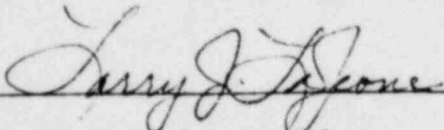


Prepared for
Union Electric Company
St. Louis, Missouri

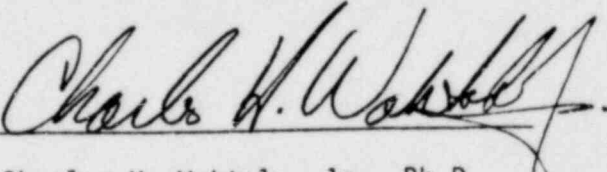
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Position Report Requesting
Relief from Certain
Monitoring Requirements
Callaway Nuclear Power Plant



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February 1981

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1.0 INTRODUCTION AND EXECUTIVE SUMMARY

1.1 Introduction

This report consists of a review of aquatic, water quality, and terrestrial data compiled during baseline, preconstruction, construction, and preoperational phases of monitoring for the Callaway Nuclear Power Plant (Union Electric Company). Results of studies conducted to date were evaluated to determine whether sufficient data are presently available to accurately describe aquatic and terrestrial communities, and if Plant operation would have any detectable adverse effects on these communities.

The Callaway Nuclear Plant will utilize Missouri River water in its condenser cooling process in a closed-cycle mode of operation at the rate of 87 cfs with blowdown discharge to the Missouri River averaging 22 cfs (Union Electric Company, undated b). Union Electric Company was issued its NPDES permit by the State of Missouri on 8 August 1980 (Appendix A).

Specific objectives of this report are:

1. to summarize results of aquatic and water quality studies conducted on the Missouri River, Logan and Mud Creeks;
2. to summarize results of terrestrial studies conducted on the Plant site;
3. to evaluate the potential for detectable adverse effects of Plant operation on these ecosystems; and
4. to assess whether continued monitoring of various segments of these communities is warranted.

1.2 Executive Summary

1. Various components of the aquatic ecosystems of the Missouri River, Logan and Mud Creeks have been extensively studied and sufficient data have been gathered to characterize each trophic level. Water quality within these streams is generally within State standards and variations in concentrations of most parameters are attributable to changes in river stage and surface runoff. Phytoplankton, zooplankton, benthic macroinvertebrate, fish and vascular hydrophyte communities of the Missouri River are

all considered typical of swift, turbid streams showing poor productivity, low taxonomic diversity and low organism densities. Logan and Mud Creek communities differ from the river, but are typical of small, slow flowing temperate streams in the area. No adverse effects due to Plant construction or properational activities have been detected. Only one rare species (brown bullhead) has been collected near the Plant site in 1973, 1974 and 1975 (Union Electric Company 1976). No rare or endangered species have been collected during the preoperational monitoring program (Camp Dresser and McKee 1980, 1981).

2. The terrestrial biota of the Callaway Plant site is typical of the regional biota. Although two rare species (ruffed grouse and long-tailed weasel) and one endangered species (American elm) were observed on the site, the site does not provide critical habitat for these species. Bald eagles and osprey have been sighted along the Missouri River but are migratory and do not nest in the area. Project impacts have already occurred from the construction of the facility. These impacts are considered minor and have resulted in loss of habitat for a few species which could easily relocate in adjacent areas.

3. A closed-cycle mode of operation coupled with low population levels for most aquatic communities indicates that possible adverse impacts attributed to operation of the Callaway Nuclear Plant would not be detectable. Impacts on the terrestrial ecosystem, beyond those related to construction, would also be minimal, if detectable at all.

4. The State of Missouri has assumed responsibility for reviewing possible effects on water quality and aquatic communities as related to operation of the Callaway Nuclear Plant. The NPDES permit issued by the Department of Natural Resources requires an assessment of the operation of the Plant's intake on fish populations. Background data to support this demonstration is being collected as part of an ongoing fish monitoring

program. Following Plant startup, entrainment and impingement monitoring will be implemented, with additional water quality monitoring as required by the permit.

5. Specifications established by the Missouri Department of Natural Resources ensure that possible impacts of Plant operation on local fishery resources will be assessed. Beyond these programs, continued monitoring of the terrestrial ecosystem and other segments of the aquatic ecosystem are considered unnecessary. For these reasons, which have been documented, Union Electric Company is requesting that non-radiological monitoring requirements for aquatic and terrestrial impacts not be included in the Callaway Nuclear Plant operating license technical specifications.

2.0 AQUATIC ECOLOGY

2.1 Introduction

Aquatic monitoring programs were conducted from early 1973 through the present to inventory the aquatic flora and fauna near the Plant site; document temporal and spatial changes in species abundance and diversity; and predict potential impacts, if any, on the biotic community due to Plant construction and operation. The following components of the aquatic ecosystem were studied to make these determinations: phytoplankton and primary productivity, zooplankton, benthic macroinvertebrates, vascular hydrophytes, fish populations and water quality.

Environmental studies were initiated in early 1973. During April, 1973, baseline studies were conducted to gain a general overview of the area, establish permanent collection stations, and to collect preliminary water samples, and benthos and plankton samples. These preliminary studies were expanded during July, September, and December 1973 and February 1974 with the goal of describing existing environmental conditions and to predict any adverse impacts resulting from construction and operation. Preconstruction surveys were conducted in June and September 1974 and in February, April, June and September 1975. The preconstruction surveys were designed to interface with the baseline program. Figure 2-1 presents a schematic drawing of monitoring locations on the Missouri River, Logan Creek and Mud Creek. During the preconstruction phase, monitoring was continued at transects located in the Missouri River above the intake structure and discharge pipeline (Transect A); at the intake structure (Transect B); below the intake and discharge (Transect C); and at Locations D and E on Logan Creek. Two additional sampling locations were established to provide a better representation of the area that may be affected by Plant construction and operation. Transect H was established midway between Transects B and C on the Missouri River. Location E-2 was added about midway between Locations D and E on Logan Creek just below the mouth of Mud Creek. In September 1974 Location E-2 was relocated on Mud Creek to

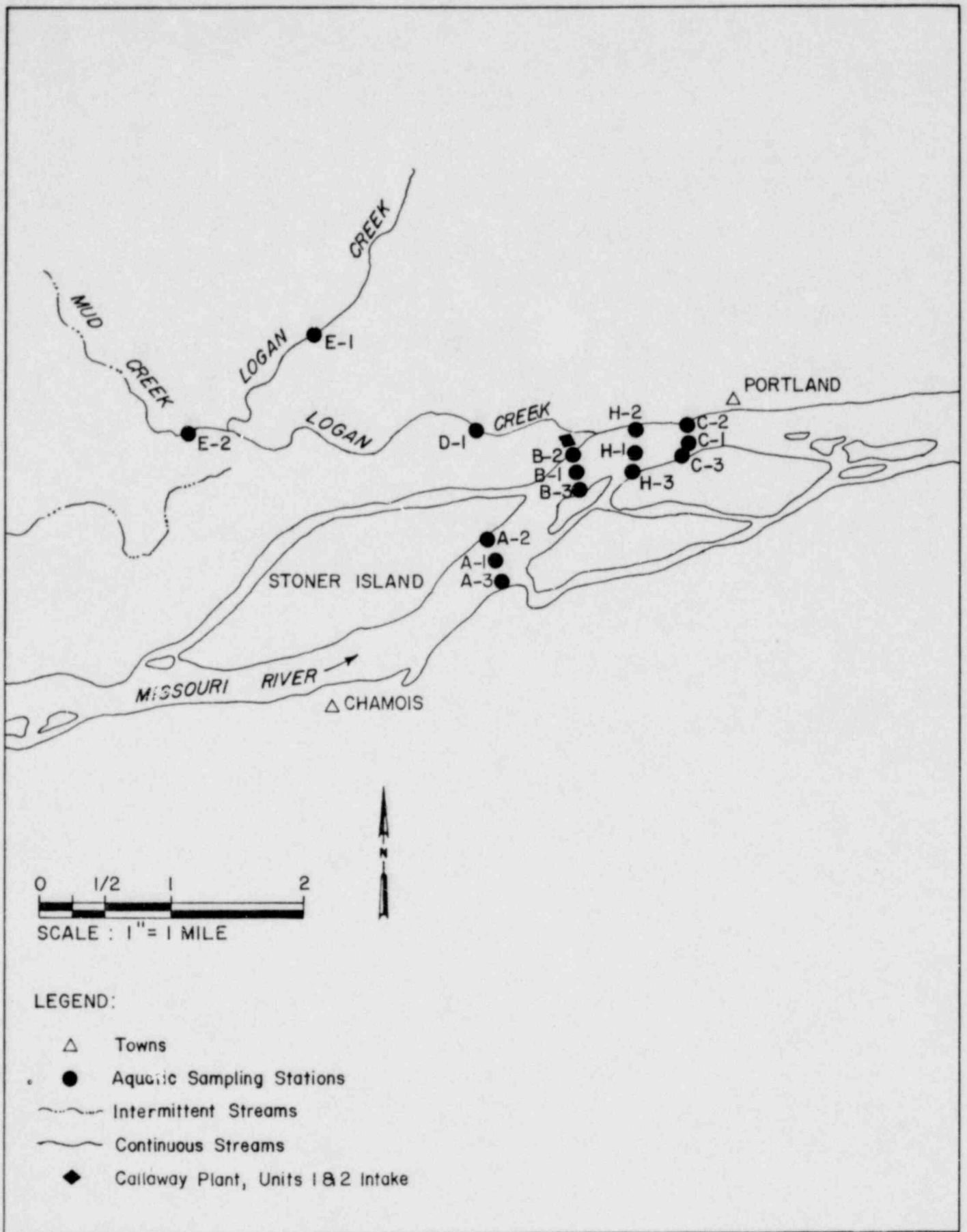


Figure 2-1. AQUATIC SAMPLING STATIONS IN THE MISSOURI RIVER, LOGAN AND MUD CREEKS NEAR THE CALLAWAY NUCLEAR PLANT.

provide a measure of water quality for this Creek. Water quality parameters were monitored on a quarterly basis during the construction phase from May 1975 until June 1978. These studies were coordinated with the construction schedule.

The preoperational program included preconstruction monitoring (the period between the initial baseline survey and the beginning of construction), construction monitoring, and an intensive preoperational program. The preoperational program was also directed toward description and delineation of the major components of the aquatic ecosystem. This intensive study was initiated during June 1980 and continues to the present.

Because rare and endangered species are discussed throughout this report, it is necessary to define the various categories. The protected species categories are as follows:

Extirpated (Extinct): a species which is no longer known to occur in Missouri even after repeated search of likely places.

Endangered: a species of fish, wildlife, or plant life which is in danger of extinction throughout all or a significant part of its range.

Rare: a species that, although not presently faced with extirpation, is in such small numbers that it could easily become endangered.

2.2 Phytoplankton and Primary Productivity

Phytoplankton of the lower Missouri River near the Callaway Plant site occurred in low densities throughout the preconstruction and preoperational surveys. Populations were dominated by diatoms. The phytoplankton assemblage of the Missouri River, Logan and Mud Creeks from June through November 1980, was comprised of 196 major taxa representing seven major algae divisions. These observations were similar to investigative findings in other studies conducted on the Missouri River (Berner 1951; Damann, 1951; Williams 1966; Stern and Stern, 1972; Callaway Plants Units 1 and 2 Environmental Baseline Inventory; Union Electric Power Company, 1974b; and

the University of Missouri-Rolla, 1974). Berner (1951) related the paucity of phytoplankton to excessive turbidity, high current velocity, and the lack of large adjoining lentic waters. Historical phytoplankton data are presented in Appendix B.

During 1975 Asterionella sp., a cold water diatom, was most abundant in winter with lowest densities occurring in September. During the previous year, Asterionella sp. was most abundant during September. These 1975 results confirm the previous findings of diatom dominance in Missouri River samples during the 1973-1974 baseline studies.

Total phytoplankton densities at the Missouri River locations were similar on each collection date from June through October 1980. Phytoplankton densities fluctuated primarily in response to river flow and turbidity. Phytoplankton densities were lower in the river than in the creeks with values typical of turbid lotic systems (Limnetics Inc. 1975; Camp Dresser & McKee Inc., 1980).

Diatoms, green algae and Euglenoids were the most prevalent algal groups during the June through August 1980 period while centric diatoms were most prevalent from September through November (CDM, 1980; CDM, 1981). The most common phytoplankton collected during the 1980 preoperational study were the colonial green alga Dictyosphaerium pulchellum; the euglenoid Lepinocinclis sp. (Spring and Summer); and the centric diatoms, Cyclotella sp. C. atomus, C. meneghiniana, and Microsiphona potamos. The increased prevalence of diatoms during the fall season is typical of turbid lotic systems (Limnetics, 1975).

Diversity of phytoplankton at all river locations from the initial commencement of the baseline studies in 1973 through the 1980 preoperational studies was relatively high. This high diversity was attributed to the relatively high number of taxa entering the Missouri River via tributaries and the general lack of abundance of any one particular species.

Logan Creek phytoplankton densities generally exceeded densities in the Missouri River and were similar or higher than levels found in Mud Creek. During the 1973 studies the principal taxa in Logan Creek were

epipellic diatoms, including the genera Cymbella, Navicula, Nitzschia, and Gomphonema. During June 1980 Cyclotella atomus and Dinobryon divergens were very abundant while in July, August and September the colonial green alga Dictyosphaerium pulchellum was most abundant. On October 13, 1980, Chrysococcus sp. was the most prevalent phytoplankton at Location D; however Nitzschia sp. and N. palea comprised the greatest population percentages upstream. In November, species of Dictyosphaerium, Dactylocoecopsis and Ochromala comprised ten percent or more of the phytoplankton population of Logan Creek. Density differences in phytoplankton population were related to the intermittent nature of the upstream location (E1) which was reduced to a shallow (<0.5m) pool during September and October. Location (D), a stretch of Logan Creek impounded by a beaver dam, generally had higher phytoplankton densities than Mud Creek and Missouri River locations due to its stable eutrophic nature.

In summary, phytoplankton populations in the Missouri River, Logan Creek and Mud Creek are typical of lotic systems. In the Missouri River, species diversity is relatively high due to the entrance of phytoplankton from various streams and water sources in the Missouri River drainage basin. There is generally a lack of dominance of any one species because many species are indigenous to feeder rivers and streams. There is low proliferation of phytoplankton in the Missouri River due to the harsh and transient nature of the environment. Phytoplankton populations in Logan and Mud Creek are representative of small, slow flowing streams with intermittent pool areas. Phytoplankton density and diversity differences between these two streams and the Missouri River are due to differences in turbidity levels, nutrient concentrations, substrate type, and current velocity.

Primary Productivity

Logan Creek's net primary productivity ranged from 69 to 363 mg c/m³/hr versus <1 to 81 mg c/m³/hr at the Missouri River locations (Camp Dresser & McKee 1980). Logan Creek appeared to be much more productive than the adjacent waters of the Missouri River. Previous productivity

studies reported by Union Electric (1976) on June 20, 1974 support this hypothesis, with net productivity values for Logan Creek and the Missouri River ranging from 5.1 to 40.1 and 1.4 to 2.3 mg c/m³/hr, respectively.

Compilation of phytoplankton and primary productivity data collected thus far, along with additional data to be gathered during 1981, are sufficient to describe the composition, seasonal abundance and productivity of this community. These data show that no major change has occurred in this trophic system in the river or Logan Creek over the 1973-1980 study period. Phytoplankton densities and productivity in the Missouri River and Logan Creek are low and it is highly unlikely that continued monitoring would detect any changes in this community attributable to Plant operation.

2.3 Zooplankton

The composition of zooplankton in the Missouri River, Logan Creek and Mud Creek were similar to previous studies and population characteristics were generally as expected from a turbid, lotic system (Union Electric Company 1974b; Camp Dresser and McKee 1980, 1981). In general population densities were low and composition of zooplankton was relatively similar over the various study periods. Zooplankton data for the baseline, preconstruction and preoperational periods are presented in Appendix B.

During the baseline study conducted in 1973 through the 1974-75 preconstruction and the 1980 preoperational phases, rotifers were the predominant zooplankton in the Missouri River. Studies conducted by Williams (1966) found rotifers to be the dominant zooplankton in most major river systems in the United States. Zooplankton densities were relatively low in the Missouri River (Union Electric 1974b, 1976; Camp Dresser & McKee 1980, 1981). Hynes (1970) attributed low zooplankton densities to turbidity and high current velocities, both of which are characteristic of the Missouri River. As with the phytoplankton, most zooplankton originate in relatively lentic areas and enter the river through tributaries. During 1972, Brachionus was the dominant rotifer collected during the Missouri

River Environmental Inventory (University of Missouri-Rolla, 1972). Rotifera (mainly species of Brachionus), were the predominant zooplankton during the 1980 preoperational studies (CDM 1980, 1981), therefore, it appears that there have been little changes in zooplankton population trends in the Missouri River from 1972 through the 1980 preoperational monitoring program. A continued dominance of rotifera during all months is typical of large rivers (Hynes 1970).

No consistent trends in zooplankton populations were apparent in Logan and Mud Creeks during baseline, preconstruction and preoperational phases (Union Electric 1972, 1975; Camp Dresser & McKee 1980, 1981). Variability in Rotifera, Cladocera and Copepoda populations was probably due to fluctuating water levels, changes in water temperature, and other natural physical/chemical changes in the creeks. Higher zooplankton densities generally occurred in pool areas due to their lentic nature.

Zooplankton populations in the Missouri River are low and typical of a large river environment. Turbidity and high current velocities provide an unstable environment for zooplankton as expressed in the low species diversity and abundance. Following completion of the monthly preoperational 1980-81 program, sufficient data will have been gathered to accurately describe the zooplankton assemblage of the Missouri River and Logan and Mud Creeks. Because of low diversity and abundance of the zooplankton population in the Missouri River, it is highly unlikely that continued monitoring of the zooplankton community will detect any changes that could be attributed to operation of the Callaway Nuclear Plant.

2.4 Benthic Macroinvertebrates

Benthic and drifting macroinvertebrate studies were conducted to determine the temporal and spatial differences in macroinvertebrate community structure. Sampling stations were located near the Plant intake and discharge and in Logan and Mud Creeks prior to the Plant's operation (Figure 2.1). Macroinvertebrate populations were found to be similar to those identified by previous investigations. Species composition, relative abundance and biomass differed greatly between river and creek stations as

expected; however, results were generally typical of their respective habitat type. Benthic macroinvertebrate data collected during the baseline, preconstruction, and preoperational phases are presented in Appendix C. In the Missouri River the benthic macroinvertebrate community is dominated by aquatic worms, burrowing mayflies and midges (Union Electric Company 1974a and b, and 1976; University of Missouri-Rolla 1972; Berner 1947; Camp Dresser & McKee 1980 and 1981). Density, biomass, and species diversity were generally low, being restricted by spaces and the sand and silt substrate. Benthic macroinvertebrates face considerable stress due to swift currents and shifting of the silt/sand substrates. Random samples (quantitative and qualitative) taken from the Missouri River by the University of Missouri (1972) and Union Electric Company (1974a), and in the upper Mississippi River by Fremling (1960) indicate that different benthic fauna colonize the pile dikes from those reported taken in the grabs. These authors report dense pile dike colonization by various caddis fly (Trichopteran) species of the net building family Hydropsychidae. CDM (1980) found that hydropsychid caddis flies, mayflies, and midge larvae constituted the majority of the drifting macroinvertebrates in the Missouri River. Hynes (1970) has indicated that portions of the benthic macroinvertebrate community enter the drift continually. The resulting downstream movement of benthic fauna is a valuable source of individuals for recolonization of barren areas. Factors regulating the number of macroinvertebrates in the drift at any one time are numerous. Berner (1951) and Weber (1973) indicated that river flow and photo-period (day or night) are important factors. Maximum densities of drifting organisms occurs after midnight and during periods of maximum river discharge.

Benthic macroinvertebrate densities and diversity were determined to be low and populations consisted predominantly of species of Oligochaeta and Insecta. The extremely low density and biomass of benthic organisms was due to siltation, shifting substrates, fluctuating water levels, swift currents, and the absence of aquatic vegetation (Berner 1951, Camp Dresser & McKee 1980). In general, the density of macroinvertebrates and numbers of taxa in the Missouri River were similarly low during the baseline, preconstruction and preoperation studies, reinforcing observations by other investigators.

In Logan and Mud Creeks, Oligochaeta (primarily tubificid worms) dominated the benthic macroinvertebrate population. During the spring and summer preoperational sampling programs, species of Tanytus, Procladius and Chironomus were the most abundant chironomids. Population dynamics appeared quite similar during baseline, preconstruction and preoperational periods in Logan Creek. The benthic community appeared to be directly related to stream flow, substrate type and organic loading from agricultural activities.

Macroinvertebrate studies conducted thus far near the Callaway Nuclear Plant indicate low densities and diversity within the benthic community, typical of the Missouri River. Consequently, it is unlikely that any significant changes in the macroinvertebrate community due to Plant operation would occur and thus continued monitoring is not necessary.

2.5 Vascular Hydrophytes

Historically, no vascular hydrophytes have been observed in the Missouri River near the site. (Union Electric 1974b; Camp Dresser & McKee 1980, 1981). Berner (1947) also reported a complete absence of hydrophytes in the channels, chutes and back waters of the Missouri River. He attributed their absence to high turbidity, water level fluctuations, and the instability of the fine river substrates.

August 1980 was selected as the best time to study vascular hydrophytes because peak biomass approaches its annual maximum during this time period. The water level in Logan Creek was low, suggesting that vascular hydrophytes were most abundant and visible at this time.

Only four vascular hydrophyte species (Lemna minor, Sagittaria latifolia var. obtusata, Potamogeton foliosus and Eleocharis obtusa) were growing exclusively in saturated soil (Appendix D) (Camp Dresser & McKee 1980). The remaining species were characteristic of stream banks and thus were not considered true aquatics in the sense that they were not always under the direct influence of Logan Creek. The absence of vascular hydrophytes in the Missouri River and paucity in Logan and Mud Creeks is sufficient evidence to conclude that no effects due to Plant operation are expected, and therefore, further monitoring would serve little purpose.

2.6 Fish

Fish populations were extensively studied during the 1973 baseline study, 1974-75 preconstruction and 1980-81 preoperational phases. These studies were designed to determine species composition, relative abundance, age structure of the population and food habits. Through the aforementioned period, fish were captured by trap netting, gillnetting, electroshocking and seining. Corresponding fish data for these studies are presented in Appendix E. During the baseline and preconstruction periods, collections yielded 66 species. The brown bullhead was the only species collected during the baseline and preconstruction phases that is classified as rare in the Missouri River. In the Missouri River, collections below the mouth of Logan Creek consistently yielded the greatest number and diversity of fish. Gizzard shad, river carpsucker, shortnose gar, and blue catfish were the most abundant species through the 1975 preconstruction studies (Union Electric 1976). Numerous juvenile fish were also collected including gizzard shad, white bass, white crappie, sauger, freshwater drum and largemouth bass.

Food habitat studies performed on 12 species during the 1973 baseline survey have indicated no unusual predator-prey relationships. Food selectivity was typical for those species examined and continued studies were not considered warranted. Age and growth characteristics have only been determined for gizzard shad from the Missouri River, and bluegill and white crappie from Logan Creek (Union Electric Company 1976). Growth of gizzard shad appeared to be average while bluegill growth was considered poor and white crappie growth was slow during the first two years of life. Because of the small number of individuals collected and lack of data from Missouri River species, age and growth studies are currently being performed on several species captured in the Missouri River during the 1980-81 intensive preoperational program.

Sampling over the six month preoperational period in 1980 yielded a collection of 50 fish species (Camp Dresser & McKee 1980, 1981). During the June through August program seven species collectively accounted for 74 percent of the total catch. These species, in order of abundance, were

gizzard shad, freshwater drum, flathead catfish, channel catfish, longnose gar, goldeye and emerald shiner. Six species collectively accounted for 86 percent of the total catch during September, October and November. In order of abundance these species were gizzard shad, emerald shiner, red shiner, freshwater drum, shovelnose sturgeon and channel catfish.

During the September through November 1980 period an additional eight species were collected. No threatened or endangered species were captured but two species not reported in previous studies were collected. The blue sucker, considered scarce in the Missouri River (Pflieger 1971) was collected in October and the rainbow smelt, only occasionally found in the Missouri River, was collected in November. Rainbow smelt appear to have originated from main-stem impoundments in the Dakotas, where they have been successfully introduced (D. Henegar, personal communication). The composition and distribution of the remaining species was comparable to the previous studies, though relative abundance did vary.

Fish species composition and relative abundance in Logan and Mud Creeks were considerably different from Missouri River collections during baseline, preconstruction and preoperational phases. Compared to the Missouri River, Logan and Mud Creeks generally have lower turbidity, slower current velocities, more varied substrates, a greater abundance of planktonic and benthic food organisms, and at least some vegetation. These conditions are more favorable for certain species and provide more diverse habitats than are found in the Missouri River near the site.

Logan Creek's flow characteristics create its varied habitats. The creek is subject to frequent water level fluctuations caused by surface runoff in the immediate area or by water backing up into the creek from an increased discharge in the Missouri River. During periods of low flow, isolated pools of water may be created in the stream's upper reaches. In general, the composition of fish comprising the fish population in Logan and Mud Creeks was similar during baseline, preconstruction and preoperational sampling periods.

Ichthyoplankton sampling produced no unusual or unexpected results during all collection periods. From June through August 1980 four taxa, Cyprinidae, freshwater drum, Ictiobinae and Catostomidae collectively accounted for 89 percent of the total drift in Missouri River samples. In September only Cyprinidae and freshwater drum comprised the ichthyoplankton. During October and November 1980 no ichthyoplankton were present in collections. The absence of larval drift in the Missouri River in October and November 1980 is considered typical for this system as is the occurrence of only juvenile and adult fish in qualitative collections from Logan and Mud Creeks during the September through November sampling period (Camp Dresser & McKee 1980, 1981).

The paucity of fish in Missouri River collections is attributed to both existing conditions in the river and sampling effectiveness. Strong currents, high turbidity, absence of appreciable backwater habitat, and lack of fish food organisms are all limiting factors to fish production. However, fish are considered an important aquatic resource to the area and most likely to be affected by Plant operation. For this reason, preoperational and operational monitoring of adult fish and larval drift, along with entrainment and impingement monitoring, shall be continued in compliance with the NPDES permit issued by the Missouri Department of Natural Resources (Appendix A).

2.7 Surface Water Quality

The physical characteristics of the Missouri River in the site vicinity have been drastically altered by channelization. The Federal Rivers and Harbors Act of March 2, 1945 authorized the River and Harbor Project to improve the Missouri River's navigation and channel stabilization from Sioux City, Iowa to its mouth. That project provided for development of one mixed navigable channel 300 feet wide and 9 feet deep from the numerous, small, shallow channels of the natural river. The refinement and control of this channel were obtained by shaping the flow into smooth, easy bends through a system of stone and/or wood pile clump dikes. As a result of this channelization, the five years of accumulated

water quality data at the Missouri River sampling stations are quite similar. Water quality is primarily adversely influenced by agricultural runoff, and, to a lesser extent, by municipal and industrial pollution (Union Electric Company 1976). Variation in concentration of chemical constituents has largely been a function of river discharge. Total dissolved solids generally decreased in concentration with increased river discharge, while suspended materials and sediment load increased.

Missouri River discharge data were obtained from the U.S.G.S. at Hermann, Missouri, approximately 20 river miles (R.M.) downstream from the study area. The following discharges were recorded on each sampling date: 18 April 1973 - 280,000 cfs; 12 July 1973 - 67,000 cfs; 7 September 1973 - 58,500 cfs; 18 December 1973 - 86,300 cfs; and 22 February 1974 - 136,000 cfs. Discharge volumes recorded during 1980 were: March - 93,300 cfs; June - 58,200 cfs; July - 46,200 cfs; August - 67,100 cfs; September - 49,900 cfs; October - 42,600 cfs; and November - 44,400 cfs. The discharge in this section of the Missouri River is partly regulated by numerous upstream reservoirs. The 75-year average discharge at Hermann is 78,370 cfs. The maximum discharge of 676,000 cfs occurred in 1903, and the minimum of about 4,200 cfs was recorded in 1940 before flow control was initiated by the Corps of Engineers (U.S. Geological Survey, 1972).

Rapid changes in its erosional and depositional properties may vary the river's morphological characteristics. Substrate texture in particular areas may also be changed by alternating erosional and depositional effects. Generally, the texture of the main channel sediments near the site varies from gravel to sand. Shorelines, where currents are greatly reduced, usually have a silt-clay (mud) bottom. Shifting sand bars are quite common in the area.

A summary of water quality data at stations located near the plant site are presented in Appendix F. In general, most parameters did not exceed maximum limits applicable to Class "P" and "P1" Waters (Missouri Department of Natural Resources 1977). Variations in concentrations of chemical species were not found to be consistent during review of data from

prebaseline, baseline, preconstruction, construction and preoperational periods. Variations were primarily attributed to runoff from lands associated with the Missouri River Watershed and its tributaries.

Logan Creek is a small, perennial tributary stream of the Missouri River. The upper portion drains most of the Callaway site and flows in a southerly direction until it reaches the flood plain. From its confluence with Mud Creek, it proceeds eastward until it empties into the Missouri River at River Mile 115.2. No gaging station is located on Logan Creek and, therefore, discharges have not been recorded. Flows are generally very low to non-existent, except for periods following local precipitation.

Water quality data collected on Logan and Mud Creek are presented in Appendix F. Concentrations of chemical species in these creeks were comparable to previously conducted studies (Union Electric Company 1974b, 1976). Variations were primarily attributed to non-point sources from agricultural lands during storm events and neither construction or preoperational activities have had a deleterious effect on the water quality of these water bodies.

The large amount of water quality data collected thus far from the Missouri River and Logan and Mud Creeks has provided sufficient information to characterize these streams near the Callaway Nuclear Plant. It is unlikely that continued preoperational and operational monitoring of water quality in these streams will provide any new information and, other than monitoring of the Plant's blowdown discharge as specified in the NPDES permit (Appendix A), further water quality monitoring is not warranted.

3.0 TERRESTRIAL ECOLOGY

3.1 Introduction

This section describes methods used to characterize the various components of the terrestrial ecosystem during the 1973 baseline study, the 1974-1975 preconstruction survey, and the construction monitoring program. The results of these studies are summarized to support the contention that the environmental impacts to the terrestrial biota resulting from plant construction and operation have been sufficiently identified, have minimal influence on the local and regional ecosystem, and consequently, that further monitoring of the terrestrial environment is not warranted.

Sampling for the baseline survey was conducted during spring, early summer, late summer, and fall of 1973 and the early winter of 1974. The preconstruction phase was initiated in the spring of 1974 and continued through the fall of 1975. A construction monitoring program has been conducted since the winter of 1975.

The terrestrial ecology baseline program of 1973 was designed to describe the major ecosystems within the Callaway site area prior to Plant construction, including a detailed inventory and relative abundance of flora and fauna. The preconstruction phase shifted the emphasis from a broad, biological inventory of the entire site area to a more specific examination of selected study areas within the major ecosystems of the site.

The objectives of the examination were:

1. to describe and record species of flora and fauna in the site area during the annual survey period
2. to provide a sufficiently detailed data base that could be implemented into a comprehensive monitoring program for the purpose of detecting impacts of Plant construction and operation on the terrestrial environment
3. to provide conclusions concerning succession, population dynamics, and overall environmental trends within the plant site, in zones of both primary or secondary impact.

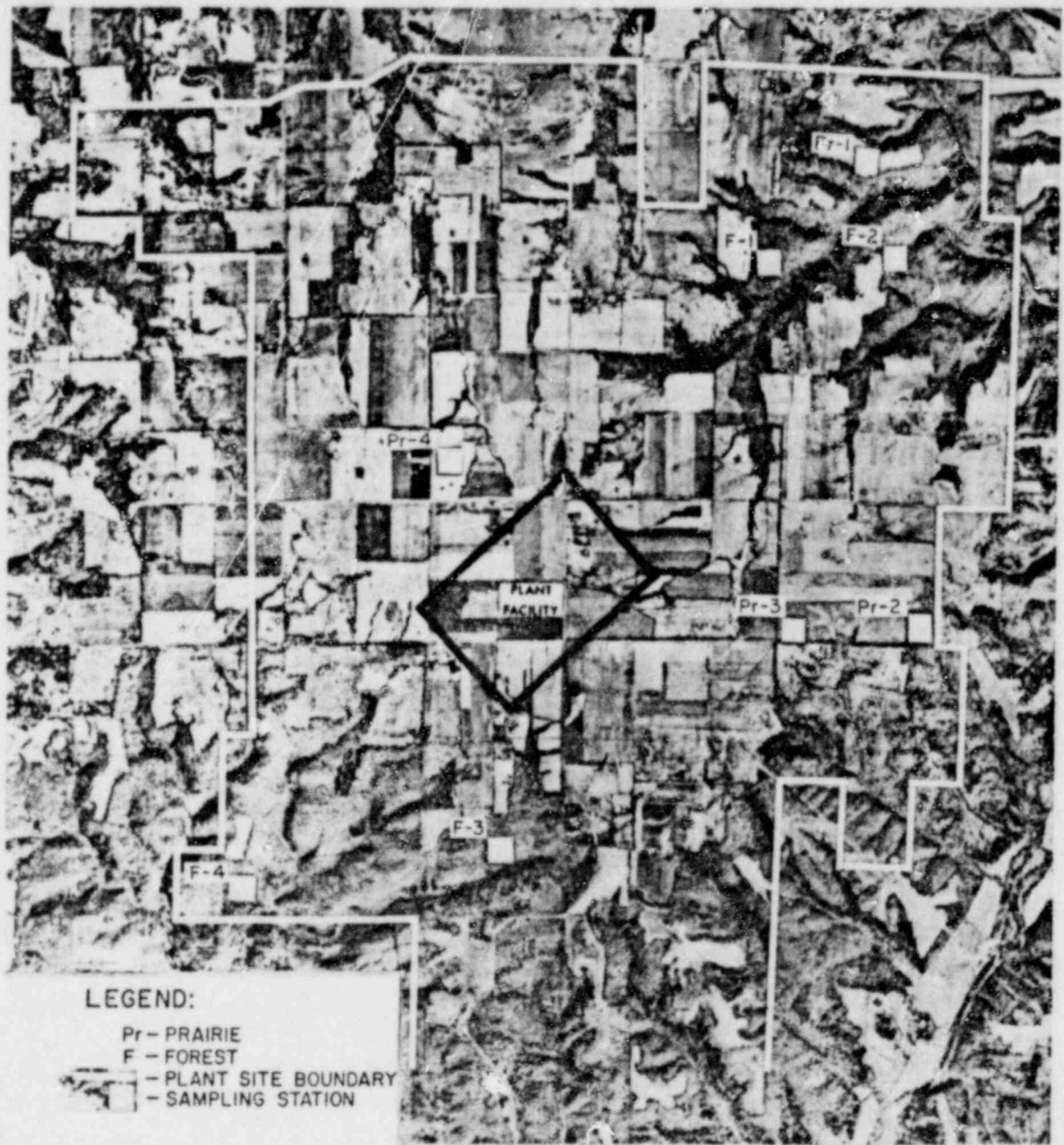
The majority of sites studied during the 1973 baseline study were in areas of direct construction impact that are no longer available for study. Therefore, sampling activities during the preconstruction phase were primarily directed toward investigation of eight permanent sampling stations, four located in forest and four in prairie or grassland (old field) habitats (see Figure 3-1). An individual sampling station consisted of a square area, 330 feet on a side and encompassing 2.5 acres. Where feasible, the sampling stations were surrounded by a buffer strip 100 feet wide.

The eight permanently marked study areas were located in places that would not only be undisturbed during preconstruction and construction monitoring but also would be isolated from public disturbance during the operational phase. Presence of public facilities such as recreational areas could influence some animal populations to the extent that information obtained from the monitored areas would give erroneous conclusions.

3.2 Vegetation

The location of forested and nonforested areas sampled during the 1973 baseline study are shown in Figure 3-1. The forest overstory was sampled by the point-centered quarter technique of Cottam and Curtis (1956). The composition of the forest understory was assessed using nested quadrats (Cox 1967) placed at randomly selected points along each forest transect. Herbaceous vegetation along the forest transects was evaluated using a modified line intercept method of Oosting (1956). Two pastures and one old field were sampled using quadrats and the modified line intercept method. Specific details of these methodologies are included in Union Electric Company (1974).

During the 1974-1975 preconstruction monitoring program the vegetation was separated into strata (overstory, understory, and ground layer) for sampling. Quantitative analysis of the overstory (woody plants >5 cm diameter at breast height) and understory (woody plants from 0.5 to 5 cm in diameter and <0.5 m in height) of the forest and prairie sampling



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CALLAWAY PLANT
UNITS 1 & 2

LOCATIONS OF PERMANENT
SAMPLING STATIONS

Figure 3-1

stations was conducted by use of the quadrat method (Curtis and Cottam, 1956). Increment core samples were taken from the major overstory species in an attempt to age the individuals of a stand.

The herbaceous layer vegetation of each station was sampled in spring, summer, and fall. The sampling procedure consisted of clipping all ground layer plants from quadrats. The clipped vegetation was sorted by species, oven dried, and weighed to determine biomass.

The construction monitoring program, conducted since 1975, has consisted of taking bimonthly photographic records of the sampling stations, and monthly visual inspection of the entire site area to identify effects of facility construction.

The Callaway Plant site is located in a region composed of two major successional vegetation communities: tall grass prairie and oak-hickory forest. The site vegetation directly reflects the regional vegetation types with the exception of the tall grass prairie originally occupying part of the site area. Non-forest communities now present on the site consist of agricultural croplands, pastures, and old fields. These communities are the most prevalent communities on the site (see Figure 3-1). Much of the land presently being cultivated would, given time, naturally revert to tall grass prairie dominated by little bluestem (Andropogon scoparius), big bluestem (A. gerardi), and Indian grass (Sorghastrum nutans).

Results of vegetational sampling in the "prairie" plots (see Figure 3-1) are presented in Appendix H. Prairie Sampling Station Pr-1 is an old field community dominated by meadow fescue (Festuca elatior). Field cinquefoil (Potentilla simplex) and panic grass (Panicum lanuginosum) were next in importance. Several small trees and shrubs consisting of persimmon (Diospyros virginiana), snowberry (Symphoricarpos sp.), pasture rose (Rosa carolina), and white ash (Fraxinus americana) were common.

Prairie Sampling Station Pr-2 showed a high diversity of species. The predominant species was redbud (Agrostis alba). Kentucky blue grass (Poa pratensis), Canada blue grass (Poa compressa), panic grass (Panicum lanuginosum), three-awned grass (Aristida oligantha) and Japanese lespedeza

(Lespedeza striata) were also important in the community. Shrubs or small trees present in Pr-2 included dewberry (Rubus flagellaris), white ash, snowberry, and slippery elm (Ulmus rubra).

Prairie Station Pr-3 had moderate species diversity. Canada blue grass was by far the dominant species. Kentucky blue grass, redbud, and Japanese lespedeza were also important. Shrubby vegetation was comprised of snowberry, slippery elm, and honey locust (Gleditsia triacanthos).

Vegetation comprising the ground cover of Prairie Station Pr-4 exhibited the least diversity of any of the Prairie Stations. Meadow fescue was the dominant species. White sweet clover (Melilotus alba), Japanese lespedeza and horse nettle (Solanum carolinense) were also frequently encountered.

Forest communities on the site are represented by oak forests, oak-hickory forests, oak-maple forests, and black walnut-red cedar forests. These communities are restricted to steep, rocky slopes in the northeastern and southern portions of the site (see Figure 3-1) which are unsuitable for agriculture.

The oak forest community (Forest Sampling Stations F-1 through F-4 in Figure 3-1) is the most common forest type on the site. In this forest type white oak (Quercus alba) is the dominant tree species (see Appendix H). Other species of importance are post oak (Q. rubra), white ash (Fraxinus americana), sugar maple (Acer saccharum), and redbud (Cercis canadensis).

One oak-hickory forest stand occurs on the Callaway site. Black oak, white oak and shagbark hickory (Carya ovata) are the most important species. Red oak and sugar maple are the dominant species in the two oak-maple forest stands which occur on the site. Other important species in this stand are white oak, hop-hornbean (Carpinus caroliniana), white ash, and pignut hickory (Carya glabra).

Black walnut (Juglans nigra) and red cedar (Juniperus virginiana) are the dominant members of a forested stand located along a drainage on the site. Honeylocust (Gleditsia triacanthos) and American elm (Ulmus americana) are common in this stand.

Only one endangered plant species has been found on the site. The State of Missouri lists the American elm (a non-dominant species on the site) as an endangered species because of its rapid decline due to Dutch elm disease. American elm has a wide range throughout the East and is not considered unique to the area.

The relative effects of Plant construction on the terrestrial ecosystem can generally be measured by examining the acreage involved. These are:

<u>Description</u>	<u>Approximate Acreage</u>
Plant	400
Railroad spur	60
Access road	50
Pipeline	70
Intake structure	<u>20</u>
	600

The major vegetational impact, that of Plant construction, has already occurred. Construction has removed some agricultural lands from available use, and a small amount of oak-hickory forest has been removed.

Aside from the rather permanent impacts resulting from the access road, railroad spur, pipeline, and intake structure, future vegetational impacts associated with the operation of the Plant may come from cooling tower drift. Natural draft cooling towers have a visible plume under certain meteorological conditions, but ground level fogging and icing rarely occur because of the high level plume release (555 feet in the case of the Callaway tower). Plume modeling studies for the Callaway Plant have shown that only six ground fogging conditions per year are projected. No ground icing instances are predicted.

Due to dissolved solids contained in the circulating water, the drift from the cooling tower contributes to some degree to the normal fallout of natural salt. The effects of salt drift can be divided into two main categories: 1) effects due to the accumulation of salts in the soil,

and 2) effects due to deposition of aerosol salts, either as particulates or in solution, on the foliage of plants.

Vegetation similar to that occurring at the Callaway site has been found to be generally tolerant of continuous low levels of salt deposition and possibly of short-term exposure to higher concentrations during storms (Wisconsin Electric Company 1978). The effects of salt drift on plant foliage are not completely understood. Quantification of foliar damage to plants has not been dealt with in any depth in the literature, and most of the available literature is qualitative. However, it is anticipated that there would be little adverse effect of cooling tower drift on soil salinity or vegetation in the area. The only significant effect on the site vegetation resulting from cooling tower operation would be shadowing of direct sunlight by the plume itself. The problem of plume shadowing has been investigated using analytical and numerical modeling techniques that have predicted reductions of up to 20 minutes per day of sunshine in the immediate vicinity of cooling tower installations similar to the type to be used at the Callaway site (Wisconsin Electric 1978). These shadowing effects are similar to those expected from natural cloud formations; therefore, plume shadowing effects on local agriculture and vegetation are not expected to be significant.

3.3 Avifauna

During the five sampling periods of the 1973 baseline study, an avian automobile survey (method of Robbins and Van Velzer 1967) was conducted to determine the variety and relative abundance of bird species on the Callaway Plant site and adjacent areas. The survey also was designed to establish the relationship between bird activity and the various habitat types found along the 19 mile automobile survey route.

A modification of Pettingill's (1970) avian strip survey was used to supplement the automobile survey. Two avian strip surveys were conducted to determine the variety and relative abundance of bird species using selected habitats on the site.

The Emlen (1971) technique was used to evaluate bird populations on the Callaway site during the 1974-1975 preconstruction monitoring program. Emlen transects were walked through the eight sampling stations designated for vegetation and wildlife studies. Each station was visited at least twice during the spring and fall sampling periods.

One hundred and twenty-two species of birds were observed on the Callaway Plant site during the terrestrial studies (Union Electric Company 1974b). Bird data collected during the baseline studies and are presented in Appendix I. The major bird habitats present on the site are hedgerows, forests, old fields, and agricultural fields. Each of these habitat types has a characteristic bird assemblage associated with it. Hedgerow communities are preferred by bobwhite, mourning dove, blue jay, common crow, mockingbird, robin, eastern bluebird, and cardinal. Birds commonly associated with the site's woodlots are turkey, woodpeckers, brown thrasher, blue jay, common crow, black-billed and yellow-billed cuckoos, eastern wood pewee, yellow shafted flicker, and various sparrows. Old fields on the site commonly support sparrows, red-winged blackbirds, starlings, eastern and western meadowlarks, and the dick cissel. Common birds of the site's agricultural fields are mourning dove, robin, chimney swift, swallows, and bobwhite.

"Important" wildlife species are those species which have some commercial or recreational value for man, are hunted for sport, are considered rare and/or endangered or a vital to the survival of other "important" wildlife or are critical to the structure and function of the ecosystem (Atomic Energy Commission Regulatory Guide 4.2, 1973). Important species found on the site are summarized below.

Game birds which use the site and nearby areas include wild turkey, bobwhite, mourning dove, ring-necked duck, mallard duck, blue-winged teal, woodduck, Canada goose, blue goose, snow goose, and woodcock. The site lacks food and general habitat for waterfowl and woodcock; hence, the species are not considered important onsite game birds. Their preferred habitats are found along the Missouri River. Bobwhite quail and mourning doves are common on the site, while wild turkey occasionally occur.

The ruffed grouse, a rare species in Missouri, was observed on the site in November 1973. No threatened or endangered birds were observed on the site, although bald eagles (a federally endangered species) and osprey (a Missouri endangered species) have been sighted along the Missouri River several miles from the Callaway Plant site (Union Electric Company, undated a).

Construction of the Callaway Plant has resulted in the loss of habitat for some species of birds and concomitant displacement of avifauna to other areas. However, due to the diversity and quality of habitats existing around the site, this impact is considered insignificant.

The greatest effect of Plant operation on avifauna may result from bird collisions with transmission lines and the cooling tower. Major periods of potential bird mortality would be expected to occur during peak periods of nocturnal migration under unfavorable weather conditions, although losses may occur at any time during the year. Studies have shown that most bird losses coincide with overcast weather conditions, wind shifts due to passing cold fronts, and precipitation and/or fog (Brewer and Ellis 1958).

The mortality of birds from a nuclear power plant with cooling towers appears small compared to mortality due to other hazards (e.g. television towers, tall buildings) encountered during migration. Effects of cooling towers on birds have been observed and recorded at the Davis/Besse Nuclear Power Station near Port Clinton, Ohio (Wisconsin Electric 1978). At the Ohio site, 157 birds were killed during the fall 1972 and spring and fall 1973 seasons. At the Ohio site, it was reported that ducks and gulls readily avoided the tower.

It is anticipated the highest potential period for bird mortalities at the Callaway site would occur during the spring and fall migration periods, especially during periods of unfavorable weather conditions which force birds to fly lower than 500 feet. These losses are not expected to be appreciable when compared to the number of birds that die from other hazards during migration, therefore, no operational monitoring program should be required.

3.4 Herpetofauna

During the 1973 baseline study, amphibians and reptiles were sampled using the Evening Automobile Survey, described in the preceding section. Species, activity, and number of individuals were recorded.

Herpetofauna were evaluated qualitatively during the preconstruction monitoring program (1974-1975) by searching a variety of suitable habitats in each of the eight sampling stations. Amphibians collected within the sampling areas in spring were marked by toe clipping. Reptiles were usually collected for voucher specimens. Turtles were marked with an identification number and date on the plastron. During the fall surveys, herpetofauna were marked by clipping toes (in the case of lizards and amphibians), subcaudals (for snakes) or by filing a notch in the marginal scutes (for turtles).

Thirty-five species of reptiles and amphibians were observed on the Callaway Plant site during the field studies (see Appendix J). No federal or State of Missouri endangered herpetile species were observed on the site. Important reptilian species encountered were snapping turtle, three-toed box turtle, and eastern garter snake. The amphibian species considered common are the American toad, gray treefrog, leopard frog, green frog, and the bullfrog. The bullfrog and snapping turtle are legal game in Missouri and serve as a food source for hunters of those species.

Because no on site aquatic habitats were adversely impacted during construction and no adverse operational effects will occur to herpetiles, further monitoring of the reptile and amphibian populations of the site is not warranted.

3.5 Mammals

During the 1973 summer baseline study, eight small mammal traplines each having 15 stations at 15 meter intervals were permanently established. Two small Sherman livetraps and one medium-sized live trap were deployed per station along seven of the traplines. The eighth trapline was set in a pasture and consisted of one rat snap-trap and two mouse snap-traps per

station to minimize interference by cattle. Traplines were checked in the morning for three consecutive days. All mammals collected were identified to species, sexed, and measured.

Large mammals were sampled by means of a 1.5 square mile rectangular grid pattern of traps. Twenty-five 32 x 11 x 13 inch wire mesh traps were set in summer; 34 were used during the spring and fall sampling periods. Each individual captured was identified to species, sexed, tagged in both ears with metal tags, weighed, measured and released.

Several evening automobile surveys were conducted for three evenings beginning one hour before sunset on the first evening, at sunset on the second evening, and one hour after sunset on the third evening.

During the preconstruction monitoring program, rodents were censused by the trap-and-recapture technique of Smith et al. (1972) and Smith and Jorgensen (1974). Four three-acre trapping grids were established in forest habitats, and four in grassland habitats. Each grid consisted of 144 line traps. Captured animals were identified to species, measured, weighed, toe clipped and released. Computer-derived population estimates were converted to density estimates and expressed as numbers per acre for each species. An evening automobile survey was conducted as in the baseline survey.

Twenty-four mammalian species were observed on the Callaway site during the baseline and preoperational field studies (Appendix K). Important mammals for sport and recreation include white-tailed deer, fox and gray squirrels, coyote, and eastern cottontail. Mammals of economic value occurring on the site are raccoon, skunk, muskrat, opossum, fox and long-tailed weasel. The long-tailed weasel is a rare species in Missouri; however, the species is trapped for its pelt. Less than 50 per year are harvested for the entire state. No endangered mammals were observed.

Major impacts associated with construction and operation of the nuclear plant have already occurred, these being loss of habitat and displacement of a few mammals into adjacent areas. The surrounding area can easily support these individuals. Operational impacts may result from cooling tower noise. There are several phases of wildlife response to noises produced during plant operation. Some animals may undergo an

initial fright reaction when the cooling tower is started up. These affected species may react by moving out of the areas immediately adjacent to the noise source or by otherwise altering their routine behavior patterns. This initial period will be followed by an interval during which these affected species will become habituated to the disturbance because of the relatively constant intensity and quality of the noise generated by the water cascading through the fill and falling into the cooling tower basin. Habituation is the development of a tendency not to respond to a certain stimulus that originally evoked some sort of response. Following the period of habituation, the animals are expected to resume their normal behavior patterns. Consequently, the noise produced by the operation of the Plant is not expected to have any permanent adverse effect on wildlife of the area (Wisconsin Electric Company 1978).

3.6 Invertebrates

Invertebrates (insects, spiders, etc.) of the herbaceous stratum were sampled in the permanent sampling stations by an aerial sweepnet with a 38 cm diameter. The sampling technique consisted of making 50 sweeps over a distance of 50 paces along three randomly placed transects within each of four 2.5 acre sampling stations. Animals (and plant fragments) were transferred into Ziploc bags, frozen, and returned to the laboratory for identification.

Taxa collected during 1975 included the Araneida, Orthoptera, Thysanoptera, Homoptera, Hemiptera, Neuroptera, and Coleoptera. Almost all trophic levels are represented by the various species sampled (see Appendix L). No adverse effects are expected to result of Plant construction and operation on insects and other invertebrates in the area.

4.0 CONCLUSIONS

4.1 Aquatic Ecology

The various trophic levels of the aquatic ecosystem in the Missouri River, and Logan and Mud Creeks in the vicinity of the Callaway Nuclear Power Plant have been extensively surveyed through baseline, preconstruction, construction and preoperational monitoring programs from 1973 to the present. The volume of data gathered thus far has provided a comprehensive characterization of water quality, phytoplankton and primary productivity, zooplankton, benthic macroinvertebrates, vascular hydrophytes and fish. Continued monitoring of these areas will provide little additional information.

Thus far, no adverse effects of Plant construction or preoperational activities have been detected in aquatic communities. Monitoring programs have determined that water quality of the Missouri River, and Logan and Mud Creeks is generally within Missouri water quality standards and varies with river stage and surface runoff. The biota of the Missouri River is typical of fast flowing, turbid streams having poor productivity, low diversity of taxa, low densities of organisms, and virtually no vascular hydrophyte growth. Logan and Mud Creeks differ considerably from the river, are more productive but are not unique to the area.

Operation of the Callaway Nuclear Power Plant will probably have no detectable adverse impact on the aquatic ecosystem of the Missouri River, Logan or Mud Creeks due to the closed-cycle mode of operation and low productivity of aquatic communities in the river. Missouri River water will be withdrawn at the rate of 87 cfs for two reactor units, which represents only 0.11% of the average daily flow rate of 78,370 cfs near the site and less than 1% of extreme low flows of 11,100 cfs. Further, blowdown discharge to the Missouri River will average only 22 cfs, which will quickly mix with the river. The blowdown water quality will comply with the limitations stated in the NPDES permit.

In compliance with the NPDES permit issued by the Missouri Department of Natural Resources, adult and larval fish populations in the Missouri River and Logan Creek will continue to be monitored. Following

Plant startup, entrainment and impingement monitoring will be implemented along with additional monitoring of Plant discharges as required. Beyond these programs, continued monitoring of ambient water quality, phytoplankton, zooplankton and benthic macroinvertebrates would not detect any measureable adverse effects of Plant operation, and it is requested that these technical specification requirements not be included in the Callaway Nuclear Plant operating license as they have been from numerous other plants which have demonstrated no adverse harm to the aquatic community.

4.2 Terrestrial Ecology

The biota of the Callaway Plant site is not unique in the area although two rare species (ruffed grouse and long-tailed weasel) and one endangered species (American elm) occur on the site. The site does not provide critical habitat for these species. All are common species in the eastern United States and are only considered rare or endangered in Missouri due to lack of suitable habitat or because they are at the edge of their ranges.

Project impacts have already occurred from the construction of the nuclear facility. These impacts are minor and have resulted in loss of habitat for species which could easily relocate in adjacent areas. Operational effects may result from the natural draft cooling towers. Again these impacts are considered minimal and may result in an avoidance zone by mammals and herpetiles due to noise, migratory bird collisions with the cooling towers, and plume-induced shading and minor salt drift effects on local vegetation.

The existing data base for the terrestrial ecosystem is sufficient to describe the biota. Plant operation will have only minimal impacts and further monitoring is not necessary. Therefore, it is requested that terrestrial monitoring requirements be deleted from the Callaway Nuclear Plant operating license.

5.0 LITERATURE CITED

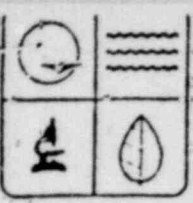
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APPENDIX A

NPDES Permit
Callaway Nuclear Power Plant



August 8, 1980

Union Electric Company
1901 Gratiot Street
P.O. Box 149
St. Louis, MO 63166

Dear Permittee:

Pursuant to the Federal Water Pollution Control Act, under the authority granted to the State of Missouri and in compliance with the Missouri Clean Water Law, we have issued and are enclosing your National Pollutant Discharge Elimination System (NPDES) Permit to Discharge from your above-referenced facility.

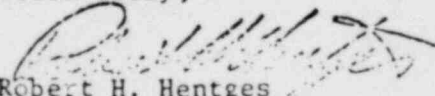
Please READ your Permit carefully: Your NPDES Permit to Discharge includes standard and special conditions which must be followed to remain in compliance with the requirements of the Federal Water Pollution Control Act and the Missouri Clean Water Law.

Monitoring reports required by the special conditons must be submitted on a periodic basis. Copies of the necessary report forms are enclosed. If you have any questions concerning these reports, please do not hesitate to call this office or our regional office in your area.

This NPDES Permit is both your Federal discharge permit and your new State operating permit and replaces all previous State operating permits for this facility. In all future correspondence regarding this facility, please refer to your NPDES Permit number, the facility name, and the file number listed at the top of this page.

I am sure that you appreciate the importance of eliminating pollution from our Nation's waters and will abide by the terms and conditions of the NPDES Permit. If you have any questions concerning this permit, please do not hesitate to call this office or our Regional Office at P.O. Box 1368, Jefferson City, MO 65101, phone: (314) 751 2729.

Yours truly,


Robert H. Hentges
Chief of Permit Section
Water Quality Program

RHH/gt

Enclosure

CC: EPA - Permit Branch
Billing Dept. - Permit Branch
Jefferson City Regional Office

MISSOURI DEPARTMENT OF NATURAL RESOURCES
P.O. Box 1368 2010 Missouri Blvd. Jefferson City, Missouri 65102 (314) 751-3241

Joseph P. Teasdale Governor
Fred A. Lafser Director

Division of Environmental Quality
James P. Odendahl Director

MISSOURI CLEAN WATER COMMISSION
AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the Federal Water Pollution Control Act, Public Law 92-500, 92nd Congress, (Hereinafter, the Act) as amended, and the Missouri Clean Water Law, (Chapter 204 R.S. Mo. Cum. Supp. 1973, hereinafter, the Law),

Owner: Union Electric Company

Owner's Address: 1901 Gratiot Street, P.O. Box 149, St. Louis, Missouri 63166

Facility Name: Callaway Power Plant

Facility Address: Reform, Missouri 65077

Legal Description: River Mile 115.4, Callaway County

Receiving Stream & Basin: Missouri River - Missouri River Basin

is authorized to discharge from the facility described herein, in accordance with effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

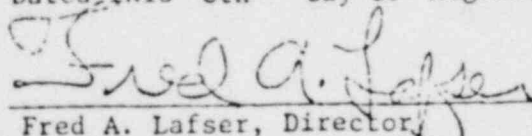
Units one and two of the Callaway Power Plant located in the NE $\frac{1}{4}$, Sec. 14, T46N, R8W, Callaway County, Missouri. The wastewater effluents will enter the Missouri River at River Mile 115.4. The maximum daily combined flow from the following outfalls will be 15,802,273 gal per day.

#001 - Radwaste treatment system (.028473 mgd) - leakage from coolant system, steam generator leakage, wastes from the laundry of clothing worn in contaminated areas, hot shower drains, floor drains in the containment, auxiliary and Radwaste buildings, and generator blowdown are processed in the liquid radwaste treatment system prior to re-use or discharge. The treatment system has strainers, filters, heat exchangers, carbon filtration, demineralization, waste evaporation to separate water from impurities, reverse osmosis, and waste monitor tanks. All processing in the Liquid Radwaste Processing System is done on a batch basis. After monitoring for radioactive content, release rates are controlled administratively to insure the "as low as practicable" radioactive discharge criteria are met. (continued on page 2)

This permit shall become effective on August 8, 1980, unless appealed in accordance with Section 204.051.6 of the Law.

This permit and authorization to discharge shall expire at midnight, August 7, 1985.

ORIGINAL SIGNED BY
Dated this 8th day of August, 1980.



Fred A. Lafser, Director
Department of Natural Resources
Permit Administrator for Missouri Clean Water Commission

- #002 - Cooling tower blowdown (13.471 mgd) ^{14. mgd}
millions
- #003 - Water treatment plant sludge (.4608 mgd)
- #004 - Demineralizer system wastes (.267 mgd)
- #005 - Oil separator discharge (.144 mgd)
- #006 - Circulating and Service Water Pumphouses oil separator and neutralization sump (.144 mgd)
- #007 - Two 20,000 gpd Clow Aer-O-Flow Model S-200-55-5 extended aeration treatment units preceded by a 25,000 gallon aerated surge tank. (.0342 mgd)
- #008 - Chemical Water Treatment Unit (.004 mgd)
- #009 - Intake structure sump (.216 mgd)

no sludge

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The effluent limitations shall become effective on the dates specified herein. Such discharges shall be controlled, limited, and monitored by the permittee as specified below:

EFFLUENT LIMITATIONS

MONITORING REQUIREMENTS

Effective Date	Interim	Interim	Final	Measurement Frequency	Sample Type
	Limitations	Limitations	Limitations		
Outfall Number and Effluent Parameter(s)			mg/l (lbs/day)		
Outfall #001 - Radwaste System			Issuance		
Flow-m ³ /Day (MGD)			***	when discharge occurs	24 hr. total
Total Suspended Solids					
*Monthly Average			30 (7.1)	when discharge occurs	grab
**Daily Maximum			45 (10.7)	when discharge occurs	grab
Oil and Grease					
*Monthly Average			15 (3.6)	when discharge occurs	grab
**Daily Maximum			20 (4.7)	when discharge occurs	grab
pH - Units (Not to be averaged)			6.0 - 9.0	when discharge occurs	grab
Outfall #002 - Cooling Tower Blowdown					
Flow-m ³ /Day (MGD)			***	continuous	24 hr. recorder
Total Suspended Solids			<i>none</i> ***	once/week	grab
Total Dissolved Solids			***	once/week	grab
Oil and Grease					
*Monthly Average			15 (1685)	once/week	grab
**Daily Maximum			20 (2247)	once/week	grab
Dissolved Copper					
*Monthly Average			1.0 (112)	once/month	grab
**Daily Maximum			1.5 (169)	once/month	grab
Dissolved Nickel					
*Monthly Average			1.0 (112)	once/month	grab
**Daily Maximum			1.5 (169)	once/month	grab
Free Available Chlorine					
*Monthly Average			0.2 (22)	once/week	grab
**Daily Maximum			0.5 (56)	once/week	grab
Temperature - °F(°C)			95°F(35°C)	continuous	24 hr. recorder

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The effluent limitations shall become effective on the dates specified herein. Such discharges shall be controlled, limited, and monitored by the permittee as specified below:

EFFLUENT LIMITATIONS

MONITORING REQUIREMENTS

Effective Date	Interim	Interim	Final	Measurement Frequency	Sample Type
	Limitations	Limitations	Limitations		
Outfall Number and Effluent Parameter(s)			mg/l (lbs/day)		
<u>Outfall #002 - continued</u>					
pH - Units (Not to be averaged)			6.0 - 9.0	continuous	24 hour recorder
<u>Outfall #003 - Water Treatment Plant</u>					
Flow-m ³ /Day (MGD)			***	once/week	instantaneous
Total Suspended Solids					
*Monthly Average			30 (115)	once/month	grab
**Daily Maximum			100 (384)	once/month	grab
Oil & Grease					
*Monthly Average			15 (58)	once/month	grab
**Daily Maximum			20 (77)	once/month	grab
pH - Units (Not to be averaged)			6.0 - 9.0	once/month	grab
<u>Outfall #004 - Demineralizer System</u>					
Flow-m ³ /Day (MGD)			***	once/week	instantaneous
Total Suspended Solids					
*Monthly Average			30 (67)	once/month	grab
**Daily Maximum			100 (223)	once/month	grab
Oil & Grease					
*Monthly Average			15 (33)	once/month	grab
**Daily Maximum			20 (45)	once/month	grab

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The effluent limitations shall become effective on the dates specified herein. Such discharges shall be controlled, limited, and monitored by the permittee as specified below:

EFFLUENT LIMITATIONS

MONITORING REQUIREMENTS

Effective Date	Interim	Interim	Final	Measurement Frequency	Sample Type
	Limitations	Limitations	Limitations		
Outfall Number and Effluent Parameter(s)			mg/l (lbs/day)		
Outfall #004 - continued)					
pH - Units (Not to be averaged)			6.0 - 9.0	once/month	grab
Outfall #005 - Oil Separator					
Flow-m ³ /Day (MGD)			***	once/week	instantaneous
Total Suspended Solids					
*Monthly Average			30 (36)	once/month	grab
**Daily Maximum			100 (120)	once/month	grab
Oil and Grease					
*Monthly Average			15 (18)	once/month	grab
**Daily Maximum			20 (24)	once/month	grab
pH - Units (Not to be averaged)			6.0 - 9.0	once/month	grab
Outfall #006 - Circulating and Service Water					
Flow-m ³ /Day (MGD)			***	once/week	instantaneous
Total Suspended Solids					
*Monthly Average			30 (36)	once/month	grab
**Daily Maximum			100 (120)	once/month	grab
Oil and Grease					
*Monthly Average			15 (18)	once/month	grab
**Daily Maximum			20 (24)	once/month	grab
pH - Units (Not to be averaged)			6.0 - 9.0	once/month	grab
Outfall #007 - Sanitary Waste					
Flow-m ³ /Day (MGD)			***	once/week	24 hr. total
Biochemical Oxygen Demand ₅					
*Monthly Average			30 (8.6)	once/month	comp.***
Daily Maximum			45 (13)	once/month	comp.*
Total Suspended Solids					
*Monthly Average			30 (8.6)	once/month	comp.***
Daily Maximum			45 (13)	once/month	comp.*
pH - Units (Not to be averaged)			6.0 - 9.0	once/month	grab
Outfall #008 - Chemical Water Treatment Unit					
Flow-m ³ /Day (MGD)			***	once/month	instantaneous
Total Suspended Solids					
*Monthly Average			30 (1.0)	once/month	grab
**Daily Maximum			100 (3.3)	once/month	grab

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The effluent limitations shall become effective on the dates specified herein. Such discharges shall be controlled, limited, and monitored by the permittee as specified below:

Effective Date Outfall Number and Effluent Parameter(s)	<u>EFFLUENT LIMITATIONS</u>			<u>MONITORING REQUIREMENTS</u>	
	Interim Limitations	Interim Limitations	Final Limitations	Measurement Frequency	Sample Type
Outfall #008 - continued			Issuance		
Oil and Grease			mg/l (lbs/day)		
*Monthly Average			15 (0.5)	once/month	grab
*Daily Maximum			20 (0.67)	once/month	grab
- Units (Not to be averaged)			6.0 - 9.0	once/month	grab
Outfall #009 - Intake Structure Sump					
Flow-m ³ /Day (MGD)			***	once/week	24 hr. total
Total Suspended Solids					
*Monthly Average			30 (54)	once/week	grab
*Daily Maximum			100 (180)	once/week	grab
Oil and Grease					
*Monthly Average			15 (27)	once/week	grab
*Daily Maximum			20 (36)	once/week	grab
- Units (Not to be averaged)			6.0 - 9.0	once/week	grab
Monthly Average: the total mass or concentration of all daily discharges sampled during a calendar month divided by the number of daily discharges sampled or measured during that month. Daily Maximum: an effluent limitation that specifies the total mass or average concentration of pollutants that may be discharged in a calendar day.					
* Monitoring requirement only.					
** Composite shall consist of a minimum of 4 grab samples in a 24 hour period with a minimum of 2 hours between each grab sample.					

Monitoring reports shall be submitted quarterly ; the first report is due 1/28/81.
 There shall be no discharge of floating solids or visible foam in other than trace amounts.

STANDARD CONDITIONS

In addition to specified conditions stated herein, this permit is subject to the attached Part I standard conditions dated October 1, 1975, and hereby incorporated as though fully set forth herein.

SCHEDULE OF COMPLIANCE Not applicable

D. SPECIAL CONDITIONS

In issuing this permit, the Missouri Clean Water Commission has not determined whether or not the radioactive discharges from this plant will affect waters of the state. Radioactive discharges are the responsibility of the Nuclear Regulatory Commission, and any discharges of these constituents will be under the NRC's regulation.

E. OTHER REQUIREMENTS

1. Discharge Limitations - There shall be no discharge of polychlorinated biphenyl compounds.
2. Intake Structure(s)

Within 90 days of the receipt of the permit the permittee shall submit to the Department for review, modification and approval the design for an intake monitoring program to document the effects of the plant intake structures on the various species and life stages of fish. Sampling shall be performed weekly (unless the permittee justifies an alternative schedule to the satisfaction of the Department) on random days and shall include the number, size, weight and species of fish trapped by the present intake structure. An assessment shall also be made of other nekton which may be entrained in the water used for cooling. The sampling program must be conducted in a manner to evaluate diel and seasonal fluctuations. The program shall also include stream flow, cooling water flow, source and discharge water temperature and screen operation schedule.

The monitoring program shall be implemented within 90 days after approval of the monitoring program. Monthly monitoring reports shall be submitted.

Within 18 months after plan approval the permittee shall submit a final report to the Department. Development of the report shall be guided by the "Development Document for Best Technology Available for minimizing Adverse Environmental Impact of Cooling Water Intake Structures" as proposed by EPA.

This report shall be evaluated with regard to Section 316(b) of the Act. As a result of this evaluation, the Department may modify the permit to establish an implementation schedule to ensure compliance with Section 316(b) of the Act.

3. Pesticides

Any pesticide discharge from any point source shall comply with the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 U.S.C. 136 et. seq.) and the use of such pesticides shall be in a manner consistent with its label.

4. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under sections 301(b)(2) (C), and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

1. Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
2. Controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

5. The permittee shall conduct the following radiological monitoring:

a. Liquid Radwaste discharge, surface water and drinking water supply:

<u>Location</u>	<u>Frequency</u>	<u>Sample Type</u>
I Radwaste building discharge	daily	continuous
II Drinking water supply, Portland, Mo.	once/month	grab
III Upstream of discharge line	once/month	grab
IV Downstream of discharge line	once/month	grab
V Western border of St. Louis County	once/month	grab

Samples are to be analyzed for gross alpha, gross beta and tritium and gamma - scanned for significant radionuclitides.

b. Groundwater - monthly sampling of the groundwater from all test wells established for NRC permit requirements, or any other test wells established by Union Electric for monitoring groundwater in the area. At a minimum these shall include the three test wells identified in Figure 6.1-14 of the Environmental Report Volume 1 Callaway Plant Units 1 and 2 dated 30 May, 1974.

Grab samples are to be analyzed for gross alpha, gross beta, and tritium and gamma scanned for significant radionuclitides.

c. Aquatic biota - monthly sampling of the edible flesh of the five most important/ abundant species of fish. Samples shall be taken from at least the locations specified in III, IV, and V of 5.a. (listed above), Other Requirements. Samples are to be analyzed for gross alpha and gross beta and gamma - scanned for significant radionuclitides.

d. Bottom Sediment - monthly samples of bottom sediment from at least the locations specified in III, IV, and V of 5.a., Other Requirements. Samples are to be analyzed for gross alpha, gross beta, Strontium 90 and Cesium 137. Also, gamma spectroscopy is to be performed on these samples.

e. All radionuclitide monitoring data performed as required above shall be reported in the Discharge Monitoring Report (DMRs) submitted quarterly. The data collected shall be available for inspection during normal working hours. The submission shall include the exact time and location of sample collections, as well as, any other reporting requirements listed in the Standard Conditions attached to this permit.

APPENDIX B
Phytoplankton/Primary Production

TABLE 2.3.2-1
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 PHYTOPLANKTON COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK IN
 JULY (J), SEPTEMBER (S), AND DECEMBER (D), 1973, AND FEBRUARY (F), 1974

Division Class Scientific Name	Occurrence in Missouri River				Occurrence In Logan Creek			
	J	S	D	F	J	S	D	F
Chlorophyta								
Chlorophyceae								
<u>Actinastrum hantzschii</u>	x	x	x			x		
<u>Ankistrodesmus falcatus</u>			x	x			x	x
<u>Ankistrodesmus spp.</u>		x			x			
<u>Characium sp.</u>	x	x				x		
<u>Chlamydomonas sp.</u>			x	x			x	x
<u>Cladophora pacta</u>						x		
<u>Closteridium sp.</u>			x					
<u>Closteriopsis sp.</u>		x				x		
<u>Closterium gracilis</u>			x					
<u>Closterium setaceum</u>					x			
<u>Closterium spp.</u>	x		x	x			x	x
<u>Cosmarium sp.</u>		x						
<u>Crucigenia crucifera</u>			x					
<u>Crucigenia tetrapedia</u>			x	x				
<u>Crucigenia sp.</u>		x		x				
<u>Elakatothrix gelatinosa</u>			x	x				
<u>Golenkinia radiata</u>		x						
<u>Kirchneriella sp.</u>		x						
<u>Micractinium pusillum</u>			x					
<u>Microspora floccosa</u>		x						
<u>Oocystis sp.</u>		x						
<u>Pediastrum boryanum</u>	x	x						
<u>Pediastrum duplex</u>	x	x	x			x		x
<u>Pediastrum integrum</u>		x						

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TABLE 2.3.2-1(Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Division Class	Scientific Name	Occurrence in Missouri River				Occurrence in Logan Creek			
		J	S	D	F	J	S	D	F
	<u>Pediastrum simplex</u>	x	x	x					
	<u>Pediastrum spp.</u>	x	x	x	x			x	
	<u>Scenedesmus acuminatus</u>			x	x			x	
	<u>Scenedesmus anomalus</u>							x	
	<u>Scenedesmus bijuga</u>			x					
	<u>Scenedesmus dimorphus</u>		x				x		
	<u>Scenedesmus quadricauda</u>		x	x	x		x		
	<u>Scenedesmus spp.</u>	x	x			x	x		x
	<u>Spirogyra sp.</u>	x		x	x				
	<u>Staurastrum paradoxum</u>	x						x	
	<u>Staurastrum pentacerum</u>	x							
	<u>Tetradesmus sp.</u>		x						
	<u>Tetrastrum staurogeniaeforme</u>			x					
	<u>Treubarria setigerum</u>		x						
	<u>Ulothrix cylindricum</u>	x				x			
	<u>Ulothrix sp.</u>		x				x		x
	<u>Volvox sp.</u>				x				
Chrysophyta									
Bacillariophyceae									
	<u>Achnanthes sp.</u>			x				x	
	<u>Amphora ovalis</u>		x	x	x			x	
	<u>Amphora sp.</u>		x				x		
	<u>Anomoeoneis sp.</u>		x				x		
	<u>Asterionella formosa</u>	x		x	x	x		x	x
	<u>Caloneis sp.</u>								x

TABLE 2.3.2-1 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Division Class	Scientific Name	Occurrence in Missouri River				Occurrence in Logan Creek			
		J	S	D	F	J	S	D	F
	<u>Cocconeis placentula</u>			X					
	<u>Cocconeis sp.</u>		X	X	X		X	X	X
	<u>Cyclotella spp.</u>		X	X	X		X	X	X
	<u>Cymbella spp.</u>		X	X	X	X	X	X	X
	<u>Diatoma hiemale</u>		X				X		
	<u>Diatoma vulgare</u>			X	X				
	<u>Eunotia maior</u>			X					
	<u>Eunotia praerupta</u>			X					
	<u>Eunotia sp.</u>			X	X			X	
	<u>Fragilaria brevistriata</u>	X							
	<u>Fragilaria capucina</u>			X	X				
	<u>Fragilaria construens</u>			X	X			X	X
	<u>Fragilaria crotonensis</u>	X	X			X	X	X	
	<u>Fragilaria intermedia</u>			X	X			X	
	<u>Fragilaria sp.</u>		X				X		X
	<u>Gomphonema acuminatum</u>			X	X				
	<u>Gomphonema angustatum</u>				X				
	<u>Gomphonema constrictum</u>			X	X				
	<u>Gomphonema olivaceum</u>			X	X			X	X
	<u>Gomphonema sp.</u>		X						X
	<u>Gyrosigma sp.</u>		X	X	X		X	X	X
	<u>Mastogloia braunii</u>		X						
	<u>Melosira granulata</u>			X	X			X	X
	<u>Melosira varians</u>			X	X			X	
	<u>Melosira sp.</u>		X	X	X		X	X	X
	<u>Meridion circulare</u>				X				X
	<u>Navicula exigua</u>			X	X			X	

TABLE 2.3.2-1(Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Division Class	Scientific Name	Occurrence in Missouri River				Occurrence in Logan Creek			
		J	S	D	F	J	S	D	F
	<u>Navicula pupula</u>			X	X			X	
	<u>Navicula rhynchocephala</u>			X	X			X	
	<u>Navicula sp.</u>		X	X	X	X	X	X	X
	<u>Nitzschia acicularis</u>		X	X	X	X		X	X
	<u>Nitzschia filiformis</u>			X	X				
	<u>Nitzschia hungarica</u>			X					
	<u>Nitzschia linearis</u>			X					
	<u>Nitzschia lorenziar</u>	X	X				X		
	<u>Nitzschia parvula</u>			X					
	<u>Nitzschia sigmoidea</u>	X	X	X			X		
	<u>Nitzschia spp.</u>	X	X	X	X		X	X	X
	<u>Pinnularia sp.</u>			X	X			X	
	<u>Rhoicosphenia curvata</u>			X	X		X	X	
	<u>Stauroneis anceps</u>			X					
	<u>Stauroneis phoenicenteron</u>			X					
	<u>Stauroneis sp.</u>							X	
	<u>Stephanodiscus spp.</u>	X	X	X					
	<u>Surirella angustata</u>			X	X				
	<u>Surirella ovata</u>			X	X			X	X
	<u>Surirella sp.</u>		X						
	<u>Synedra actinastroides</u>			X					
	<u>Synedra acus</u>	X		X	X				
	<u>Synedra ulna</u>	X	X	X	X	X	X	X	
	<u>Synedra sp.</u>		X	X	X		X	X	X
	<u>Tabellaria fenestrata</u>	X	X	X	X	X	X	X	
	<u>Tabellaria flocculosa</u>			X	X			X	
	<u>Tabellaria sp.</u>		X						X

TABLE 2.3,2-1 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Division Class Scientific Name	Occurrence in Missouri River				Occurrence in Logan Creek			
	J	S	D	F	J	S	D	F
Coscinodiscaceae-Unid. spp.		x				x		
Naviculaceae-Unid. spp.		x				x		
Centrales-Unid. spp.		x				x		
Pennales-Unid. spp.		x	x	x		x	x	x
Chrysophyceae								
<u>Chrysmoeba</u> sp.		x						
<u>Dinobryon sertularia</u>							x	
<u>Dinobryon</u> sp.			x					
Xanthophyceae								
<u>Characiopsis</u> sp.		x						
<u>Tribonema</u> sp.		x				x		
Cyanophyta								
Myxophyceae								
<u>Anabaena</u> sp.		x				x		
<u>Aphanizomenon flos-aquae</u>			x	x			x	
<u>Chroococcus</u> sp.		x				x		
<u>Dactylococcopsis smithii</u>		x						
<u>Glaucocystis</u> sp.		x						
<u>Gloeotrichia echinulata</u>		x						
<u>Gomphosphaeria lacustris</u>		x				x		
<u>Lyngbya contorta</u>				x				
<u>Merismopedia</u> sp.		x				x		

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TABLE 2.3,2-1 (Continued)

RFF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Division Class Scientific Name	Occurrence in Missouri River				Occurrence in Logan Creek			
	J	S	D	F	J	S	D	F
<u>Microcystis aeruginosa</u>			x					
<u>Microcystis</u> sp.		x						
<u>Oscillatoria</u> sp.	x	x				x		
<u>Spirulina</u> sp.	x	x	x	x			x	x
Euglenophyta								
Euglenophyceae								
<u>Euglena spirogyra</u>		x						
<u>Euglena</u> sp.			x	x				x
<u>Phacus</u> sp.		x	x	x	x			x
<u>Trachelomonas</u> sp.		x		x		x	x	x
Pyrrhophyta								
Dinophyceae								
<u>Ceratium hirundinella</u>							x	x
<u>Glenodinium</u> sp.			x	x				x

TABLE 2.3.2-2
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 WILCOXAN'S TEST VALUES FOR DIFFERENCES BETWEEN SAMPLING DATES
 IN OCCURRENCE OF GREEN ALGAE, BLUE-GREEN ALGAE, DIATOMS,
 AND TOTAL PHYTOPLANKTON PER LITER

<u>Months Compared</u>	<u>green algae/liter</u>		<u>blue-green algae/liter</u>		<u>diatoms/liter</u>		<u>phytoplankton/liter</u>	
	<u>Smallest Rank</u>	<u>Significance^a</u>	<u>Smallest Rank</u>	<u>Significance</u>	<u>Smallest Rank</u>	<u>Significance</u>	<u>Smallest Rank</u>	<u>Significance</u>
7/73 & 9/73	32	ns	29	ns	24	*	34	ns
7/73 & 12/73	21	**	25.5	*	21	**	38	ns
7/73 & 2/74	21	**	21	**	25	*	31	ns
9/73 & 12/73	21	**	37.5	ns	33	ns	31	ns
9/73 & 2/74	21	**	21	**	37	ns	25	*
12/73 & 2/74	27.5	ns	21	**	29	ns	26	*

^a ns = nonsignificant, $p > 0.025$

* = $p \leq 0.025$

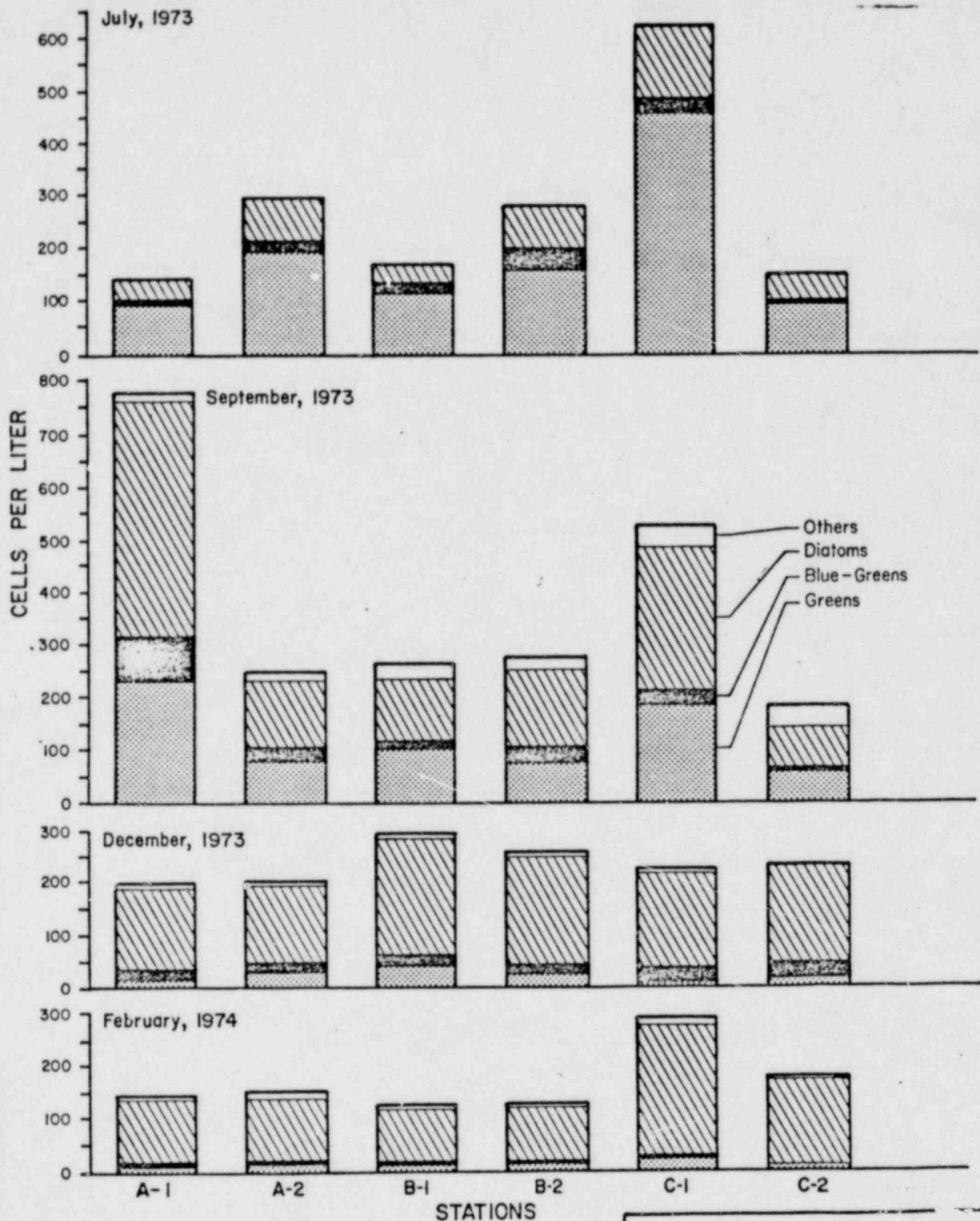
** = $p \leq 0.005$

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TABLE 2.3.2-4
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 AVERAGE DENSITIES (CELLS PER LITER) OF PHYTOPLANKTON COLLECTED IN LOGAN CREEK
 IN JULY, SEPTEMBER, AND DECEMBER, 1973, AND FEBRUARY, 1974

Sampling Periods	Station D					Station E				
	Greens	Diatoms	Blue-greens	Others ^o	Total	Greens	Diatoms	Blue-greens	Others	Total
July 1973	69,000	54,000	513,000	0	636,000	15,000	1,100,000	0	0	1,115,000
September 1973	281	1,427	3.5	70	1,718.5	402	9,507.5	0	312.5	10,222
December 1973	6	31	0	5	42	6	566.5	7.5	15	595
February 1974	1	65	0.5	4.5	71	2	208	1	1	212

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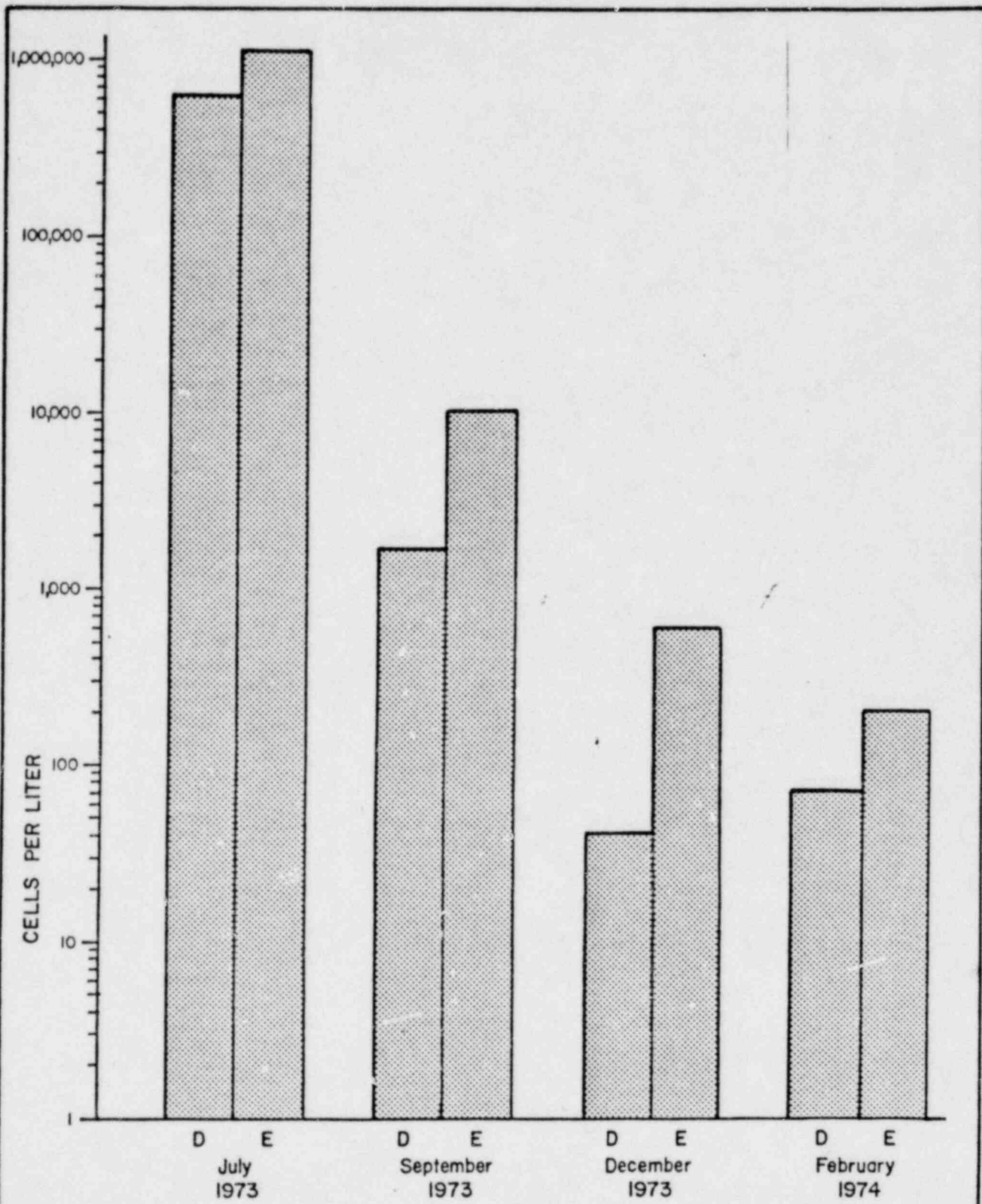


UNION ELECTRIC
CALLAWAY PLANT
UNITS 1 & 2

PHYTOPLANKTON DENSITIES
AT MISSOURI RIVER STATIONS

Figure 2 3.2-1

REF. EVE. BASELINE INVENTORY - ANNUAL SUMMARY
CALLAWAY PLANT



UNION ELECTRIC CO.
CALLAWAY PLANT
UNITS 1 & 2

PHYTOPLANKTON AT
LOGAN CREEK STATIONS

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY
CALLAWAY PLANT

Figure 2.3.2-2

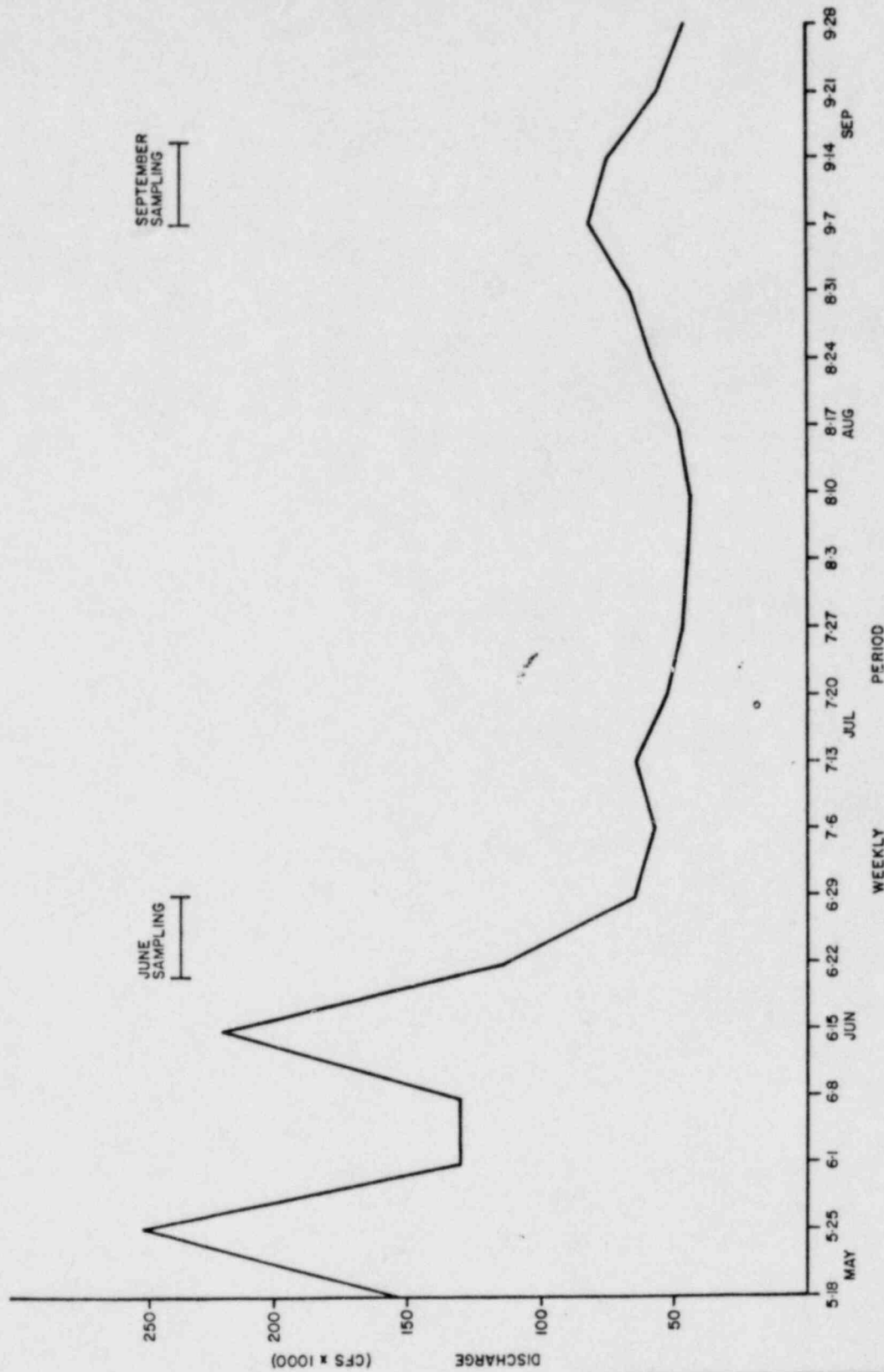
TABLE 2.3.2-1
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 DENSITIES (cells/liter) OF PHYTOPLANKTON COLLECTED IN THE
 MISSOURI RIVER AND LOGAN CREEK,
 JUNE 1974

<u>Organism</u>	<u>Missouri River Stations</u>				<u>Logan Creek Stations</u>	
	<u>H-1</u>	<u>H-2</u>	<u>C-1</u>	<u>C-2</u>	<u>D</u>	<u>E</u>
Green						
Cocoid	3,266		6,532	+	1,633	+
Filamentous	+	+	+	1,633	+	+
Flagellated	+	+	+	+	+	+
Other	9,798	14,697	6,532	14,697	3,266	9,798
Euglenoid	‡	‡	+	1,633	+	+
Diatoms						
Centric	4,899	9,798	8,165	3,266	3,266	6,532
Pennate	71,852	73,540	52,311	65,320	39,192	50,623
Blue-green						
Cocoid	+	+	+	+	+	+
Filamentous	1,633	3,266	3,266	3,266	4,899	
Total	91,448	101,301	76,806	89,815	52,256	66,953

TABLE 2.3.2-2

DENSITIES (CELLS/LITER) OF PHYTOPLANKTON COLLECTED IN THE MISSOURI RIVER
AND LOGAN CREEK, SEPTEMBER 1974

Organism	Missouri River Stations					Logan Creek Stations	
	A-2	B-2	H-2	C-1	C-2	D	E
Green							
Cocoid	163,300	163,300	163,300	326,600	163,300	+	+
Filamentous	+	+	+	+	+	+	+
Flagellated	+	+	+	163,300	+	+	+
Other	2,122,900	2,776,100	1,796,300	653,200	1,632,900	979,800	+
Euglenoid	+	163,300	+	+	+	+	+
Diatoms							
Centric	5,388,900	6,042,100	6,205,400	3,919,200	5,551,200	489,900	163,300
Pennate	2,449,500	3,102,700	3,592,600	1,633,000	5,552,200	2,122,900	3,592,600
Blue-green							
Cocoid	+	+	+	+	+	+	+
Filamentous	1,143,100	489,900	+	816,500	653,200	163,300	326,500
Dinoflagellate	+	+	+	+	326,600	+	+
TOTAL	11,267,700	12,737,400	11,757,600	7,511,800	13,879,400	3,755,900	4,082,400



REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY
CALLAWAY PLANT 1974

UNION ELECTRIC CO.
CALLAWAY PLANT
UNITS 1&2

MEAN WEEKLY DISCHARGE
OF THE MISSOURI RIVER,
HERMANN, MISSOURI

Figure 2.3.2-1

TABLE 2.3.3-1
 REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 DENSITIES (cells/liter) OF PHYTOPLANKTON COLLECTED IN THE
 MISSOURI RIVER AND LOGAN CREEK,
 8 FEBRUARY 1975

Organism	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
GREEN								
Coccoid	-	-	-	-	-	-	-	-
Filamentous	-	-	-	-	-	-	-	-
Flagellated	-	-	-	-	-	-	-	-
Other	537,000	358,000	-	-	179,000	-	-	-
EUGLENOID	-	-	-	-	-	-	-	-
DIATOM								
Centric	537,000	179,000	895,000	179,000	179,000	179,000	179,000	-
Pennate	4,833,000	4,654,000	4,117,000	1,611,000	1,969,000	179,000	537,000	179,000
BLUE-GREEN								
Coccoid	-	-	-	-	-	-	-	-
Filamentous	895,000	537,000	537,000	-	537,000	358,000	358,000	-
Colonial	-	-	-	-	-	-	-	-
DESMID	-	-	-	-	-	-	-	-
TOTAL	6,802,000	5,728,000	5,549,000	1,790,000	2,864,000	716,000	1,074,000	179,000

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TABLE 2.3.3-2

DENSITIES (cells/liter) OF PHYTOPLANKTON COLLECTED IN THE
MISSOURI RIVER AND LOGAN CREEK,
2 JUNE 1975

Organism	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
GREEN								
Cocoid	-	-	-	NS ^a	-	104,272	-	NS
Filamentous	-	-	-	NS	-	-	32,928	NS
Flagellated	-	-	-	NS	-	-	-	NS
Other	25,720	36,008	56,580	NS	82,304	91,924	2,058	NS
EUGLENOID	15,432	10,288	-	NS	-	9,604	-	NS
DIATOM								
Centric	288,064	226,336	324,072	NS	262,344	54,880	12,38	NS
Pennate	313,784	519,544	411,520	NS	334,360	48,020	376,614	NS
BLUE-GREEN								
Cocoid	-	-	-	NS	-	-	-	NS
Filamentous	15,432	15,432	15,432	NS	20,576	5,488	-	NS
Colonial	66,872	66,872	56,584	NS	25,720	12,348	-	NS
DESMID	-	-	-	NS	-	5,488	-	NS
TOTAL	725,304	874,480	864,192	-	725,304	332,024	423,948	-

^aNot sampled.

