. Mowing and manual removal along fence rows were done in the summer of 1989 and a second spraying by the County was completed in the fall of 1989. Some musk thistle infestations found were small and easily controlled through manual removal. Johnson grass infestation on WCGS grasslands consisted of scattered small areas around the cooling lake which were sprayed with Roundup herbicide. Both Johnson grass and musk thistle have trouble expanding in well managed rangeland, however, they will always threaten disturbed areas such as old farmsteads, road ditches, dams, and abandoned cropland if left uncontrolled.

Approximately 35 acres were planted to native grass. The acreage consisted of "old field" areas along the lake shorelines. Establishment of native prairie grasses will reduce weedy areas, increase wildlife habitat, and allow for easier control of tree and brush invasion. Soil erosion will also be checked.

Cropland

Cropland at WCGS consists of those fields left unflooded by the cooling lake. Most are upland areas along the sides of the lake with some bottom land along Wolf Creek upstream from the lake. Approximately 1412 acres were leased to 14 local farmers for crop production: primarily corn, milo, soybeans, and wheat. These are common crops grown in this region. Limited legume crops were also produced from WCGS cropland leases. Crops produced were not dictated in the lease agreements, but common conservation practices such as contour farming and limited fall tillage were specified. Legume establishment by interested tenants was encouraged. By requiring or encouraging these practices where practical, soil loss is greatly reduced keeping WCGS cropland production sustainable, maintaining land values, and greatly reducing silt accumulation in the cooling lake. Wildlife also benefit.

As on WCGS grasslands, noxious weed control was necessary on some cropland areas. These are handled primarily through tenant agreements as part of their normal farming practices. However, some areas required attention to insure that widespread infestation along the lake shorelines and odd areas would not occur. Control attempts with musk thistle and Johnson grass were effective.

Highly Erodible Land (HEL) plans are management plans required by the Agricultural Stabilization and Conservation Service (ASCS). These are the responsibility of the landowners and are required to remain eligible for

government agricultural programs. Even though WCGS does not participate in the programs, compliance is necessary to allow tenants to participate as they see fit. Determinations of HEL have been completed by the SCS of most fields in Coffey County, including those at WCGS. Only one field was determined to be HEL and a plan was developed for it by the Soil Conservation Service (SCS) and approved by the ASCS committee. The requirements in this plan which were designed to keep soil loss tolerances acceptable included terrace maintenance, contour farming, crop rotations, and reduced tillage. The first two are common lease requirements on all WCGS fields. The latter two are common practices previously employed or easily done by the tenant. Because soil conservation is a primary objective of this land management program, compliance is not expected to be a problem.

Native grass seeding and wildlife weed strip establishment in cropland areas were designed to increase wildlife food and cover habitat diversity along field borders. These practices devote edge areas of limited crop production value to wildlife habitat. They consist of planted native grasses or natural weed growth in strips adjacent to fences or tree lines. Wildlife strips established in previous years were maintained through 1989.

Conclusion

Land management activities during 1989 accomplished program goals to the extent practicable. Fences necessary for continued leasing of company rangeland were completed. The establishment of soil conservation structures progressed on cropland areas. Overall tenant compliance with lease requirements was good. Rent income in 1989 continued to increase while remaining competetive with local rental rates. These, as well as activities on unleased lands, continued to promote wildlife and soil conservation, increase land values, and ensure regulatory compliance while keeping agricultural production compatible on Wolf Creek lands.

2. 1989 WATER QUALITY MONITORING ACTIVITIES

Environmental monitoring completed by personnel included studies on the Neosho River and Wolf Creek Cooling Lake (WCCL). 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 phytoplankton productivity of the Neosho River and WCCL

Water quality studies in the Neosho River near WCCL have been conducted at locations above and below its confluence with Wolf Creek since 1973. Seasonal mean concentrations of most water quality parameters during 1989 were within previously established ranges for the study area and no between-location differences were seen for any of the parameters monitored. The differences in average 1989 values for conductivity, sulfates, chemical oxygen demand (COD) and nitrates which were attributed to drought conditions in 1988 remained similar during 1989, except for COD. The 1989 annual mean for COD rose higher than recorded previously, but still within the range of the previous high observed during 1984. Rainfall amounts were close to normal during 1989, but dry conditions prevailed during winter and spring. Average values for river nitrates remained near the bottom of their previous ranges while sulfates maintained levels close to their upper ranges observed during 1979 and 1980. 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. Between 1982 and 1986 makeup water was generally only added during routine use of the auxiliary raw water pumps and quarterly testing of the makeup water pumps. In 1987 use of makeup water increased to nearly 0.97 billion gallons and this rose to 3.9 and 2.9 billion in 1988 and 1989, respectively. Despite this increase, 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 shallower upstream sampling site slightly different in water quality than near the main dam and the station intake. In general, concentrations of dissolved and suspended constituents in 1989 were within ranges established during previous years of cooling lake operation. Exceptions to this were increasing trends continued from 1988 for sulfates, total dissolved solids (TDS), chlorides, and conductivity. These parameters were at their highest levels since lake fill. With drought conditions during much of 1988 and early 1989, WCCL had reduced natural inflows and lower lake level than during previous years. In combination with forced evaporation due to plant operations, these conditions produced chloride and sulfate concentrations which continued their mild trend of increase while TDS and conductivity, which are affected by sulfate levels, also increased up to or slightly above previous observed marks. These same conditions helped maintain turbidity levels in the lake at low levels. The TDS rise was a reversal of the decline seen in 1986 and 1987. In summary, the mild trends observed in the cooling lake chemistry are indicative of limited natural inflows since 1987 compounded by increased forced evaporation due to plant operations.