TABLE 2.3.3-3
 REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 DENSITIES (cells/liter) OF PHYTOPLANKTON COLLECTED IN THE
 MISSOURI RIVER AND LOGAN CREEK,
 10 SEPTEMBER 1975

Organism	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
GREEN								
Cocoid	-	-	-	-	-	7,332	-	-
Filamentous	-	-	-	-	-	-	10,262	-
Flagellated	-	-	3,666	-	-	40,326	-	1,466
Other	14,664	32,904	40,326	7,332	36,660	40,326	27,854	13,194
EUGLENOID	-	3,666	10,998	14,664	10,998	146,640	30,786	29,008
DIATOMS								
Centric	29,328	36,660	32,994	36,660	62,322	54,990	16,126	55,776
Pennate	131,976	135,642	84,318	102,648	106,332	40,326	65,970	54,242
BLUE-GREEN								
Cocoid	-	-	-	-	-	-	-	-
Filamentous	73,320	14,664	65,988	3,666	54,990	10,998	21,990	5,864
Colonial	-	-	-	-	-	7,332	-	-
DESMIDS	-	-	-	-	-	-	-	-
OTHERS	-	-	-	-	7,332	21,996	23,456	174,454
TOTAL	249,288	223,536	238,290	164,970	278,634	370,266	196,444	334,004

TABLE 2.3.3-4

GENERAL DIVERSITY AND PALMER RATING FOR PHYTOPLANKTON COLLECTED FROM THE
MISSOURI RIVER AND LOGAN CREEK, 1974 AND 1975

Date	Stations																	
	A-2		B-2		H-1		H-2		C-1		C-2		D		E		E-2	
	PI ^a	DI ^b	PI	DI	PI	DI	PI	DI	PI	DI	PI	DI	PI	DI	PI	DI	PI	DI
June 1974	-	-	-	-	3	2.3	3	2.5	0	2.5	3	2.5	0	2.1	0	1.8	-	-
September 1974	20	3.0	22	3.0	-	-	13	3.0	18	2.7	20	3.6	19	3.0	13	2.4	-	-
February 1975	16	2.3	17	1.7	-	-	6	1.8	6	2.2	16	2.5	5	1.5	9	1.9	3	0.0
June 1975	0	2.7	6	2.9	-	-	3	3.0	-	-	7	3.1	4	3.1	3	2.6	-	-
September 1975	5	3.2	0	3.6	-	-	5	3.7	0	3.5	0	3.6	2	3.7	0	3.8	0	3.1
Average	10	2.8	11	2.8	3	2.3	6	2.8	6	2.7	9	3.1	6	2.7	5	2.5	2	1.6

^aPI = Palmer Index.

^bDI = Diversity Index.

Table 1 Total phytoplankton densities (D), number of taxa (N), diversity (H) and evenness (J) from the Missouri River, Logan Creek and Mud Creek from June 17 to August 20, 1980. Phytoplankton densities are expressed in units/ml.

Location	June 17 & 19				July 22				August 20			
	D	N	H	J	D	N	H	J	D	N	H	J
Missouri River												
A2	1,577	25	3.64	0.91	9,519	40	4.31	0.91	4,519	32	4.00	0.94
B2	2,775	20	2.96	0.80	11,301	40	3.90	0.82	2,771	28	3.71	0.91
C1	1,635	22	3.58	0.89	10,753	42	4.26	0.86	3,072	25	3.71	0.90
C2	2,095	23	3.48	0.88	9,287	48	4.53	0.89	2,557	24	3.76	0.91
H1	1,270	28	3.77	0.92	11,148	45	4.29	0.88	2,626	26	3.25	0.81
H2	2,110	32	3.89	0.87	9,672	50	4.55	0.87	3,365	22	3.45	0.91
Mean	1,910	25	3.55	0.88	10,282	44	4.31	0.87	3,152	26	3.65	0.90
Logan Creek												
D	31,418	30	4.07	0.87	29,849	39	3.71	0.80	59,053	42	3.95	0.79
E1	16,635	33	2.87	0.65	9,420	31	3.98	0.88	11,446	26	3.84	0.92
Mean	24,026	32	3.47	0.76	19,634	35	3.84	0.84	35,250	34	3.90	0.86
Mud Creek												
E2	9,061	34	3.41	0.74	18,110	34	3.90	0.87	18,375	47	4.17	0.89

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Table 2 Total phytoplankton abundance and percent composition of the major algae divisions in the Missouri River (A2, B2, C1, C2, H1 and H2), Logan Creek (D and E1) and Mud Creek (E2) near the Callaway Nuclear Plant from June 17 through August 20, 1980.

Sampling Date	Station	Total Phytoplankton (units/ml)	Chrysophyta						
			% Pennales	% Centrales	Total	% Crysohyceae	% Chlorophyta	% Euglenophyta	% Cryptophyta
17 June 1980	A2	1,577	3.8	39.9	43.7	1.7	28.7	23.9	0.0
	B2	2,775	13.3	20.5	33.8	0.0	28.1	37.0	0.0
	C1	1,635	0.0	34.9	34.9	0.0	27.0	32.9	0.0
	C2	2,095	23.6	18.2	41.9	2.3	20.8	21.3	7.7
	H1	1,270	24.9	27.5	52.4	2.6	21.2	17.1	4.0
	H2	2,110	35.3	31.7	67.0	0.0	17.6	9.4	3.5
19 June 1980	D	31,418	0.3	8.1	8.4	33.6	39.6	5.9	7.9
	E1	16,635	4.5	50.9	55.4	6.1	14.6	5.6	14.1
	Mud Creek E2	9,061	3.3	29.5	32.8	3.7	41.9	4.6	12.4
	Missouri River Mean	1,910	16.8	28.8	45.6	1.1	23.9	23.6	2.5
	Logan Creek Mean	24,026	2.4	29.5	31.9	19.8	27.1	5.8	11.0
22 July 1980	A2	9,519	15.9	15.8	31.7	0.0	49.6	7.4	2.8
	B2	11,301	4.2	31.1	35.4	0.0	54.8	2.7	0.0
	C1	10,763	15.2	28.6	43.8	0.7	38.7	2.7	1.9
	C2	9,287	8.8	19.9	28.7	2.9	48.2	7.1	1.5
	H1	11,148	9.8	23.4	33.2	1.4	48.8	4.1	4.8
	H2	9,672	13.8	18.6	32.4	3.2	51.3	3.9	2.5
	D	29,849	0.0	24.0	24.0	3.8	30.6	27.2	4.9
	E1	9,420	1.5	0.0	1.6	28.3	45.0	6.8	2.5
	Mud Creek E2	18,110	0.6	2.4	3.0	23.7	50.8	9.2	1.8
	Missouri River Mean	10,282	11.3	22.9	34.2	1.4	48.6	4.6	2.2
Logan Creek Mean	16,635	0.3	8.1	8.4	33.6	39.6	5.9	7.9	

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Table 2 (continued)

Sampling Date	Station	Total Phytoplankton (units/ml)	Chrysophyta					% Chlorophyta	% Euglenophyta	% Cryptophyt
			% Pennales	% Centrales	Total	% Crysohyceae				
20 August 1980	A2	4,519	17.8	14.8	32.6	0.0	49.6	5.0	3.1	
	B2	2,771	8.2	8.2	16.4	3.3	62.3	6.5	0.0	
	C1	3,072	12.1	22.8	35.0	0.0	55.6	6.0	0.0	
	C2	2,557	14.8	20.6	35.3	0.0	52.6	0.0	0.0	
	H1	2,626	19.2	12.8	32.0	1.2	55.2	2.6	1.2	
	H2	3,365	8.6	15.5	24.1	1.3	50.5	10.4	1.3	
	D	59,053	0.6	43.5	44.1	4.4	37.6	0.3	3.0	
	E1	11,446	7.5	2.0	9.5	5.7	38.2	30.5	10.1	
	E2	18,375	19.3	1.0	20.4	4.1	29.8	20.0	2.8	
Missouri River	Mean	3,152	13.5	15.8	29.2	1.0	54.3	5.1	0.9	
Logan Creek	Mean	35,250	4.0	22.8	26.8	5.0	37.9	15.4	6.6	

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Table 3 Percent occurrence of phytoplankton taxa comprising 10 percent or more of the total densities from locations in the Missouri River (A2, B2, C1, C2, H1 and H2), Logan Creek (D and E1) and Mud Creek (E2) between June 17 and August 20, 1980.

Sampling Date/Taxa	Location								
	A2	B2	C1	C2	H1	H2	D	E1	E2
17,19 June 1980									
Chlorophyta									
Dictyosphaerium pulchellum	- ^a	11.9	-	-	-	-	-	-	23.2
Scenedesmus abundans	10.6	-	-	-	-	-	-	-	-
Euglenophyta									
Lepocinclis species	17.1	35.0	18.1	15.2	-	-	-	-	-
Chrysophyta									
Dinobryon divergens	-	-	-	-	-	-	16.8	-	-
Cyclotella atomus	11.9	-	12.4	-	-	-	-	50.3	28.2
Stephanodiscus hantzschii	10.2	-	-	-	-	-	-	-	-
Fragilaria species	-	12.3	-	12.3	-	12.9	-	-	-
Fragilaria pinnata	-	-	-	-	10.3	-	-	-	-
Fragilaria crotonensis	-	-	-	-	-	14.2	-	-	-
22 July 1980									
Chlorophyta									
Scenedesmus opoliensis	-	10.2	-	10.8	-	-	-	-	-
Carteria species	-	-	-	-	-	-	-	10.2	-
Dictyosphaerium pulchellum	-	-	-	-	11.0	15.5	18.6	20.4	15.8
Kirchneriella obesa	-	-	-	-	-	-	-	-	10.3
Euglenophyta									
Euglena species	-	-	-	-	-	-	20.5	-	-
Chrysophyta									
Synura sphagnicola	-	-	-	-	-	-	-	12.4	-
Chrysococcus species	-	-	-	-	-	-	-	-	15.1
Cyclotella menegheniana	14.0	26.5	22.3	15.4	19.0	10.7	-	-	-
Stephanodiscus astraea	-	-	-	-	-	-	16.7	-	-

Table (continued)

Sampling Date/Taxa	Location								
	A2	B2	C1	C2	H1	H2	D	E1	E2
20 August 1980									
Chlorophyta									
Chlamydomonas species	-	-	-	-	-	-	-	12.1	-
Dictyosphaerium pulchellum	12.4	19.6	20.6	20.2	39.5	19.2	15.2	13.2	10.4
Scenedesmus opoliensis	-	18.1	15.6	-	-	19.5	-	-	-
Euglenophyta	-	-	-	-	-	-	-	10.9	-
Euglena species	-	-	-	-	-	-	-	-	13.5
Chrysophyta									
Microsiphona potamos	-	-	-	-	-	-	27.0	-	-

^a present less than 10% or not found in sample.

Table 4 Mean total phytoplankton abundance (A) and primary productivity rates (P) for samples collected in the Missouri River and Logan Creek from June 20 through August 15, 1980. Mean phytoplankton abundance is in units/ml and primary productivity rates are expressed as mg C/m³/hr.

Date	Missouri River				Logan Creek	
	Station B2		Station C2		Station D	
	A	P	A	P	A	P
20 June 1980	2,775	<1	2,035	<1	34,418	98
18 July 1980	11,301	62	9,287	40	29,849	363
15 August 1980	2,771	31	2,557	81	59,053	69
Mean*	5,616	31	4,646	41	41,107	177

*Assumes a value of 1 mg c/m³/hr for less than values.

Table 1. Total phytoplankton densities (D), number of taxa (N), diversity (H) and evenness (J) from the Missouri River, Logan Creek and Mud Creek from 15 September to 10 November, 1980. Phytoplankton densities are expressed in units/ml.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Location	September 15				October 13				November 10			
	D	N	H	J	D	N	H	J	D	N	H	J
Missouri River												
A2	6,210	28	3.72	0.87	26,380	37	3.77	0.81	12,832	33	3.59	0.79
B2	5,962	39	4.31	0.89	29,191	43	3.81	0.78	23,658	31	3.57	0.79
C1	6,357	36	3.98	0.86	32,328	43	3.92	0.80	28,350	33	3.48	0.77
C2	6,853	36	4.13	0.90	35,885	44	4.16	0.84	24,311	33	3.30	0.73
H1	5,419	42	3.76	0.80	28,625	34	3.91	0.82	26,310	27	3.21	0.74
H2	7,367	38	3.79	0.83	30,986	36	3.86	0.83	26,881	36	3.51	0.75
Mean	6,361	36	3.95	0.86	30,566	40	3.90	0.81	23,724	32	3.44	0.76
Logan Creek												
D	93,893	47	4.45	0.90	52,186	40	3.87	0.79	15,379	33	4.23	0.90
E1	6,136	28	2.98	0.68	2,972	13	2.84	0.88	17,946	20	2.98	0.76
Mean	50,014	38	3.72	0.79	27,579	26	3.36	0.84	16,662	26	3.60	0.83
Mud Creek												
E2	46,958	27	3.42	0.81	5,345	22	1.66	0.43	11,644	24	2.70	0.67

Table 2. Total phytoplankton abundance and percent composition of the major algae divisions in the Missouri River (A2, B2, C1, C2, H1 and H2), Logan Creek (D and E1) and Mud Creek (E2) near the Callaway Nuclear Plant from 15 September through 10 November, 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Station	Total Phytoplankton (units/ml)	Chrysophyta						
			% Pennales	% Centrales	Total	% Crysophyceae	% Chlorophyta	% Euglenophyta	% Cryptophyta
15 September 1980	A2	6,210	14.4	13.1	27.5	1.2	57.6	1.0	1.0
	B2	5,962	19.0	18.7	37.8	0.0	51.9	1.9	0.0
	C1	6,357	8.4	20.7	29.1	0.0	57.7	1.9	1.9
	C2	6,853	16.4	22.2	38.6	0.0	46.6	1.0	2.2
	H1	5,419	12.3	17.3	29.6	0.0	61.9	4.9	0.0
	H2	7,367	10.4	19.2	29.6	0.0	56.2	4.3	2.2
	D	93,893	2.0	21.0	23.0	6.2	29.7	13.4	8.4
	E1	6,136	1.9	6.6	8.5	36.9	31.0	8.6	3.4
	E2	46,958	24.1	0.0	24.1	0.0	14.6	45.4	1.6
	Mud Creek	46,958	24.1	0.0	24.1	0.0	14.6	45.4	1.6
Missouri River	6,361	13.5	18.5	32.0	0.2	55.3	2.5	1.2	
Logan Creek	50,014	2.0	13.8	15.8	21.6	30.4	11.0	5.9	
13 October 1980	A2	26,380	1.7	38.3	39.5	1.0	50.0	1.7	0.0
	B2	29,191	1.6	56.3	57.9	0.5	36.9	1.6	0.2
	C1	32,328	1.7	54.6	56.3	0.0	37.6	0.3	1.5
	C2	35,885	2.3	44.7	47.0	3.4	40.8	2.3	1.7
	H1	28,625	0.6	58.9	59.5	0.6	30.7	2.9	0.3
	H2	30,986	0.4	49.9	50.3	3.2	41.1	0.3	0.8
	D	52,186	1.8	41.4	43.2	30.8	10.7	2.8	7.7
	E1	2,972	75.4	1.5	77.0	13.8	3.1	6.2	0.0
	E2	5,344	1.1	2.0	3.1	4.1	6.5	2.5	76.9
	Mud Creek	5,344	1.1	2.0	3.1	4.1	6.5	2.5	76.9
Missouri River	30,566	1.4	50.4	51.8	1.4	39.5	1.5	0.8	
Logan Creek	27,579	38.6	21.4	60.1	22.3	6.9	4.5	3.8	

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Station	Total Phytoplankton (units/ml)	Chrysophyta					% Chlorophyta	% Euglenophyta	% Cryptophyta
			% Pennales	% Centrales	Total	% Crysohyceae				
10 November 1980	A2	12,832	2.1	58.7	60.8	1.9	28.5	1.1	2.0	
	B2	23,658	2.5	64.1	66.6	0.8	26.3	2.1	1.2	
	C1	28,350	1.0	60.0	61.1	0.0	30.6	2.0	0.6	
	C2	24,311	0.9	65.8	66.8	0.6	25.1	1.6	2.6	
	H1	26,310	2.4	72.3	74.7	0.0	17.8	0.7	2.4	
	H2	26,881	3.3	66.6	69.9	0.3	21.4	1.6	2.0	
	D	15,379	0.0	7.3	7.3	19.4	32.2	8.6	9.0	
	E1	17,946	1.8	3.5	5.3	22.7	2.5	0.3	3.0	
	E2	11,644	0.6	0.0	0.6	57.5	1.6	2.8	3.9	
Mud Creek		11,644	0.6	0.0	0.6	57.5	1.6	2.8	3.9	
Missouri River		23,724	2.0	64.6	66.6	0.6	25.0	1.5	1.8	
Logan Creek		16,662	0.9	5.4	6.3	21.0	17.4	4.4	6.0	

Table 3. Percent occurrence of phytoplankton taxa comprising 10 percent or more of the total densities from locations in the Missouri River (A2, B2, C1, C2, H1 and H2), Logan Creek (D and E1) and Mud Creek (E2) between 15 September and 10 November, 1980.

RFF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date/Taxa	Location								
	A2	B2	C1	C2	H1	H2	D	E1	E2
15 September 1980									
Chlorophyta									
<u>Dictyosphaerium pulchellum</u>	26.4	14.9	26.4	19.1	33.4	30.2	15.9	26.6	----
<u>Scenedesmus opoliensis</u>	----	11.8	----	10.6	----	----	----	----	----
Euglenophyta									10.0
<u>Euglena species</u>	----	----	----	----	----	----	----	----	29.9
Chrysophyta									
<u>Chrysococcus species</u>	----	----	----	----	----	----	----	36.9	----
<u>Nitzschia species</u>	----	----	----	----	----	----	----	----	12.0
13 October 1980									
Chlorophyta									
<u>Dictyosphaerium pulchellum</u>	25.7	17.0	16.1	17.4	11.5	16.2	----	----	----
Cryptophyta									76.0
<u>Chilomonas species</u>	----	----	----	----	----	----	----	----	76.0
Chrysophyta									
<u>Cyclotella species</u>	----	----	10.4	----	----	----	----	----	----
<u>C. atomus</u>	12.9	13.8	14.8	10.9	17.4	16.2	11.6	----	----
<u>Microsiphona potamos</u>	----	19.6	11.7	17.4	15.5	14.5	----	----	----
<u>Stephanodiscus astrea</u>	----	----	----	----	----	11.2	----	----	----
<u>Nitzschia species</u>	----	----	----	----	----	----	----	24.6	----
<u>N. palea</u>	----	----	----	----	----	----	----	23.1	----
<u>Chrysococcus species</u>	----	----	----	----	----	----	23.9	13.8	----
10 November 1980									
Chlorophyta									
<u>Dictyosphaerium species</u>	----	----	----	----	----	----	10.5	----	----
<u>D. pulchellum</u>	14.5	13.0	15.0	13.3	10.6	10.4	----	----	----
Chrysophyta									
<u>Cyclotella species</u>	11.5	15.5	11.0	----	11.6	16.7	----	----	----
<u>C. atomus</u>	20.3	20.3	23.2	19.4	18.7	15.7	----	----	----
<u>Stephanodiscus astrea</u>	13.6	14.7	14.0	28.6	27.5	24.2	----	----	----
<u>Microsiphona potamos</u>	----	----	----	----	12.0	----	----	----	----
<u>Ochromonas species</u>	----	----	----	----	----	----	----	20.0	52.0
Cyanophyta									
<u>Dactylococcopsis species</u>	----	----	----	----	----	----	10.8	20.2	----

APPENDIX C

Zooplankton

TABLE 2.3.3-1
REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
ZOOPLANKTON COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK IN
JULY (J), SEPTEMBER (S), AND DECEMBER (D), 1973, AND FEBRUARY (F), 1974

	Occurrence in Missouri River				Occurrence in Logan Creek			
	J	S	D	F	J	S	D	F
Rotatoria								
<u>Ascomorpha</u> sp.		x						
<u>Asplanchna priodonta</u>		x	x	x		x		x
<u>Asplanchna</u> sp.	x				x			
<u>Brachionus angularis</u>		x	x			x		
<u>Brachionus bidentata</u>		x				x		
<u>Brachionus calyciflorus</u>	x	x	x	x	x	x		
<u>Brachionus caudatus</u>	x				x			
<u>Brachionus havanaensis</u>	x	x						
<u>Brachionus plicatilis</u>	x	x				x		
<u>Brachionus quadridentata</u>		x				x		
<u>Brachionus variabilis</u>			x	x				x
<u>Brachionus</u> sp.		x						
<u>Chromogaster</u> sp.		x						
<u>Collotheca</u> sp.		x						
<u>Colurella</u> sp.				x				
<u>Filinia longiseta</u>		x	x					
<u>Filinia opoliensis</u>	x				x			
<u>Kellicottia bostoniensis</u>			x	x				
<u>Kellicottia longispina</u>		x						
<u>Kellicottia</u> sp.		x						
<u>Keratella cochlearis</u>	x	x	x		x	x		
<u>Keratella earlinae</u>			x					
<u>Keratella quadrata</u>	x	x	x					
<u>Keratella</u> sp.		x						
<u>Lecane</u> sp.		x				x		

C-1

TABLE 2.3.3-1(Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

	Occurrence in Missouri River				Occurrence in Logan Creek			
	J	S	D	F	J	S	D	F
<u>Lepadella ovalis</u>					x			
<u>Monostyla sp.</u>	x	x				x		
<u>Notholca sp.</u>		x	x					
<u>Platylas patulus</u>			x					
<u>Platylas quadricornis</u>		x						
<u>Platylas sp.</u>	x							
<u>Ploesoma sp.</u>		x						
<u>Polyarthra sp.</u>	x	x	x		x	x		
<u>Synchaeta sp.</u>			x			x		x
<u>Testudinella sp.</u>			x					
<u>Trichotria tetrades</u>		x				x		
<u>Trichotria sp.</u>					x			
<u>Vanogella sp.</u>		x						

Cladocera

<u>Bosmina coregoni</u>			x	x				
<u>Bosmina sp.</u>	x	x				x		
<u>Ceriodaphnia reticulata</u>	x	x	x	x				
<u>Chydorus sphaericus</u>			x	x			x	x
<u>Daphnia longiremis</u>			x	x				
<u>Daphnia pulex</u>		x						
<u>Daphnia sp.</u>			x					
<u>Diaphanosoma brachyurum</u>		x				x		
<u>Holopedium gibberum</u>		x						
<u>Latonopsis sp.</u>	x				x			
Immature cladoceran				x				

TABLE 2.3.3-1 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

	Occurrence in Missouri River			Occurrence in Logan Creek			
	S	D	F	J	S	D	F
Copepoda							
<u>Cyclops bicuspidatus</u>	x	x	x				
<u>Cyclops vernalis</u>	x				x		
<u>Diaptomus forbesi</u>			x				
<u>Diaptomus siciloides</u>			x				
Calanoid copepodite		x	x			x	
Cyclopoid copepodite	x	x	x		x	x	x
Harpacticoid copepod			x				
Nauplii	x	x	x	x	x	x	x
Nematoda							
Unidentified sp.			x				
Tardigrada							
Unidentified sp.			x				

C-3

TABLE 2.3.3-2
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 WILCOXAN'S TEST VALUES FOR DIFFERENCES BETWEEN SAMPLING DATES
 IN OCCURENCE OF ROTIFERS, COPEPODS, AND TOTAL
 ZOOPLANKTON PER LITER

<u>Months Compared</u>	<u>rotifers/liter</u>		<u>copepods/liter</u>		<u>zooplankton/liter</u>	
	<u>Smallest Rank</u>	<u>Significance^a</u>	<u>Smallest Rank</u>	<u>Significance</u>	<u>Smallest Rank</u>	<u>Significance</u>
7/73 & 9/73	21	**	36.5	ns	21	**
7/73 & 12/73	30.5	ns	31.5	ns	35	ns
7/73 & 2/74	21	**	38.5	ns	27	ns
9/73 & 12/73	21	**	27	ns	21	**
9/73 & 2/74	21	**	32	ns	21	**
12/73 & 2/74	21	**	23	**	21	**

^a ns = nonsignificant, $p > 0.025$

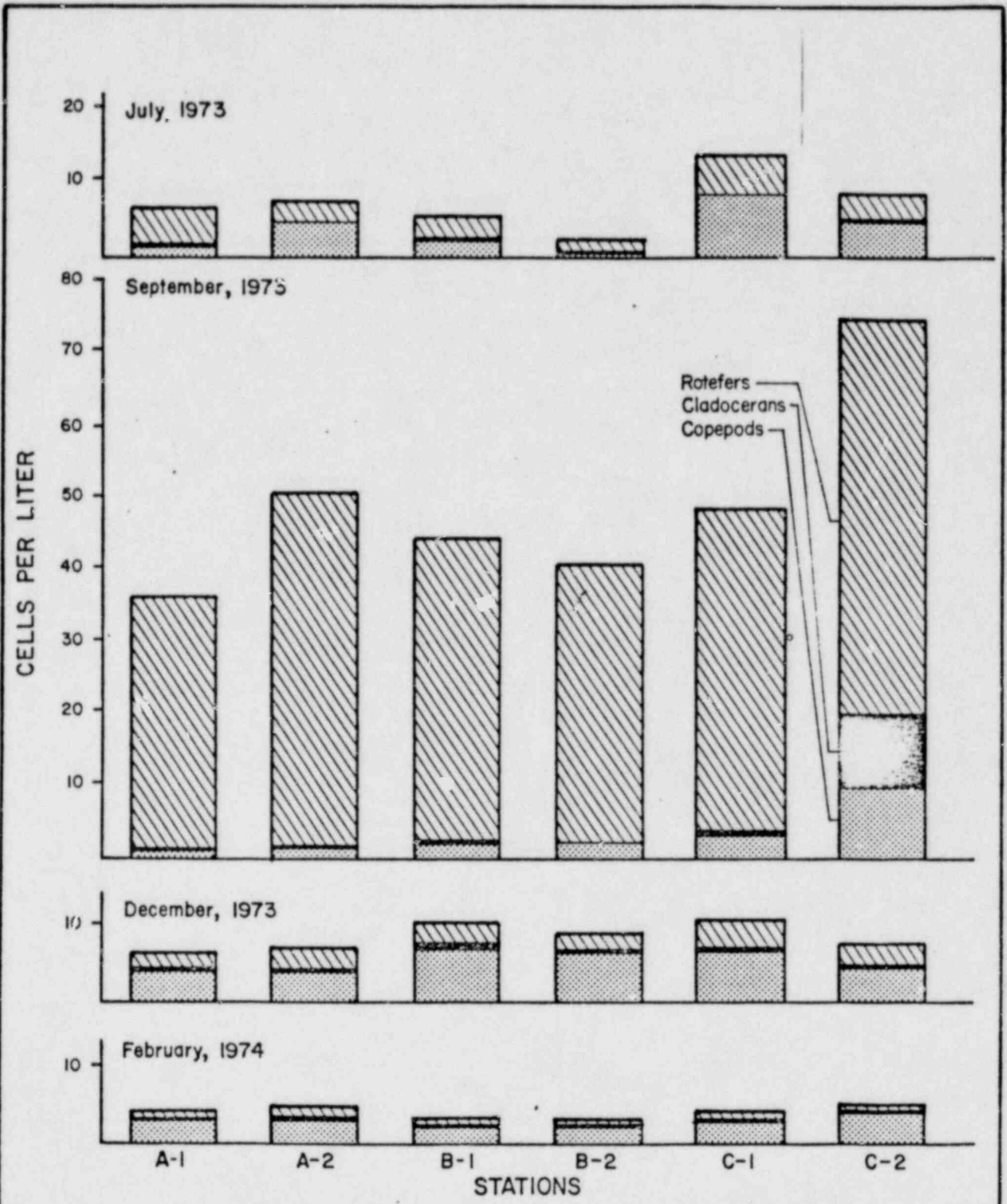
** = $p \leq 0.005$

C-4

TABLE 2.3.3-3
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 AVERAGE DENSITIES (ORGANISMS PER LITER) OF ZOOPLANKTON COLLECTED IN LOGAN CREEK
 IN JULY, SEPTEMBER, AND DECEMBER 1973, AND FEBRUARY 1974

Sampling Periods	Station D				Station E			
	<u>Rotifers</u>	<u>Cladocerans</u>	<u>Copepods</u>	<u>Total</u>	<u>Rotifers</u>	<u>Cladocerans</u>	<u>Copepods</u>	<u>Total</u>
July 1973	1,992.1	44.6	95.9	2,132.6	62.5	0	5.0	67.5
September 1973	79	11	13	103	60.6	1	82.6	144.2
December 1973	0	0.35	1.35	1.7	0	0.35	1.35	1.7
February 1974	0.8	0.4	0.6	1.8	0.4	0	0.8	1.2

C-5

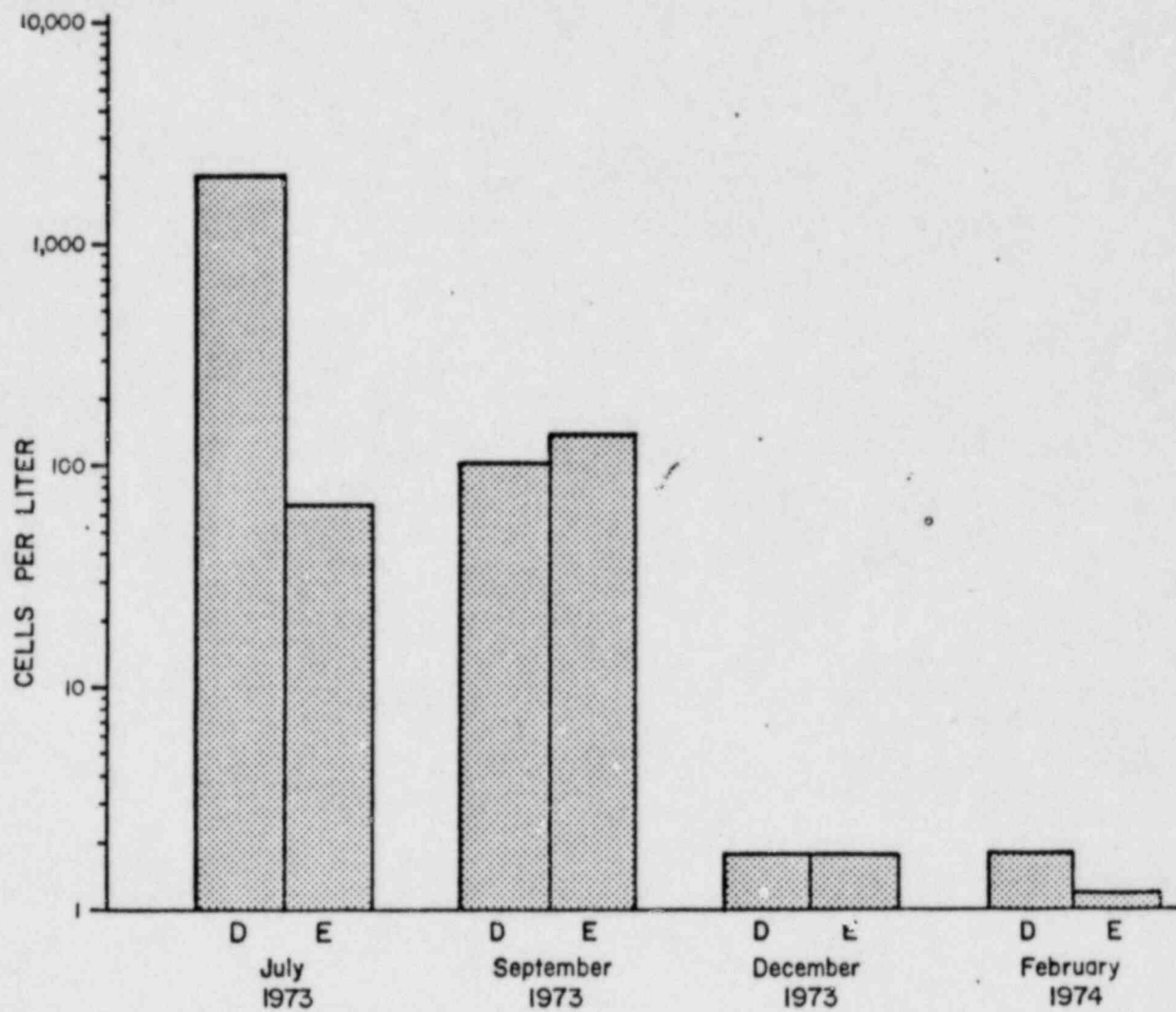


UNION ELECTRIC CO.
CALLAWAY PLANT
UNITS 1 & 2

ZOOPLANKTON DENSITIES
AT MISSOURI RIVER STATIONS

Figure 2.3.3-1

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY
CALLAWAY PLANT



UNION ELECTRIC CO.
CALLAWAY PLANT
UNITS 1 & 2

ZOOPLANKTON AT
LOGAN CREEK STATIONS

Figure 2.3.3-2

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY
CALLAWAY PLANT

TABLE 2.3.4-1
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 DENSITY (organisms/liter) OF ZOOPLANKTON COLLECTED
 FROM THE MISSOURI RIVER AND LOGAN CREEK,
 JUNE 1974

<u>Organism</u>	<u>Missouri River Sampling Stations</u>				<u>Logan Creek Sampling Stations</u>	
	<u>H-1</u>	<u>H-2</u>	<u>C-1</u>	<u>C-2</u>	<u>D</u>	<u>E</u>
ROTIFERA						
<u>Branchionus</u> sp.	9.07	9.19	7.98	9.42	9.77	6.81
<u>Filinia</u> sp.	0.95	1.02	+	+	+	2.27
<u>Keratella</u> sp.	1.91	2.55	2.09	3.62	8.15	4.54
<u>Polyarthra</u> sp.	+	2.04	0.42	1.09	1.62	+
<u>Trichotria</u> sp.	+	+	+	+	1.62	+
Total Rotifer Density	11.93	14.80	10.49	14.13	21.16	13.62
CLADOCERA						
<u>Bosmina</u> sp.	1.43	1.53	0.84	0.72	+	+
COPEPODA						
<u>Cyclops</u> sp. (naupli)	1.91	2.55	2.94	1.81	3.25	6.81
<u>Cyclops</u> sp.	+	+	+	+	+	2.27
Cyclopoid	+	2.04	1.26	1.81	+	+
Total Crustacea Density	3.34	6.12	5.04	4.34	3.25	9.08
OTHER INVERTEBRATES						
Ostracoda	0.48	0.51	+	+	+	+
Tardigrada	1.43	+	+	0.36	+	+
TOTAL	17.18	21.43	15.53	18.83	24.41	22.70

TABLE 2.3.4.2

DENSITY (ORGANISMS/LITER) OF ZOOPLANKTON COLLECTED FROM THE MISSOURI RIVER
AND LOGAN CREEK, SEPTEMBER 1974

Organism	Missouri River Stations					Logan Creek Stations	
	A-2	B-2	H-2	C-1	C-2	D	E
Rotifera							
<u>Branchionus</u> sp.	10.29	20.58	13.72	13.72	3.43		6.86
<u>Filinia</u> sp.	+	+	+	+	+	+	+
<u>Keratella</u> sp.	+	+	10.29	+	+	3.43	+
<u>Polyarthra</u> sp.	+	6.86	+	+	+	+	3.43
Sessile Rotifera	61.73	30.86	+	34.29	+	+	+
Unidentified Rotifera	+	6.86	+	+	+	+	+
Total Rotifera Density	72.02	65.16	24.01	48.01	3.43	3.43	10.29
Cladocera							
<u>Bosmina</u> sp.	4.12	+	6.86	3.43	+	6.86	+
Unidentified Cladocera	2.06	+	+	+	+	+	+
Copepoda							
<u>Cyclona</u> sp. (naupli)	+	+	6.86	6.86	+	10.29	6.86
<u>Cylops</u> sp.	2.06	+	3.43	+	+	+	+
Unidentified Copepoda	2.06	+	+	+	+	+	+
Total Crustacea Density	10.29	+	17.15	10.29	+	17.15	6.86
Other Invertebrates							
Chironomidae	+	3.43	3.43	3.43	+	+	+
Ephemeroptera	+	+	+	3.43	+	+	+
Ostracoda	6.17	+	3.43	3.43	+	3.43	+
TOTAL	88.48	68.59	48.02	68.59	3.43	24.01	17.15

TABLE 2.3.4-1

REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 DENSITY (organisms/liter) OF ZOOPLANKTON COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK
 8 FEBRUARY 1975

Organism	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Rotifera								
Ascomorpha sp.	1.03	-	-	-	-	-	-	-
Branchionus sp.	3.13	3.13	1.03	1.03	2.09	-	-	-
Polyarthra sp.	-	1.03	1.03	-	-	-	-	-
Rotaria sp.	-	-	-	-	-	-	1.03	-
Rotifera (Sessile)	4.17	-	1.03	-	-	-	-	-
Rotifera (unidentified)	1.03	1.03	-	1.03	-	-	-	-
TOTAL ROTIFER DENSITY	9.36	5.19	3.09	2.06	2.09	-	1.03	-
Cladocera								
Bosmina sp.	-	1.03	2.09	2.09	1.03	-	-	-
Cladocera (unidentified)	1.03	-	-	-	-	-	-	-
Copepoda								
Nauplius sp.	4.17	5.22	2.09	3.13	4.17	-	2.09	-
Cyclopoid	1.03	2.09	2.09	2.09	2.09	-	-	-
Calanoid	-	1.03	1.03	-	-	-	-	-
TOTAL CRUSTACEA PER LITER	6.23	9.37	7.30	7.31	7.29	-	2.09	-
Other invertebrates								
Ostracod	-	1.03	-	-	-	-	-	-
TOTAL	15.59	15.59	10.39	9.37	9.38	-	3.12	-

TABLE 2.3.4-2
 REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 DENSITY (organisms/liter) OF ZOOPLANKTON COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK
 2 JUNE 1975

Organism	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Rotifera	-	-	1.12	NS ^a	-	1.02	-	NS
Asplanchna sp.	18.83	-	20.71	NS	8.44	29.60	1.14	NS
Branchionus sp.	-	1.98	-	NS	.89	-	-	NS
Branchionus angularis	-	-	-	NS	1.33	2.04	-	NS
Branchionus plicatilis	-	-	-	NS	-	-	-	NS
Branchionus quadridentatus	-	32.40	15.11	NS	-	-	-	NS
Collotheca sp.	-	-	.56	NS	-	1.02	-	NS
Euchlanis sp.	-	-	-	NS	-	-	.57	NS
Filinia sp.	3.85	1.58	1.68	NS	1.33	-	-	NS
Kellicottia sp.	.43	.40	-	NS	.44	-	-	NS
Keratella cochleasis	4.28	4.74	1.68	NS	3.11	3.06	1.70	NS
Lecane sp.	-	-	1.12	NS	-	-	-	NS
Platylas quadricornis	.86	1.19	-	NS	-	1.02	-	NS
Polyarthra sp.	1.28	-	1.12	NS	.44	1.02	.57	NS
Trichocerca sp.	-	-	3.36	NS	-	-	-	NS
Trichotria sp.	-	.40	-	NS	-	-	-	NS
Rotifera (unidentified)	-	1.19	-	NS	.44	-	-	NS
TOTAL ROTIFERA DENSITY	29.53	43.88	46.46	-	16.42	38.78	3.98	-
Cladocera	-	-	-	NS	-	.51	.57	NS
Bosmina sp.	5.56	4.74	1.68	NS	-	-	-	NS
Ceriodaphnia sp.	-	.79	1.12	NS	-	-	-	NS
Chydorus sp.	-	.40	-	NS	-	.51	-	NS
Daphnia sp.	1.28	.79	.56	NS	.44	-	-	-
Copepoda	-	-	-	NS	-	8.16	2.27	NS
Nauplius sp.	6.42	4.35	6.16	NS	2.67	-	-	NS
Cyclops sp.	3.42	1.19	-	NS	-	1.53	1.14	NS
Cyclopoid copepodite	3.42	2.77	3.92	NS	1.78	-	-	NS
Calanoid copepodite	-	-	.56	NS	-	-	-	NS
Copepoda (unidentified)	-	-	-	NS	.44	-	-	-
TOTAL CRUSTACEA PER LITER	20.1	15.03	14.00	-	5.33	10.71	3.98	-
Other invertebrates	-	-	-	NS	-	1.14	-	NS
Chironomids	.43	-	-	NS	-	-	-	NS
Ostracoda	1.71	-	-	NS	-	-	-	-
TOTAL	51.77	58.91	60.46	-	21.75	50.63	7.96	-

^aNot Sampled.

TABLE 2.3.4-3

DENSITY (organisms/liter) OF ZOOPLANKTON COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK
10 SEPTEMBER 1975

Organism	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Rotifera								
<i>Asplanchna</i> sp.	3.80	-	2.55	5.96	-	11.93	6.09	-
<i>Branchionus</i> sp.	5.76	2.77	-	14.91	2.98	20.88	6.09	5.76
<i>Branchionus angulus</i>	1.90	-	-	-	-	-	-	-
<i>Cephalodella</i> sp.	-	-	-	-	-	-	-	-
<i>Keratella cochlearis</i>	7.66	-	2.55	-	2.98	8.95	6.09	-
<i>Keratella quadrata</i>	-	-	-	2.98	-	-	-	-
<i>Keratella</i> sp.	1.90	-	2.55	8.95	-	5.97	-	-
<i>Lecane</i> sp.	-	-	-	-	-	-	-	-
<i>Monostyla</i> sp.	1.90	-	-	-	-	-	27.41	-
<i>Platylas</i> sp.	-	-	-	-	-	2.98	3.05	-
<i>Polyarthra</i> sp.	-	-	-	-	-	-	3.05	-
<i>Rotaria</i> sp.	-	-	-	-	-	5.97	-	-
<i>Trichocera</i> sp.	1.90	-	-	-	-	2.98	-	-
Rotifera (unidentified)	1.90	11.11	-	5.96	2.98	2.98	15.23	2.88
TOTAL ROTIFER DENSITY	26.72	13.88	7.65	38.75	8.94	71.59	82.24	11.52
Cladocera								
<i>Bosmina</i> sp.	-	-	-	-	-	-	6.09	-
<i>Daphnia</i> sp.	-	-	-	2.98	-	-	-	-
<i>Leptodora</i> sp.	-	-	-	-	-	2.98	-	-
<i>Macrothrix</i> sp.	-	-	-	-	-	-	-	5.76
Cladocera (unidentified)	-	-	-	-	-	8.97	6.09	11.52
Copepoda								
<i>Nauplius</i> sp.	-	-	-	-	-	23.87	97.45	23.05
<i>Cyclopoid</i> sp.	-	-	2.55	-	-	-	24.36	5.76
TOTAL CRUSTACEA PER LITER	0	0	2.55	2.98	0	35.82	133.99	46.09
Other invertebrates								
Ostracoda	5.76	2.77	-	-	-	11.93	12.18	17.28
Protozoan	21.08	11.11	-	20.88	2.98	20.88	30.45	14.40
Insect pupa	-	-	-	-	-	-	-	2.88
TOTAL	53.56	27.76	10.20	62.61	11.92	140.22	258.86	92.17

Table 1 Zooplankton taxa collected in the Missouri River, Logan Creek, and Mud Creek from June 17 to August 22, 1980.

<p>Rotifera</p> <p><u>Ascomorpha</u> spp. Perty</p> <p><u>Asplanchna</u> spp. Gosse</p> <p><u>Bdelloidea</u> spp.</p> <p><u>Brachionus</u> spp. Pallas</p> <p><u>B. angularis</u> Gosse</p> <p><u>B. bidentata</u> Anderson</p> <p><u>B. budapestinensis</u> Daday</p> <p><u>B. calyciflorus</u> Pallas</p> <p><u>B. caudatus</u> Barrois and Daday</p> <p><u>B. havanaensis</u> Rousselet</p> <p><u>B. quadridentatus</u> Hermann</p> <p><u>B. urceolaris</u> Muller</p> <p><u>Cephalodella</u> spp. Bory de St. Vincent</p> <p><u>Euchlanis</u> spp. Ehrenberg</p> <p><u>Filinia longiseta</u> (Ehrenberg)</p> <p><u>Keratella</u> spp. Bory de St. Vincent</p> <p><u>K. quadrata</u> (Muller)</p> <p><u>K. valga</u> Carlin</p> <p><u>Lecane</u> spp. Nitzsch</p> <p><u>Monostyla</u> spp. Ehrenberg</p> <p><u>Notholca</u> spp. Gosse</p> <p><u>Platylas patulus</u> (Muller)</p> <p><u>P. quadricornis</u> (Ehrenberg)</p> <p><u>Polyarthra</u> spp. Ehrenberg</p> <p>Rotifera spp.</p> <p><u>Synchaeta</u> spp. Ehrenberg</p> <p><u>Testudinella</u> spp. Bory de St. Vincent</p> <p><u>Trichocerca</u> spp. Lamarck</p> <p><u>Trichotria</u> spp. Bory de St. Vincent</p>	<p>Tardigrada spp.</p> <p>Cladocera</p> <p><u>Alona</u> spp. Baird</p> <p><u>Bosmina longirostris</u> (Muller)</p> <p><u>Ceriodaphnia</u> Dana (immature)</p> <p><u>Chydorus sphaericus</u> (Muller)</p> <p><u>Daphnia</u> Muller (immature)</p> <p><u>Diaphanosoma</u> Fischer (immature)</p> <p><u>D. brachyurum</u> (Lieven)</p> <p><u>D. Teuchtenbergianum</u> Fischer</p> <p><u>Macrothrix laticornis</u> (Turine)</p> <p><u>Moina</u> spp. Baird</p> <p><u>Pleuroxus denticulatus</u> Birge</p> <p><u>Scapholeberis kingi</u> Sars</p> <p><u>Simocephalus</u> spp. Schodler</p> <p><u>S. serrulatus</u> (Koch)</p> <p><u>S. vetulus</u> Schodler</p> <p>Copepoda</p> <p>Copepoda nauplii</p> <p>Calanoida copepodids</p> <p><u>Diaptomus</u> spp.</p> <p><u>D. pallidus</u> Herrick</p> <p><u>D. reighardi</u> Marsh</p> <p>Cyclopoida copepodids</p> <p><u>Cyclops bicuspidatus thomasi</u> Forbes</p> <p><u>C. vernalis</u> Fischer</p> <p><u>Eucyclops agilis</u> (Koch)</p> <p><u>E. speratus</u> (Lilljeborg)</p> <p><u>Mesocyclops edax</u> (Forbes)</p>
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REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Table 2 Total zooplankton densities (D), number of taxa (N), diversity (H) and evenness (J) in the Missouri River, Logan Creek and Mud Creek from June 17 to August 22, 1980. Zooplankton densities are expressed as organisms per liter.

Location	June 17 and 19				July 19 and 20				August 22			
	D	N	H	J	D	N	H	J	D	N	H	J
<u>Missouri River</u>												
A2	30	20	2.55	0.65	8	15	2.49	0.69	5	21	2.80	0.69
B2	38	17	2.42	0.64	10	14	2.32	0.64	5	21	2.75	0.68
C1	92	14	2.46	0.69	10	13	2.52	0.69	4	22	2.67	0.67
C2	32	14	2.31	0.64	7	17	2.00	0.56	4	21	2.52	0.61
H1	28	17	2.53	0.67	7	18	2.38	0.62	4	21	2.76	0.68
H2	36	17	2.52	0.65	11	14	2.33	0.68	7	23	2.53	0.60
Mean	43	16	2.46	0.66	9	15	2.34	0.65	5	22	2.67	0.66
<u>Logan Creek</u>												
D	613	27	3.25	0.72	826	18	1.33	0.35	2,339	16	2.65	0.69
E1	21	28	2.88	0.69	84	14	2.43	0.68	52	22	3.00	0.73
Mean	317	28	3.06	0.70	455	16	1.88	0.52	1,196	19	2.82	0.71
<u>Mud Creek</u>												
E2	20	26	2.80	0.69	489	17	2.53	0.68	431	20	2.33	0.59

Table 3 Total zooplankton abundance and percent composition of major zooplankton groups in the Missouri River, Logan Creek, and Mud Creek near the Callaway Nuclear Plant from June 17 to August 22, 1980.

Sampling Date	Location	Total Zooplankton (organisms/liter)	Copepoda			% Rotifera	% Cladocera
			% Calanoida	% Cyclopoida	% Total ^a		
17 June 1980	Missouri River						
	A2	30	0.0	1.7	5.2	94.4	0.2
	B2	38	0.2	1.0	3.4	96.4	0.2
	C1	92	0.0	0.2	2.2	97.8	0.0
	C2	32	0.0	0.4	1.7	97.6	0.7
	H1	28	0.0	1.7	4.0	95.8	0.2
	H2	36	0.0	2.4	4.2	95.4	0.4
	Mean	43	0.0	1.2	3.4	96.2	0.3
19 June 1980	Logan Creek						
	D	613	0.0	0.9	4.8	53.5	41.7
	E1	21	0.9	1.6	40.5	39.3	20.2
	Mean	317	0.4	1.2	22.6	46.4	31.0
19 June 1980	Mud Creek						
	E2	20	1.0	2.8	39.2	21.0	39.7
19 July 1980	Missouri River						
	A2	8	0.0	2.1	7.5	92.5	0.0
	B2	10	0.0	2.4	8.0	91.6	0.5
	C1	10	0.0	3.0	8.1	90.1	1.8
	C2	7	0.0	1.6	4.7	94.7	0.6
	H1	7	0.0	3.9	8.3	90.9	0.8
	H2	11	0.0	1.6	6.5	93.5	0.0
	Mean	9	0.0	2.4	7.2	92.2	0.6

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Table 3 (continued) REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Location	Total Zooplankton (organisms/liter)	Copepoda			% Rotifera	% Cladocera
			% Calanoida	% Cyclopoida	% Total ^a		
20 July 1980	Logan Creek						
	D	826	0.3	0.8	8.2	91.6	0.2
	E1	84	0.0	4.7	11.8	42.4	45.8
	Mean	455	0.2	2.8	10.0	67.0	23.0
20 July 1980	Mud Creek						
	E2	489	0.0	13.1	32.6	64.1	3.3
22 August 1980	Missouri River						
	A2	5	0.4	1.5	8.9	90.0	1.0
	B2	5	0.2	1.5	6.8	92.6	0.7
	C1	4	0.9	11.8	19.6	80.0	0.3
	C2	4	0.0	3.0	8.8	90.6	0.5
	H1	4	0.0	11.8	18.5	80.1	1.4
	H2	7	0.2	2.9	6.6	92.4	1.0
	Mean	5	0.3	5.4	11.5	87.6	0.8
	Logan Creek						
	D	2,339	2.2	2.2	10.3	89.1	0.5
	E1	52	2.6	33.4	49.1	34.1	16.8
	Mean	1,195	2.4	17.8	21.7	61.6	8.6
	Mud Creek						
	E2	431	3.2	7.7	14.3	85.7	0.0

^a includes Copepoda nauplii

Table 4. Percent occurrence of zooplankton taxa comprising 10 percent or more of the total densities from locations in the Missouri River (A2, B2, C1, C2, H1, and H2), Logan Creek (D and E1) and Mud Creek (E2) between June 17 and August 22, 1980.

Sampling Date and Taxa	Location								
	A2	B2	C1	C2	H1	H2	D	E1	E2
<u>17, 19 June 1980</u>									
Rotifera									
<u>Brachionus angularis</u>	43.2	40.4	43.5	42.2	37.9	37.1	-	-	-
<u>Brachionus calyciflorus</u>	13.6	17.4	11.2	15.8	13.8	18.8	-	-	-
<u>Brachionus quadridentatus</u>	16.7	24.0	22.1	25.1	27.6	24.3	-	-	-
<u>Brachionus caudatus</u>	-	-	10.8	-	-	-	16.6	-	-
<u>Brachionus bidentata</u>	-	-	-	-	-	-	16.0	-	-
<u>Ascomorpha spp.</u>	-	-	-	-	-	-	-	31.4	15.6
Cladocera									
<u>Scapholeberis kingi</u>	-	-	-	-	-	-	29.2	-	-
<u>Chydorus sphaericus</u>	-	-	-	-	-	-	-	-	15.0
<u>19, 20 July 1980</u>									
Rotifera									
<u>Brachionus calyciflorus</u>	29.5	45.6	40.5	51.9	42.2	37.6	-	-	-
<u>Brachionus caudatus</u>	30.0	24.5	25.6	25.0	28.0	30.9	-	-	-
<u>Brachionus budapestinensis</u>	19.6	10.5	10.4	10.5	-	13.1	-	-	-
<u>Brachionus bidentata</u>	-	-	-	-	12.0	-	-	-	-
<u>Brachionus angularis</u>	-	-	-	-	-	-	79.1	-	-
<u>Lecane spp.</u>	-	-	-	-	-	-	-	20.3	42.7
Copepoda									
nauplii	-	-	-	-	-	-	-	-	19.5
Cyclopoida copepodids	-	-	-	-	-	-	-	-	12.2
Cladocera									
<u>Diaphanosoma leuchtenbergianum</u>	-	-	-	-	-	-	-	45.3	-
<u>22 August 1980</u>									
Rotifera									
<u>Brachionus calyciflorus</u>	36.4	38.2	46.1	51.4	43.3	48.5	13.9	-	-
<u>Brachionus caudatus</u>	24.8	23.7	12.6	16.6	15.8	21.0	25.7	-	-
<u>Brachionus angularis</u>	-	-	-	-	-	-	27.6	-	-
<u>Brachionus budapestinensis</u>	-	-	-	-	-	-	13.4	-	-
<u>Lecane spp.</u>	-	-	-	-	-	-	-	16.8	63.1
Copepoda									
nauplii	-	-	-	-	-	-	-	13.1	-
Cyclopoida copepodids	-	-	11.2	-	11.2	-	-	33.0	-
Cladocera									
<u>Diaphanosoma immature</u>	-	-	-	-	-	-	-	10.2	-

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Table 1. Zooplankton taxa collected in the Missouri River, Logan Creek, and Mud Creek from 10 September to 14 November, 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Rotifera

Ascomorpha spp. Perty
Asplanchna spp. Gosse
Bdelloidea spp.
Brachionus spp. Pallas
B. angularis Gosse
B. bidentata Anderson
B. budapestinensis Daday
B. calyciflorus Pallas
B. caudatus Barrois and Daday
B. havanaensis Rousselet
B. quadridentatus Hermann
B. urceolaris Muller
Cephalodella spp. Bory de St. Vincent
Euchlanis spp. Ehrenberg
Filinia longiseta (Ehrenberg)
Keratella spp. Bory de St. Vincent
K. quadrata (Muller)
K. valga Carlin
Lecane spp. Nitzsch
Lophocharis spp. Ehrenberg
Monostyla spp. Ehrenberg
Mytilina spp. Bory de St. Vincent
Notholca spp. Gosse
N. acuminata (Ehrenberg)
Platylas patulus (Muller)
P. quadricornis (Ehrenberg)
Polyarthra spp. Ehrenberg
 Rotifera spp.
Synchaeta spp. Ehrenberg
Testudinella spp. Bory de St. Vincent
Trichocerca spp. Lamarck
Trichotria spp. Bory de St. Vincent

Tardigrada spp.

Cladocera

Alona spp. Baird
Bosmina longirostris (Muller)
Ceriodaphnia Dana (immature)
C. lacustris Birge
Chydorus sphaericus (Muller)
Daphnia Muller (immature)
D. parvula Fordyce
Diaphanosoma Fischer (immature)
D. brachyurum (Lieven)
D. leuchtenbergianum Fischer
Disparalona rostrata
Alyocryptus sordidus (Lieven)
Kurzia latissima (Kurz)
Leydigia leydigi (Leydig)
Macrothrix laticornis (Turine)
Moina spp. Baird
Pleuroxus denticulatus Birge
Scapholeberis kingi Sars
Simocephalus spp. Schodler
S. serrulatus (Koch)
S. vetulus Schodler

Copepoda

Copepoda nauplii
 Calanoida copepodids
Diaptomus spp.
D. pallidus Herrick
D. reighardi Marsh
D. siciloides Lilljeborg
 Cyclopoida copepodids
Cyclops bicuspidatus thomasi Forbes
C. vernalis Fischer
Eucylops agilis (Koch)
E. speratus (Lilljeborg)
 Harpacticoida spp.
Mesocyclops edax (Forbes)
Tropocyclops prasinus (Fischer)

Table 2. Total zooplankton densities (D), number of taxa (N), diversity (H), and evenness (J) in the Missouri River, Logan Creek and Mud Creek from 10 September to 14 November, 1980. Zooplankton densities are expressed as organisms per liter.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Location	September 10 & 11				October 15 & 16				November 12 & 14			
	D	N	H	J	D	N	H	J	D	N	H	J
<u>Missouri River</u>												
A2	11	18	1.93	0.50	2	14	1.81	0.52	2	17	1.55	0.45
B2	13	13	1.24	0.36	3	17	2.16	0.58	2	14	1.36	0.45
C1	63	19	1.86	0.48	2	16	1.84	0.54	2	18	1.96	0.56
C2	79	17	1.27	0.35	2	16	1.83	0.53	<1	13	2.17	0.67
H1	67	20	1.52	0.38	2	15	1.83	0.55	1	11	2.08	0.67
H2	47	18	1.36	0.36	4	16	1.83	0.50	1	10	1.72	0.59
Mean	47	18	1.53	0.40	2	16	1.88	0.54	1	14	1.81	0.56
<u>Logan Creek</u>												
D	920	29	3.57	0.78	421	33	3.40	0.72	196	25	2.85	0.70
E1	1328	21	2.34	0.56	122	23	2.52	0.60	9	20	2.36	0.59
Mean	1124	25	2.96	0.67	272	28	2.96	0.66	102	22	2.60	0.64
<u>Mud Creek</u>												
E2	7	19	3.03	0.85	1181	14	2.79	0.74	42	17	2.13	0.57

Table 3. Total zooplankton abundance and percent composition of major zooplankton groups in the Missouri River, Logan Creek and Mud Creek near the Callaway Nuclear Plant from 10 September to 14 November, 1980.
REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Location	Total Zooplankton (organisms/liter)	Cepopoda			%Rotifera	%Cladocera
			%Calanoida	%Cyclopoida	%Total ^a		
10 & 11 September	Missouri River						
	A2	11	0	1.6	3.8	95.6	.6
	B2	13	0	1.3	3.6	95.9	.5
	C1	63	0	2.8	10.3	87.8	1.8
	C2	79	0	1.9	4.6	93.9	1.6
	H1	67	0	2.5	8.3	90.2	1.5
	H2	47	0.5	2.1	4.9	94.7	0.4
	Mean	47	0.1	2.0	5.9	93.0	1.1
	Logan Creek						
	D	920	8.8	2.8	30.0	62.1	7.9
	E1	1328	8.8	14.6	53.5	46.0	0.5
	Mean	1124	8.8	8.7	41.8	54.0	4.2
	Mud Creek						
	E2	7	2.5	24.4	37.0	62.2	0.8
15 & 16 October	Missouri River						
	A2	2	0	3.4	5.4	93.9	.7
	B2	3	0	2.1	6.4	92.6	1.1
	C1	2	0.6	2.5	8.0	91.3	0.7
	C2	2	0	1.3	2.1	96.7	1.2
	H1	2	1.2	2.3	4.4	95.2	0.4
	H2	4	0.5	0.6	4.4	95.1	0.5
	Mean	2	0.4	2.0	5.1	94.1	0.8

Table 3. (continued) REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Location	Total Zooplankton (organisms/liter)	Copepoda		%Total ^a	%Rotifera	%Cladocera
			%Calanoida	%Cyclopoida			
	Logan Creek						
	D	421	5.6	7.2	45.3	24.0	30.7
	E1	122	1.0	10.6	65.4	27.4	7.2
	Mean	272	3.3	8.9	55.4	25.7	19.0
	Mud Creek						
	E2	1181	13.9	14.3	56.4	43.3	0.3
12 & 14 November 1980	Missouri River						
	A2	2	0.4	0.9	12.4	87.6	0.0
	B2	2	0.9	0.0	5.1	91.7	2.2
	C1	2	0.8	2.2	12.3	52.2	35.5
	C2	<1	2.1	1.0	14.2	84.7	1.0
	H1	1	2.2	3.2	18.4	79.7	1.9
	H2	1	2.4	0.4	9.8	88.3	1.9
	Mean	1	1.5	1.3	12.2	80.7	7.1
	Logan Creek						
	D	196	0.9	20.1	39.6	10.4	50.0
	E1	9	1.9	8.1	71.6	18.0	10.4
	Mean	102	1.4	14.1	55.6	14.2	30.2
	Mud Creek						
	E2	42	0.0	7.8	68.4	30.3	1.4

^a includes Calanoida, Cyclopoida, Harpacticoida, Copepoda nauplii.

Table 4. Percent occurrence of zooplankton taxa comprising 10 percent or more of the total densities from locations in the Missouri River (A2, B2, C1, C2, H1 & H2), Logan Creek (D & E1) & Mud Creek (E2) between 10 September to 14 November, 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date and Taxa	Location								
	A2	B2	C1	C2	H1	H2	D	E1	E2
<u>10, 11 September 1980</u>									
Rotifera									
Bdelloidea spp.	-	-	-	-	-	-	-	-	16.0
Brachionus angularis	-	-	-	-	-	-	12.0	-	-
B. budapestinensis	17.6	-	-	-	-	-	-	-	-
B. calyciflorus	62.7	79.6	69.0	81.7	76.6	79.8	11.7	-	-
B. caudatus	-	-	-	-	-	-	17.5	-	-
Keratella spp.	-	-	-	-	-	-	-	41.9	-
Lecane spp.	-	-	-	-	-	-	-	-	16.0
Polyarthra spp.	-	-	-	-	-	-	-	-	16.0
Copepoda									
nauplii	-	-	-	-	-	-	18.4	30.2	10.1
Cyclopoida copepodids	-	-	-	-	-	-	-	10.5	-
Tropocyclops prasinus	-	-	-	-	-	-	-	-	10.9
<u>15, 16 October 1980</u>									
Rotifera									
Bdelloidea spp.	-	-	-	-	-	-	10.3	-	-
Brachionus calyciflorus	68.2	60.7	67.7	63.5	62.1	65.3	-	-	-
B. urceolaris	-	-	10.0	-	-	-	-	-	-
B. quadridentatus	-	-	-	15.9	17.2	12.0	-	-	-
Keratella spp.	-	-	-	-	-	-	-	-	26.4
Lecane spp.	-	-	-	-	-	-	-	10.3	-

Table 4. (continued) REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date and Taxa	Location									
	A2	B2	C1	C2	H1	H2	D	E1	E2	
Copepoda										
nauplii	-	-	-	-	-	-	32.5	53.8	28.2	
Calanoida copepodids	-	-	-	-	-	-	-	-	11.2	
Cyclopoida copepodids	-	-	-	-	-	-	-	-	11.0	
Cladocera										
<u>Chydorus sphaericus</u>	-	-	-	-	-	-	14.6	-	-	
<u>12, 14 November 1980</u>										
Rotifera										
<u>Keratella</u> spp.	-	-	-	-	11.6	14.4	-	-	-	
<u>Notholca acuminata</u>	-	-	-	-	-	-	-	-	12.1	
<u>Rotifera</u> spp.	74.2	78.7	44.7	57.4	57.0	64.6	-	-	-	
Copepoda										
nauplii	10.6	-	-	11.0	13.0	-	18.7	61.6	58.7	
Cladocera										
<u>Chydorus sphaericus</u>	-	-	29.9	-	-	-	40.1	-	-	

APPENDIX D
Benthic Macroinvertebrates

TABLE 2.3.5-1
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 BENTHIC MACROINVERTEBRATES COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK
 DURING JULY (J), SEPTEMBER (S), DECEMBER (D) 1973 AND FEBRUARY (F) 1974

Species	Missouri River				Logan Creek			
	<u>J</u>	<u>S</u>	<u>D</u>	<u>F</u>	<u>J</u>	<u>S</u>	<u>D</u>	<u>F</u>
Oligochaeta								
Enchytraeidae								
Unidentified species			X	X				X
Lumbriculidae								
Unidentified species							X	
Tubificidae								
<u>Branchiura sowerbyi</u>	X	X	X	X		X	X	X
<u>Aulodrilus pigneti</u>							X	X
<u>Ilyodrilus templetoni</u>				X				
<u>Limnodrilus cervix</u>			X	X			X	X
<u>L. claparedeanus</u>			X	X			X	X
<u>L. hoffmeisteri</u>			X	X			X	X
<u>L. udekemianus</u>	X		X	X			X	X
<u>Limnodrilus</u> spp.	X	X	X	X	X	X	X	X
<u>Tubifex</u> sp.		X						
<u>Pelosclex</u> sp.		X						
Unidentified species	X	X	X	X	X	X	X	X
Naididae								
<u>Aulophorus</u> sp.						X		
<u>Dero digitata</u>			X	X			X	X
<u>Nais elinguis</u>			X	X				
<u>Nais</u> sp.								X
<u>Paranais frici</u>			X	X				
Diptera								
Culicidae								
<u>Chaoborus punctipennis</u>				X			X	
<u>Chaoborus</u> sp.		X	X			X		

I-0

TABLE 2.3.5-1 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Species	Missouri River				Logan Creek			
	<u>J</u>	<u>S</u>	<u>D</u>	<u>F</u>	<u>J</u>	<u>S</u>	<u>D</u>	<u>F</u>
Chironomidae								
<u>Ablethesmyia janta</u>			X					
<u>Zavreliomyia</u> spp.	X				X			
<u>Procladius adumbratus</u>			X	X			X	X
<u>P. riparius</u>	X		X	X	X		X	X
<u>Procladius</u> spp.	X							
<u>Paralauterborniella</u> sp.	X	X	X					
<u>Rheotanytarsus</u> sp.		X	X	X	X	X		
<u>Polypedilum haltera</u>				X			X	
<u>P. scalaenum</u>					X			
<u>Polypedilum</u> sp.		X		X	X	X		
<u>Cryptochironomus blarina</u>			X					
<u>Cryptochironomus fulvus</u>			X	X	X		X	X
<u>Cryptochironomus</u> sp.	X	X				X		
<u>Trissocladius</u> sp.			X	X			X	X
<u>Tendipedini</u> spp.		X	X					
<u>Paracladopelma</u> sp.				X			X	
<u>Paratendipes</u> sp.		X	X		X			
<u>Chironomus</u> spp.		X	X	X	X	X	X	X
<u>Cricotopus exilis</u>			X	X				X
<u>Stictochironomus</u> sp.				X	X			X
<u>Conchapelopia</u> sp.			X					
<u>Coelotanypus</u> sp.			X					
<u>Pseudochironomus</u> sp.		X				X	X	
<u>Orthocladius</u> sp.				X				
<u>Dicrotendipes</u> sp.		X	X	X	X	X	X	
<u>Trichocladius</u> sp.		X						
<u>Glyptotendipes lobiferus</u>			X					X
<u>Glyptotendipes senilis</u>					X			
<u>Glyptotendipes</u> sp.				X		X		
Unidentified species		X						

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TABLE 2.3.5-1 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Species	Missouri River				Logan Creek			
	<u>J</u>	<u>S</u>	<u>D</u>	<u>F</u>	<u>J</u>	<u>S</u>	<u>D</u>	<u>F</u>
Ceratopogonidae								
<u>Bezzia</u> sp.					X			
Unidentified sp.			X	X				X
Psychodidae								
<u>Psychoda</u> sp.				X				
Ephemeroptera								
<u>Hexagenia</u> sp.			X					
<u>Pentagenia vittigena</u>		X						
<u>Pentagenia</u> sp.	X		X					
<u>Caenis</u> sp.	X							
<u>Stenonema femoratum</u>			X			X		
<u>Ephemerella frisoni</u>		X				X		
Trichoptera								
<u>Neureclipsis</u> sp.			X					
<u>Hydropsyche orris</u>			X	X				
<u>Cheumatopsyche</u> sp.			X	X				
Unidentified sp.	X							
Odonata								
<u>Argia</u> sp.			X					
<u>Gomphus</u> sp.				X				
Coleoptera								
<u>Dubiraphia</u> sp.	X			X				
Unidentified sp.								
Collembolla								
Unidentified sp.			X	X	X			
Amphipoda								
<u>Hyalella azteca</u>		X						
Gastropoda								
<u>Ferrisia</u> sp.			X					
Pelecypoda								
Corbiculidae								
<u>Corbicula</u> sp.	X							
Sphaeriidae								
Unidentified sp.								X

D-3

X

TABLE 2.3.5-2
REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

MACROBENTHIC INVERTEBRATES COLLECTED FROM THE MISSOURI RIVER
DURING JULY, SEPTEMBER, DECEMBER, AND FEBRUARY

Date	Organisms	Station A-1		Station A-2		Station B-1		Station B-2		Station C-1		Station C-2	
		No/m ²	% Total	No/m ²	% Total	No/m ²	% Total	No/m ²	% Total	No/m ²	% Total	No/m ²	% Total
July 1973	Oligochaeta	7	50	49	32	0	-	14	25	0	-	7	100
	Diptera	0	-	21	14	98	100	0	-	14	100	0	-
	Ephemeroptera	7	50	77	50	0	-	35	63	0	-	0	-
	Trichoptera	0	-	0	-	0	-	7	13	0	-	0	-
	Coleoptera	0	-	7	5	0	-	0	-	0	-	0	-
	TOTAL	14	100	154	101	98	100	56	101	14	100	7	100
September 1973	Oligochaeta	0	-	231	52	0	-	505	96	0	-	539	99
	Diptera	42	100	35	8	42	100	7	1	476	100	7	1
	Ephemeroptera	0	-	173	39	0	-	14	3	0	-	0	-
	Pelecypoda	0	-	7	2	0	-	0	-	0	-	0	-
	TOTAL	42	100	446	101	42	100	526	100	476	100	546	100
December 1973	Oligochaeta	Not collected		0	-	0	-	364	68	7	33	2205	81
	Diptera	bottom scoured		21	100	0	-	154	29	7	33	434	16
	Ephemeroptera	by high water		0	-	0	-	14	3	7	33	56	2
	Trichoptera			0	-	0	-	0	-	0	-	21	1
	TOTAL	-	-	21	100	0	-	532	100	21	99	2716	100
February 1974	Oligochaeta	Not collected		0	-	Not collected		525	67	0	-	21	60
	Diptera	Bottom scoured		0	-	Bottom scoured		224	29	0	-	14	40
	Trichoptera	by high water		14	100	by high water		14	2	0	-	0	-
	Odonata			0	-			14	2	0	-	0	-
	Coleoptera			0	-			7	1	0	-	0	-
	TOTAL	-	-	14	100	-	-	784	101	0	-	35	100

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TABLE 2.3.5-3
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 MACROBENTHIC SPECIES DIVERSITY INDICES FOR STATIONS
 ON THE MISSOURI RIVER AND LOGAN CREEK

Date	A-1	A-2	B-1	B-2	C-1	C-2	D	E
July 1973	1.00	2.42	0.75	1.30	0.00	0.00	1.16	3.44
September 1973	0.00	1.66	0.00	0.74	2.66	1.00	1.43	2.76
December 1973	N.C. ^a	1.59	0.00	3.36	1.59	3.57	2.75	3.12
February 1974	N.C. ^a	0.92	N.C. ^a	3.58	0.00	2.16	2.85	2.70
Average	0.50	1.65	0.25	2.25	1.06	1.69	2.05	3.00

^aNot collected - bottom scoured by high water.

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TABLE 2.3.5-4
REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
WET-WEIGHT BENTHIC BIOMASS - MISSOURI RIVER AND LOGAN CREEK

Date	Station	(Number of Organisms) Wet-Weight in mg/m ²								Total Wet-Wt
		Oligochaeta	Diptera	Ephemeroptera	Trichoptera	Pelecypoda	Odonata	Coleoptera	Other	
July 1973	A-1	(7)2.1	-	(7)2.8	-	-	-	-	-	4.9
	A-2	(49)11.6	(21)3.2	(77)28.7	-	-	-	(7)19.6	-	63.1
	B-1	-	(98)7.0	-	-	-	-	-	-	7.0
	B-2	(14)2.8	-	(35)9.8	(7)40.6	-	-	-	-	53.2
	C-1	-	(14)2.1	-	-	-	-	-	-	2.1
	C-2	(7)3.5	-	-	-	-	-	-	-	3.5
	D	(73)33.6	(30)9.8	-	-	-	-	-	-	43.4
	E	(73)27.7	(991)317.6	-	-	-	-	-	(29)5.8	351.1
September 1973	A-1	-	(42)13.4	-	-	-	-	-	-	13.4
	A-2	(231)234.5	(35)11.2	(173)192.5	-	(7)161.7	-	-	-	599.9
	B-1	-	(42)13.4	-	-	-	-	-	-	13.4
	B-2	(505)648.9	(7)2.2	(14)16.1	-	-	-	-	-	667.2
	C-1	-	(476)152.3	-	-	-	-	-	-	152.3
	C-2	(539)990.5	(7)2.2	-	-	-	-	-	-	992.7
	D	(1130)711.2	(118)37.8	-	-	-	-	-	-	749.0
	E	(205)91.0	(3549)1135.7	(206)58.1	-	-	-	-	(73)1.4	1286.2
December 1973	A-1	Not Collected								
	A-2	-	(21)8.4	-	-	-	-	-	-	8.4
	B-1	-	-	-	-	-	-	-	-	-
	B-2	(364)327.6	(154)81.6	(14)1.4	-	-	-	-	-	410.6
	C-1	(7)21.0	(7)4.2	(7)0.7	-	-	-	-	-	25.9
	C-2	(2205)5512.5	(434)173.6	(56)89.6	(21)21.0	-	-	-	-	5796.7
	D	(1750)7227.5	(235)517.0	(15)33.0	-	-	-	-	(59)5.9	7783.4
	E	(573)879.0	(309)669.5	-	-	-	-	-	-	1548.5

TABLE 2,3,5-4 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 (Number of Organisms) Wet-Weight in mg/m²

Date	Station	Oligochaeta	Diptera	Ephemeroptera	Trichoptera	Pelecypoda	Odonata	Coleoptera	Other	Total Wet-Wt
February 1974	A-1	Not Collected								
	A-2	-	-	-	(14)186.2	-	-	-	-	186.2
	B-1	Not Collected								
	B-2	(525)525.0	(224)107.1	-	(14)9.8	-	(14)487.9	(7)2.4	-	1132.2
	C-1	-	-	-	-	-	-	-	-	-
	C-2	(21)12.6	(14)1.4	-	-	-	-	-	-	14.0
	D	(2484)18,795.6	(382)636.7	-	-	(15)57.0	-	-	-	19,489.3
	E	(441)1367.1	(221)839.8	-	-	(74)532.8	-	-	-	2739.7

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TABLE 2.3.5-5
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 MACROBENTHIC INVERTEBRATES COLLECTED FROM LOGAN CREEK
 DURING JULY, SEPTEMBER, DECEMBER, AND FEBRUARY

Date	Organisms	Station D		Station E	
		No/m ²	% Total	No/m ²	% Total
July 1973	Oligochaeta	73	71	73	7
	Diptera	30	29	991	91
	Other	0	-	29	3
	TOTAL	103	100	1093	101
September 1973	Oligochaeta	1130	91	205	5
	Diptera	118	9	3549	88
	Ephemeroptera	0	-	206	5
	Other	0	-	73	2
TOTAL	1248	100	4033	100	
December 1973	Oligochaeta	1750	85	573	65
	Diptera	235	11	309	35
	Ephemeroptera	15	1	0	-
	Other	59	3	0	-
TOTAL	2059	100	882	100	
February 1974	Oligochaeta	2484	86	441	60
	Diptera	382	13	221	30
	Pelecypoda	15	.1	74	10
TOTAL	2881	100	736	100	

TABLE 2.3.6-1
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 BENTHIC MACROINVERTEBRATES COLLECTED FROM THE
 MISSOURI RIVER AND LOGAN CREEK,
 JUNE 1974

Organism	Missouri River Sampling Stations				Logan Creek Sampling Stations	
	A-2	B-2	H-2	C-2	D	E
Nematoda						
Unknown sp.	P ^a	+	+	P	E ^b	E
Annelida						
Oligochaeta						
<u>Dero</u> sp.	P	+	+	P	E	+
<u>Tubifex</u> sp.	P	+	P	P	E	E
<u>Limnodrilus</u> sp.	P	P	P	P	E	E
<u>Branchiura sowerbyi</u>	+	P	+	+	E	E
<u>Lumbriculus</u> sp.	P	+	+	P	+	+
Crustacea						
Copepoda	+	+	+	+	+	+
Calanoida	P	P	+	R ^C	+	+
Cyclopoid	+	+	+	R	E	E
Cladocera	+	+	+	P	+	+
Amphipoda						
<u>Crangonyx</u> sp.	+	+	+	R	+	+
Decapoda						
<u>Palaemonetes kadiakensis</u>	+	+	+	+	+	R
Astacidae (immature)	+	+	+	+	+	R
Diptera						
Chironomidae						
<u>Ablabesmyia</u> sp.	+	+	+	+	+	R
<u>Chironomus</u> sp.	+	+	+	P,R	E	E
<u>Chironomus</u> sp. B	+	R	+	+	+	+
<u>Cryptochironomus</u> sp.	P	+	+	+	+	+
<u>Tribelos</u> sp.	+	+	+	+	+	E
<u>Polypedilum</u> sp.	+	+	+	R	+	+
<u>Microtendipes</u> sp.	+	+	+	+	+	E
Culicidae						
<u>Chaeborus</u> sp.	+	+	+	R	+	+
Trichoptera						
<u>Hydropsyche</u> sp.	+	R	+	R	+	+
<u>Chematopsyche</u> sp.	+	R	+	+	+	+
Ephemoptera						
<u>Centroptilum</u> sp.	+	R	+	+	R	+
<u>Stenonema</u> sp.	+	R	+	R	+	R
<u>Paraleptophlebia</u> sp.	+	+	+	R	+	+
<u>Isonychia</u> sp.	+	R	+	+	+	+
<u>Caenis</u> sp.	R	+	+	+	+	+

TABLE 2.3.6-1 (continued)

<u>Organism</u>	<u>Missouri River Sampling Stations</u>				<u>Logan Creek Sampling Stations</u>	
	<u>A-2</u>	<u>B-2</u>	<u>H-2</u>	<u>C-2</u>	<u>D</u>	<u>E</u>
Odonata						
Zygoptera	+	+	+	+	+	+
<u>Argia sp.</u>	R	+	+	+	+	+
Anisoptera						
<u>Gomphus sp.</u>	+	+	+	P	R	+
<u>Macromia sp.</u>	+	+	+	+	+	R
Mollusca						
<u>Anilima sp.</u>	+	+	+	+	+	R
<u>Uniomeras sp.</u>	+	+	+	+	+	R

^aPonar grabs

^bEkman grabs

^cRandom samples

TABLE 2.3.6-2
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 WET-WEIGHT BENTHIC MACROINVERTEBRATE BIOMASS AND DENSITIES FOR
 MISSOURI RIVER AND LOGAN CREEK, JUNE 1974^a

<u>Stations</u>	<u>Nematoda</u>	<u>Oligochaeta</u>	<u>Crustacea</u>	<u>Diptera</u>	<u>Odonota</u>	<u>Total Wet-Weight</u>
A-2	(10) 1	(1720) 1919	(10) 5	(19) 14	+	1939
B-2	+	(912) 8	(10) 5	+	+	904
C-2	(19) 1	(1159) 1744	+	(10) 5	(10) 1938	3687
D	(43) 2	(3099) 15136	+	(150) 130	+	15268
E	(21) 1	(705) 280	+	(171) 237	+	518
H-2	+	(808) 262	+	+	+	262

^a(number of organisms) wet-weight in mg/m²

TABLE 2.3.6-3

BENTHIC MACROINVERTEBRATES COLLECTED FROM THE MISSOURI RIVER
AND LOGAN CREEK, SEPTEMBER 1974

Organism	Missouri River Sampling Stations				Logan Creek Sampling Stations	
	A-2	B-2	H-2	C-2	D	E
Platyhelminthes						
Turbellaria	P ^a	R ^b	+	+	+	+
Annelida						
Oligochaeta						
<u>Branchiura sowerbyi</u>	P	P	P	P	E ^C	E
<u>Limnodrilus</u> sp.	P	P	P	P	E	E
<u>Lumbriculus</u> sp.	+	+	+	+	+	E
Crustacea						
Amphipoda						
<u>Craygonyx</u> sp.	+	R	+	+	+	+
Decapoda						
Astacidae (immature)	+	+	+	+	+	R
<u>Palaemonetes kadiakensis</u>	+	+	+	+	+	R
Diptera						
Chironomidae						
<u>Ablabesmyia</u> sp.	+	P	+	P	+	E
<u>Chironomus</u> sp.	+	P	P	P	+	E
<u>Coelotanypus</u> sp.	+	P	P	P	+	+
<u>Cryptochironomus</u> sp.	+	P	+	P	E	E
<u>Glyptotendipes</u> sp.	+	+	+	+	+	E
<u>Microtendipes</u> sp.	+	+	+	+	+	E
Pentaneurini	+	+	P	+	+	+
<u>Procladius</u> sp.	+	+	P	P	+	E
<u>Polypedilum</u> sp.	+	R	P	+	+	E
<u>Psectrocladius</u> sp.	+	R	+	+	+	+
<u>Pseudochironomus</u> sp.	+	+	+	+	+	E
Tanypodinae	P	R	+	+	+	+

TABLE 2.3.6-3 (continued)

REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

Organism	Missouri River Sampling Stations				Logan Creek Sampling Stations	
	A-2	B-2	H-2	C-2	D	E
Tanytarsini	+	+	+	+	+	E
<u>Tanytarsus</u> sp.	+	R	+	+	+	+
Culicidae						
<u>Chaoborus</u> sp.	+	R	P	+	+	+
Tipulidae	+	+	+	+	+	R
Tabanidae						
<u>Tabanus</u> sp.	+	+	+	+	+	R
Trichoptera						
<u>Chematopsyche</u> sp.	P	R	P	+	+	+
<u>Hydropsyche</u> sp.	+	P	+	+	+	+
<u>Lype</u> sp.	+	R	+	+	+	+
Ephemoptera						
<u>Caenis</u> sp.	+	R	+	+	+	E
<u>Centroptilum</u> sp.	+	R	+	R	+	+
<u>Hexagenia</u> sp.	+	P	P	P	+	+
<u>Stenonema</u> sp.	+	R	+	R	+	+
Megaloptera						
<u>Sialis</u> sp.	+	+	+	+	+	E
Odonata						
<u>Gomphus</u> sp.	P	P	+	+	+	+
Hemiptera						
<u>Buenoa</u> sp.	+	+	+	R	+	+
<u>Gyretes</u> sp.	+	+	+	R	E	+
Coleoptera						
<u>Stenelmis</u> sp.	+	+	+	R	+	+
Mollusca						
<u>Lasmigona</u> sp.	P	+	+	+	+	+

TABLE 2.3.6-3 (continued)

<u>Organism</u>	<u>Missouri River Sampling Stations</u>				<u>Logan Creek Sampling Stations</u>	
	<u>A-2</u>	<u>B-2</u>	<u>H-2</u>	<u>C-2</u>	<u>D</u>	<u>E</u>
<u>Pisidium (cyclocalyx) adamsi</u>	P	P	+	+	+	+
<u>Shaerium (musculium) partiumeium</u>	P	+	+	+	+	+

^a Ponar grab sample

^b Random sample

^c Ekman Dredge Sample

TABLE 2.3.6-4
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 WET-WEIGHT BENTHIC MACROINVERTEBRATE BIOMASS AND DENSITIES
 FOR MISSOURI RIVER AND LOGAN CREEK, SEPTEMBER 1974^a

<u>Groups</u>	<u>Stations</u>					
	<u>A-2</u>	<u>B-2</u>	<u>H-2</u>	<u>C-2</u>	<u>D</u>	<u>E</u>
Oligochaeta	(886)1.007	(2219)3.309	(848)0.889	(743)0.893	(3057)3.656	(606)0.594
Diptera	(10)0.005	(48)0.024	(124)0.071	(162)0.081	(14)0.007	(222)0.111
Trichoptera	(10)0.005	(48)0.135	(10)0.042	+	+	+
Ephemoptera	+	(86)0.632	(19)0.322	(67)2.295	+	(10)0.008
Odonata	(10)0.430	(10)0.134	+	+	+	+
Coleoptera	+	+	+	+	(14)0.143	+
Mollusca	(67)1.710	(10)1.086	+	+	+	+
Other	<u>(10)0.005</u>	<u>+</u>	<u>+</u>	<u>+</u>	<u>+</u>	<u>(10)0.233</u>
Total/m ²	(993)3.162	(2421)5.320	(1001)1.324	(972)3.269	(3085)3.806	(868)0.946

^a(number of organisms) wet-weight in mg/m²

TABLE 2.3.6-5

NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED
IN A METERED LARVAL NET IN THE
MISSOURI RIVER,
JUNE 23, 1974

<u>Organism</u>	<u>Station B</u>	<u>Station C</u>
Crustacea		
Amphipoda		
<u>Crangonyx</u> sp.	+	1
Diptera		
Chironomidae		
<u>Chironomus</u> sp.	1	1
<u>Chironomus</u> sp. B	1	+
<u>Polypedilum</u> sp.	+	1
Culicidae		
<u>Chaoborus</u> sp.	+	1
Trichoptera		
<u>Hydropsyche</u> sp.	1	1
<u>Chematopsyche</u> sp.	1	+
Ephemoptera		
<u>Centroptilum</u> sp.	3	+
<u>Stenonema</u> sp.	10	13
<u>Paraleptophleba</u> sp.	+	1
<u>Tsonychia</u> sp.	2	+
<u>Caenis</u> sp.	2	+
Odonata		
<u>Gomphus</u> sp.	+	1
TOTAL	20	20
DENSITY	0.0503/m ³	0.0568/m ³

TABLE 2.3.6-6
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED IN A METERED LARVAL NET
 IN THE MISSOURI RIVER JUNE 23 AND SEPTEMBER 8, 1974

Organism	June 23		September 8	
	Station B	Station C	Station B	Station C
Annelida				
Oligochaete				
<u>Limnodrilus</u> sp.	+	+	+	1
Crustacea				
Amphipoda				
<u>Crangonyx</u> sp.	+	1	1	+
Diptera				
Chironomidae				
<u>Chironomus</u> sp.	1	1	+	+
<u>Chironomus</u> sp. B	1	+	+	+
<u>Polypedilum</u> sp.	+	1	1	3
Tanypodinae (unknown)	+	+	1	1
Culicidae				
<u>Chaoborus</u> sp.	+	1	4	3
Trichoptera				
<u>Chematopsyche</u> sp.	1	+	+	+
<u>Hydropsyche</u> sp.	1	1	2	6
<u>Lype</u> sp.	+	+	1	+
Ephemeroptera				
<u>Caenis</u> sp.	2	+	+	+
Caenidae (unknown)	+	+	+	2
<u>Centroptilum</u> sp.	3	+	+	+
<u>Hexagenia</u> sp.	+	+	5	4
<u>Isonychia</u> sp.	2	+	+	+
<u>Paraleptophleba</u> sp.	+	1	+	+
<u>Stenonema</u> sp.	10	13	1	2
Odonata				
<u>Gomphus</u> sp.	+	1	+	+

TABLE 2.3.6-6 (continued)

<u>Organism</u>	<u>June 23</u>		<u>September 8</u>	
	<u>Station B</u>	<u>Station C</u>	<u>Station B</u>	<u>Station C</u>
Hemiptera				
<u>Buena</u> sp.	+	+	+	1
Coleoptera				
<u>Stenelmis</u> sp.	<u>+</u>	<u>+</u>	<u>+</u>	<u>1</u>
TOTAL	21	20	16	24
DENSITY	0.0527/m ³	0.0568/m ³	0.0490/m ³	0.0603/m ³

TABLE 2.3.6-7

NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED IN
 DRIFT NETS^a IN LOGAN CREEK,
 JUNE 22, 1974

<u>Organism</u>	<u>Station D</u>	<u>Station E</u>
Crustacea		
Copepoda		
Cyclopoid	6	38
Diptera		
Chironomidae		
<u>Ablabesmyia</u> sp.	+	1
Ephemoptera		
<u>Stenonema</u> sp.	+	1
<u>Centroptilum</u> sp.	1	+

^a0.135-m² nets

TABLE 2.3.6-8
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 BENTHIC MACROINVERTEBRATES COLLECTED FROM THE MISSOURI RIVER AND LOGAN CREEK
 DURING JULY (J-3), SEPTEMBER (S-3), DECEMBER (D-3), 1973, AND
 FEBRUARY (F-4), JUNE (J-4), AND SEPTEMBER (S-4), 1974

Organism	Missouri River						Logan Creek					
	J-3	S-3	D-3	F-4	J-4	S-4	J-3	S-3	D-3	F-4	J-4	S-4
Platyhelminthes												
Turbellaria						x						
Nematoda												
unknown sp.					x						x	
Annelida												
Oligochaeta												
Enchytraeidae												
unknown sp.			x	x						x		
Lumbriculidae												
Lumbriculus sp.					x							x
unknown sp.									x			
Tubificidae												
Aulodrilus pigneti									x	x		
Branchiura sowerbyi	x	x	x	x	x	x	x	x	x	x	x	x
Ilyodrilus templetoni				x								
Limnodrilus ceruix			x	x					x	x		
L. claparedeanus			x	x					x	x		
L. hoffmeisteri			x	x					x	x		
L. sp.	x	x	x	x	x	x	x	x	x	x	x	x
L. udekemianus	x		x	x					x	x		
Peloscolex sp.		x										
Tubifex sp.		x			x						x	
unknown sp.	x	x	x	x			x	x	x	x		
Naididae												
Aulophorus sp.								x				
Dero digitata			x	x					x	x		
Dero sp.					x						x	
Nais elinguis			x	x								
N. sp.										x		

TABLE 2.3.6-8 (continued)

REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

Organism	Missouri River						Logan Creek					
	J-3	S-3	D-3	F-4	J-4	S-4	J-3	S-3	D-3	F-4	J-4	S-4
<u>Paranais frici</u>			x	x								
Crustacea												
Amphipoda												
<u>Crangonyx sp.</u>					x	x						
<u>Hyalrella azteca</u>		x										
Decapoda												
Astacidae (immature)											x	x
<u>Palaemonetes kadiakensis</u>											x	x
Diptera												
Chironomidae												
<u>Ablabesmyia janta</u>			x									
<u>Ablabesmyia sp.</u>						x					x	x
<u>Chironomus sp.</u>		x	x	x	x	x	x	x	x	x	x	x
<u>Coelotanypus sp.</u>			x			x						
<u>Conchapelopia sp.</u>			x									
<u>Cricotopus exilis</u>			x	x					x			
<u>Cryptochironomus blarina</u>			x									
<u>Cryptochironomus fulvus</u>			x	x			x		x			
<u>Cryptochironomus sp.</u>	x	x			x			x				x
<u>Dicrotendipes sp.</u>		x	x	x			x	x	x			
<u>Glyptotendipes lobiferus</u>			x							x		
<u>Glyptotendipes senilis</u>							x					
<u>Glyptotendipes sp.</u>				x				x				x
<u>Microtendipes sp.</u>											x	x
<u>Orthocladius sp.</u>				x								
<u>Paracladopelma sp.</u>				x						x		
<u>Paralauterborneilla sp.</u>	x	x	x									
<u>Paratendipes sp.</u>		x	x				x					
Pentaneurini (unknown)											x	
<u>Polypedilum halterale</u>				x						x		
<u>Polypedilum scalaenum</u>							x					
<u>Polypedilum sp.</u>		x		x	x	x	x	x				x

TABLE 2.3.6-8 (continued)

Organism	Missouri River						Logan Creek					
	J-3	S-3	D-3	F-4	J-4	S-4	J-3	S-3	D-3	F-4	J-4	S-4
<u>Procladius adumbratus</u>			x	x					x	x		
<u>Procladius riparius</u>	x		x	x			x		x	x		
<u>Procladius sp.</u>	x					x						x
<u>Psectrocladius sp.</u>						x						
<u>Pseudochironomus sp.</u>		x						x	x			x
<u>Rheotanytarsus sp.</u>		x	x	x			x	x				
<u>Stictochironomus sp.</u>				x			x			x		
Tanypodinae						x						
Tanytarsini												x
<u>Tanytarsus sp.</u>						x						
Tendipedini		x	x									
<u>Tribelos sp.</u>											x	
<u>Trichocladius sp.</u>		x										
<u>Trissocladius sp.</u>			x	x					x	x		
<u>Zavreliomyia sp.</u>	x						x					
Culicidae												
<u>Chaoborus punctipennis</u>				x						x		
<u>Chaoborus sp.</u>		x	x		x	x		x				
Ceratopogonidae												
<u>Bezzia sp.</u>							x					
Unidentified sp.			x	x						x		
Psychodidae												
<u>Psychoda sp.</u>				x								
Tipulidae												x
Tabanidae												
<u>Tabanus sp.</u>												x
Trichoptera												
<u>Chematopsyche sp.</u>			x	x	x	x						
<u>Hydropsyche orris</u>			x	x								
<u>Hydropsyche sp.</u>					x	x						
<u>Lype sp.</u>						x						
<u>Neureclipsis sp.</u>			x									
Unidentified sp.	x											

TABLE 2.3.6-8 (continued)

REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

Organism	Missouri River						Logan Creek					
	J-3	S-3	D-3	F-4	J-4	S-4	J-3	S-3	D-3	F-4	J-4	S-4
Ephemeroptera												
<u>Caenis</u> sp.	x			x	x							x
<u>Centroptilum</u> sp.					x	x					x	
<u>Ephemerella frisoni</u>		x						x				
<u>Hexagenia</u> sp.			x			x						
<u>Paraleptophlebia</u> sp.					x							
<u>Isonychia</u> sp.					x							
<u>Pentagenia vittigena</u>		x										
<u>Pentagenia</u> sp.	x		x									
<u>Stenonema femoratum</u>		x						x				
Megaloptera												
<u>Sialis</u> sp.												x
Odonata												
<u>Argia</u> sp.			x									
<u>Gomphus</u> sp.				x	x						x	x
<u>Macromia</u> sp.											x	
Hemiptera												
<u>Buena</u> sp.						x						
<u>Gyretes</u> sp.						x						x
Coleoptera												
<u>Dubiraphia</u> sp.	x			x								
<u>Stenelmis</u> sp.						x						
Mollusca												
Gastropoda												
<u>Ferrisia</u> sp.			x									
Pelecypoda												
<u>Amblema</u> sp.											x	
<u>Corbicula</u> sp.		x										
<u>Lasmigona</u> sp.						x						
<u>Pisidium adamsi</u>						x						
Shaeriidae unknown				x								
<u>Shaerium partumeium</u>						x						
<u>Uniomeras</u> sp.											x	

Table 1. Benthic and drifting macroinvertebrates collected in the Missouri River near the Callaway Nuclear Power Plant, June 1980 through May 1981.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Benthic	Drifting
Oligochaeta		
Naididae		
<u>Allonais inaequalis</u> (Stephenson)		X
<u>Aulophorus furcatus</u> (Muller)		X
<u>Nais</u> sp. Muller		X
Tubificidae		
<u>Branchiura sowerbyi</u> Beddard	X	
<u>Limnodrilus cervix</u> Brinkhurst	X	
<u>L. claparedianus</u> Ratzel	X	
<u>L. hoffmeisteri</u> (Claparede)	X	
<u>L. udekemianus</u> Claparede	X	
Hirudinea		
Erpobdellidae		
<u>Mooreobdella microstoma</u> (Moore)		X
Plecoptera		
Perlidae		
<u>Neoperla</u> sp. Needham		X
<u>Perlesta placida</u> (Hagen)		X
Ephemeroptera		
Siphonuridae		
<u>Isonychia</u> sp. Eaton		X
Baetidae		
<u>Baetis</u> sp. Leach		X
Heptageniidae		
<u>Aneoporus</u> sp. Mc. Dunnough		X
<u>Heptagenia</u> sp. Walsh		X
<u>Stenonema integrum</u> McDunnough		X
Caenidae		
<u>Caenis</u> sp. Stephens	X	X
Tricorythidae		
<u>Tricorythodes</u> sp. Ulmer		X
Epheridae		
<u>Hexagenia</u> sp. Walsh	X	X
<u>Pentagenia vittigera</u> (Walsh)	X	X
Odonata		
Coenagrionidae		
<u>Argia</u> sp. Rambur		X
<u>Ischnura</u> sp. Charpentier		X
Gomphidae		
<u>Dromogomphus</u> sp. Selys	X	X
<u>Gomphus</u> sp. Leach	X	X

Table 1.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Benthic	Drifting
Hemiptera		
Corixidae		X
Pleidae		
<u>Plea striola</u> Fieber		X
Megaloptera		
Sialidae		
<u>Sialis</u> sp. Latreille		X
Trichoptera		
Polycentropodidae		
<u>Neureclipsis</u> sp. Mc Lachlan		X
Hydropsychidae		
<u>Cheumatopsyche</u> sp. Wallengren		X
<u>Hydropsyche orris</u> Ross	X	X
<u>H. simulans</u> Ross		X
<u>H. venularis</u> Banks		X
<u>Potamyia flava</u> (Hagen)		X
Leptoceridae		
<u>Tranodes</u> sp. McLachlan		X
Coleoptera		
Dytiscidae		
<u>Hydroporus</u> sp. Clairville		X
<u>Laccophilus</u> sp. Leach		X
Elmidae		
<u>Dubiraphia</u> sp. Sanderson		X
<u>Macronychus glabratus</u> Say		X
<u>Stenelmis</u> sp. Dufour		X
Diptera		
Tipulidae		X
Chaoboridae		
<u>Chaoborus punctipennis</u> (Say)	X	X
Chironomidae		
<u>Ablabesmyia ornata</u> Saether		X
<u>Chernovskiiia orbicus</u> Townes	X	X
<u>Chironomus</u> sp. (Meigen)	X	X
<u>Coelotanypus</u> sp. Kieffer		X
<u>Corynoneura</u> sp. Winnertz	X	
<u>Cryptochironomus</u> sp. Kieffer	X	X
<u>Dicrotendipes</u> sp. Kieffer		X
<u>Eukiefferiella</u> sp. Thienemann	X	
<u>Larsia</u> sp. Fittkau	X	
<u>Nanocladius</u> sp. Kieffer		X
<u>Paracladopelma</u> sp. Harnish	X	X

Table 1.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Benthic	Drifting
<u>Parametricnemus</u> sp. Goetghebuer		X
<u>Paratendipes</u> sp. Kieffer	X	X
<u>Polypedilum</u> sp. (Convictum Group)	X	X
<u>Polypedilum</u> sp. (Scalaenum Group)	X	X
<u>Procladius</u> sp. Skuse		X
<u>Rheotanytarsus</u> sp. (Bause)		X
<u>Robackia claviger</u> Townes	X	X
<u>Robackia demeijerei</u> Kruseman		X
<u>Tanytus stellatus</u> Coquillet		X
<u>Tanytarsus</u> sp. Van der Wulp	X	X
<u>Thienemannimyia</u> Group		X
Ceratopogonidae		X
Empididae		X
Stratiomyiidae		X
Pelecypoda		
Sphaeriidae		
<u>Sphaerium transversum</u> (Say)		X
TOTAL NUMBER OF TAXA	24	58

Table 2. Macroinvertebrates collected in Logan Creek and Mud Creek near the Callaway Nuclear Plant, June 1980 through May 1981.
REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Turbellaria						
Planariidae				X		
Oligochaeta						
Naididae						
<u>Dero digitata</u> (Muller)	X	X	X		X	X
<u>Habonnais waldvogeli</u> Bretscher	X	X	X			
<u>Stylaria lacustris</u> Leidy					X	
Tubificidae						
<u>Aulodrilus nigueti</u> Kowalewski	X	X				
<u>Branchiura sewerbyi</u> Beddard	X	X	X	X	X	
<u>Ilodrilus templetoni</u> (Southern)	X	X				
<u>Limnodrilus cervix</u> Brinkhurst	X	X	X	X	X	
<u>L. claparedianus</u> Ratzel	X					
<u>L. hoffmeisteri</u> (Claparede)	X	X	X			
<u>L. naumensis</u> Brinkhurst and Cook	X	X	X			
<u>L. udekenianus</u> Claparede	X	X	X			
Hirudinea						
Glossiphoniidae						
<u>Helobdella stagnalis</u> (Linnaeus)				X	X	
Erpobdellidae						
<u>Mooreobdella microstoma</u> (Moore)			X	X		
Decapoda						
Astacidae		X		X	X	X
Palaemonidae						
<u>Palaemonetes kadiakensis</u> Rathbun				X	X	X
Amphipoda						
Talitridae						
<u>Hyalella azteca</u> (Saussure)	X	X	X	X	X	X
Hydracarina		X	X			X
Plecoptera						
Perlidae					X	
<u>Acroneuria</u> sp. Pictet					X	

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Ephemeroptera						
Baetidae						
<u>Baetis</u> sp. Leach		X	X			
<u>Callibaetis</u> sp. Eaton		X		X	X	X
Heptageniidae						
<u>Stenonema integrum</u> McDunnough		X				
<u>S. tripunctatum</u> Banks					X	X
Caenidae						
<u>Caenis</u> sp. Stephens	X	X	X	X	X	X
Ephemeridae						
<u>Hexagenia</u> sp. Walsh	X	X	X		X	
Odonata						
Coenagrionidae						
<u>Argia</u> sp. Rambar				X		
<u>Ischnura</u> sp. Charpentier		X	X	X	X	X
Gomphidae						
<u>Dromogomphus</u> sp. Selys			X		X	
<u>Gomphus</u> sp. Leach			X			
Aeshnidae						
<u>Anax</u> sp. Leach					X	
Libellulidae						
<u>Erythemis</u> sp. Hagen						X
<u>Libellula</u> sp. Linne'						X
<u>Macrothemis</u> sp. Hagen			X			
<u>Perithemis</u> sp. Hagen			X	X		
<u>Plathemis lydia</u> Drury				X		
<u>Sympetrum</u> sp. Newman					X	X
<u>Tramea</u> sp. Hagen						X
Hemiptera						
Corixidae						
<u>Trichocorixa</u> sp. Kirkaldy	X	X	X	X	X	X

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Pleidae						
<u>Plea striola</u> Fieber					X	X
Belostomatidae						
<u>Belostoma</u> sp. Latreille				X		
<u>Lethocerus</u> sp. Mayr				X		
Gerridae						
<u>Gerris</u> sp. Fabricius						X
<u>Rheumatobates</u> sp. Bergroth			X		X	
<u>Irepobates</u> sp. Uhler					X	
Megaloptera						
Sialidae						
<u>Sialis</u> sp. Latreille		X	X		X	X
Trichoptera						
Hydropsychidae						
<u>Hydropsyche orris</u> Ross			X			
Coleoptera						
Haliplidae						
<u>Peltodytes</u> sp. Regimbart			X	X	X	X
Dytiscidae						
<u>Agabus</u> sp. Leach				X		
<u>Hydroporus</u> sp. Clairville					X	X
<u>Hyrotus</u> sp. Stephens			X			
<u>Laccophilus</u> sp. Leach					X	X
Gyrinidae						
<u>Gyrinus</u> sp. (Geoffroy <u>in</u>) Muller					X	
Hydrophilidae						
<u>Berosus</u> sp. Leach				X		
<u>Enochrus</u> sp. Thomson			X			X
<u>Hydrochus</u> sp. Leach				X		X
<u>Tropisternus</u> sp. Solier			X	X	X	X

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Elmidae						
<u>Dubiraphia</u> sp. Sanderson		X	X	X	X	X
Diptera						
Tipulidae					X	
Psychodidae					X	
Culicidae			X			
<u>Anopheles</u> sp. Meigen					X	X
Chaoboridae						
<u>Chaoborus punctipennis</u> (Say)	X	X	X	X	X	X
Chironomidae						
<u>Ablabesmyia</u> sp. Johannsen			X			
<u>Chironomus</u> sp. (Meigen)		X	X		X	
<u>Cladotanytarsus</u> sp. Kieffer		X	X			
<u>Clinotanytus</u> sp. Kieffer	X	X	X	X	X	X
<u>Coelotanytus</u> sp. Kieffer	X					
<u>Cricotopus</u> sp. (V. d. Wulp)					X	
<u>Cryptochironomus</u> sp. Kieffer	X	X		X		
<u>Cryptotendipes</u> sp. Lenz	X	X				
<u>Dicrotendipes</u> sp. Kieffer	X	X	X		X	X
<u>Endochironomus</u> sp. Kieffer			X	X		
<u>Glyptotendipes</u> sp. Kieffer	X		X	X		
<u>Labrundinia</u> sp. Fittkau					X	
<u>Larsia</u> sp. Fittkau		X	X	X		X
<u>Micropsectra</u> sp. Kieffer		X			X	
<u>Phaenopsectra</u> sp. Kieffer		X				
<u>Polypedilum</u> sp. (Convictum Group)	X		X			
<u>Polypedilum</u> sp. Kieffer		X	X	X	X	X

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location ET	Location EZ	Location D	Location ET	Location EZ
<u>Procladius</u> sp. Skuse	X	X	X		X	X
<u>Rheotanytarsus</u> sp. (Bause)			X			
<u>Stictochironomus</u> sp. Kieffer		X				
<u>Tanytus</u> sp. Meigen	X	X	X	X		
<u>T. carinatus</u> Sublette			X			
<u>T. grodhouzi</u> Sublette			X			
<u>T. neofunctipennis</u> Sublette		X	X			
<u>T. stellatus</u> Coquillet	X	X	X			
<u>Tanytarsus</u> sp. Van der Wulp	X	X	X		X	X
<u>Zavrelia</u> sp. Kieffer					X	
Ceratopogonidae	X	X	X	X	X	X
Empididae			X		X	
Tabanidae				X		
Gastropoda						
Physidae						
<u>Physa</u> sp. Draparnaud	X	X	X	X	X	X
Pelecypoda						
Sphaeriidae						
<u>Sphaerium transversum</u> (Say)	X	X		X	X	X
<u>Pisidium</u> sp. Peiffer		X			X	
Unionidae						
<u>Anodonta imbecilis</u> Say					X	
<u>Ligumia subrostrata</u> (Say)					X	
TOTAL NUMBER OF TAXA	29	42	50	35	49	35

Table 3. Summary of macroinvertebrate data from drift samples collected in the Missouri River near the Callaway Nuclear Plant, June 1980 through May 1981. Densities are the means of three samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Location			
	B1	B2	B3	C2
<u>June 1980</u>				
Density (no/100 m ³)	62	37	33	73
Ephemeroptera (%)	3	18	15	8
Trichoptera (%)	46	53	65	65
Chironomidae (%)	43	21	17	18
Other Drift (%)	8	8	3	9
Number of Taxa	19	19	14	22
Diversity ^a	0.78	0.84	0.70	0.80
Evenness ^b	0.76	0.83	0.78	0.73
Redundancy ^c	0.38	0.33	0.39	0.43
<u>July 1980</u>				
Density (no/100 m ³)	89	58	ND ^d	43
Ephemeroptera (%)	38	39		37
Trichoptera (%)	46	41		43
Chironomidae (%)	11	18		14
Other Drift (%)	5	2		6
Number of Taxa	23	19		14
Diversity	0.88	0.79		0.79
Evenness	0.76	0.79		0.82
Redundancy	0.35	0.32		0.30

Table 3.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Location			
	B1	B2	B3	C2
<u>August 1980</u>				
Density (no/100m ³)	68	37	39	58
Ephemeroptera (%)	25	35	45	31
Trichoptera (%)	42	26	21	28
Chironomidae (%)	29	33	23	35
Other Drift (%)	4	6	11	6
Number of Taxa	24	24	20	25
Diversity	0.95	0.98	0.95	1.07
Evenness	0.80	0.86	0.85	0.86
Redundancy	0.34	0.37	0.37	0.27

a Diversity (Shannon - Log Base 2) (Zar 1974)

b Evenness (Pielow 1966)

c Redundancy (Zar 1974)

d ND - No Data

Table 4. Summary of macroinvertebrate data from Ponar grab samples collected in the Missouri River near the Callaway Nuclear Plant, June 1980 through May 1981. Densities are the means of three samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Location			
	A2	B2	H2	C2
<u>June 1980</u>				
Density (no/m ²)	70	134	498	274
Tubificidae (%)	18	0	0	95
Chironomidae (%)	82	24	4	2
Ephemeroptera (%)	0	0	0	0
Other Benthos (%)	0	76	96	2
Biomass (mg/m ²)	51	15	5	225
Number of Taxa	5	5	3	5
Diversity ^a	0.10	0.14	0.09	0.20
Evenness ^b	0.21	0.22	0.21	0.56
Redundancy ^c	0.13	0.11	0.46	0.47
Depth (m)	3.0	7.5	9.5	ND ^d
Substrate	Medium & Gravel, Fine Sand		Gravel, Medium & Fine Sand	Silt, Detritus
<u>July 1980</u>				
Density (no/m ²)	102	13	38	115
Tubificidae (%)	44	0	50	83
Chironomidae (%)	0	0	17	0
Ephemeroptera (%)	50	100	0	11
Other Benthos (%)	6	0	33	6
Biomass (mg/m ²)	305	13	29	42
Number of Taxa	7	1	5	3
Diversity	0.39	0.00	0.10	0.16
Evenness	0.62	0.00	0.32	0.43
Redundancy	0.05	0.00	0.01	0.25
Depth (m)	3.0	3.0	3.0	3.0
Susbtrate	Medium & Fine Sand	Medium & Fine Sand	Medium & Fine Sand	Fine Sands, Silt

Table 4.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Location			
	A2	B2	H2	C2
<u>August 1980</u>				
Density (no/m ²)	664	19	13	19
Tubificidae (%)	63	33	0	0
Chironomidae (%)	9	67	50	100
Ephemeroptera (%)	19	0	0	0
Other Benthos (%)	9	0	50	0
Biomass (mg/m ²)	2,348	15	6	25
Number of Taxa	14	3	2	3
Diversity	0.69	0.10	0.00	0.10
Evenness	0.86	0.33	0.00	0.33
Redundancy	0.15	0.00	0.00	0.00
Depth (m)	5.0	5.0	5.5	3.5
Substrate	Muck, Fine Sand, Coarse Sand & Silt	Fine Sand, Medium Sand Gravel	Fine Sand, Medium Sand	Fine Sand,

a Diversity (Shannon-Log Base 2) (Zar 1974)

b Evenness (Pielow 1966)

c Redundancy (Zar 1974)

d ND - No Data

Table 5. Summary of macroinvertebrate data from Ponar grab samples collected in Logan Creek and Mud Creek near the Callaway Nuclear Power Plant, June 1980 through May 1981. Densities are the means of three samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Logan Creek		Mud Creek
	Location D	Location E1	Location E2
<u>June 1980</u>			
Density (no/m ²)	1,837	10,872	1,863
Naididae (%)	0	1	1
Tubificidae (%)	78	43	24
Chironomidae (%)	2	53	72
Other Benthos (%)	20	3	3
Biomass (mg/m ²)	7,273	66,358	7,320
Number of Taxa	17	35	20
Diversity ^a	0.64	0.91	0.57
Evenness ^b	0.63	0.68	0.56
Redundancy ^c	0.38	0.32	0.45
Depth (m)	0.5	0.5	0.5
Substrate	Silt & Detritus	Silt, Sand Gravel & Detritus	Silt, Sand Gravel & Detritus
<u>July 1980</u>			
Density (no/m ²)	3,547	4,204	4,083
Naididae (%)	11	7	1
Tubificidae (%)	57	52	22
Chironomidae (%)	19	27	14
Other Benthos (%)	13	14	63
Biomass (mg/m ²)	9,895	9,723	4,211
Number of Taxa	23	32	30
Diversity	0.75	0.91	0.62
Evenness	0.64	0.72	0.50
Redundancy	0.37	0.28	0.50
Depth (m)	0.3	0.3	0.3
Substrate	Silt & Detritus	Sand & Muck	Rock, Muck & Detritus

Table 5.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Sampling Date	Logan Creek		Mud Creek
	Location D	Location E1	Location E2
<u>August 1980</u>			
Density (no/m ²)	2,520	6,399	2,858
Naididae (%)	6	18	11
Tubificidae (%)	43	32	30
Chironomidae (%)	42	22	45
Other Benthos (%)	9	26	14
Biomass (mg/m ²)	15,032	7,044	5,780
Number of Taxa	23	26	36
Diversity	0.84	0.84	0.94
Evenness	0.71	0.70	0.73
Redundancy	0.29	0.30	0.27
Depth (m)	0.5	0.5	0.5
Substrate	Muck	Silt, Sand Gravel & Detritus	Silt & Fine Sand

a Diversity (Shannon-Log Base 2) (Zar 1974)

b Evenness (Pielow 1966)

c Redundancy (Zar 1974)

Table 6. Ranked mean percent occurrence and mean abundance of predominant drifting macroinvertebrate taxa collected from metered net samples at four locations in the Missouri River near the Callaway Nuclear Plant, June through August 1980. Densities for each location are the means of 9 samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Percent	Mean no/100m ³
Location B-1		
<u>Hydropsyche orris</u>	25.5	18.6
<u>Hydropsyche simulans</u>	13.9	10.1
Chironomidae pupae	12.6	9.2
<u>Caenis sp.</u>	11.1	8.1
<u>Stenonema integrum</u>	5.6	4.1
<u>Chernovskiia orbicus</u>	5.4	3.9
<u>Baetis sp.</u>	4.7	3.4
<u>Polypedilum sp.</u>	4.2	3.1
<u>Potamyia flava</u>	3.7	2.7
<u>Isonychia sp.</u>	<1.0	0.1
Total Trichoptera	44.9	32.7
Total Chironomidae	25.4	18.5
Total Ephemeroptera	24.2	17.6
Total Drift		72.8
Location B-2		
<u>Hydropsyche orris</u>	23.2	10.2
<u>Caenis sp.</u>	13.2	5.8
<u>Hydropsyche simulans</u>	13.0	5.7
Chironomidae pupae	10.2	4.5
<u>Stenonema integrum</u>	8.4	3.7
<u>Polypedilum sp.</u>	6.2	2.7
<u>Baetis sp.</u>	4.6	2.0
<u>Chernovskiia orbicus</u>	3.6	1.6
<u>Potamyia flava</u>	2.7	1.2
<u>Isonychia sp.</u>	2.3	1.0
Total Trichoptera	39.6	17.4
Total Ephemeroptera	31.9	14.0
Total Chironomidae	22.8	10.0
Total Drift		43.9

Table 6.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Percent	Mean no/100m ³
Location B-3 ^a		
<u>Hydropsyche simulans</u>	21.1	7.6
<u>Hydropsyche orris</u>	18.0	6.5
<u>Stenonema integrum</u>	17.2	6.2
<u>Baetis</u> sp.	6.1	2.2
<u>Chernovskii orbicus</u>	5.0	1.8
Chironomidae pupae	4.4	1.6
<u>Polypedilum</u> sp.	4.2	1.5
<u>Caenis</u> sp.	3.3	1.2
<u>Potamyia flava</u>	1.7	0.6
<u>Isonychia</u> sp.	1.7	0.6
Total Trichoptera	41.4	14.9
Total Ephemeroptera	31.7	11.2
Total Chironomidae	20.0	7.2
Total Drift		36.0
Location C-2		
<u>Hydropsyche simulans</u>	25.5	14.8
<u>Hydropsyche orris</u>	17.6	10.2
Chironomidae pupae	14.5	8.4
<u>Caenis</u> sp.	9.5	5.5
<u>Chernovskii orbicus</u>	6.0	3.5
<u>Stenonema integrum</u>	5.5	3.2
<u>Baetis</u> sp.	4.5	2.6
<u>Polypedilum</u> sp.	4.3	2.5
<u>Potamyia flava</u>	3.1	1.8
<u>Isonychia</u> sp.	1.0	0.6
Total Trichoptera	47.4	27.5
Total Ephemeroptera	22.9	13.3
Total Chironomidae	22.8	13.2
Total Drift		58.0

a values for this location represent the mean of 6 samples

Table 7. Ranked mean percent occurrence and mean abundance of predominant benthic macroinvertebrate taxa collected from Ponar samples at four locations in the Missouri River near the Callaway Nuclear Plant June through August 1980. Densities for each location are the means of 9 samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Percent	Mean no/m ²
Location A-2		
Unidentified immature Tubificidae without capilliform chaetae	34	95
<u>Hexaenia</u> sp.	17	47
<u>Paratenipes</u> sp.	14	38
<u>Limnodrilus cervix</u>	14	38
<u>Pentagenia vittigera</u>	4	11
<u>Limnodrilus udekemianus</u>	3	8
<u>Gomphus</u> sp.	2	6
<u>Cryptochironomus</u> sp.	2	6
<u>Chernovskia orbicus</u>	1	2
		°
Total Benthos		279
Location B-2		
Unknown Annelida	62	34
<u>Chernovskia orbicus</u>	11	6
<u>Caenis</u> sp.	7	4
Unidentified immature Tubificidae without capilliform chaetae	4	2
Total Benthos		55

Table 7.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Percent	Mean no/m ²
Location C-2		
Unidentified immature Tubificidae without capilliform chaetae	82	111
<u>Limnodrilus cervix</u>	3	4
<u>L. claparedianus</u>	3	4
<u>Cryptochironomus</u> sp	3	4
<u>Caenis</u> sp.	2	2
<u>Pentagenia vittigera</u>	2	2
<u>Hydropsyche orris</u>	2	2
<u>Paratendipes</u> sp.	2	2
<u>Paracladopelma</u> sp.	2	2
Total Benthos		136
Location H-2		
Unknown Annelida	87	160
<u>Chernovskiiia orbicus</u>	2	4
Unidentified immature Tubificidae without capilliform chaetae	3	6
Total Benthos		183

Table 8. Ranked mean percent occurrence and mean abundance of predominant benthic macroinvertebrate taxa collected from Ponar samples at three locations in Mud Creek and Logan Creek near the Callaway Nuclear Plant, June through August 1980. Densities for each location are the means of 9 samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Percent	Mean no/m ²
Location D		
Unidentified immature Tubificidae without capilliform chaetae	42	1,110
<u>Tanypus</u> spp.	17	455
<u>Chaoborus punctipennis</u>	9	230
<u>Limnodrilus cervix</u>	8	200
<u>Branchiura sowerbyi</u>	7	194
<u>Dero digitata</u>	7	179
Total Benthos		2,635
Location E?		
Unidentified immature Tubificidae without capilliform chaetae	19	1,389
<u>Chironomus</u> sp.	13	963
<u>Branchiura sowerbyi</u>	12	844
<u>Chaoborus punctipennis</u>	9	634
<u>Dero digitata</u>	7	523
<u>Tanypus</u> spp.	6	447
<u>Procladius</u> sp.	5	381
<u>Limnodrilus cervix</u>	4	306
<u>Stictochironomus</u> sp.	4	301
<u>Limnodrilus maumeensis</u>	4	296
<u>Dicrotendipes</u> sp.	3	185
Total Benthos		7,158

Table 8.
Continued REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	Percent	Mean no/m ²
Location E2		
Ceratopogonidae	27	789
Unidentified immature Tubificidae without capilliform chaetae	19	572
<u>Chironomus</u> sp.	12	355
<u>Tanytarsus</u> sp.	9	271
<u>Larsia</u> sp.	5	136
<u>Dero digitata</u>	4	121
Total Benthos		2,935

Table 9. Mean density (no/100m³) of predominant drifting macroinvertebrate taxa collected from metered net samples at four locations in the Missouri River near the Callaway Nuclear Plant, June 1980 through May 1981. Densities for each month are the means of 12 samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	1980		
	June	July ^d	August
<u>Isonychia</u> sp.	1.5	0.1	0.1
<u>Baetis</u> sp.	0.0	0.2	7.0
<u>Stenonema integrum</u>	0.6	5.1	6.8
<u>Caenis</u> sp.	0.9	16.4	2.0
Total Ephemeroptera	5.0	24.0	16.2
<u>Hydropsyche orris</u>	7.7	19.1	10.4
<u>Hydropsyche simulans</u>	20.2	6.3	1.9
<u>Potamyia flava</u>	0.6	1.5	2.8
Total Trichoptera	29.3	27.7	15.6
<u>Polypedilum</u> sp. ^b	1.0	2.3	4.3
<u>Chernovskiiia orbicus</u> ^b	0.3	0.3	7.2
<u>Chironomidae pupae</u>	9.2	4.7	4.6
Total Chironomidae	13.3	8.6	15.2
TOTAL DRIFT	51.4	63.2	50.3

a July values represent the mean of 9 samples.

b Values do not include pupae of this taxon in June and July.

Table 10. Mean density (No/m²) of predominant benthic macroinvertebrate taxa collected from Ponar grabs at four locations in the Missouri River near the Callaway Nuclear Plant, June 1980 through May 1981. Densities for each month are the means of 12 samples.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Taxa	1980		
	June	July	August
Unknown Annelida	145	0	0
Unidentified immature Tubificidae without capilliform chaetae	62	35	64
<u>Limnodrilus cervix</u>	3	3	26
<u>Limnodrilus claparedianus</u>	3	0	0
<u>Limnodrilus udekemianus</u>	0	2	5
<u>Hexagenia sp.</u>	0	3	32
<u>Pentagenia vittigera</u>	0	10	0
<u>Caenis sp.</u>	0	5	0
<u>Gomphus sp.</u>	0	2	3
<u>Chernovskii orbicus</u>	5	2	3
<u>Cryptochironomus sp.</u>	2	0	6
<u>Paracladopelma sp.</u>	0	0	2
<u>Paratendipes sp.</u>	11	0	2
Total Oligochaeta ^a	68	40	107
Total Ephemeroptera	0	19	32
Total Chironomidae	29	2	24
Total Benthos	244	67	179

a Unknown Annelida excluded

Table 1. Vascular hydrophytes and lowland plants collected from Logan Creek on August 14, 1980. See Figure for the location of the collection stations.

REF. PREOPERATIONAL MONITORING PROGRAM JUNE-AUGUST 1980

Scientific Name	Common Name	Location ^a	Stations of Occurrence	Abundance	Habitat Description
<u>Lemna minor</u>	Duckweed	1,2	1a-C, 2a-c	Common (1a-c) Rare (2a-c)	Downstream - floating or stranded plants on mud bottom Midstream - floating plants found mostly along stream banks
<u>Cyperus esculentus</u>	Nut sedge	1	1a-c	Abundant (1a) Common (1b-c)	Downstream - plants growing on exposed mud creek bottom
<u>Populus deltoides</u>	Marsh cottonwood	1	1a-c	Abundant (1a) Common (1b-c)	Downstream - seedlings growing on exposed mud creek bottom
<u>Bidens</u> sp.	Beggar tick	1	1a-c	Common (1a-c)	Downstream - plants growing on exposed mud creek bottom and banks
<u>Sagittaria latifolia</u> v. <u>obtusata</u>	Arrowhead	1	1b	Rare (1b)	Downstream - one plant encountered on exposed mud creek bottom
<u>Ammannia coccinea</u>	Tooth-cup	1	1b-c	Rare (1b-c)	Downstream - plants growing on exposed mud creek bottom and banks
<u>Cyperus</u> sp.	Sedge	1	1b-c	Rare (1b-c)	Downstream - plants growing on exposed mud creek bottom and banks
<u>Commelina communis</u>	Day flower	2	2a-e	Common (2a-3)	Midstream - plants growing on creek banks
<u>Polygonum persicaria</u>	Smartweed	2	2a-e	Common (2a-e)	Midstream - plants growing on creek banks
<u>Penthorum sedoides</u>	Ditch stonecrop	2	2a-e	Common (2a-e)	Midstream - plants growing on creek banks

Table 1 . Benthic and drifting macroinvertebrates collected in the Missouri River near the Callaway Nuclear Power Plant, June 1980 through May 1981.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Benthic	Drifting
Hydrada		
Hydridae		
<u>Hydra</u> sp. Linnaeus		X
Clavidae		
<u>Codylophora lacustris</u> Allman		X
Turbellaria	X	
Planariidae	X	
Ectoprocta		X
Entoprocta		
Urnatellidae		
<u>Urnatella gracilis</u> Leidy		X
Oligochaeta		
Enchytraeidae		X
Naididae		
<u>Allonais inaequalis</u> (Stephenson)		X
<u>A. paraguayensis</u> (Michaelson)	X	X
<u>Aulophorus furcatus</u> (Muller)		X
<u>Dero digitata</u> (Muller)	X	X
<u>Nais</u> sp. (Muller)		X
<u>Ophidonais serpentina</u> (Muller)		X
Tubificidae		
<u>Branchiura sowerbyi</u> Beddard	X	X
<u>Limnodrilus cervix</u> Brinkhurst	X	
<u>L. claparedianus</u> Ratzel	X	
<u>L. hoffmeisteri</u> (Claparede)	X	
<u>L. maumeensis</u> Brinkhurst & Cook	X	
<u>L. udekemianus</u> Claparede	X	
Hirudinea		
Erpobdellidae		
<u>Mooreobdella microstoma</u> (Moore)		X
Plecoptera		
Perlidae		
<u>Neoperla</u> sp. Needham		X
<u>Perlesta placida</u> (Hagen)		X
Ephemeroptera		
Siphonuridae		
<u>Isonychia</u> sp. Eaton		X
Baetidae		
<u>Baetis</u> sp. Leach		X
Heptageniidae		
<u>Aneoporus</u> sp. McDunnough		X
<u>Heptagenia</u> sp. Walsh		X
<u>Stenonema integrum</u> McDunnough	X	X

Table 1.
Continued REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Benthic	Drifting
Caenidae		
<u>Brachycercus</u> sp. Curtis	x	
<u>Caenis</u> sp. Stephens	x	x
Tricorythidae		
<u>Tricorythodes</u> sp. Ulmer		x
Epheridae		
<u>Hexagenia</u> sp. Walsh	x	x
<u>Pentagenia vittigera</u> (Walsh)	x	x
Odonata		
Coenagrionidae		x
<u>Argia</u> sp. Rambur		x
<u>Ischnura</u> sp. Charpentier		x
Gomphidae		
<u>Dromogomphus</u> sp. Selys	x	x
<u>Gomphus</u> sp. Leach	x	x
Plecoptera		
Perlodidae		
<u>Isoperla</u> sp. Banks	x	x
Hemiptera		
Corixidae		x
Pleidae		
<u>Plea striola</u> Fieber		x
Notonectidae		
<u>Buenoa</u> sp. Kirkaldy		x
Megaloptera		
Sialidae		
<u>Sialis</u> sp. Latreille		x
Trichoptera		
Polycentropodidae		
<u>Neureclipsis</u> sp. McLachlan	x	x
Hydropsychidae		
<u>Cheumatopsyche</u> sp. Wallengren		x
<u>Hydropsyche orris</u> Ross	x	x
<u>H. simulans</u> Ross	x	x
<u>H. venularis</u> Banks		x
<u>Potamyia flava</u> (Hagen)	x	x
Leptoceridae		
<u>Trianodes</u> sp. McLachlan		x
Coleoptera		
Dytiscidae		
<u>Hydroporus</u> sp. Clairville		x
<u>Laccophilus</u> sp. Leach		x
Elmidae		
<u>Dubiraphia</u> sp. Sanderson		x
<u>Macronychus glabratus</u> Say		x
<u>Stenelmis</u> sp. Dufour		x

Table 1.
Continued REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Benthic	Drifting
Diptera		
Tipulidae		x
Chaoboridae		
<u>Chaoborus punctipennis</u> (Say)	x	x
Chironomidae		
<u>Ablabesmyia ornata</u> Saether		x
<u>Chernovskiiia orbicus</u> Townes	x	x
<u>Chironomus</u> sp. (Meigen)	x	x
<u>Coelotanypus</u> sp. Kieffer		x
<u>Corynoneura</u> sp. Winnertz	x	
<u>Cryptochironomus</u> sp. Kieffer	x	x
<u>Dicrotendipes</u> sp. Kieffer		x
<u>Eukiefferiella</u> sp. Thienemann	x	
<u>Larsia</u> sp. Fittkau	x	
<u>Nanocladius</u> sp. Kieffer	x	x
<u>N. anderseni</u> Saether	x	x
<u>Orthocladius</u> sp. (Van der wulp)		x
<u>Parachironomus</u> sp. Lenz		x
<u>Paracladopelma</u> sp. Harnish	x	x
<u>Parametriocnemus</u> sp. Goetghebuer		x
<u>Paratendipes</u> sp. Kieffer	x	x
<u>Polypedilum</u> sp. (Convictum Group)	x	x
<u>Polypedilum</u> sp. (Scalaenum Group)	x	x
<u>Polypedilum</u> sp. (Simulans Group)	x	
<u>Procladius</u> sp. Skuse		x
<u>Rheotanytarsus</u> sp. (Bause)		x
<u>Robackia claviger</u> Townes	x	x
<u>Robackia demeigerei</u> Kruseman		x
<u>Stictochironomus</u> sp. (Kieffer)	x	
<u>Tanypus stellatus</u> Coquillet		x
<u>Tanytarsus</u> sp. Van der wulp	x	x
Thienemannimyia Group		x
Ceratopogonidae		x
Empididae		x
Psychodidae		
<u>Pericoma</u> sp. Walker		x
<u>Psychoda</u> sp. Latreille		
Simuliidae		x
Stratiomyiidae		x
Tabanidae		x
Pelecypoda		
Sphaeriidae		
<u>Sphaerium transversum</u> Say	x	x
Unionidae		
<u>Leptodea</u> sp. Rafinesque	x	
TOTAL NUMBER OF TAXA	41	77

Table 2. Macroinvertebrates collected in Logan Creek and Mud Creek near the Callaway Nuclear Plant, June 1980 through May 1981.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Turbellaria						
Planariidae	x			x		
Oligochaeta						
Enchytraeidae		x	x			
Naididae						
Chaetogaster diaphanus (Gruithuisen)				x		
Dero digitata (Muller)	x	x	x		x	x
Haemonais waldvogeli Bretscher	x	x	x			
Nais sp. Muller					x	
Stylaria lacustris Leidy					x	
Tubificidae						
Aulodrilus piqueti Kowalewski	x	x			x	
Branchiura somerbyi Beddard	x	x	x	x	x	x
Ilyodrilus templetoni (Southern)	x	x				
Limnodrilus cervix Brinkhurst	x	x	x	x	x	
L. claparedianus Ratzel	x					
L. hoffmeisteri (Claparede)	x	x	x			
L. maumeensis Brinkhurst & Cook	x	x	x			
L. udekemianus Claparede	x	x	x			
Hirudinea						
Glossiphoniidae						
Helobdella stagnalis (Linnaeus)				x	x	
Erpobdellidae						
Mooreobdella microstoma (Moore)			x	x		
Decapoda						
Astacidae		x		x	x	x
Palaemonidae						
Palaemonetes kadiakensis Rathbun				x	x	x

Table 2. REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980
Continued

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Isopoda						
Asellidae						
<u>Lirceus</u> sp. Rafinesque						x
Amphipoda						
Talitridae						
<u>Hyalella azteca</u> (Saussure)	x	x	x	x	x	x
Hydracarina		x	x			x
Plecoptera						
Perlidae						
<u>Acroneuria</u> sp. P tet					x	
Ephemeroptera						
Baetidae						
<u>Baetis</u> sp. Leach		x	x	x		
<u>Callibaetis</u> sp. Eaton		x		x	x	x
Heptageniidae						
<u>Stenonema integrum</u> McDunnough						
<u>S. tripunctatum</u> Banks					x	x
Caenidae						
<u>Caenis</u> sp. Stephens	x	x	x	x	x	x
Ephermeridae						
<u>Hexagenia</u> sp. Waiusu	x	x	x		x	
Odonata						
Coenagrionidae						
<u>Argia</u> sp. Rambar	x	x			x	
<u>Ischnura</u> sp. Charpentier		x	x	x	x	x
Gomphidae						
<u>Dromogomphus</u> sp. Selys			x		x	
<u>Gomphus</u> sp. Leach			x			

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Aeshnidae						
<u>Anax</u> sp. Leach					x	
<u>Basiaeschna</u> sp. Selys					x	
Libellulidae						
<u>Erythemis</u> sp. Hagen						x
<u>Libellula</u> sp. Linne						x
<u>Macrothemis</u> sp. Hagen			x			
<u>Pachydiplax longipennis</u> (Burmeister)						x
<u>Perithemis</u> sp. Hagen			x	x		
<u>Plathemis lydia</u> Drury				x		
<u>Sympetrum</u> sp. Newman					x	
<u>Tetragoneuria</u> sp. Hagen		x	x			x
<u>Tramea</u> sp. Hagen						x
Macromiidae						
<u>Didymops</u> sp. Rambur			x			
He.:iptera						
Corixidae						
<u>Trichocorixa</u> sp. Kirkaldy	x	x	x	x	x	x
Pleidae						
<u>Plea striola</u> Fieber				x	x	x
Belostomatidae						
<u>Belostoma</u> sp. Latreille				x		
<u>Lethocerus</u> sp. Mayr				x		
Gerridae						
<u>Gerris</u> sp. Fabricius						x
<u>Rheumatobates</u> sp. Bergroth			x		x	
<u>Trepobates</u> sp. Uhler					x	
Veliidae						
<u>Microvelia</u> sp. Westwood				x		

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Megaloptera						
Sialidae						
<u>Sialis</u> sp. Latreille		x	x		x	x
Trichoptera						
Hydropsychidae						
<u>Hydropsyche orris</u> Ross			x			
Leptoceridae						
<u>Oecetis</u> sp. McLachlan	x					
Lepidoptera						
Pyralidae						
<u>Parargyractis</u> sp. Lange				x	x	
Coleoptera						
Haliplidae						
<u>Peltodytes</u> sp. Regimbart		x	x	x	x	x
Dytiscidae						
<u>Agabus</u> sp. Leach				x		
<u>Hydroporus</u> sp. Clairville					x	x
<u>Hygrotus</u> sp. Stephens			x			
<u>Laccophilus</u> sp. Leach					x	x
Gyrinidae						
<u>Gyrinus</u> sp. (Geoffrey in) Muller					x	
Hydrophilidae						
<u>Berosus</u> sp. Leach				x		
<u>Enochrus</u> sp. Thomson			x			x
<u>Hydrochus</u> sp. Leach				x		x
<u>Tropisternus</u> sp. Solier			x	x	x	x
<u>Hydrobaenus</u> sp. Fries						x

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Elmidae						
<u>Dubiraphia</u> sp. Sanderson	x	x	x	x	x	x
Diptera						
Tipulidae					x	
Psychodidae					x	
Culicidae	x		x			
<u>Anopheles</u> sp. Meigen					x	x
Chaoboridae						
<u>Chaoborus punctipennis</u> (Say)	x	x	x	x	x	x
Chironomidae						
<u>Ablabesmyia</u> sp. Johannsen			x			
<u>Chironomus</u> sp. (Meigen)	x	x	x		x	
<u>Cladotanytarsus</u> sp. (Kieffer)		x	x			
<u>Clinotanypus</u> sp. Kieffer	x	x	x	x	x	x
<u>Coelotanypus</u> sp. Kieffer	x					
<u>Cricotopus</u> sp. (Van der wulp)					x	
<u>Cryptochironomus</u> sp. Kieffer	x	x	x	x		
<u>Cryptotendipes</u> sp. Lenz	x	x				
<u>Dicrotendipes</u> sp. Kieffer	x	x	x	x	x	x
<u>Endochironomus</u> sp. Kieffer			x	x		
<u>Glyptotendipes</u> sp. Kieffer	x		x	x		
<u>Labrundinia</u> sp. Fittkau					x	
<u>Larsia</u> sp. Fittkau		x	x	x		x
<u>Micropsectra</u> sp. Kieffer		x			x	
<u>Orthocladius</u> sp. (Van der wulp)					x	
<u>Parachironomus</u> sp. Lenz				x		
<u>Parametrioctenus</u> sp. Goetghebuer		x				

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
<i>Phaenopsectra</i> sp. Kieffer		x				
<i>Polypedilum</i> sp. (Convictum Group)	x		x		x	
<i>Polypedilum</i> sp. (Fallax Group)				x		
<i>Polypedilum</i> sp. (Simulans Group)		x	x	x	x	x
<i>Polypedilum</i> sp. Kieffer	x	x	x			
<i>Procladius</i> sp. Skuse	x	x	x		x	x
<i>Rheotanytarsus</i> sp. (Bause)			x			
<i>Smittia</i> sp. (Holmgr.)		x				
<i>Stictochironomus</i> sp. Kieffer		x				
<i>Tanypus</i> sp. Meigen	x	x	x	x	x	
<i>T. carinatus</i> Sublette		x	x			
<i>T. grodhousi</i> Sublette			x			
<i>T. neopunctipennis</i> Sublette		x	x			x
<i>T. stellatus</i> Coquillet	x	x	x			
<i>Tanytarsus</i> sp. Van der wulp	x	x	x		x	x
<i>Zavrelia</i> sp. Kieffer					x	
Ceratopogonidae	x	x	x	x	x	x
Empididae			x		x	
Stratiomyiidae				x		
Tabanidae		x	x	x		
<i>Tabanus</i> sp. Linnaeus				x		
Gastropoda						
Physidae						
<i>Physa</i> sp. Draparnaud	x	x	x	x	x	x
Pelecypoda						
Sphaeriidae						
<i>Sphaerium transversum</i> (Say)	x	x		x	x	x
<i>Pisidium</i> sp. (Peiffer)		x			x	

Table 2.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Ponar			Qualitative		
	Logan Creek		Mud Creek	Logan Creek		Mud Creek
	Location D	Location E1	Location E2	Location D	Location E1	Location E2
Unic. idae	x	x	x			
<i>Aradonta imbecilis</i> Say		x			x	
<i>Ligumia subrostrata</i> (Say)					x	
TOTAL NUMBER OF TAXA	37	53	57	45	57	40

Table 3. Summary of macroinvertebrate data from drift samples collected in the Missouri River near the Callaway Nuclear Plant, September through November 1980. Densities are the means of three samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Location			
	B1	B2	B3	C2
<u>September 1980</u>				
Density (no/100 m ³)	157	67	45	67
Ephemeroptera (%)	15	25	30	16
Trichoptera (%)	33	23	33	48
Chaoboridae (%)	9	15	18	12
Chironomidae (%)	42	36	11	23
Other Drift (%)	1	1	8	1
Number of Taxa	25	22	16	14
Diversity ^a	3.51	3.42	3.10	2.82
Evenness ^b	0.90	0.90	0.90	0.88
Redundancy ^c	0.13	0.15	0.19	0.21
<u>October 1980</u>				
Density (no/100 m ³)	116	228	63	197
Ephemeroptera (%)	10	5	10	7
Trichoptera (%)	48	38	38	44
Chironomidae (%)	31	28	39	47
Psychodidae (%)	11	30	11	0
Other Drift (%)	0	0	2	2
Number of Taxa	16	17	23	26
Diversity	2.78	2.94	3.15	2.91
Evenness	0.85	0.84	0.85	0.73
Redundancy	0.20	0.18	0.24	0.33
<u>November 1980</u>				
Density (no/100 m ³)	205	149	82	169
Coelenterata (%)	22	19	10	15
Plecoptera (%)	41	57	62	57
Ephemeroptera (%)	2	1	7	5
Trichoptera (%)	28	13	14	14
Chironomidae (%)	3	5	4	3
Other Drift (%)	4	5	3	6
Number of Taxa	15	12	16	21
Diversity	2.26	2.02	1.97	2.08
Evenness	0.73	0.67	0.60	0.58
Redundancy	0.31	0.39	0.54	0.51

^a Diversity (Shannon - Log Base 2) (Zar 1974).

^b Evenness (Pielow 1966).

^c Redundancy (Zar 1974).

Table 4. Summary of macroinvertebrate data from Ponar grab samples collected in the Missouri River near the Callaway Nuclear Plant, September through November 1980. Densities are the means of three samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Location			
	A2	B2	H2	C2
<u>September 1980</u>				
Density (no/m ²)	376	6	128	32
Tubificidae (%)	98	0	95	80
Chironomidae (%)	0	100	0	0
Ephemeroptera (%)	0	0	5	0
Other Benthos (%)	2	0	0	20
Biomass (mg/m ²)	167	5	46	1,884
Number of Taxa	6	1	3	3
Diversity ^a	0.55	0.00	0.44	0.27
Evenness ^b	0.21	0.00	0.44	0.27
Redundancy ^c	0.12	0.00	0.24	0.07
Depth (m)	3.0	4.0	3.5	2.5
Substrate	Fine Sand, Silt	Fine Sand, Silt	Fine Sand, Silt, Clay, Gravel, Detritus	Fine Sand, Silt
<u>October 1980</u>				
Density (no/m ²)	1,429	19	0	0
Tubificidae (%)	92	0	0	0
Chironomidae (%)	3	100	0	0
Ephemeroptera (%)	3	0	0	0
Other Benthos (%)	2	0	0	0
Biomass (mg/m ²)	6,616	4	0	0
Number of Taxa	13	1	0	0
Diversity	1.69	0.00	0.00	0.00
Evenness	0.55	0.00	0.00	0.00
Redundancy	0.46	0.00	0.00	0.00
Depth (m)	6.0	4.0	4.0	4.0
Substrate	Fine Sand, Silt, Gravel, Detritus	Fine, Coarse Sand, Silt	Fine Sand	Fine Sand, Gravel, Silt, Detritus

Table 4.
Continued REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Location			
	A2	B2	H2	C2
November 1980				
Density (no/m ²)	408	26	402	587
Tubificidae (%)	81	0	38	8
Chironomidae (%)	8	50	44	32
Ephemeroptera (%)	3	25	0	1 ^d
Other Benthos (%)	8	25	18	59 ^d
Biomass (mg/m ²)	987	10	100	602
Number of Taxa	12	3	10	16
Diversity	1.60	0.33	1.45	1.57
Evenness	0.51	0.33	0.74	0.49
Redundancy	0.17	0.00	0.27	0.18
Depth (m)	3.0	4.0	4.0	3.5
Substrate	Muck, Silt, Fine Sand	Fine, Medium, Coarse Sand	Fine, Medium Sand, Silt	Fine, Medium, Coarse Sand, Silt, Muck, Gravel

a Diversity (Shannon-Log Base 2) (Zar 1974).

b Evenness (Pielow 1966).

c Redundancy (Zar 1974).

d Trichoptera = 51%.

Table 5. Summary of macroinvertebrate data from Ponar grab samples collected in Logan Creek and Mud Creek near the Callaway Nuclear Power Plant, September through November 1980. Densities are the means of three samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980.

Sampling Date	Logan Creek		Mud Creek
	Location D	Location E1	Location E2
<u>September 1980</u>			
Density (no/m ²)	1,353	2,897	96
Naididae (%)	4	1	0
Tubificidae (%)	69	82	73
Chironomidae (%)	18	6	13
Other Benthos ₂ (%)	9	11	14
Biomass (mg/m ²)	1,927	174,325	5,408
Number of Taxa	21	23	7
Diversity ^a	2.58	2.22	0.94
Evenness ^b	0.70	0.60	0.50
Redundancy ^c	0.31	0.41	0.17
Depth (m)	1.0	0.5	0.5
Substrate	Muck, Clay	Clay, Rock, Muck Sand, Detritus	Rock, Muck, Detritus
<u>October 1980</u>			
Density (no/m ²)	1,531	2,705	817
Naididae (%)	9	19	5
Tubificidae (%)	67	68	93
Chironomidae (%)	17	5	0
Other Benthos (%)	7	8	2
Biomass (mg/m ²)	2,864	28,945	18,694
Number of Taxa	16	18	5
Diversity	2.53	1.94	0.90
Evenness	0.73	0.55	0.47
Redundancy	0.28	0.46	0.55
Depth (m)	0.5	0.5	0.5
Substrate	Muck	Fine Sand, Silt	Muck

Table 5.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Sampling Date	Logan Creek		Mud Creek
	Location D	Location E1	Location E2
November 1980			
Density (no/m ²)	453	887	849
Naididae (%)	3	11	4
Tubificidae (%)	86	58	68
Chironomidae (%)	6	19	23
Other Benthos (%)	5	12	5
Riomass (mg/m ²)	1,356	815	523
Number of Taxa	12	22	10
Diversity	2.04	3.04	2.12
Evenness	0.85	0.81	0.76
Redundancy	0.16	0.19	0.25
Depth (m)	0.5	0.5	0.5
Substrate	Clay, Silt Detritus	Silt, Detritus	Clay, Silt, Detritus

^a Diversity (Shannon-Log Base 2) (Zar 1974).

^b Evenness (Pielow 1966).

^c Redundancy (Zar 1974).

Table 6. Ranked mean percent occurrence and mean abundance of predominant drifting macroinvertebrate taxa collected from metered net samples at four locations in the Missouri River near the Callaway Nuclear Plant, September through November, 1980. Densities for each location are the means of 9 samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Percent	Mean no/100m ³
Location B-1		
<u>Hydropsyche orris</u>	21	34
<u>Isoperla</u>	17	28
<u>Hydra</u>	9	15
<u>Potamyia flava</u>	6	11
<u>Rheotanytarsus pupa</u>	6	10
Total Trichoptera	34	55
Total Chironomidae	22	36
Total Plecoptera	17	28
Total Ephemeroptera	8	13
Total Chaoboridae	5	3
Total Drift		159
Location B-2		
<u>Isoperla</u>	17	28
<u>Hydropsyche orris</u>	15	25
<u>Rheotanytarsus pupae</u>	8	14
<u>Pericoma</u>	8	13
<u>Hydra</u>	6	10
<u>Psychoda</u>	5	9
<u>Potamyia flava</u>	5	7
Total Trichoptera	27	40
Total Chironomidae	21	31
Total Plecoptera	14	28
Total Psychodidae	15	23
Total Ephemeroptera	7	10
Total Drift		148
Location B-3		
<u>Isoperla</u>	27	17
<u>Hydropsyche orris</u>	13	8
<u>Rheotanytarsus pupae</u>	10	6
<u>Stenonema integrum</u>	6	4
<u>Hydra</u>	5	3
<u>Potamyia flava</u>	5	3
Total Trichoptera	27	17
Total Plecoptera	27	17
Total Chironomidae	17	11
Total Ephemeroptera	12	8
Total Chaoboridae	5	3
Total Drift		63

Table 6.
Continued

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Percent	Mean no/100m ³
Location C-2		
<u>Isoperla</u>	22	32
<u>Hydropsyche orris</u>	22	31
<u>Rheotanytarsus pupae</u>	14	22
<u>Hydra</u>	6	9
Total Trichoptera	32	47
Total Chironomidae	26	38
Total Plecoptera	13	19
Total Ephemeroptera	7	11
Total Hydropsychidae	7	10

Table 7. Ranked mean percent occurrence and mean abundance of predominant benthic macroinvertebrate taxa collected from Ponar samples at four locations in the Missouri River near the Callaway Nuclear Plant September through November 1980. Densities for each location are the means of 9 samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Percent	Mean no/m ²
Location A-2		
IWO ^a	63	468
<u>Limnodrilus cervix</u>	11	79
<u>Branchiura sowerbyi</u>	7	53
<u>Limnodrilus hoffmeisteri</u>	6	42
Tubificidae	91	672
Total Benthos		737
Location B-2		
<u>Robackia claviger</u>	49	8
<u>Chernovskii orbicus</u>	24	4
<u>Hydropsyche simulans</u>	12	2
<u>Stenonema integrum</u>	12	2
Chironomidae	74	13
Ephemeroptera	12	2
Trichoptera	12	2
Total Benthos		17
Location H-2		
IWO	47	83
Turbellaria	13	23
<u>Stictochironomus</u>	11	19
<u>Chernovskii orbicus</u>	10	17
<u>Robackia claviger</u>	7	13
Tubificidae	52	91
Turbellaria	13	23
Chironomidae	34	60
Total Benthos		177
Location C-2		
<u>Stictochironomus</u>	21	42
<u>Hydropsyche orris</u>	17	36
<u>Potamyia flava</u>	16	32
Hydropsychidae	14	29
IWO	7	15
<u>Nanocladius anderseni</u>	6	12
Trichoptera	48	100
Chironomidae	30	62
Tubificidae	11	24
Total Benthos		206

^a Unidentifiable immature Tubificidae without capilliform chaetae.

Table 8. Ranked mean percent occurrence and mean abundance of predominant benthic macroinvertebrate taxa collected from Ponar samples at three locations in Mud Creek and Logan Creek near the Callaway Nuclear Plant, September through November 1980. Densities for each location are the mean of 9 samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	Percent	Mean no/m ²
Location D		
Iwo ^a	47	521
<u>Branchiura sowerbyi</u>	10	109
Iw ^b	7	77
<u>Dero digitata</u>	6	70
Tubificidae	70	780
Total Benthos		1,112
Location E1		
Iwo	57	1,236
<u>Dero digitata</u>	10	219
<u>Limnodrilus udekemianus</u>	6	119
<u>Dubiraphia</u>	2	40
Tubificidae	73	1,576
Naididae	8	164
Chironomidae	10	96
Total Benthos		2,163
Location E2		
Iwo	67	395
<u>Limnodrilus cervix</u>	7	43
<u>Tanytus neopunctipennis</u>	5	32
Iw	5	30
Tubificidae	80	470
Chironomidae	12	70
Total Benthos		587

^a Unidentifiable immature Tubificidae without capilliform chaetae.

^b Unidentifiable immature Tubificidae with capilliform chaetae.

Table 9. Mean density (no/100m³) of predominant drifting macroinvertebrate taxa collected from metered net samples at four locations in the Missouri River near the Callaway Nuclear Plant, September 1980 through November 1980. Densities for each month are the means of 12 samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	1980		
	September	October	November
<u>Hydra</u>	0.0	0.6	26.9
Total Coelenterata	0.0	0.6	26.9
<u>Isoperla</u>	0.0	0.0	58.3
Total Plecoptera	0.0	0.0	79.0
<u>Baetis</u>	3.6	5.0	0.4
<u>Caenis</u>	4.7	1.2	0.0
<u>Stenonema integrum</u>	6.4	2.6	3.6
Total Ephemeroptera	16.3	10.7	4.9
<u>Hydropsyche orris</u>	15.8	37.9	20.6
Unidentified Hydropsychidae	1.1	16.0	3.8
<u>Potamyia flava</u>	6.8	7.7	3.4
Total Trichoptera	28.3	62.6	28.3
<u>Pericoma</u>	0.0	10.8	0.0
<u>Psychoda</u>	0.0	11.0	0.0
Total Psychodidae	0.0	21.8	0.0
<u>Chernovskii orbicus</u>	6.6	1.3	0.3
<u>Polypedilum Pupae</u>	4.1	1.9	0.3
<u>Rheotanytarsus Pupae</u>	0.3	36.4	1.5
Total Chironomidae	27.4	54.1	5.1
Total Drift	83.9	150.7	151.1

Table 10. Mean density (No/m²) of predominant benthic macroinvertebrate taxa collected from Ponar grabs at four locations in the Missouri River near the Callaway Nuclear Plant, September 1980 through November 1980. Densities for each month are the means of 12 samples.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxa	1980		
	September	October	November
<u>Branchiura sowerbyi</u>	3.2	36.7	11.2
<u>Limnodrilus cervix</u>	22.3	12.8	27.1
<u>L. hoffmeisteri</u>	1.6	28.7	4.8
<u>L. udekemianus</u>	3.2	3.2	1.6
Iw ^a	0.0	3.2	4.8
Iw ^b	90.9	244.0	89.3
Total Oligochaeta	129.2	328.6	132.4
<u>Hydropsyche orris</u>	0.0	0.0	27.1
<u>Potamyia flava</u>	0.0	0.0	23.9
Total Trichoptera	0.0	1.6	78.2
<u>Stictochironomus</u>	0.0	0.0	46.3
Total Chironomidae	1.6	16.0	102.1
Total Benthos	135.6	362.1	355.7

^a Unidentifiable Tubificidae with capilliform chaetae.

^b Unidentifiable Tubificidae without capilliform chaetae.

APPENDIX E
Vascular Hydrophytes

Table 1. Vascular hydrophytes and lowland plants collected from Logan Creek on August 14, 1980. See Figure for the location of the collection stations.
 Ref. Preoperational monitoring program June through August.

Scientific Name	Common Name	Location ^a	Stations of Occurrence	Abundance	Habitat Description
<u>Lemna minor</u>	Duckweed	1,2	1a-C, 2a-c	Common (1a-c) Rare (2a-c)	Downstream - floating or stranded plants on mud bottom Midstream - floating plants found mostly along stream banks
<u>Cyperus esculentus</u>	Nut sedge	1	1a-c	Abundant (1a) Common (1b-c)	Downstream - plants growing on exposed mud creek bottom
<u>Populus deltoides</u>	Marsh cottonwood	1	1a-c	Abundant (1a) Common (1b-c)	Downstream - seedlings growing on exposed mud creek bottom
<u>Bidens</u> sp.	Beggar tick	1	1a-c	Common (1a-c)	Downstream - plants growing on exposed mud creek bottom and banks
<u>Sagittaria latifolia</u> V. obtusa	Arrowhead	1	1b	Rare (1b)	Downstream - one plant encountered on exposed mud creek bottom
<u>Amannia coccinea</u>	Tooth-cup	1	1b-c	Rare (1b-c)	Downstream - plants growing on exposed mud creek bottom and banks
<u>Cyperus</u> sp.	Sedge	1	1b-c	Rare (1b-c)	Downstream - plants growing on exposed mud creek bottom and banks
<u>Comelina communis</u>	Day flower	2	2a-e	Common (2a-3)	Midstream - plants growing on creek banks
<u>Polygonum persicaria</u>	Smartweed	2	2a-e	Common (2a-e)	Midstream - plants growing on creek banks
<u>Penthorum sedoides</u>	Ditch stonecrop	2	2a-e	Common (2a-e)	Midstream - plants growing on creek banks

Table 1. (continued).

Scientific Name	Common Name	Location ^a	Stations of Occurrence	Abundance	Habitat Description
<u>Potamogeton foliosus</u>	Narrow leaf pondweed	3	3a	Common (3a)	Upstream - submergent plants with some floating leaves growing in two pools on either side of gravel road running through Logan Creek at Station E-1.
<u>Eleocharis obtusa</u>	Spike rush	3	3a	Rare (3a)	Upstream - growing on mud stream bank at water's edge of two pools on either side of gravel road running through Logan Creek at Station E-1.

^a 1 = downstream

2 = midstream

3 = upstream

APPENDIX F

Fish

TABLE 2.3.6-1
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 THERMAL TOLERANCES OF CERTAIN FRESHWATER FISHES
 AS DETERMINED BY LABORATORY EXPERIMENTS^a

	<u>Acclimation Temperature °F</u>	<u>Final Lethal Temperature °F</u>
Shovelnose sturgeon	-	82.4 - 86.0
Paddlefish	-	82.4 - 86.0
Longnose gar	-	96.8 - 100.4 ^b
Shortnose gar	-	96.8 - 100.4 ^b
Gizzard shad	86.0	96.6 ^c
Skipjack herring	-	89.6 - 93.2
Carp	-	96.8 - 100.4
Sicklefin chub	-	86.0 - 89.6 ^b
Stoneroller	-	89.6 - 93.2
River carpsucker	-	86.0 - 89.6
Largemouth buffalo	-	89.6 - 93.2
Smallmouth buffalo	-	89.6 - 93.2
Blue catfish	-	93.2 - 96.8 ^b
Black bullhead	-	93.2 - 96.8
Yellow bullhead	-	93.2 - 96.8
Channel catfish	77.0	93.2 ^d
Flathead catfish	-	93.2 - 96.8
Mosquitofish	95.0	98.6 ^d
White bass	-	86.0 - 89.6
Largemouth bass	86.0	101.5 ^d
Green sunfish	-	93.2 - 96.8
Longear sunfish	-	93.2 - 96.8 ^b
Bluegill	86.0	93.2 ^d
White crappie	-	93.2 - 96.8
Freshwater drum	-	93.2 - 96.8 ^b

^aAll temperatures from Bush et al. (1972), except those otherwise noted.

^bEstimated from data on nearest related species.

^cBattelle's Columbus Laboratories (1971).

^dWurtz and Renn (1965).