Surface water temperatures in the cooling lake during spring and summer periods have been warmer than during preoperational years. This was expected with the plant operating and has been especially evident at the

upstream monitoring location. This area receives heated effluent during spring, summer and fall when southerly winds prevail. Dissolved oxygen data indicated stratification similar to 1988 with an anoxic hypolimnion forming strongly by August and being dispersed by October. This pattern varied somewhat from that before 1988 when WCCL generally stratified completely by June or July and had mixed, well oxygenated bottom waters by August. Based on WCCL's relatively large average depth (21 ft.) and data from other Kansas impoundments, longer periods of vertical stratification for the cooling lake would be expected but have not occurred during preoperational or operational years. Considering data prior to and including 1989, stratification patterns in WCCL appear to be independent of the generating station's intake, warming, and discharge of circulating water.

Phytoplankton chlorophyll a concentrations as indicators of standing crop have been monitored in the Neosho River above and below the confluence with Wolf Creek since 1973. Flow in the study area is controlled by releases from John Redmond Reservoir (JRR). In 1989 average Neosho River flows were comparable with normal years. The annual average chlorophyll a concentration was 19.56 mg/m^3 which fell within the previous years' range of averages (3.81-63.88 mg Chl a/m^3). Chlorophyll a monthly and yearly average values above and below the Wolf Creek - Neosho River confluence were similar in 1989 and were similar to those from previous years. Therefore, there is no indication that adverse effects have occurred on Neosho River phytoplankton as a result of plant operation.

Phytoplankton chlorophyll a concentrations in WCCL have been monitored bimonthly since 1981. Previous annual averages ranged from 11.0 mg/m^3 in 1981 to 6.3 mg/m^3 in 1987 but within that span have shown slow oscillations. Means were down during 1982-1984 and up during 1985-1986. Concentrations in 1989 increased to 7.94 mg/m^3 which fits well within the

established range. Locational chlorophyll a differences within WCCL in 1989 were similar to the pattern seen previously. The highest levels were at the shallower, upstream area, lowest concentrations at the deep, pelagic location with samples from near the circulating water intake channel falling in-between. Overall, chlorophyll a concentration as an indicator of phytoplankton standing crop shows WCCL in the mesotrophic range with mild, infrequent fluctuations indicating little or no plant operational impacts.

3. ASIATIC CLAM MONITORING ACTIVITIES (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 Wolf Creek confluence. To compliment the on-going ecological monitoring program, a discrete survey was conducted during the fall of 1989 to identify the distribution of Corbicula in the vicinity of WCGS. This late summer effort has been completed annually and this report presents the findings of the 1989 survey.

During the Corbicula survey 47 discrete sampling efforts were completed, including 24 efforts in WCCL, and 18 below and 5 above JRR in the Neosho River. Forty-one live clams and 101 isolated valves (unbroken, half-shell, dead) were collected. These included 19 live clams and 66 valves collected below and 10 live and 27 valves collected above the Wolf Creek confluence to the Neosho River. Eleven live and three valves were found at the Burlington city dam while one live and eight valves were found further upstream. 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.

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 prevalent in the Neosho River immediately below or in JRR. This condition should decrease the likelihood of Corbicula pioneering into WCCL. Thus far, monitoring in the vicinity of WCGS has shown Corbicula far below nuisance levels. Chances that Corbicula will become established in WCCL are limited at this time 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. 1989 FISHERY MONITORING ACTIVITIES

Fishery monitoring surveys were conducted on WCCL from April through October 1989. These resulted in the collection of 2,957 individual fish representing 11 families and 26 species. Collection methods used were fyke netting, seining, electroshocking and gill netting. 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. Catch data calculated as percent relative abundance for all gears combined showed gizzard shad highest (22.1%) and bluegill next (21.7%). This shad percentage represents a return to normal abundance levels established prior to 1988. Predators came next with largemouth bass (9.5%), white bass (8.1%), walleye (5.8%) and wipers (5.5%) maintaining high numbers. Smallmouth bass continue to rise to hit their highest abundance to date at 3.8% in 1989. When total biomass of all species in the standardized effort is considered, wipers were first at 21.2% followed by largemouth bass (13.6%), walleye (12.4%), common carp (11.8%), white bass (11.6%), channel catfish (7.7%) and gizzard shad (4.4%). White crappie were eighth at 4.2%. Considering a life expectancy of five to seven years and that the age of the dominant wiper year class was eight in 1989, it is surprising that natural mortality hasn't reduced their number further thus far. The only other noteworthy results were the increased catch of white bass, going from 6.1% in 1988 to 11.6% in 1989 and the tenfold drop in smallmouth buffalo from 7.2% to 0.6% during the last two years. Gizzard shad from 1988 to 1989 rose from 2.3% to 4.4% and from eleventh to seventh position. This increase, while substantial, still left shad biomass within the narrow range (5.7% to 2.2%) that it has occupied since 1983.