TABLE 2.3.6-2
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 SPECIES OF FISH COLLECTED IN THE MISSOURI RIVER AND LOGAN CREEK

FAMILY <u>Species</u>	<u>Common Name</u>	Missouri River			<u>Logan Creek^d</u>
		<u>Pflieger^a</u>	<u>MREI^b</u>	<u>D&M^c</u>	
PETROMYZONTIDAE <u>Ichthyomyzon castaneus</u>	Chestnut lamprey	X	X	X	
ACIPENSERIDAE <u>Scaphirhynchus platyrhynchus</u>	Shovelnose sturgeon	X		X	
POLYDONTIDAE <u>Polyodon spathula</u>	Paddlefish ^e			X	
LEPISOSTHEIDAE <u>Lepisosteus osseus</u>	Longnose gar	X		X	
<u>Lepisosteus platostomus</u>	Shortnose gar	X	X	X	
CLUPEIDAE <u>Dorosoma cepedianum</u>	Gizzard shad	X	X	X	X
<u>Alosa chrysochloris</u>	Skipjack herring			X	
HIODONTIDAE <u>Hiodon alosoides</u>	Goldeye	X	X	X	X
<u>Hiodon tergisus</u>	Mooneye			X	
ESOCIDAE <u>Esox lucius</u>	Northern pike			X	
CYPRINIDAE <u>Cyprinus carpio</u>	Carp	X	X	X	X
<u>Notemigonus crysoleucas</u>	Golden shiner	X			
<u>Semotilus atromaculatus</u>	Creek chub	X			
<u>Hybopsis storeriana</u>	Silver chub	X			
<u>Hybopsis x-punctata</u>	Gravel chub	X			
<u>Hybopsis aestivalis</u>	Speckled chub	X			

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TABLE 2.3.6-2 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

FAMILY <u>Species</u>	<u>Common Name</u>	<u>Missouri River</u>			<u>Logan Creek^d</u>
		<u>Pflieger^a</u>	<u>MREI^b</u>	<u>D&M^c</u>	
CYPRINIDAE (continued)					
<u>Hybopsis gracilis</u>	Flathead chub	X			
<u>Hybopsis meeki</u>	Sicklefin chub	X			
<u>Phenacobius mirabilis</u>	Suckermouth minnow	X			
<u>Notropis atherinoides</u>	Emerald shiner	X	X	X	
<u>Notropis rubellus</u>	Rosyface shiner	X			
<u>Notropis umbratilis</u>	Redfin shiner	X		X	X
<u>Notropis shumardi</u>	Silverband shiner	X			
<u>Notropis zonatus</u>	Bleeding shiner	X			
<u>Notropis boops</u>	Bigeye shiner	X			
<u>Notropis lutrensis</u>	Red shiner	X			X
<u>Notropis stramineus</u>	Sand shiner	X			X
<u>Notropis topeka</u>	Topeka shiner	X			
<u>Notropis heterolepis</u>	Blacknose shiner	X			
<u>Notropis volucellus</u>	Mimic shiner	X	X		
<u>Notropis buchanani</u>	Ghost shiner	X			
<u>Phoxinus erythrogaster</u>	Southern redbelly dace	X			X
<u>Hybognathus argyritis</u>	Western silvery minnow	X			
<u>Hybognathus placitus</u>	Plains minnow	X	X		
<u>Pimephales notatus</u>	Bluntnose minnow	X			X
<u>Campostoma anomalum</u>	Stoneroller	X			X
CATOSTOMIDAE					
<u>Carpiodes carpio</u>	River carpsucker	X	X	X	X
<u>Carpiodes cyprinus</u>	Quillback	X		X	X
<u>Carpiodes velifer</u>	High-finned carpsucker			X	
<u>Catostomus commersoni</u>	White sucker	X		X	
<u>Catostomus catostomus</u>	Longnose sucker			X	
<u>Hypentilium nigricans</u>	Northern hog sucker	X			

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TABLE 2.3.6-2 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

FAMILY Species	Common Name	Missouri River			Logan Creek ^d
		Pflieger ^a	MREI ^b	D&M ^c	
CATOSTOMIDAE (Continued)					
<u>Ictiobus cyprinellus</u>	Largemouth buffalo			X	
<u>Ictiobus bubalus</u>	Smallmouth buffalo			X	
<u>Moxostoma duquesnei</u>	Black redhorse	X			
<u>Moxostoma erythrurum</u>	Golden redhorse	X	X		
<u>Moxostoma macrolepidotum</u>	Northern redhorse	X			
ICTALURIDAE					
<u>Ictalurus furcatus</u>	Blue catfish	X		X	
<u>Ictalurus melas</u>	Black bullhead	X			
<u>Ictalurus natalis</u>	Yellow bullhead	X			X
<u>Ictalurus nebulosus</u>	Brown bullhead				X
<u>Ictalurus punctatus</u>	Channel catfish	X	X	X	
<u>Ptyodictis olivaris</u>	Flathead catfish	X	X	X	
<u>Noturus exilis</u>	Slender madtom	X			
<u>Noturus flavus</u>	Stonecat	X			
CYPRINODONTIDAE					
<u>Fundulus catenatus</u>	Northern studfish	X			
<u>Fundulus olivaceus</u>	Black spotted topminnow	X			
<u>Fundulus notatus</u>	Blackstripe topminnow	X			X
POECILIIDAE					
<u>Gambusia affinis</u>	Mosquitofish	X			X
ATHERINIDAE					
<u>Labidesthes sicculus</u>	Brook silverside	X			X
PERCICHTHYIDAE					
<u>Morone chrysops</u>	White bass	X	X	X	

TABLE 2.3.6-2 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

FAMILY Species	Common Name	Missouri River			Logan Creek ^d
		Pflieger ^a	MREI ^b	D&M ^c	
CENTRARCHIDAE					
<u>Micropterus dolomieu</u>	Smallmouth bass	X	X		
<u>Micropterus salmoides</u>	Largemouth bass	X		X	X
<u>Lepomis cyanellus</u>	Green sunfish	X			X
<u>Lepomis humilus</u>	Orange spotted sunfish	X			
<u>Lepomis megalotis</u>	Longear sunfish	X			X
<u>Lepomis macrochirus</u>	Bluegill	X	X	X	X
<u>Lepomis cyanellus</u> x <u>macrochirus</u>	Hybrid sunfish				X
<u>Pomoxis nigromaculatus</u>	Black crappie	X			
<u>Pomoxis annularis</u>	White crappie	X	X	X	X
PERCIDAE					
<u>Stizosteidon canadense</u>	Sauger	X	X	X	
<u>Percina phoxocephala</u>	Slenderhead darter	X			
<u>Percina caprodes</u>	Logperch	X			X
<u>Etheostoma nigrum</u>	Johnny darter	X			X
<u>Etheostoma spectabile</u>	Orangethroat darter	X			
<u>Etheostoma flabellare</u>	Fantail darter	X			
<u>Etheostoma punctulatum</u>	Stippled darter				X
<u>Etheostoma exile</u>	Iowa darter				X
SCIAENIDAE					
<u>Aplodinotus grunniens</u>	Freshwater drum	X	X	X	X

^a Collected from 14 stations by Pflieger, 1962-63 (University of Missouri, Rolla, 1972)

^b Collected from 1 station at Hermann, Missouri (Missouri River Environmental Inventory, 1972). An unidentified Notropis species was also collected near Hermann, but has not been included in the table.

^c Collected from 5 stations near the site area by Dames & Moore, July, September, and December, 1973.

^d Collected from 2 stations by Dames & Moore, July, September and December, 1973 and February, 1974.

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TABLE 2.3.6-3
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 NUMBERS AND SIZE RANGES (TOTAL LENGTH IN MM) OF FISH TAKEN
 FROM THE MISSOURI RIVER DURING EACH SAMPLING PERIOD

<u>Species</u>	<u>July</u>	<u>September</u>	<u>December</u>	<u>Total All Surveys</u>	<u>Percent of Total Catch</u>
Chestnut lamprey			5 (315-325) ^a	5	0.8
Shovelnose sturgeon		1 (618)	5 (347-642)	6	0.9
Longnose gar	1	10 (562-932)	1 (653)	12	1.9
Shortnose gar	2 (542)	9 (435-608)		11	1.7
Gizzard shad	5 (129-325)	116 (78-388)	297 (72-329)	418	65.8
Skipjack herring		2 (302,346)	13 (134-375)	5	2.4
Goldeye		3 (92-248)		3	0.5
Mooneye			3 (211-296)	3	0.5
Northern pike			1 (670)	1	0.2
Carp		23 (205-545)	27 (277-668)	50	7.9
Emerald shiner			qualitative ^b		
Redfin shiner			qualitative		
River carpsucker	1 (445)	23 (168-427)	5 (132-443)	29	4.6
Quillback	1 (330)		3 (390-476)	4	0.6
Highfin carpsucker			1	1	0.2
Longnose sucker			1 (494)	1	0.2
White sucker			1	1	0.2
Largemouth buffalo			3 (426-512)	3	0.5
Smallmouth buffalo			1 (165)	1	0.2
Blue catfish	1 (818)	4 (418-540)		5	0.8
Channel catfish	1 (248)			1	0.2
Flathead catfish	2 (330,336)	1 (204)		3	0.5
White bass	1			1	0.2
Largemouth bass		2 (233,510)		2	0.3
Bluegill		1 (104)	1 (64)	2	0.3

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TABLE 2.3.6-3 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Species</u>	<u>July</u>	<u>September</u>	<u>December</u>	<u>Total All Surveys</u>	<u>Percent of Total Catch</u>
White crappie	1 (205)	15 (188-273)	18 (68-286)	34	5.4
Sauger			1 (347)	1	0.2
Freshwater drum	3 (176-300)	7 (194-356)	12 (92-363)	22	3.5
TOTAL ALL SPECIES	19	217	399	635	

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^aAll length data available is included in parentheses.

^bNo numerical data were recorded.

TABLE 2.3.6-4
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 AGE, GROWTH AND CONDITION OF GIZZARD SHAD TAKEN FROM MISSOURI RIVER
 DURING SEPTEMBER AND DECEMBER, 1973

SEPTEMBER

Age (Yr)	Sample Size	Total Length (mm)		Weight (gm)		Mean Condition Factor (K_{TL})	Percent of Sample
		Mean	Range	Mean	Range		
<1	10	94	78-115	8	2- 22	0.92	10
1	10	138	104-185	25	12- 42	0.95	10
2	26	223	146-310	99	24-288	0.86	25
3	34	263	164-344	179	42-380	0.95	33
4	15	317	285-388	267	148-402	0.85	15
5	6	300	198-340	275	80-362	0.97	6
6	1	308	-	358	-	1.23	1
7	1	324	-	356	-	1.05	1

DECEMBER

<1	44	94	74-168	7	2- 38	0.56	56
1	1	159	-	28	-	0.70	1
2	13	191	167-213	58	38- 82	0.81	17
3	15	216	169-243	86	42-120	0.84	19
4	5	266	239-292	166	128-218	0.88	6

TABLE 2.3.6-5
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 SUMMARY TABLE OF ALL FOOD ITEMS FOUND IN THE STOMACHS OF FISH COLLECTED FROM THE MISSOURI RIVER DURING
 JULY, SEPTEMBER AND DECEMBER, 1973 (NUMBERS REPRESENT PERCENT OF TOTAL WEIGHT)

Fish Species	Number of Stomachs Examined	Number of Empty Stomachs	FOOD ITEM							Fish	Unidentified Organic Material	Inorganic Material	Mean Weight/Stomach	Total Weight	
			Diatoms	Green Algae	Ephemeroptera	Hemiptera	Trichoptera	Diptera	Crustacea						
Shortnose Gar	2	1									100			2.63	2.63
Longnose Gar	1	0									100			7.13	7.13
Gizzard Shad	86	20	45	6	1							24	25	0.54	35.59
Carp	25	9							37			63		0.24	3.86
River Carpsucker	18	7							11			89		0.32	3.52
Largemouth Buffalo	1	1													
Goldeye	1	0			45			45				10		0.43	0.43
Skipjack Herring	1	0				9			63				27	0.11	0.11
Channel Catfish	1	0			18			25	2		56			0.68	0.68
Flathead Catfish	3	0								64	36			0.29	0.89
Blue Catfish	1	1													
White Crappie	5	1			3	3		1	1		93			0.66	2.64
Bluegill	1	0			67				33					0.03	0.03
Freshwater Drum	12	3			6			11	4			79		0.06	0.54
TOTALS	158	43													

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TABLE 2.3.6-6
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 NUMBERS AND SIZE RANGES (TOTAL LENGTH IN MM) OF FISH TAKEN FROM
 LOGAN CREEK DURING EACH SAMPLING PERIOD

Species	July	September	December	February	Total All Surveys	Percent of Total Catch
				3 (138-156)	3	0.9
Goldeye					27	7.8
Gizzard shad	17 (40-162) ^a	10			5	1.4
Carp	5 (109-157)				5	1.4
Redfin shiner	5		1		1	0.3
Sand shiner			1		1	0.3
Red shiner					4	1.2
Southern redbelly dace	4			12	24	6.9
Bluntnose minnow	12			1	16	4.6
Stoneroller	15				6	1.7
River carpsucker	6 (59-119)					
Quillback	qualitative ^b			2 (143,214)	10	2.9
Yellow bullhead		8			10	2.9
Brown bullhead	2 (114,118)	8		23	43	12.4
Blackstripe topminnow	5	15	25		70	20.2
Mosquitofish	20	25			5	1.4
Brook silverside	5			1 (266)	9	2.6
Largemouth bass	6 (55-220)	2 (147,149)	5 (111-178)	7 (74-198)	14	4.0
Green sunfish	2		4 (92-127)	6 (96-139)	11	3.2
Longear sunfish	1 (125)		3 (98-103)	16 (87-155)	57	16.5
Bluegill	28	10 (139-174)				
Bluegill-green sunfish hybrid					2	0.6
White crappie	2 (101,110)			3 (65-180)	11	3.2
Logperch	8 (116-173)				4	1.2
Stippled darter	3	1			1	0.3
Johnny darter	1	4			6	1.7
Iowa darter	2				1	0.3
Freshwater drum	qualitative					
	1					
TOTAL ALL SPECIES	150	83	39	74	346	

^aAll length data available is included in parentheses.

^bNO numerical data were recorded.

TABLE 2.3.6-7
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT
 ITEM ANALYSIS OF STOMACH CONTENTS OF FISH FROM LOGAN CREEK COLLECTED DURING
 JULY AND SEPTEMBER, 1973 (NUMBERS REPRESENT PERCENT OF WEIGHT)

July

Fish Species	Number of Stomachs Examined	Number of Empty Stomachs	FOOD ITEM							Unidentified Organic Material	Mean Weight/Stomach	Total Weight
			Odonata	Ephemeroptera	Hemiptera	Coleoptera	Diptera	Crustacea	Fish			
Largemouth Bass	2	1	21			79					0.14	0.14
White Crappie	4	0		14	31		41		14		0.07	0.29
Hybrid Sunfish	3	1	21						79		0.55	1.11
<u>September</u>												
Logperch	2	0					60			40	0.17	0.35
TOTALS	11	2										

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TABLE 2.3.7-1
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 . SPECIES OF FISH COLLECTED IN THE MISSOURI RIVER AND LOGAN CREEK

Family	Species	Common Name	Collection Dates						
			Missouri River				Logan Creek		
			1853-1969 ^a	1972 ^b	1973 ^c	1974 ^d	1973-74 ^e	1974 ^f	
Petromyzontidae									
	<u>Ichthyomyzon castaneus</u>	Chestnut lamprey	R	x	x				
Acipenseridae									
	<u>Scaphirhynchus platyrhynchus</u>	Shovelnose sturgeon	R		x	x			
Polyodontidae									
	<u>Polyodon spathula</u>	Paddlefish			x ^g	x			x
Lepisosteidae									
	<u>Lepisosteus osseus</u>	Longnose gar	R		x	x			
	<u>Lepisosteus platostomus</u>	Shortnose gar	R	x	x	x			x
Clupeidae									
	<u>Dorosoma cepedianum</u>	Gizzard shad	R	x	x	x		x	x
	<u>Alosa chrysochloris</u>	Skipjack herring			x	x			
Hiodontidae									
	<u>Hiodon alosoides</u>	Goldeye	R	x	x	x		x	
	<u>Hiodon tergisus</u>	Mooneye			x				
Esocidae									
	<u>Esox lucius</u>	Northern pike			x	x			
Cyprinidae									
	<u>Cyprinus carpio</u>	Carp	R ^o	x	x	x		x	
	<u>Semotilus atromaculatus</u>	Creek chub	R						
	<u>Hybopsis storeriana</u>	Silver chub	R				x		
	<u>Hybopsis x-punctata</u>	Gravel chub	R						
	<u>Hybopsis gracilis</u>	Flathead chub	R				x		

TABLE 2.3.7-1 (continued)
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

Family	Species	Common Name	Collection Dates						
			Missouri River				Logan Creek		
			1853-1969 ^a	1972 ^b	1973 ^c	1974 ^d	1973-74 ^e	1974 ^f	
Cyprinidae (continued)									
	<u>Hybopsis meeki</u>	Sicklefin chub	R						
	<u>Phenacobius mirabilis</u>	Suckermouth minnow	R						
	<u>Notropis atherinoides</u>	Emerald shiner	R	x	x	x			x
	<u>Notropis rubellus</u>	Rosyface shiner	T						
	<u>Notropis umbratilis</u>	Redfin shiner	R		x	x	x		x
	<u>Notropis shumardi</u>	Silverband shiner	R						
	<u>Notropis zonatus</u>	Bleeding shiner	T						
	<u>Notropis cornutus</u>	Common shiner	T						
	<u>Notropis boops</u>	Bigeye shiner	T						
	<u>Notropis lutrensis</u>	Red shiner	R				x		x
	<u>Notropis stramineus</u>	Sand shiner	R				x		x
	<u>Notropis topeka</u>	Topeka shiner	T						
	<u>Notropis heterolepis</u>	Blacknose shiner	T						
	<u>Notropis volucellus</u>	Mimic shiner	R	x					
	<u>Notropis buechanani</u>	Ghost shiner	R						
	<u>Dionda nubila</u>	Ozark minnow	T						
	<u>Phoxinus erythrogaster</u>	Southern redbelly dace	T				x		
	<u>Hybognathus argyritis</u>	Western silvery minnow	T				x		
	<u>Hybognathus placitus</u>	Plains minnow	R	x					
	<u>Pimephales notatus</u>	Bluntnose minnow	T				x		x
	<u>Pimephales promelas</u>	Flathead minnow	T						
	<u>Campostoma anomalum</u>	Stoneroller	T				x		x
Catostomidae									
	<u>Carpiodes carpio</u>	River carpsucker	R	x	x	x	x		x
	<u>Carpiodes cyprinus</u>	Quillback	R		x	x	x		x
	<u>Carpiodes velifer</u>	High-finned carpsucker			x	x			
	<u>Catostomus commersoni</u>	White sucker	R		x				
	<u>Catostomus catostomus</u>	Longnose sucker			x				

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TABLE 2.3.7-1 (continued)

Family	Species	Common Name	Collection Dates						
			Missouri River				Logan Creek		
			1853-1969 ^a	1972 ^b	1973 ^c	1974 ^d	1973-74 ^e	1974 ^f	
Catostomidae (continued)									
	<u>Hypentelium nigricans</u>	Northern hog sucker	T						
	<u>Ictiobus cyprinellus</u>	Largemouth buffalo			x				
	<u>Ictiobus bubalus</u>	Smallmouth buffalo	R		x	x			x
	<u>Moxostoma duquesnei</u>	Black redhorse	R						
	<u>Moxostoma erythrurum</u>	Golden redhorse	T	x					
	<u>Moxostoma macrolepidotum</u>	Northern redhorse	T						
Ictaluridae									
	<u>Ictalurus furcatus</u>	Blue catfish	R		x	x			
	<u>Ictalurus melas</u>	Black bullhead	T			x			x
	<u>Ictalurus natalis</u>	Yellow bullhead	T			x		x	x
	<u>Ictalurus nebulosus</u>	Brown bullhead						x	
	<u>Ictalurus punctatus</u>	Channel catfish	R	x	x	x			x
	<u>Plyodictis olivaris</u>	Flathead catfish	R	x	x	x			
	<u>Noturus exilis</u>	Slender madtom	T						
Cyprinodontidae									
	<u>Fundulus catenatus</u>	Northern studfish	T						
	<u>Fundulus olivaceus</u>	Blackspotted topminnow	T						
	<u>Fundulus notatus</u>	Blackstripe topminnow	T				x	x	x
Poeciliidae									
	<u>Gambusia affinis</u>	Mosquitofish	T			x		x	x
Atherinidae									
	<u>Labidesthes sicculus</u>	Brook silverside	T			x		x	x
Percichthyidae									
	<u>Morone chrysops</u>	White bass		x	x	x			

TABLE 2.3.7-1 (continued)

REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

Family	Species	Common Name	Collection Dates					
			Missouri River				Logan Creek	
			1853-1969 ^a	1972 ^b	1973 ^c	1974 ^d	1973-74 ^e	1974 ^f
Centrarchidae								
	<u>Micropterus dolomieu</u>	Smallmouth bass	T	x		x		x
	<u>Micropterus salmoides</u>	Largemouth bass	R		x	x	x	x
	<u>Lepomis gulosus</u>	Warmouth						x
	<u>Lepomis cyanellus</u>	Green sunfish	T			x	x	x
	<u>Lepomis humilus</u>	Orangespotted sunfish	T					
	<u>Lepomis megalotis</u>	Longear sunfish	T			x	x	x
	<u>Lepomis macrochirus</u>	Bluegill	R	x	x	x	x	x
	<u>Pomoxis annularis</u>	White crappie	R	x	x	x	x	x
Percidae								
	<u>Stizosteidon canadense</u>	Sauger	R	x	x	x		
	<u>Percina phoxocephala</u>	Slenderhead darter	T					
	<u>Percina caprodes</u>	Logperch	T				x	
	<u>Etheostoma nigrum</u>	Johnny darter	T				x	
	<u>Etheostoma spectabile</u>	Orangethroat darter	T			x		x
	<u>Etheostoma flabellare</u>	Fantail darter	T					
	<u>Etheostoma punctulatum</u>	Stippled darter					x	
	<u>Etheostoma exile</u>	Iowa darter					x	
Sciaenidae								
	<u>Aplodinotus grunniens</u>	Freshwater drum	R	x	x	x	x	x

^a River (R) and tributary (T) collections reported by Pflieger (1971).

^b Collected from one station at Hermann, Missouri (Missouri River Environmental Inventory, 1972). An unidentified Notropis species was also collected near Hermann, but has not been included in the table.

^c Collected from five stations near the site area by Dames & Moore, July, September, and December, 1973.

^d Collected from six stations by Dames & Moore, June, 1974.

^e Collected from two stations by Dames & Moore, July, September and December, 1973 and February, 1974.

^f Collected from two stations by Dames & Moore, July and September, 1974.

TABLE 2.3.7-2

REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 TOTAL NUMBER AND LENGTH RANGE OF FISHES COLLECTED WITH GILL AND
 FYKE NETS FROM THE MISSOURI RIVER, JUNE 1974^a

Common Name	Station A-North End		Station A-South End		Station B-South End		Station B-North End	
	Number	Length	Number	Length	Number	Length	Number	Length
Shovelnose sturgeon	+	+	2	430(467)490	+	+	+	+
Longnose gar	+	+	1	615	+	+	1	605
Shortnose gar	+	+	+	+	+	+	+	+
Gizzard shad	+	+	+	+	+	+	+	+
Northern pike	+	+	+	+	+	+	+	+
Carp	+	+	2	300(385)470	+	+	2	248(337)425
River carpsucker	+	+	+	+	1	377	+	+
Blue catfish	1	210	1	805	+	+	+	+
Black bullhead	1	200	+	+	+	+	+	+
Flathead catfish	+	+	1	705	+	+	+	+
White crappie	+	+	+	+	+	+	+	+
Sauger	+	+	+	+	+	+	+	+
Freshwater drum	+	+	+	+	+	+	3	225(267)309

Common Name	Station H-South End		Station C-North End		Station C-South End	
	Number	Length	Number	Length	Number	Length
Shovelnose sturgeon	+	+	+	+	1	530
Longnose gar	+	+	+	+	1	965
Shortnose gar	+	+	+	+	4	525(562)570
Gizzard shad	+	+	+	+	2	282(287)292
Northern pike	+	+	1	666	+	+
Carp	+	+	+	+	+	+
River carpsucker	1	377	+	+	2	401(412)422
Blue catfish	+	+	+	+	+	+
Black bullhead	+	+	+	+	+	+
Flathead catfish	+	+	+	+	+	+
White crappie	+	+	1	185	5	178(210)250
Sauger	+	+	1	308	1	423
Freshwater drum	+	+	+	+	3	114(204)340

^a Total length range (mm) with mean length in parentheses.

TABLE 2.3.7-3

TOTAL NUMBER AND LENGTH RANGE OF FISHES COLLECTED WITH
A BOOM ELECTROSHOCKER IN THE MISSOURI RIVER, JUNE 1974^a

<u>Common Name</u>	<u>Station B-North End Number</u>	<u>Length</u>	<u>Station C-North End Number</u>	<u>Length</u>
Shortnose gar	2	490;517	3	565(582)618
Gizzard shad	+	+	2	210;214
Carp	+	+	1	432
White crappie	+	+	1	185
Freshwater drum	+	+	2	231;234

^aTotal length range (mm) with mean length in parentheses.

TABLE 2.3.7-4
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 TOTAL NUMBER AND LENGTH RANGE OF FISHES COLLECTED WITH GILL AND
 FYKE NETS FROM THE MISSOURI RIVER, SEPTEMBER 1974^a

Common Name	Station A-South End		Station B-South End		Station B-North End		Station H-North End		Station C-North End	
	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length
Shovelnose sturgeon	1	430	+	+	+	+	+	+	+	+
Paddlefish	+	+	+	+	+	+	1	910	+	+
Longnose gar	+	+	1	1366	1	630	2	550(553)555	+	+
Shortnose gar	+	+	+	+	3	484(556)604	5	415(508)649	+	+
Gizzard shad	+	+	1	306	+	+	10	320(342)374	2	457(463)530
Goldeye	+	+	1	263	16	260(277)300	1	259	12	71(170)329
Carp	+	+	1	485	4	450(493)534	5	320(397)450	+	+
River carpsucker	+	+	1	420	+	+	7	391(405)415	+	+
Smallmouth buffalo	+	+	+	+	12	275(373)427	1	340	1	77
Blue catfish	2	460(465)470	+	+	+	+	+	+	+	+
Channel catfish	+	+	+	+	1	163	1	540	+	+
Flathead catfish	+	+	+	+	1	91	+	+	+	+
White bass	+	+	+	+	+	+	+	+	1	130
White crappie	+	+	+	+	1	320	+	+	12	77(206)261
Freshwater drum	+	+	+	+	13	65(134)395	4	66(79)90	2	84(102)119

^aTotal length range (mm) with mean length in parentheses.

TABLE 2.3.7-5
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 TOTAL NUMBER AND LENGTH RANGE OF FISHES COLLECTED WITH SEINES IN THE MISSOURI
 RIVER AND LOGAN CREEK, JUNE 1974^a

Common Name	Station B June 22		Station B-South June 23		Station H June 22		Station D June 22		Station E June 22		Station E May 30	
	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length
Longnose gar	+	+	1	57	+	+	+	+	+	+	+	+
Shortnose gar	+	+	+	+	+	+	1	59	+	+	+	+
Skipjack herring	+	+	7	16(28)35	+	+	+	+	+	+	+	+
Gizzard shad	18	21(27)40	13	22(30)65	1	27	2	33(34)35	9	131(186)322	1	244
Stoneroller	14	35(54)64	2	46-60	+	+	+	+	+	+	+	+
Flathead chub	1	95	+	-	+	+	+	+	+	+	+	+
Silver chub	+	+	46	18(25)34	+	+	+	+	+	+	+	+
Emerald shiner	96	19(30)60	368	17(22)30	47	19(21)27	4	23(25)27	13	36(50)62	1	61
Red shiner	+	+	+	+	+	+	+	+	1	70	+	+
Redfin shiner	+	+	+	+	+	+	+	+	5	54(58)61	+	+
Bluntnose minnow	21	17(22)30	+	+	+	+	+	+	46	15(27)62	+	+
Quillback	+	+	+	+	+	+	+	+	2	139(145)151	+	+
Smallmouth buffalo	+	+	2 ^b	21(22)23	2 ^b	20(23)26	+	+	1	287	+	+
Channel catfish	+	+	+	+	+	+	5	85(98)137	+	+	+	+
Black bullhead	+	+	+	+	+	+	+	+	+	+	1	95
Blackstripe topminnow	+	+	+	+	+	+	+	+	4	54(59)65	9	51(60)75
Mosquitofish	+	+	+	+	+	+	1	30	1	31	+	+
Brook silverside	3	18(22)25	+	+	+	+	+	+	+	+	+	+
White bass	1	22	13	18(27)35	2	19(23)26	+	+	+	+	+	+
Green sunfish	+	+	+	+	+	+	+	+	+	+	16	61(131)170
Longear sunfish	+	+	+	+	+	+	+	+	25	61(103)129	3	98(107)112
Bluegill	+	+	+	+	+	+	1	56	21	78(109)132	32	91(116)175
Sunfish hybrid	+	+	+	+	+	+	+	+	1	98	+	+
Smallmouth bass	+	+	1	37	+	+	5	27(43)58	1	33	+	+
White crappie	+	+	2	18(22)25	+	+	2	87(100)112	3	164(168)174	+	+
Oranget ^o cat darter	+	+	+	+	+	+	1	22	+	+	+	+
Sauger	7	44(61)91	+	+	1	67	+	+	+	+	+	+
Freshwater drum	+	+	4	27(29)30	+	+	4	22(25)27	+	+	+	+

^aTotal length range (mm) with mean length in parentheses.

^bMay be *Carpiodes* sp.

+ Not observed.

TABLE 2.3.7-5

TOTAL NUMBER AND LENGTH RANGE OF FISHES COLLECTED WITH SEINES IN THE MISSOURI RIVER AND LOGAN CREEK, JUNE 1974^a

Common Name	Station B June 22		Station B-South June 23 ^o		Station H June 22		Station D June 22		Station E June 22		Station E May 30	
	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length
Longnose gar	+	+	1	57	+	+	+	+	+	+	+	+
Shortnose gar	+	+	+	+	+	+	1	59	+	+	+	+
Skipjack herring	+	+	7	16(28)35	+	+	+	+	+	+	+	+
Gizzard shad	18	21(27)40	13	22(30)65	1	27	2	33(34)35	9	131(186)322	1	244
Stoneroller	14	35(54)64	2	46-60	+	+	+	+	+	+	+	+
Flathead chub	1	95	+	-	+	+	+	+	+	+	+	+
Silver chub	+	+	46	18(25)34	+	+	+	+	+	+	+	+
Emerald shiner	96	19(30)60	368	17(22)30	47	19(21)27	4	23(25)27	13	36(50)62	1	61
Red shiner	+	+	+	+	+	+	+	+	1	70	+	+
Redfin shiner	+	+	+	+	+	+	+	+	5	54(58)61	+	+
Bluntnose minnow	21	17(22)30	+	+	+	+	+	+	46	15(27)62	+	+
Quillback	+	+	+	+	+	+	+	+	2	139(145)151	+	+
Smallmouth buffalo	+	+	2 ^b	21(22)23	2 ^b	20(23)26	+	+	1	287	+	+
Channel catfish	+	+	+	+	+	+	5	85(98)137	+	+	+	+
Black bullhead	+	+	+	+	+	+	+	+	+	+	1	95
Blackstripe topminnow	+	+	+	+	+	+	+	+	4	54(59)65	9	51(60)75
Mosquitofish	+	+	+	+	+	+	1	30	1	31	+	+
Brook silverside	3	18(22)25	+	+	+	+	+	+	+	+	+	+
White bass	1	22	13	18(27)35	2	19(23)26	+	+	+	+	+	+
Green sunfish	+	+	+	+	+	+	+	+	+	+	16	61(131)170
Longear sunfish	+	+	+	+	+	+	+	+	25	61(103)129	3	98(107)112
Llugill	+	+	+	+	+	+	1	56	21	78(109)132	32	91(116)175
Sunfish hybrid	+	+	+	+	+	+	+	+	1	98	+	+
Smallmouth bass	+	+	1	37	+	+	5	27(43)58	1	33	+	+
White crappie	+	+	2	18(22)25	+	+	2	87(100)112	3	164(168)174	+	+
Orangethroat darter	+	+	+	+	+	+	1	22	+	+	+	+
Sauger	7	44(61)91	+	+	1	67	+	+	+	+	+	+
Freshwater drum	+	+	4	27(29)30	+	+	4	22(25)27	+	+	+	+

^aTotal length range (mm) with mean length in parentheses.^bMay be *Carpionodes* sp.

+ Not observed.

TABLE 2.3.7-7

CONDITION FACTOR AND LENGTH-WEIGHT REGRESSIONS FOR FIVE
SPECIES OF MISSOURI RIVER FISH COLLECTED,
JUNE AND SEPTEMBER 1974

<u>Species</u>	<u>Condition Factor</u>	<u>Length-Weight Regressions</u>
Gizzard shad (male)	(19) ^a 0.929	log W = -4.87 +2.93 log L
Gizzard shad (female)	(19) 0.971	log W = -5.42 +3.16 log L
Gizzard shad (combined)	(38) 0.950	log W + -5.32 +3.12 log L
Carp	(15) 1.353	log W + -4.83 +2.98 log L
River carpsucker	(21) 1.217	log W + -4.46 +2.82 log L
White crappie (male)	(9) 1.560	log W = -2.15 +1.82 log L
White crappie (female)	(7) 1.654	log W = -4.76 +2.98 log L
White crappie (combined)	(22) 1.546	log W = -2.77 +1.34 log L
Freshwater drum	(12) 1.352	log W = -5.73 +3.36 log L

^aNumber of specimens used for calculation.

TABLE 2.3.7-8
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 LARVAL FISH COLLECTED WITH A METERED TOW NET FROM THE MISSOURI RIVER,
 JUNE 23, 1974

<u>Species</u>	<u>Transect B</u>			<u>Transect C</u>		
	<u>Number</u>	<u>Total Length (mm)</u>	<u>No./m³</u>	<u>Number</u>	<u>Total Length (mm)</u>	<u>No./m³</u>
<u>Aloea chrysochloris</u>	4	10-15	0.010	2	20-24	0.006
<u>Dorosoma cepedianum</u>	15	5-13	0.377	39	4-12	0.111
<u>Micropterus</u> spp.	2	6-7	0.005	12	6-9	0.034
<u>Notropis</u> spp.	12	4-10	0.030	28	4-7	0.079
<u>Cyprinus carpio</u>	2	22-27	0.005	+	+	+
<u>Morone chrysops</u>	3	6-8	0.007	+	+	+
Centrarchidae species	3	<4	0.007	+	+	+
Unidentified species	39	<4	0.098	14	<4	0.040
Unidentified fish eggs	+	+	+	3	+	(0.008)
TOTAL	80		0.201	98		0.270

TABLE 2.3.7-9
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 TOTAL NUMBER AND RANGE OF FISHES COLLECTED WITH SEINES IN LOGAN CREEK,
 SEPTEMBER 6, 1974

Common Name	Station D		Station E	
	Number	Length	Number	Length
Shortnose gar	1	515	1	
Gizzard shad	8	75(162)265	+	331
Stoneroller	+	+	4	45(51)67
Silver chub	9	29(37)52	+	+
Emerald shiner	34	31(39)65	+	+
Red shiner	1	60	+	+
Redfin shiner	7	53(60)67	+	+
Sand shiner	8	30(37)47	6	27(35)49
Bluntnose minnow	+	+	7	33(35)38
<u>Carp</u> <i>Carpiodes</i> spp.	5	44(52)62	+	+
Smallmouth buffalo	1	186	+	+
Carp	2	216(241)266	+	+
Channel catfish	1	75	+	+
Blackstripe topminnow	+	+	4	30(44)72
Mosquitofish	4	29(30)32	+	+
Green sunfish	+	+	6	25(42)69
Longear sunfish	+	+	1	97
Bluegill	15	30(55)108	4	30(49)103
Largemouth bass	1	228	+	+
Warmouth	1	142	+	+
White crappie	10	129(155)187	+	+
Crangethroat darter	+	+	2	38(39)41
Freshwater drum	6	57(79)97	+	+

TABLE 2.3.7-10

MEAN BACK-CALCULATED TOTAL LENGTH (mm) AT END OF EACH YEAR
OF LIFE OF BLUEGILL AND GIZZARD SHAD COLLECTED IN 1974

		<u>Bluegill</u>			
<u>Year Class</u>	<u>Number of Fish</u>	<u>Age</u>			
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
1973	4	84			
1972	31	63	91		
1971	9	62	95	111	
1970	5	55	85	122	137
mean length		66	90	116	137
mean increment		66	30	26	21

		<u>Gizzard Shad</u>			
<u>Year Class</u>	<u>Number of fish</u>	<u>Age</u>			
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
1973	6	126			
1972	10	148	218		
1971	25	142	208	260	
1970	1	104	170	268	317
mean length		130	199	264	317
mean increment		130	68	75	53

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Table 1. Checklist of fishes collected near the Callaway Nuclear Power Plant, June through August 1980. Ref. Preoperational monitoring program June through August.

Taxa ^a	
Common Name	Scientific Name
Chestnut lamprey	<u>Ichthyomyzon castaneus</u>
Shovelnose sturgeon	<u>Scaphirhynchus platyrhynchus</u>
Longnose gar	<u>Lepisosteus osseus</u>
Shortnose gar	<u>Lepisosteus platostomus</u>
American eel	<u>Anguilla rostrata</u>
Gizzard shad	<u>Dorosoma cepedianum</u>
Skipjack herring	<u>Alosa chrysochloris</u>
Goldeye	<u>Hiodon alosoides</u>
Central stoneroller	<u>Compostoma anomalum</u>
Carp	<u>Cyprinus carpio</u>
Bluntnose minnow	<u>Pimephales notatus</u>
Silver chub	<u>Hybopsis storeriana</u>
Speckled chub	<u>Hybopsis aestivalis</u>
Plains minnow	<u>Hybognathus placitus</u>
Redfin shiner	<u>Notropis umbratilis</u>
Red shiner	<u>Notropis lutrensis</u>
Emerald shiner	<u>Notropis atherinoides</u>
Common shiner	<u>Notropis cornutus</u>
River shiner	<u>Notropis blennius</u>
Sand shiner	<u>Notropis stramineus</u>
Smallmouth buffalo	<u>Ictiolum bubalus</u>
River carpsucker	<u>Carpionodes carpio</u>
White sucker	<u>Catostomus commersoni</u>
Channel catfish	<u>Ictalurus punctatus</u>
Blue catfish	<u>Ictalurus fureatus</u>
Flathead catfish	<u>Pylodictis olivaris</u>
Yellow bullhead	<u>Ictalurus natalis</u>
Black bullhead	<u>Ictalurus melas</u>
Blackstripe topminnow	<u>Fundulus notatus</u>
Brook silversides	<u>Labidesthes sicculus</u>
Largemouth bass	<u>Micropterus punctulatus</u>
Spotted bass	<u>Micropterus salmoides</u>
Harmouth	<u>Lepomis gulosus</u>
Green sunfish	<u>Lepomis cyanellus</u>
Longear sunfish	<u>Lepomis megalotis</u>
Bluegill	<u>Lepomis macrochirus</u>
White crappie	<u>Pomoxis annularis</u>
Walleye/sauger	<u>Stizostedion sp.</u>
Sauger	<u>Stizostedion canadense</u>
Johnny darter	<u>Etheostoma nigrum</u>
Freshwater drum	<u>Aplodinotus grunniens</u>
Golden redhorse	<u>Moxostoma erythrurum</u>

^a Names according to Bailey 1970

Table 2. Total number of fish collected in the Missouri River by all sampling methods near Callaway Nuclear Power Plant, June through August 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish/Month			Total No.
	June	July	August	
Gizzard shad	5	31	32	68
Freshwater drum	15	7	26	48
Flathead catfish	10	20	18	48
Channel catfish	7	21	19	47
Longnose gar	15	7	3	25
Goldeye	14	6	2	22
Emerald shiner	4	6	10	20
Silver chub	0	18	0	18
River carpsucker	7	4	5	16
Shovenose sturgeon	9	2	2	13
River Shiner	2	8	0	10
Plains minnow	0	7	0	7
Shortnose gar	6	1	0	7
Carp	4	0	2	6
Stizostedion sp.	4	0	0	4
Blue catfish	2	1	1	4
Sauger	0	3	0	3
Sand shiner	2	0	0	2
Spotted bass	0	2	0	2
Smallmouth buffalo	1	0	1	2
White crappie	1	1	0	2
Speckled chub	0	1	0	1
American eel	0	1	0	1
Skipjack herring	0	0	1	1
TOTAL NO.	108	147	122	377

Table 3. Number of fish species collected by minnow seine at Missouri River sampling locations near Callaway Nuclear Power Plant, June 1980.

Ref. Preoperational monitoring program June through August.

Species	Number of Fish/Location								Total No.
	Location								
	A2	A3	B2 ^a	B3	H2 ^a	H3 ^a	C?	C3	
Goldeye	3	0	-	6	-	-	0	4	13
Stizostedion sp.	0	0	-	2	-	-	1	1	4
Emerald shiner	1	0	-	3	-	-	0	0	4
Red shiner	0	0	-	2	-	-	0	0	2
Sand shiner	1	1	-	0	-	-	0	0	2
Freshwater drum	1	0	-	0	-	-	0	0	1
Channel cat fish	1	0	-	0	-	-	0	0	1
TOTAL NO.	7	1		13	-	-	1	5	27

^a Not suitable for sampling due to substrate and water levels.

Table 4. Number of fish species collected by minnow seine at Missouri River sampling locations near Callaway Nuclear Power Plant, July 1980. Ref. Preoperational monitoring program June through August.

Species	Number of Fish/Location								Total No.
	Location								
	A2	A3 ^a	B2 ^a	B3 ^a	H2 ^a	H3	C2	C3	
Gizzard shad	0	-	-	-	-	16	0	3	19
Silver chub	6	-	-	-	-	0	10	0	16
Red shiner	2	-	-	-	-	2	3	1	8
Plains minnow	0	-	-	-	-	4	0	3	7
Emerald shiner	0	-	-	-	-	5	0	1	6
Freshwater drum	0	-	-	-	-	0	4	0	4
Spotted bass	1	-	-	-	-	1	0	0	2
Speckled chub	0	-	-	-	-	0	0	1	1
Channel catfish	1	-	-	-	-	0	0	0	1
Goldeye	1	-	-	-	-	0	0	0	1
TOTAL NO.	11	-	-	-	-	28	17	9	65

^a Not suitable for sampling due to substrate and water levels.

Table 5. Number of fish species collected by minnow seine at Missouri River sampling locations near Callaway Nuclear Power Plant, August 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish/Location								Total No.
	Location								
	A2	A3 ^a	B2 ^a	B3 ^a	H2 ^a	H3	C2 ^a	C3	
Gizzard shad	0	-	-	-	-	16	-	9	25
Emerald shiner	1	-	-	-	-	9	-	0	10
Freshwater drum	0	-	-	-	-	1	-	5	6
Channel catfish	0	-	-	-	-	0	-	3	3
TOTAL NO.	1	-	-	-	-	26	-	17	44

^a Not suitable for sampling due to substrate and water levels.

Total 6. Number and catch-per-effort of fish species collected by trap net at Missouri River sampling locations near Callaway Nuclear Power Plant, June 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations														Total No.		
	Location																
	A2		A3		B2		B3		H2 ^b		H3 ^b		C2			C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		
Freshwater drum	1	0.6	1	1.0	0	-	6	3.5	-	-	-	-	0	-	0	-	8
Flathead catfish	0	-	4	4.1	2	2.1	0	-	-	-	-	-	0	-	0	-	6
Channel catfish	0	-	3	3.1	0	-	2	1.2	-	-	-	-	0	-	0	-	5
Blue catfish	1	0.6	0	-	0	-	0	-	-	-	-	-	0	-	0	-	1
Shovelnose sturgeon	0	-	1	1.0	0	-	0	-	-	-	-	-	0	-	0	-	1
River carpsucker	0	-	0	-	0	-	0	-	-	-	-	-	1	0.6	0	-	1
TOTAL NO. FISH	2		9		2		8						1		0		22
TOTAL NO. SPECIES	2		4		1		2						1				
TOTAL CATCH/24 hr.		1.2		9.2		2.1		4.7						0.6		0.0	

^a Number/24 hours
^b Not sampled

Table 7. Number and catch-per-effort of fish species collected by trap net at Missouri River sampling locations near Callaway Nuclear Power Plant, July 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a Sampling Location														Total No.		
	A2		A3 ^b		B2		B3		H2		H3		C2			C3	
	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		No.	CPE
Channel catfish	1	0.5	-	-	2	1.1	2	1.1	0	-	4	2.1	0	-	8	4.1	17
Flathead catfish	3	1.6	-	-	3	1.6	1	0.5	2	1.0	1	0.5	1	0.5	0	-	11
Freshwater drum	0	-	-	-	2	1.1	0	-	0	-	0	-	0	-	0	-	2
Sauger	0	-	-	-	0	-	0	-	0	-	1	0.5	0	-	1	0.5	2
Silver chub	0	-	-	-	0	-	0	-	0	-	0	-	0	-	2	1.0	2
Blue catfish	0	-	-	-	1	0.5	0	-	0	-	0	-	0	-	0	-	1
American eel	0	-	-	-	0	-	0	-	0	-	0	-	1	0.5	0	-	1
White crappie	0	-	-	-	0	-	1	0.5	0	-	0	-	0	-	0	-	1
TOTAL NO. FISH	4				8		4		2		6		2		11		37
TOTAL NO. SPECIES	2				4		3		1		3		2		3		
TOTAL CATCH/24 hr.		2.1				4.3		2.1		1.0		3.1		1.0		5.6	

^a Number/24 hours
^b Net Stolen

Table 8. Number and catch-per-effort of fish species collected by trap net at Missouri River sampling locations near Callaway Nuclear Power Plant, August 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations														Total No.		
	A2		A3		B2		B3		H2		H3		C2			C3	
	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		No.	CPE
Freshwater drum	0	-	2	1.0	13	7.1	1	0.5	1	0.5	0	-	0	-	0	-	17
Channel catfish	2	1.0	0	-	4	2.0	0	-	1	0.5	2	1.0	0	-	7	3.5	16
Flathead catfish	3	1.5	1	0.5	3	1.5	0	-	1	0.5	0	-	4	2.0	3	1.5	15
Gizzard shad	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	1	0.5	2
Longnose gar	1	0.5	0	-	0	-	0	-	0	-	0	-	0	-	-	-	1
River carpsucker	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	1
TOTAL NO. FISH	6		3		22		1		3		2		4		11		52
TOTAL NO. SPECIES	3		2		5		1		3		1		1		3		
TOTAL CATCH/24 HR.		3.0		1.5		11.6		0.5		1.5		1.0		2.0		5.5	

^aNumber/24 Hours

Table 9. Number and catch-per-effort of fish species collected by electroshocking at Missouri River sampling locations near Callaway Nuclear Power Plant, June 1980.
 Ref. Preoperational monitoring program June through August.

	Number of Fish and Catch-per-Effort ^a /Sampling Locations															Total No.	
	Locations																
	A2		A3		B2		B3		H2		H3		C2		C3		
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE
Longnose gar	0	-	2	6.0	1	3.0	1	3.0	4	12.0	2	6.0	2	6.0	1	3.0	13
Shortnose gar	0	-	1	3.0	0	-	1	3.0	3	9.0	0	-	0	-	1	3.0	6
River carpsucker	0	-	1	3.0	0	-	3	9.0	0	-	0	-	1	3.0	1	3.0	6
Gizzard shad	1	3.0	0	-	0	-	0	-	2	6.0	0	-	1	3.0	0	-	4
Carp	0	-	0	-	0	-	1 ^b	3.0	1 ^b	3.0	0	-	2 ^b	6.0	0	-	4
Freshwater drum	3	9.0	0	-	0	-	0	-	0	-	0	-	0	-	0	-	3
Flathead catfish	2	6.0	0	-	1	3.0	0	-	0	-	0	-	0	-	0	-	3
Shovelnose sturgeon	1	3.0	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1
Goldeye	0	-	0	-	0	-	0	-	0	-	1	3.0	0	-	0	-	1
White crappie	0	-	0	-	0	-	1	3.0	0	-	0	-	0	-	0	-	1
TOTAL NO. FISH	7		4		2		7		4		3		6		3		42
TOTAL NO. SPECIES	4		3		2		5		4		2		4		3		
TOTAL CATCH/HR.		21.0		12.0		6.0		21.0		30.0		9.0		18.0		9.0	

^a Number/Hour

^b Each carp had at least one chestnut lamprey attached at the time of capture.

Table 10. Number and catch-per-effort of fish species collected by electroshocking at Missouri River sampling locations near Callaway Nuclear Power Plant, July 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No		
	Locations																
	A2		A3		B2		B3		H2		H3		C2			C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		
Gizzard shad	0	-	2	6.0	1	3.0	5	15.0	4	12.0	0	-	0	-	0	-	12
Longnose gar	0	-	0	-	1	3.0	0	-	1	3.0	1	3.0	3	9.0	1	3.0	7
Flathead catfish	0	-	0	-	3	9.0	0	-	0	-	3	9.0	0	-	0	-	6
Goldeye	0	-	0	-	0	-	0	-	0	-	4	12.0	0	-	1	3.0	5
River carpsucker	0	-	0	-	0	-	3	-	1	3.0	0	-	0	-	1	3.0	2
Freshwater drum	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	3.0	1
Shortnose gar	0	-	0	-	0	-	0	-	0	-	0	-	1	3.0	0	-	1
TOTAL NO. FISH	0		2		5		5		6		8		4		4		34
TOTAL NO. SPECIES			1		3		1		3		3		2		4		
TOTAL CATCH/Hr.				6.0		15.0		15.0		18.0		24.0		12.0		12.0	

^a Number/hour

Table 11. Number and catch-per-effort of fish species collected by electroshocking at Missouri River sampling locations near Callaway Nuclear Power Plant, August 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations														Total No.		
	Location																
	A2		A3		B2		B3		H2		H3		C2			C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		
Gizzard shad	0	-	1	3.0	0	-	2	6.0	1	3.0	0	-	0	-	0	-	4
Flathead catfish	0	-	0	-	3	9.0	0	-	0	-	0	-	0	-	0	-	3
River carpsucker	0	-	0	-	0	-	0	-	0	-	1	3.0	2	6.0	0	-	3
Coldeye	0	-	0	-	0	-	0	-	2	6.0	0	-	0	-	0	-	2
Freshwater drum	0	-	0	-	0	-	0	-	0	-	2	6.0	0	-	0	-	2
Longnose gar	0	-	1	3.0	0	-	0	-	0	-	0	-	0	-	0	-	1
Skipjack herring	1	3.0	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1
TOTAL NO. FISH	1		2		3		2		3		3		2		0		16
TOTAL NO. SPECIES	1		2		1		1		2		2		1		0		
TOTAL CATCH/HR.		3.0		6.0		9.0		6.0		9.0		9.0		6.0		-	

^a Number/hour

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Table 12. Number and catch-per-effort of fish species collected by gill net at Missouri River sampling locations near Callaway Nuclear Power Plant, June 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.		
	A2		A3		B2		B3		H2		H3		C2			C3	
	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		No.	CPE
Spoonnose sturgeon	4	2.0	0	-	0	-	1	0.5	2	1.0	0	-	0	-	0	-	7
Freshwater drum	0	-	3	1.5	0	-	0	-	0	-	0	-	0	-	0	-	3
Longnose gar	0	-	0	-	0	-	1	0.5	1	0.5	0	-	0	-	0	-	2
Flathead catfish	0	-	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	1
Channel catfish	0	-	0	-	0	-	0	-	0	-	0	-	1	0.5	0	-	1
Blue catfish	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	0	-	1
Smallmouth Buffalo	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	0	-	1
Gizzard shad	0	-	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	1
TOTAL NO. FISH	4		5		0		2		5		0		1		0		17
TOTAL NO. SPECIES	1		3				2		4				1				
TOTAL CATCH/24 HR.		2.0		2.5		0.0		1.0		2.5		0.0		0.5		0.0	

^a Number/24 hours

Table 13. Number and catch-per-effort of fish species collected by gill net at Missouri River sampling locations near Callaway Nuclear Power Plant, July 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location												Total No.						
	Location																		
	A2		A3		B2		B3		H2		H3			C2		C3			
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		
Flathead catfish	2	1.0	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	3
Channel catfish	1	0.5	0	-	0	-	0	-	1	0.5	1	0.5	0	-	0	-	0	-	3
River carpsucker	1	0.5	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	2
Shovelnose sturgeon	0	-	0	-	0	-	0	-	0	-	1	0.5	1	0.5	0	-	0	-	2
Sauger	0	-	0	-	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	1
TOTAL NO. FISH	4		0		0		2		1		3		1		0				11
TOTAL NO. SPECIES	3						2		1		3		1						
TOTAL CATCH/24 hr.		2.0		0.0		0.0		1.0		0.5		1.5		0.5		0.0			

^a Number/24 hours

Table 14. Number and catch-per-effort of fish species collected by gill net at Missouri River sampling locations near Callaway Nuclear Power Plant, August 1980.

Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.		
	Location																
	A2		A3		B2		B3		H2 ^b		H3		C2			C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE		
Shovelnose sturgeon	1	0.5	0	-	0	-	1	0.5	-	-	0	-	0	-	0	-	2
Carp	0	-	0	-	0	-	1	0.5	-	-	1	0.5	0	-	0	-	2
Blue catfish	0	-	0	-	0	-	0	-	-	-	0	-	1	0.5	0	-	1
Smallmouth buffalo	0	-	0	-	0	-	0	-	-	-	0	-	1	0.5	0	-	1
Freshwater drum	0	-	0	-	1	0.5	0	-	-	-	0	-	0	-	0	-	1
Longnose gar	0	-	1	0.5	0	-	0	-	-	-	0	-	0	-	0	-	1
Gizzard shad	0	-	1	0.5	0	-	0	-	-	-	0	-	0	-	0	-	1
River carpsucker	0	-	1	0.5	0	-	0	-	-	-	0	-	0	-	0	-	1
TOTAL NO. FISH	1		3		1		2		-		1		2		0		10
TOTAL NO. SPECIES	1		3		1		2		-		1		2				
TOTAL CATCH/24 hr.		0.5		1.5		0.5		1.0		-		0.5		1.0		0.0	

^a Number/24hrs.

^b Net previously fished and not recovered until 2nd day with help of plant personnel.

Table 15. Total number of fish collected in Logan and Mud Creeks by all sampling methods near Callaway Nuclear Power Plant, June through August 1980.

Ref. Preoperational monitoring program June through August.

Species	Number of Fish/Month			Total
	June	July	August	
Green sunfish	29	17	14	60
Redfin shiner	21	0	2	23
Bluntnose minnow	12	5	4	21
Gizzard shad	0	10	8	18
Black bullhead	1	1	16	18
Bluegill	3	10	4	17
Longear sunfish	9	5	2	16
Blackstripe topminnow	12	1	0	13
Sand Shiner	7	3	0	10
Largemouth bass	2	5	1	8
White crappie	0	3	2	5
Stoneroller	2	3	0	5
Common shiner	0	2	0	2
Yellow bullhead	1	0	0	1
Red shiner	1	0	0	1
Brook silverside	0	0	1	1
Spotted bass	0	0	1	1
White sucker	1	0	0	1
Carp	1	0	0	1
River carpsucker	1	0	0	1
Golden redhorse	1	0	0	1
Warmouth	0	1	0	1
Emerald shiner	0	1	0	1
Sauger	0	1	0	1
TOTAL NO.	104	68	55	227

Table 16. Number and catch-per-effort of fish species collected by electroshocking at Logan and Mud creek sampling locations near Callaway Nuclear Power Plant., June 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations						Total No.
	Location						
	E1		E2		D		
No.	CPE	No.	CPE	No.	CPE		
Green sunfish	14	84.0	10	60.0	2	12.0	26
Bluntnose minnow	7	42.0	0	-	0	-	7
Longear sunfish	3	18.0	2	12.0	0	-	5
Bluegill	0	-	1	6.0	2	12.0	3
Blackstripe topminnow	2	12.0	1	6.0	0	-	3
Largemouth bass	1	6.0	1	6.0	0	-	2
Sand shiner	2	12.0	0	-	0	-	2
White sucker	1	6.0	0	-	0	-	1
Stoneroller	1	6.0	0	-	0	-	1
Carp	0	-	0	-	1	6.0	1
River carpsucker	0	-	0	-	1	6.0	1
Golden redhorse	1	6.0	0	-	0	-	1
TOTAL NO. FISH	32		15		6		53
TOTAL NO. SPECIES	8		5		4		
TOTAL CATCH/HR.		192.0		90.0		36.0	

^a Number/Hour

Table 17. Numbers and catch-per-effort of fish species collected by electroshocking at Logan and Mud Creek sampling locations near Callaway Nuclear Power Plant, July 1980.
Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations						Total No.
	Location						
	E1		E2		D		
	No.	CPE	No.	CPE	No.	CPE	
Green sunfish	11	66.0	1	6.0	1	6.0	13
Bluegill	3	18.0	0	-	2	12.0	5
Bluntnose minnow	5	30.0	0	-	0	-	5
Gizzard shad	0	-	0	-	5	30.0	5
Stoneroller	3	18.0	0	-	0	-	3
Largemouth bass	1	6.0	0	-	1	6.0	2
Longear sunfish	2	12.0	0	-	0	-	2
Common shiner	2	12.0	0	-	-	-	2
Blackstripe topminnow	0	-	1	6.0	0	-	1
Sand shiner	1	6.0	0	-	0	-	1
Warmouth	0	-	1	6.0	0	-	1
Black bullhead	0	-	1	6.0	0	-	1
Emerald shiner	0	-	0	-	1	6.0	1
Sauger	0	-	0	-	1	6.0	1
TOTAL NO. FISH	28		4		11		43
TOTAL NO. SPECIES	8		4		6		
TOTAL CATCH/HR.		168.0		24.0		66.0	

^a Number/Hour

Table 18. Numbers and catch-per-effort of fish species collected by electroshocking at Logan and Mud Creek sampling locations near Callaway Nuclear Power Plant, August 1980.
 Ref. Preoperational monitoring program June through August.

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations						Total No.
	Location						
	E1		E2		D		
	No.	CPE	No.	CPE	No.	CPE	
Green sunfish	8	48.0	1	6.0	0	-	9
Black bullhead	0	-	8	48.0	0	-	8
Gizzard shad	4	24.0	0	-	3	18.0	7
Bluegill	2	12.0	0	-	1	6.0	3
Bluntnose minnow	0	-	3	18.0	0	-	3
White crappie	0	-	0	-	1	6.0	1
Largemouth bass	1	6.0	0	-	0	-	1
TOTAL NO. FISH	15		12		5		32
TOTAL NO. SPECIES	4		3		3		
TOTAL CATCH/HR.		90.0		72.0		30.0	

^aNumber/hour

Table 19. Number of fish species collected by minnow seine at Logan and Mud Creek sampling locations near Callaway Nuclear Power Plant, June through August 1980.
 Ref. Preoperational monitoring program June through August.

	Number of Fish/Sampling Location/Month												3 Month Total
	June			Total No.	July			Total No.	August			Total No.	
	Location				Location				Location				
E1	E2	D ^a	E1	E2	D	E1	E2	D					
Redfin shiner	9	12	-	21	0	0	0	0	1	1	0	2	23
Blackstripe topminnow	2	7	-	9	0	0	0	0	0	0	0	0	9
Sand shiner	5	0	-	5	2	0	0	2	0	0	0	0	7
Bluntnose minnow	5	0	-	5	0	0	0	0	1	0	0	1	6
Longear sunfish	4	0	-	4	3	0	0	3	2	0	0	2	9
Green sunfish	3	0	-	3	1	3	0	4	1	0	4	5	12
Bluegill	0	0	-	0	0	0	5	5	0	0	1	1	6
Gizzard shad	0	0	-	0	3	0	2	5	0	0	1	1	6
White crappie	0	0	-	0	0	0	3	3	0	0	1	1	4
Largemouth bass	0	0	-	0	0	1	2	3	0	0	0	0	3
Black bullhead	1	0	-	1	0	0	0	0	0	8	0	8	9
Stoneroller	1	0	-	1	0	0	0	0	0	0	0	0	1
Yellow bullhead	1	0	-	1	0	0	0	0	0	0	0	0	1
Red shiner	1	0	-	1	0	0	0	0	0	0	0	0	1
Brook silversides	0	0	-	0	0	0	0	0	1	0	0	1	1
Spotted bass	0	0	-	0	0	0	0	0	0	0	1	1	1
TOTAL NO. FISH	32	19		51	9	4	12	25	6	9	8	23	99

^a Not suitable for sampling due to substrate and water levels.

Table 1 Number and density of ichthyoplankton collected at Missouri River sampling locations near Callaway Nuclear Power Plant, June 1980.
Ref. Preoperational monitoring program June through August.

Taxon	Rep- licate	Number of Ichthyoplankton and Density (No/100m ³)/Location											
		Location											
		B1 Surface		B2 Surface		B2 Mid-Depth		B3 Surface		C1 Surface		C2 Surface	
No.	Density	No.	Density	No.	Density	No.	Density	No.	Density	No.	Density		
Catostomidae	1	0	-	0	-	0	-	2	4.0	4	4.0	2	2.6
	2	0	-	1	1.5	1	1.5	0	-	0	-	2	2.3
	3	1	1.2	0	-	0	-	4	6.7	1	1.8	3	3.8
TOTAL		1	0.4	1	0.5	1	0.5	6	3.6	5	1.9	7	2.9
Cyprinidae	1	0	-	2	3.3	0	-	0	-	0	-	0	-
	2	0	-	0	-	1	1.5	0	-	0	-	8	9.1
	3	0	-	0	-	1	1.2	3	5.0	0	-	4	5.0
TOTAL		0	-	2	1.1	2	0.9	3	1.7	0	-	12	4.7
Sauger	1	0	-	0	-	0	-	0	-	0	-	0	-
	2	0	-	0	-	0	-	0	-	0	-	0	-
	3	0	-	1	1.2	0	-	0	-	0	-	0	-
TOTAL		0	-	1	0.4	0	-	0	-	0	-	0	-
Freshwater drum	1	0	-	0	-	0	-	1	2.0	0	-	0	-
	2	1	1.3	1	1.5	0	-	0	-	1	1.7	1	1.1
	3	0	-	2	2.4	0	-	1	1.7	0	-	1	1.3
TOTAL		1	0.4	3	1.3	0	-	2	1.2	1	0.6	2	0.8
Unidentified egg	1	0	-	0	-	0	-	0	-	0	-	0	-
	2	0	-	0	-	0	-	0	-	0	-	1	1.1
	3	1	1.2	1	1.2	0	-	0	-	0	-	1	1.3
TOTAL		1	0.4	1	0.4	0	-	0	-	0	-	2	0.8

Table 1 (Continued)

Taxon	Rep- licate	Number of Ichthyoplankton and Density (No/100m ³)/Location											
		B1		B2		B2		B3		C1		C2	
		Surface		Surface		Mid-Depth		Surface		Surface		Surface	
		No.	Density	No.	Density	No.	Density	No.	Density	No.	Density	No.	Density
Goldeye	1	0	-	1	1.6	0	-	0	-	0	-	1	1.3
	2	0	-	0	-	0	-	0	-	1	1.7	0	-
	3	1	1.2	0	-	0	-	0	-	0	-	0	-
TOTAL		1	0.4	1	0.5	0	-	0	-	1	0.6	1	0.4
Carp	1	0	-	1	1.6	0	-	0	-	0	-	0	-
	2	0	-	0	-	0	-	0	-	0	-	0	-
	3	0	-	0	-	0	-	0	-	0	-	0	-
TOTAL		0	-	1	0.5	0	-	0	-	0	-	0	-
Gizzard shad	1	0	-	2	3.3	0	-	0	-	0	-	0	-
	2	0	-	0	-	0	-	0	-	0	-	0	-
	3	0	-	0	-	0	-	0	-	0	-	0	-
TOTAL		0	-	2	1.1	0	-	0	-	0	-	0	-
Unidentified (damaged)	1	0	-	0	-	0	-	0	-	0	-	0	-
	2	0	-	0	-	0	-	0	-	0	-	0	-
	3	0	-	0	-	0	-	0	-	0	-	2	2.5
TOTAL		0	-	0	-	0	-	0	-	0	-	2	0.8
Ictiobinae	1	0	-	3	4.8	0	-	2	4.0	0	-	1	1.3
	2	0	-	0	-	1	1.5	0	-	0	-	0	-
	3	0	-	1	1.2	0	-	0	-	0	-	0	-
TOTAL		0	-	4	2.0	1	0.5	2	1.3	0	-	1.	0.4

Table 2 Number and density of ichthyoplankton collected at Missouri River sampling locations near Callaway Nuclear Power Plant, July 1980.
Ref. Preoperational monitoring program June through August.

Taxon	Rep- licate	Number of Ichthyoplankton and Density (No/100m ³)/Location											
		B1		B2		B2		B3 ^d		C1		C2	
		Surface		Surface		Mid-Depth		Surface		Surface		Surface	
		No.	Density	No.	Density	No.	Density	No.	Density	No.	Density	No.	Density
Freshwater drum	1	0	-	1	0.9	4	3.7	-	-	1	1.0	1	0.8
	2	3	2.5	1	0.8	3	3.1	-	-	2	1.7	2	1.7
	3	3	3.0	1	0.8	6	6.5	-	-	1	0.8	1	0.9
TOTAL		6	1.8	3	0.8	13	4.4	-	-	4	1.2	4	1.1
Cyprinidae	1	1	0.9	4	3.6	3	2.7	-	-	2	2.0	3	2.4
	2	2	1.7	3	2.3	0	-	-	-	4	3.5	2	1.7
	3	4	4.0	2	1.7	2	2.2	-	-	2	1.7	3	2.7
TOTAL		7	2.2	9	2.5	5	1.6	-	-	8	2.4	8	2.3
Carp	1	0	-	0	-	0	-	-	-	0	-	0	-
	2	0	-	0	-	0	-	-	-	2	1.7	0	-
	3	0	-	0	-	1	1.1	-	-	0	-	0	-
TOTAL		0	-	0	-	1	0.4	-	-	2	0.6	0	-
Unidentified egg	1	0	-	0	-	0	-	-	-	0	-	0	-
	2	0	-	1	0.8	0	-	-	-	0	-	0	-
	3	0	-	0	-	0	-	-	-	0	-	0	-
TOTAL		0	-	1	0.3	0	-	-	-	0	-	0	-
Gizzard shad	1	1	0.9	0	-	0	-	-	-	0	-	0	-
	2	0	-	0	-	0	-	-	-	0	-	0	-
	3	0	-	0	-	0	-	-	-	0	-	0	-
TOTAL		1	0.3	0	-	0	-	-	-	0	-	0	-
Ictiobinae	1	1	0.9	1	0.9	14	12.8	-	-	0	-	5	4.0
	2	2	1.7	3	2.3	13	13.6	-	-	0	-	6	5.2
	3	2	2.0	4	3.3	10	10.8	-	-	2	1.7	6	5.4
TOTAL		5	1.5	8	2.2	37	12.4	-	-	2	0.6	17	4.9

Table 3. Number and density of ichthyoplankton collected at Missouri River sampling locations near Callaway Nuclear Power Plant, August 1980.
 Ref. Preoperational monitoring program June through August.

Taxon	Rep- licate	Number of Ichthyoplankton and Density (No/100m ³)/Location											
		Location											
		B1 Surface		B2 Surface		B2 Mid-Depth		B3 Surface		C1 Surface		C2 Surface	
No.	Density	No.	Density	No.	Density	No.	Density	No.	Density	No.	Density		
Cyprinidae	1	1	0.7	6	5.4	3	2.8	2	1.6	0	-	0	-
	2	3	2.2	3	2.5	0	-	1	0.8	0	-	2	1.4
	3	0	-	2	1.7	8	7.1	2	2.2	2	1.2	3	2.4
TOTAL		4	1.0	11	3.2	11	3.3	5	1.3	2	0.4	5	1.3
Freshwater drum	1	1	0.7	1	0.9	0	-	1	0.8	1	0.7	0	-
	2	0	-	4	3.3	0	-	1	0.8	0	-	1	0.7
	3	0	-	0	-	0	-	0	-	0	-	0	-
TOTAL		1	0.2	5	1.4	0	-	2	0.5	1	0.2	1	0.2
Unidentified Larvae (damaged)	1	0	-	0	-	0	-	0	-	0	-	5	3.7
	2	0	-	0	-	0	-	0	-	0	-	0	-
	3	0	-	0	-	0	-	0	-	0	-	0	-
TOTAL		0	-	0	-	0	-	0	-	0	-	5	1.2
Unidentified egg	1	1	0.7	0	-	0	-	0	-	0	-	0	-
	2	1	0.7	0	-	0	-	0	-	0	-	1	0.7
	3	0	-	0	-	0	-	0	-	0	-	0	-
TOTAL		2	0.5	0	-	0	-	0	-	0	-	1	0.2

Table 4. Number of ichthyoplankton collected in Logan and Mud Creeks near the Callaway Nuclear Power Plant, June through August 1980.
 Ref. Preoperational monitoring program June through August.

Taxon	Number of Ichthyoplankton/Month/Location												3 Month Total
	June				July				August				
	E1	E2	D	Total	E1	E2	D	Total	E1	E2	D	Total	
Mosquitofish	0	1	0	1	0	1	0	1	0	0	1	1	3
<i>Fundulus</i> sp.	0	1	0	1	4	4	0	8	0	0	0	0	9
Cyprinidae	3	4	0	7	2	1	0	3	0	1	0	1	11
Gizzard shad	0	0	2	2	0	0	0	0	0	0	0	0	2
<i>Lepomis</i> sp.	0	0	0	0	30	12	3	45	6	0	1	7	52
Bluntnose minnow	0	0	0	0	1	3	0	4	0	0	0	0	4
Johnny darter	0	0	0	0		0	0	1	1	1	0	2	3
Sand shiner	0	0	0	0	1	0	0	1	0	0	0	0	1
Blackstripe topminnow	0	0	0	0	0	0	0	0	2	0	0	2	2
TOTAL				11				63				13	87

Table 1. Checklist of fishes collected near the Callaway Nuclear Plant, June through November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Common Name	Taxa ^a	Scientific Name
Chestnut lamprey		<u>Ichthyomyzon castaneus</u>
Shovelnose sturgeon		<u>Scaphirhynchus platyrhynchus</u>
Longnose gar		<u>Lepisosteus osseus</u>
Shortnose gar		<u>Lepisosteus platostomus</u>
American eel		<u>Anguilla rostrata</u>
Gizzard shad		<u>Dorosoma cepedianum</u>
Skipjack herring		<u>Alosa chrysochloris</u>
Rainbow smelt		<u>Osmerus mordax</u>
Goldeye		<u>Hiodon alosoides</u>
Mooneye		<u>Hiodon tergisus</u>
Central stoneroller		<u>Campostoma anomalum</u>
Carp		<u>Cyprinus carpio</u>
Golden shiner		<u>Notemigonus crysoleucas</u>
Bluntnose minnow		<u>Pimephales notatus</u>
Flathead chub		<u>Hybopsis gracilis</u>
Silver chub		<u>Hybopsis storeriana</u>
Speckled chub		<u>Hybopsis aestivalis</u>
Plains minnow		<u>Hybognathus placitus</u>
Redfin shiner		<u>Notropis umbratilis</u>
Red shiner		<u>Notropis lutrensis</u>
Emerald shiner		<u>Notropis atherinoides</u>
Common shiner		<u>Notropis cornutus</u>
River shiner		<u>Notropis blennius</u>
Sand shiner		<u>Notropis stramineus</u>
Blue sucker		<u>Cycleptus elongatus</u>
Smallmouth buffalo		<u>Ictiobus bubalus</u>
River carpsucker		<u>Carpionodes carpio</u>
White sucker		<u>Catostomus commersoni</u>
Golden redbreast		<u>Moxostoma erythrurum</u>
Shorthead redbreast		<u>Moxostoma macrolepidotum</u>
Channel catfish		<u>Ictalurus punctatus</u>
Blue catfish		<u>Ictalurus furcatus</u>
Flathead catfish		<u>Pylodictis olivaris</u>
Yellow bullhead		<u>Ictalurus natalis</u>
Black bullhead		<u>Ictalurus melas</u>
Blackstripe topminnow		<u>Fundulus notatus</u>
Mosquitofish		<u>Gambusia affinis</u>
Brook silversides		<u>Labidesthes sicculus</u>
White bass		<u>Morone chrysops</u>
Largemouth bass		<u>Micropterus salmoides</u>

Table 1. (continued) PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Common Name	Taxa ^a	Scientific Name
Spotted bass		<u>Micropterus punctulatus</u>
Warmouth		<u>Lepomis gulosus</u>
Green sunfish		<u>Lepomis cyanellus</u>
Longear sunfish		<u>Lepomis megalotis</u>
Bluegill		<u>Lepomis macrochirus</u>
White crappie		<u>Pomoxis annularis</u>
Walleye/sauger		<u>Stizostedion sp.</u>
Sauger		<u>Stizostedion canadense</u>
Johnny darter		<u>Etheostoma nigrum</u>
Freshwater drum		<u>Aplodinotus grunniens</u>

^a Names according to Bailey 1970.

Table 2. Total number of fish collected in the Missouri River by all sampling methods near the Callaway Nuclear Plant, September through November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish/Month			Total No.
	September	October	November	
Gizzard shad	30	279	245	554
Emerald shiner	47	177	42	266
Red shiner	0	65	17	82
Freshwater drum	20	24	19	63
Shovelnose sturgeon	2	21	22	45
Channel catfish	28	12	3	43
Goldeye	3	14	18	35
Silver chub	1	15	12	28
River carpsucker	7	3	17	27
Shorthead redhorse	0	2	13	15
Flathead catfish	11	2	0	13
Speckled chub	0	1	6	7 ^a
Sauger	0	5	2	7
Longnose gar	6	0	0	6
Flathead chub	1	4	0	5
Blue catfish	2	3	0	5
Rainbow smelt	0	0	5	5
Plains minnow	0	4	0	4
Spotted bass	0	1	3	4
Skipjack herring	2	1	0	3
Carp ^a	1	1	1	3
Smallmouth buffalo	0	2	1	3
Shortnose gar	2	0	0	2
Mooneye	0	0	2	2
American eel	1	0	0	1
Sand shiner	0	1	0	1
Blue sucker	1	0	0	1
Golden redhorse	0	0	1	1
White bass	0	0	1	1
White crappie	1	0	0	1
Total	166	637	430	1232

^a All carp had at least one chestnut lamprey attached at time of collection.

Table 3. Number of fish species collected by minnow seine at Missouri River sampling locations near the Callaway Nuclear Plant, September 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish/Location								Total No.	Length Range
	Location									
	A2 ^a	A3 ^a	B2 ^a	B3 ^a	H2 ^a	H3	C2 ^a	C3		
Emerald shiner	--	--	--	--	--	11	--	36	47	43-70
Flathead chub	--	--	--	--	--	1	--	0	1	54
Silver chub	--	--	--	--	--	0	--	1	1	51
TOTAL NO.	--	--	--	--	--	13	--	37	49	

^a Not suitable for sampling due to substrate and water levels.

Table 4. Number of fish species collected by minnow seine at Missouri River sampling locations near the Callaway Nuclear Plant, October 1980.
 REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish/Location							Total No.	Length Range (mm)	
	Location									
	A2 ^a	A3 ^a	B2 ^a	B3 ^a	H3 ^a	H3	C2			C3
Emerald shiner	--	--	--	--	--	48	80	46	174	42-72
Red shiner	--	--	--	--	--	22	33	10	65	25-60
Silver chub	--	--	--	--	--	10	2	0	12	32-62
Flathead chub	--	--	--	--	--	0	0	4	4	55-87
Gizzard shad	--	--	--	--	--	4	0	0	4	130-140
Plains minnow	--	--	--	--	--	2	1	0	3	38-40
Speckled chub	--	--	--	--	--	0	0	1	1	36
TOTAL NO.									263	

^a Not suitable for sampling due to substrate and water levels.

Table 5. Number of fish species collected by minnow seine at Missouri River sampling locations near the Callaway Nuclear Plant, November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish/Location								Total No.	Length Range (mm)
	Location									
	A2 ^a	A3 ^a	B2 ^a	B3 ^a	H2 ^a	H3	C2	C3		
Emerald shiner	--	--	--	--	--	27	4	7	38	35-65
Red shiner	--	--	--	--	--	9	8	1	17	32-45
Silver chub	--	--	--	--	--	5	1	3	9	52-70
Speckled chub	--	--	--	--	--	0	3	3	6	32-38
Rainbow smelt	--	--	--	--	--	5	0	0	5	55-65
River carpsucker	--	--	--	--	--	1	1	1	3	75-92
Gizzard shad	--	--	--	--	--	0	1	0	1	125
TOTAL NO.									79	

^a Not suitable for sampling due to substrate and water levels.

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Table 6. Number and catch-per-effort of fish species collected by electroshocking at Missouri River sampling locations near the Callaway Nuclear Plant, September, 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.	Length Range(mm)		
	Location																	
	A2		A3		B2		B3		H2		H3		C2				C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	
Gizzard shad	1	0.05	3	0.30	0	--	15	0.75	5	0.25	0	--	3	0.15	0	--	27	120-340
Freshwater drum	0	--	2	0.20	0	--	0	--	2	0.10	3	0.15	2	0.10	0	--	9	75-305
River carpsucker	1	0.05	2	0.20	1	0.05	0	--	0	--	2	0.10	1	0.05	0	--	7	270-425
Flathead catfish	0	--	1	0.10	3	0.15	1	0.05	1	0.05	0	--	0	--	0	--	6	141-365
Channel catfish	0	--	3	0.30	1	0.05	0	--	0	--	0	--	2	0.10	0	--	6	168-460
Longnose gar	0	--	2	0.20	0	--	0	--	3	0.15	0	--	0	--	0	--	5	485-700
Goldeye	0	--	0	--	2	0.10	0	--	1	0.05	0	--	0	--	0	--	3	105-324
American eel	0	--	0	--	0	--	0	--	1	0.05	0	--	0	--	0	--	1	740
Blue sucker	0	--	0	--	0	--	0	--	0	--	1	0.05	0	--	0	--	1	666
Shortnose gar	0	--	0	--	0	--	0	--	0	--	1	0.05	0	--	0	--	1	545
White crappie	0	--	0	--	0	--	0	--	0	--	1	0.05	0	--	0	--	1	165
Carp	0	--	0	--	0	--	1	0.05	0	--	0	--	0	--	0	--	1	455
Blue catfish	0	--	0	--	0	--	1	0.05	0	--	0	--	0	--	0	--	1	390
Skipjack herring	1	0.05	0	--	0	--	0	--	0	--	0	--	0	--	0	--	1	275
TOTAL NO. FISH	3		13		7		18		13		8		8		0		70	
TOTAL NO. SPECIES	3		6		4		4		6		5		4		0			
TOTAL CATCH/MINUTE		0.15		1.3		0.35		0.90		0.65		0.40		0.40		--		

^a Number/minute

Table 7. Number and catch-per-effort of fish species collected by electroshocking at Missouri River sampling locations near the Callaway Nuclear Plant, October 1980.

REF. - PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Locations												Total No.	Length Range (mm)				
	Location																	
	A2		A3		B2		B3		H2		H3				C2		C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE			
Gizzard shad	26	1.30	42	2.10	28	1.87	77	3.85	16	1.33	24	1.20	35	2.33	18	0.90	266	100-360
Freshwater drum	3	0.15	2	0.10	5	0.33	3	0.15	0	--	4	0.20	3	0.20	0	--	20	92-355
Goldeye	1	0.05	0	--	1	0.07	0	--	1	0.08	7	0.35	0	--	1	0.05	11	125-394
Channel catfish	0	--	3	0.15	1	0.07	0	--	1	0.08	0	--	0	--	0	--	5	72-525
Sauger	1	0.05	0	--	0	--	2	0.10	0	--	1	0.05	0	--	0	--	4	180-325
River carpsucker	0	--	1	0.05	0	--	1	0.05	0	--	0	--	1	0.07	0	--	3	82-472
Emerald shiner	0	--	0	--	2	0.13	1	0.05	0	--	0	--	0	--	0	--	3	65-87
Silver chub	0	--	0	--	1	0.07	2	0.10	0	--	0	--	0	--	0	--	3	78-81
Shorthead redhorse	0	--	0	--	0	--	0	--	1	0.08	0	--	0	--	0	--	1	392
Flathead catfish	0	--	0	--	0	--	0	--	1	0.08	0	--	0	--	0	--	1	195
Carp	0	--	0	--	0	--	1	0.5	0	--	0	--	0	--	0	--	1	552
Spotted bass	0	--	0	--	0	--	1	0.5	0	--	0	--	0	--	0	--	1	257
Sand shiner	0	--	0	--	1	0.07	0	--	0	--	0	--	0	--	0	--	1	53
Skipjack herring	1	0.05	0	--	0	--	0	--	0	--	0	--	0	--	0	--	1	330
Plains minnow	1	0.05	0	--	0	--	0	--	0	--	0	--	0	--	0	--	1	85
TOTAL NO. FISH	33		48		39		88		20		36		39		19		322	
TOTAL NO. SPECIES	6		4		7		8		5		4		3		2			
TOTAL CATCH/MINUTE		1.65		2.40		2.61		4.40		1.65		1.80		2.60		0.95		

^a Number/minute

Table 8. Number and catch-per-effort of fish species collected by electroshocking at Missouri River sampling locations near the Callaway Nuclear Plant, November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.	Length Range(mm)		
	Location																	
	A2		A3		B2		B3		H2		H3		C2				C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE			
Gizzard shad	31	2.07	33	1.65	10	0.67	49	2.45	17	1.13	78	3.9	9	0.90	16	1.07	243	90-330
Freshwater drum	2	0.12	1	0.05	6	0.40	0	--	6	0.40	0	--	1	0.10	0	--	16	90-350
River carpsucker	1	0.07	0	--	0	--	4	0.20	0	--	3	0.15	1	0.10	0	--	9	83-410
Goldeye	0	--	1	0.05	0	--	0	--	3	0.20	2	0.10	0	--	1	0.07	7	80-398
Shorthead redhorse	1	0.07	0	--	2	0.13	0	--	2	0.13	0	--	0	--	0	--	5	140-402
Emerald shiner	0	--	0	--	0	--	0	--	3	0.20	1	0.05	0	--	0	--	4	60-76
Spotted bass	0	--	0	--	0	--	2	0.10	0	--	1	0.05	0	--	0	--	3	103-295
Silver chub	0	--	0	--	0	--	0	--	0	--	1	0.05	1	0.10	0	--	2	75-90
White bass	0	--	0	--	0	--	0	--	1	0.07	0	--	0	--	0	--	1	185
Sauger	0	--	0	--	0	--	1	0.05	0	--	0	--	0	--	0	--	1	438
Carp	0	--	0	--	0	--	1	0.05	0	--	0	--	0	--	0	--	1	455
Channel catfish	0	--	1	0.05	0	--	0	--	0	--	0	--	0	--	0	--	1	532
TOTAL NO. FISH	35		36		18		57		32		86		12		17		293	
TOTAL NO. SPECIES	4		4		4		5		6		6		4		2			
TOTAL CATCH/MINUTE		2.34		1.80		1.20		2.85		2.13		4.30		1.2		1.14		

^a Number/minute

Table 9. Number and catch-per-effort of fish species collected by gill net at Missouri River sampling locations near the Callaway Nuclear Plant, September 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.	Length Range (mm)		
	Location																	
	A2		A3		B2		B3		H2		H3		C2				C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	
Freshwater drum	0	-	0	-	0	-	3	1.5	0	-	0	-	0	-	0	-	3	96-225
Gizzard shad	0	-	0	-	0	-	0	-	0	-	0	-	3	1.5	0	-	3	295-302
Shovelnose sturgeon	0	-	2	1.0	0	-	0	-	0	-	0	-	0	-	0	-	2	650-715
Blue catfish	0	-	0	-	0	-	0	-	0	-	1	0.5	0	-	0	-	1	116
Shortnose gar	0	-	0	-	0	-	0	-	0	-	0	-	1	0.5	0	-	1	500
Longnose gar	0	-	0	-	0	-	0	-	0	-	0	-	1	0.5	0	-	1	666
Flathead catfish	1	0.5	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	505
TOTAL NO. FISH	1		2		0		3		0		1		5		0		12	
TOTAL NO. SPECIES	1		1		0		1		0		1		3		0			
TOTAL CATCH/24 hr.		0.5		1.0		-		1.5		-		0.5		2.5		-		

^a Number/24 hours.

Table 10. Number and catch-per-effort of fish species collected by gill net at Missouri River sampling locations near Callaway Nuclear Plant, October 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location																Total No.	Length Range (mm)
	Location																	
	A2		A3		B2		B3		H2		H3		C2		C3			
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	
Shovelnose sturgeon	3	1.4	0	-	0	-	0	-	0	-	1	0.5	17	8.3	0	-	21	405-685
Gizzard shad	3	1.4	0	-	0	-	6	2.8	0	-	0	-	0	-	0	-	9	259-360
Goldeye	0	-	0	-	0	-	2	1.0	1	0.5	0	-	0	-	0	-	3	225-394
Freshwater drum	0	-	0	-	1	0.5	0	-	0	-	0	-	1	0.5	0	-	2	260-337
Smallmouth buffalo	0	-	0	-	0	-	2	1.0	0	-	0	-	0	-	0	-	2	612-618
Channel catfish	0	-	0	-	0	-	2	1.0	0	-	0	-	0	-	0	-	2	426-473
Blue catfish	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	0	-	1	466
Sauger	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	1	b
TOTAL NO. FISH	6		1		1		13		1		1		18		0		41	
TOTAL NO. SPECIES	2		1		1		5		1		1		2		0			
TOTAL CATCH/24 hr.		2.8		0.5		0.5		6.3		0.5		0.5		8.8		-		

^a Number/24 hours.

^b Escaped before a weight or length was taken.

Table 11. Number and catch-per-effort of fish species collected by gill net at Missouri River sampling locations near the Callaway Nuclear Plant, November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.	Length Range (mm)		
	Location																	
	A2		A3		B2		B3		H2		H3		C2				C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	
Shovelnose sturgeon	0	-	6	3.0	0	-	0	-	0	-	0	-	16	8.0	0	-	22	325-650
Goldeye	0	-	0	-	7	3.5	1	0.5	0	-	0	-	0	-	0	-	8	230-330
Freshwater drum	0	-	1	0.5	1	0.5	1	0.5	0	-	0	-	0	-	0	-	3	235-345
Shorthead redhorse	0	-	0	-	1	0.5	0	-	1	0.5	0	-	1	0.5	0	-	3	310-330
River carpsucker	0	-	1	0.5	0	-	1	0.5	0	-	0	-	0	-	0	-	2	330-385
Sauger	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	1	360
Mooneye	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	1	210
Golden redhorse	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	1	405
Channel catfish	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	1	320
Smallmouth buffalo	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	1	265
Gizzard shad	0	-	0	-	0	-	0	-	1	0.5	0	-	0	-	0	-	1	253
TOTAL NO. FISH	0		8		11		6		2		0		17		0		44	
TOTAL NO. SPECIES	0		3		5		6		2		0		2		0			
TOTAL CATCH/24 hr.		-		4.0		5.5		3.0		1.0		-		8.5		-		

^a Number/24 hours.

Table 12. Number and catch-per-effort of fish species collected by trap net at Missouri River sampling locations near the Callaway Nuclear Plant, September 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location																Total No.	Length Range (mm)
	Location																	
	A2		A3		B2		B3		H2		H3		C2		C3			
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	
Channel catfish	4	5.5	1	0.6	2	1.0	0	-	2	1.2	0	-	0	-	13	6.7	22	76-180
Freshwater drum	0	-	3	1.8	1	0.5	1	0.5	3	1.8	0	-	0	-	0	-	8	71-325
Flathead catfish	0	-	0	-	1	0.5	1	0.5	1	0.6	0	-	0	-	1	0.5	4	160-290
Skipjack herring	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	0.5	1	117
TOTAL NO. FISH	4		4		4		2		6		0		0		15		35	
TOTAL NO. SPECIES	1		2		3		2		3		0		0		3			
TOTAL CATCH/24 hr.		5.5		2.4		2.0		1.0		3.6		-		-		7.7		

^a Number/24 hours.

Table 13. Number and catch-per-effort of fish species collected by trap net at Missouri River sampling locations near the Callaway Nuclear Plant, October 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.	Length Range (mm)		
	Location																	
	A2		A3		B2		B3		H2		H3		C2				C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE			
Channel catfish	0	-	0	-	1	0.5	0	-	0	-	0	-	1	0.5	3	1.5	5	90-125
Blue catfish	2	1.0	0	-	0	-	0	-	0	-	0	-	0	-	0	-	2	210-255
Freshwater drum	0	-	0	-	0	-	0	-	2	1.0	0	-	0	-	0	-	2	205-245
Flathead catfish	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	1	100
Shorthead redhorse	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	0.5	1	380
TOTAL NO. FISH	2		0		2		0		2		0		1		4		11	
TOTAL NO. SPECIES	1		0		2		0		1		0		1		2			
TOTAL CATCH/24 hr.		1.0		-		1.0		-		1.0		-		0.5		2.0		

^a Number/24 hours.

Table 14. Number and catch-per-effort of fish species collected by trap net at Missouri River sampling locations near the Callaway Nuclear Plant, November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-Effort ^a /Sampling Location														Total No.	Length Range (mm)		
	Location																	
	A2		A3		B2		B3		H2		H3		C2				C3	
No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.	CPE	No.		
Shorthead redhorse	0	-	0	-	2	1.0	0	-	0	-	3	1.6	0	-	0	-	5	55-365
River carpsucker	0	-	0	-	3	1.5	0	-	0	-	0	-	0	-	0	-	3	140-310
Goldeye	0	-	0	-	3	1.5	0	-	0	-	0	-	0	-	0	-	3	138-242
Mooneye	0	-	0	-	1	0.5	0	-	0	-	0	-	0	-	0	-	1	255
Channel catfish	0	-	0	-	0	-	0	-	0	-	1	0.5	0	-	0	-	1	80
Silver chub	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	0.5	1	105
TOTAL NO. FISH	0		0		9		0		0		4		0		1		14	
TOTAL NO. SPECIES	0		0		4		0		0		2		0		1			
TOTAL CATCH/24 hr.		-		-		4.5			-			2.1		-		0.5		

^a Number/24 hours.

Table 15. Total number of fish collected in Logan and Mud Creeks by all sampling methods near the Callaway Nuclear Plant, September through November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish/Month			Total No.
	September	October	November	
Green sunfish	22	22	6	50
Bluegill	10	12	4	26
Blackstripe topminnow	7	6	12	25
Black bullhead	4	7	0	11
Redfin shiner	1	0	10	11
Longear sunfish	2	5	0	7
Golden shiner	2	4	0	6
White crappie	5	1	0	6
Bluntnose minnow	3	2	0	5
Spotted bass	3	1	1	5
Gizzard shad	4	0	0	4
Sand shiner	2	0	0	2
White sucker	2	0	0	2
Brook silversides	0	0	2	2
Mosquitofish	0	0	1	1
Largemouth bass	1	0	0	1
Smallmouth buffalo	1	0	0	1
TOTAL NO.	69	60	36	165

Table 16. Number and catch-per-effort of fish species collected by Electroshocking at Logan and Mud Creek Sampling Locations near the Callaway Nuclear Plant, September 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-effort ^a /Sampling Location							
	Location						Total No.	Length Range (mm)
	E1		E2b		D			
No.	CPE	No.	CPE	No.	CPE	No.		
Green sunfish	11	1.1	9	0.9	0	-	20	65-155
Bluegill	1	0.1	0	-	2	0.2	3	40- 83
Gizzard shad	1	0.1	0	-	1	0.1	2	95-115
Bluntnose minnow	1	0.1	0	-	0	-	1	65
Black bullhead	0	-	4	0.4	0	-	4	140-255
Largemouth bass	0	-	1	0.1	0	-	1	178
White sucker	0	-	2	0.2	0	-	2	135-158
Redfin shiner	0	-	1	0.1	0	-	1	51
Golden shiner	0	-	2	0.2	0	-	2	125-155
White crappie	0	-	0	-	1	0.1	1	72
Smallmouth buffalo	0	-	0	-	1	0.1	1	85
TOTAL NO. FISH	14		19		5		38	
TOTAL NO. SPECIES	4		6		4			
TOTAL CATCH/Minute		1.4		1.9		0.5		

^a Number/minute.

^b Shocking location was moved 30 yards downstream due to low water levels and an apparent oil spill.

Table 17. Number and catch-per-effort of fish species collected by electroshocking at Logan and Mud Creek sampling locations near the Callaway Nuclear Power Plant, October 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish and Catch-per-effort ^a /Sampling Location						Total No.	Length Range (mm)
	Location							
	E1		E2		D			
No.	CPE	No.	CPE	No.	CPE			
Green sunfish	4	0.4	10	1.0	0	-	14	35-150
Black bullhead	0	-	6	0.6	0	-	6	130-160
Bluegill	1	0.1	0	-	4	0.4	5	42-100
Blackstripe topminnow	1	0.1	0	-	1	0.1	2	45- 72
Longear sunfish	2	0.2	0	-	0	-	2	48- 72
Bluntnose minnow	2	0.2	0	-	0	-	2	53- 60
Golden shiner	0	-	2	0.2	0	-	2	150-195
Spotted bass	0	-	0	-	1	0.1	1	61
TOTAL NO. FISH	10	.	18		6		34	
TOTAL NO. SPECIES	5		3		3			
TOTAL CATCH/Minute		1.0		1.8		0.6		

^a Number/Minute.

Table 18. Number and catch-per-effort of fish species collected by electroshocking at Logan and Mud Creek sampling locations near the Callaway Nuclear Plant, November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Location						Total No.	Length Range (mm)
	E1		E2		D			
	No.	CPE	No.	CPE	No.	CPE		
Green sunfish	5	0.5	1	0.1	0	-	6	98-135
Blackstripe topminnow	1	0.1	0	-	3	0.3	4	53- 61
Spotted bass	1	0.1	0	-	0	-	1	80
Mosquitofish	0	-	1	0.1	0	-	1	42
TOTAL NO. FISH	7		2		3		12	
TOTAL NO. SPECIES	3		2					
TOTAL CATCH/Minute		0.7		0.2		0.3		

^a Number/minute.

Table 19. Number of fish species collected by minnow seine at Logan and Mud Creek sampling locations near Callaway Nuclear Plant, September through November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Species	Number of Fish/Sampling Location/Month												3 Month Total	Length Range (mm)
	September				October				November					
	Location			Total No.	Location			Total No.	Location			Total No.		
	E1	E2 ^a	D		E1	E2	D		E1	E2	D			
Blackstrine topminnow	7	0	0	7	1	1	2	4	1	3	4	8	19	40- 70
Bluegill	2	0	5	7	1	0	6	7	0	0	4	4	18	30- 90
Redfin shiner	0	0	0	0	0	0	0	0	10	0	0	10	10	48- 62
Green sunfish	2	0	0	2	4	3	1	8	0	0	0	0	10	33-172
Longear sunfish	2	0	0	2	3	0	0	3	0	0	0	0	5	41-105
White crappie	0	0	4	4	0	0	1	1	0	0	0	0	5	71-130
Spotted bass	0	0	3	3	0	0	0	0	0	0	0	0	3	77- 79
Gizzard shad	2	0	0	2	0	0	0	0	0	0	0	0	2	111-130
Bluntnose minnow	2	0	0	2	0	0	0	0	0	0	0	0	2	65- 72
Sand shiner	2	0	0	2	0	0	0	0	0	0	0	0	2	62- 67
Golden shiner	0	0	0	0	0	2	0	2	0	0	0	0	2	35- 42
Brook silversides	0	0	0	0	0	0	0	0	2	0	0	2	2	62- 65
Black bullhead	0	0	0	0	0	1	0	1	0	0	0	0	1	105
TOTAL NO. FISH	19	0	12	31	9	7	10	26	13	3	8	24	81	

^a Seining location moved 30 yards downstream due to low water and apparent oil spill.

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Table 1. Number and density of ichthyoplankton collected at Missouri River sampling locations near Callaway Nuclear Power Plant, September 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

		Number of Ichthyoplankton and Density (No/100m ³)/Location											
		Location											
Taxon	Replicate	B1 Surface		B2 Surface		B2 Mid-Depth		B3 Surface		C1 Surface		C2 Surface	
		No.	Density	No.	Density	No.	Density	No.	Density	No.	Density	No.	Density
Cyprinidae	1	1	0.9	2	2.2	1	0.9	1	0.9	0	-	1	0.8
	2	0	-	0	-	0	-	0	-	0	-	0	-
	3	0	-	2	1.8	1	1.2	0	-	0	-	2	1.8
TOTAL		1	0.3	4	1.3	2	0.7	1	0.3	0	-	3	0.8
Freshwater drum	1	0	-	0	-	0	-	0	-	0	-	0	-
	2	0	-	1	0.9	0	-	0	-	0	-	0	-
	3	0	-	1	0.9	0	-	0	-	0	-	1	0.9
TOTAL		0	-	2	0.6	0	-	0	-	0	-	1	0.3

Table 2. Number of ichthyoplankton collected in Logan and Mud Creeks near the Callaway Nuclear Power Plant, September through November 1980.

REF. PREOPERATIONAL MONITORING PROGRAM SEPTEMBER-NOVEMBER 1980

Taxon	Number of Ichthyoplankton/Month/Location												3 Month Total
	September				October				November				
	E1	E2	D	Total	E1	E2	D	Total	E1	E2	D	Total	
Mosquitofish	10	4	1	15	12	2	1	15	0	0	0	0	30
Blackstripe topminnow	5	1	0	6	4	0	0	4	0	0	0	0	10
<u>Lepomis</u> sp.	1	0	5	6	1	0	0	1	0	0	0	0	7
Bluntnose minnow	2	0	0	2	0	0	0	0	0	0	0	0	2
Green sunfish	0	1	0	1	0	0	0	0	0	0	0	0	1
Bluegill	0	0	0	0	0	0	1	1	0	0	0	0	1
TOTAL NO.	18	6	6	30	17	2	2	21	0	0	0	0	51

APPENDIX G
Water Quality

TABLE 2.3.1-1

MISSOURI RIVER WATER QUALITY DATA
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Parameter	Sample Date	Transect A		Transect B		Transect C		Average
		A-1	A-2	B-1	B-2	C-1	C-2	
Temperature °C	April '73	13.0	13.0	12.0	12.0	11.0	11.0	12.0
	July '73	30.0	29.0	29.0	29.0	29.0	28.5	29.1
	Sept. '73	24.8	24.8	24.5	24.9	24.5	24.9	24.7
	Dec. '73	2.8	2.9	2.9	2.8	2.9	2.9	2.9
	Feb. '74	4.0	4.0	4.0	4.0	4.0	4.0	4.0
pH Standard Units	April '73	6.4	6.8	6.5	6.7	6.7	6.6	6.6
	July '73	8.3	8.3	8.2	8.3	8.3	8.3	8.3
	Sept. '73	7.9	8.0	8.0	8.0	8.1	8.0	8.0
	Dec. '73	7.9	7.9	7.9	7.9	7.9	7.9	7.9
	Feb. '74	7.5	7.4	7.3	7.5	7.3	7.2	7.4
Conductivity µmhos/cm	April '73	220	300	250	300	260	300	272
	July '73	575	575	500	550	500	575	546
	Sept. '73	700	700	625	700	600	700	671
	Dec. '73	490	490	480	500	400	440	467
	Feb. '74	330	360	260	370	260	345	321
Turbidity FTU	April '73	550	600	575	575	525	600	571
	July '73	210	215	215	210	215	100	194
	Sept. '73	22	16	18	19	17	19	19
	Dec. '73	43	42	41	42	40	40	41
	Feb. '74	125	160	120	140	50	130	121
Chloride mg/l	April '73	19	20	20	20	17	20	19
	July '73	21	22	19	22	17	30	22
	Sept. '73	27	26	21	26	22	26	25
	Dec. '73	26	29	24	28	28	28	27
	Feb. '74	19	24	15	25	14	22	20

G-1

TABLE 2.3.1-1 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Parameter	Sample Date	Transect A		Transect B		Transect C		Average
		A-1	A-2	B-1	B-2	C-1	C-2	
Nitrate mg/l N	April '73	3.0	4.5	4.3	3.3	2.5	3.8	3.6
	July '73	2.9	3.0	2.5	3.2	2.5	2.2	2.7
	Sept. '73	0.3	0.4	0.6	0.7	0.4	0.4	0.5
	Dec. '73	1.3	1.3	1.3	1.2	1.3	1.3	1.3
	Feb. '74	1.5	1.9	1.3	1.7	1.4	2.0	1.6
Organic Nitrogen mg/l	April '73	-	-	-	-	-	-	-
	July '73	3.6	3.2	3.2	3.9	2.5	1.4	3.0
	Sept. '73	0.7	0.7	0.6	0.6	0.6	0.6	0.6
	Dec. '73	6.9	0.9	1.0	1.1	0.9	0.8	0.9
	Feb. '74	1.2	1.4	1.3	1.4	1.3	1.8	1.4
Total Organic Carbon mg/l	April '73	44	62	39	44	48	113	58
	July '73	-	-	-	-	-	-	-
	Sept. '73	-	-	-	-	-	-	-
	Dec. '73	-	-	-	-	-	-	-
	Feb. '74	-	-	-	-	-	-	-
Orthophosphate mg/l P	April '73	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	July '73	0.01	0.06	0.01	0.01	0.01	0.01	<0.02
	Sept. '73	0.19	0.19	0.18	0.16	0.13	0.16	0.17
	Dec. '73	0.18	0.18	0.16	0.17	0.17	0.14	0.17
	Feb. '74	0.11	0.13	0.09	0.13	0.07	0.12	0.11
Total Phosphorus mg/l P	April '73	0.53	0.57	0.56	0.57	0.41	0.50	0.52
	July '73	0.69	0.66	0.66	0.69	0.65	0.33	0.61
	Sept. '73	0.24	0.22	0.21	0.19	0.17	0.18	0.20
	Dec. '73	0.27	0.28	0.26	0.25	0.25	0.21	0.25
	Feb. '74	0.19	0.23	0.15	0.23	0.15	0.23	0.20

G-2

TABLE 2.3.1-1 (Continued)

Parameter	REF. ENV.	BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT						
	Sample	Transect A		Transect B		Transect C		Average
	Date	A-1	A-2	B-1	B-2	C-1	C-2	
Dissolved Oxygen mg/l	April '73	8.2	8.0	7.5	7.2	7.1	7.7	7.6
	July '73	6.4	5.8	5.7	6.8	6.2	5.7	6.1
	Sept. '73	7.5	7.3	7.5	7.5	7.5	6.9	7.4
	Dec. '73	12.9	12.9	12.7	12.6	12.9	13.0	12.8
	Feb. '74	12.0	12.0	11.8	11.6	11.6	12.0	11.8
Chemical Oxygen Demand mg/l	April '73	102	82	94	123	94	82	95
	July '73	66	56	57	62	48	22	52
	Sept. '73	20	14	16	12	12	8	14
	Dec. '73	14	14	17	19	24	17	18
	Feb. '74	25	32	23	32	14	17	24
Total Suspended Solids mg/l	April '73	659	772	624	652	412	664	631
	July '73	912	760	860	850	776	238	733
	Sept. '73	128	124	118	107	92	32	100
	Dec. '73	133	125	140	101	128	91	120
	Feb. '74	196	234	144	208	90	204	179
Total Dissolved Solids mg/l	April '73	525	444	530	473	605	472	508
	July '73	306	232	288	280	248	292	274
	Sept. '73	506	530	540	519	450	518	511
	Dec. '73	414	482	528	538	484	544	498
	Feb. '74	472	530	414	514	384	458	462
Total Solids mg/l	April '73	1184	1216	1154	1125	1017	1136	1139
	July '73	1218	992	1148	1130	1024	530	1007
	Sept. '73	634	654	658	626	542	550	611
	Dec. '73	547	607	668	639	612	635	618
	Feb. '74	668	764	558	722	474	662	641

TABLE 2.3.1-1 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Parameter	Sample Date	Transect A		Transect B		Transect C		Average
		A-1	A-2	B-1	B-2	C-1	C-2	
Hardness mg/l CaCO ₃	April '73	-	-	-	-	-	-	-
	July '73	-	-	-	-	-	-	-
	Sept. '73	235	228	217	229	200	226	223
	Dec. '73	246	246	234	240	232	237	239
	Feb. '74	186	208	160	214	162	198	188
Arsenic mg/l	April '73	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	July '73	0.012	0.009	0.014	0.008	0.010	0.008	0.010
	Sept. '73	0.004	0.004	0.004	0.006	0.004	0.005	0.005
	Dec. '73	0.002	0.003	0.003	0.003	0.002	0.002	0.003
	Feb. '74	0.002	0.003	0.002	0.003	0.002	0.003	0.003
Cadmium mg/l	April '73	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	July '73	0.006	0.005	0.005	0.007	0.005	0.006	0.006
	Sept. '73	0.006	0.008	0.003	0.003	0.001	<0.001	<0.004
	Dec. '73	0.008	0.001	0.001	0.002	0.002	0.006	0.003
	Feb. '74	0.027	0.014	0.015	0.016	0.015	0.018	0.018
Iron (total) mg/l	April '73	11.6	11.0	12.4	12.0	11.2	12.4	11.8
	July '73	5.4	5.5	0.1	5.6	0.9	3.1	3.4
	Sept. '73	1.4	1.3	1.4	1.3	1.3	0.7	1.2
	Dec. '73	2.4	1.4	1.3	2.0	1.3	1.3	1.6
	Feb. '74	2.5	2.5	1.1	1.6	1.1	1.7	1.8
Copper mg/l	April '73	<0.02	0.66 ^a	<0.02	<0.02	<0.02	<0.02	<0.13
	July '73	0.029	0.027	0.028	0.029	0.031	0.016	0.027
	Sept. '73	0.021	0.012	0.013	0.012	0.007	0.004	0.012
	Dec. '73	0.003	0.002	0.004	0.003	0.003	0.004	0.003
	Feb. '74	0.017	0.019	0.014	0.019	0.018	0.020	0.018

TABLE 2.3.1-1 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Parameter	Sample Date	Transect A		Transect B		Transect C		Average
		A-1	A-2	B-1	B-2	C-1	C-2	
Lead mg/l	April '73	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	July '73	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Sept. '73	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Dec. '73	0.01	0.02	0.01	0.05	0.03	0.03	0.03
	Feb. '74	0.02	<0.02	0.02	0.02	<0.02	<0.02	<0.02
Mercury µg/l	April '73	<0.5	<0.5	<0.5	<0.5	<0.5	5.5 ^a	<1.3
	July '73	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Sept. '73	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
	Dec. '73	0.6	0.1	<0.1	<0.1	0.4	0.3	<0.3
	Feb. '74	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium mg/l	April '73	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	July '73	0.008	0.006	0.007	0.005	0.007	0.003	0.006
	Sept. '73	0.005	0.003	0.027	<0.003	0.006	<0.003	<0.008
	Dec. '73	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Feb. '74	0.004	0.005	0.003	0.003	0.003	0.010	0.005
Selenium mg/l	April '73	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	July '73	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Sept. '73	0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001
	Dec. '73	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001
	Feb. '74	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate mg/l	April '73	63	63	56	63	55	63	61
	July '73	184	178	168	192	153	139	169
	Sept. '73	165	161	172	161	113	161	156
	Dec. '73	96	90	90	93	85	88	89
	Feb. '74	73	89	57	96	61	85	77

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TABLE 2.3.1-1 (Continued)
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Parameter	Sample Date	Transect A		Transect B		Transect C		Average
		A-1	A-2	B-1	B-2	C-1	C-2	
Hexane Solubles mg/l	April '73	5	10	12	10	21	13	12
	July '73	2	2	3	5	3	4	3
	Sept. '73	4	6	7	7	3	3	5
	Dec. '73	10	9	6	7	8	8	8
	Feb. '74	5	6	6	6	6	7	6
Fecal Coliforms number/100 ml	April '73	3000	2000	4000	7000	7000	2000	4167
	July '73	3600	5800	4100	9600	2500	2700	4717
	Sept. '73	800	1700	1900	1600	840	2100	1490
	Dec. '73	4200	3300	2200	8700	4400	3600	4400
	Feb. '74	980	1100	670	830	700	890	862
Total Coliforms number/100 ml	April '73	17,000	30,000	6000	8000	19,000	9000	14,800
	July '73	12,000	24,000	11,000	16,000	4100	21,000	14,700
	Sept. '73	21,000	18,000	12,000	24,000	3400	4100	13,800
	Dec. '73	8100	9400	9200	41,000	32,000	27,000	21,100
	Feb. '74	6800	7400	4300	1200	2600	2200	4100

^aPossible Sample Contamination

TABLE 2.3.1-2

HISTORICAL DATA ON MISSOURI RIVER WATER QUALITY
(From EPA STORET System)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Sampling Site: Hermann, Missouri

Longitude: 38-42-36 N

Latitude: 91-26-21 W

Time of Record: 7/31/69 to 4/18/72

(Based on flow
data)

<u>Parameter</u>	<u>Number of Samples</u>	<u>Mean Value</u>	<u>Maximum Value</u>	<u>Minimum Value</u>
Water Temperature, °C	18	12.9	27	0
Dissolved Oxygen, mg/l	18	8.9	13	5.6
Turbidity, JTU	11	132	330	19
Flow, cfs. entire	18	80,500	230,000	19,000
pH, units	18	7.9	8.3	7.7
Dissolved Solids, mg/l	18	375	499	253
Specific Conductance, micromhos/cm	18	577	770	359
Total Hardness, mg/l as CaCO ₃	18	213	260	140
Calcium, mg/l	11	56	70	38
Magnesium, mg/l	11	17	21	11
Alkalinity, mg/l as CaCO ₃	18	157	197	112
Ammonia Nitrogen, mg/l	18	0.06	0.49	0
Organic Nitrogen, mg/l	10	0.71	1.20	0.44
Total Phosphorous, mg/l	18	0.39	1.70	0.03
Chemical Oxygen Demand, mg/l	8	12.3	28	5.6
Sulfate, mg/l	18	120	186	56
Chloride, mg/l	12	16	25	8
Iron, µg/l	11	182	900	0
Cadmium, µg/l	11	1	5	0
Chromium, µg/l	11	3.2	16	0
Copper, µg/l	11	38.5	180	0
Lead, µg/l	10	7.3	15	0
Manganese, µg/l	15	31	221	0
Mercury, µg/l	1	0.5	0.5	0.5
Zinc, µg/l	11	67.4	210	14

TABLE 2.3.1-3

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE VALUES FOR DIFFERENCES
 AMONG STATIONS AND SEASONS IN WATER QUALITY PARAMETERS
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Water Quality Parameter</u>	<u>Station Variance^a</u>		<u>Seasonal Variance^b</u>	
	<u>H Value</u>	<u>Significance^c</u>	<u>H Value</u>	<u>Significance</u>
pH	0.2799	ns	27.8408	*
Turbidity	0.3160	ns	27.1733	*
Temperature	0.0270	ns	27.8407	*
Conductivity	1.1932	ns	26.9677	*
Dissolved oxygen	0.3109	ns	27.6712	*
Chemical oxygen demand	1.4718	ns	23.5880	*
Total suspended solids	1.6885	ns	23.7195	*
Total dissolved solids	0.8887	ns	16.0878	*

^aTests for differences among stations for all sampling periods.

^bTests for seasonal differences in data from the same station.

^cns = nonsignificant, $p > 0.05$

* = significant

(All significant p values in these analyses were ≤ 0.001)

TABLE 2.3.1-4

WILCOXAN'S TWO SAMPLE TEST RESULTS FOR
 DIFFERENCES BETWEEN STATIONS IN
 WATER QUALITY PARAMETERS^a
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

Stations Compared	pH	Turbidity	Temperature	Conductivity	Dissolved Oxygen	Chemical Oxygen Demand	Total Suspended Solids	Total Dissolved Solids
A1, A2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
A1, B1	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
A1, B2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
A1, C1	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p= <u>.005</u>	p=.025
A1, C2	p=.025	p=.025	p=.025	p=.025	p= <u>.005</u>	p= <u>.005</u>	p=.025	p=.025
A2, B1	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
A2, B2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
A2, C1	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
A2, C2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
B1, B2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
B1, C1	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p= <u>.005</u>	p=.025
B1, C2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025
B2, C1	p=.025	p=.025	p=.025	p= <u>.005</u>	p=.025	p=.025	p=.025	p=.025
B2, C2	p=.025	p=.025	p=.025	p= <u>.005</u>	p=.025	p= <u>.005</u>	p=.025	p=.025
C1, C2	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025	p=.025

^ap=.005 is significant
 p=.025 is nonsignificant

TABLE 2.3.1-5

LOGAN CREEK WATER QUALITY DATA
 REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Parameter</u>	<u>Sample Date</u>	<u>Station D-1</u>	<u>Station E-1</u>	<u>Missouri River Average</u>
Temperature °C	April '73	12.5	-	12.0
	July '73	27.2	23.5	29.1
	Sept. '73	21.5	21.0	24.7
	Dec. '73	2.0	0.9	2.9
	Feb. '74	5.0	5.5	4.0
pH Standard Units	April '73	6.3	-	6.6
	July '73	8.6	7.8	8.3
	Sept. '73	7.7	8.1	8.0
	Dec. '73	7.4	7.8	7.9
	Feb. '74	7.2	7.3	7.4
Conductivity µmhos/cm	April '73	296	-	272
	July '73	750	264	546
	Sept. '73	600	430	671
	Dec. '73	425	295	467
	Feb. '74	225	220	321
Turbidity FTU	April '73	220	-	571
	July '73	70	90	194
	Sept. '73	23	3	19
	Dec. '73	10	7	41
	Feb. '74	5	3	121
Chloride mg/l	April '73	17	-	19
	July '73	7	2	22
	Sept. '73	5	3	25
	Dec. '73	5	5	27
	Feb. '74	3	2	20

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TABLE 2.3.1-5 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Parameter</u>	<u>Sample Date</u>	<u>Station D-1</u>	<u>Station E-1</u>	<u>Missouri River Average</u>
Nitrate mg/l N	April '73	5.3	-	3.6
	July '73	0.2	1.2	2.7
	Sept. '73	0.1	0.1	0.5
	Dec. '73	<0.1	0.6	1.3
	Feb. '74	0.5	0.3	1.6
Organic Nitrogen mg/l	April '73	-	-	-
	July '73	1.2	0.2	3.0
	Sept. '73	0.7	0.5	0.6
	Dec. '73	0.7	0.4	0.9
	Feb. '74	1.4	1.1	1.4
Total Organic Carbon mg/l	April '73	34	-	58
	July '73	-	-	-
	Sept. '73	-	-	-
	Dec. '73	-	-	-
	Feb. '74	-	-	-
Orthophosphate mg/l P	April '73	<0.01	-	<0.01
	July '73	0.06	0.01	<0.02
	Sept. '73	0.13	0.02	0.17
	Dec. '73	0.02	0.01	0.17
	Feb. '74	0.03	0.06	0.11
Total Phosphorus mg/l P	April '73	0.17	-	0.52
	July '73	0.15	0.02	0.61
	Sept. '73	0.23	0.05	0.20
	Dec. '73	0.12	0.10	0.25
	Feb. '74	0.12	0.06	0.20

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TABLE 2.3.1-5. (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Parameter</u>	<u>Sample Date</u>	<u>Station D-1</u>	<u>Station E-1</u>	<u>Missouri River Average</u>
Dissolved Oxygen mg/l	April '73	9.4	-	7.6
	July '73	5.6	5.8	6.1
	Sept. '73	3.4	6.4	7.4
	Dec. '73	9.8	10.2	12.8
	Feb. '74	11.8	12.3	11.8
Chemical Oxygen Demand mg/l	April '73	127	-	96
	July '73	22	4	52
	Sept. '73	20	8	14
	Dec. '73	8	5	18
	Feb. '74	32	23	24
Total Suspended Solids mg/l	April '73	384	-	631
	July '73	76	1	733
	Sept. '73	118	18	100
	Dec. '73	18	5	120
	Feb. '74	98	34	179
Total Dissolved Solids mg/l	April '73	117	-	508
	July '73	364	210	274
	Sept. '73	476	320	511
	Dec. '73	394	496	498
	Feb. '74	270	318	462
Total Solids mg/l	April '73	501	-	1139
	July '73	440	211	1007
	Sept. '73	594	338	611
	Dec. '73	412	501	618
	Feb. '74	368	352	641

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TABLE 2.3.1-5 (Continued).

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Parameter</u>	<u>Sample Date</u>	<u>Station D-1</u>	<u>Station E-1</u>	<u>Missouri River Average</u>
Hardness mg/l CaCO ₃	April '73	-	-	-
	July '73	-	-	-
	Sept. '73	351	247	223
	Dec. '73	340	264	239
	Feb. '74	92	102	188
Arsenic mg/l	April '73	<0.01	-	<0.01
	July '73	0.006	<0.001	0.010
	Sept. '73	0.004	<0.001	0.005
	Dec. '73	0.004	<0.001	0.003
	Feb. '74	<0.001	<0.001	0.003
Cadmium mg/l	April '73	<0.02	-	<0.02
	July '73	0.005	0.005	0.006
	Sept. '73	0.008	0.005	<0.004
	Dec. '73	0.002	0.001	0.003
	Feb. '74	0.009	0.009	0.018
Iron (total) mg/l	April '73	3.0	-	11.8
	July '73	5.6	5.2	3.4
	Sept. '73	1.8	0.1	1.2
	Dec. '73	1.2	0.3	1.6
	Feb. '74	3.1	0.7	1.8
Copper mg/l	April '73	<0.02	-	<0.13
	July '73	0.010	0.008	0.027
	Sept. '73	0.015	0.005	0.012
	Dec. '73	<0.002	0.003	0.003
	Feb. '74	0.014	0.016	0.018

TABLE 2.3.1-5 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Parameter</u>	<u>Sample Date</u>	<u>Station D-1</u>	<u>Station E-1</u>	<u>Missouri River Average</u>
Lead mg/l	April '73	<0.05	-	<0.05
	July '73	<0.01	<0.01	<0.01
	Sept. '73	<0.02	<0.02	<0.02
	Dec. '73	0.07	0.02	0.03
	Feb. '74	0.02	<0.02	<0.02
Mercury mg/l	April '73	<0.5	-	<1.3
	July '73	<0.1	<0.1	<0.1
	Sept. '73	<0.1	0.1	<0.1
	Dec. '73	0.4	0.4	<0.3
	Feb. '74	<0.1	<0.1	<0.1
Chromium mg/l	April '73	<0.02	-	<0.02
	July '73	0.004	0.005	0.006
	Sept. '73	0.008	0.009	<0.008
	Dec. '73	<0.003	<0.003	<0.003
	Feb. '74	0.006	0.004	0.005
Selenium mg/l	April '73	<0.1	-	<0.1
	July '73	<0.001	<0.001	<0.001
	Sept. '73	<0.001	<0.001	<0.001
	Dec. '73	<0.001	<0.001	<0.001
	Feb. '74	<0.001	<0.001	<0.001
Sulfate mg/l	April '73	66	-	61
	July '73	30	8	169
	Sept. '73	17	19	156
	Dec. '73	29	23	89
	Feb. '74	15	17	77

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TABLE 2.3.1-5 (Continued)

REF. ENV. BASELINE INVENTORY - ANNUAL SUMMARY CALLAWAY PLANT

<u>Parameter</u>	<u>Sample Date</u>	<u>Station D-1</u>	<u>Station E-1</u>	<u>Missouri River Average</u>
Hexane Solubles mg/l	April '73	8	-	12
	July '73	1	2	3
	Sept. '73	4	1	5
	Dec. '73	7	6	8
	Feb. '74	4	6	6
Fecal Coliforms number/100 ml	April '73	1000	-	4167
	July '73	120	130	4717
	Sept. '73	20	380	1490
	Dec. '73	210	90	4400
	Feb. '74	1100	440	862
Total Coliforms number/100 ml	April '73	10,000	-	14,800
	July '73	120	2,200	14,700
	Sept. '73	110	13,000	13,800
	Dec. '73	260	200	21,100
	Feb. '74	1600	830	4100

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TABLE 2.3.1-1
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 WATER QUALITY DATA FROM THE MISSOURI RIVER AND LOGAN CREEK, SPRING 1974^a

Parameter	Missouri River Stations				Logan Creek Stations		
	H-1	H-2	C-1	C-2	D	E	E-2
Alkalinity (as CaCO ₃) Bicarbonate	150	168	157	164	333	139	212
Ammonia	.08	.08	.07	.06	.02	.02	.02
Biochemical Oxygen Demand	0.8	0.9	0.6	0.9	0.4	1.0	1.7
Chemical Oxygen Demand	25.6	32.6	21.0	42.1	12.8	20.8	16.3
Chloride	15.3	19.9	16.7	20.5	5.80	5.30	4.60
Total Hardness (as CaCO ₃)	196	217	198	220	323	184	231
Hexane Sol. Materials	<.002	<.001	<.001	<.001	<.001	<.002	<.001
Nitrate	1.59	1.59	0.80	2.80	0.78	0.69	0.60
Nitrite	0.01	0.01	<0.01	<0.01	0.02	0.01	<0.01
Total Nitrogen, Kjeldahl	2.30	2.51	3.20	3.40	0.75	1.22	1.75
Orthophosphate, sol.	0.48	0.86	0.63	0.93	0.12	0.36	0.23
Total Phosphorus	0.62	1.10	0.89	1.10	0.40	0.55	0.55
Sulfate	151	154	115	151	157	50	52
Total Dissolved Solids	340	382	322	368	370	238	261

TABLE 2.3.1-1 (continued)
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

Parameter	Missouri River Stations				Logan Creek Stations		
	H-1	H-2	C-1	C-2	D	E	E-2
Total Suspended Solids	318	350	256	386	16	92	52
Total Solids	720	786	652	826	420	360	368
Total Coliform (col/100 ml)	>20,000	>20,000	>20,000	>20,000	>20,000	>20,000	>20,000
Fecal Coliform (col/100 ml)	O.G. ^b	O.G.	O.G.	288	60	2148	204
pH (standard units)	7.9	7.9	7.8	7.9	8.0	7.9	7.8
Temperature (°C)	25.2	25.0	25.0	25.0	25.0	25.0	25.0
Specific Conductivity (µmho/cm)	520	600	490	610	620	270	430
Dissolved Oxygen	6.4	7.6	6.8	7.6	5.0	7.3	6.2
Turbidity (FTU)	80	97	84	100	13	65	33

^aAll values are expressed in mg/l except where noted.

^bO.G. = over-grown (to numerous to count).

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TABLE 2.3.1-2

WATER QUALITY DATA FROM THE MISSOURI RIVER AND LOGAN CREEK, SEPTEMBER 1974^a

<u>Parameter</u>	<u>Missouri River Stations</u>					<u>Logan Creek Stations</u>		
	<u>A-2</u>	<u>B-2</u>	<u>H-2</u>	<u>C-1</u>	<u>C-2</u>	<u>D</u>	<u>E</u>	<u>E-2</u>
Alkalinity (as CaCO ₃)								
Carbonate	0	0	0	0	0	0	0	0
Bicarbonate	153	155	151	129	152	225	230	266
Ammonia (as N)	.08	.08	.04	.06	.08	.08	.02	.02
Biochemical Oxygen Demand	0.7	0.6	1.0	1.1	1.4	0.9	1.4	1.0
Chemical Oxygen Demand	18.8	25.6	22.0	17.2	20.0	20.8	7.8	17.2
Chloride	25.5	25.9	25.5	11.5	25.5	2.47	4.11	3.70
Hardness, Total (as CaCO ₃)	244	222	226	161	220	272	258	293
Hexane Sol. Materials	.001	.001	<.001	<.001	.002	.002	<.001	<.001
Nitrate (as N)	.55	.51	.42	.29	.31	.14	.16	.24
Nitrite (as N)	.01	.01	.01	.01	.01	.02	<.01	<.01
Nitrogen, Total Kjeldahl (as N)	.97	.08	.75	.73	.87	.83	.25	1.02
Orthophosphate, Sol. (as P)	.10	.09	.11	.07	.11	.03	.02	.02
Phosphorus, Total (as P)	.13	.13	.12	.08	.13	.03	.04	.02
Sulfate	164	161	162	78.8	157	226	16.9	20.6
Total Dissolved Solids	424	418	410	284	456	282	250	302

TABLE 2.3.1-2 (continued)

REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974

<u>Parameter</u>	<u>Missouri River Stations</u>					<u>Logan Creek Stations</u>		
	<u>A-2</u>	<u>B-2</u>	<u>H-2</u>	<u>C-1</u>	<u>C-2</u>	<u>D</u>	<u>E</u>	<u>E-2</u>
Total Suspended Solids	96	103	93	87	94	26	<10	17
Total Solids	581	580	582	344	548	328	274	322
Total Coliform (col/100 ml)	3,000	3,000	2,800	2,200	2,300	375	400	2,100
Fecal Coliform (col/100 ml)	900	2,300	1,300	900	850	700	290	360
Turbidity	33	32	24	25	23	15	3.8	5.8
Temperature (°C)	20.5	21.8	21.5	23.0	21.8	20.0	20.0	21.0
Specific Conductivity (µmho/cm)	490	690	1500	400	690	455	425	465
Dissolved Oxygen	8.7	8.5	8.1	6.8	7.5	5.0	10.4	9.3

^aAll values are expressed in mg/l except where noted.

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TABLE 2.3.1-3

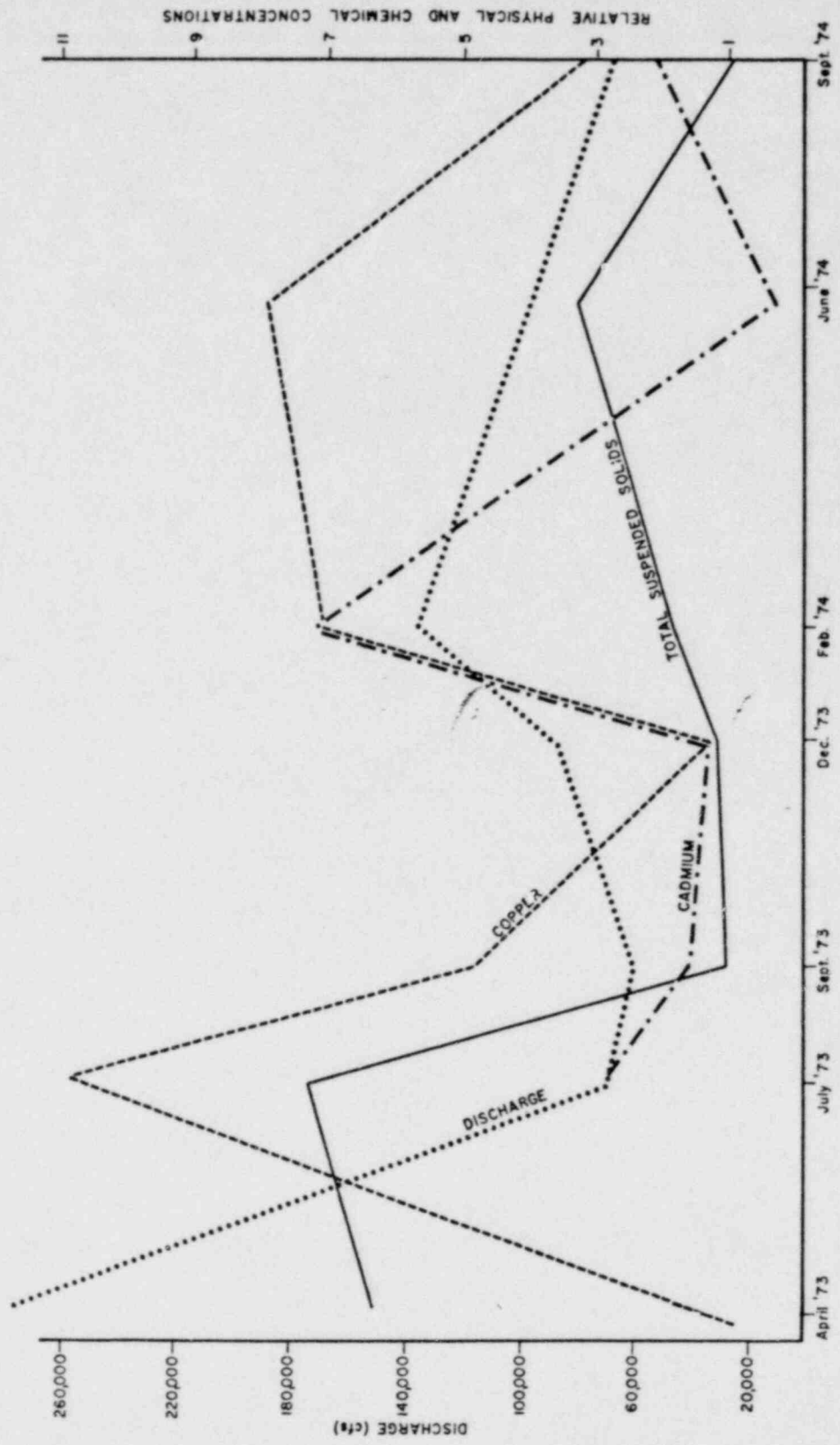
TRACE METAL CONCENTRATIONS FROM MISSOURI RIVER AND LOGAN CREEK
WATER SAMPLES, SPRING 1974^a

Parameter	Missouri River Station				Logan Creek Station		
	H-1	H-2	C-1	C-2	D-1	E	E-2
Arsenic	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cadmium	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Calcium	60	54	54	56	94	50	72
Total Chromium	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Copper	.04	.019	.012	.011	.004	.008	.006
Iron	8.5	11	8.0	11	1.6	6.5	4.0
Total Iron	14	20	16	20	1.6	8.5	4.5
Lead	.140	.047	.047	<.020	<.020	.195	.080
Magnesium	15	17	16	17	32	16	23
Mercury	.001	.0003	.0005	.0003	.0002	.0002	.0009
Selenium	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	29	39	29	36	7.6	4.0	5.2
Zinc	.02	.04	.04	.04	.02	.02	.05

^a All values are expressed in mg/l

TABLE 2.3.1-4
 REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY CALLAWAY PLANT 1974
 TRACE METAL CONCENTRATIONS (mg/l) FROM MISSOURI RIVER AND
 LOGAN CREEK WATER SAMPLES, SEPTEMBER 1974

<u>Parameter</u>	<u>Missouri River Stations</u>					<u>Logan Creek Stations</u>		
	<u>A-2</u>	<u>B-2</u>	<u>H-2</u>	<u>C-1</u>	<u>C-2</u>	<u>D</u>	<u>E</u>	<u>E-2</u>
Arsenic	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cadmium	.009	.007	.004	.004	.003	.006	.005	.005
Calcium	52	55	52	42	52	57	55	63
Chromium, Total	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Copper	.011	.007	.007	.008	.008	.006	.004	.006
Iron	3.3	2.1	1.6	1.4	1.6	1.2	0.5	0.5
Iron, Total	5.2	3.8	2.8	2.7	2.8	1.9	0.5	0.6
Lead	.020	.020	<.020	<.020	<.020	<.020	<.020	.120
Magnesium	19	19	18	12	18	25	26	31
Mercury	.0003	.003	.0007	.0006	.003	.016	.001	.001
Selenium	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	58	59	58	23	54	4.4	4.8	4.6
Zinc	.04	.06	.04	.04	.04	.06	.01	.04



REF. PRECONSTRUCTION MONITORING ANNUAL SUMMARY
CALLAWAY PLANT 1974

UNION ELECTRIC CO.
CALLAWAY PLANT
UNITS 1 & 2

RELATIONSHIP BETWEEN
WATER QUALITY
AND DISCHARGE

Figure 2.3.1-1

TABLE 2.3.2-1
 REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 WATER QUALITY DATA FROM THE MISSOURI RIVER AND LOGAN CREEK
 8 FEBRUARY 1975^a

Parameters	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Alkalinity (as CaCO ₃)								
Carbonate	0	0	0	0	0	0	0	0
Bicarbonate	164	164	165	123	165	180	182	204
Ammonia (as N)	.08	.33	.24	.20	.24	.13	.13	.12
Biochemical oxygen demand	.9	1.0	.8	1.3	1.0	.7	.9	.7
Chemical oxygen demand	33.2	14.9	16.6	11.6	13.3	6.6	9.6	4.9
Chloride	22.6	20.3	20.7	9.8	21.1	2.7	3.1	3.5
Hardness, total (as CaCO ₃)	220	227	225	169	223	212	212	235
Hexane sol. materials	1.0	<1.0	3.2	<1.0	<1.0	2.0	3.0	3.0
Nitrate (as N)	.09	.54	.51	.50	1.7	.17	.09	.36
Nitrite (as N)	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Nitrogen, total Kjeldahl (as N)	.92	.87	.77	.28	.79	.30	.33	.24
Orthophosphate, sol. (as P)	.09	.09	.08	.04	.10	<.01	.02	<.01
Phosphorus, total (as P)	.10	.11	.08	.05	.11	.02	.02	.02
Sulfate	118	116	114	34	109	12	14	12
Total dissolved solids	382	426	405	261	431	267	263	274
Total suspended solids	62	58	77	48	55	3	3	3
Total solids	444	484	482	306	486	270	268	276
Total coliforms (col/100 ml)	1,850	310	4,000	555	3,850	NG ^b	325	165
Fecal coliforms (col/100 ml)	410	310	1,700	555	1,800	NG	325	40
Turbidity (FTU)	35	34	34	26	33	4.9	3.0	3.0
Temperature (°C)	.5	1.0	1.0	2.5	1.0	1.0	1.0	2.0
Specific conductance (µmhos/cm)	345	355	350	245	350	230	220	40
Dissolved oxygen	NM ^c	NM	NM	NM	NM	NM	NM	NM

^aAll values are expressed in mg/l except where noted.

^bNo growth.

^cNot measured.

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TABLE 2.3.2-2

WATER QUALITY DATA FROM THE MISSOURI RIVER AND LOGAN CREEK
2 JUNE 1975^a

Parameter	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Alkalinity (as CaCO ₃)								
Carbonate	0	0	0	0	0	0	0	NS ^b
Bicarbonate	105	112	105	NS	106	140	184	NS
Ammonia (as N)	.20	.15	.15	NS	.18	.15	.10	NS
Biochemical oxygen demand	2.8	2.2	2.6	NS	2.6	1.5	.8	NS
Chemical oxygen demand	137	120	130	NS	118	14.4	14.4	NS
Chloride	12.8	12.0	12.9	NS	12.9	14.9	3.0	NS
Hardness, total (as CaCO ₃)	172	170	172	NS	174	221	238	NS
Hexane sol. materials	7.4	3.8	.8	NS	4.4	2.2	1.4	NS
Nitrate (as N)	1.29	.75	.72	NS	1.13	.63	.33	NS
Nitrite (as N)	.04	.03	.03	NS	.03	.02	.01	NS
Nitrogen								
total Kjeldahl (as N)	4.90	4.50	4.64	NS	4.24	.93	.58	NS
Orthophosphate, sol. (as P)	.08	.06	.06	NS	.07	.08	.01	NS
Phosphorus, total (as P)	1.4	1.1	1.2	NS	1.1	.21	.08	NS
Sulfate	103	106	103	NS	105	122	25.1	NS
Total dissolved solids	302	310	306	NS	338	390	254	NS
Total suspended solids	2,116	2,040	2,208	NS	2,064	54	31	NS
Total solids	2,570	2,530	2,600	NS	2,514	610	354	NS
Total coliforms (col/100 ml)	39,500	29,500	32,000	NS	33,000	69,500	1,350	NS
Fecal coliforms (col/100 ml)	26,000	8,200	28,000	NS	13,050	29,000	550	NS
Turbidity (FTU)	220	220	205	NS	220	41	16	NS
Temperature (°C)	24.0	22.0	23.0	NS	22.5	22.0	20.5	NS
Specific Conductance								
(µmhos/cm)	620	605	620	NS	650	415	315	NS
Dissolved oxygen	6.8	6.2	7.2	NS	6.5	4.1	8.0	NS

^aAll values are expressed in mg/l except where noted.

^bNot sampled.

TABLE 2.3.2-3
 REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 WATER QUALITY DATA FROM THE MISSOURI RIVER AND LOGAN CREEK
 10 SEPTEMBER 1975^a

Parameters	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	F-2	C-1	C-2	D	E	E-2
Alkalinity (as CaCO ₃)								
Carbonate	0	0	0	0	0	0	0	0
Bicarbonate	159	153	150	153	154	173	222	227
Ammonia (as N)	.18	.18	.20	.30	.18	.20	.20	.18
Biochemical oxygen demand	2.0	1.3	.6	.9	.9	4.6	1.6	1.1
Chemical oxygen demand	37.8	30.4	27.2	34.6	31.7	44.2	20.2	19.5
Chloride	16.9	16.6	15.9	15.2	16.9	4.6	3.5	3.8
Hardness, total (as CaCO ₃)	224	222	218	220	220	194	249	257
Hexane sol. materials	3.8	2.4	1.6	2.0	2.2	4.0	1.8	1.6
Nitrate (as N)	.73	.68	.53	.65	.79	.02	.06	.08
Nitrite (as N)	.01	.02	.01	.01	.01	<.01	<.01	<.01
Nitrogen, total Kjeldahl (as N)	.90	.83	.38	1.00	.95	1.03	.40	.22
Orthophosphate, sol. (as P)	.10	.09	.09	.09	.09	.02	.01	.03
Phosphorus, total (as P)	.10	.10	.09	.09	.09	.04	.01	.03
Sulfate	170	170	170	170	180	24	16	21
Total dissolved solids	448	436	452	444	408	264	268	272
Total suspended solids	320	342	72	344	298	44	26	4
Total solids	796	778	524	846	714	308	316	278
Total coliforms (col/100 ml)	22,500	15,500	3,850	25,000	12,500	2,150	10,500	2,450
Fecal coliforms (col/100 ml)	17,700	6,400	2,950	3,550	4,850	215	3,750	205
Turbidity (FTU)	130	130	52	130	120	28	14	4
Temperature (°C)	24.0	24.5	24.5	24.5	24.5	25.0	23.0	22.5
Specific conductance								
(µmhos/cm)	500	480	440	450	450	385	405	430
Dissolved oxygen	5.3	6.8	7.0	7.1	6.8	5.4	7.3	5.4

^aAll values are expressed in mg/l except where noted.

TABLE 2.3.2-4

TRACE METAL CONCENTRATIONS (mg/l) FROM MISSOURI RIVER AND LOGAN CREEK WATER SAMPLES
8 FEBRUARY 1975

Parameter	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Arsenic	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cadmium	<.001	<.001	<.001	<.001	.001	<.001	.002	.002
Calcium	59	56	56	48	58	49	49	59
Chromium, total	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Copper	<.001	.005	<.001	.001	.002	<.001	.002	.001
Iron, total	2.9	3.0	4.0	1.8	2.8	.6	.4	.4
Lead	.005	.005	.005	.010	.005	.002	.002	.012
Magnesium	18.0	17.2	17.5	12.5	17.5	23	23	26.5
Mercury	<.0001	<.0001	.0002	<.0001	<.0001	<.0001	.0002	.0002
Selenium	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	50	47	48	18	48	4.6	4.4	4.2
Zinc	.003	.004	<.002	.006	<.002	.002	.002	.005

TABLE 2.3.2-5
 REF. PRECONSTRUCTION MONITORING - TWO YEAR SUMMARY CALLAWAY PLANT 1974-1975
 TRACE METAL CONCENTRATIONS (mg/l) FROM MISSOURI RIVER AND LOGAN CREEK WATER SAMPLES
 2 JUNE 1975

Parameter	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Arsenic	<.005	.005	.005	NS ^a	<.005	<.005	<.005	NS
Cadmium	.001	.002	.001	NS	.002	.002	.001	NS
Calcium	36	39	40	NS	44	44	47	NS
Chromium, total	.07	.07	.07	NS	.07	<.005	<.005	NS
Copper	.060	.080	.034	NS	.030	.010	.008	NS
Iron, total	64	57	66	NS	60	2.4	1.2	NS
Lead	.050	.050	.030	NS	.030	.015	.020	NS
Magnesium	17	18	18	NS	17	21	28	NS
Mercury	.0002	<.0001	<.0001	NS	.0008	<.0001	<.0001	NS
Selenium	<.005	<.005	<.005	NS	<.005	<.005	<.005	NS
Sodium	24	24	24	NS	24	33	3.8	NS
Zinc	.12	.12	.07	NS	.05	.01	.007	NS

^aNot Sampled.

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TABLE 2.3.2-6

TRACE METAL CONCENTRATIONS (mq/l) FROM MISSOURI RIVER AND LOGAN CREEK WATER SAMPLES
10 SEPTEMBER 1975

Parameter	Missouri River Stations					Logan Creek Stations		
	A-2	B-2	H-2	C-1	C-2	D	E	E-2
Arsenic	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cadmium	<.001	.003	.002	.003	<.001	<.001	.002	.003
Calcium	74	74	68	74	74	61	66	66
Chromium, total	.013	.010	<.005	.013	<.005	<.005	<.005	<.005
Copper	.005	.017	.014	.017	.010	.005	.007	.009
Iron, total	11	16	4.0	16	12	1.8	.76	.26
Lead	.010	.030	.010	.020	.010	.010	.020	.020
Magnesium	16	10	18	18	16	15	24	27
Mercury	.0010	.0005	.0005	.0008	.0005	.0006	.0008	.0010
Selenium	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Sodium	60	45	45	49	49	11	5.2	5.2
Zinc	.040	.040	.025	.037	.029	.007	.009	.012

WATER QUALITY DATA FROM THE MISSOURI RIVER, LOGAN AND MUD CREEKS

JUNE 10, 1976

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

TRACE METALS (continued)	Missouri River				C-1	Logan and Mud Creeks		
	A-1	B-2	B-1	C-2		D	E-1	E-2
Magnesium	1.9	20.1	30.0	29.2	19.8	34.4	35.6	36.8
Mercury	<0.0001	<0.0001	<0.0001	0.0002	0.0001	<0.0001	<0.0001	<0.0001
Selenium	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Sodium	48.6	52.2	57.0	60.2	65.2	4.0	3.6	3.4
Zinc	0.016	0.000	0.024	0.042	0.022	0.008	0.001	0.001
Estimated Flow (cfs)	--	--	--	--	--	--	5	3
Time of Day	11:30	10:50	11:05	10:15	10:35	14:45	13:55	14:15

*All units ppm unless indicated otherwise.

WATER QUALITY DATA FROM THE MISSOURI RIVER, LOGAN AND MUD CREEKS
JUNE 10, 1976

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	Missouri River					Logan and Mud Creeks		
	A-1	B-2	E-1	C-2	C-1	D	E-1	E-2
<u>NON-METALS*</u>								
Alkalinity (as CaCO ₃)	169	190	168	180	168	309	251	252
Ammonia	0.06	0.05	0.06	0.06	0.05	0.21	0.05	0.06
Biochemical Oxygen Demand (5)	<1	1	1	2	1	3	1	1
Chemical Oxygen Demand	75	30	20	60	<5	10	20	20
Chloride	18.6	16.5	17.5	18.6	17.5	2.1	5.2	5.2
Hardness, total (as CaCO ₃)	226	243	237	245	235	333	271	278
Hexane sol. materials	16.4	5.5	4.8	3.9	10.9	10.2	11.6	8.7
Nitrate	0.73	0.73	0.72	0.77	0.79	0.27	0.21	0.87
Nitrogen, total Kjeldahl (as N)	1.66	1.34	1.79	1.78	1.90	2.34	0.98	0.71
Orthophosphate, sol. (as P)	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1
Phosphate, total (as P)	1.0	0.3	0.6	0.3	0.2	0.1	0.1	0.1
Sulfate	135	129	154	143	151	30	27	25
Total Dissolved Solids	421	438	452	465	454	382	308	316
Total Suspended Solids	167	85	204	297	191	13	59	49
Total Solids	588	523	656	762	645	441	357	329
Total Coliforms (Col/100 ml)	700	800	2400	1900	1100	100	60	160
Fecal Coliforms (col/100 ml)	20	10	500	600	350	90	60	160
Turbidity (JTU)	57	67	65	105	69	29	9	11
Temperature, °C	25.0	24.0	24.5	25.0	24.5	23.5	21.0	23.0
Specific Conductance (umhos/cm)	610	620	680	660	630	610	400	480
Dissolved Oxygen	7.6	6.8	7.6	7.8	7.8	8.6	8.5	8.5
pH	8.0	7.7	8.0	7.8	8.0	7.7	7.8	7.8
<u>TRACE METALS</u>								
Arsenic	0.006	0.006	0.006	0.006	0.006	0.003	0.002	0.002
Cadmium	<.002	<.002	<.002	<.002	.001	<.002	.006	.002
Calcium	50.2	51.8	52.4	52.6	49.2	76.2	58.0	58.4
Chromium, total	0.02	0.02	0.02	0.04	0.04	0.02	0.04	0.02
Copper	0.01	0.04	0.04	0.04	0.02	0.01	0.01	0.02
Iron, total	4.62	3.98	6.34	4.94	6.02	1.44	0.38	0.04
Lead	<.1	<.1	0.3	<.1	0.2	0.3	<.1	<.1

TABLE 1
 WATER QUALITY DATA FROM THE MISSOURI RIVER, LOGAN AND MUD CREEKS
 OCTOBER 27, 1976
 (Continued)
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

TRACE METALS (Continued)	Missouri River					Logan and Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
Lead	0.02	0.08	0.07	<0.01	0.04	0.02	0.02	0.04
Magnesium	21.2	23.8	20.7	21.4	21.5	25.7	30.5	12.2
Mercury	0.0011	0.0017	0.0012	0.0017	0.0007	0.0016	0.0012	0.0003
Selenium	0.012	0.009	0.005	0.003	0.007	0.010	0.012	0.006
Sodium	64.4	49.2	61.8	66.0	73.2	15.8	13.0	8.2
Zinc	0.021	0.028	0.026	0.017	0.026	0.033	0.017	0.027
Estimated Flow (cfs)	--	--	--	--	--	3	2	0
Time of Day	11:40	11:10	11:25	10:45	11:00	13:50	14:45	14:15

NOTES: (a) Value questionable, insufficient sample to verify value.
 (b) Values unobtainable due to unusual bacterial interference during test.

TABLE 1
 WATER QUALITY DATA FROM THE MISSOURI RIVER, LOGAN AND MUD CREEKS
 OCTOBER 27, 1976

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	Missouri River					Logan and Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
<u>NON-METALS (a)</u>								
Alkalinity (as CaCO ₃)	160	200	160	160	160	224	222	88
Ammonia	1.43	0.49	1.69	0.34	1.53	0.94	1.05	0.94
Biochemical Oxygen Demand ₅	1	2	<1	<1	<1	14	4	12
Chemical Oxygen Demand	10	20	10	10	10	90	20	50
Chloride	17.9	14.4	14.9	17.4	17.9	11.9	9.2	7.9
Hardness, total (as CaCO ₃)	220	240	220	220	220	260	240	100
Hexane sol. materials	8.2	26.7	7.8	5.7	7.0	3.5	1.8	5.6
Nitrate	0.42	0.35	0.45	0.42	0.45	0.07	0.12	0.06
Nitrogen, total Kjeldahl (as N)	13.2	9.6	10.8	11.1	12.4	11.1	14.8	14.1
Orthophosphate sol. (as P)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate, total (as P)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate	437 (a)	195	165	175	175	45	20	40
Total Dissolved Solids	458	408	414	452	442	402	299	209
Total Suspended Solids	75	77	134	104	98	52	30	34
Total Solids	533	485	548	556	540	454	329	243
Total Coliforms (Col/100 ml)	6000	1100	7400	3700	3600	700	<10 (b)	-- (b)
Fecal Coliforms (Col/100 ml)	1200	300	550	480	490	250	6	-- (b)
Turbidity (JTU)	67	64	96	74	83	96	64	67
Temperature °C	10.0	10.0	10.5	10.0	10.0	10.0	9.0	8.0
Specific Conductance (μhos/cm)	480	450	485	470	480	350	330	160
Dissolved Oxygen	11.1	10.8	11.1	11.1	11.2	4.9	12.1	1.9
pH	7.6	7.5	7.6	7.6	7.6	7.6	8.0	7.4
<u>TRACE METALS</u>								
Arsenic	0.003	0.003	0.002	0.002	0.002	0.006	0.001	0.002
Cadmium	0.006	0.006	0.008	0.009	0.007	0.006	0.020	0.016
Calcium	66	73	64	66	66	68	67	31
Chromium, total	0.02	<0.01	<0.01	<0.01	0.01	0.02	<0.01	0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, total	6.55	7.36	6.90	5.54	6.99	9.12	4.06	6.35

TABLE 1
 WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS
 MARCH 1977
 (Continued)

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	Missouri River					Logan and Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
<u>METALS (Continued)</u>								
Magnesium	16.2	22.8	17.4	17.3	15.6	20.3	22.4	20.7
Mercury	0.0004	0.0008	0.0002	<0.0001	0.0002	<0.0001	<0.0001	0.0015
Selenium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	50.6	52.8	40.0	51.5	50.6	3.9	4.0	5.3
Zinc	0.034	0.033	0.027	0.102	0.088	0.085	0.060	0.022
ESTIMATED FLOUR (cfs)	--	<1	--	<1	--	10-12	4-6	5-10
TIME OF DAY	1030	1020	1020	940	950	1310	1415	1330

TABLE 1
 WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS
 MARCH 9, 1977

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	Missouri River					Logan and Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
<u>NON-METALS</u>								
Alkalinity (as CaCO ₃)	168	180	166	173	163	176	182	185
Ammonia	1.00	1.00	0.96	1.05	1.05	1.05	.85	1.05
Biochemical Oxygen Demand (5)	1	<1	<1	1	1	<1	<1	<1
Chemical Oxygen Demand	8	18	25	25	19	22	16	17
Chloride	28	10	28	28	30	11	11	10
Hardness, total (as CaCO ₃)	219	217	219	234	191	211	223	221
Hexane Soluble Materials	14	5		8	8	61	11	17
Nitrate	0.69	0.15	0.60	0.69	0.69	0.11	1.12	0.13
Nitrogen, total Kjeldahl (as N)	2.1	2.0	2.0	1.8	2.0	1.7	1.8	1.8
Orthophosphate, sol. (as P)	0.4	<0.1	0.2	0.2	0.2	0.2	0.2	<0.1
Phosphate, total (as P)	0.5	0.1	0.4	0.2	0.3	0.2	0.2	0.2
Sulfate	119	55	128	119	87	43	31	36
Total Dissolved Solids	460	249	448	449	466	259	251	260
Total Suspended Solids	57	31	73	64	56	2	3	11
Total Solids	517	280	521	513	522	261	254	271
Total Coliforms (Col/100 ml)	81	9	90	27	100	<10	<2	<2
Fecal Coliforms (Col/100 ml)	20	<2	35	<2	15	<2	<2	<2
Turbidity (JTU)	28	13	26	22	25	8	5	3
Temperature °C	7.0	11.0	7.1	7.5	7.0	15.2	14.5	14.0
Specific Conductance (µhos/cm)	385	285	415	410	415	295	310	315
Dissolved Oxygen	9.0	9.7	9.4	8.9	9.5	11.9	12.0	11.0
pH	7.2	7.8	7.5	7.4	7.6	8.2	8.2	8.4
<u>METALS</u>								
Arsenic	<0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.022	<0.001	0.005	<0.001	0.003	0.002	0.002	<0.001
Calcium	46	39	43	43	42	36	40	37
Chromium, total	0.01	0.01	<0.01	0.01	0.01	0.02	0.02	<0.01
Copper	0.07	0.01	.01	0.07	0.05	0.05	0.06	<0.01
Iron, total	3.44	0.96	2.09	2.00	2.71	0.72	0.62	0.29
Lead	0.06	0.04	0.06	0.01	0.02	0.03	0.05	0.06

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TABLE 1
 WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS
 JUNE 6, 1977

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

NON-METALS (mg/l)	Missouri River					Logan and Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-1
Alkalinity (as CaCO ₃)	156	126	136	152	148	144	220	190
Ammonia	<1	<1	<1	<1	<1	<1	<1	<1
Biochemical Oxygen Demand	<3	<3	<3	<3	<3	<3	3	<3
Chemical Oxygen Demand	100	30	100	32	80	16	11	15
Chloride	23	23	26	23	21	23	11	13
Hardness, total (as CaCO ₃)	190	160	190	170	170	200	250	210
Hexane Soluble Materials	19	6	9	6	4	8	7	4
Nitrate	1.13	1.12	1.16	1.08	1.17	0.69	0.05	0.34
Nitrogen, total Kjeldahl (as N)	4	2	8	1	5	1	2	<1
Orthophosphate, sol. (as P)	0.5	0.5	0.6	0.3	0.8	0.3	0.2	0.1
Phosphate, total (as P)	0.5	0.5	0.5	0.3	0.8	0.3	0.2	0.1
Sulfate	73	131	94	114	76	123	28	35
Total Dissolved Solids	352	368	500	372	210	398	276	244
Total Suspended Solids	1,548	184	1,390	320	1,670	60	16	26
Total Solids	1,900	552	1,890	692	1,880	458	292	270
Total Coliforms (Col/100 ml)	1,300	3,100	2,000	2,200	2,500	600	30	5
Fecal Coliforms (Col/100 ml)	1,300	3,100	2,000	1,200	1,500	200	20	5
Turbidity (JTU) APAH	630	300	762	410	760	100	8	10
Temperature °C	25	27	25	25	25	27	28	31
Specific Conductance (µhos/cm)	470	485	465	485	470	600	510	455
Dissolved Oxygen	5.2	5.1	5.3	4.8	5.3	3.9	8.7	12.3
pH	8.2	7.7	8.0	7.7	7.8	8.2	6.8	7.4
METALS (mg/l)								
Arsenic	0.003	0.001	0.002	<0.001	0.002	<0.001	0.001	0.001
Cadmium	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium	68	27	72	31.6	60	76	90	75
Chromium, total	0.02	0.03	0.07	0.06	0.01	0.02	<0.01	<0.01
Copper	0.07	0.02	0.07	0.08	0.01	0.01	0.02	0.01
Iron, total	44.5	9.60	45.9	36.3	12.0	4.24	1.10	1.78
Lead	<0.01	<0.01	0.01	0.12	<0.01	<0.01	<0.01	0.08
Magnesium	22.6	15.6	24.0	18.3	13.6	20.6	31.6	28.9
Mercury	<0.0004	0.005	0.002	<0.0004	<0.0002	0.005	<0.0001	<0.0001
Selenium	0.0025	0.0034	0.0017	0.0022	0.0019	0.0019	0.0026	0.0022
Sodium	36	41	38	32	37	47	12	13
Zinc	0.188	0.043	0.116	0.144	0.118	0.984	0.259	< 0.001
Estimated Flow (cfs)	-	minor	-	-	-	5+	3-5	2
Time of Day	10:15	10:05	9:50	9:30	9:40	12:40	1:15	1:05

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TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 January 30, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter ^(a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	222	225	200	209	221	-	-	-	-
Hardness, total (as CaCO ₃)	284	264	292	244	286	-	-	-	-
Hexane Soluble Materials	2	2	3	1	<1	<1	1	4	12
Total Suspended Solids	15.5	772	13	46.5	24	4.5	4.5	4.5	15
Total Solids	578	933	581	336	578	330	335	320	335
Turbidity (JTU)	6.5	460	5	11	7	14	3	11	9
Temperature (°C)	0°C	-1	0	0	0	0	0	0	0
Specific Conductance (µmhos/cm)	280	210	360	255	340	272	263	240	240
pH	7.5	7.7	7.6	7.6	7.6	6.9	7.1	6.8	6.4
Dissolved Oxygen	9.1	9.8	8.8	9.5	9.0	10.1	14.2	9.4	10.0
Magnesium	23.6	31.7	25.8	29.2	24.5	30.1	30.1	26.5	27.5
Calcium	90.6	69.3	93.6	65.3	95	80.6	80.6	90.7	85.0
Time	16 30	1500	1530	1430	1400	1050	1040	0930	0940
Air Temperature (°C)	-2	-2	-2	-2	-2	-2	-2	-2	-2
BOD	-	-	-	-	-	2	2	2	2
Discharge (CFS)	33,800		33,800		33,800				

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

WATER QUALITY DATA FROM THE MISSOURI RIVER, LOGAN AND MUD CREEKS
 SEPTEMBER 22, 1977
 (Continued)

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980 .

	Missouri River				Logan and Mud Creeks			
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
<u>TRACE METALS</u> (continued)								
Magnesium	14.2	17.3	14.8	14.1	14.9	15.5	30.0	35.0
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.004	<0.002	<0.004	<0.002	<0.004	<0.004	<0.004	<0.004
Sodium	58	37	48	58	86	44	21	44
Zinc	0.027	0.034	0.032	0.031	0.109	<0.001	<0.001	<0.001
Estimated Flow (cfs)	-	-	-	-	-	-	5-7	3-5
Time of Day	1000	0930	0940	0845	0915	1220	1300	1350

*All units mg/l unless otherwise specified.
 **Confluent Growth - interference with test by other bacteria
 ***Suspected contamination of sample

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WATER QUALITY DATA FROM THE MISSOURI RIVER, LOGAN AND MUD CREEKS
SEPTEMBER 22, 1977

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	Missouri River					Logan and Mud Creeks		
	A-1	B-2	D-1	C-2	C-1	D	U-1	E-2
NON-METALS*								
Alkalinity (as CaCO ₃)	130	130	128	130	132	136	64	76
Ammonia	<1	<1	<1	<1	<1	<1	<1	<1
Biochemical Oxygen Demand (5)	3	<3	<3	<3	<3	<3	<3	<3
Chemical Oxygen Demand	100	136	188	100	68	264	64	76
Chloride	24	22	22	24	9	21	14	12
Hardness, total (as CaCO ₃)	157	157	155	155	161	155	234	301
Hexane sol. materials	<1.0	2.5	1.9	7.0	1.0	1.2	1.2	4.0
Nitrate	1.03	0.90	1.80	1.34	6.45	0.20	0.34	0.47
Nitrogen, total Kjeldahl (as N)	<1	3.0	<1	2.0	1.9	1.6	2.0	1.0
Orthophosphate, sol. (as P)	0.3	0.3	0.3	0.3	0.3	0.3	<0.1	<0.1
Phosphate, total (as P)	0.3	0.3	0.3	0.3	0.3	0.3	<0.1	0.1
Sulfate	76	145	79	65	80	51	24	48
Total Dissolved Solids	346	310	322	352	350	328	286	390
Total Suspended Solids	554	514	494	294	448	42	38	32
Total Solids	900	824	816	646	798	370	324	422
Total Coliforms (Col/100 ml)	CG**	CG	CG	CG	CG	32	16	252
Fecal Coliforms (col/100 ml)	680	520	680	640	600	15	110	160
Turbidity (JTU)	50	60	50	48	58	9	8	14
Temperature, °C	21	21	21	21	21	22	21	22
Specific Conductance (µmhos/cm)	410	411	420	408	418	400	425	550
Dissolved Oxygen	7.2	7.1	7.2	6.5	7.3	2.5	7.6	6.4
pH	7.4	7.3	7.4	7.6	7.6	7.5	7.6	7.5
TRACE METALS*								
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cadmium	<0.001	<0.001	<0.003	<0.001	<0.001	<0.001	<0.004	<0.001
Calcium	62	61	61	60	71	75	115	116
Chromium, total	<0.01	0.01	0.01	0.01	0.02	<0.01	<0.01	0.01
Copper	<0.01	<0.01	<0.01	0.02	0.05	0.01	<0.01	<0.01
Iron, total	8.34	10.0	9.07	7.40	8.97	0.91	0.80	1.22
Lead	0.01	0.12***	0.13***	0.01	0.01	0.01	0.01	0.01

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER
 BARGE SLIP FACILITY
 NOVEMBER 22, 1977
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	A-1	B-2	B-1	C-2	C-1
Alkalinity (as CaCO ₃)	174	174	174	184	184
Hardness, total (as CaCO ₃)	228	224	224	230	224
Hexane Sol. Materials	<1	<1	<1	<1	<1
Total Suspended Solids	203	176	204	94	163
Total Solids	428	433	436	394	413
turbidity (JTU)	16	25	15	34	25
Temperature °C	8	8	8	8	8
Specific Conductance (mmhos/cm)	390	365	390	375	390
pH	7.7	7.8	7.8	7.3	7.6
Dissolved Oxygen	12.1	11.1	12.1	11.2	12.0
Magnesium	21	20	21	22	20
Calcium	87	87	86	87	76

NOTE: All values in mg/l unless otherwise indicated.

TABLE 1
 WATER QUALITY DATA FROM MISSOURI RIVER, LAGON AND MUD CREEKS
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

NON METALS* (mg/l)	Missouri River					Logan & Mud Creeks			
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2	
Alkalinity (as CaCO ₃)	178	262	178	222	178	256	224	228	
Ammonia	<1	<1	<1	<1	<1	<1	1	<1	
Biochemical Oxygen Demand (5)	3	<2	3	<3	3	<3	<3	<3	
Chemical Oxygen Demand	33	8	30	55	32	5	5	4	
Chloride	23	8	24	6	23	7	5	6	
Hardness, total (as CaCO ₃)	256	316	252	274	252	308	278	286	
Hexane Sol. Materials	<1	6	10	<1	<1	14	20	21	
Nitrate	1.60	0.84	1.48	0.36	1.30	1.14	0.58	1.21	
Nitrogen, TKN (as N)	2.0	1.7	2.2	2.2	1.7	2.2	2.3	5.6	
Orthophosphate, sol. (as P)	0.2	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	
Phosphate, total (as P)	0.5	<0.1	0.1	0.4	0.5	0.1	<0.1	<0.1	
Sulfate	115	19	96	30	118	39	23	34	
Total Dissolved Solids	440	362	449	295	445	355	307	304	
Total Suspended Solids	289	47	303	621	284	24	2	11	
Total Solids	730	410	750	920	730	375	310	314	
Total Coliforms (Col/100 ml)	13,700	92	3,000	2,200	15,000	25	31	7	
fecal Coliforms (Col/100 ml)	7,400	20	7,500	620	6,400	0	0	8	
Turbidity (JTU)	190	33	190	78	120	15	2	10	
Temperature, °C	0°	1	0	1	0	1	1	1.5	
Specific Conductance (µmhos/cm)	350	320	350	260	350	300	290	275	
Dissolved Oxygen	11.0	9.9	11.2	9.7	12.2	9.7	8.6	7.0	
pH	8.0	8.0	8.1	8.2	8.0	7.9	8.1	8.3	
<u>MINERALS (mg/l)</u>									
Arsenic	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	
Cadmium	<.001	.015	.001	.005	.003	.002	.012	.012	
Calcium	83.5	107	80.5	64.8	65.8	103	89.5	89.3	
Chromium, total	0.02	.01	0.02	.04	.01	.01	<0.01	<0.01	
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Iron, total	7.72	2.85	7.75	9.44	7.07	2.21	0.33	0.49	
Lead	0.16	<0.01	0.16	<0.01	0.28	<0.01	0.20	0.16	
Magnesium	22.5	34.1	22.8	36.6	22.9	34.8	32.2	34.6	
Mercury	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	
Selenium	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	
Sodium	52.9	10.6	53.1	10.1	54.2	15.1	10.1	11.8	
Zinc	.030	.009	.034	.040	.042	.012	.009	.024	
Estimated Flow	LOW	LOW	LOW	LOW	LOW	2 CFS	2 CFS	2 CFS	
Time of Day	2:00	1:30	1:00	12:00	12:30	4:00	4:15	4:30	

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER
 BARGE SLIP FACILITY
 FEBRUARY 1978
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	<u>A-1</u>	<u>B-2</u>	<u>B-1</u>	<u>C-2</u> (a)	<u>C-1</u>
Alkalinity (as CaCO ₃)	186	272	180	1436	178
Hardness, total (as CaCO ₃)	268	330	268	1680	272
Hexane Sol. Materials	25	6	5	5	15
Total Suspended Solids	26	15	29	74	40
Total Solids	547	410	565	1982	569
Turbidity (JTU)	9	22	2	190	6
Temperature °C	2.2	2.0	1.8	2.0	2.0
Specific Conductance µmhos/cm	400	320	410	1500	410
pH	8.2	7.4	8.0	7.1	8.1
Dissolved Oxygen	12.2	7.2	12.0	2.8	12.0
Magnesium	23	23	36	156	25
Calcium	100	100	100	530	102
Estimated Flow	---	---	---	0	---

NOTE: (a) Sampling point disturbed by ice clearing. Data not representative of stream condition.

TABLE 1
 WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEK
 MARCH 29, 1978
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Non-Metals (n = 1)	Missouri River					Logan & Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
Alkalinity (as CaCO ₃)	109	109	109	98	109	62	88	90
Ammonia	<1	<1	<1	<1	<1	<1	<1	<1
Biochemical Oxygen Demand	10	13	8	15	10	2	1	2
Chemical Oxygen Demand	72	60	64	52	52	32	18	28
Chloride	18	17	18	16	16	9	8	7
Hardness, total (as CaCO ₃)	150	150	145	130	150	90	110	115
Hexane Sol. Materials	3	2	<1	3	1	6	<1	2
Nitrate (as N)	1.47	1.46	1.48	1.31	1.41	0.77	0.76	0.80
Nitrogen, TKN (as N)	<1	3.4	2.4	1.5	4.1	1.7	<1	<1
Orthophosphate, Sol. (as P)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate, Total (as P)	1.1	1.3	1.1	0.3	1.2	0.3	0.2	0.2
Sulfate	41	44	46	38	41	24	16	17
Total Dissolved Solids	220	220	220	220	220	170	140	190
Total Suspended Solids	1,030	550	1,080	480	890	40	46	15
Total Solids	1,380	1,380	1,270	910	1,560	250	200	160
Total Coliforms (Col./100 ml)	35,000	7,000	35,000	900	1,000	500	500	1,050
Fecal Coliforms (Col./100 ml)	1,100	770	680	550	780	335	58	40
Turbidity (JTU)	540	850	720	520	550	190	57	63
Temperature (°C)	6	6	6	7	6	7	8	10
Specific Conductance (µmho/cm)	200	200	205	180	190	110	160	160
Dissolved Oxygen	N/A (a)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pH	7.2	7.1	7.1	7.3	7.0	7.1	7.2	7.4
<u>Metals (mg/l)</u>								
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	28.8	26.5	27.1	23.5	26.9	15.2	23.6	26.8
Chromium, Total	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.04	<0.01	<0.01	<0.01	0.01	0.01	0.04	0.02
Iron, Total	12.7	14.6	14.0	10.6	15.2	2.8	1.1	0.8
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	11.7	12.9	10.6	11.9	13.5	6.8	12.7	12.4
Mercury (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1
Selenium	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.005
Sodium	12.5	15.0	12.0	6.2	11.0	4.8	8.5	6.5
Zinc	0.04	0.02	0.02	0.04	0.05	0.01	0.01	<0.01
Time of Day	1540	1515	1445	1420	1400	1030	1100	1130
Air Temperature (°C)	11	11	11	10	15	9	12	10

NOTE: (a) Dissolved oxygen not available - meter malfunction.

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TABLE 1

WATER QUALITY FROM MISSOURI RIVER
BARGE SLIP FACILITY
APRIL 20, 1978

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	A-1	B-2	B-1	C-2	C-1
Alkalinity (as CaCO ₃)	132	134	136	136	136
Hardness, total (as CaCO ₃)	145	152	147	158	152
Hexane Sol. Materials	3	6	6	2	4
Total Suspended Solids	1,450	1,860	1,800	2,050	1,730
Total Solids	1,900	2,350	2,160	2,370	2,070
Turbidity (JTU)	940	1,020	1,360	1,240	960
Temperature (°C)	9.3	9.2	9.0	9.2	9.5
Specific Conductance (µmhos/cm)	293	300	290	297	280
pH	7.9	7.8	7.9	7.8	7.4
Dissolved Oxygen	9.8	8.6	9.3	8.7	8.4
Magnesium	16.2	16.0	15.8	16.3	15.5
Calcium	31.6	34.6	33.0	36.4	35.4
Time	14:00	15:00	14:40	15:30	15:45
Temperature (°C)	5	5	5	5	5

NOTE: All values in mg/l unless otherwise indicated.

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 APRIL 20, 1978
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter (a)	Station				
	A-1	B-2	B-1	C-2	C-1
Alkalinity (as CaCO ₃)	156	152	151	152	151
Hardness, total (as CaCO ₃)	206	212	208	208	208
Hexane Soluble Materials	12	9	12	6	3
Total Suspended Solids	732	868	724	680	700
Total Solids	1,038	1,215	1,038	1,027	1,029
Turbidity (JTU)	640	695	500	715	695
Temperature (°C)	23.5	23.0	24.5	24.0	23.0
Specific Conductance (µmhos/cm)	490	490	490	490	475
pH	7.6	7.3	7.5	7.4	7.4
Dissolved Oxygen	6.9	7.4	7.6	7.5	7.2
Magnesium	17.5	18.4	17.7	17.4	16.3
Calcium	46.9	37.6	38.3	36.2	37.6
Time	12:00	11:50	11:55	11:15	11:30
Air Temperature (°C)	32	27	32	32	32

NOTES: (a) All values in mg/l unless otherwise noted.

TABLE 1

WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS
 June 20, 1978
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

	Missouri River					Logan & Mud Creeks		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
<u>Non Metals (a)</u>								
Alkalinity (as CaCO ₃)	180	168	170	197	166	362	262	260
Ammonia	<1	<1	<1	<1	<1	<1	<1	<1
Biochemical Oxygen Demand (5)	1	2	<1	1	1	4	3	3
Chemical Oxygen Demand	14	15	10	10	13	15	28	17
Chloride	28	26	26	26	28	19	16	13
Hardness, total (as CaCO ₃)	230	230	230	250	226	372	275	275
Hexane Sol. Materials	4	4	2	6	4	6	2	3
Nitrate (as N)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Nitrogen, TKN (as N)	1.4	<1	1.4	<1	<1	<1	1.4	1.4
Orthophosphate, sol. (as P)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate, total (as P)	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1
Sulfate	154	132	153	133	156	40	32	44
Total Dissolved Solids	414	421	454	436	425	413	299	299
Total Suspended Solids	142	242	112	42	130	58	62	50
Total Solids	570	506	538	469	547	475	368	356
Total Coliforms (Col/100 ml)	8,500	3,700	5,400	7,700	7,900	30,000	40,000	26,000
Fecal Coliforms (Col/100 ml)	680	90	680	490	130	320	20,400	2,060
Turbidity (JTU)	26	14	17	10	21	32°	10	26
Temperature (°C)	25	25	25	24	25	22	21	21
Specific Conductance (µmhos/cm)	N/A (b)	N/A	N/A	N/A	N/A	650	N/A	N/A
Dissolved Oxygen	8.2	10.8	8.7	8.9	8.2	10.8	6.1	6.6
pH	7.9	8.3	7.6	7.6	7.6	7.2	7.2	7.3
<u>Metals (a)</u>								
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cadmium	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	49.8	49.6	61.0	33.4	27.6	116	80.6	75.9
Chromium, total	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Copper	0.14	0.02	0.04	0.06	0.06	0.12	0.05	0.05
Iron, total	1.64	0.96	1.38	0.68	1.84	0.82	0.52	0.80
Lead	0.025	0.015	0.017	0.018	0.031	0.048	0.019	0.030
Magnesium	14.3	19.4	9.7	20.6	19.0	29.2	31.2	28.1
Mercury (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sodium	53.6	52.2	54.0	45.8	49.2	8.6	4.0	6.4
Zinc	0.02	0.07	0.01	0.02	0.09	0.08	0.01	0.04
Time of Day	12:40	12:34	12:24	12:07	12:17	09:30	10:05	09:55

NOTES: (a) All units are mg/l unless otherwise indicated.