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 of early predator year classes and low

to moderate condition for Wolf Creek predators. Wiper growth continues but at rates which are more modest and variable than in its earliest years and the 1981 year class is beginning to be supplemented by recruitment from 1988 and 1989 fingerling stockings. Growth of largemouth bass, 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 young-of-the year gizzard shad in WCCL remain through their first winter. Little survival of the last five 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 so 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 meant predator condition was low but more importantly, so were impingement rates.

5. WILDLIFE MONITORING ACTIVITIES
October 1988 through March 1989

The general objectives of the program were to document and assess any trends or impacts that may be due from station operation to migrating or wintering populations of waterbirds, waterfowl and threatened or endangered species. Of the latter category, bald eagles (Haliaeetus leucocephalus) are of primary concern. Use of WCCL may expose birds to transmission line collision mortality or to disease outbreaks. Damage to local agricultural crops by large waterfowl concentrations using WCCL is also a concern. To document and assess such occurrences or increased potential for such, specific objectives of the program were to monitor how many and where waterbirds, waterfowl, and threatened and endangered species used WCCL during the winter migration season and compare these to the norm observed since station operation began.

Thirty species of waterbirds and waterfowl were observed with mallard and American coot being most abundant, which was the case during most previous seasons. Increased numbers of mallards, Canada geese and snow geese were attracted to the ice-free water caused by the heated effluent from station operations. This factor, in combination with seclusion and close abundant food supplies, kept wintering birds on WCCL longer than during preoperational seasons. Significant ($p \leq 0.05$) preferences for areas of WCCL providing these were found for these species. No disease or crop depredation problems were observed.

The bald eagle, an endangered species, was a common winter resident. During the first two operational winters (1985-1986 and 1986-1987), bald eagle usage of WCCL declined from preoperational levels. Responsible for this was the heated effluent from continuous station operations which reduced the quantity of winter-stressed fish, an important eagle food source. Also, the normally prevalent thawing and refreezing of the surface waters exposing winter-killed fish were absent because of mild weather, further discouraging

eagle usage. However, because the plant operated intermittently through much of the 1987-1988 winter, the quantity and to a greater extent the availability of these fish were increased. Colder than normal weather during February played a role in increasing forage availability on WCCL during the 1988-1989 survey period. These factors attracted and held larger numbers of eagles than observed previously. It was shown that since operations began, more of the area eagles were found on WCCL when air temperatures declined. No such relationship was present before station operation.

Past monitoring included formal transmission line collision surveys. However, upon analyses of data collected during the 1987-1988 program, it was concluded that enough monitoring had been completed to sufficiently characterize line impaction mortality of birds using WCCL. The significance of the estimated collision mortality was not considered very great. Consequently, no routine monitoring was planned to be completed during the 1988-1989 winter and usage surveys did not identify changes that increased collision potential. Therefore, surveys to characterize such increases were not warranted.

October through December 1989

This synopsis provides a summary of WCCL bird usage data collected from October through December 1989 as part of the 1989/1990 Operational Wildlife Monitoring Program. These data are not presented in the report summarized above. Except for a lack of surveys during September, the WCGS monitoring schedule matched that used by local wildlife agencies monitoring other Kansas reservoirs. This schedule will allow station biologists to determine if changes from previously characterized patterns justify increased monitoring or mitigative action. Formal transmission line collision surveys were discontinued because enough information had been collected to

characterize the mortality caused by the lines and it was shown to be insignificant. Special attention was given to both state and federally listed threatened and endangered wildlife species occurring in the vicinity of WCGS.

A total of 28 waterfowl and waterbird species were observed on 6 ground counts during fall and early winter of 1989. The most abundant species were the Franklin's gull, mallard, and American coot making up 54, 22, and 9 percent of the total, respectively. This is similar to the fall monitoring completed during past monitoring seasons. 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. The vast numbers of Franklin's gulls were most likely attracted to WCCL because of its close proximity to the Coffey County landfill. Some winter wheat fields on WCGS lands may have experienced crop damage, however these were fairly localized and widespread depredation events were not present. No disease problems were present among waterfowl concentrations on WCCL during the fall and early winter of 1989 nor were usage pattern changes apparent that increased transmission line collision potential.

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. 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 1989 were identified.