(b) Conductivity not available resulting from meter malfunction.

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 AUGUST 29, 1978

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter (a)	Station				
	A-1	B-2	B-1	C-2	C-1
Alkalinity (as CaCO ₃)	158	146	159	148	158
Hardness, total (as CaCO ₃)	236	232	232	244	236
Hexane Soluble Materials	7	4	13	4	3
Total Suspended Solids	121	35	112	44	129
Total Solids	592	515	586	514	597
Turbidity (JTU)	83	51	35	56	87
Temperature (°C)	26	26	26	26	26
Specific Conductance (µmhos/cm)	750	760	750	740	750
pH (units)	7.5	7.5	7.6	7.9	7.8
Dissolved Oxygen	7.3	7.2	7.0	7.6	6.
Magnesium	20	20	20	20	20
Calcium	67	67	64	64	63
Time	1155	1139	1134	1115	1127
Air Temperature (°C)	24	24	24	24	24
River Stage (ft)	10.2				
River Discharge (cfs)	68,000				

NOTES: (a) All parameters measured in mg/l unless otherwise indicated.

G-46

TABLE 1

WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY

February 28, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter (a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	121	118	122	120	118				
Hardness, total (as CaCO ₃)	172	168	172	168	168				
Hexane Soluble Materials	11	8	13	12	8				
Total Suspended Solids	402	323	450	306	444	134		30	26
Total Solids	726	608	610	672	1,558	332		90	28
Turbidity (JTU)	110	155	132	210	155	65		37	68
Temperature (°C)	1	1	1	1	1				
Specific Conductance (µmhos/cm)	250	252	251	240	251	350		340	340
pH	7.2	7.0	7.0	7.1	6.8	7.1		7.1	7.2
Dissolved Oxygen	9.1	8.8	8.8	8.8	8.6	9.1		9.6	9.6
Magnesium	23.6	31.7	25.8	29.5	24.5				
Calcium	90.6	69.3	93.6	65.3	95				
Time	1305	1300	1310	1240	1315	0940		1015	1015
Air Temperature (°C)	1	1	1	1	1	2		2	2
BOD						2		2	2
Discharge (CFS)	130,000		130,000		130,000	14.5		18.0	18.0

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

G-47

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 July 25, 1978

RFP. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter	Station				
	A-1	B-2	B-1	C-2	C-1
Alkalinity (as CaCO ₃)	132	132	130	130	132
Hardness, total (as CaCO ₃)	232	232	232	232	236
Hexane Soluble Materials	8	20	4	6	10
Total Suspended Solids	3,213	2,680	3,000	2,410	2,970
Total Solids	3,470	3,068	3,506	3,016	3,476
Turbidity (JTU)	1,560	1,560	1,560	1,360	1,560
Temperature (°C)	27	27	27	26.5	27
Specific Conductance (µmhos/cm)	590	590	600	600	575
pH	7.4	7.5	7.4	7.5	7.8
Dissolved Oxygen	4.8	4.8	4.6	5.2	5.0
Magnesium	23	23	22	21	22
Calcium	12	10	13	11	12
Time	11:23 A.M.	11:12 A.M.	11:19 A.M.	10:53 A.M.	11:05 A.M.
Air Temperature (°C)	32	32	32.5	26.5	27

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

G-48

LOGAN AND MUD CREEKS

TABLE 1

Date: 9/26

REF. CONSTRUCTION WATER QUALITY MONITORING
CALLAWAY PLANT 1976-1980

Project #: 1409

	Missouri River					Logan & Mud Creek		
	A-1	B-2	B-1	C-2	C-1	D	E-1	E-2
NON METALS*(a)								
Alkalinity (as CaCO ₃)	108	116	110	106	118	122	312	247
Ammonia	<1	<1	<1	<1	<1	<1	<1	<1
Biochemical Oxygen Demand (5)	9	8	9	8	9	<2	<2	<2
Chemical Oxygen Demand	62	60	76	60	68	15	13	14
Chloride	22	18	17	19	18	17	11	15
Hardness, total (as CaCO ₃)	176	176	176	176	176	184	332	312
Hexane Sol. Materials	9	3	3	1	4	1	1	2
Nitrate (as N)	3.2	2.2	2.4	2.2	2.3	1.9	0.7	1.2
Nitrogen, TKN (as N)	<0.02	<0.02	<0.02	<0.20	<0.20	<0.20	<0.02	<0.02
Orthophosphate, sol. (as P)	0.12	0.09	0.13	0.09	0.09	0.07	0.10	0.05
Phosphate, total (as P)	0.68	0.65	1.13	0.87	1.13	0.20	0.07	0.12
Sulfate	89	88	88	88	88	91	108	109
Total Dissolved Solids	322	308	304	290	304	326	350	448
Total Suspended Solids	1,230	1,300	1,250	1,230	1,390	61	20	24
Total Solids	1,610	1,666	1,652	1,612	1,773	426	396	505
Total Coliforms (Col/100 ml)	49,000	54,000	61,000	72,000	55,000	23,000	13,000	12,900
Fecal Coliforms (Col/100 ml)	6,600	7,800	7,100	7,300	6,600	380	40	10
Turbidity (JTU)	610	450	700	1,000	620	120	25	6
Temperature, °C	19	19	19.5	19	19	19	16	17
Specific Conductance (µmhos/cm)	400	395	395	395	400	450	550	565
Dissolved Oxygen	4.5	4.7	4.3	4.5	4.7	4.50	6.6	3.0
	7.4	7.3	7.2	7.4	7.3	6.5	6.4	6.8
METALS (a)								
Arsenic	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium	30.0	16.0	18.0	11.5	13	51	103	74
Chromium, total	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Copper	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Iron, total	12.24	5.22	8.68	5.16	4.62	2.88	0.12	0.28
Lead	<0.001	0.003	0.005	<0.001	0.007	<0.001	<0.001	0.001
Magnesium	12.88	14.36	12.64	13.6	14.28	14.8	35.00	24.24
Mercury (µg/l)	1.0	0.6	1.0	0.8	0.4	0.4	0.4	0.4
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sodium	35.0	31.0	33.5	29.0	31.5	53.5	13.0	12.0
Zinc	0.13	<0.01	0.09	0.12	0.12	<0.01	<0.01	<0.01
Estimated Flow								
Time of Day	12:45	12:15	12:35	11:55	12:05	0925	0950	1005

NOTE: (a) All units in mg/l unless otherwise indicated.

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Parameter (a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	154	154	153	201	152	--	--	--	--
Hardness, total (as CaCO ₃)	236	236	236	272	236	--	--	--	--
Hexane Soluble Materials	5	7	4	5	9	16	4	6	7
Total Suspended Solids	562	504	568	498	582	562	558	434	436
Total Solids	70	35	80	5	90	105	65	15	10
Turbidity (JTU)	62	43	17	38	17	26	24	7	19
Temperature (°C)	15	15	15	15	15	13.5	13.5	12.9	12.9
Specific Conductance (µmhos/cm)	595	600	595	600	600	560	560	350	550
pH	7.8	7.3	7.4	7.6	7.5	6.8	6.9	7.0	7.1
Dissolved Oxygen	9.3	9.2	9.2	9.9	9.2	5.8	5.9	6.8	6.8
Magnesium	21.1	20.0	19	24.6	23.5	36.3	34.3	29.5	30.9
Calcium	104	90	85	104	83	162	158	132	135
Time	1,530	1,505	1,515	1,440	1,445	1,120	1,110	1,205	1,208
Air Temperature (°C)	17	17	17	17	17	18.5	18.5	15.5	15.5
BOD	--	--	--	--	--	2	2	5	4
Discharge (CFS)	65,000	NA	65,000	NA	65,000	.1	.1	NF	NF

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

NA - Not Available.

NF - No Significant Flow.

G-50

TABLE 1

WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
November 28, 1978

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter (a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	150	156	145	150	145	180	180	143	145
Hardness, total (as CaCO ₃)	224	232	216	232	212	248	244	192	188
Hexane Soluble Materials	20	17	16	6	6	5	6	<1	<1
Total Suspended Solids	121	169	186	120	200	11	11	14	17
Total Solids	564	622	592	535	620	321	324	291	283
Turbidity (JTU)	185	195	235	185	120	94	132	137	137
Temperature (°C)	4	4	4	3.8	4	4	4	4	4
Specific Conductance (µmhos/cm)	390	397	368	365	370	275	275	230	230
pH	7.6	7.5	7.5	7.4	7.4	7.4	7.5	7.0	7.0
Dissolved Oxygen	8.8	8.8	8.8	8.7	8.7	7.9	7.9	7.6	7.7
Magnesium	18.5	18.9	16.4	17.3	17.5	21.8	21.2	18.0	16.9
Calcium	61	59	58	57	58	65	64	53	49
Time	1150	1137	11.45	1110	1125	0840	0835	0900	0900
Air Temperature (°C)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
BOD	--	--	--	--	--	1	1	1	1
Discharge (CFS)	107,000	NA	107,000	NA	107,000	3	3	14.5	14.5

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

G-51

TABLE 1

WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

December 14, 1978

Non Metals	Missouri River					Logan and Mud Creeks						
	A-1	B-1	B-2	C-1	C-2	D	E-1	E-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	174	172	252	171	319	321	260	244				
Ammonia	1	1	1	1	1.7	1	1	1				
Biochemical Oxygen Demand	2	1	3	3	3	2	1	4	2	2	2	2
Chemical Oxygen Demand	15	19	9	17	7	1	4	13				
Chloride	1	2	3	2	1	2	1	2				
Hardness, total (as CaCO ₃)	257	230	201	230	350	368	293	297				
Hexane Sol. Materials	11	9.0	13.2	11.7	11.9	9.7	4.6	6.9	3.6	16.7	12.3	8.7
Nitrate	0.9	0.9	0.6	0.8	0.4	0.5	0.4	1.3				
Nitrogen, TKN	1.2	1	1	1	1	1	1	1				
Orthophosphate, Sol. (as P)	0.06	0.07	0.04	0.06	0.01	0.01	0.01	0.04				
Phosphate, total (as P)	0.03	0.01	0.02	0.01	0.01	0.01	0.01	0.04				
Sulfate	157	152	118	148	38	39	11	17				
Total Dissolved Solids	434	434	444	430	384	416	316	338				
Total Sus. Sol.	370	100	52	86	182	9	5	17	13	21	10	17
Total Solids	842	554	496	502	558	396	314	346	340	392	396	400
Total Coliforms (Col/100 ml)	2,600	4,800	1	4,600	1	2	5	3,900				
Fecal Coliforms (Col/100 ml)	1,070	1,210	1	330	1	2	3	480				
Turbidity (JTU)	31	38	11	34	22	7	7	14				
Temperature, °C	3	2	5	2	4	2	5	3	5	5	2	2
Specific Conduc- tance (µmhos/cm)	365	350	430	340	340	355	285	290	300	310	370	310
Dissolved Oxygen	10.1	9.8	9.4	9.8	6.6	8.7	9.4	9.6	9.2	8.8	8.4	9.1
pH	6.9	6.9	6.9	6.9	7.2	7.4	6.8	6.9	6.9	6.9	6.9	6.8
Metals												
Arsenic	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002				
Cadmium	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01				
Calcium	65	67	86	70	102	105	83	82	83	85	103	97
Chromium, total	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01				
Copper	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01				
Iron, total	1.10	1.27	0.46	1.53	1.38	0.52	0.44	0.63				
Lead	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001				
Magnesium	22.7	22.1	30.7	22.7	37.4	39.7	35.3	37.5	36.2	37.4	40.0	37.8
Mercury	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
Selenium	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004				
Sodium	59	62	45	55	19	12	67	14				
Zinc	0.01	0.01	0.01	0.04	0.02	0.02	0.05	0.02				
Discharge (cfs)	53,800	53,800	-	53,800	-	-	-	-				
Time of Day	1:30	1:45	1:20	1:15	1:30	10:15	9:00	8:50	9:20	9:25	9:55	9:45

TABLE 1

WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
January 30, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter (a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	222	225	200	209	221	-	-	-	-
Hardness, total (as CaCO ₃)	284	264	292	244	286	-	-	-	-
Hexane Soluble Materials	2	2	3	1	<1	<1	1	4	12
Total Suspended Solids	15.5	772	13	46.5	24	4.5	4.5	4.5	15
Total Solids	578	933	581	336	578	330	335	320	335
Turbidity (JTU)	6.5	460	5	11	7	14	3	11	9
Temperature (°C)	0°C	-1	0	0	0	0	0	0	0
Specific Conductance (µmhos/cm)	280	210	360	255	340	272	253	240	240
pH	7.5	7.7	7.6	7.6	7.6	6.9	7.1	6.8	6.4
Dissolved Oxygen	9.1	9.8	8.8	9.5	9.0	10.1	14.2	9.4	10.0
Magnesium	23.6	31.7	25.8	29.2	24.5	30.1	30.1	26.5	27.5
Calcium	90.6	69.3	93.6	65.3	95	80.6	80.6	90.7	85.0
Time	16 30	1500	1530	1430	1400	1050	1040	0930	0940
Air Temperature (°C)	-2	-2	-2	-2	-2	-2	-2	-2	-2
BOD	-	-	-	-	-	2	2	2	2
Discharge (CFS)	33,800		33,800		33,800				

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS

March 28, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Non Metals	Missouri River					Logan and Mud Creeks						
	A-1	B-1	B-2	C-1	C-2	D	E-1	E-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	135	153	135	135	133	108	166	112				
Ammonia	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5				
Biochemical Oxygen Demand	10	10	8	9	9	2	0	0				
Chemical Oxygen Demand	149	132	125	108	108	35	8	24				
Chloride	17	20	16	15	16	19	13	16				
Hardness, total (as CaCO ₃)	220	184	177	160	168	124	188	125				
Hexane Sol. Materials	8	13	10	4	12	6	15	15				
Nitrate	5.5	4.8	5.0	4.9	4.8	3.9	4.1	2.7				
Nitrogen, TRN	5.7	5.7	6.6	6.6	6.0	1.3	1.3	1.3				
Orthophosphate, Sol. (as P)	0.07	0.06	0.06	0.06	0.06	0.04	<0.01	0.01				
Phosphate, total (as P)	0.52	0.63	0.66	0.57	0.02	0.01	0.03	<0.01				
Sulfate	57	59	56	53	55	52	35	32				
Total Dissolved Solids	248	144	56	232	274	292	198	196				
Total Sus. Sol.	2,604	2,324	3,240	2,340	2,062	168	28	22			10	
Total Solids	3,068	2,394	3,512	2,410	2,126	428	266	216			202	
Total Coliforms (Col/100 ml)	130	3,100	2,500	120	2,500	500	100	45				
Fecal Coliforms (Col/100 ml)	<100	800	2,500	40	530	170	10	43				
Turbidity (JTU)	1,500	1,000	1,000	700	900	260	15	62			78	125
Temperature, °C	5	5	5	5	6	8	12	8			8	
Specific Conductance (µmhos/cm)	200	200	200	200	205	200	220	140			160	165
Dissolved Oxygen	9.2	9.8	8.7	9.5	7.3	7.5	8.4	<.5			6.9	
pH	7.4	7.5	7.5	7.5	7.3	7.1	6.9	6.8			7.5	
Metals												
Arsenic	0.007	0.014	0.008	0.008	0.007	<0.002	<0.002	<0.002				
Cadmium	0.003	0.004	0.016	<0.001	<0.001	0.004	0.004	0.003				
Calcium	34.5	36.2	32.1	32.2	31.1	33.0	60.8	41.0				
Chromium, total	0.02	0.02	0.01	0.01	0.02	<0.01	<0.01	<0.01				
Copper	0.04	0.05	0.03	0.05	0.04	0.01	<0.01	<0.01				
Iron, total	21.5	23.8	27.0	24.3	23.3	15.5	0.5	1.3				
Lead	0.067	0.067	0.045	0.045	0.027	0.001	<.001	<.001				
Magnesium	14.5	13.3	15.4	14.1	14.5	10.3	17.2	12.1				
Mercury	.9	.6	.5	.75	.7	.5	.55	.4				
Selenium	<.004	<.004	<.004	<.004	<.004	<.004	<.004	<.004				
Sodium	19	19	21	19	19	18	4	1				
Zinc	0.07	0.08	0.11	.009	.005	<0.01	<0.01	<0.01				
Discharge (cfs)	252,000	252,000	-	252,000	-	-	-	-				
Time of Day	1420	1440	1500	1400	1410		9:30	9:40			1000	1015

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

TABLE 1

WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
APRIL 19, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Parameter (a)	Station									
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2	
Alkalinity (as CaCO ₃)	169	169	169	169	169					
Hardness, Total (as CaCO ₃)	288	262	277	258	263					
Hexane Soluble Materials	<1	3	2	<1	<1					
Total Suspended Solids	434	418	356	318	320	41	10	15	16	
Total Solids	769	716	775	728	737	343	273	256	253	
Turbidity (JTU)	188	240	160	300	296	80	13	36	28	
Temperature (°C)	11	11	11	11	11					
Specific Conductance (mhos/cm)	390	325	325	320	320	370	350	290	290	
pH	7.4	7.5	7.5	7.7	7.5	7.0	7.0	7	7	
Dissolved Oxygen	8.0	9.1	9.5	8.6	9.3	7.2	7.4	8.2	8.2	
Magnesium	19.1	17.6	18.3	18.4	17.8					
Calcium	84.0	75.8	80.7	72.9	75.8					
Time	10:35	10:50	10:45	11:30	11:00	9:45	9:40	9:20	9:20	
Air Temperature (°C)	12.5	12.5	12.5	12.0	12.5	12	12	12	12	
BOD						2	ND	2	2	
Discharge	138,000		138,000		138,000	14	14 CFS	17 CFS	17 CFS	

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 MAY 30, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Parameter (a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	180	183	180	193	181				
Hardness, total (as CaCO ₃)	221	235	225	228	235				
Hexane Soluble Materials	2	4	4	4	2				
Total Suspended Solids	186	177	201	107	175	39	59	20	16
Total Solids	596	617	648	574	656	356	366	356	372
Turbidity (JTU)	74	48	65	84	90	40	49	5	5
Temperature (°C)	21	21	21	21	21	19	19	19	19
Specific Conductance (µmhos/cm)	620	610	610	620	610	485	490	510	510
pH	7.8	7.9	8.0	7.9	8.0	7.5	7.5	7.2	7.3
Dissolved Oxygen	7.6	7.7	7.7	8.1	8.3	1.8	1.8	7.2	6.9
Magnesium	18	19	18	20	20				
Calcium	77	87	75	84	80				
Time	1100	1120	1105	1115	1110	1005	1000	0950	0945
Air Temperature (°C)	20	21	20	21	21	21	21	21	21
BOD						3	2	3	3
Discharge (CFS)	90,000		90,000		90,000	2.5	2.5	4.4	4.4

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

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Date: June 1979

Project #: 1409

TABLE 1

WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS

June 27, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Non Metals	Missouri River					Logan and Mud Creeks						
	A-1	B-1	B-2	C-1	C-2	D	E-1	E-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	160	220	193	190	190	370	300	290	-	-	-	-
Ammonia	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	-	-	-	-
Biochemical Oxygen Demand	<1	<1	2	1	1	4	1	2	2	1	2	4
Chemical Oxygen Demand	62	50	50	58	54	20	9	16	-	-	-	-
Chloride	19	20	20	21	21	8	7	5	-	-	-	-
Hardness, total (as CaCO ₃)	270	250	270	260	260	360	300	280	-	-	-	-
Hexane Sol. Materials	18	8	10	6	6	15	6	5	-	-	-	-
Nitrate	1.9	1.9	1.7	1.9	1.9	0.4	0.6	0.6	-	-	-	-
Nitrogen, TKN	0.6	1.4	2.3	1.1	1.1	<.5	<.5	<.5	-	-	-	-
Orthophosphate, Sol. (as P)	<.01	<.01	0.02	0.02	<.01	0.02	<.01	0.07	-	-	-	-
Phosphate, total (as P)	0.50	0.80	0.70	0.20	0.30	0.01	0.30	0.01	-	-	-	-
Sulfate	144	142	188	156	144	34	20	22	-	-	-	-
Total Dissolved Solids	400	440	410	440	440	430	350	330	-	-	-	-
Total Sus. Sol.	1350	1260	1220	1280	1150	115	40	40	115	20	40	15
Total Solids	1750	1680	1640	1800	1590	545	390	370	484	418	475	445
Total Coliforms (Col/100 ml)	7200	7000	7600	6700	6700	1100	235	1100	-	-	-	-
Fecal Coliforms (Col/100 ml)	3600	3100	3400	4200	3200	160	55	45	-	-	-	-
Turbidity (JTU)	770	1300	1000	750	900	90	31	62	50	20	30	20
Temperature, °C	23	22.5	23	22.5	23	17	20	19	18.5	18	22	23
Specific Conductance (µmhos/cm)	650	650	675	650	675	690	470	470	600	600	705	705
Dissolved Oxygen	6.4	6.5	6.5	6.8	6.6	6.1	8.9	5.2	4.9	5.1	7.4	7.4
pH	7.8	7.8	7.9	7.9	7.9	7.5	7.2	7.4	7.6	7.6	7.5	7.5
Metals												
Arsenic	.009	.008	.008	.009	.009	.010	<.002	.006	-	-	-	-
Cadmium	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	-	-	-	-
Calcium	82	85	85	81	82	122	100	101	-	-	-	-
Chromium, total	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	-	-	-	-
Copper	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	-	-	-	-
Iron, total	0.06	0.33	0.02	0.09	0.07	<0.01	0.06	0.01	-	-	-	-
Lead	.008	.006	.008	.003	.004	.002	.002	.001	-	-	-	-
Magnesium	20	20	20	20	20	31	38	30	-	-	-	-
Mercury (µg/l)	<.1	<.1	<.1	<.1	<.1	<.1	0.25	<.1	-	-	-	-
Selenium	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	-	-	-	-
Sodium	57	60	77	76	78	21	14	8	-	-	-	-
Zinc	0.35	0.07	0.02	0.04	0.07	0.05	0.05	0.06	-	-	-	-
Discharge (cfs)	93200	93200	71	93200	<1	<1	<1	<1	<1	<1	<1	<1
Time of Day	1440	1420	1430	1400	1450	1145	1130	1215	1100	1100	1030	1030

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 JULY 26, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Parameter (a)	Station								
	A-1	B-1	B-2	C-1	C-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	160	157	160	156	163				
Hardness, total (as CaCO ₃)	228	224	230	226	229				
Hexane Soluble Materials	4.0	4.0	7.0	2.0	4.0				
Total Suspended Solids	327	420	239	278	123	234 ^(b)	37	19	32
Total Solids	731	699	672	694	576	645 ^(b)	511	417	436
Turbidity (JTU)	210	160	150	145	100	^(b)	26	8	10
Temperature (°C)	27	27	28	27	28	27	27	25	25
Specific Conductance (µmhos/cm)	700	700	700	700	725	775	775	700	700
pH (units)	7.7	7.7	7.7	7.6	7.5	6.8	6.8	7.5	7.5
Dissolved Oxygen	6.4	6.4	6.7	6.4	6.5	8.8	12.2	6.5	6.1
Magnesium	22	22	21	22	22				
Calcium	88	80	86	83	92				
Time (hrs., 24-hr. clock)	1300	1240	1250	1235	1225	1105	1050	1015	1030
Air Temperature (°C)									
BOD						12 ^(b)	3	4	5
Discharge (CFS)	102,000		102,000		102,000	<1	<1	<1	<1

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

(b) Algae in samples; no turbidity reading obtainable.

TABLE 1
 WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
 August 29, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Mr. Donald F. Schnell
 Union Electric Company
 September 26, 1979
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Parameter (a)	Station								
	A-1	B-2	B-1	C-2	C-1	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	170	170	170	170	170	-	-	-	-
Hardness, total (as CaCO ₃)	232	228	232	232	228	-	-	-	-
Hexane Soluble Materials	10	3	3	5	3	-	-	-	-
Total Suspended Solids	390	40	378	73	267	169	26	78	38
Total Solids	804	827	827	506	786	579	432	431	436
Turbidity (JTU)	3100	60	1800	100	80	70	14	90	67
Temperature (°C)	24.0	25.0	24.0	24.5	24.0	20.5	20.5	23.0	18.0
Specific Conductance (µmhos/cm)	700	725	700	675	700	600	650	625	575
pH (units) (b)	7.9	7.8	7.8	7.9	7.9	7.5	7.2	7.6	7.3
Dissolved Oxygen	8.3	8.7	8.2	7.7	7.9	6.7	2.7	6.7	8.7
Magnesium	23.2	21.6	22.0	21.5	22.0	-	-	-	-
Calcium	78	89	76	84	75	-	-	-	-
Time (hrs, 24 hr clock)	1120	1140	1125	1130	1128	1000	0955	0933	0930
Air Temperature (°C)	23.0	23.0	23.0	23.0	23.0	20	20	20	20
BOD	-	-	-	-	-	6	3	4	2
Discharge (cfs)	57,500	-	57,000	-	57,000	<1	<1	<1	<1

NOTES: (a) All parameters measured in mg/l unless otherwise indicated.

(b) pH measured in laboratory because field unit was inoperable.

TABLE 1
 WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS
 Date September 26, 1979
 REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980

Non Metals	Missouri River Stations					Logan and Mud Creek Stations							
	A-1	B-1	B-2	C-1	C-2	D	E-1	E-2	F-1	F-2	G-1	G-2	
Alkalinity (as CaCO ₃)	183	185	187	183	191	359	286	401					
Ammonia	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
Biochemical Oxygen Demand	<1	1	<1	<1	<1	3	1	3					
Chemical Oxygen Demand	14	16	12	14	18	29	25	40					
Chloride	24	22	23	23	23	5	13	5					
Hardness, total (as CaCO ₃)	264	256	264	256	260	368	292	388					
Hexane Sol. Materials	1	7	6	4	6	12	12	5					
Nitrate (as N)	1.4	1.4	0.9	1.2	0.9	<0.1	<0.1	<0.1					
Nitrogen, TKN (as N)	1.6	1.2	1.8	1.2	1.4	2.7	3.3	4.4					
Orthophosphate, Sol. (as P)	0.14	0.14	0.14	0.16	0.12	0.05	0.02	0.02					
Phosphate, total (as P)	0.18	0.21	0.12	0.20	0.14	0.22	0.06	0.31					
Sulfate	173	173	174	174	174	30	38	9					
Total Dissolved Solids	505	490	506	491	493	425	362	429					
Total Sus. Sol.	124	134	42	125	59	73	125	145	79	20	61	24	
Total Solids	623	623	543	622	549	527	541	632	509	440	335	472	
Total Coliforms (Col/100 ml)	2900	2900	9600	2700	17,100	1020	290	1200					
Fecal Coliforms (Col/100 ml)	250	340	360	320	630	1400	2900	2700					
Turbidity (JTU)	60	57	24	57	49	62	72	114	49	18	52	18	
Temperature, °C	21.5	21.5	22.0	20.0	20.0	17.0	16.5	16.0	16.5	16.5	17.5	16.5	
Specific Conductance (µmhos/cm ²)	680	680	690	680	700	620	540	640	640	640	540	550	
Dissolved Oxygen	7.7	8.0	8.6	8.8	8.3	8.7	5.7	7.3	10.5	3.1	8.5	9.7	
pH (units)	7.8	7.9	8.0	7.8	8.0	7.6	7.4	7.2	7.5	7.2	7.7	7.5	
Metals													
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002					
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005					
Calcium	100	96	87	93	97	141	100	100					
Chromium, total	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Iron, total	2.62	1.74	2.22	1.36	1.74	1.72	2.12	5.00					
Lead	0.003	0.002	0.002	0.002	0.005	0.003	0.002	0.003					
Magnesium	23.9	21.3	23.5	24.3	22.8	29.6	34.0	33.4					
Mercury (µg/l)	<0.02	<0.02	<0.02	0.04	0.05	0.04	<0.02	<0.02					
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002					
Sodium	54	52	46	57	52	13	16	8					
Zinc	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02					
Discharge (cfs)	53,600	53,600	0	53,600	0	0	<1	0	0	0	0	0	
Time of Day (24 hour clock)	1250	1230	1240	1205	1220	0950	1035	1050	1025	1020	1010	1005	

TABLE 1

WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
Date October 28, 1979

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980:

Parameter (a)	Missouri River Stations					Logan and Mud Creek Stations			
	A-1	B-1	B-2	C-1	C-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	172	170	170	169	172				
Hardness, total (as CaCO ₃)	268	244	256	256	252				
Hexane Soluble Materials	<1	4.8	<1	7.8	2.6				
Total Suspended Solids	241	223	40	224	58	132	181	34	19
Total Solids	819	793	597	786	614	588	607	419	449
Turbidity (JTU)	127	79	60	75	75	90	75	27	32
Temperature (°C)	13	13	13	13	13	8	8	10	10
Specific Conductance (µmhos/cm)	550	550	500	550	600	420	430	465	465
pH (units)	7.5	7.5	7.8	7.6	7.7	7.0	7.0	6.8	6.8
Dissolved Oxygen	8.7	8.6	7.9	8.5	7.2	2.3	2.3	3.2	3.2
Magnesium	22	22	21	22	23				
Calcium	81	76	79	78	83				
Time (24 hour clock)	1100	1140	1050	1030	1015	0925	0925	0900	
Air Temperature (°C)		10	10	10	10	8	8	10	
BOD						10	8	5	5
Discharge (cfs)	57,500	57,500	0	57,500	0	0	0	<1	<1

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

TABLE 1

WATER QUALITY FROM MISSOURI RIVER BARGE SLIP FACILITY
Date November 29, 1979

1409

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Parameter (a)	Missouri River Stations					Logan and Mud Creek Stations			
	A-1	B-1	B-2	C-1	C-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	168	168	166	168	168				
Hardness, total (as CaCO ₃)	248	256	252	250	252				
Hexane Soluble Materials	<5	7	<5	6	<5				
Total Suspended Solids	308	107	286	298	124	11	14	18	63
Total Solids	978	632	822	812	662	534	550	394	480
Turbidity (JTU)	560	300	500	340	440	48	80	22	44
Temperature (°C)	4	4	2.5	4	4	2	2	2.5	2.5
Specific Conductance (µmhos/cm)	440	465	420	460	400	475	490	465	470
pH (units)	8.2	7.8	8.1	8.2	8.2	8.0	8.0	7.5	7.5
Dissolved Oxygen	10.9	9.4	10.7	10.8	11.2	9.2	9.2	9.1	9.4
Magnesium	27	25	29	26	29				
Calcium	59	65	61	58	60				
Time (24 hour clock)	1230	1410	1310	1320	1345	1020	1015	0935	0930
Air Temperature (°C)									
BOD						<5	<5	<5	<5
Discharge (cfs)	72,500	0	72,500	<1	<1	<1	<1	<1	<1

NOTE: (a) All parameters measured in mg/l unless otherwise indicated.

TABLE 1

WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS

Date

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Non Metals	Missouri River Stations					Logan and Mud Creek Stations						
	A-1	B-1	B-2	C-1	C-2	D	E-1	E-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	194	188	194	188	192	343	323	246				
Ammonia	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
Biochemical Oxygen Demand	0	0	0	1	0	3	0	0				
Chemical Oxygen Demand	19	19	14	12	19	28.8	20	1				
Chloride	22	22	24	21	21	4	8	14				
Hardness, total (as CaCO ₃)	280	272	280	268	276	356	352	364				
Hexane Sol. Materials	9	<5	<5	<5	<5	<5	<5	<5				
Nitrate (as N)	1.3	1.3	1.3	1.2	1.3	<.01	<.01	<.01				
Nitrogen, TKN (as N)	1.2	3.0	1.2	1.2	0.6	1.8	1.2	1.8				
Orthophosphate, Sol. (as P)	0.20	0.15	0.16	0.17	0.17	0.11	0.05	0.04				
Phosphate, total (as P)	0.62	0.34	0.22	0.30	0.25	0.34	0.22	<0.01				
Sulfate	134	148	148	147	157	12	25	80				
Total Dissolved Solids	494	514	526	522	536	400	378	418				
Total Sus. Sol.	171	128	81	145	150	10	86	49				
Total Solids	708	738	566	620	618	404	452	446				
Total Coliforms (Col/100 ml)	17,000	12,500	3800	3000	11,800	90	90	160				
Fecal Coliforms (Col/100 ml)	3,700	3,600	4,500	2,900	2,900	<10	30	120				
Turbidity (JTU)	29	43	11	29	31	3	7	<3				
Temperature, °C	0.5	0.5	1	0.5	1		1	1				
Specific Conductance (µmhos/cm ²)	600	600	600	600	600	440	440	460				
Dissolved Oxygen	12.2	12.2	11.8	12.2	11.5	7.1	10.9	11.1				
pH (units)	7.3	7.3	7.1	7.5	7.3	7.3	7.3	7.3				
Metals												
Arsenic	<.004	<.004	<.004	<.004	<.004	<.004	<.004	<.004				
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01				
Calcium	97	100	107	102	96	153	139	128				
Chromium, total	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02				
Copper	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01				
Iron, total	2.26	2.31	0.60	2.37	2.44	0.16	0.84	0.14				
Lead	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002				
Magnesium	27	27	27	26	26	40	51	53				
Mercury (µg/l)	<.1	.24	<.1	.23	.27	.10	.11	.35				
Selenium	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005				
Sodium	50	53	53	55	59	8	8	7				
Zinc	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01				
Discharge (cfs)	59,000	59,000		59,000								
Time of Day (24 hour clock)	1040	1050	1110	1130	1140	0845	0900	0930				

TABLE 1

WATER QUALITY DATA FROM MISSOURI RIVER, LOGAN AND MUD CREEKS

Date March 20, 1980

REF. CONSTRUCTION WATER QUALITY MONITORING CALLAWAY PLANT 1976-1980.

Non Metals	Missouri River Stations					Logan and Mud Creek Stations						
	A-1	B-1	B-2	C-1	C-2	D	E-1	E-2	F-1	F-2	G-1	G-2
Alkalinity (as CaCO ₃)	134	135	135	135	138	143	180	180				
Ammonia	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5				
Biochemical Oxygen Demand	3	3	3	2	2	<2	<2	<2				
Chemical Oxygen Demand	67	67	71	60	44	11	5	7				
Chloride	15	17	18	13	5	9	6	8				
Hardness, total (as CaCO ₃)	140	140	150	140	130	250	330	340				
Hexane Sol. Materials	8	2	2	1	1	2	2	1				
Nitrate (as N)	1.66	1.66	1.70	1.39	1.55	1.19	0.65	2.05				
Nitrogen, TKN(as N)	<5	<5	<5	<5	1.2	1.7	1.1	6.4				
Orthophosphate, Sol. (as P)	0.84	0.63	0.74	0.51	0.83	0.41	0.28	0.30				
Phosphate, total (as P)	0.80	0.90	0.70	1.0	1.0	0.70	0.30	0.40				
Sulfate	85	81	95	78	80	40	56	54				
Total Dissolved Solids	600	500	570	510	280	280	310	280				
Total Sus. Sol.	890	840	830	780	460	30	10	50				
Total Solids	1490	1340	1400	1290	740	310	320	330				
Total Coliforms (Col/100 ml)	3500	6100	3200	4400	6400	2400	240	240				
Fecal Coliforms (Col/100 ml)	1240	1010	980	1020	610	15	15	30				
Turbidity (JTU)	600	372	544	544	312	35	<5	<5				
Temperature, °C	6	6	7	6	7	10	8	7				
Specific Conductance (µmhos/cm ²)	330	330	360	330	320	250	305	305				
Dissolved Oxygen	11.3	11.3	11.2	11.5	11.5	12.2	11.8	11.5				
pH (units)	7.5	7.4	7.4	7.5	7.4	7.8	7.8	7.6				
Metals												
Arsenic	0.009	.008	.008	.006	.003	<.001	.001	<.001				
Cadmium	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005				
Calcium	15.93	18.12	18.34	14.9	16.61	53.63	85.06	89.45				
Chromium, total	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05				
Copper	0.03	0.02	0.03	0.03	<0.02	<0.02	<0.02	<0.02				
Iron, total	15.80	14.28	14.56	16.32	8.75	1.14	0.22	0.72				
Lead	.025	.030	.029	.026	.009	<.001	<.001	<.001				
Magnesium	18.30	18.10	18.40	17.9	18.65	22.15	28.00	27.95				
Mercury (µg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				
Sodium	36.7	35.7	39.1	40.3	27.9	6.8	7.0	8.5				
Zinc	.022	.067	.024	.027	.066	<.005	<.005	<.005				
Discharge (cfs)	93,300	93,300	<1	93,300	<1	<1.5	<1	1				
Time of Day (24 hour clock)	1040	1045	1130	1100	1120	0915	0940	0955				

APPENDIX H
Vegetational Data

APPENDIX A-2

DATA SUMMARY FOR PRAIRIE VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION PR-1, CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	Subplots - presence indicated by dry weight (grams/0.25-microliter Plot)																Frequency ^a (%)	Relative ^b Frequency	Day ^c Weight Per Species	Relative ^d Weight (%)	Importance ^e Value
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Festuca arundinacea</i> Schreb. reed fescue	130.57		152.31		195.22	179.88	179.88	119.48	177.05	159.96	102.46	173.78					90.00	17.39	2373.60	94.12	111.51
<i>Festuca elatior</i> L. meadow fescue		145.31		146.19	11.39	13.78	127.49	175.55	1.18		190.87	185.92					56.25	9.78	31.32	1.24	11.02
<i>Oxytalia glomerata</i> L. orchard grass	0.32	0.45	2.51						2.41	0.38	0.77	3.91	1.01	30.00	8.70	11.94	30.00	8.70	11.94	0.47	8.17
<i>Juncus tenuis</i> Willd. path rush	3.85	3.87	3.10	3.86	0.35	24.48		2.64	0.99	0.24	0.05	7.59	4.61	75.00	13.04	35.43	75.00	13.04	35.43	2.70	15.24
--- <i>Carpenteria</i> L. wild geranium		0.08		0.10													12.50	2.17	0.16	0.006	2.17
<i>Poa pratensis</i> L. Kentucky bluegrass	0.27		0.78	0.08		33.57	2.53	1.66	0.31	0.21	0.10						43.75	7.61	16.20	0.64	8.25
--- <i>Panicum laetigium</i> Ell. panicum							0.10	0.97	0.10	34.79	0.29	0.62	0.27	56.25	9.78	4.22	56.25	9.78	4.22	0.17	9.95
<i>Trifolium pratense</i> L. red clover							1.29				0.07						12.50	2.17	1.36	0.05	2.22
<i>Oxalis europaea</i> Jord. yellow wood sorrel				0.08		0.08		1.08	0.43		0.08						25.00	4.35	0.28	0.01	4.36
<i>Aster</i> sp. L. aster				0.17			1.85										12.50	2.17	2.07	0.08	2.25
<i>Franseria vulgaris</i> L. wild horehound					0.15	2.50											18.75	3.28	2.83	0.11	3.37
<i>Centaurea jacobina</i> Mack. --- <i>Ambrosia bidentata</i> Michx. ragweed						0.25	0.30	0.46									18.75	3.28	1.01	0.04	3.30
<i>Veronica arvensis</i> L. corn speedwell						0.28											6.25	1.09	0.28	0.01	1.10
<i>Dactylis spicata</i> (L.) Beauv. poverty grass						0.42											6.25	1.09	0.18	0.007	1.09
<i>Lespedeza stipularis</i> Maxim. Korean clover						1.25											6.25	1.09	0.42	0.02	1.11
<i>Plantago virginica</i> L. plantain						0.25											6.25	1.09	1.25	0.05	1.14
<i>Rumex crispus</i> L. wild rhubarb						0.25											6.25	1.09	0.25	0.009	1.09
<i>Agrostis humilis</i> (Walt.) RSP. hair grass						0.13		0.58									12.50	2.17	0.81	0.03	2.20
<i>Carex festucacea</i> Schk. --- <i>Trifolium repens</i> L. white clover								0.14	0.74								6.25	1.09	0.14	0.006	1.09
Totals	135.36	153.44	160.99	151.87	207.11	97.35	183.14	139.94	139.86	178.71	181.09	131.11	194.30	169.49	174.68	575.00	100.00	3321.78	100.10	100.00	100.00

^a Number of subplots the species occurs x 100

^b Number of subplots sampled (16)

^c Frequency of a species occurrence

^d Cumulative frequency for all species

^e Cumulative weight (16 subplots) by species

^f Cumulative weight (6 species)

^g Cumulative weight (all species)

^h Relative frequency and relative weight

APPENDIX A-3

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION PR-1,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

<u>Scientific Name</u> <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Diospyros virginiana</u> L. persimmon	3.0	23.0	21.0	41.2	64.2
<u>Symphoricarpos</u> sp. Duham. snowberry	1.0	7.7	15.0	29.4	37.1
<u>Rosa carolina</u> L. pasture rose	2.0	15.4	7.0	13.8	29.2
<u>Fraxinus americana</u> L. white ash	1.0	7.7	2.0	3.9	11.6
<u>Crataegus</u> sp. L. hawthorn	1.0	7.7	1.0	2.0	9.7
<u>Quercus velutina</u> Lam. black oak	1.0	7.7	1.0	2.0	9.7
<u>Quercus stellata</u> Wang. post oak	1.0	7.7	1.0	2.0	9.7
<u>Carya</u> sp. Nutt. hickory	1.0	7.7	1.0	2.0	9.7
<u>Ulmus rubra</u> Muhl. slippery elm	1.0	7.7	1.0	2.0	9.7
<u>Rubus flagellaris</u> Willd. dewberry	<u>1.0</u>	<u>7.7</u>	<u>1.0</u>	<u>2.0</u>	<u>9.7</u>
TOTAL	13.0	100.0	51.0	100.3	200.3

APPENDIX A-3 (continued)

Trees and/or shrubs per quadrat = 3.2
Trees and/or shrubs per acre = 518.4

^a Tree or shrub species less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density.

APPENDIX A-4

DATA SUMMARY FOR PRAIRIE VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION PR-2,
CALLAGWAY PLANT SITE, CALLAGWAY COUNTY, MISSOURI, FALL 1974

Scientific Name (Common Name)	Subplots—percentages indicated by dry weight (grams/0.125-milacre plots)														Relative ^b Frequency (%)	Dry Weight ^b for Species	Relative ^b Weight (%)	Importance ^c Value			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14					15	16	
<i>Elymus spicatus</i> (Lam.) Beauv. prairie foxtail	.05																6.25	0.54	.05	0.00	0.54
<i>Poa compressa</i> L. Canada blue grass	35.60	36.70	3.20	41.20	33.50	3.20	2.80	8.30	0.20	2.50	1.00	42.30	6.20	50.60	44.60	2.60	100.00	8.74	214.00	15.49	24.23
<i>Carex sp.</i> L. sedges	.50	4.42				3.10	2.50										25.00	2.18	10.50	0.51	2.68
<i>Festuca longissima</i> Ell.	.85	8.90	5.20	1.90	13.40	2.10	3.40	1.40	6.50	9.90	1.20	16.10	14.40	11.70			87.50	7.65	97.25	4.80	12.45
<i>Tridens flavus</i> (L.) Hitchc. parrotfoot	3.60			12.30		0.70	6.30										25.00	2.18	22.90	1.13	3.31
<i>Mixisida oligantha</i> Michx. prairie three awn grass	36.80	6.70		10.30	91.70	21.20											37.50	3.27	172.50	8.51	11.78
<i>Agrostis alba</i> L. cuttop	17.60	25.30	22.20	54.50	57.00	48.30	21.20	67.20	80.30	61.20	38.30	31.50	17.80	48.20	51.20		91.75	8.19	647.80	31.72	39.91
<i>Aster pilosus</i> Willd. white heart aster	12.70	2.70		9.80													18.75	1.63	25.30	1.24	3.87
<i>Asterias angustata</i> Greene poor's love	1.10																6.25	0.54	1.10	0.05	0.59
<i>Sorghastrum nutans</i> L. perennial ironweed	2.20						1.70										12.50	1.09	3.80	0.19	3.28
<i>Erigeron phillyriaefolius</i> Raf. coral berry	6.10											12.20					15.50	1.09	18.30	0.90	1.99
<i>Muhlenbergia bidentata</i> Michx. reynolds	.70			1.60		1.90	3.20		3.40	4.50	5.10	5.10	1.50				6.25	0.54	2.30	0.11	0.65
<i>Eragrostis ciliaris</i> L. leaf beard	4.30						0.60		1.30	8.30							25.00	2.18	14.50	0.71	2.99
<i>Clintonia virginiana</i> Michx. popwort	1.00						2.20		0.40	1.10	0.20	0.80	4.20	1.80			50.00	4.37	11.80	0.58	4.95
<i>Andropogon virginicus</i> L. broom sedge	2.10						2.50	3.20									18.75	1.63	7.80	0.38	2.01
<i>Muhlenbergia illinoensis</i> L. common millet	13.20				1.00												12.50	1.09	14.20	0.70	1.79

Sheet 1

APPENDIX A-4 (continued)

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (%)	Relative ^c Frequency (%)	Dry Weight ^d for Species	Relative ^e Weight (%)	Importance ^f Value
<i>Sporobolus carolinensis</i> L. bottle	0.45	1.00		1.30									2.20	1.20		2.10	37.50	3.27	8.25	0.40	3.87
<i>Brizopyrum simplex</i> Michx. cirsifolium	0.30			2.30		2.30		0.60	0.50	2.00							37.50	3.27	8.30	0.31	3.58
<i>Carex glauca</i> Pursh. ---	0.70			2.20	0.60			0.60	0.75								37.50	3.27	6.75	0.33	3.60
<i>Phlox hirsuta</i> L. timothy	10.30	14.30		10.30				3.90		2.20	42.20	6.60					41.75	3.82	91.80	4.53	8.35
<i>Lycopodium stipulaceum</i> Nees. juncus clove	1.10			2.30	1.70			0.70		1.30	3.90	1.00	1.20				50.00	4.27	13.20	0.45	5.02
<i>Lagotis sibirica</i> (Thunb.) H. & A. Japanese lespedeza	3.30	1.30	1.40	4.70	2.10	2.30	2.30	0.20	0.20	0.60	19.50	10.50	2.10	2.40			93.75	8.19	70.50	3.47	11.66
<i>Strophostyles umbellata</i> (Walt.) Britt. wild leek																	4.25	0.54	0.70	0.03	0.57
<i>Pycnanthemum tenuifolium</i> Schrad. slender mountain mint	19.60			6.40	1.50	47.00											25.00	2.18	74.50	3.67	5.85
<i>Andropogon furcatus</i> L. tail goldenrod	50.30			50.30			3.10			2.20			25.50	0.70			37.50	3.27	83.10	4.10	7.37
<i>Paspalum laeve</i> Michx. ---				0.70				41.20		1.60							18.75	1.63	43.50	2.34	3.72
<i>Eragrostis spectabilis</i> (Pursh) Steud. purple love grass				4.70													6.25	0.54	4.70	0.23	0.77
<i>Humilis humilis</i> Nutt. wild petunia				2.10						2.40	0.20						18.75	1.63	4.70	0.23	1.06
<i>Conoclinium spatum</i> L. bedstraw				1.70							1.40		1.40				12.50	1.09	3.50	0.17	1.26
<i>Juncus tenuis</i> Willd. pachy rusc				1.30				1.20					2.30				18.75	1.63	4.70	0.23	1.06
<i>Muhlenbergia schreberei</i> Geesl. nimble will				30.20				1.90		11.30							18.75	1.63	43.40	2.14	3.77
<i>Poa pratensis</i> L. Kentucky bluegrass				5.20				22.40	30.30	44.60			49.80				31.25	2.73	142.30	7.02	9.75
<i>Fragaria virginiana</i> Duchesne wild strawberry				1.40													6.25	0.54	1.40	0.37	0.91
<i>Rubus flagellaris</i> Willd. demure				6.20													6.25	0.54	6.20	0.30	0.84
--- Misc sp.				2.20													6.25	0.54	2.20	0.10	0.44

APPENDIX A-4 (continued)

Scientific Name Common Name	Subplots/presence indicated by dry weight (grams/0.125-m ² plots)																Relative ^c Frequency (%)	Dry Weight ^d for Species	Relative ^e Weight (%)	Importance ^f Value
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				
<i>Fragaria virginiana</i> Michx. ---																	6.25	2.20	0.10	0.64
<i>Sisyrinchium lancoletum</i> (Walt.) Gray loosestrife								2.20	1.10								6.25	1.10	0.05	0.59
<i>Spiraea ovata</i> (Michx.) Torr. heavenly club-rub									3.20								6.25	3.20	0.15	0.69
<i>Cyperus strigosus</i> L. umbrella sedge									0.90								6.25	0.90	0.04	0.59
<i>Veronica baldovini</i> Torr. ironweed									5.40			6.40					12.50	12.00	0.59	3.68
<i>Lactuca canadensis</i> L. wild lettuce											13.70						6.25	13.70	0.67	3.21
TOTAL	120.10	119.05	122.20	122.40	129.20	130.30	115.20	120.40	143.20	120.80	120.80	120.80	160.40	111.40	128.10	116.75	122.20	2,025.40	100.12	199.87

^a Includes woody and herbaceous plants of less than 20 inches in height.

^b Number of subplots the species occurs
Number of subplots sampled (16) x 100

^c Frequency of a species occurrence
Cumulative frequency of all species x 100

^d Cumulative weight (16 subplots) by species

^e Cumulative weight in species
Cumulative weight (all species) x 100

^f Relative frequency = relat. w weight.

APPENDIX A-5
 DATA SUMMARY FOR PRAIRIE VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION PR-2,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JULY, 1974

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency x	Relative Frequency %	Weight for Species (z)	Relative Weight Importance y	
<i>Bromus racemosus</i> L. bromus	1.48	9.34	14.05	0.85	15.59	14.09	0.57	3.52	4.18	0.22	17.01	7.29	12.25	9.19	87.50	5.53	109.83	5.86	11.39		
<i>Achillea millefolium</i> L. common yarrow	0.55				1.54		0.84		0.15						25.00	1.58	2.84	0.15	1.73		
<i>Strophostyles umbellata</i> (Nutt.) Britt. wild bean	0.06							0.07							12.50	0.79	0.13	0.01	0.80		
<i>Carex bushii</i> Mack. --- <i>Diapropis virginiana</i> L. persimmon	1.14	2.26	2.26	2.16	3.45	11.50	19.29	3.74	20.26	5.40	16.34	1.46	2.34	0.24	1.10	87.50	5.53	90.68	4.84	10.37	
<i>Lactuca canadensis</i> L. wild lettuce	2.16				1.86		2.40	3.40							25.00	1.58	9.82	0.52	2.10		
<i>Sparganium obtusatum</i> Michx. cort grass	0.26			0.32				0.55							12.50	0.79	14.95	0.80	1.59		
<i>Veronica</i> sp. Schreb. --- <i>Leptodesia stipulacea</i> Maxim. Korean clover	13.74				3.25	6.73	1.11								1.21						
<i>Solanum carolinense</i> L. horse nettle	7.26				0.12		0.29	0.06	3.50	1.52	3.44	1.12	2.45	0.26	0.08		75.00	4.74	14.88	0.79	5.53
<i>Oxalis europaea</i> Jord. yellow wood sorrel	0.37	1.69			0.10	0.20	0.31	0.09	0.13			0.71	0.32	0.05	0.35		88.75	4.35	2.60	0.14	4.49
<i>Androsida bidentata</i> Michx. ragwort	0.11														12.50	0.79	0.43	0.02	0.81		
<i>Cephaelis triflorus</i> L. Pursh --- <i>Phlox pratincola</i> L. --- <i>Carex glauca</i> Tuckerm. --- <i>Panicum lanuginosum</i> Ell. --- <i>Poa pratensis</i> L. Kentucky bluegrass	0.83	0.15	0.10	0.13	0.06	0.09	0.11	0.20	0.33	5.63	20.81	6.12	11.00	66.70	34.17	35.86	100.00	6.32	286.69	15.31	21.63
<i>Agrostis alba</i> L. redtop	0.07	0.08	7.73	1.98	20.54	10.57	12.07	5.63	24.81	19.02	20.81	6.12	11.00	66.70	34.17	35.86	100.00	6.32	286.69	15.31	21.63
<i>Panicum virginicum</i> L. bushy panicum	3.58	6.30	7.73	1.98	20.54	10.57	12.07	5.63	24.81	19.02	20.81	6.12	11.00	66.70	34.17	35.86	100.00	6.32	286.69	15.31	21.63
<i>Junca tenuis</i> Willd. --- <i>Prunella vulgaris</i> L. --- <i>Erigeron strigosus</i> Muhl. daisy fleabane	0.32	0.24	12.08	6.13		2.86	0.60	12.69		2.68	1.30	13.13	8.76		0.24		68.75	4.35	60.79	3.35	7.70
<i>Croton</i> --- <i>Trifolium pratense</i> L. red clover	8.10	22.68	41.05	16.00	50.88	26.11	9.36	53.09	32.53	26.37	15.93	31.50	17.40	37.86	24.18	3.44	100.00	6.32	105.86	5.45	11.97
<i>Prananthemum flexuosum</i> (Walt.) BSP slender mountain mint	57.16	4.72	12.08	6.13		2.86	0.60	12.69		2.68	1.30	13.13	8.76		0.24		100.00	6.32	416.56	22.25	28.57
<i>Trifolium compressum</i> Schreb. --- <i>Potentilla simplex</i> Michx. cinquefoil	0.10	0.10	7.43	.91	23.61	2.52	4.64	6.63	10.94	1.55	3.43	7.76	10.42	10.15	5.98	1.11	100.00	6.32	402.82	21.32	27.05
<i>Panicum perfoliatum</i> Nash --- <i>Rumex acetosella</i> L. sheep sorrel	0.10	0.10	7.43	.91	23.61	2.52	4.64	6.63	10.94	1.55	3.43	7.76	10.42	10.15	5.98	1.11	31.25	1.98	0.37	0.02	2.00
<i>Trifolium repens</i> L. white clover	2.93	0.45	7.43	0.39	0.74		0.11	0.19				14.16		12.10			18.75	1.19	3.78	0.20	1.39
<i>Trifolium pratense</i> L. red clover	2.97	0.20	7.43	0.20	0.17		0.47										43.75	2.77	27.34	1.48	4.25
<i>Trifolium repens</i> L. white clover	0.15	0.15	7.43	0.12	0.04		0.04	0.26	0.01								31.25	1.98	4.05	0.22	2.20
<i>Trifolium repens</i> L. white clover	8.58																87.50	5.53	402.82	21.32	27.05
<i>Trifolium repens</i> L. white clover	19.17	19.17	36.45	6.07	6.00	31.85	8.71	15.19									31.25	1.98	0.37	0.02	2.00
<i>Trifolium repens</i> L. white clover	0.45	0.45	36.45	0.25	0.17	0.50	0.12	0.12					1.09		0.01		18.75	1.19	3.78	0.20	1.39
<i>Trifolium repens</i> L. white clover	0.40																43.75	2.77	2.59	0.14	2.93
<i>Trifolium repens</i> L. white clover	0.17																6.25	0.40	0.40	0.02	0.42
<i>Trifolium repens</i> L. white clover	5.93	5.93	36.45	3.85													12.50	0.79	2.02	0.11	0.90
<i>Trifolium repens</i> L. white clover	0.27	0.27	36.45	0.39													25.00	1.58	37.51	2.00	3.58
<i>Trifolium repens</i> L. white clover	0.48	0.48	36.45	0.80													18.75	1.19	1.33	0.07	1.26
<i>Trifolium repens</i> L. white clover	4.67	4.67	36.45	0.48													18.75	1.19	1.33	0.07	1.26
<i>Trifolium repens</i> L. white clover	1.11	1.11	36.45	10.55													6.25	0.40	0.48	0.03	0.43
<i>Trifolium repens</i> L. white clover	2.35	2.35	36.45	4.67		1.73	0.38	0.31	7.91	7.45	5.00						63.75	2.77	27.65	1.48	4.25
<i>Trifolium repens</i> L. white clover																	12.50	0.79	11.66	0.62	1.41
<i>Trifolium repens</i> L. white clover																	6.25	0.40	2.35	0.13	0.93
<i>Trifolium repens</i> L. white clover																	6.25	0.40	1.37	0.07	0.97

APPENDIX A-5 (Continued)

Scientific Name Common Name	Subplots - presence indicated by dry weight (grams/0.125-milacre plots)																Frequency (%)	Relative Frequency ^b	Dry Weight per Species ^c	Relative ^d Weight (%)	Importance ^e Value
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
Erigeron sp. L. Fleabane					6.21												6.25	0.40	6.21	0.33	0.73
Convolvulus sepium L. hedge bindweed						1.59											6.25	0.40	1.59	0.08	0.48
Ruellia humilis Nutt. wild petunia					2.14						0.61		0.13				18.75	1.19	2.88	0.15	1.34
Praxera virginiana Duchesne wild strawberry								13.94	3.54	1.68	1.11	1.90					31.25	1.98	22.17	1.18	3.16
Gleditsia trisacanthos L. honey locust								0.08									6.25	0.40	0.08	.004	0.40
Rosa setigera Michx. var. tomentosa Torr. & Gray prairie rose								0.24									6.25	0.40	0.24	0.01	0.41
Penstemon pallidus Small. beard tongue								0.74									6.25	0.40	0.74	0.04	0.44
Carex sp. L. ---											0.07						6.25	0.40	0.07	.004	0.40
Carya ovalis (Wang.) Sarg. false shagbark												6.14					6.25	0.40	6.14	0.33	0.73
Eupatorium serotinum Michx. late boneset												0.61					6.25	0.40	0.61	0.03	0.43
Carex festucacea Schk. ---													9.37				6.25	0.40	9.37	0.50	0.90
Eleocharis tenuis (Willd.) Schultes spike rush														0.68	0.02	12.50	6.25	0.79	0.70	0.04	0.83
Dianthus armeria L. deftord pink														0.17		6.25	6.25	0.40	0.17	0.01	0.41
Carex alboluteacens (Willd.) Schwein																	6.25	0.40	1.80	0.10	0.50
Total	97.83	93.32	137.71	75.23	138.44	125.71	137.89	107.09	116.81	125.62	109.91	112.02	128.60	147.85	139.79	78.43	1581.25	100.00	1872.25	100.00	230.18

^a Number of subplots the species occurs
Number of subplots sampled (16) X 100

^b Frequency of a species occurrences
Cumulative frequency for all species X 100

^c Cumulative weight (16 subplots) by species

^d Cumulative weight (a species)
Cumulative weight (all species) X 100

^e Relative frequency and relative weight

Sheet 2

APPENDIX A-6

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION PR-2,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Importance ^f Value
<u>Diospyros virginiana</u> L. persimmon	12.0	52.2	107.0	77.0	129.2
<u>Rubus flagellaris</u> Willd. dewberry	4.0	17.4	14.0	10.1	27.5
<u>Fraxinus americana</u> L. white ash	3.0	13.0	14.0	10.1	23.1
<u>Symphoricarpos</u> sp. Duham. snowberry	2.0	8.7	2.0	1.4	10.1
<u>Ulmus rubra</u> Muhl. slippery elm	<u>2.0</u>	<u>8.7</u>	<u>2.0</u>	<u>1.4</u>	<u>10.1</u>
TOTAL	23.0	100.0	139.0	100.0	200.0

Trees and/or shrubs per quadrat = 8.7
Trees and/or shrubs per acre = 1,409.4

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density

APPENDIX A-7

DATA SUMMARY FOR PRAIRIE VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION PB-3,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Frequency ^b (N)	Relative ^b Frequency(S)	Dry weight ^c for species	Relative ^d weight(N)	Importance ^e Value
<i>Lespedeza stilocephala</i> Moench. Korean clover	1.20		2.65	0.80	2.10	17.50	0.40	3.22		3.90	2.30	0.25			62.50	8.99	34.10	1.81	8.80	
<i>Festuca longiligulata</i> Ell. ---	0.20	3.80	1.30	13.30	11.30	2.00	0.15	3.90	0.35	1.00	1.30	1.40			75.00	8.79	60.00	2.12	10.51	
<i>Lespedeza bicolor</i> (Thunb.) H. & A. Japanese lespedeza	4.70		1.75	2.50	2.30	14.80	1.10	0.80	5.30	0.75	2.20	0.40	1.20		75.00	8.79	37.80	2.00	10.79	
<i>Muhlenbergia schreberei</i> Desv. nimble will	36.70	20.00			2.30	7.10									25.00	2.79	86.10	3.32	6.30	
<i>Apocynum androsaemifolium</i> L. redtop	20.20	20.00	25.00	41.40	12.90	16.60	11.40	47.60	17.30	76.40	29.20	48.30	45.30		81.25	9.09	431.80	22.95	32.04	
<i>Phlox pilularis</i> L. timothy	2.00		2.20					12.10		4.30	25.10	25.10			31.25	3.49	45.70	2.42	5.91	
<i>Solanum carolinense</i> L. horse nettle	0.20		2.20												18.75	2.09	2.95	0.15	2.24	
<i>Ambrosia biacanthata</i> Michx. ragweed	0.80				0.90			0.75	6.20			2.60	1.10		37.50	4.19	12.35	0.65	4.84	
<i>Poa compressa</i> L. Canada blue grass	70.00	65.70	80.00	55.60	71.20	35.60	61.20	1.20	36.90	67.40	35.60	65.60	1.70	4.20	91.80	10.49	637.10	34.93	45.42	
<i>Zizania tenuis</i> Willd. pach rusk		1.60		3.45		0.20	0.30					0.80	0.30		37.50	4.19	6.65	0.35	4.54	
<i>Veronica missouriensis</i> Raf. ironweed		22.20													6.25	0.69	22.50	1.18	1.87	
<i>Aster pilosus</i> Willd. white heart aster		4.10			1.65	1.30		4.20	0.20			1.10			37.50	4.19	12.45	0.66	4.85	
<i>Trifolium repens</i> L. white clover		0.40			0.20			1.20	0.50	2.90	0.30	0.40	0.40		50.00	3.59	6.50	0.34	5.93	
<i>Solidago altissima</i> L. tall goldenrod		2.40			26.50	0.30		4.20	1.70						35.00	2.79	34.80	1.85	4.64	
<i>Musa</i> sp. old-field goldenrod								62.60		1.10					25.00	2.79	65.20	3.48	6.25	
<i>Solidago nemoralis</i> Mill. old-field goldenrod					0.20										6.25	0.69	0.20	0.01	0.70	
<i>Festuca rubra</i> L. meadow fescue					7.20							42.50			12.50	1.39	48.70	2.64	7.03	

APPENDIX A-7 (continued)

Species	Subplots/Presence indicated by dry weight (grams/0.125-milacre plots)																Frequency ^a (%)	Relative ^b Frequency (%)	Dry Weight ^c for Species	Relative ^d Weight (%)	Importance ^e Value
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Eriogonum</i> sp. L. Firechase						9.90											6.25	0.69	9.90	0.52	1.21
<i>Sagurus stizomus</i> L. umbrella sedge						2.45											6.25	0.59	3.45	0.18	0.87
<i>Carex glaucoidea</i> Tuckerm. ---						0.20											6.25	0.69	0.20	0.01	0.70
<i>Poa pratensis</i> L. Kentucky bluegrass						36.10											31.25	3.49	226.30	12.03	15.52
<i>Fragaria virginiana</i> Michx. ---						0.80											18.75	2.09	57.00	3.03	5.12
<i>Tridax flavus</i> (L.) Hitchc. purpletop						19.10					12.10	43.90					12.50	1.39	30.40	1.61	3.00
<i>Eragrostis spectabilis</i> (Pursh) Steud. purple love grass						5.20											6.25	0.69	5.20	0.27	0.96
<i>Bromus</i> sp. L. brom grass						0.60					1.50						12.50	1.39	2.10	0.11	1.50
<i>Cortaderia elliptica</i> Willd. rustfolli						0.10	0.13										12.50	1.39	0.25	0.02	1.40
<i>Trifolium pratense</i> Schreb. large hop clover						0.10	0.10										6.25	0.69	0.10	0.00	0.69
<i>Poa annua</i> L. ---						0.60	0.60										25.00	2.79	3.40	0.18	2.87
<i>Aristida oligantha</i> Michx. prairie three awn grass						2.90	0.20				1.00	0.20					12.50	1.39	3.10	0.16	1.55
<i>Carex</i> sp. L. sedge						0.10	0.10										6.25	0.69	0.10	0.00	0.69
<i>Pycnanthemum tenuifolium</i> Schrad. slender mountain mint																	25.00	2.79	3.40	0.18	2.87
<i>Teucrium canadense</i> L. weed sage																	12.50	1.39	3.10	0.16	1.55
<i>Sagurus ovellata</i> (Michx.) Torr. holboell club rush											7.30						6.25	0.69	7.30	0.38	1.07
<i>Rhynchospora alba</i> Willd. dewberry																	6.25	0.69	0.10	0.00	0.69
<i>Carex festucacea</i> Schrad. sedge																	6.25	0.69	2.20	0.11	0.80
TOTALS	236.00	132.40	108.75	10.85	115.65	125.85	141.00	77.00	122.85	105.00	178.05	151.05	126.90	100.10	116.50	111.25	6.25	6.69	1,200	6.06	0.75
																	893.80	99.75	1,893.00	95.85	199.60

* Includes woody and herbaceous plants of less than 20 inches in height.

b Number of subplots the species occurs * 100 / number of subplots sampled (16)

c Frequency of a species occurrence * 100

d Cumulative frequency of all species

e Cumulative weight (16 subplots) by species

f Cumulative weight (a species) * 100

g Cumulative weight (all species) * 100

h Relative frequency * relative weight

APPENDIX A-8
 DATA SUMMARY FOR PRAIRIE VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION PR-3,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	Subplots - presence indicated by dry weight (grams/0.125-m ² -area plots)																Frequency (%)	Relative Frequency ^b	Dry Weight Per Weight ^c Species	Relative Importance Value ^d	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Poa pratensis</i> L. timothy	29.51	24.44	1.95	1.05	21.31	1.33	2.05	14.75	17.00	9.91	10.92	28.30	1.85	12.25	30.85	83.75	7.81	203.47	8.80	16.61	
<i>Stemona racemosa</i> L. hairy chernia	6.19	13.10	3.08	7.09	34.84	12.56	6.73	13.98	19.17	14.71	8.01	1.39	7.87	10.10	11.62	10.37	8.33	182.81	7.81	16.24	
<i>Agrostis alba</i> L. Poa pratensis	48.53	41.29	60.13	55.48	23.30	2.25	77.46	2.40	3.99	63.17	6.01	75.12	27.79	30.07	83.50	31.07	100.00	8.33	932.56	27.36	35.59
<i>Kentucky blue grass</i> <i>Panicum lanuginosum</i> Ell.	49.01	39.24	48.69	0.16	45.68	55.46	50.98	61.60	80.78	64.96	70.54	45.86	35.68	28.69	32.09	13.44	100.00	8.33	703.46	30.43	38.78
---	0.75	3.94	0.51	4.00	13.15	10.40	3.92	2.97	0.60	1.89	0.30	0.43	0.30	0.18	0.18	0.18	87.50	7.29	46.74	1.93	9.22
<i>Trifolium repens</i> L. white clover	1.52				8.65	0.78				6.13	0.05	3.54	2.37	3.37	2.01	10.47	62.50	5.21	39.09	1.69	6.90
<i>Lespedeza stipularis</i> Maxim. Korean clover	0.75	0.31	0.33	1.25	2.45	2.65	1.55	1.83	0.31								62.50	5.21	11.48	0.51	5.72
<i>Carex glauca</i> Tuckerm. ---	0.35	3.54	1.78				0.77										31.25	2.60	9.82	0.42	3.02
<i>Carex bulbil</i> Michx. Ceratium viscosum L. clammy chickweed	0.76	12.13	4.35	0.65	0.75	0.93	13.98	0.05	4.69	1.39	2.48	4.71	2.45	2.45	15.25	93.75	7.81	87.24	2.91	10.72	
<i>Fernoxia vulgaris</i> L. self-heal	0.36	1.52	0.14	0.25	1.03	0.85	1.82	1.47								50.00	4.17	7.44	0.32	4.49	
<i>Erigeron annuus</i> (L.) Pers. whit-top fleabane	0.29															6.25	0.52	0.29	0.01	0.33	
<i>Vernonia</i> sp. tansy	17.56				28.69											12.50	1.04	45.85	1.98	3.02	
<i>Juncea tenuis</i> Willd. Soy patch rush	6.24	3.25			0.08			0.08		1.37	2.01	16.07	25.09	0.76		50.00	4.17	57.87	2.50	6.87	
<i>Solidago</i> sp. horsetail	4.00			0.36						1.45	4.90	18.60	13.08	3.99	43.75	3.65	46.40	4.00	2.01	5.66	
<i>Solidago</i> sp. Goldenrod	0.18			0.36	0.31	0.41				0.09	0.10	0.15		0.20	50.00	4.17	1.88	0.08	4.25		
<i>Oxalis europaea</i> Jord. yellow wood sorrel	16.15									28.24	30.17	18.40			25.00	2.08	92.96	4.02	6.10	8.10	
<i>Achillea millefolium</i> L. milkweed	0.15												2.87		6.25	0.52	0.15	0.01	0.33	3.01	
<i>Erigeron strigosus</i> Michx. daisy fleabane	0.22														18.75	1.56	33.53	1.65	3.01	3.01	
<i>Androsida bidentata</i> Michx. ragwort	71.41									4.81					25.00	2.08	86.82	3.50	5.58	5.58	
<i>Fraxinella</i> L. meadow fescue	0.08	0.20	0.36							0.15	0.05		0.27		37.50	3.13	1.11	0.05	3.18	3.18	
<i>Croton monanthogynus</i> Michx. croton	9.00														6.25	0.52	9.00	0.39	0.91	0.91	
<i>Veronica</i> sp. corn speedwell	0.12									30.44					6.25	0.52	0.12	0.01	0.33	0.33	
<i>Barbarea vulgaris</i> (R.) B.R. yellow rocket	0.50														6.25	0.52	0.50	0.02	0.54	0.54	
<i>Aster</i> sp. aster	0.36														6.25	0.52	0.36	0.02	0.34	0.34	
<i>Elymus compressus</i> Sull. spike rush	0.81								0.64						18.75	1.56	1.72	0.07	1.63	1.63	
<i>Carex albostriata</i> Schwesin. ---															18.75	1.56	6.38	0.27	1.63	1.63	
<i>Trifolium campestre</i> Schreb. large hop clover										2.73	1.53	2.02			12.50	1.04	1.20	0.05	1.09	1.09	
<i>Strophostyles umbellata</i> (Nutt.) Britt. wild bean										1.10	0.10				12.50	1.04	5.75	0.25	1.29	1.29	
<i>Carex subulbergii</i> Schk. var. australis Oiley										0.15	5.60				12.50	1.04	0.23	0.01	0.33	0.33	
---															6.25	0.52					
<i>Lactuca canadensis</i> L. lettuce										5.32					6.25	0.52	3.32	0.23	0.75	0.75	
<i>Plantago virginica</i> L. hoary plantain										0.15	1.65				12.50	1.04	1.80	0.08	1.12	1.12	
<i>Juncea dudleyi</i> Wieg. ---										0.15					6.25	0.52	0.15	0.01	0.33	0.33	
<i>Trifolium pratense</i> L. red clover															6.25	0.52	0.84	0.04	0.36	0.36	
<i>Symphoricarpos orbiculatus</i> Moench. coral berry													6.60	8.67	12.50	1.04	15.27	0.64	1.70	1.70	
Totals	138.04	162.71	144.53	141.38	148.65	125.95	156.92	136.63	139.85	146.84	140.57	157.62	157.99	118.44	137.94	124.33	1200.00	99.97	2312.41	100.02	199.99

^a Number of subplots the species occurs
^b Relative frequency + relative weight
^c Cumulative weight (all species) x 100
^d Cumulative frequency for all species

APPENDIX A-9

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION PR-3,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

<u>Scientific Name</u> <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Symphoricarpos</u> sp. Duham. snowberry	1.0	33.3	4.0	66.7	100.0
<u>Ulmus rubra</u> Muhl. slippery elm	1.0	33.3	1.0	16.7	50.0
<u>Gleditsia triacanthos</u> L. honey locust	<u>1.0</u>	<u>33.3</u>	<u>1.0</u>	<u>16.7</u>	<u>50.0</u>
TOTAL	3.0	99.9	6.0	100.1	200.0

Trees and/or shrubs per quadrat = 0.4
Trees and/or shrubs per acre = 64.8

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density.

APPENDIX A-10
 DATA SUMMARY FOR PRAIRIE VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION PR-4,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974

Scientific Name Common Name	Subplots (grams/0.125-acre plots)																Frequency ^a (N)	Relative ^b Frequency(N)	Dry Weight ^c for Species	Relative ^d Weight(N)	Importance Value
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Festuca elatior</i> L. meadow fescue	135.35	171.75	163.80	142.30	136.60	152.80	100.90	154.00	112.80	203.25	164.80	131.35	147.00	192.40	142.25	228.90	100.00	37.20	2,517.35	99.00	136.20
<i>Melilotus alba</i> Desr. white sweet clover	0.20	0.25	0.20	4.10		1.80	1.20										37.50	33.95	7.75	0.30	14.25
<i>Leguminos stipularis</i> Maxim. Korean clover	0.45				0.40	0.30	3.10		0.35	0.20							37.50	33.95	5.00	0.19	14.14
<i>Conoclinium</i> sp. L. hickweed				0.10													6.25	2.32	0.10	0.00	2.32
<i>Solanum carolinense</i> L. horse nettle				0.50		1.80											12.50	4.65	2.30	0.09	4.74
<i>Lactuca canadensis</i> L. wild lettuce				0.40													6.25	2.32	0.40	0.01	2.32
<i>Solidago nemoralis</i> Ait. old-field goldenrod							0.80										6.25	2.32	0.80	0.03	2.35
<i>Lespedeza violacea</i> (L.) Pers. bush clover								0.10						0.65	0.10		18.75	6.97	0.85	0.03	7.00
<i>Leguminos sibirica</i> (Thunb.) H.S.A. Japanese lespedeza									0.20				2.50				18.75	6.97	3.05	0.11	7.08
<i>Bidens aristata</i> (Michx.) Britt. tickseed sunflower										0.35							6.25	2.32	0.25	0.00	2.32
<i>Vitis cinerea</i> Engelm. grayback grape										0.25							6.25	2.32	0.50	0.01	2.33
<i>Carex glaucoidea</i> Puckerm. --- rose pink										0.50							6.25	2.32	0.10	0.00	2.32
TOTAL	156.00	172.00	164.00	147.00	137.00	157.10	108.00	154.00	113.00	201.00	165.00	133.65	147.00	195.00	147.00	229.00	268.75	99.83	2,542.55	99.83	199.96

^aIncludes woody and herbaceous plants of less than 20 inches in height.

^bNumber of subplots the species occurs
Number of subplots sampled (16) * 100

^cFrequency of a species occurrence
Cumulative frequency of all species * 100

^dCumulative weight (16 subplots) by species

^eCumulative weight (a species)
Cumulative weight (all species) * 100

^fRelative f = $\frac{y}{Y}$ * relative weight

APPENDIX A-11
 DATA SUMMARY FOR PRAIRIE VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION PR-4
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	Subplots - presence indicated by dry weights (grams/0.125-m ² plots)																Frequency (%)	Relative Frequency ^b	Dry Weight Per Species ^c	Relative Weight Value ^d	Importance Value ^e
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Festuca arundinacea</i> Schreb. reed fescue	94.12	71.11	147.85	147.85	171.64	171.64	106.68	117.65	97.45	108.00	95.95	120.75	115.87				100.00	25.81	1712.43	97.99	173.80
<i>Festuca elatior</i> L. meadow fescue																	6.25	1.61	6.91	0.40	2.01
<i>Melilotus officinalis</i> (L.) Lam. yellow horned clover	6.91		103.38	119.06	160.45	106.68	117.65	64.93	65.96								50.00	12.90	2.43	0.14	13.04
<i>Lespedeza bicolor</i> Vahl Korean clover																	31.25	8.06	0.56	0.03	8.09
<i>Aster</i> sp. L. aster		0.09	0.23	1.75	0.15	0.12	0.12	0.08	0.08	0.15	0.09	0.03	0.10				82.50	16.13	2.23	0.13	16.26
<i>Solanum carolinense</i> L. horse nettle		0.11	0.05	0.15													6.25	1.61	0.15	0.01	1.62
<i>Cirsium altissimus</i> (L.) Spreng. tall thistle		0.02	0.84	0.06	0.08	0.40	0.01	0.37									6.25	1.61	0.42	0.02	1.63
<i>Erigeron strigosus</i> Muhl. daisy fleabane		0.15															25.00	6.45	2.95	0.17	6.62
<i>Trifolium campestre</i> Schreb. large hop clover		0.16			0.01	1.96	0.82										12.50	3.23	0.11	0.01	3.24
<i>Strophostyles umbellata</i> (Muhl.) Britt. wild bean		0.04	0.07														6.25	1.61	0.06	.003	1.61
<i>Lactuca canadensis</i> L. Oxalis acetosella yellow wood sorrel						0.06											6.25	1.61	0.15	0.01	1.62
<i>Sabatia angularis</i> (L.) Pursh rose pink						0.15											6.25	1.61	1.00	0.06	1.67
<i>Panicum lanuginosum</i> Ell. --- Carex glauca Tuckerm.								1.00									6.25	1.61	0.32	0.02	1.63
<i>Rubus pensilvanicus</i> Poir. high-bush blackberry								0.09	0.10								12.50	3.23	0.19	0.01	3.24
<i>Ambrosia artemisiifolia</i> L. common ragweed												13.67					6.25	1.61	13.67	0.78	2.39
<i>Eupatorium perfoliatum</i> L. white snakeroot												0.10	0.03				12.50	3.23	0.13	0.01	3.24
<i>Ulmus rubra</i> Muhl. slippery elm												0.36					6.25	1.61	0.36	0.02	1.63
<i>Hypericum punctatum</i> L. dotted St. John's-wort												0.06					6.25	1.61	0.06	0.003	1.61
<i>Solidago</i> sp. goldenrod											1.64						6.25	1.61	1.64	0.09	1.70
<i>Potentilla simplex</i> Michx. cinquefoil														1.59			6.25	1.61	1.59	0.09	1.70
Totals	101.03	71.29	105.27	149.98	119.15	162.87	121.92	107.87	118.65	97.73	108.49	81.52	65.96	97.74	122.69	115.85	387.30	96.97	1747.91	100.00	199.97

a - Number of subplots the species occurs / Number of subplots sampled x 100
 b - Frequency of a species occurrence / Cumulative frequency for all species x 100
 c - Cumulative weight (16 subplots) by species
 d - Cumulative weight (16 species) / Cumulative weight (all species) x 100
 e - Relative frequency + relative weight

APPENDIX A-12

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION PR-4,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Importance ^f Value
<u>Rubus flagellaris</u> Willd. dewberry	<u>2.0</u>	<u>100.0</u>	<u>3.0</u>	<u>100.0</u>	<u>200.0</u>
TOTAL	2.0	100.0	3.0	100.0	200.0

Trees and/or shrubs per quadrat = 0.2
Trees and/or shrubs per acre = 32.4

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density.

APPENDIX A-13

TRANSITIONAL SPECIES PREFERRING DISTURBED SITES
(including overstory, understory, and ground layer)

Family <u>Genus & Species</u>	<u>Forest Sampling Stations</u>				<u>Prairie Sampling Stations</u>			
	<u>F-1</u>	<u>F-2</u>	<u>F-3</u>	<u>F-4</u>	<u>Pr-1</u>	<u>Pr-2</u>	<u>Pr-3</u>	<u>Pr-4</u>
Aceraceae								
<u>Acer saccharum</u> Marsh	x	x	x	x				
Acanthaceae								
<u>Ruellia humilis</u> Nutt.					x	x		
Anacardiaceae								
<u>Rhus radicans</u> L.	x	x						
Apocynaceae								
<u>Apocynum cannabinum</u> L.				x	x	x		x
Caprifoliaceae								
<u>Symphoricarpos orbiculatus</u> Moench	x	x	x	x	x	x	x	
Caryophyllaceae								
<u>Cerastium viscosum</u> L.					x	x	x	
<u>Dianthus armeria</u> L.						x		
Celastraceae								
<u>Celastrus scandens</u> L.		x	x					
Cistaceae								
<u>Lechea tenuifolia</u> Michx.	x	x			x			
Compositae								
<u>Achillea millifolium</u> L.						x	x	
<u>Ambrosia artemisifolia</u> L.			x					
<u>Ambrosia bidentata</u> Michx.					x	x	x	x
<u>Aster pilosus</u> Willd.		x			x	x	x	x
<u>Aster anomalus</u> Engelm.	x			x				
<u>Bidens aristosa</u> (Michx.) Britt.		x						
<u>Cirsium altissimum</u> (L.) Spreng.				x			x	x

APPENDIX A-13 (continued)

Family Genus & Species	Forest Sampling Stations				Prairie Sampling Stations			
	F-1	F-2	F-3	F-4	Pr-1	Pr-2	Pr-3	Pr-4
<u>Erigeron strigosus</u> Muhl.						x	x	x
<u>Erigeron annuus</u> (L.) Pers.						x	x	
<u>Eupatorium serotinum</u> Michx.		x			x	x		x
<u>Helianthus strumosus</u> L.			x	x				x
<u>Lactuca canadensis</u> L.			x	x			x	x
<u>Solidago altissima</u> L.		x	x			x	x	
<u>Solidago nemoralis</u> Ait.		x		x				
<u>Vernonia baldwinii</u> Torr.				x	x		x	
<u>Vernonia missurica</u> Raf.					x	x	x	x
Convolvulaceae								
<u>Convolvulus sepium</u> L.		x				x		x
Cruciferae								
<u>Barbarea vulgaris</u> R. Br.							x	
Cupressaceae								
<u>Juniperus virginiana</u> L.	x	x	x	x		x		
Cyperaceae								
<u>Carex bushii</u> Mack.	x		x	x	x	x	x	
<u>Carex festucacea</u> Schk.						x		
<u>Carex grvida</u> Bailey	x					x	x	
<u>Cyperus ovularis</u> (Michx.) Torr.					x			
<u>Cyperus strigosus</u> L.						x	x	
Ebenaceae								
<u>Diospyros virginiana</u> L.	x	x	x		x	x		x
Euphorbiaceae								
<u>Croton capitatus</u> Michx.				x	x	x		x
<u>Croton monogynanthus</u> Michx.						x	x	
<u>Crotonopsis elliptica</u> Willd.		x	x					

APPENDIX A-13 (continued)

Family Genus & Species	Forest Sampling Stations				Prairie Sampling Stations			
	F-1	F-2	F-3	F-4	Pr-1	Pr-2	Pr-3	Pr-4
Gramineae								
<u>Agrostis alba</u> L.					x	x	x	
<u>Agrostis hyemalis</u> (Walt.) BSP					x			
<u>Aristida oligantha</u> Michx.						x		
<u>Dactylis glomerata</u> L.					x			
<u>Danthonia spicata</u> (L.) Beauv.		x						
<u>Festuca elatior</u> L.					x		x	x
<u>Eragrostis spectabilis</u> (Pursh) Steud.					x		x	
<u>Panicum lanuginosum</u> Ell. & Vars.	x				x	x	x	x
<u>Paspalum laeve</u> Michx. & Vars.						x	x	
<u>Phleum pratense</u> L.				x	x	x	x	
<u>Poa compressa</u> L.						x	x	
<u>Poa pratensis</u> L.					x	x	x	
Guttiferae								
<u>Hypericum punctatum</u> Lam.		x	x	x	x	x		x
Juncaeae								
<u>Juncus tenuis</u> Willd.					x	x	x	
Labiatae								
<u>Prunella vulgaris</u> L.				x	x	x	x	
<u>Pycnanthemum tenuifolium</u> Schrad.		x				x	x	x
<u>Teucrium canadense</u> L.				x	x			
Lauraceae								
<u>Sassafras albidum</u> (Nutt.) Nees			x	x				
Leguminosae								
<u>Amorpha canescens</u> Pursh				x				
<u>Gleditsia triacanthos</u> L.						x	x	
<u>Lespedeza stipulacea</u> Maxim.				x	x	x	x	x
<u>Lespedeza striata</u> (Thunb.) H.&A.		x	x	x			x	
<u>Lespedeza violacea</u> (L.) Pers.	x	x	x	x	x			

APPENDIX A-13 (continued)

Family Genus & Species	Forest Sampling Stations				Prairie Sampling Stations			
	F-1	F-2	F-3	F-4	Pr-1	Pr-2	Pr-3	Pr-4
<u>Melilotus alba</u> Desr.								x
<u>Trifolium campestre</u> Schreb.						x	x	x
<u>Trifolium pratense</u> L.						x	x	
<u>Trifolium repens</u> L.						x	x	
Moraceae								
<u>Morus rubra</u> L.	x		x	x		x	x	
Oleaceae								
<u>Fraxinus americana</u> L.	x	x	x	x		x		
Plantaginaceae								
<u>Plantago virginiana</u> L.					x	x		
Podophyllaceae								
<u>Podophyllum peltatum</u> L.				x				
Polygonaceae								
<u>Rumex acetocella</u> L.						x		
Primulaceae								
<u>Lysmachia lanceolata</u> Walt.		x						
Rosaceae								
<u>Potentilla simplex</u> Michx.	x	x			x	x		
<u>Prunus americana</u> L.	x	x		x				
<u>Prunus serotina</u> L.	x	x	x	x				
<u>Prunus virginiana</u> L.	x	x	x					
<u>Rosa arkansana</u> Porter	x							
<u>Rosa carolina</u> L.	x	x	x	x	x			
<u>Rosa setigera</u> Michx.	x					x		
<u>Rubus flagellaris</u> L.		x	x		x	x	x	x
<u>Rubus occidentalis</u> L.	x	x		x				
<u>Rubus pensylvanicus</u> Poir.			x			x		x

APPENDIX A-13 (continued)

Family Genus & Species	Forest Sampling Stations				Prairie Sampling Stations			
	<u>F-1</u>	<u>F-2</u>	<u>F-3</u>	<u>F-4</u>	<u>Pr-1</u>	<u>Pr-2</u>	<u>Pr-3</u>	<u>Pr-4</u>
Saxifragaceae								
<u>Heuchera</u> sp.		x						
Solanaceae								
<u>Solanum carolinense</u> L.						x	x	x
Ulmaceae								
<u>Ulmus rubra</u> Muhl.	x	x	x		x	x	x	
Vitaceae								
<u>Parthenocissus quinquefolia</u> (L.)								
Planch	x	x	x	x				
<u>Vitis aestivalis</u> Michx.	x		x					
<u>Vitis cinerea</u> Engelm.	x	x	x	x				
<u>Vitis vulpina</u> L.	x	x	x	x				

Adapted from D. B. Dunn, 1974-personal communication.

APPENDIX A-14

DATA SUMMARY FOR IDENTIFIED SPECIES OF SAMPLING STATIONS,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI,
SPRING, SUMMER, FALL 1974

(Letter designations: A=ground cover, B=understory, C=overstory-stratifications)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Acalypha gracilens</u> Gray three-seeded mercury					A		A	
<u>Acer saccharum</u> Marsh sugar maple					B	AB	BC	BC
<u>Achillea millefolium</u> L. common milfoil		A	A					
<u>Aesculus glabra</u> Willd. Ohio buckeye					B			
<u>Agrimonia rostellata</u> Wallr. agrimony							A	
<u>Agrostis alba</u> L. redtop		A	A			A		
<u>Agrostis hyemalis</u> (Walt.) BSP. hair grass	A						A	
<u>Agrostis perennans</u> (Walt.) Tuckerm. upland bent					A	A		A
<u>Agrostis sp.</u> L. bent grass	A							
<u>Ambrosia artemisifolia</u> L. common ragweed			A	A				
<u>Ambrosia bidentata</u> Michx. ragweed	A	A	A					
<u>Amelanchier arborea</u> (Michx.) Fern. shadbush					ABC	ABC	AB	ABC
<u>Amorpha canescens</u> Pursh. lead plant								A
<u>Andropogon virginicus</u> L. broom sedge	A	A		A				
<u>Anemonella thalictroides</u> (L.) Spach. rue anemone					A	A	A	
<u>Antennaria neglecta</u> Greene pussy's toes		A						
<u>Antennaria plantaginifolia</u> (L.) Hook. pussy's toes						A	A	A

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Apocynum cannabinum</u> L. Indian hemp					A			
<u>Aristida oligantha</u> Michx. prairie three-awn grass		A	A					
<u>Asclepias hirtella</u> (Pennell) Woods milkweed		A						
<u>Asclepias purpureus</u> L. purple milkweed			A					
<u>Asclepias quadrifolia</u> Jacq. milkweed						A		
<u>Asclepias</u> sp. L. milkweed					A			
<u>Asimina triloba</u> (L.) Dunal. pawpaw							A	
<u>Asplenium platyneuron</u> (L.) Oakes ebony spleenwort					A		A	
<u>Aster anomalus</u> Engelm. aster						A		A
<u>Aster patens</u> Ait. spreading aster					A		A	
<u>Aster pilosus</u> Willd. white heath aster		A	A					
<u>Aster</u> sp. L. aster	A	A	A	A	A	A	A	A
<u>Aster turbinellus</u> Lindl. aster								A
<u>Baptisim leucantha</u> T. & G. white wild indigo		A	A					
<u>Barbarea vulgaris</u> (R.) B.R. yellow rocket			A					
<u>Bidens aristosa</u> (Michx.) Britt. tickseed sunflower				A				
<u>Botrychium virginianum</u> (L.) Sw. rattlesnake fern					A	A		A
<u>Brachyelytrum erectum</u> (Schreb.) Beauv. ---					A			
<u>Bromus purgans</u> L. Canada brome					A	A		

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Bromus racemosus</u> L. hairy chess		A	A					
<u>Bromus</u> sp. L. Brome grass			A					
<u>Campsis radicans</u> (L.) Seem. trumpet creeper							B	
<u>Carex alata</u> Torr. and Gray ---								A
<u>Carex albolutescens</u> (Schwein) ---		A	A			A		
<u>Carex artitecta</u> Mack. ---					A	A		
<u>Carex bushii</u> Mack. ---	A	A	A		A	A	A	A
<u>Carex cephalophora</u> Muhl. ---							A	
<u>Carex festucacea</u> Schkuhr. ---	A	A	A					
<u>Carex glaucodea</u> Tuckerm. ---	A	A	A	A	A	A	A	A
<u>Carex gravida</u> Bailey ---					A		A	
<u>Carex muhlenbergii</u> Schk. ---								A
<u>Carex muhlenbergii</u> Schk. var. <i>australis</i> Olney ---			A					
<u>Carex rosea</u> Schk. ---					A	A	A	A
<u>Carex</u> sp. L. sedge	A	A	A					
<u>Carya ovalis</u> (Wang.) Sarg. false shagbark		A						
<u>Carya ovata</u> (Mill.) K. Koch shagbark hickory					AC	C	AC	C
<u>Carya</u> sp. Nutt. hickory	B				B	B	B	B
<u>Carya texana</u> Buckl. black hickory					C	C	C	C
<u>Carya texana</u> Buckl. var. <i>villosa</i> (Sarg.) Little black hickory					A			

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APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Carya tomentosa</u> Nutt. mockernut hickory					AC	C	C	
<u>Cassia fasciculata</u> Michx. partridge pea		A						
<u>Ceanothus americana</u> L. New Jersey tea								A
<u>Celastrus scandens</u> L. bittersweet						AB	A	A
<u>Celastrus</u> sp. L. bittersweet						B		
<u>Celtis occidentalis</u> L. hackberry					B		B	
<u>Celtis tenuifolia</u> Nutt. var. <u>smallii</u> (Beadle) Sarg. dwarf hackberry					B			
<u>Cerastium viscosum</u> L. clammy chickweed	A	A	A					
<u>Cercis canadensis</u> L. redbud					A		B	B
<u>Cirsium altissimum</u> (L.) Spreng. tall thistle				A				
<u>Compositae</u> (genus unident.) ---								A
<u>Convolvulus sepium</u> L. hedge bindweed		A						
<u>Convolvulus</u> sp. L. bindweed				A				
<u>Conyza canadensis</u> (L.) Cron. horse weed					A			
<u>Cornus florida</u> L. flowering dogwood					ABC	ABC	ABC	ABC
<u>Crataegus danielsii</u> Palmer hawthorn								A
<u>Crataegus</u> sp. L. hawthorn	B				B	B	B	B
<u>Crataegus uniflora</u> Muench. hawthorn	A							
<u>Croton capitatus</u> Michx. hogwort		A						
<u>Croton monanthogynus</u> Michx. croton		A	A					
<u>Crotonopsis elliptica</u> Willd. rushfoil			A				A	

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Cunila origanoides</u> (L.) Britt. dittany					A	A	A	
<u>Cyanthum laeve</u> (Michx.) Pers. angle-pod						A		A
<u>Cyperus esculentus</u> L. yellow nut grass			A					
<u>Cyperus ovularis</u> (Michx.) Torr. hedgehog club rush	A	A	A					A
<u>Cyperus strigosus</u> L. umbrella sedge	A	A	A					
<u>Dactylis glomerata</u> L. orchard grass	A							
<u>Danthonia spicata</u> (L.) Beauv. poverty grass	A				A	A	A	
<u>Daucus carota</u> L. wild carrot		A						
<u>Desmodium dillenii</u> Darl. tick trefoil					A	A	A	A
<u>Desmodium glutinosum</u> (Muhl.) Wood tick trefoil						A	A	A
<u>Desmodium nudiflorum</u> (L.) D.C. tick trefoil					A	A	A	A
<u>Dianthus armeria</u> L. deptford pink		A						
<u>Digitaria ischaemum</u> (Schreb.) Muhl. crab grass		A						
<u>Diodia teres</u> Walt. rough buttonweed				A				
<u>Dioscorea villosa</u> L. yam						A		A
<u>Diospyros virginiana</u> L. persimmon	B	AB				A9C	B	AB
<u>Echinochloa muricata</u> (Beauv.) Fern. barnyard grass			A					
<u>Eleocharis compressa</u> Sull. spike rush			A					
<u>Eleocharis tenuis</u> (Willd.) Schultes spike rush		A						
<u>Elymus villosus</u> Muhl. wild rye					A	A		A
<u>Eragrostis spectabilis</u> (Pursh) Steud. purple love grass	A	A	A					

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Erechtites brieracifolia</u> (L.) Raf. fireweed					A			
<u>Erigeron annuus</u> (L.) Pers. whitetop fleabane		A	A					
<u>Erigeron</u> sp. L. fleabane		A	A					
<u>Erigeron strigosus</u> Muhl. woolly fleabane		A	A	A		B	A	B
<u>Euonymus atropurpeus</u> Jacq. wahoo							A	
<u>Eupatorium fistulosum</u> Barrett Joe-pye weed								
<u>Eupatorium perfoliatum</u> L. boneset				A				
<u>Eupatorium serotinum</u> Michx. late boneset		A						A
<u>Euphorbia corollata</u> L. flowering spurge		A						
<u>Euphorbia maculata</u> L. nodding spurge				A				A
<u>Euphorbia</u> sp. L. spurge								
<u>Festuca arundinacea</u> Schreb. reed fescue	A			A				
<u>Festuca elatior</u> L. meadow fescue	A	A	A	A				
<u>Festuca obtusa</u> Biehler nodding fescue					A			
<u>Fragaria virginiana</u> Duchesne strawberry		A						
<u>Fraxinus americana</u> L. white ash	B	B			ABC	AB	AB	BC
<u>Fraxinus pennsylvanica</u> Marsh green ash								
<u>Galium ciraleans</u> Michx. wild licorice					A	A	A	A
<u>Galium concinnum</u> Torr. & Gray elegant bedstraw					A	A		
<u>Galium pilosum</u> Ait. hairy bedstraw					A	A		
<u>Gaura filiformis</u> Small. ---		A						

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Geum canadense</u> Jacq. white avens								
<u>Gillenia stipulata</u> (Muhl.) Trel. Indian physic					A			
<u>Gleditsia triacanthos</u> L. honey locust						A		A
<u>Gramineae</u> (sterile culm) ---		A	B					
<u>Helianthus</u> sp. L. sunflower		A						
<u>Helianthus strumosus</u> L. sunflower						A		A
<u>Helianthus tuberosa</u> L. Jerusalem artichoke								A
<u>Helienium flexuosum</u> Raf. sneezeweed							A	
<u>Heuchera hirsuticaulis</u> (Wheelock) Rydb. alum root		A						
<u>Heuchera</u> sp. L. alum root							A	
<u>Hieraceum gronovii</u> L. hawkweed					A	A	A	
<u>Hypericum punctatum</u> L. dotted St. Johns-wort					A	A	A	A
<u>Ipomoea pandulata</u> (L.) G.F.W. Mey. wild potato vine				A				A
<u>Juglans nigra</u> L. walnut	A							
<u>Juncus dudleyi</u> Wieg. ---						A		
<u>Juncus tenuis</u> Willd. path rush			A					
<u>Juniperus virginiana</u> L. red cedar	A	A	A					
<u>Krigia biflora</u> (Walt.) Blake dwarf dandelion					ABC	B	B	B
<u>Lactuca canadensis</u> L. wild lettuce						A		
<u>Lactuca canadensis</u> L. var. <i>obovata</i> Wieg. wild lettuce		A	A	A				A
<u>Lactuca</u> sp. L. lettuce		A		A				
						A		A

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Lechia tenuifolia</u> Michx. pineweed	A					A		
<u>Lespedeza procumbens</u> Michx. bush clover	A							
<u>Lespedeza stipulacea</u> Maxim. Korean clover	A	A	A	A				
<u>Lespedeza striata</u> (Thunb.) H.&A. Japanese lespedeza	A	A	A	A				
<u>Lespedeza violacea</u> (L.) Pers. bush clover	A			A	A	A	A	A
<u>Lespedeza virginica</u> (L.) Britt. bush clover					A			
<u>Linum</u> sp. L. flax					A			A
<u>Lobelia inflata</u> L. Indian tobacco	A				A		A	
<u>Lobelia spicata</u> Lam. ---								
<u>Lysmachia lanceolata</u> Walt. loosestrife						A		
<u>Melilotus alba</u> Desr. white sweet clover								
<u>Melilotus officinalis</u> (L.) Lam. yellow sweet clover								
<u>Monarda russelliana</u> Nutt. horsemint								
<u>Monotropa uniflora</u> L. Indian pipe								
<u>Morus rubra</u> L. red mulberry								
<u>Moss</u> sp. ---	A	A	A					
<u>Muhlenbergii schreberi</u> Gmel. nimble will		A	A					
<u>Muhlenbergia sobolifera</u> (Muhl.) Trin. muhly					A	A		
<u>Oenothera strigosa</u> (Rydb.) Mac. & Bush evening primrose								
<u>Ostrya virginiana</u> (Mill.) K. Koch hop-hornbeam								
<u>Oxalis europaea</u> Jord. yellow wood sorrel	A	A	A	A	A	A	B	B

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Panicum boscii</u> Poir. ---							A	A
<u>Panicum clandestinum</u> L. ---			A					
<u>Panicum dichotomum</u> L. ---							A	
<u>Panicum dichotomiflorum</u> Michx. ---			A					
<u>Panicum lanuginosum</u> Ell. ---	A	A	A	A	A	A		A
<u>Panicum lanuginosum</u> var. <u>implicatum</u> (Scribn.) Fern. ---			A		A		A	
<u>Panicum lanuginosum</u> var. <u>lanuginosum</u> (Scribn.) Fern. ---						A		
<u>Panicum linearifolium</u> Scribn. ---								A
<u>Panicum perlongum</u> Nash ---		A						
<u>Panicum</u> sp. L. panic grass						A		
<u>Panicum sphaerocarpon</u> Ell. ---								A
<u>Panicum subvillosum</u> Ashe ---							A	A
<u>Parthenium integrifolium</u> Ait. American feverfew								A
<u>Parthenocissus quinquefolia</u> (L.) Pursh Virginia creeper					A	A	A	A
<u>Paspalum ciliatifolium</u> Michx. ---		A	A					
<u>Paspalum floridanum</u> Michx. ---		A						
<u>Paspalum laeve</u> Michx. ---		A	A					
<u>Penstemon pallidus</u> Small. beard tongue		A						
<u>Phleum pratense</u> L. timothy		A	A					
<u>Phryma leptostachya</u> L. lopseed					A			
<u>Physalis virginiana</u> Mill. ground cherry							A	

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Plantago rugelii</u> Decne. plantain	A							
<u>Plantago virginica</u> L. hoary plantain	A		A					
<u>Poa compressa</u> L. Canada bluegrass		A	A					
<u>Poa pratensis</u> L. Kentucky bluegrass	A	A	A					
<u>Poa sylvestris</u> Gray sylvan bluegrass					A			
<u>Podophyllum peltatum</u> L. may apple					A	A	A	
<u>Polygonum scandens</u> L. var. <u>cristatum</u> (Engelm & Gray) Gl. false buckwheat					A			
<u>Polystichum acrostichoides</u> (Michx.) Scott Christmas fern					A		A	
<u>Potentilla simplex</u> Michx. cinquefoil	A	A		A		A	A	A
<u>Prunella vulgaris</u> L. self heal	A	A	A					A
<u>Prunus americana</u> Marsh. wild plum					A	B	B	B
<u>Prunus mexicana</u> Wats. big tree plum								B
<u>Prunus serotina</u> Ehrh. black cherry					AB	ABC	AB	B
<u>Prunus</u> sp. L. cherry						A		A
<u>Prunus virginiana</u> L. choke cherry					A	A	A	
<u>Psoralea psoralioides</u> (Walt.) Cory var. <u>eglandulosa</u> (Ell.) Freeman Sampson's snakeroot								A
<u>Pycnanthemum tenuifolium</u> Schrad. slender mountain mint		A	A					
<u>Quercus alba</u> L. and/or var. white oak					ABC	ABC	ABC	ABC
<u>Quercus x fernowi</u> Trel. (<u>Quercus alba</u> x <u>Quercus stellata</u>) oak								B
<u>Quercus imbricaria</u> Michx. shingle oak						A		

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Quercus macrocarpa</u> Michx. bur oak					A	A		
<u>Quercus macrocarpa</u> Michx. x <u>Q. marilandica</u> bur oak hybrid								A
<u>Quercus marilandica</u> Muenchh. x <u>Q. unknown</u> black jack and/or oak hybrid					A	A		AC
<u>Quercus rubra</u> L. and var. red oak					BC	BC	BC	AB
<u>Quercus shumardii</u> Buckl. shumard oak					A			A
<u>Quercus stellata</u> Wang. post oak	B				C	AC	C	BC
<u>Quercus stellata</u> Wang. x <u>Q. alba</u> or <u>Q. mari.</u> post oak hybrid					A			
<u>Quercus velutina</u> Lam. black oak	B				ABC	ABC	ABC	ABC
<u>Quercus velutina</u> Lam. x <u>Q. bushii</u> Sarg. black oak hybrid								A
<u>Rhamnus lanceolata</u> Pursh buckthorn					A			
<u>Rhus aromatica</u> Ait. fragrant sumac					AB	AB	AB	AB
<u>Rhus radicans</u> L. poison ivy					B	AB	A	
<u>Ribes missouriensis</u> Nutt. Missouri gooseberry					A			
<u>Rosa arkansana</u> Porter cockerell					A			B
<u>Rosa carolina</u> L. pasture rose	B				A	AB	AB	AB
<u>Rosa setigera</u> Michx. var. <u>tomentosa</u> Torr. & Gray prairie rose		A			A			
<u>Rubus argutus</u> Link high-bush blackberry			A					
<u>Rubus flagellaris</u> Willd. dewberry	B	B	A	B	AB	A	AB	B
<u>Rubus occidentalis</u> L. black raspberry					A	AB		

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Rubus ostryfolius</u> Rydb. high-bush blackberry	A			B		B		
<u>Rubus pensilvanicus</u> Poir. high-bush blackberry				A			A	
<u>Rudbeckia hirta</u> L. black-eyed susan		A						
<u>Ruellia humilis</u> Nutt. wild petunia	A	A						
<u>Rumex acetocella</u> L. sheep sorrel		A						
<u>Rumex crispus</u> L. sour dock			A					
<u>Sabatia angularis</u> (L.) Pursh rose pink			A	A				
<u>Sanicula canadensis</u> L. black snakeroot					A	A		A
<u>Sassafras albidum</u> (nut.) Nees sassafras					AB	ABC	B	AB
<u>Schrankia nuttallii</u> (A.D.C. ex Britt. & Rose) Standl. sensitive brier	A	A	A			A		A
<u>Scutellaria parvula</u> Michx. skullcap						A		
<u>Setaria geniculata</u> (Lam.) Beauv. prairie foxtail		A						
<u>Setaria glauca</u> (L.) Beauv. yellow foxtail	A							
<u>Smilacina racemosa</u> L. Desf. false Solomon's seal					A	A	A	
<u>Smilacina stellata</u> (L.) Desf. starry false Solomon's seal					A			
<u>Smilax</u> sp. L. catbrier						B		
<u>Smilax tamnoides</u> L. bristly greenbrier					A	A		A
<u>Solanum carolinense</u> L. horse nettle		A	A	A				
<u>Solidago altissima</u> L. tall goldenrod		A	A					
<u>Solidago nemoralis</u> Ait. old-field goldenrod	A		A	A				
<u>Solidago petiolaris</u> Ait. goldenrod								A
<u>Solidago</u> sp. L. goldenrod		A	A	A	A			A

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Solidago ulmifolia</u> Muhl. elm-leaf goldenrod					A	A	A	A
<u>Spiranthes tuberosa</u> Raf. little ladies' tresses					A			
<u>Strophostyles helvola</u> (L.) D.C. wild bean					A	A	A	A
<u>Strophostyles leiosperma</u> (T&G) Piper wild bean	A							
<u>Strophostyles umbellata</u> (Muhl.) Britt. wild bean		A	A	A				
<u>Symphoricarpos orbiculatus</u> Moench coral berry		A	A			A	A	A
<u>Symphoricarpos</u> sp. Duham. snowberry	B	B	B			B	B	
<u>Teucrium canadense</u> L. wood sage			A					A
<u>Tradescantia earnestiana</u> Anders. & Woods spiderwort					A			
<u>Tradescantia ohiensis</u> Raf. spiderwort						A		
<u>Tridens flavus</u> (L.) Hitchc. purple-top		A	A					
<u>Trifolium campestre</u> Schreb. large hop clover		A	A	A				
<u>Trifolium pratense</u> L. red clover	A	A	A					
<u>Trifolium repens</u> L. white clover	A	A	A					
<u>Triphora trianthophora</u> (S.W.) Rydb. nodding pogonia					A			
<u>Ulmus rubra</u> Muhl. slippery elm	B	B	B	A	ABC	AB	B	BC
<u>Verbena hastata</u> L. blue vervain			A					
<u>Vernonia balwini</u> Torr. ironweed		A	A					
<u>Vernonia missurica</u> Raf. ironweed		A	A					

APPENDIX A-14 (Continued)

Scientific Name Common Name	Prairie Sampling Stations				Forest Sampling Stations			
	Pr-1	Pr-2	Pr-3	Pr-4	F-1	F-2	F-3	F-4
<u>Vernonia</u> sp. Schreb. ironweed		A	A					
<u>Veronica</u> arvensis L. corn speedwell	A		A					
<u>Veronicastrum</u> virginicum (L.) Farw. culvers root							A	
<u>Viburnum</u> prunifolium L. black haw						B	B	
<u>Viburnum</u> rafinesquianum Schultes downy arrow-wood						A		
<u>Viburnum</u> rufidulum Raf. southern black haw					A	AB	A	
<u>Viburnum</u> sp. L. viburnum					B			
<u>Viola</u> papilionacea Pursh common violet						A		
<u>Viola</u> triloba Schwein. f. dilatata Ell. three-lobed violet					A		A	A
<u>Vitis</u> aestivalis Michx. summer grape					B		AB	B
<u>Vitis</u> cinerea Engelm. grayback grape				A	AB	AB	ABC	AB
<u>Vitis</u> vulpina L. winter grape					B	AB	AB	B
<u>Zanthoxylum</u> americanum Mill. prickly ash						B		

APPENDIX A-15

DATA SUMMARY OF FOREST CANOPIE VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION P-1, CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974

Scientific Name Common Name	Subplots-presence indicated by dry weights (grams/0.25-m ² litter plots)																Relative ^c Frequency (%)	Dry Weight ^d for Species	Relative ^e Weight (%)	Importance ^f Value	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Carex texana</i> Scrib. --- swamp	2.50		0.40	0.35	2.20		0.80	7.60							0.25		43.75	7.77	14.10	8.79	-6.56
<i>Amelanchier alboterres</i> (Michx.) Fern. side-slip	0.50																6.25	1.11	0.50	0.30	1.41
<i>Solidago bimifolia</i> Wuhl. side-slip goldenrod	1.30						1.50										12.50	2.22	2.80	1.72	3.94
<i>Cornus florida</i> L. flowering dogwood	3.20							0.27									12.50	2.22	3.45	2.12	4.34
<i>Quercus alba</i> L. and var. white oak	4.30				2.10	13.30		3.95				1.70	0.35				37.50	6.66	25.70	15.80	22.46
<i>Styposostyles helvola</i> (L.) Mill. wild bean	0.15	0.40	0.40			0.30						0.30					37.50	6.66	2.80	1.72	8.38
<i>Desmodium nudiflorum</i> (L.) D.C. tick trefoil	1.20	2.00						1.25			1.40						25.00	4.44	6.05	3.72	8.16
<i>Galium concinnum</i> Torr. & Gray steeped bedstraw	0.30	0.30	0.50			0.30											18.75	3.33	1.10	0.67	4.00
<i>Fraxinus americana</i> L. white ash	5.20		0.60		0.30	2.20				1.25							31.25	5.55	17.55	10.79	16.34
<i>Microbium stipitatum</i> (L.) Sw. sattlemate fern	0.10																6.25	1.11	0.10	0.06	1.17
<i>Galium ciliolatum</i> Michx. wild licorice			0.25					0.05									18.75	3.33	0.35	0.21	3.54
<i>Gnaphalium obtusifolium</i> Jacq. whiteaven			2.10														6.25	1.11	2.10	1.29	2.40
<i>Salicix canadensis</i> L. black willow			1.40														6.25	1.11	1.40	0.86	1.97
<i>Polypodium scolopendria</i> (L.) Presl molly			1.70														6.25	1.11	1.70	1.04	2.15
<i>Carya texana</i> Buckl. var. <i>villosa</i> (Sarg.) Little black hickory					3.00												6.25	1.11	3.00	1.84	2.95
<i>Trichostema triflorum</i> (S.W.) Rydb. molding poponia					0.01												6.25	1.11	0.01	0.00	1.11
<i>Vitis cinerea</i> Engelm. grayback grape					1.15												6.25	1.11	1.15	0.70	1.81

Sheet 1

APPENDIX A-15 (continued)

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (N)	Relative ^c Frequency	Dry weight ^d for Species	Relative ^e Height(N)	Importance ^f Value
<i>Blas arvensis</i> Mill. Fragrant smartweed																	18.75	3.33	35.50	21.82	25.13
<i>Carya tomentosa</i> Nutt. hickory							4.90										6.25	1.11	5.60	3.44	4.55
<i>Leguminosae violacea</i> (L.) Pers. bush clover																	6.25	1.11	0.50	0.30	1.41
<i>Rosa carolina</i> L. rose							1.25		0.10	2.40							25.00	4.44	4.95	3.04	7.48
<i>Rubus figularis</i> Willd. raspberry						0.90					1.10						12.50	2.22	2.00	1.22	3.44
<i>Festuca obtusa</i> Stebler nodding fescue						1.30											6.25	1.11	1.30	0.79	1.90
<i>Carex babilii</i> Mack. sedge						0.70		1.80									12.50	2.22	2.50	1.53	3.75
<i>Carya ovata</i> (Mill.) K. Koch bitter hickory						1.10											12.50	2.22	6.20	3.81	6.03
<i>Basella alba</i> (Mill.) Wett. basil						0.60											6.25	1.11	0.60	0.36	1.47
<i>Cercis canadensis</i> L. redbud																	6.25	1.11	0.15	0.09	1.20
<i>Prunus americana</i> Marsh. wild plum							0.60										6.25	1.11	0.60	0.36	1.47
<i>Carex glauca</i> Tuckerm. sedge							0.10	0.40	0.15								25.00	4.44	1.20	0.73	5.17
<i>Parthenocissus quinquefolia</i> (L.) Planch. Virginia creeper							0.50	0.60	2.60	1.45							42.75	7.77	7.55	4.54	12.41
<i>Panicum lanuginosum</i> Ell. panicum								0.40	0.02								18.75	3.33	0.47	0.28	3.61
<i>Desmodium illinoense</i> Desv. desmodium								1.10									6.25	1.11	1.10	0.67	1.78
<i>Melilotus alba</i> (L.) Desf. starry false Solomon's seal							0.80										6.25	1.11	0.80	0.49	1.60
<i>Nocypum canadense</i> L. Indian hemp									1.05								6.25	1.11	1.05	0.64	1.75

APPENDIX A-15 (continued)

Scientific Name Common Name	Subplot-presence indicated by dry weights (grams/0.25-meter plots)																Relative ^c Frequency (%)	Dry Weight ^d per Species	Relative ^e Weight (%)	Importance ^f Value	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Juniperus virginiana</i> L. red cedar								0.20									6.75	3.11	0.20	0.12	1.23
<i>Quercus velutina</i> Lam. black oak									4.20								6.75	1.11	4.20	2.58	3.69
<i>Prunus virginiana</i> L. choke cherry											0.15			0.65			12.50	2.22	0.80	0.49	2.71
<i>Rhus glabra</i> Michx. prairie rose											0.80						6.25	1.11	0.80	0.49	1.60
<i>Rhus</i> sp. L. alum root											0.10						6.25	1.11	0.10	0.06	1.17
<i>Viburnum cassinii</i> Raf. southern black haw														0.20			6.25	1.11	0.20	0.12	1.23
<i>Smilax virginiana</i> (Mill.) K. Koch hop-nettle																0.20	6.25	1.11	0.20	0.12	1.23
TOTAL:																	562.50	99.90	162.63	99.82	139.72

*Includes woody and herbaceous plants of less than 20 inches in height.

^bNumber of subplots the species occurs
Number of subplots sampled (16)

^cFrequency of a species occurrence
Cumulative frequency of all species

^dCumulative weight (16 subplots) by species

^eCumulative weight (16 species)
Cumulative weight (all species)

^fRelative frequency = relative weight.

APPENDIX A-16
 DATA SUMMARY OF FOREST GROUND VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION F-1,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	Subplots - presence indicated by dry weights (grams/0.25-milacre plots)																Frequency (%)	Relative Frequency (%)	Dry Weight per Square Meter (g/m ²)	Relative Weight (%)	Importance Value
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Fraxinus americana</i> L. white ash	4.10	19.33	17.37				0.03			0.10							31.25	4.85	40.93	14.75	19.60
<i>Aemilanchiet arborea</i> (Michx.) Fern. shadbush	0.10																6.25	0.97	0.10	0.04	1.01
<i>Rubus flagellaris</i> Willd. dodder	0.40	0.26															12.50	1.94	0.46	0.24	2.18
<i>Desmodium nudiflorum</i> (L.) D.C. tick trefoil	0.48	0.13				1.46				0.70	0.30						37.50	5.83	3.27	1.18	7.01
<i>Parthenocissus quinquefolia</i> (L.) Pursh virginia creeper	7.56	9.82	11.15	1.97	0.05	8.13	2.29	2.35	3.48	0.52	1.87	0.01	1.30	0.17	0.24	100.00	15.33	51.04	18.40	33.93	
<i>Aster</i> sp. Quercus alba L. white oak	1.03							4.92	26.82	0.09							18.75	2.91	1.14	0.41	3.32
<i>Carex toosa</i> Michx. --- <i>Prunus serotina</i> Ehrh. black cherry	1.50	0.02	0.81														25.00	3.88	34.33	12.65	16.33
<i>Quercus macrocarpa</i> Michx. bur oak	1.06																18.75	2.91	1.37	0.49	3.40
<i>Anemone thalictroides</i> (L.) Spach. fur anemone	1.58	10.96	22.59														6.25	0.97	1.05	0.38	1.35
<i>Gallium cirtense</i> Michx. wild licorice	0.01																18.75	2.91	35.13	12.66	15.57
<i>Phlox pilularis</i> Gray sage	0.02	0.02								0.22							0.03	0.26	0.09	0.03	3.00
<i>Ostrya virginiana</i> (Mill.) K. Koch hop hornbeam	2.03									0.05							18.75	2.91	0.09	0.03	2.94
<i>Strophostyles helvola</i> (L.) D.C. wild bean	0.97																6.25	0.97	1.33	0.73	1.70
<i>Solidago</i> sp. Koldenrod	1.32																31.25	4.85	1.57	0.57	5.42
<i>Gallium concinnum</i> Torr. & Gray elegant bedstraw	3.17																31.25	4.85	1.76	0.63	5.48
<i>Danthonia spicata</i> (L.) Beauv. poverty grass	0.78	0.11			1.00	0.30											6.25	0.97	3.17	1.14	2.11
<i>Elymus lanceolatus</i> Pursh buckhorn	2.00																6.25	0.97	2.00	0.72	1.69
<i>Rhus glabra</i> L. Carthagenian sumac	0.17																6.25	0.97	0.17	0.06	1.03
<i>Rhus typhina</i> L. Coccoloba	0.31				15.85	0.07											31.25	4.85	22.90	8.25	13.10
<i>Carex hughii</i> Mack. --- <i>Elymus villosus</i> Muhl. wild eye	0.60																25.00	3.88	7.02	2.53	6.41
<i>Sisylia tannoides</i> L. bristly greenbrar	0.31																6.25	0.97	0.51	0.18	1.13
<i>Sanicula canadensis</i> L. black snakeroot	0.45																6.25	0.97	0.45	0.16	1.13
<i>Festuca obtusa</i> Siehler nodding fescue	6.64																6.25	0.97	6.64	2.39	3.36
<i>Rubus occidentalis</i> L. Carthagenian raspberry	7.15																6.25	0.97	7.15	2.58	3.55
<i>Carex ovesti</i> (Mill.) K. Koch shagbark siccary	4.32																6.25	0.97	4.32	1.56	2.53
<i>Quercus maclandica</i> Moench. X Q. unknown black jack and/or oak hybrid	3.01	0.22															25.00	3.88	4.74	1.71	5.59
<i>Carex graveida</i> Bailey --- <i>Rosa carolina</i> L. pasture rose	0.26							4.48									12.50	1.94	4.97	1.79	3.73
<i>Quercus stellata</i> Meng. X Q. alba or Q. mar. l. post oak hybrid	3.27																12.50	1.94	6.57	2.37	4.31
<i>Pedophyllum peltatum</i> L. may apple	16.82																6.25	0.97	16.92	6.10	7.07
<i>Tradescantia virginiana</i> Anders. & Woods spiderwort	0.06																6.25	0.97	0.06	0.02	0.99
																	6.25	0.97	0.10	0.03	1.00

APPENDIX A-14 (continued)

Scientific Name Common Name	Subplots - presence indicated by dry weights (grams/0.25-milacre plots)																Frequency (%)	Relative Frequency ^b	Dry Weight Per Species ^c	Relative Weight (%) ^d	Importance Value ^e
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
Cornus florida L. Flowering dogwood											0.06						6.25	0.97	0.06	0.01	0.99
Azalea sp. L. Rhododendron										0.08							6.25	0.97	0.08	0.03	1.00
Salix roemeriana Desf. Swamp willow											3.48						6.25	0.97	3.48	1.26	2.23
Rhus glabra L. Sweetgum											1.27						6.25	0.97	1.27	0.46	1.43
Ulmus rubra Muhl. Slippery elm											0.27						6.25	0.97	0.27	0.10	1.07
Quercus shumardii Michx. Shumard oak												1.25					6.25	0.97	1.25	0.45	1.42
Vitis cinerea Engelm. Grape												0.52					6.25	0.97	0.52	0.19	1.16
Carex stricta Michx. Sedge																	6.25	0.97	0.52	0.19	1.16
Totals	16.77	30.78	34.06	20.13	39.00	27.95	7.32	12.00	26.90	27.41	4.61	8.48	5.41	11.97	3.93	0.72	643.75	99.93	277.66	100.00	199.93

*Includes woody and herbaceous plants of less than 20 inches in height.
**Includes the species and/or its hybrids.

^a Number of subplots in which species occurs x 100
Number of subplots samples (16)

^b Frequency of a species occurrence x 100
Cumulative frequency of all species

^c Cumulative weight (16 subplots) by species

^d Cumulative weight (all species) x 100
Cumulative weight (all species)

^e Relative frequency + relative weight

Sheet 2

APPENDIX A-17

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION F-1,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

<u>Scientific Name</u> <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Cornus florida</u> L. flowering dogwood	14.0	14.1	78.0	21.2	35.3
<u>Quercus alba</u> ^g L. and var. white oak	10.0	10.1	45.0	12.2	22.3
<u>Carya</u> sp. Nutt. hickory	12.0	12.1	37.0	10.1	22.2
<u>Fraxinus americana</u> L. white ash	7.0	7.1	46.0	12.5	19.6
<u>Rhus aromatica</u> Ait. fragrant sumac	5.0	5.1	53.0	14.4	19.5
<u>Ostrya virginiana</u> (Mill.) K. Koch hop-hornbeam	8.0	8.1	25.0	6.8	14.9
<u>Quercus velutina</u> Lam. black oak	6.0	6.1	22.0	6.0	12.1
<u>Amelanchier arborea</u> (Michx. f.) Fern. shadbush	6.0	6.1	10.0	2.6	8.7
<u>Ulmus rubra</u> Muhl. slippery elm	6.0	6.1	6.0	1.6	7.7
<u>Juniperus virginiana</u> L. red cedar	5.0	5.1	8.0	2.2	7.3
<u>Quercus rubra</u> ^g L. and var. red oak	4.0	4.0	8.0	2.2	6.2

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APPENDIX A-17 (continued)

Scientific Name ^a Common Name	Frequency ^b	Relative Frequency (%) ^c	Density ^d	Relative Density (%) ^e	Importance ^f Value
<u>Vitis vulpina</u> L. winter grape	3.0	3.0	5.0	1.4	4.4
<u>Rubus flagellaris</u> Willd. dewberry	2.0	2.0	5.0	1.4	3.4
<u>Rhus radicans</u> L. poison ivy	1.0	1.0	7.0	1.9	2.9
<u>Morus rubra</u> L. red mulberry	1.0	1.0	2.0	0.5	1.5
<u>Vitis aestivalis</u> Michx. summer grape	1.0	1.0	2.0	0.5	1.5
<u>Celtis occidentalis</u> L. hackberry	1.0	1.0	2.0	0.5	1.5
<u>Aesculus glabra</u> Willd. Ohio buckeye	1.0	1.0	1.0	0.3	1.3
<u>Viburnum</u> sp. L. viburnum	1.0	1.0	1.0	0.3	1.3
<u>Prunus serotina</u> Ehrh. black cherry	1.0	1.0	1.0	0.3	1.3
<u>Crataegus</u> sp. L. hawthorn	1.0	1.0	1.0	0.3	1.3
<u>Sassafras albidum</u> (Nutt.) Nees sassafras	1.0	1.0	1.0	0.3	1.3
<u>Acer saccharum</u> Marsh sugar maple	1.0	1.0	1.0	0.3	1.3
<u>Vitis cinerea</u> Engelm. grayback grape	1.0	1.0	1.0	0.3	1.3
TOTAL	99.9	100.0	368.0	100.1	200.1

APPENDIX A-17 (continued)

Trees and/or shrubs per quadrat = 23.0

Trees and/or shrubs per acre = 3,726

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density.

^g Includes the species and varieties.

APPENDIX A-18

DATA SUMMARY FOR OVERSTORY VEGETATION^a OF SAMPLING STATION F-1,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 25-milacre plots)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Dominance ^f	Relative ^g Dominance (%)	Importance ^h Value
<u>Quercus alba</u> ⁱ L. and var. white oak	14.0	25.5	32.0	28.8	4,377.4	78.5	132.8
<u>Cornus florida</u> L. flowering dogwood	9.0	16.4	28.0	25.2	124.0	2.2	43.8
<u>Quercus velutina</u> Lam. black oak	8.0	14.5	19.0	17.1	143.4	2.6	34.2
<u>Carya ovata</u> (Mill.) K. Koch shagbark hickory	6.0	10.9	8.0	7.2	34.9	0.6	18.7
<u>Quercus stellata</u> Wang. post oak	2.0	3.6	4.0	3.6	495.2	8.9	16.1
<u>Amelanchier arborea</u> (Michx.f.) Fern. shadbush	4.0	7.3	5.0	4.5	22.7	0.4	12.2
<u>Carya texana</u> Buckl. black hickory	2.0	3.6	2.0	1.8	313.6	5.6	11.0
<u>Ostrya virginiana</u> (Mill.) K. Koch hop-hornbeam	3.0	5.5	5.0	4.5	20.9	0.4	10.4
<u>Quercus rubra</u> L. red oak	2.0	3.6	2.0	1.8	9.8	0.2	5.6
<u>Ulmus rubra</u> Muhl. slippery elm	1.0	1.8	2.0	1.8	8.0	0.1	3.7

APPENDIX A-18 (continued)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Dominance ^f	Relative ^g Dominance (%)	Importance ^h Value
<u>Juniperus virginiana</u> L. red cedar	1.0	1.8	1.0	0.9	12.6	0.2	2.9
<u>Carya tomentosa</u> Nutt. mockernut hickory	1.0	1.8	1.0	0.9	4.9	0.1	2.8
<u>Fraxinus americana</u> L. white ash	<u>1.0</u>	<u>1.8</u>	<u>1.0</u>	<u>0.9</u>	<u>3.1</u>	<u>0.1</u>	<u>2.8</u>
TOTAL	55.0	98.1	110.0	99.0	5,570.5	99.9	297.0

Trees per quadrat = 6.9
 Trees per acre = 279.5
 Basal area per quadrat = 348.5 sq. in.
 Basal area per acre = 14,114.3 sq. in.

^a Tree species 20 inches or greater diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Cumulative basal area (sq. in.) of a species within subplots sampled.

^g $\frac{\text{Cumulative basal area of a species}}{\text{Cumulative basal area of all species}} \times 100$

^h Summation of relative frequency + relative density + relative dominance.

ⁱ includes species and varieties.

APPENDIX A-19

INCREMENT CORE SUMMARY FOR OVERSTORY VEGETATION^a OF SAMPLING STATIONS F-1 TO F-4,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
 (Distribution and Mean Age^b, by Diameter Size Classes)

<u>Sampling Station</u>	<u>Species</u>	<u>Specimen Number</u>	<u>Age</u>	<u>Diameter Class</u>	<u>Age</u>	<u>Diameter Class</u>	<u>Age</u>	<u>Diameter Class</u>	<u>Age</u>	<u>Diameter Class</u>
F-1	Slippery elm	21500	15	2.04	20	2.20				
	White ash	21501	20	2.00						
	White oak	21502	90	17.00	127	15.18	129	13.20	129	13.23
	Post oak	21504	77	7.60						
	Hybrid oak	21505	135	12.10	132	12.01				
	Black oak	21506	29	2.06	31	3.16	38	4.24		
	Red oak	21507	31	2.28	22	2.40				
	Red mulberry	21508	30	2.36						
	Flowering dogwood	21509	29	2.50	15	2.00	22	2.36		
	Shadbush	21510	21	2.16	27	2.39	25	2.30		
	Red cedar	21511	54	4.10						
	Hop-hornbeam	21512	25	2.20						
	Black hickory	21513	111	16.52						
	Shagbark hickory	21514	24	2.12	23	2.06				
	Mockernut hickory	21515	20	2.24						
F-2	Red oak	21516	27	3.44	36	8.30	24	5.00	34	8.00
	Black oak	21517	29	3.00	39	8.16	34	9.00	40	6.32
	Post oak	21518	32	6.60						
	Hybrid oak	21519a	41	7.18	43	6.48				
	White oak	21519	39	5.00	62	11.18	27	6.08		
	Shagbark hickory	21520	28	3.50	18	2.22	54	7.18		
	Black hickory	21521	24	5.40	26	4.04	25	3.43		
	Mockernut hickory	21522	23	3.00	19	2.16	27	5.00		
	Shadbush	21523	22	2.50	30	3.08				
	Sassafras	21524	17	3.40	28	3.18				
	Red mulberry	21525	23	3.00						
	Flowering dogwood	21526	24	2.16	21	2.36				
	Black cherry	21527	25	3.00						

APPENDIX A-19 (continued)

Sampling Station	Species	Specimen Number	Age	Diameter Class	Age	Diameter Class	Age	Diameter Class	Age	Diameter Class
F-3	Red oak	21529	32	7.28		11.19	50	10.18		
	Post oak	21530	29	4.40	50	8.16				
	Hybrid oak	21531	38	6.60						
	White oak hybrid	21532	31	6.36	49	90.38	49	11.14		
	White oak	21533	19	3.06	37	6.34				
	Black oak	21534	16	2.50	47	13.40				
	Black oak hybrid	21535	53	13.08	54	11.18	48	13.04		
	Black hickory	21537	31	4.12	16	3.32	35	5.46	61	7.48
	Shagbark hickory	21538	43	6.32						
	Mockernut hickory	21539	10	2.06	15	2.00				
	Red mulberry	21540	20	2.12						
	Sugar maple	21541	43	11.18	23	2.17				
	Flowering dogwood	21542	19	2.29	11	2.00				
F-4	Black-jack oak	21543	102	7.14						
	Post oak	21544	97	6.37	103	9.75	84	5.62		
	Hybrid oak	21545	32	3.15	57	6.5				
	White oak	21546	110	16.0	30	4.16				
	White oak hybrid	21547	35	3.56	66	15.40	34	4.22	32	3.22
	Black oak	21548	72	13.26	67	11.55	69	11.30		
	Sugar maple	21549	21	2.56						
	Flowering dogwood	21550	22	2.32	22	2.25	26	2.08		
	Black hickory	21551	32	3.12	27	2.30				
	Shagbark hickory	21552	102	10.62						
	Shadbush	21553	31	2.36	27	2.11				
	Slippery elm	21554	31	3.20						
	White ash	21555	26	2.22						

^aTree species 2.0 inches or greater diameter at breast height.

^bAges in years were determined from cores taken at 4.5 feet from ground.

APPENDIX A-20

DATA SUMMARY OF FOREST GROUND VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION F-2,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (%)	Relative ^c Frequency (%)	Dry Weight ^d For Species	Relative ^e Weight (%)	Importance ^f Value
<i>Galium concinnum</i> Torr. & Gray	2.90			2.05	1.60	2.10	0.01					0.10					37.50	6.97	0.76	6.97	13.94
<i>Rubus occidentalis</i> L. black raspberry	1.70																6.25	1.16	1.70	1.35	2.51
<i>Onoclea sensibilis</i> L. yellow wood sorrel	0.01																6.25	1.16	0.03	0.02	1.18
<i>Rhus glabra</i> L. cyclopetal	1.90			0.50													12.50	2.32	2.40	1.91	4.23
<i>Rhus aromatica</i> Mill. fragrant sumac	0.50			0.60	7.20			9.50	1.50								31.25	5.81	19.30	15.07	23.18
<i>Elyophosia helvola</i> (L.) Britt. wild bean	0.04		2.55		0.20			0.55	0.05			2.60	0.25				43.75	8.13	6.24	4.97	13.10
<i>Quercus sphaera</i> L. var. white oak	0.20						2.30					2.80	1.50	5.30			31.25	5.81	12.10	9.63	15.44
<i>Carex glaucoidea</i> Tuckerm. ---	0.10																6.25	1.16	0.10	0.07	1.23
<i>Parthenocissus quinquefolia</i> (L.) Planch. Virginia creeper	0.60			0.70	0.15	1.30		3.30				0.75	1.30				50.00	9.30	8.90	7.08	16.38
<i>Carex bushii</i> Mack. ---	1.00																18.75	3.46	3.00	2.38	5.86
<i>Vitis cinerea</i> Vahl. gray/black grape	0.20	1.50															18.75	3.46	2.00	1.59	5.07
<i>Galium aparine</i> L. wild licorice	0.30			0.10													18.75	3.48	0.43	0.24	3.82
<i>Quercus stellata</i> Wang. post oak	1.60																6.25	1.16	1.60	1.27	2.43
<i>Onoclea sensibilis</i> (Mill.) K. Koch hop hornbeam	2.75			3.60								2.50					18.75	3.48	8.85	7.04	10.52
<i>Panicum lanuginosum</i> var. <i>lanuginosum</i> (Scribn.) Fern. ---	0.02																18.75	3.48	0.52	0.41	3.89
<i>Carex corymbosa</i> Schultze ---	2.60			2.20	0.03			4.10									31.25	5.81	9.68	7.71	13.52
<i>Agraria perennans</i> (Mill.) Tuckerm. upland bent	0.55																6.25	1.16	0.55	0.43	1.59
<i>Aster anomalous</i> Engelm. aster	0.05																6.25	1.16	0.05	0.03	1.19

Sheet 1

APPENDIX A-20 (continued)

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (N)	Relative ^c Frequency(N)	Dry Weight ^d Total Species	Relative ^e Weight(N)	Importance ^f Value
<i>Solidago virginica</i> Muhl. stem-leaf polychaet			4.30				2.20										12.50	2.32	6.50	5.37	7.49
<i>Heuchera</i> sp. L. alum root			0.01						0.20								12.50	2.32	0.21	0.16	2.48
<i>Desmodium illinoense</i> Desf. --- <i>Fraxinus americana</i> L. white ash			3.15		0.70												6.25	1.16	3.15	2.50	3.66
<i>Quercus imbricaria</i> Michx. single oak					0.15												6.25	1.16	0.70	0.55	1.71
<i>Rosa carolina</i> L. pasture rose						0.40											18.75	3.48	1.05	0.83	4.31
<i>Prunus virginiana</i> L. choke cherry						0.40							0.10				12.50	2.32	0.70	0.55	2.87
<i>Vitis vulpina</i> L. Frost grape							1.40					2.25					12.50	2.32	3.65	2.80	5.22
<i>Muhlenbergia subulifera</i> (Muhl.) Trin. muhly							1.40										6.25	1.16	1.40	1.11	2.27
<i>Hyalembia lanceolata</i> Walt. lowenshrift									0.60								6.25	1.16	0.60	0.47	0.80
<i>Misc. saccharum</i> Marsh sugar maple									0.03		0.75						12.50	2.32	0.78	0.62	2.94
<i>Desmodium nudiflorum</i> (L.) D.C. tick trefoil								3.40									6.25	1.16	3.40	2.70	3.86
<i>Anthem. glabra</i> (L.) Beauv. poverty grass								0.20									6.25	1.16	0.20	0.15	1.31
<i>Quercus velutina</i> Lam. black oak											0.60						6.25	1.16	0.60	0.47	1.63
<i>Legedra virginica</i> (L.) Pers. bush clover											1.00						6.25	1.16	1.00	0.78	1.95
<i>Ulmus rubra</i> Muhl. slippery elm													1.40				6.25	1.16	1.40	1.11	2.27
<i>Sanguin. canadensis</i> L. black snakeroot													0.50				6.25	1.16	0.50	0.39	1.55
<i>Asterias plantaginifolia</i> (L.) Hook. pussy's toes													0.90				6.25	1.16	0.90	0.71	1.87
													3.20				6.25	1.16	3.20	2.54	3.70

Sheet 2

APPENDIX A-20 (continued)

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (N)	Relative ^c Frequency(N)	Dry Weight ^d For Species	Relative ^e Weight(N)	Importance ^f Value
<i>Desmodium illinoense</i> (Michx.) Wood tick trefoil																	6.25	1.16	0.20	0.15	1.31
<i>Diostyris virginiana</i> L. perennium																	5.25	1.16	0.20	0.15	1.31
TOTAL	7.97	5.85	14.73	6.25	11.05	4.95	7.24	9.50	3.45	17.88	3.90	6.85	8.00	11.63	5.10	1.20	57.50	99.83	125.55	99.76	159.59

^a Incl. a woody and herbaceous plants of less than 20 inches in height.

^b Number of subplots the species occurs
number of subplots sampled (16) * 100

^c Frequency of a species occurrence
Cumulative frequency of all species * 100

^d Cumulative weight (16 subplots) by species
Cumulative weight (all species) * 100

^e Relative frequency + relative weight.

APPENDIX A-21
 DATA SUMMARY OF FOREST GROUND VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION F-2,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	Subplots - Percentages indicated by dry weight (grams/25-milliliter plots)											Frequency (%)	Relative Frequency (%)	Dry Weight Per Species ^a (g)	Relative Weight Importance (%)					
	1	2	3	4	5	6	7	8	9	10	11					12	13	14	15	16
<i>Rubus occidentalis</i> L. Black raspberry															8.25	0.70	19.05	7.25	7.95	
<i>Tradescantia virginiana</i> Raf. Spiderwort															6.25	0.70	10.27	3.81	4.81	
<i>Puccinellia simplex</i> Michx. Climaculid						0.43									18.75	2.10	4.81	1.75	3.85	
<i>Gallium concinnum</i> Torr. & Gray Sessant bedstraw				2.53	0.47	1.46									0.38	31.25	3.50	8.25	3.18	6.84
<i>Onalis europaea</i> Jord. Purple bedstraw																				
<i>Carex lasiocarpa</i> Michx. Carex																				
<i>Lespedeza violacea</i> (L.) Pers. Bush clover		1.26	3.41			1.44	0.20			0.82		4.51			6.25	0.70	0.08	0.03	0.73	
<i>Lactuca</i> sp. L. Lettuce						0.38									12.50	1.40	0.48	0.18	1.58	
<i>Parthenocissus quinquefolia</i> (L.) Planch. Virginia creeper															12.50	1.40	0.10	0.04	1.44	
<i>Saxifraga albidum</i> (Nutt.) Nees, Saxifraga		1.76	0.13	13.82	1.24	1.81	0.91	0.28	13.62	6.94	0.98	7.15	3.12	0.26	0.02	87.50	9.79	52.02	19.70	29.38
<i>Carex glaucescens</i> Tuckerm. Carex		1.50						1.50							12.50	1.40	2.80	1.07	2.47	
<i>Viola</i> sp. Common violet		1.55	0.19	0.30		0.21				4.27	0.11				37.50	4.20	6.63	2.52	6.72	
<i>Vicia ciliata</i> Engelm. Knapweed		0.02		0.01				0.03	0.31	0.05	0.01				37.50	4.20	0.43	0.16	4.36	
<i>Panicum lanuginosum</i> Ell. Panicum		3.60	4.31							0.46					4.76	31.25	3.50	13.12	4.89	8.49
<i>Cornus florida</i> L. Flowering dogwood		0.09				0.06									12.50	1.40	0.15	0.06	1.46	
<i>Melastichus</i> sp. L. Sunflower		0.10			2.41										12.50	1.40	2.71	1.03	2.43	
<i>Hieracium</i> sp. L. Hairy-cress		0.43													6.25	0.70	0.43	0.18	0.86	
<i>Podophyllum peltatum</i> L. May apple		0.26													6.25	0.70	0.24	0.09	0.79	
<i>Strigomyces helveticus</i> (L.) Britt. Wild berm		2.03													6.25	0.70	0.24	0.09	0.79	
<i>Quercus macrocarpa</i> Michx. White oak		1.03				1.01		3.19							2.34	18.75	2.10	7.56	2.88	4.98
<i>Desmodium illinoense</i> (Nutt.) Wood Tick trefoil		3.25													0.06	37.50	4.20	2.73	1.04	3.26
<i>Astilbe trifolium</i> L. Starwort		0.07				0.34					1.28				6.25	0.70	3.25	1.24	1.84	
<i>Amelanchier alba</i> (Mill.) Torr. Shadbush		0.07				0.89	1.11				0.07	0.28			0.34	31.25	3.50	3.26	1.24	1.84
<i>Lysimachia imbricata</i> Walt. Loosestrife		0.05													0.09	37.50	4.20	2.46	0.86	5.16
<i>Arenaria thalictroides</i> (L.) Spach. Rue anemone		0.01				0.23									17.50	1.40	0.18	0.07	1.47	
<i>Scutellaria parviflora</i> Michx. Skullcap		0.11				0.06									31.25	3.50	0.36	0.14	3.84	
<i>Rhus purpurea</i> L. Canada brom		1.71													4.25	0.70	1.71	0.65	1.35	
<i>Symphoricarpos obtusilobus</i> Nees, Coral berry		4.84													6.25	0.70	4.84	1.84	2.54	
<i>Diarrhoea villosa</i> L. Yew		12.19													1.07	12.50	1.40	13.26	5.04	6.44
<i>Fraxinus americana</i> L. White ash		6.45						0.60	15.86	9.16	0.18				31.25	3.50	30.25	11.51	15.01	
<i>Quercus alba</i> L. White oak		0.02				0.20									12.50	1.40	0.22	0.08	1.48	
<i>Aronia arbutifolia</i> (L.) Hook. Dove's foot						3.62		11.15							12.50	1.40	14.77	5.82	7.02	
<i>Viburnum acerifolium</i> (L.) Hook. Dove's foot						0.51			0.07	0.31	3.45				25.00	2.80	6.34	2.41	3.21	
<i>Gallium aparine</i> L. Dove's foot						1.83					0	7.26			12.50	1.40	4.07	1.55	2.85	
<i>Gallium aparine</i> L. Dove's foot						1.03					0.14				12.50	1.40	1.17	0.45	1.85	
<i>Carex</i> sp. Carex						0.05						0.21	0.03		18.75	2.10	0.29	0.11	2.21	
<i>Agrostis alba</i> L. Redtop						0.84		0.38		1.28	1.22				1.55	37.50	4.20	5.83	2.22	6.42
<i>Rosa carolina</i> L. Rosa						0.49									6.25	0.70	0.48	0.19	0.89	
<i>Shilonea racemosa</i> L. False Solomon's seal						7.04		0.29							12.50	1.40	7.33	2.79	4.19	
<i>Linum catharticum</i> L. Flax						0.13							0.05		0.05	0.20	0.81	0.31	2.41	
<i>Linum catharticum</i> L. Flax						0.10									6.25	0.70	0.30	0.04	0.74	

APPENDIX A-21 (continued)

Scientific Name Common Name	Subplots - grasses indicated by dry weight (grams/0.25-milliliter plot)																Frequency (%)	Relative Frequency ^b (%)	Dry Weight Per Species ^c (%)	Relative Weight ^d (%)	Importance Value ^e
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Rhus radicans</i> L. poison ivy									5.71								8.25	0.70	5.71	2.17	2.87
<i>Rhus typhina</i> (Mill.) Blake staghorn sumac									0.38								6.25	0.70	0.38	0.14	0.84
<i>Prunus</i> sp. L. cherry									0.11								6.25	0.70	0.11	0.04	0.74
<i>Celastrus scandens</i> L. bittersweet									1.32								6.25	0.70	1.32	0.50	1.20
<i>Aster</i> sp. L. aster											0.81						6.25	0.70	0.61	0.23	0.83
<i>Quercus marilandica</i> Moench, EQ. spp. black jack and/or oak hybrid												7.40 (0.06)					12.50	1.40	7.44	2.83	4.23
<i>Rubus flagellaris</i> Willd. dewberry												0.72					6.25	0.70	0.72	0.27	0.87
<i>Cynanchum laeve</i> (Michx.) Pers. snake-pot												0.45					6.25	0.70	0.45	0.17	0.87
<i>Boerhaavia virginiana</i> (L.) M. rattlesnake fern												0.06					6.25	0.70	0.06	0.02	0.72
<i>Viburnum tomentosum</i> Raf. southern black haw												0.45					6.25	0.70	0.45	0.17	0.87
<i>Elymus villosus</i> Muhl. wild rye												1.03					6.25	0.70	1.03	0.39	1.09
<i>Panicum</i> sp. L. ---													0.01				6.25	0.70	0.01	0.004	0.07
<i>Carex acuticula</i> Mack. ---													0.13				6.25	0.70	0.13	0.05	0.75
<i>Prunus serotina</i> Ehrh. black cherry																	6.25	0.70	0.13	0.05	0.75
Totals	42.68	8.19	17.82	37.62	15.71	4.78	5.11	26.59	30.94	20.74	3.30	9.59	12.53	16.28	0.76	10.95	893.75	100.08	282.90	100.01	200.09

^a Includes woody and herbaceous plants of less than 20 inches in height, excludes the species and/or its hybrids.

^b Number of subplots the species occurs x 100
Number of subplots sampled (16)

^c FREQUENCY OF A SPECIES OCCURS x 100
Cumulative frequency of all species

^d Cumulative weight (16 subplots) by species

^e Cumulative weight (all species) x 100

^f Relative frequency + relative weight

Sheet 2

APPENDIX A-22

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION F-2,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

<u>Scientific Name</u> <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Rhus aromatica</u> Ait. fragrant sumac	11.0	7.6	117.0	18.3	25.9
<u>Cornus florida</u> L. flowering dogwood	13.0	9.0	88.0	13.8	22.8
<u>Quercus alba</u> ^g L. and var. white oak	12.0	8.3	66.0	10.3	18.6
<u>Fraxinus americana</u> L. white ash	14.0	9.7	35.0	5.5	15.2
<u>Acer saccharum</u> Marsh sugar maple	7.0	4.8	43.0	6.7	11.5
<u>Carya</u> sp. L. hickory	9.0	6.2	17.0	2.7	8.9
<u>Symphoricarpos</u> sp. Duham. snowberry	4.0	2.8	38.0	6.0	8.8
<u>Quercus velutina</u> Lam. black oak	7.0	4.8	17.0	2.7	7.5
<u>Rosa carolina</u> L. pasture rose	7.0	4.8	12.0	1.9	6.7
<u>Rhus radicans</u> L. poison ivy	2.0	1.3	34.0	5.3	6.6
<u>Amelanchier arborea</u> (Michx.f.) Fern. shadbush	6.0	4.1	13.0	2.0	6.1

APPENDIX A-22 (continued)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Importance ^f Value
<u>Ulmus rubra</u> Muhl. slippery elm	5.0	3.4	15.0	2.4	5.8
<u>Viburnum prunifolium</u> L. black haw	1.0	0.7	32.0	5.0	5.7
<u>Prunus americana</u> Marsh. wild plum	5.0	3.4	12.0	1.9	5.3
<u>Juniperus virginiana</u> L. red cedar	6.0	4.1	7.0	1.1	5.2
<u>Prunus serotina</u> Ehrh. black cherry	5.0	3.4	8.0	1.3	4.7
<u>Zanthoxylum</u> sp. L. prickly ash	2.0	1.3	21.0	3.3	4.6
<u>Sassafras albidum</u> (Nutt.) Nees sassafras	4.0	2.8	11.0	1.7	4.5
<u>Diospyros virginiana</u> L. persimmon	3.0	2.1	10.0	1.6	3.7
<u>Celastrus</u> sp. L. bittersweet	4.0	2.8	4.0	0.6	3.4
<u>Vitis vulpina</u> L. winter grape	3.0	2.1	7.0	1.1	3.2
<u>Vitis cinerea</u> Engelm. grayback grape	3.0	2.1	4.0	0.6	2.7
<u>Rubus occidentalis</u> L. black raspberry	2.0	1.3	7.0	1.1	2.4
<u>Ostrya virginiana</u> (Mill.) K. Koch hop-hornbeam	2.0	1.3	6.0	0.9	2.2

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APPENDIX A-22 (continued)

Scientific Name <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Crataegus</u> sp. L. hawthorn	2.0	1.3	3.0	0.5	1.8
<u>Quercus rubra</u> L. red oak	2.0	1.3	2.0	0.3	1.6
<u>Celastrus scandens</u> L. american bittersweet	1.0	0.7	3.0	0.5	1.2
<u>Morus rubra</u> L. red mulberry	1.0	0.7	4.0	0.6	1.3
<u>Euonymus atropurpureus</u> Jacq. wahoo	1.0	0.7	1.0	0.2	0.9
<u>Smilax</u> sp. L. catbrier	<u>1.0</u>	<u>0.7</u>	<u>1.0</u>	<u>0.2</u>	<u>0.9</u>
TOTAL	145.0	99.6	638.0	100.1	199.7

Trees and/or shrubs per quadrat = 39.9

Trees and/or shrubs per acre = 6,463.8

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density

^g Includes the species and varieties.

APPENDIX A-23

DATA SUMMARY FOR OVERSTORY VEGETATION^a OF SAMPLING STATION F-2,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
 (based on sixteen 25-milacre plots)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Dominance ^f	Relative ^g Dominance (%)	Importance ^h Value
<u>Quercus alba</u> ⁱ L. and var. white oak	15.0	25.0	73.0	46.7	2,859.7	63.2	134.9
<u>Carya ovata</u> (Mill.) K. Koch shagbark hickory	11.0	18.3	24.0	15.4	442.5	9.8	43.5
<u>Carya texana</u> Buckl. black hickory	6.0	10.0	17.0	10.9	248.4	5.5	26.4
<u>Quercus rubra</u> L. red oak	5.0	8.3	6.0	3.8	515.9	11.4	23.5
<u>Quercus velutina</u> Lam. black oak	6.0	10.0	10.0	6.4	264.4	.8	22.2
<u>Cornus florida</u> L. flowering dogwood	6.0	10.0	14.0	9.0	67.2	1.5	20.5
<u>Amelanchier arborea</u> (Michx.f.) Fern. shadbush	3.0	5.0	3.0	1.9	19.1	0.4	7.3
<u>Carya tomentosa</u> Nutt. mockernut hickory	2.0	3.3	3.0	1.9	29.8	0.7	5.9
<u>Sassafras albidum</u> (Nutt.) Nees sassafras	2.0	3.3	2.0	1.3	19.2	0.4	5.0
<u>Quercus stellata</u> Wang. post oak	1.0	1.7	1.0	0.6	38.5	0.9	3.2
<u>Prunus serotina</u> Ehrh. black cherry	1.0	1.7	1.0	0.6	7.1	0.2	2.5

APPENDIX A-23 (continued)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Dominance ^f	Relative ^g Dominance (%)	Importance ^h Value
<u>Morus rubra</u> L. red mulberry	1.0	1.7	1.0	0.6	7.1	0.2	2.5
<u>Diospyros virginiana</u> L. persimmon	1.0	1.7	1.0	0.6	4.9	0.1	2.4
TOTAL	60.0	100.0	156.0	99.7	4,523.8	100.1	299.8

Trees per quadrat = 9.8
 Trees per acre = 396.8
 Basal area per quadrat = 282.7 sq. in.
 Basal area per acre = 11,449.4 sq. in.

^a Tree species 2.0 inches or greater diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Cumulative basal area (sq. in.) of a species within subplots sampled.

^g $\frac{\text{Cumulative basal area of a species}}{\text{Cumulative basal area of all species}} \times 100$

^h Summation of relative frequency + relative density + relative dominance.

ⁱ Includes species and varieties

APPENDIX A-24

DATA SUMMARY OF FOREST GROUND VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION P-3,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (N)	Relative ^c Frequency(N)	Dry Weight ^d for Species	Relative ^e Weight(N)	Importance ^f Value	
<i>Carex edoxa</i> Schumbr																						
--- <i>Desmodium nudiflorum</i> (L.) D.C. tick trefoil	2.00	1.65		0.70	0.10	2.00	0.10	1.05		4.60				1.10		0.25	62.5 ^b	13.45	13.75	12.66	25.31	
<i>Strophomena helveticus</i> (L.) Britt. wild bean	1.00		0.30		0.20	6.60	0.60	4.60						0.40			37.50	7.59	13.40	12.34	19.93	
<i>Prunus virginiana</i> (L.) choke cherry	2.50	0.75	0.25		2.05						0.50	0.30	2.50				37.50	7.59	8.15	7.50	15.09	
<i>Morinda fusculata</i> Nutt. horsemint		0.30			1.60						7.30						12.50	2.63	1.00	0.92	3.55	
<i>Prunum boreale</i> Poir. ---		0.10															18.75	3.79	9.20	8.47	12.28	
<i>Parthenocissus quinquefolia</i> (L.) Planch Virginia creeper		0.30	0.40				0.40	0.05	2.60	1.30	0.85	3.95	0.05	3.80			6.25	1.26	0.10	0.90	2.16	
<i>Quercus velutina</i> Lam. black oak		2.30									0.65						62.50	12.65	13.70	12.61	25.28	
<i>Carex boottii</i> Michx. ---	0.80	0.20	0.75		0.80						0.60						31.25	6.32	3.15	2.90	9.22	
<i>Quercus alba</i> L. and var. white oak		0.15															12.50	2.63	0.45	0.41	2.04	
<i>Rhus glabra</i> Mill. fragrant sumac		3.50	4.10								0.30						31.25	6.32	22.17	20.41	26.73	
<i>Galium coccineum</i> Michx. wild licorice		0.02			0.02				0.25								18.75	3.79	0.29	0.26	4.05	
<i>Bidens uniflora</i> Nutt. sun-leaf goldenrod					0.90												6.25	1.26	0.90	0.82	2.08	
<i>Leguminosae violacea</i> (L.) Pers. bush clover									0.60								12.50	2.63	0.42	0.37	3.20	
<i>Fraxinus americana</i> L. white ash					0.02												6.25	1.26	0.05	0.04	1.30	
<i>Potentilla anagallis</i> Michx. cinquefoil					0.05												12.50	2.63	1.15	1.05	3.68	
<i>Muehlenbergia sp.</i> L. alum root					0.15												6.25	1.26	0.15	0.13	1.39	

APPENDIX A-24 (continued)

Scientific Name Common Name	Subplots—presence indicated by dry weights (grams/0.25-meter plots)																Frequency ^b (%)	Relative ^c Frequency (%)	Dry Weight ^d for Species	Relative ^e Weight (%)	Importance ^f Index
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Zenaidura macroura</i> var. <i>implicatus</i> (Scribn.) Fern. --- pussy's toes						0.10											6.25	1.26	0.10	0.90	2.16
<i>Antennaria plantaginifolia</i> (L.) Moq. pussy's toes						2.10	0.20							0.50			18.75	3.79	2.80	2.57	6.36
<i>Vicia cifernea</i> Engelm. greyback grape							3.50										6.25	1.26	3.50	3.22	4.48
<i>Rosa carolina</i> L. pasture rose								0.40					0.90	0.80			18.75	3.79	2.10	1.93	5.72
<i>Lactuca canadensis</i> L. wild lettuce									0.30								6.25	1.26	0.30	0.27	1.33
<i>Cornus florida</i> L. flowering dogwood										0.05	0.05						12.50	2.63	0.10	0.90	3.53
<i>Galium concinnum</i> Torr. & Gray elegant bedstraw										1.15			0.80			12.50	2.63	3.95	1.79	4.42	
<i>Demodermis glutinosus</i> (Muhl.) Wood tick trefoil										4.85						6.25	1.26	4.85	4.48	5.72	
<i>Viburnum trifidulum</i> Raf. southern black haw											0.50					6.25	1.26	0.50	0.46	1.72	
<i>Rubus flagellaris</i> Willd. dewberry												0.80				6.25	1.26	0.80	0.73	1.99	
<i>Vicia vulpina</i> L. winter grape																6.25	1.26	1.00	0.92	2.18	
TOTAL	6.30	3.30	7.67	4.80	4.67	5.77	10.40	2.45	4.65	8.35	13.35	13.45	4.75	6.35	5.70	6.62	473.75	100.55	108.58	102.30	202.85

^a Includes woody and herbaceous plants of less than 20 inches in height.

^b Number of subplots the species occurs
Number of subplots sampled (16) x 100

^c Frequency of a species occurrence
Cumulative frequency of all species x 100

^d Cumulative weight (16 subplots) by species

^e Cumulative weight (6 species) x 100
Cumulative weight (all species)

^f Relative frequency + relative weight.

APPENDIX A-25
 DATA SUMMARY OF FOREST GROUND VEGETATION* CLIPPED FROM SUBPLOTS OF SAMPLING STATION P-3,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency (%)	Relative Frequency	Dry Weight Per Square Meters	Relative Weight Per Square Meters	Importance Value ¹	
Aster sp. L.																						
Parthenocissus quinquefolia (L.) Pursh	1.12								0.08									12.50	1.88	1.20	0.43	2.37
Virginia creeper	1.50	7.64	0.84	0.35	1.37	1.96	3.28	0.38	0.34	6.73	0.02	0.94	0.83					81.25	12.26	26.56	14.91	27.25
Carex hughii Michx.	0.22	1.68	0.35	0.03					1.29	0.01	1.49							43.75	6.40	5.07	2.86	9.48
Gallium circaeasense Michx.	0.11	0.01	0.18	0.02	0.07				0.13	0.15	0.07	2.39	0.56	0.07				56.25	8.49	3.67	2.07	10.58
Arenonella thalictroides (L.) Spach.	0.10	0.40	0.02	0.07														31.25	4.72	0.62	0.35	5.07
Rus aromatica Ait.									11.95	0.20	2.22							25.00	3.77	14.79	8.35	12.12
Desmodium nudiflorum (L.) D.C.	0.42								5.06	0.04	0.78	1.06	0.43	20.20				56.25	8.49	34.43	30.72	39.21
Rhus aromatica Ait.									0.01	0.05	0.02	2.41	1.06	1.07	0.34			82.50	9.63	9.17	5.17	14.60
Strophostyles helvola (L.) Britt.	11.65	1.21	6.00	0.37	0.32							1.85						18.75	2.83	4.60	2.60	5.43
Monarda mollis L.	1.60								0.10	0.03	0.09	0.05						31.25	4.72	10.01	5.85	10.37
Monarda mollis L.	2.43	0.32																12.50	1.89	4.94	2.79	4.68
Vitis cinerea Engelm.	9.74																	18.75	2.83	0.65	0.37	3.20
Grayback grape	4.83	0.11							0.14	(0.20)								6.25	0.94	0.81	0.46	1.40
Quercus alba* L.	0.31																	6.25	0.94	0.20	0.11	1.05
Carya ovata (Mill.) K. Koch	0.81																	6.25	0.94	2.90	1.64	2.58
Shagbark hickory	0.20																	6.25	0.94	0.35	0.20	1.14
Carex glaucoidea Tuckerm.																		6.25	0.94	0.23	0.13	1.07
--- Rhus radicans L. poison ivy																		12.50	1.89	1.91	1.08	2.97
Celastrus scandens L. hitchcock																		25.00	3.77	2.61	1.47	5.24
Ambrosia arbuscula (Michx. f.) Fern. shadbush									1.83	0.40	0.09							6.25	0.94	0.01	0.01	0.94
Smilacina racemosa L. false Solomon's seal																		6.25	0.94	0.16	0.09	1.03
Cornus florida L. flowering dogwood																		6.25	0.94	0.18	0.10	1.04
Plantago boottii Poir. --- Plantago subvillosum Ashe																		6.25	0.94	1.94	1.09	2.03
Antennaria plantaginifolia (L.) Hook. pussy's toes																		6.25	0.94	0.16	0.09	1.03
Carex rosea Schk. --- Carex rosea Schk.																		6.25	0.94	0.18	0.10	1.04

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APPENDIX A-25 (continued)

Scientific Name Common Name	Subplots - Presence Indicated by Dry Weights (grams/0.25-meter plots)																Frequency (%) ^a	Relative Frequency ^b	Dry Weight Per Square ^c	Relative Weight ^d	Importance Value ^e
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Viola tricolor</i> Schwein. f. <i>dilatata</i> Ell. three-lobed violet							0.15										6.25	0.94	0.15	0.08	1.02
<i>Lactuca canadensis</i> L. var. <i>obovata</i> Wieg. wild lettuce							0.55										6.25	0.94	0.55	0.31	1.25
<i>Prunella americana</i> Ehrh. black cherry							0.19	1.56	1.18								18.75	2.83	2.93	1.65	4.48
<i>Podochilus pelianthus</i> L. may apple								3.33									6.25	0.94	3.33	1.88	2.82
<i>Viola mestivalis</i> Michx. summer viola							0.01										6.25	0.94	0.01	.001	0.94
<i>Symphoricarpos obtusolatus</i> Muench. coral berry							2.91										6.25	0.94	2.91	1.64	2.58
<i>Carex gracilis</i> Bailey ---							0.04	0.87		1.66							18.75	2.83	2.37	1.34	4.17
<i>Dianthus spicatus</i> (L.) Benth. poverty grass							0.12										6.25	0.94	0.12	0.08	1.02
<i>Rubus flagellatus</i> Willd. dewberry								2.03									6.25	0.94	2.03	1.15	2.09
<i>Galium aparine</i> L. elegant bedstraw								0.15									6.25	0.94	0.15	0.08	1.02
<i>Rubus pennsylvanicus</i> Post. highbush blackberry								4.10									6.25	0.94	4.10	2.31	3.25
<i>Veronicastrum virginicum</i> (L.) Fernald. culvert root								0.38									6.25	0.94	0.38	0.21	1.15
<i>Eustoma atrorubra</i> Jacq. wahoo								9.96									6.25	0.94	9.96	5.62	8.56
<i>Agrimonia costellata</i> Wallr. agrimony								0.34									6.25	0.94	0.34	0.19	1.13
<i>Asimina triloba</i> (L.) Dunal. pawpaw								0.86									6.25	0.94	0.86	0.49	1.63
Totals	3.05	0.83	37.89	5.07	10.53	4.87	14.12	8.57	10.76	5.26	14.30	13.70	2.80	11.46	1.49	32.53	642.50	99.92	177.70	100.00	199.92

*Includes woody and herbaceous plants of less than 20 inches in height.
**Includes the species and/or its hybrids.

- a - Number of subplots the species occurs x 100
Number of subplots sampled (16)
- b - Frequency of all species occurrences x 100
Cumulative frequency of all species
- c - Cumulative weight (16 subplots) by species
- d - Cumulative weight (all species)
Cumulative weight (all species) x 100
- e - Relative frequency + relative weight

Sheet 2

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APPENDIX A-26

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION F-3,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
 (based on sixteen 6.25-milacre plots)

<u>Scientific Name</u> <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Rhus aromatica</u> Ait. fragrant sumac	14.0	12.3	306.0	58.4	70.7
<u>Cornus florida</u> L. flowering dogwood	15.0	13.2	49.0	9.4	22.6
<u>Prunus serotina</u> Ehrh. black cherry	12.0	10.5	22.0	4.2	14.7
<u>Quercus velutina</u> Lam. black oak	10.0	8.8	24.0	4.6	13.4
<u>Carya</u> sp. Nutt. hickory	9.0	7.9	27.0	5.2	13.1
<u>Quercus alba</u> ^g L. and var. white oak	9.0	7.9	15.0	2.9	10.8
<u>Acer saccharum</u> Marsh sugar maple	3.0	2.6	22.0	4.2	6.8
<u>Sassafras albidum</u> (Nutt.) Nees sassafras	5.0	4.4	12.0	2.3	6.7
<u>Quercus rubra</u> L. red oak	4.0	3.5	6.0	1.1	4.6
<u>Vitis vulpina</u> L. winter grape	5.0	4.4	1.0	0.2	4.6
<u>Rosa carolina</u> L. pasture rose	4.0	3.5	4.0	0.8	4.3

APPENDIX A-26 (continued)

Scientific Name Common Name	Frequency ^b	Relative Frequency (%) ^c	Density ^d	Relative ^e Density (%)	Importance ^f Value
<u>Rubus flagellaris</u> Willd. dewberry	3.0	2.6	6.0	1.1	3.7
<u>Vitis cinerea</u> Engelm. grayback grape	3.0	2.6	4.0	0.8	3.4
<u>Prunus americana</u> Marsh. wild plum	2.0	1.8	6.0	1.1	2.9
<u>Morus rubra</u> L. red mulberry	2.0	1.8	4.0	0.8	2.6
<u>Juniperus virginiana</u> L. red cedar	2.0	1.8	3.0	0.6	2.4
<u>Symphoricarpos</u> sp. Duham. snowberry	2.0	1.8	3.0	0.6	2.4
<u>Crataegus</u> sp. L. hawthorn	2.0	1.8	2.0	0.4	2.2
<u>Fraxinus americana</u> L. white ash	2.0	1.8	2.0	0.4	2.2
<u>Vitis aestivalis</u> Michx. summer grape	2.0	1.8	2.0	0.4	2.2
<u>Amelanchier arborea</u> (Michx.f.) Fern. shadbush	1.0	0.9	1.0	0.2	1.1
<u>Celtis occidentalis</u> L. hackberry	1.0	0.9	1.0	0.2	1.1
<u>Diospyros virginiana</u> L. persimmon	1.0	0.9	1.0	0.2	1.1

APPENDIX A-26 (continued)

Scientific Name <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Viburnum prunifolium L.</u> black haw	<u>1.0</u>	<u>0.9</u>	<u>1.0</u>	<u>0.2</u>	<u>1.1</u>
TOTAL	114.0	100.4	524.0	100.3	200.7
Trees and/or shrubs per quadrat =	39.9				
Trees and/or shrubs per acre =	6,463.8				

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density.

^g Includes the species and varieties.

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APPENDIX A-27

DATA SUMMARY FOR OVERSTORY VEGETATION^a OF SAMPLING STATION F-3,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 25 milacre plots)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Dominance ^f	Relative ^g Dominance (%)	Importance ^h Value
<u>Quercus alba</u> ⁱ L. and var. white oak	14.0	26.9	102.0	57.0	3,175.1	58.3	142.2
<u>Quercus velutina</u> Lam. black oak	9.0	17.3	24.0	13.4	1,296.3	23.8	54.5
<u>Cornus florida</u> L. flowering dogwood	9.0	17.3	12.0	6.7	63.6	1.2	25.2
<u>Carya texana</u> Buckl. black hickory	6.0	11.5	14.0	7.8	210.6	3.9	23.2
<u>Quercus stellata</u> Wang. post oak	4.0	7.7	9.0	5.0	204.3	3.8	16.5
<u>Quercus rubra</u> L. red oak	3.0	5.8	6.0	3.4	287.0	5.3	14.5
<u>Carya ovata</u> (Mill) K. Koch shagbark hickory	2.0	3.3	6.0	3.4	84.2	1.5	8.7
<u>Acer saccharum</u> Marsh sugar maple	2.0	3.8	2.0	1.1	108.8	2.0	6.9
<u>Carya tomentosa</u> Nutt. mockernut hickory	1.0	1.9	2.0	1.1	6.2	0.1	3.1
<u>Morus rubra</u> L. red mulberry	1.0	1.9	1.0	0.6	3.1	0.1	2.6
<u>Vitis cinerea</u> Engelm. grayback grape	1.0	1.9	1.0	0.6	3.1	0.1	2.6
TOTAL	52.0	99.8	179.0	100.1	5,442.3	100.1	300.0

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APPENDIX A-27 (continued)

Trees per quadrat = 11.2
 Trees per acre = 453.6
 Basal area per quadrat = 340.1 sq. in.
 Basal area per acre = 13,774.1 sq. in.

^aTree species 2.0 inches or greater diameter at breast height.

^bNumber of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^dCumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^fCumulative basal area (sq. in.) of a species within the subplots sampled.

^g $\frac{\text{Cumulative basal area of a species}}{\text{Cumulative basal area of all species}} \times 100$

^hSummation of relative frequency + relative density + relative dominance.

ⁱIncludes species and varieties.

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APPENDIX A-28

DATA SUMMARY OF FOREST GROUND VEGETATION^a CLIPPED FROM SUBPLOTS OF SAMPLING STATION F-4,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974

Scientific Name Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Frequency ^b (%)	Relative ^c Frequency (%)	Weight ^d for Species	Relative ^e Importance ^f Value	
<i>Rhus aromatica</i> Ait. fragrant sumac	6.00		4.75	5.95	4.25	4.25	3.55	4.55					11.20				43.75	10.6	40.25	24.04	34.64 ¹
<i>Festuca buchii</i> Poir.		0.40			0.65									0.25	3.90		25.00	6.54	5.40	3.22	9.76
<i>Potentilla simplex</i> Michx. cinquefoil		6.80															6.25	1.81	6.80	4.06	5.57
<i>Helianthus strumosus</i> L. sunflower		4.45		12.80													12.50	3.03	17.25	10.30	13.33 ³
<i>Rosa carolina</i> L. pasture rose			2.10			2.80			0.55	2.40						1.50	31.25	7.57	9.55	5.70	13.27 ⁴
<i>Vitis cinerea</i> Engelm grayback grape			4.10					2.80									12.50	3.03	7.00	4.18	7.21
<i>Quercus velutina</i> Lam. black oak			3.20	2.10			0.05			0.50	1.45						31.25	7.57	7.30	4.36	11.93 ⁵
<i>Legumes violaceae</i> (L.) Pers bush clover			2.30		0.90												18.75	4.54	7.80	4.65	9.19
<i>Carex rosae</i> Schic.					6.25									0.05		3.40	18.75	4.54	9.70	5.79	10.33 ⁷
<i>Carex glaucodes</i> Tuckerm.					0.30												6.25	1.51	0.30	0.17	1.08
<i>Carex subnervosa</i> Schk.					0.20												6.25	1.51	0.20	0.11	1.62
<i>Carex buchii</i> Michx.					0.40												1.10	12.50	1.30	0.89	3.92
<i>Festuca longirostris</i> Ell.					0.15											0.40	12.50	3.03	0.55	0.32	3.35
<i>Astilbeae albosa</i> (Michx.) Fern. shadbush					0.55												6.25	1.51	0.55	0.32	1.83
<i>Solidago ulmifolia</i> Michx. elm leaf goldenrod					8.00		0.30										18.75	4.54	9.20	5.49	10.03 ⁷
<i>Moracis rosaeifolia</i> Nutt. horsemint					0.70		5.20							2.80			18.75	4.53	8.70	5.19	9.73
<i>Strigolizium halvols</i> (L.) Britt. wild bean					0.40						0.30	0.75	6.55	1.10	0.55	37.50	9.09	9.65	5.76	14.85 ²	
<i>Quercus alba</i> L. and var. white oak					1.10						0.30						12.50	3.03	1.40	0.81	3.66

Sheet 1

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APPENDIX A-28 (continued)

Scientific Name Common Name	Subplots - grasses indicated by dry weights (grams/0.25-milacre plots)																Dry ⁿ Weight for Species	Relative ^m Weight (%)	Importance ^f Value		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Cornus florida</i> L. Flowering dogwood							10.50										6.25	1.51	10.50	6.27	7.78
<i>Celastrus scandens</i> L. American bitterweet							0.40										6.25	1.51	0.40	0.23	1.74
<i>Quercus rubra</i> L. red oak									2.55					1.25			12.50	3.03	3.80	2.27	5.30
<i>Parthenocissus quinquefolia</i> (L.) Planch. Virginia creeper									0.35								6.25	1.51	0.35	0.20	1.71
<i>Arisaema canadense</i> Pursh leaf plant									0.65								6.25	1.51	0.65	0.38	1.89
<i>Miconia planaginifolia</i> (L.) Swartz. josey's toes											0.55		1.30				12.50	3.03	1.85	1.10	4.13
<i>Vitis</i> Tiss												2.10					6.25	1.51	2.10	1.25	2.76
<i>Euphorbia corollata</i> L. Flowering spurge														0.45			6.25	1.51	0.45	0.26	1.77
<i>Miter anomala</i> Engelm. miter															2.6		6.25	1.51	2.65	1.58	3.09
<i>Sassafras albidum</i> (Mill.) Nees sassafras															0.40		6.25	1.51	0.40	0.23	1.74
<i>Panicum spharagocarpum</i> Ell. ---															1.15		6.25	1.51	1.15	0.68	2.15
TOTALS	6.00	11.85	16.45	8.05	30.90	5.75	4.80	20.00	7.45	4.10	3.10	2.60	2.85	10.95	22.50	12.05	412.50	100.37	167.40	99.83	200.20

* Includes woody and herbaceous plants of less than 20 inches in height.

ⁿ Includes species and varieties

^b = Number of subplots the species occurs
Number of subplots samples (16) x 100

^c = Frequency of a species occurrence
Cumulative frequency of all species x 100

^d = Cumulative weights (16 subplots) by species

^e = Cumulative weight (6 species)
Cumulative weight (all species) x 100

^f = Relative frequency + relative weight

APPENDIX A-29
 DATA SUMMARY OF FOREST GROUND VEGETATION CLIPPED FROM SUBPLOTS OF SAMPLING STATION F-4,
 CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Scientific Name Common Name	Subplots - Presence indicated by dry weights (grams/0.25-meter plots)																Dry Weight Per Species ^a (g)	Relative Importance Value ^b			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
<i>Symphoricarpos orbiculatus</i> Muench. coral berry	0.01																6.25	1.19	0.01	.003	1.19
<i>Cynanchum laeve</i> Michx.	0.02																6.25	1.19	0.02	0.01	1.20
<i>Quercus pedunculata</i> ** Muenchb. white post oak	1.43	22.05						13.81 (13.96)									18.75	3.37	39.46	16.92	18.49
<i>Forstia simplex</i> Michx. black oak	9.84																6.25	1.19	9.84	3.72	4.91
<i>Smilax tamnoides</i> L. bristly greenbrier	0.08																6.25	1.19	0.08	0.03	1.22
<i>Rosa carolina</i> L. pasture rose	0.11	1.91	0.58				0.17	1.73	11.24								37.50	7.14	15.77	5.95	13.09
<i>Desmodium illinoense</i> Darl. tick trefoil	0.08						0.03	0.02				0.33					31.25	3.95	1.82	0.69	8.84
<i>Prunus</i> sp. L. cherry	0.07																6.25	1.19	0.07	0.03	1.22
<i>Psoralea pteriloides</i> (Walt.) Cory var. <i>eglandulosa</i> (Ell.) Treman	0.39					3.26	7.31		1.38	5.19	2.46	14.27	10.26				56.25	10.71	45.81	17.32	28.03
<i>Vitis</i> sp. L. Sampson's snakeroot	0.17								0.01								12.50	2.38	0.18	0.07	2.45
<i>Rhus aromatica</i> Ait. fragrant sumac											11.54	3.15					50.00	9.52	30.01	11.35	20.87
<i>Dioscorea villosa</i> L. yam	0.17																6.25	1.19	0.17	0.06	1.25
<i>Botrychium virginianum</i> (L.) Sw. rattlesnake fern	0.02																6.25	1.19	0.02	0.01	1.20
<i>Helleborus</i> sp. L. sunflower																	6.25	1.19	0.02	0.01	1.20
<i>Ceratogon danielae</i> Palmer hachibon	5.05																12.50	2.38	5.90	2.23	4.61
<i>Sanicula canadensis</i> L. black snakeroot	5.79																6.25	1.19	5.79	2.19	3.38
<i>Lepidosiphon violaceus</i> (L.) Pers. purple bladderwort	0.01																6.25	1.19	0.01	.003	1.19
<i>Strophostyles helvola</i> (L.) Britton wild bean	0.06																12.50	2.38	0.08	0.03	2.61
<i>Cornus florida</i> L. flowering dogwood	0.05																12.50	2.38	2.22	0.84	3.73
<i>Carex bushii</i> Mack. ---	1.82																12.50	2.38	0.15	0.06	2.44
<i>Quercus macrocarpa</i> Michx. & Q. <i>martlandiae</i> bur oak hybrid	32.32																12.50	2.38	4.48	1.69	4.07
<i>Carex rostrata</i> Suck. ---	1.51																6.25	1.19	32.32	12.22	13.61
<i>Viola cribrata</i> Schow. f. <i>dilatata</i> Ell. three-lobed violet	0.01																12.50	2.38	3.43	1.30	3.68
<i>Perennicissus quinquefolia</i> (L.) Planch. Virginia creeper	0.27																6.25	1.19	0.01	.003	1.19
<i>Quercus</i> sp. L. white oak	12.99																12.50	2.38	0.55	0.21	2.39
<i>Quercus velutina</i> ** Lam. & Q. <i>bushii</i> Sarg. black oak hybrid	0.21	(3.65)															6.25	1.19	32.99	4.91	6.16
<i>Solidago</i> sp. L. solidago	0.88																12.50	2.38	3.86	1.46	3.86
<i>Aster</i> sp. L. aster	0.60																6.25	1.19	0.88	0.33	1.27
<i>Pteris</i> sp. L. ---	0.49																6.25	1.19	0.49	0.19	1.38
<i>Perithous</i> sp. L. American feverfew	10.95																6.25	1.19	10.95	4.14	5.33
<i>Aster</i> sp. L. American aster	9.93																6.25	1.19	9.93	3.75	4.94
<i>Panicum linearifolium</i> Scribn. ---	0.26																12.50	2.38	1.90	0.72	3.10
<i>Saxifraga albidum</i> (Nutt.) Nees saxifrage	0.22																6.25	1.19	0.22	0.08	1.27
<i>Hieracium</i> sp. hawkweed	0.02																6.25	1.19	0.02	0.01	1.20
<i>Carex alata</i> Torr. & Gray ---	0.45																6.25	1.19	0.45	0.17	1.26
<i>Panicum subvillosum</i> Ashe ---	0.01	0.07															12.50	2.38	0.08	0.03	2.61
<i>Antennaria plantaginifolia</i> (L.) Hook. pussy's toes	2.67																6.25	1.19	2.67	1.01	2.20
<i>Elymus villosus</i> Moq. wild rye	3.61																6.25	1.19	3.61	1.36	2.35
<i>Euphorbia</i> sp. L. spurge	0.10																6.25	1.19	0.10	0.04	1.23
<i>Lactuca</i> sp. L. wild lettuce	0.23																6.25	1.19	0.24	0.11	1.30

APPENDIX A-28 (continued)

Scientific Name Common Name	Subplots - presence indicated by dry weights (grams/0.25-milacre plots)																		Frequency (%) ^a	Relative Frequency ^b	Dry Weight No. Species ^c	Relative Weight No. Species ^c	Importance Value ^d
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18					
<i>Desmodium nudiflorum</i> (L.) D.C. tick trefoil																	0.41	6.25	1.19	0.61	0.23	1.42	
Compositae (genus unident.) ---																	0.37	6.25	1.19	0.37	0.16	1.33	
<i>Quercus alvarezi</i> Buckl. Shumard oak																	9.27	6.25	1.19	9.27	3.50	4.69	
<i>Panicum Bonellii</i> Poir. ---																	0.13	6.25	1.19	0.13	0.06	1.22	
Totals	0.03	11.54	26.39	4.23	45.27	4.76	7.69	15.57	21.65	1.80	22.05	26.95	29.26	12.53	10.53	28.23	535.00	99.95	266.48	100.00	199.96		

Includes woody and herbaceous plants of less than 20 inches in height.

Includes the species and/or its hybrids.

^a Number of subplots the species occurs \times 100
Number of subplots sampled (16)

^b Frequency of a species occurrence \times 100
Cumulative frequency of all species

^c Cumulative weight (16 subplots) by species

^d Cumulative weight (6 species) \times 100
Cumulative weight (all species) \times 100

^e Relative frequency + relative weight

APPENDIX A-30

DATA SUMMARY FOR UNDERSTORY VEGETATION^a OF SAMPLING STATION F-4,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 6.25-milacre plots)

<u>Scientific Name</u> <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Rhus aromatica</u> Ait. fragrant sumac	12.0	13.5	129.0	31.4	44.9
<u>Quercus velutina</u> Lam. black oak	12.0	13.5	75.0	18.2	31.7
<u>Quercus alba</u> ^g L. and var. white oak	10.0	11.2	65.0	15.8	27.0
<u>Cornus florida</u> L. flowering dogwood	4.0	4.5	30.0	7.3	11.8
<u>Quercus rubra</u> L. red oak	4.0	4.5	12.0	2.9	7.4
<u>Fraxinus americana</u> L. white ash	5.0	5.6	5.0	1.2	6.8
<u>Ostrya virginiana</u> (Mill.) K. Koch hop-hornbeam	3.0	3.4	13.0	3.2	6.6
<u>Carya</u> sp. Nutt. hickory	3.0	3.4	12.0	2.9	6.3
<u>Acer saccharum</u> Marsh sugar maple	3.0	3.4	11.0	2.7	6.1
<u>Amelanchier arborea</u> (Michx.f.) Fern. shadbush	3.0	3.4	10.0	2.4	5.8
<u>Prunus serotina</u> Ehrh. black cherry	3.0	3.4	8.0	1.9	5.3

H-71

APPENDIX A-30 (continued)

Scientific Name <u>Common Name</u>	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Importance ^f Value
<u>Rosa carolina</u> L. pasture rose	3.0	3.4	8.0	1.9	5.3
<u>Vitis cinerea</u> Engelm. grayback grape	3.0	3.4	7.0	1.7	5.1
<u>Vitis vulpina</u> L. winter grape	3.0	3.4	6.0	1.5	4.9
<u>Crataegus</u> sp. L. hawthorn	3.0	3.4	3.0	0.7	4.1
<u>Diospyros virginiana</u> L. persimmon	2.0	2.2	2.0	0.5	2.7
<u>Juniperus virginiana</u> L. red cedar	2.0	2.2	2.0	0.5	2.7
<u>Quercus x fernowi</u> Trel. (<u>Quercus alba</u> x <u>Quercus stellata</u>) oak	2.0	2.2	2.0	0.5	2.7
<u>Quercus stellata</u> Wang. post oak	2.0	2.2	2.0	0.5	2.7
<u>Rubus flageiilaris</u> Willd. dewberry	2.0	2.2	2.0	0.5	2.7
<u>Cercis canadensis</u> L. redbud	1.0	1.1	3.0	0.7	1.8
<u>Euonymus atropurpureus</u> Jacq. wahoo	1.0	1.1	1.0	0.2	1.3
<u>Prunus americana</u> Marsh. wild plum	1.0	1.1	1.0	0.2	1.3

H-72

APPENDIX A-30 (continued)

Scientific Name <u>Common Name</u>	<u>Frequency</u> ^b	<u>Relative</u> ^c <u>Frequency (%)</u>	<u>Density</u> ^d	<u>Relative</u> ^e <u>Density (%)</u>	<u>Importance</u> ^f <u>Value</u>
<u>Sassafras albidum (Nutt.) Nees</u> sassafras	1.0	1.1	1.0	0.2	1.3
<u>Ulmus rubra Muhl.</u> slippery elm	<u>1.0</u>	<u>1.1</u>	<u>1.0</u>	<u>0.2</u>	<u>1.3</u>
TOTAL	89.0	99.9	411.0	99.7	199.6
Trees and/or shrubs per quadrat =	25.7				
Trees and/or shrubs per acre =	4,163.4				

^a Tree or shrub less than 2.0 inches diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Summation of relative frequency + relative density.

^g Includes the species and varieties.

APPENDIX A-31

DATA SUMMARY FOR OVERSTORY VEGETATION^a OF SAMPLING STATION F-4,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI, FALL 1974
(based on sixteen 25-milacre plots)

Scientific Name Common Name	Frequency ^b	Relative ^c Frequency (%)	Density ^d	Relative ^e Density (%)	Dominance ^f	Relative ^g Dominance (%)	Value
<u>Quercus alba</u> ⁱ L. and var. white oak	12.0	28.6	34.0	37.4	1,241.9	26.7	92.7
<u>Quercus velutina</u> Lam. black oak	10.0	23.8	17.0	18.7	2,115.3	45.5	88.0
<u>Quercus stellata</u> Wang. post oak	9.0	21.4	21.0	23.1	954.4	20.5	65.0
<u>Cornus florida</u> L. flowering dogwood	3.0	7.1	7.0	7.7	35.1	0.8	15.6
<u>Quercus marilandica</u> Muenchh black-jack oak	1.0	2.4	2.0	2.2	151.6	3.3	7.9
<u>Carya texana</u> Buckl. black hickory	2.0	4.8	2.0	2.2	12.0	0.3	7.3
<u>Acer saccharum</u> Marsh. sugar maple	1.0	2.4	3.0	3.3	19.8	0.4	6.1
<u>Carya ovata</u> (Mill.) K. Koch shagbark hickory	1.0	2.4	1.0	1.1	95.0	2.0	5.5
<u>Amelanchier arborea</u> (Michx.f.) Fern. shadbush	1.0	2.4	2.0	2.2	8.0	0.2	4.8
<u>Ulmus rubra</u> Muhl. slippery elm	1.0	2.4	1.0	1.1	9.6	0.2	3.7
<u>Fraxinus americana</u> L. white ash	1.0	2.4	1.0	1.1	4.9	0.1	3.6
TOTAL	42.0	100.1	91.0	100.1	4,647.6	100.0	300.2

APPENDIX A-31 (continued)

Trees per quadrat = 5.7
 Trees per acre = 230.9
 Basal area per quadrat = 290.5 sq. in.
 Basal area per acre = 11,765.3 sq. in.

^a Tree species 2.0 inches or greater diameter at breast height.

^b Number of subplots a species occurs.

^c $\frac{\text{Frequency of a species occurrence}}{\text{Cumulative frequency of all species}} \times 100$

^d Cumulative number of a species within subplots sampled.

^e $\frac{\text{Density of a species occurrence}}{\text{Cumulative density of all species}} \times 100$

^f Cumulative basal area (sq. in.) of a species within subplots sampled.

^g $\frac{\text{Cumulative basal area of a species}}{\text{Cumulative basal area of all species}} \times 100$

^h Summation of relative frequency + relative density + relative dominance.

ⁱ Includes the species and varieties.

H-75

TABLE 3.3.1-9
 COMPARISONS WITHIN AND BETWEEN SAMPLING STATIONS BASED ON CALCULATED IMPORTANCE VALUES^a FOR MAJOR COMPONENT SPECIES OF GROUND LAYER VEGETATION^b
 OCCURRING IN SUBPLOTS OF FOREST HABITATS, GALLAWAY PLANT SITE, GALLAWAY COUNTY, MISSOURI, MAY-JUNE 1974

Species ^c	Sampling Stations				Index of similarity ^d
	F-1	F-2	F-3	F-4	
<i>Aemulachar arborea</i> (Michx.) Fern.	1.01	5.14	1.07	4.94	
<i>Anemone thalictrifolia</i> (L.) Spach.	3.00	3.44	3.07	3.64	
<i>Antennaria plantaginifolia</i> (L.) Hook	3.32	2.85	1.04	2.20	
<i>Aster</i> sp.	6.41	9.31	2.57	7.58	
<i>Carex babbii</i> Mack.	6.41	9.31	2.57	7.58	
<i>Carex glauca</i>	4.31	6.72	1.03	4.07	
<i>Carex grisea</i> Nutt.	3.40	6.42	2.03	3.68	
<i>Carex oerea</i> (Mill.) K. Koch.	5.59	3.40	1.40	2.44	
<i>Cornus florida</i> L.	0.99	2.43	5.26	6.44	
<i>Desmodium illinoense</i> Dur.	7.01	4.74	12.12	1.42	
<i>Desmodium glutinosum</i> (Nutt.) Wood				1.25	
<i>Desmodium nudiflorum</i> (L.) D.C.				1.30	
<i>Dioscorea villosa</i> L.				4.88	
<i>Eumyos atricarpa</i> Jacq.				3.10	
<i>Fraxinus americana</i> L.	18.06	7.02	6.56	2.41	
<i>Galium circoceras</i> Michx.	2.94	2.21	10.36	2.41	
<i>Galium coccineum</i> Torr. & Gray	4.67	6.44	1.02	2.59	
<i>Helianthus</i> sp.		0.86		4.91	
<i>Leptodes violacea</i> (L.) Pers.		1.58		28.03	
<i>Lactuca</i> sp.		1.44		13.41	
<i>Lysimachia lanceolata</i> Walt.		1.67		18.49	
<i>Monarda rupestris</i> Nutt.		1.46		3.86	
<i>Ostrya virginiana</i> (Mill.) K. Koch.	5.42			20.87	
<i>Panicum lanuginosum</i> Ell.				13.08	
<i>Panicum linearifolium</i> Scribn.				1.27	
<i>Panicum subvillosum</i> Ashe.				3.22	
<i>Parthenium integrifolium</i> Ait.	33.93	29.58	27.25	1.19	
<i>Parthenocissus quinquefolia</i> (L.) Planch.	0.99	4.98	2.82		
<i>Podophyllum peltatum</i> L.		3.85			
<i>Potentilla simplex</i> Michx.		0.72			
<i>Prunus serotina</i>					
<i>Prunella parviflora</i> (Walt.) Corry var. <i>eslandulosa</i> (Ell.) Sampson					
<i>Quercus alba</i> L. and/or hybrids	16.33	5.21	3.20		
<i>Quercus macrocarpa</i> Michx. and/or hybrids	15.57	1.94			
<i>Quercus marilandica</i> Muhl. and/or hybrids	3.73	4.23			
<i>Quercus stellata</i> Wang. and/or hybrids	7.07				
<i>Quercus velutina</i> Lam. and/or hybrids					
<i>Rhus aromatica</i> Ait.	13.10	15.01	39.21	3.66	
<i>Rosa carolina</i> L.	3.96	4.19	20.87	3.66	
<i>Rubus flagellaris</i> Willd.	2.18	0.37	2.09	3.22	
<i>Rubus occidentalis</i> L.	2.53	2.95		1.19	
<i>Saxifraga albium</i> (Rott.) Nees.		2.47			
<i>Scutellaria parviflora</i> Michx.		1.46			
<i>Smilacina racemosa</i> L.	2.23	2.41	2.97		
<i>Strophostyles helvola</i> (L.) Britt.	5.48	5.26	14.40		
<i>Symphoricarpos orbiculatus</i> Moench.		6.44	2.56		
<i>Tradescantia virginiana</i> Raf.		4.61			
<i>Viburnum rafinesquianum</i> Schultes.		1.85			
<i>Viola papilionacea</i> Pursh.		4.36			
<i>Vitis cinerea</i> Engelm.		8.57	10.37		
Totals	177.28	192.40	191.96	172.85	

Comparisons between SAMPLING STATIONS -
 F-1 vs. F-2 282.54
 F-1 vs. F-3 290.49
 F-1 vs. F-4 219.76
 F-2 vs. F-3 286.43
 F-2 vs. F-4 241.27
 F-3 vs. F-4 231.09

^a Calculated as Number of points of occurrence of the species + Total dry weight of each species x 100 (each sampling station)
 Number of points of occurrence of all species / Total dry weight of all species

^b Includes all herbaceous species and woody plants of less than 20 inches in height

^c Includes all species for which the percent frequency (16 subplots) and Total dry weight of each species x 100 (relative dominance) exceeded a value of 10.0
 Total dry weight of all species

^d Calculated as Summation of Importance values for species common to both stations / Summation of total importance values for the same stations

APPENDIX I
Avifauna Data

TABLE 3.3.3-1

BIRD SPECIES OBSERVED DURING THE ENVIRONMENTAL BASELINE INVENTORY (JUNE 1973),
AND THE SPRING AND FALL MONITORING SURVEYS 1974-1975,
CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI

<u>Common Name</u>	<u>Scientific Name</u>	<u>Baseline Inventory</u>	<u>Spring 1974 Monitoring Survey</u>	<u>Fall 1974 Monitoring Survey</u>	<u>Spring 1975 Monitoring Survey</u>	<u>Fall 1975 Monitoring Survey</u>
Pied-billed grebe	<u>Podilymbus podiceps</u>	-	-	X	-	X
Great blue heron	<u>Ardea herodias</u>	-	-	X	X	X
Green heron	<u>Butorides virescens</u>	X	X	-	X	X
Cattle egret	<u>Bubulcus ibis</u>	-	-	-	X	-
Canada goose	<u>Branta canadensis</u>	-	-	-	-	X
Snow goose	<u>Chen caerulescens</u>	-	-	-	-	X
Mallard	<u>Anas platyrhynchos</u>	-	-	X	-	X
Green-winged teal	<u>Anas crecca</u>	-	-	-	X	-
Blue-winged teal	<u>Anas discors</u>	-	-	-	X	X
Northern shoveler	<u>Anas clypeata</u>	-	-	-	-	X
Wood duck	<u>Aix sponsa</u>	-	X	-	X	X
Ring-necked duck	<u>Aythya collaris</u>	-	-	-	X	-
Turkey vulture	<u>Cathartes aura</u>	X	X	X	X	X
Sharp-shinned hawk	<u>Accipiter striatus</u>	-	-	-	-	X
Red-tailed hawk	<u>Buteo jamaicensis</u>	X	X	X	X	X
Bald eagle	<u>Haliaeetus leucocephalus</u>	-	-	X	-	-
Marsh hawk	<u>Circus cyaneus</u>	-	X	X	X	X
American kestrel	<u>Falco sparverius</u>	X	X	X	X	X
Bobwhite	<u>Colinus virginianus</u>	X	X	X	X	X
Turkey	<u>Meleagris gallopavo</u>	-	-	-	X	-
Killdeer	<u>Charadrius vociferus</u>	-	X	X	X	X
American woodcock	<u>Philohela minor</u>	-	-	-	X	X
Common snipe	<u>Capella gallinago</u>	-	-	-	-	X
Rock dove	<u>Columba livia</u>	X	X	-	X	X
Mourning dove	<u>Zenaidura macroura</u>	X	X	X	X	X
Yellow-billed cuckoo	<u>Coccyzus americanus</u>	X	X	X	X	X
Black-billed cuckoo	<u>Coccyzus erythrophthalmus</u>	X	-	-	X	-
Great horned owl	<u>Bubo virginianus</u>	X	-	X	X	X
Barred owl	<u>Strix varia</u>	-	-	X	-	X
Long-eared owl	<u>Asio otus</u>	-	-	-	X	-
Chuck-will's-widow	<u>Caprimulgus carolinensis</u>	-	-	-	X	-
Whip-poor-will	<u>Caprimulgus vociferus</u>	X	X	-	X	-
Common nighthawk	<u>Chordeiles minor</u>	X	X	X	X	X
Chimney swift	<u>Chaetura pelagica</u>	X	X	-	X	X
Ruby-throated hummingbird	<u>Archilochus colubris</u>	X	X	-	X	-
Belted kingfisher	<u>Megaceryle alcyon</u>	X	X	-	X	X
Common flicker	<u>Colaptes auratus</u>	X	X	X	X	X
Pileated woodpecker	<u>Dryocopus pileatus</u>	X	-	X	X	X
Red-bellied woodpecker	<u>Centurus carolinus</u>	X	X	X	X	X
Red-headed woodpecker	<u>Melanerpes erythrocephalus</u>	X	X	X	X	X
Hairy woodpecker	<u>Dendrocopos villosus</u>	-	-	-	X	X
Downy woodpecker	<u>Dendrocopos pubescens</u>	-	X	X	X	X
Eastern kingbird	<u>Tyrannus tyrannus</u>	X	X	X	X	-
Great crested flycatcher	<u>Myiarchus crinitus</u>	X	X	-	X	-

TABLE 3.3.3-1 (Continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Baseline Inventory</u>	<u>Spring 1974 Monitoring Survey</u>	<u>Fall 1974 Monitoring Survey</u>	<u>Spring 1975 Monitoring Survey</u>	<u>Fall 1975 Monitoring Survey</u>
Eastern phoebe	<u>Sayornis phoebe</u>	-	X	X	X	X
Acadian flycatcher	<u>Empidonax virescens</u>	X	-	-	X	-
Least flycatcher	<u>Empidonax minimus</u>	-	-	X	-	-
Eastern wood pewee	<u>Contopus virens</u>	X	X	-	X	-
Horned lark	<u>Eremophila alpestris</u>	X	X	-	X	X
Barn swallow	<u>Hirundo rustica</u>	X	X	-	X	X
Purple martin	<u>Progne subis</u>	-	X	-	X	-
Blue jay	<u>Cyanocitta cristata</u>	X	X	X	X	-
Common crow	<u>Corvus brachyrhynchos</u>	X	X	X	X	X
Black-capped chickadee	<u>Parus atricapillus</u>	X	X	-	X	-
Tufted titmouse	<u>Parus bicolor</u>	X	X	X	X	X
White-breasted nuthatch	<u>Sitta carolinensis</u>	-	X	X	X	X
Red-breasted nuthatch	<u>Sitta canadensis</u>	-	-	-	-	X
Brown creeper	<u>Certhia familiaris</u>	-	-	X	-	-
House wren	<u>Troglodytes aedon</u>	X	X	-	X	-
Bewick's wren	<u>Thryomanes bewickii</u>	-	X	-	X	-
Carolina wren	<u>Thryothorus ludovicianus</u>	-	X	-	X	-
Mockingbird	<u>Mimus polyglottis</u>	X	X	X	X	X
Gray catbird	<u>Dumetella carolinensis</u>	X	X	X	X	X
Brown thrasher	<u>Toxostoma rufum</u>	X	X	X	X	-
American robin	<u>Turdus migratorius</u>	X	X	X	X	X
Wood thrush	<u>Hylocichla mustelina</u>	X	X	-	X	-
Swainson's thrush	<u>Catharus ustulatus</u>	-	-	-	X	-
Gray-cheeked thrush	<u>Catharus minimus</u>	-	-	-	X	-
Eastern bluebird	<u>Sialia sialis</u>	X	X	X	X	X
Blue-gray gnatcatcher	<u>Polioptila caerulea</u>	-	X	-	X	-
Ruby-crowned kinglet	<u>Regulus calendula</u>	-	-	X	-	-
Cedar waxwing	<u>Bombycilla cedrorum</u>	-	-	-	-	X
Loggerhead shrike	<u>Lanius ludovicianus</u>	X	X	-	X	X
Starling	<u>Sturnus vulgaris</u>	X	X	X	X	X
White-eyed vireo	<u>Vireo griseus</u>	-	X	-	X	-
Bell's vireo	<u>Vireo bellii</u>	-	-	-	X	-
Red-eyed vireo	<u>Vireo olivaceus</u>	X	X	-	X	-
Black-and-white warbler	<u>Mniotilta varia</u>	-	-	-	X	-
Prothonotary warbler	<u>Protonotaria citrea</u>	-	-	-	X	-
Worm-eating warbler	<u>Helmitheros vermivorus</u>	-	-	-	X	-
Golden-winged warbler	<u>Vermivora chrysoptera</u>	-	-	-	X	-
Blue-winged warbler	<u>Vermivora pinus</u>	-	-	-	X	-
Tennessee warbler	<u>Vermivora peregrina</u>	-	-	-	X	-
Nashville warbler	<u>Vermivora ruficapilla</u>	-	-	-	X	-
Northern parula	<u>Parula americana</u>	-	-	-	X	-
Yellow warbler	<u>Dendroica petechia</u>	-	-	-	X	-
Yellow-rumped warbler	<u>Dendroica coronata</u>	-	-	-	X	-
Blackburnian warbler	<u>Dendroica fusca</u>	-	-	-	X	-
Louisiana waterthrush	<u>Seiurus motacilla</u>	-	X	-	X	-
Kentucky warbler	<u>Oporornis formosus</u>	-	-	-	X	-
Common yellowthroat	<u>Geothlypis trichas</u>	X	X	-	X	-
Yellow-breasted chat	<u>Icteria virens</u>	X	X	-	X	-
Hooded warbler	<u>Wilsonia citrina</u>	-	-	X	X	-

TABLE 3.3.3-6

CHECKLIST OF BIRD SPECIES OBSERVED DURING THE ENVIRONMENTAL BASELINE INVENTORY (JUNE 1973),
THE SPRING MONITORING SURVEY (JUNE 1974), AND THE FALL MONITORING SURVEY
(SEPTEMBER 1974), CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI

<u>Common Name</u>	<u>Scientific Name</u>	<u>Baseline Inventory</u>	<u>Spring Monitoring Survey</u>	<u>Fall Monitoring Survey</u>
Acadian flycatcher	<u>Empidonax virescens</u>	x	-	-
American goldfinch	<u>Spinus tristus</u>	x	x	x
Bald eagle	<u>Haliaeetus leucocephalus</u>	-	-	x
Baltimore oriole	<u>Icterus galbula</u>	x	x	-
Barn swallow	<u>Hirundo rustica</u>	x	x	-
Barred owl	<u>Strix varia</u>	-	-	x
Belted kingfisher	<u>Megaceryle alcyon</u>	x	x	-
Bewick's wren	<u>Thryomanes bewickii</u>	-	x	-
Black-billed cuckoo	<u>Coccyzus erythrophthalmus</u>	x	-	-
Black-capped chickadee	<u>Parus atricapillus</u>	x	x	-
Blue-gray gnatcatcher	<u>Polioptila caerulea</u>	-	x	-
Blue grosbeak	<u>Guiraca caerulea</u>	-	x	-
Bluejay	<u>Cyanocitta cristata</u>	x	x	x
Bobwhite	<u>Colinus virginianus</u>	x	x	x
Brown creeper	<u>Certhia familiaris</u>	-	-	x
Brown-headed cowbird	<u>Molothrus ater</u>	x	x	x
Brown thrasher	<u>Toxostoma rufum</u>	x	x	x
Cardinal	<u>Richmondia cardinalis</u>	x	x	x
Carolina wren	<u>Thryothorus ludovicianus</u>	-	x	-
Catbird	<u>Dumetella carolinensis</u>	x	x	-
Chimney swift	<u>Chaetura pelagica</u>	x	x	-
Chipping sparrow	<u>Spizella passerina</u>	x	x	x
Common crow	<u>Corvus brachyrhynchos</u>	x	x	x
Common flicker	<u>Colaptes auratus</u>	x	x	x
Common grackle	<u>Quiscalus quiscula</u>	x	x	x
Common nighthawk	<u>Chordeiles minor</u>	x	x	x
Dickcissel	<u>Spiza americana</u>	x	x	-
Downy woodpecker	<u>Dendrocopos pubescens</u>	-	x	x
Eastern bluebird	<u>Sialia sialis</u>	x	x	x

TABLE 3.3.3-6 (continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Baseline Inventory</u>	<u>Spring Monitoring Survey</u>	<u>Fall Monitoring Survey</u>
Eastern kingbird	<u>Tyrannus tyrannus</u>	x	x	x
Eastern meadowlark	<u>Sturnella magna</u>	x	x	x
Eastern phoebe	<u>Sayornis phoebe</u>	-	x	x
Eastern wood pewee	<u>Contopus virens</u>	x	x	-
Field sparrow	<u>Spizella pusilla</u>	x	x	x
Grasshopper sparrow	<u>Ammodramus savannarum</u>	x	x	-
Great blue heron	<u>Ardea herodias</u>	-	-	x
Great crested flycatcher	<u>Myiarchus crinitus</u>	x	x	-
Great horned owl	<u>Bubo virginianus</u>	x	-	x
Green heron	<u>Butorides virescens</u>	x	x	-
Hooded warbler	<u>Wilsonia citrina</u>	-	-	x
Horned lark	<u>Eremophila alpestris</u>	x	x	-
House sparrow	<u>Passer domesticus</u>	x	x	-
House wren	<u>Troglodytes aedon</u>	x	x	-
Indigo bunting	<u>Passerina cyanea</u>	x	x	-
Killdeer	<u>Charadrius vociferus</u>	-	x	x
Lark sparrow	<u>Chondestes grammacus</u>	-	x	-
Least flycatcher	<u>Empidonax minimus</u>	-	-	x
Loggerhead shrike	<u>Lanius ludovicianus</u>	x	x	-
Louisiana waterthrush	<u>Seiurus motacilla</u>	-	x	-
Mallard	<u>Anas platyrhynchos</u>	-	-	x
Marsh hawk	<u>Circus cyaneus</u>	-	x	x
Mockingbird	<u>Mimus polyglottos</u>	x	x	x
Mourning dove	<u>Zenaidura macroura</u>	x	x	x
Orchard oriole	<u>Icterus spurius</u>	-	x	-
Pied-billed grebe	<u>Podilymbus podiceps</u>	-	-	x
Pileated woodpecker	<u>Dryocopus pileatus</u>	x	-	x
Purple martin	<u>Progne subis</u>	-	x	-
Red-bellied woodpecker	<u>Centurus carolinus</u>	x	x	x
Red-eyed vireo	<u>Vireo olivaceus</u>	x	x	-
Red-headed woodpecker	<u>Melanerpes erythrocephalus</u>	x	x	x
Red-tailed hawk	<u>Buteo jamaicensis</u>	x	x	x
Red-winged blackbird	<u>Agelaius phoeniceus</u>	-	x	x

TABLE 3.3.3-6 (continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Baseline Inventory</u>	<u>Spring Monitoring Survey</u>	<u>Fall Monitoring Survey</u>
Robin	<u>Turdus migratorius</u>	x	x	x
Rock dove	<u>Columba livia</u>	x	x	-
Ruby-crowned kinglet	<u>Regulus calendula</u>	-	-	x
Ruby-throated hummingbird	<u>Archilochus colubris</u>	x	x	-
Rufous-sided towhee	<u>Pipilo erythrophthalmus</u>	x	x	-
Song sparrow	<u>Melospiza melodia</u>	x	x	x
Sparrow hawk	<u>Falco sparverius</u>	x	x	x
Starling	<u>Sturnus vulgaris</u>	x	x	x
Summer tanager	<u>Piranga rubra</u>	x	x	-
Tree sparrow	<u>Spizella arborea</u>	-	-	x
Tufted titmouse	<u>Parus bicolor</u>	x	x	x
Turkey vulture	<u>Cathartes aura</u>	x	x	x
Vesper sparrow	<u>Poecetes gramineus</u>	-	-	x
Whip-poor-will	<u>Caprimulgus vociferus</u>	x	x	-
White-breasted nuthatch	<u>Sitta carolinensis</u>	-	x	x
White-eyed vireo	<u>Vireo griseus</u>	-	x	-
White-throated sparrow	<u>Zonotrichia albicollis</u>	-	-	x
Wood duck	<u>Aix sponsa</u>	-	x	-
Wood thrush	<u>Hylocichla mustelina</u>	x	x	-
Yellow-billed cuckoo	<u>Coccyzus americanus</u>	x	x	x
Yellow-breasted chat	<u>Icteria virens</u>	x	x	-
Yellowthroat	<u>Geothlypis trichas</u>	x	x	-

APPENDIX J
Herpetofaunal Data

TABLE 3.3.

AMPHIBIANS AND REPTILES^a OBSERVED IN THE VICINITY OF THE CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SPRING AND FALL 1974-75

<u>Common Name</u>	<u>Scientific Name</u>	<u>Spring and/or Fall 1974</u>	<u>Spring 1975</u>	<u>Fall 1975</u>
Newt	<u>Notophthalmus viridescens</u>	X	X	X
Slimy salamander	<u>Plethodon glutinosus</u>	-	X	X
Plains spadefoot toad	<u>Scaphiopus bombifrons</u>	X	-	-
Bullfrog	<u>Rana catesbeiana</u>	X	X	X
Green frog	<u>Rana clamifans</u>	X	-	X
Leopard frog	<u>Rana pipiens</u>	X	-	X
Pickerel frog	<u>Rana palustris</u>	-	X	X
Eastern narrow-mouthed toad	<u>Gastrophryne carolinensis</u>	-	-	X
American toad	<u>Bufo americanus</u>	X	X	X
Woodhouse's toad	<u>Bufo woodhousei</u>	X	-	-
Gray tree frog	<u>Hyla versicolor</u>	X	X	-
Spring peeper	<u>Hyla crucifer</u>	X	X	X
Northern cricket frog	<u>Acris crepitans</u>	X	X	X
Chorus frog	<u>Pseudacris triseriata</u>	-	X	-
Common snapping turtle	<u>Chelydra serpentina</u>	X	X	X
Box turtle	<u>Terrapene carolina</u>	X	X	X
Eastern fence lizard	<u>Sceloporus undulatus</u>	X	X	X
Slender glass lizard	<u>Ophisaurus attenuatus</u>	X	-	-
Five-lined skink	<u>Eumeces fasciatus</u>	X	X	X

TABLE 3.3. (Continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Spring and/or Fall</u>		<u>Fall</u>
		<u>1974</u>	<u>1975</u>	
Broad-headed skink	<u>Eumeces laticeps</u>	-	X	-
Ground skink	<u>Lygosoma laterale</u>	X	X	X
Common water snake	<u>Natrix sipedon</u>	X	X	-
Brown snake	<u>Storeria dekayi</u>	X	X	X
Red-bellied snake	<u>Storeria occipitomaculata</u>	X	X	-
Western ribbon snake	<u>Thamnophis proximus</u>	X	-	-
Common garter snake	<u>Thamnophis sirtalis</u>	X	X	-
Smooth earth snake	<u>Virginia valeriae</u>	X	-	-
Eastern hognose snake	<u>Heterodon platyrhinos</u>	X	X	-
Ringneck snake	<u>Diadophis punctatus</u>	X	X	X
Worm snake	<u>Carphophis amoenus</u>	X	X	X
Racer	<u>Coluber constrictor</u>	X	X	X
Rat snake	<u>Elaphe obsoleta</u>	X	X	X
Prairie king snake	<u>Lampropeltis calligaster</u>	-	X	X
Common king snake	<u>Lampropeltis getulus</u>	X	X	X
Copperhead	<u>Agkistrodon contortrix</u>	X	-	-

^aPhylogeny follows Cochran and Goin, 1970.

TABLE 3.3.4-1

VARIETY AND NUMBERS OF HERPETOFAUNA OBSERVED IN THE VICINITY OF THE CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SPRING AND FALL 1974

Species	Habitat Type														Total	
	Shrubland		Cropland		Oldfield		Pasture		Creek		Pond		Forest		S	F
	S	F	S	F	S	F	S	F	S	F	S	F				
Newt (efts)	^a	3	+	1	+	+	+	+	+	+	+	+	+	+	0	4
Newt (adults)	+		+	+	+	+	+	+	+	+	53	+	+	0	53	
Plains spadefoot toad	+	+	+	+	+	+	1	+	+	+	+	+	+	0	1	
Fowler's toad	+	5	+	+	+	+	+	+	+	1	+	+	+	1	5	
American toad	+	+	+	+	1	+	+	+	+	+	+	+	12	13	0	
Gray treefrog	+	+	+	+	+	+	+	+	1	+	+	5	+	1	5	
Spring peeper	+	+	+	+	+	+	+	+	+	+	+	+	+	0	1	
Northern cricket frog	+	+	+	+	+	+	+	+	+	+	+	16	+	0	20	
Leopard frog	+	+	+	5	1	+	+	+	2	+	+	1	1	4	6	
Bullfrog	+	+	+	+	+	+	+	+	3	+	41	11	+	44	11	
Green frog	+	+	+	+	+	+	+	+	2	1	1	+	+	3	1	
Snapping turtle	+	+	+	+	+	+	+	+	+	+	2	+	+	2	0	
Three-toed box turtle	1	+	9	+	7	+	3	1	+	+	+	+	11	31	2	
Eastern fence lizard	+	3	+	+	+	+	1	+	+	+	+	+	+	1	3	
Slender glass lizard	+	+	+	+	+	+	1	+	+	+	+	+	+	1	0	
Ground skink	+	3	+	2	+	+	+	+	+	+	+	+	9	9	5	
Five-lined skink	+	14	+	+	+	+	+	+	+	+	+	+	1	1	17	
Common water snake	+	+	+	+	+	+	+	+	2	+	+	+	+	2	0	
Brown snake	+	+	+	1	+	+	1	+	+	+	+	+	+	1	1	
Red-bellied snake	+	2	+	+	+	+	+	+	+	+	+	+	+	0	2	
Western ribbon snake	+	1	+	+	+	+	+	+	+	+	+	+	+	0	1	
Common garter snake	+	+	1	+	+	+	+	+	+	+	+	+	+	1	0	
Smooth earth snake	+	1	+	+	+	+	+	+	+	+	+	+	+	0	1	
Eastern hognose snake	+	+	1	+	+	+	+	+	+	+	+	+	+	1	0	
Worm snake	+	+	+	+	+	+	+	+	+	+	+	+	+	0	1	
Eastern ringneck snake	+	+	+	+	+	10	+	+	+	+	+	+	+	0	12	
Racer	+	+	+	1	+	+	+	+	+	+	+	+	+	0	1	
Rat snake	1	+	+	+	2	1	+	+	+	+	+	+	+	3	1	
Common kingsnake	+	+	+	+	+	+	1	+	+	+	+	+	+	1	0	
Copperhead	+	+	+	+	2	+	+	+	+	+	+	+	+	2	0	
TOTAL	2	32	11	10	13	11	7	2	10	1	45	86	34	122	154	

^a not observed.

TABLE 3.3.4-2

VARIETY AND NUMBERS OF HERPETOFAUNA OBSERVED WITHIN PERMANENT SAMPLING STATIONS LOCATED ON THE CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SPRING AND FALL 1974

	Prairie Stations								Forest Stations							
	1		2		3		4		1		2		3		4	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Spring peeper	+	+	+	+	+	+	+	+	+	1	+	+	+	+	+	+
American toad	+	+	+	+	1	+	+	+	+	+	2	+	2	+	1	+
Three-toed box turtle	+	+	+	+	+	+	+	+	1	+	1	1	+	+	1	+
Ground skink	+	+	+	+	+	+	+	+	+	+	2	+	2	+	4	+
Copperhead	+	+	+	+	1	+	+	+	+	+	+	+	+	+	+	+

+ = not observed.

TABLE 3.3.4-3

AMPHIBIANS AND REPTILES MARKED AND RELEASED IN THE VICINITY OF PERMANENT PLOTS,
FALL 1974

	<u>Prairie Stations</u>				<u>Forest Stations</u>				<u>Total</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
Newt - efts	+	+	+	+	+	1	3	+	4
Newt - adults	+	53	+	+	+	+	+	+	53
Fowler's toad	+	+	+	+	+	+	1	+	1
Gray treefrog	+	+	+	+	+	+	5	+	5
Spring peeper	+	+	+	+	1	+	+	+	1
Northern cricket frog	+	4	+	+	+	+	12	4	20
Leopard frog	+	+	+	+	+	+	1	+	1
Bullfrog	+	5	+	+	+	+	6	+	11
Green frog	+	+	+	+	+	+	+	1	1
Three-toed box turtle	+	1	+	+	+	1	+	+	2
Eastern fence lizard	+	+	+	+	+	+	+	3	3
Ground skink	+	+	+	+	1	1	+	3	5
Five-lined skink	+	1	1	+	2	+	6	7	17
Brown snake	1	+	+	+	+	+	+	+	1
Red-bellied snake	+	+	+	+	+	+	2	+	2
Western ribbon snake	+	+	+	+	+	+	1	+	1
Worm snake	+	+	+	+	+	+	+	1	1
TOTAL	12	64	1	0	5	3	37	20	142

+ not observed.

APPENDIX K
Mammal Data

TABLE 3.3.2-1

A PHYLOGENETIC^a LISTING OF MAMMAL SPECIES OBSERVED ON OR IMMEDIATE TO
THE CALLAWAY PLANT SITE, CALLAWAY COUNTY, MISSOURI

FAMILY	Scientific Name Common Name	Baseline Survey 1973-74	Spring Survey May-June 1974	Fall Survey September 1974	Spring Survey May 1975	Fall Survey September 1975
DIDELPHIDAE	<u>Didelphis marsupialis virginiana</u> Opossum	X	X	X	X	X
SORICIDAE	<u>Blarina brevicauda carolinensis</u> Short-tailed shrew	-	X	X	X	X
	<u>Cryptotis parva parva</u> Least shrew	-	X	X	-	X
TALPIDAE	<u>Scalopus aquaticus machrinoides</u> Eastern mole	X	X	-	-	-
LEPORIDAE	<u>Sylvilagus floridanus alacer</u> Eastern cottontail	X	X	X	X	X
SCIURIDAE	<u>Marmota monax monax</u> Woodchuck	X	-	-	-	-
	<u>Sciurus carolinensis carolinensis</u> Gray squirrel	X	X	X	X	-
	<u>Sciurus niger rufiventer</u> Fox squirrel	X	X	X	X	X
	<u>Glaucomys volans volans</u> Southern flying squirrel	-	-	-	-	X
CRICETIDAE	<u>Reithrodontomys megalotis dychei</u> Western harvest mouse	-	X	X	X	X
	<u>Peromyscus maniculatus gairdii</u> Deer mouse	X	-	-	X	X
	<u>Peromyscus leucopus noveboracensis</u> White-footed mouse	X	X	-	X	X
	<u>Microtus ochrogaster ochrogaster</u> Prairie vole	-	X	X	X	X
	<u>Microtus pinetorum nemoralis</u> Woodland vole	-	-	-	X	X
	<u>Ondatra zibethicus zibethicus</u> Muskrat	X	-	-	X	X
	<u>Synaptomys cooperi gossii</u> Southern bog lemming	-	X	-	X	X

TABLE 3.3.2-1 (Continued)

FAMILY Scientific Name Common Name	Baseline Survey 1973-74	Spring Survey May-June 1974	Fall Survey September 1974	Spring Survey May 1975	Fall Survey September 1975
MURIDAE					
<u>Rattus norvegicus norvegicus</u> Norway rat	-	-	-	X	X
CANIDAE					
<u>Canis latrans frustror</u> Coyote	X	X	X	X	X
<u>Vulpes vulpes fulva</u> Red fox	-	X	-	X	X
<u>Urocyon cinereoargenteus ocythous</u> Gray fox	-	-	-	X	-
PROCYONIDAE					
<u>Procyon lotor hirtus</u> Raccoon	X	X	X	X	X
MUSTELIDAE					
<u>Mustela frenata primulina</u> Long-tailed weasel	X	X	-	-	-
<u>Mephitis mephitis avia</u> Striped skunk	X	X	X	X	X
CERVIDAE					
<u>Odocoileus virginiana macroura</u> White-tailed deer	X	X	X	X	X

^aPhylogeny and species nomenclature follow Jones, Carter, and Genoways, 1973.
Subspecific nomenclature was derived from range maps and follows Hall and Kelson, 1959.

TABLE 3.3.2-1

ESTIMATED^a SMALL MAMMAL DENSITIES (PER ACRE) FOR PERMANENT SAMPLING STATIONS
LOCATED IN FOREST HABITAT, CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SPRING AND FALL 1974

Species	FOREST STATIONS							
	F-1		F-2		F-3		F-4	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Short-tail shrew	P ^b	1.68	0.37	0.34	P	1.51	P	+ ^c
Adult	P	1.68	0.37	0.34	P	1.51	P	+
Male	P	0.84	P	0.34	P	0.74	P	+
Female	P	0.84	0.37	+	P	0.75	+	+
Sub-Adult	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Juvenile	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Least shrew	+	P	+	+	+	+	+	+
Adult	+	P	+	+	+	+	+	+
Male	+	P	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Sub-Adult	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Juvenile	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
White-footed mouse	+	+	0.67	+	0.40	+	+	+
Adult	+	+	0.34	+	P	+	+	+
Male	+	+	0.34	+	P	+	+	+
Female	+	+	+	+	P	+	+	+
Sub-Adult	+	+	0.34	+	0.37	+	+	+
Male	+	+	0.34	+	0.34	+	+	+
Female	+	+	+	+	P	+	+	+
Juvenile	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+

^aEstimates are based on the EM-2 small mammal estimator (Smith and Jorgensen, 1974) utilizing 144 live traps in a 2.98-acre grid for a total of 864 trap nights.

^bP=Present, but in insufficient numbers for density estimate.

^c+ = Not observed.

TABLE 3.3.2-2

ESTIMATED^a SMALL MAMMAL DENSITIES (PER ACRE) FOR PERMANENT SAMPLING STATIONS
LOCATED IN PRAIRIE HABITAT, CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SPRING AND FALL 1974

Species	PRAIRIE STATIONS							
	Pr-1		Pr-2		Pr-3		Pr-4	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Short-tailed shrew	+ ^b	+	+	+	+	+	P ^c	+
Adult	+	+	+	+	+	+	P	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	P	+
Sub-Adult	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Juvenile	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Least shrew	P	+	+	+	+	+	P	P
Adult	P	+	+	+	+	+	P	P
Male	P	+	+	+	+	+	P	+
Female	+	+	+	+	+	+	P	P
Sub-Adult	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Juvenile	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Western harvest mouse	+	+	0.60	1.34	P	P	0.67	0.44
Adult	+	+	0.60	1.01	+	P	0.67	0.44
Male	+	+	P	+	+	+	0.67	+
Female	+	+	0.34	1.01	+	P	+	0.44
Sub-Adult	+	+	+	+	P	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	P	+	+	+
Juvenile	+	+	+	0.34	+	+	+	+
Male	+	+	+	0.34	+	+	+	+
Female	+	+	+	+	+	+	+	+
Prairie vole	1.81	11.74	1.78	16.11	6.14	31.08	8.09	9.40
Adult	1.81	9.80	1.51	11.21	3.12	21.44	6.78	8.02
Male	1.81	5.64	0.67	5.00	0.44	10.54	5.20	5.65
Female	+	4.09	0.64	5.74	2.35	11.14	1.54	2.39
Sub-Adult	+	1.01	0.34	3.02	0.34	3.19	P	2.01
Male	+	+	+	2.55	0.34	1.68	+	1.01
Female	+	1.01	0.34	0.34	+	1.50	P	1.01
Juvenile	+	P	+	0.67	+	9.47	0.67	+
Male	+	P	+	P	+	4.09	+	+
Female	+	+	+	0.67	+	4.46	P	+

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TABLE 3.3.2-2 (continued)

	PRAIRIE STATIONS							
	Pr-1		Pr-2		Pr-3		Pr-4	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Southern bog lemming	+	+	+	+	+	+	1.17	+
Adult	+	+	+	+	+	+	1.17	+
Male	+	+	+	+	+	+	0.67	+
Female	+	+	+	+	+	+	P	+
Sub-Adult	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+
Juvenile	+	+	+	+	+	+	+	+
Male	+	+	+	+	+	+	+	+
Female	+	+	+	+	+	+	+	+

^a Estimates are based on the EM-2 small mammal estimator (Smith and Jorgensen, 1974) utilizing 144 live traps in a 2.98-acre grid for a total of 864 trap nights.

^b +=not observed.

^c P=present, but in insufficient numbers for density estimate.

TABLE 3.3.2-3

STANDARD MEASUREMENTS OF SMALL MAMMALS CAPTURED ON THE CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SPRING AND FALL 1974

	Sample Size ^c		Field Measurements ^a (mm)		Published ^b Measurements (mm)
	Spring	Fall	Spring	Fall	
Short-tailed shrew	13	7			
Total length			107.5 ± 3.5	105.4 ± 12.0	95-134
Tail length			19.8 ± 0.5	19.0 ± 1.9	17-30
Ear length			3.1 ± 0.1	---	---
Hind foot length			15.1 ± 0.1	13.1 ± 0.7	11.5-17
Least shrew	4	0			
Total length			87.5 ± 1.3	---	75-89
Tail length			15.5 ± 0.6	---	12-22
Ear length			2.0 ± 0.0	---	---
Hind foot length			11.9 ± 0.5	---	9-12
Western harvest mouse	7	8			
Total length			129.1 ± 2.6	122.6 ± 19.2	118-170
Tail length			58.4 ± 3.5	59.6 ± 9.5	55-96
Ear length			12.2 ± 0.3	---	10-16
Hind foot length			16.1 ± 0.8	15.9 ± 0.6	14-20
White-footed mouse	4	0			
Total length			160.8 ± 3.4	---	156-205
Tail length			66.1 ± 1.6	---	63-97
Ear length			15.3 ± 1.7	---	13-16
Hind foot length			23.3 ± 2.5	---	19-24
Prairie vole	20	132			
Total length			143.6 ± 2.9	133.2 ± 3.5	130-172
Tail length			30.7 ± 1.4	33.6 ± 1.1	24-41
Ear length			12.6 ± 0.4	---	11-15
Hind foot length			19.5 ± 0.7	18.2 ± 0.2	17-22
Southern bog lemming	3	0			
Total length			138.0 ± 16.9	---	118-154
Tail length			15.7 ± 0.7	---	13-24
Ear length			12.6 ± 1.5	---	8-14
Hind foot length			20.0 ± 1.1	---	16-24

^a means and confidence limits (p=95%).

^b Hall and Kelson (1959).

^c numbers indicate sample size from which means are derived.

APPENDIX L
Invertebrate Data

TABLE 3.3.5-1

TAXONOMIC IDENTIFICATION OF INVERTEBRATES COLLECTED IN SELECTED PERMANENT FOREST (F)
AND PRAIRIE (PR) SAMPLING STATIONS LOCATED WITHIN THE CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, JUNE 1974

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Arachnida															
Araneida															
Araneidae															
			<u>Araneus maruoratus</u>	+	+	+	+	+	+	+	+	+	1	+	
			Genus sp.	+	+	1	+	+	+	1	+	+	2	+	
Chomisidae															
			<u>Misumenops</u> sp.	1	+	+	+	+	+	+	+	+	+	+	
Linyphiidae															
			Genus sp.	+	1	1	+	+	+	+	+	+	+	+	
Micryphantidae															
			<u>Ceraticelus</u> sp.	+	+	+	1	1	+	+	+	+	+	+	
			Genus sp.	+	1	1	+	1	+	1	+	1	+	+	
Phalangidae															
			Genus sp.	1	1	+	3	1	+	+	+	+	+	+	
Salticidae															
			<u>Hentzia</u> sp.	+	+	1	+	+	+	+	+	+	+	+	
			<u>Icius</u> sp.	+	+	+	+	+	+	+	+	1	+	+	
			<u>Metaphieppus</u> sp.	+	+	+	+	+	1	+	+	+	3	+	
			<u>Paraphidippus</u> sp.	1	+	+	+	1	+	1	+	+	1	+	
Thomisidae															
			<u>Coriarachne</u> sp.	+	+	1	+	+	+	+	+	+	+	+	
			<u>Misamena</u> sp.	+	+	1	+	+	+	+	+	+	+	+	
			<u>Misumenops</u> sp.	+	1	+	+	+	+	+	+	+	+	+	
			<u>Philodronus</u> sp.	+	1	+	+	+	+	+	+	+	+	+	
			<u>Synema parvula</u>	+	+	+	+	+	+	+	+	1	+	+	
			Genus sp.	+	+	+	+	+	+	+	+	+	1	+	
Acarina															
Ascidae															
			<u>Asca</u> sp.	+	+	+	+	+	+	+	1	+	+	+	
Bdellidae															
			Genus sp.	+	+	+	+	+	+	+	+	+	1	+	
Clubionidae															
			Genus sp.	+	+	+	+	+	1	+	+	+	1	+	
Erythraeidae															
			<u>Leptus</u> sp.	+	+	+	1	+	+	+	+	+	+	+	
Ixodides															
			<u>Amblyomma americanum</u>	+	+	1	+	+	+	+	+	+	+	+	

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Arachnida (continued)															
Acarina (continued)															
Lycosidae															
			<u>Pardosa</u> sp.	+	+	+	+	+	+	+	+	+	+	1	
Oecobiidae															
			<u>Oecobius</u> sp.	+	+	+	+	+	+	+	+	+	1	+	
Oxyopidae															
			<u>Oxyopes salticus</u>	+	+	+	+	+	+	+	+	1	+	1	+
Trombididae															
			Genus sp.	+	+	+	+	+	+	+	+	+	1	+	+
Tydeidae															
			Genus sp.	+	+	+	+	+	+	+	+	+	2	+	+
Insecta															
Collembola															
Entomobryidae															
			Genus sp.	1	+	+	+	+	+	+	+	+	+	+	1
Sminthuridae															
			Genus sp.	+	+	+	1	+	+	+	+	+	+	+	+
Orthoptera															
Acrididae															
			Genus sp. (Nymph)	+	+	+	+	+	+	+	+	1	+	+	1
Gryllidae															
			Genus sp. (Nymph)	+	+	+	+	1	+	+	+	+	1	+	+
Oecanthinae															
			Genus sp. (Nymph)	+	+	+	1	+	+	+	+	+	+	+	+
Phasmatidae															
			Genus sp. (Nymph)	+	+	+	1	+	+	+	+	+	+	+	+
Tettigoniidae															
			Genus sp. (Nymph)	1	+	+	2	4	+	4	7	7	10	+	5
Hemiptera															
Anthocoridae															
			<u>Orius insidiosus</u>	+	+	+	+	+	+	+	+	+	3	+	+
Lygaeidae															
			<u>Phlegyas abbreviatus</u>	+	+	+	+	+	+	+	+	+	1	+	3
Miridae															
			<u>Leptopterna dolabrata</u>	+	+	+	+	+	+	2	3	+	1	+	1
			<u>Lygus lineolaris</u>	+	+	+	+	+	+	+	+	7	13	+	7
			<u>Phlegiognathus politus</u>	+	+	+	+	+	+	+	+	1	+	+	+
			<u>Platytyellus fraternus</u>	+	+	+	+	+	1	+	+	+	+	+	+

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Hemiptera															
Miridae															
			<u>Reuteroscopus sulphureus</u> (adult)	+	+	+	+	1	+	+	+	+	+	+	
			<u>Reuteroscopus sulphureus</u> (nymph)	+	+	+	+	2	+	+	+	+	+	+	
			<u>Stenotus binotatus</u>	+	+	+	+	+	+	2	4	+	6	+	
			<u>Trigonotylus ruficornis</u>	+	+	+	+	+	+	+	+	+	6	+	
			Genus sp.	+	1	+	+	+	+	+	+	+	+	+	
Neuroptera															
Chrysopidae															
			<u>Chrysopa oculata</u>	+	+	+	+	+	+	+	+	+	2	+	
			<u>Chrysopa</u> sp. (larva)	+	+	+	+	+	+	+	+	+	3	+	
Coniopterygidae															
			<u>Coniopteryx vicina</u>	+	+	+	+	2	+	+	+	+	+	+	
Homoptera															
Aphididae															
			Genus sp.	+	+	+	+	1	+	+	+	+	+	+	
			Genus sp. (nymph)	+	+	2	+	+	+	+	+	+	13	3	
Cercopidae															
			<u>Philaenus spumarius</u>	+	+	+	+	+	+	+	+	+	1	+	
Cicadellidae															
			<u>Albera</u> sp.	+	+	+	+	+	+	+	+	1	1	+	
			<u>Cloanthanus frontalis</u>	+	+	+	3	+	+	+	+	+	3	4	
			<u>Doleranus longulus</u>	+	+	+	+	+	+	4	10	4	1	+	
			<u>Draeculacephala</u> sp.	+	+	+	+	+	+	+	+	+	+	+	
			<u>Remadosus magnus</u>	+	+	+	+	+	1	+	+	+	+	+	
			Genus sp.	+	2	+	+	+	+	+	+	+	2	+	
			Genus sp. (nymph)	1	+	+	3	1	4	+	+	2	+	+	
Cixiidae															
			<u>Cixus coloepeum</u>	+	+	1	+	+	+	+	+	+	+	+	
Delphacidae															
			<u>Stobaera</u> sp.	+	+	+	+	+	+	3	+	2	1	+	
Derbidae															
			<u>Cedusa vulgaris</u>	5	1	4	5	3	4	+	+	1	+	+	
			<u>Otiocerus abbotii</u>	1	+	1	+	+	+	+	+	+	+	+	
Membracidae															
			<u>Micrutalis calva</u>	+	+	+	+	+	+	+	+	+	+	1	
Psyllidae															
			<u>Trioza diospyri</u>	+	+	+	+	+	+	+	+	+	2	5	

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Thysanoptera															
Acolothripidae															
			<u>Aeolothrips albicinctus</u>	+	+	+	+	+	+	1	+	+	+		
			<u>Aeolothrips bicolor</u>	+	+	+	+	+	2	2	+	3	+		
Thripidae															
			<u>Anaphothrips obscurus</u>	91	277	68	54	25	4	271	424	54	363	+	64
			<u>Aptinothrips rufus</u>	+	+	1	+	+	+	+	+	+	+	+	+
			<u>Caliothrips sp.</u>	+	+	+	+	+	+	+	+	1	+	+	
			<u>Frankliniella fusca</u>	+	+	+	1	+	+	+	3	+	+	+	4
			<u>Frankliniella tritica</u>	+	+	+	+	+	+	+	+	15	1	7	
			Genus sp.	+	+	+	+	+	+	+	+	4	2	+	
Lepidoptera															
Geometridae															
			Genus sp.	+	+	+	2	+	+	+	+	+	+	+	+
			Genus sp. (larva)	+	+	+	+	+	+	+	+	+	1	+	
Hesperiidae															
			Genus sp.	+	+	+	+	+	+	+	1	+	1	+	
Noctuidae															
			<u>Acronicta obliqua</u>	+	+	+	+	+	+	+	+	1	+	+	
			Genus sp. (larva)	+	+	+	+	+	+	+	+	2	+	+	
Pyralididae															
			Genus sp. (larva)	+	1	1	+	+	+	+	+	+	+	+	
Sphingidae															
			<u>Hemaris diffinis</u> (larva)	+	+	+	+	+	+	+	+	+	+	1	
Unknown															
			Genus sp. (adult)	2	+	2	+	+	3	+	+	+	+	+	
			Genus sp. (larva)	1	+	+	+	+	+	+	+	+	+	+	
Diptera															
Asilidae															
			<u>Dioctria sp.</u>	+	+	+	1	+	+	+	+	+	+	+	
			<u>Leptogaster sp.</u>	+	+	1	+	+	+	+	+	+	+	+	
Cecidomyiidae															
			Genus sp.	+	+	+	1	+	+	+	+	1	1	+	
Chironomidae															
			Genus sp.	1	+	1	+	+	+	+	+	+	+	+	
Chloropidae															
			Genus sp.	8	+	+	+	+	2	1	+	2	+	+	
Culicidae															
			<u>Aedes vexans</u>	1	+	1	1	1	+	+	+	+	+	+	

L-4

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Diptera															
Dolichopodidae															
			<u>Chrysotus</u> sp.	+	+	2	+	+	+	12	8	7	+	+	1
			Genus sp.	3	1	2	3	4	1	2	1	1	+	+	1
Empididae															
			Genus sp.	+	+	1	+	+	+	+	+	+	+	+	+
Lauxaniidae															
			<u>Homoneura philadelphica</u>	+	+	+	1	+	+	+	+	+	+	+	+
			Genus sp.	1	+	+	+	+	+	+	+	+	+	+	+
Muscidae															
			Genus sp.	+	+	1	1	2	1	1	+	3	7	+	+
Mycetophilidae															
			<u>Mycomya</u> sp.	1	1	3	1	2	2	+	+	+	+	+	+
			<u>Trichonta</u> sp.	+	+	+	1	+	+	+	+	+	+	+	+
Phoridae															
			Genus sp.	+	1	2	+	2	+	+	+	1	+	+	+
Pipurculidae															
			<u>Chalarus</u> sp.	1	+	+	+	+	+	+	+	+	+	+	+
Sarcophagidae															
			<u>Ravinia</u> sp.	+	+	+	+	+	+	+	4	+	3	+	3
Sciaridae															
			<u>Bradsia</u> sp.	+	2	1	+	+	+	+	+	+	+	+	+
			Genus sp.	+	+	+	+	+	+	+	+	1	+	+	+
Sphaeroceridae															
			<u>Sphaerocera</u> sp.	+	+	+	1	+	+	+	+	+	+	+	+
Syrphidae															
			<u>Paragus tibialis</u>	1	+	+	1	+	+	+	+	+	+	+	+
			<u>Sphaerophoria cylindrica</u>	+	+	+	+	+	+	+	+	+	+	+	1
			<u>Toxomerus geminatus</u>	+	+	+	+	+	+	+	1	1	5	1	4
Tipulidae															
			<u>Elleiptera</u> sp.	+	1	+	+	+	+	+	+	+	+	+	+
			<u>Helius</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
			Genus sp.	+	+	+	+	1	+	+	+	+	+	+	+
Unknown															
			Genus sp.	+	+	1	+	+	1	1	+	1	1	+	+
Hymenoptera															
Apidae															
			<u>Apid mellifera</u>	+	+	+	+	+	+	+	+	+	1	+	+
Argidae															
			<u>Sofus pilicornis</u>	+	+	+	+	+	1	+	+	+	+	+	+

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
				Insecta (continued)	Hymenoptera	Brachonidae	Genus sp. a.	+	+	+	+	+	+	2	1
			Genus sp. b.	+	2	1	1	+	1	+	+	+	+	+	1
		Chalcidoidea	Genus sp.	+	+	2	4	+	+	+	+	+	+	+	+
		Diapriidae	Genus sp.	1	1	1	3	2	+	+	+	+	+	+	+
		Encyrtidae	Genus sp.	+	+	+	+	1	+	+	+	+	1	+	+
		Eulophidae	Genus sp.	+	1	+	+	1	+	+	+	+	1	+	+
		Eupelmidae	Genus sp.	+	+	+	+	+	+	1	+	+	7	+	+
		Formicidae	<u>Acanthomyops</u> sp.	+	+	+	+	1	+	+	+	+	+	+	+
			<u>Camponotus</u> sp.	1	+	1	+	+	1	+	+	+	+	+	+
			<u>Crematogaster</u> sp.	+	+	+	+	+	2	+	+	1	+	+	+
			<u>Dolichoderus</u> sp.	+	+	2	+	+	+	+	+	+	+	+	+
			<u>Formica</u> sp.	+	+	+	+	+	1	+	+	1	+	2	1
			<u>Harpagoxenus americanus</u>	+	+	+	+	+	+	+	+	+	2	+	+
			<u>Leptothorax</u> sp.	2	5	2	1	+	1	+	+	+	+	+	+
			<u>Monomorium geninatus</u>	+	+	+	+	+	+	+	+	+	+	1	+
			<u>Myrica</u> sp.	1	+	1	+	+	+	+	+	+	+	+	+
			<u>Paratrechina</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
			<u>Pheidole</u> sp.	+	+	+	3	2	1	+	+	+	+	+	+
			<u>Tetramorium caespitum</u>	+	+	+	+	+	1	+	+	+	+	+	+
		Halictidae	<u>Lasioglossum rohweri</u>	+	+	+	1	+	+	+	+	+	+	+	+
		Ichneumonidae	Genus sp.	1	+	+	+	1	+	+	+	+	+	+	+
		Mymeridae	Genus sp.	+	1	1	1	+	+	+	+	+	+	+	+
		Pteromalidae	Genus sp.	+	+	+	+	+	+	+	+	3	1	+	+
		Psocoptera	Pseudocaeciliidae	Genus sp.	+	2	1	3	+	+	+	+	+	+	+
			Psocidae	Genus sp.											

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Coleoptera															
Alleculidae															
			<u>Isomira</u> sp.	+	1	+	+	1	3	+	+	+	+	+	+
Anobiidae															
			<u>Brachytarsus stricticus</u>	+	+	+	+	+	+	+	+	+	+	+	1
			<u>Caenocara oculata</u>	+	+	+	+	1	1	+	+	+	+	+	+
			<u>Petalium bistratum</u>	1	+	+	1	+	+	+	+	+	+	+	+
Cantheridae															
			<u>Cantharis marginalis</u>	1	+	+	1	1	+	+	+	+	+	+	+
			<u>Cantharis tantillus</u>	+	1	2	+	+	+	+	1	+	+	+	+
			<u>Chauliognathus marginatus</u>	+	+	+	+	+	+	+	+	+	4	1	+
			<u>Malthinus occipitalis</u>	+	+	+	1	+	1	+	+	+	+	+	+
			<u>Malthinus</u> sp.	+	+	+	1	+	+	+	+	+	+	+	+
			<u>Podabus rugulosus</u>	+	+	+	+	+	+	+	+	+	1	+	+
Cerambycidae															
			<u>Hetoemis cinerea</u>	+	+	1	+	+	+	+	+	+	+	+	+
Chrysomelidae															
			<u>Babia quadriguttata</u>	+	+	+	1	+	+	+	+	+	+	+	+
			<u>Chaetocnema</u> sp.	+	+	+	+	+	+	+	+	+	+	+	1
			<u>Chlamys</u> sp. (larva)	+	+	+	+	+	+	+	+	+	+	1	+
			<u>Epitrix</u> sp.	+	+	+	+	+	+	+	+	+	1	+	+
			<u>Exema</u> sp.	+	+	+	+	+	+	+	1	1	+	+	+
			<u>Longitarsus</u> sp.	+	+	+	+	+	+	+	+	1	1	+	+
			<u>Microrhopala vittata</u>	+	+	+	+	+	+	+	+	+	+	1	+
			<u>Oedionychus quercata</u>	1	+	+	+	+	+	+	+	+	+	+	+
			<u>Ophraella cribrata</u>	+	+	+	+	+	+	+	+	+	+	+	2
			<u>Paria</u> sp.	1	+	1	+	+	+	+	+	+	1	+	+
			<u>Phyllecthris dorsalis</u>	2	1	+	1	+	+	+	+	+	+	+	+
			<u>Xanthonia</u> sp.	3	2	2	8	1	4	+	+	+	+	+	+
Cleridae															
			<u>Korynetinae opetiopalpus</u>	+	+	+	+	+	+	1	+	+	+	+	+
			<u>Phyllobaenus humeralis</u>	+	+	+	+	1	+	+	+	+	+	+	+
Coccinellidae															
			<u>Ceratomegilla maculata</u>	+	+	+	+	+	+	+	3	1	1	+	+
			<u>Hippodamia convergens</u>	+	+	+	+	+	+	+	+	+	5	+	2
			<u>Hippodamia tibialis</u>	+	+	+	+	+	+	+	+	1	+	+	+
			<u>Psyllobora vigintimaculata</u>	+	+	+	+	+	1	+	+	+	+	+	+
			<u>Scymes terminatus</u>	+	+	+	+	+	+	+	2	1	2	+	+
			Genus sp. (larva)	+	+	+	+	+	+	1	5	1	+	+	+

TABLE 3.3.5-1 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Coleoptera (continued)															
Curculionidae															
			<u>Anametus granulata</u>	+	+	+	+	+	+	+	+	+	1	+	
			<u>Apion</u> sp.	9	5	12	10	+	2	+	+	+	+	+	
			<u>Baris</u> sp.	+	+	+	+	+	+	+	+	+	1	+	
			<u>Odontocorynus</u> sp.	+	+	+	+	+	+	+	+	+	2	1	
			<u>Pandeleteius hilaris</u>	+	2	2	+	+	1	+	+	+	+	+	
Elateridae															
			<u>Ctenicera signaticollis</u>	+	+	+	1	+	+	+	+	+	+	+	
			<u>Limonius basillaris</u>	+	1	2	+	1	+	+	+	+	+	+	
			<u>Limonius quercinus</u>	1	2	2	3	3	5	1	+	+	+	+	
Erotylidae															
			<u>Tritoma sanguinipennis</u>	1	+	+	+	+	+	+	+	+	+	+	
Euglenidae															
			<u>Zonantes fasciatus</u>	3	2	3	+	+	+	+	+	+	+	+	
Histeridae															
			<u>Saprinus</u> sp.	+	+	+	+	+	+	+	+	+	1	+	
Melandryidae															
			<u>Micronotus sericans</u>	+	1	+	+	1	+	+	+	+	+	+	
			<u>Scraptia</u> sp.	+	+	+	1	+	+	+	+	1	+	+	
Mordellidae															
			<u>Mordellistena</u> sp.	+	+	1	+	+	+	+	+	+	+	+	
Orthoperidae															
			<u>Orthoperus</u> sp.	+	+	+	+	+	+	2	+	+	+	+	
Phalacridae															
			<u>Phalacrus</u> sp.	+	+	+	+	+	+	+	+	+	1	+	
Staphylinidae															
			<u>Apocellus sphaericollis</u>	+	+	+	1	+	+	+	+	+	+	+	
			<u>Stenus</u> sp.	+	+	+	+	+	+	+	+	+	1	+	
			<u>Tachinus fimbriatus</u>	+	+	+	+	+	+	+	+	+	+	1	

^aindicates numbers of specimens collected.

TABLE 3.3.5-2

TAXONOMI^C IDENTIFICATION OF INVERTEBRATES COLLECTED IN SELECTED PERMANENT FOREST (F)
AND PRAIRIE (PR) SAMPLING STATIONS LOCATED WITHIN THE CALLAWAY PLANT SITE,
CALLAWAY COUNTY, MISSOURI, SEPTEMBER 13, 1974

Class	Order	Family	F-1			F-4			Pr-1			Pr-4		
			1a	2	3	1	2	3	1	2	3	1	2	3
Nematoda														
	Unknown													
		Unknown												
		Genus sp.	+	+	1 ^b	+	+	+	+	+	+	+	+	+
Gastropoda														
	Pulmonata													
		Pupillidae												
		<u>Vertigo milium</u>	+	+	+	+	+	+	12	3	32	+	19	2
		Succineidae												
		Genus sp.	+	+	+	+	+	+	7	3	13	+	+	+
Diplopoda														
	Unknown													
		Unknown												
		Genus sp.	+	+	+	+	2	+	+	+	+	+	+	+
Arachnida														
	Chelonethida													
		Unknown												
		Genus sp.	1	+	+	1	+	+	+	+	+	+	+	+
	Phalangida													
		Unknown												
		Genus sp.	2	2	1	+	1	+	+	+	+	+	+	+
	Araneida													
		Anyphaenidae												
		<u>Anyphaena</u> sp.	+	3	+	+	+	+	+	+	+	+	+	+
		<u>Aysha</u> sp.	+	+	+	+	+	1	+	+	+	+	+	+
		Araneidae												
		<u>Acanthepeira stellata</u>	+	+	+	+	+	+	+	2	+	+	+	+
		<u>Aranea</u> sp.	+	+	+	1	+	+	+	+	+	+	+	+
		<u>Argiope trifasciata</u>	+	+	+	3	+	+	+	+	+	+	+	+
		<u>Micrathena</u> sp.	1	+	+	+	3	+	+	+	+	+	+	+
		<u>Neoscona</u> sp.	+	+	+	+	1	+	+	+	+	+	+	+
		Genus spp.	+	2	1	+	+	+	7	15	13	1	1	6
	Dictynidae													
		<u>Dictyna</u> sp.	+	+	+	1	1	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
			1	2	3	1	2	3	1	2	3	1	2	3
Arachnida	(continued)													
	Araneida	(continued)												
	Gnaphosidae	Drassodes sp.	+	+	+	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+
	Linyphiidae		+	+	+	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+
	Lycosidae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Lycosa cardinensis</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Pirata sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
	Microphantidae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Lophocarenum</u>	+	+	+	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+
	Oonopidae		+	+	+	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+
	Oxyopidae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Oxyopes salticus</u>	+	+	+	+	+	+	+	+	+	+	+	+
	Pisauridae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Pisaurina sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
	Salticidae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Ballus sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Icius sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Maevia sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Metacymba sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Phidippus sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Thiodina sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
	Tetragnathidae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Tetragnatha sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+
	Theridiidae		+	+	+	+	+	+	+	+	+	+	+	+
		<u>Pholcomma spp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Thomisidae</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Coriarchne sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Misumenops sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Synema parvula</u>	+	+	+	+	+	+	+	+	+	+	+	+
		<u>Xycticus sp.</u>	+	+	+	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+
36	37	14	9	35	+	+	+	+	+	+	+	+	+	+
+	1	+	+	+	+	+	+	+	+	+	+	+	+	+
3	6	3	1	10	2	1	1	1	+	+	+	+	+	13
25	25	14	+	19	58	+	+	+	+	+	+	+	+	+
.	+	+	+	+	+	+	+	+	+	+	+	+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Arachnida (continued)															
Acarina															
		Anystidae	Genera spp.	+	+	+	+	1	+	+	+	2	9	3	4
		Bdellidae	Genus spp.	+	+	+	+	+	+	+	1	2	+	+	1
		Cunaxidae	Genus spp.	+	1	1	+	+	+	1	+	+	+	+	+
		Erythraeidae	Genus spp.	+	+	+	1	1	+	+	+	+	+	+	+
		Oribatelloididae	Genera spp.	+	4	4	19	14	+	250	318	472	319	262	310
		Pachygnathidae	Genus sp.	+	+	+	+	+	1	+	+	+	+	+	+
		Phytoseiidae	Genera spp.	+	+	1	+	+	14	101	65	70	22	5	23
		Tarsonemidae	Genus sp.	+	+	+	+	+	+	+	1	+	+	+	+
		Tetranychidae	<u>Bryobia</u> sp.	+	+	+	+	+	+	+	1	+	+	+	+
			<u>Tetranychus urticae</u>	+	+	+	+	+	+	74	13	54	4	+	2
		Tydeidae	Genera spp.	+	+	+	+	+	+	3	5	8	1	+	2
Insecta															
Collembola															
		Entomobryidae	Genus spp.		4	2	+	2	+	545	121	627	99	105	93
		Sminthuridae	Genus spp.	+	+	+	+	+	+	+	+	6	163	154	74
Odonata															
		Coenagrionidae	<u>Enallagma</u> sp.	+	+	+	+	+	+	+	+	+	1	+	+
Isoptera															
		Rhinotermitidae	<u>Reticulotermes flavipes</u> (workers)	+	+	2	+	+	+	+	+	+	+	+	+
Orthoptera															
		Acrididae	<u>Dichromorpha viridis</u>	+	+	+	+	+	+	2	1	2	+	+	+
			<u>Syrbula admirabilis</u>	+	+	+	+	+	+	+	1	1	+	+	+
			Genus spp.	+	1	+	+	+	+	1	+	+	+	+	+
		Blattoidae	Genus sp. (nymph)	+	+	+	+	1	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Orthoptera (continued)															
Gryllidae															
			<u>Hapithus agitator</u>	+	1	1	2	+	1	+	+	+	+	+	+
			<u>Nemobius fasciatus</u>	+	+	+	+	+	+	1	+	4	+	1	4
			<u>Oecanthus angustipennis</u>	+	+	2	+	+	+	+	+	+	+	+	+
			<u>Oecanthus latipennis</u>	+	2	1	+	+	+	+	+	+	+	+	+
			Genus sp.	+	+	+	+	+	+	+	1	+	+	+	+
Phasmatidae															
			<u>Diapheromera femorata</u>	1	1	5	2	2	1	+	+	+	+	+	+
Tetrigidae															
			<u>Tettigidea lateralis</u> (nymph)	+	+	+	+	+	1	+	+	+	+	+	+
Tettigoniidae															
			<u>Conocephalus strictus</u>	+	+	+	+	+	+	17	15	25	6	9	3
			<u>Orchelimum nigripes</u>	+	+	+	+	+	+	1	+	1	+	+	1
Psocoptera															
Psocidae															
			Genus sp.	+	1	+	1	+	+	+	+	+	+	+	+
			Genus sp. (nymph)	+	+	+	+	1	+	+	+	+	+	+	+
Hemiptera															
Alydidae															
			<u>Alydus eurinus</u> (nymph)	+	+	+	+	+	+	+	+	+	1	+	+
			<u>Megalotomus quinquespinosus</u>	+	+	1	+	+	+	+	+	+	+	+	+
Anthocoridae															
			<u>Orius insidiosus</u>	+	+	+	+	+	+	1	+	1	+	+	1
Berytidae															
			<u>Jalysus spinosus</u>	8	4	7	+	5	3	+	+	+	+	+	+
Coreidae															
			<u>Archimerus alterhatus</u>	+	+	2	+	+	+	+	+	+	+	+	+
Largidae															
			<u>Euryphthalmus succinctus</u>	+	+	+	+	1	+	+	+	+	+	+	+
Lygaeidae															
			<u>Geocoris uliginosus</u>	+	+	+	+	+	+	+	+	1	+	+	+
			<u>Orthaea</u> sp.	+	+	+	+	+	+	1	+	+	+	+	+
			Genus sp. (nymphs)	+	+	+	+	+	+	+	+	2	+	+	+
Miridae															
			<u>Hyaliodes harti</u>	+	1	6	3	2	2	+	+	+	+	+	+
			<u>Lygus lineolaris</u>	+	+	+	+	+	+	+	+	+	1	+	3
			<u>Phytocoris</u> sp. a.	+	1	+	1	+	+	+	+	+	+	+	+
			<u>Phytocoris</u> sp. b.	+	2	+	+	1	+	+	+	+	+	+	+
			<u>Plagiognathus cuneatus</u>	+	1	+	1	+	+	+	+	+	+	+	+
			Genus spp. (nymphs)	4	7	5	2	5	4	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	F-1			F-4			Pr-1			Pr-4		
			1 ^a	2	3	1	2	3	1	2	3	1	2	3
		Genus and species												
Insecta	(continued)													
	Hemiptera	(continued)												
		Pentatomidae												
		<u>Mormidea lugens</u>	1	+	+	+	+	+	+	+	+	+	+	+
		Reduviidae												
		<u>Sinea</u> sp. (nymphs)	1	+	+	+	+	+	+	+	+	+	+	+
		<u>Zelus</u> sp. (nymphs)	+	3	1	+	3	+	+	+	+	+	+	+
		Tingidae												
		<u>Corythucha arcuata</u>	2	1	4	1	8	7	+	+	+	+	+	+
		<u>Corythucha associata</u>	+	+	+	17	+	+	+	+	+	+	+	+
		<u>Corythucha cydoniae</u>	+	+	+	5	12	2	+	+	+	+	+	+
		<u>Leptopharsa clitoriae</u>	+	7	1	+	+	+	+	+	+	+	+	+
		<u>Leptopharsa oblonga</u>	3	+	+	+	10	+	+	+	+	+	+	+
		<u>Leptoypa mutica</u>	4	2	+	+	+	+	+	+	+	+	+	+
		<u>Physatocheila variegata</u>	+	+	1	+	+	+	+	+	+	+	+	+
		Genera spp. (nymphs)	2	1	+	10	9	3	+	+	+	+	+	+
	Homoptera													
		Acanaloniidae												
		<u>Acanalonia bivittata</u>	+	+	2	+	+	1	+	+	+	+	+	+
		Achiliidae												
		<u>Catonia cinctifrons</u>	+	+	+	3	2	1	+	+	+	+	+	+
		Alerodidae												
		Genus sp.	+	1	6	1	+	1	+	+	+	+	+	+
		Aphididae												
		Genera spp. (adults and nymphs)	9	38	17	23	25	28	14	12	10	9	+	1
		Cercopidae												
		<u>Philaenus spumarius</u>	+	+	+	2	+	+	+	+	+	+	+	+
		Cicadellidae												
		<u>Cloanthanus cupresecens</u>	2	1	3	1	6	5	+	+	+	2	+	+
		<u>Cloanthanus frontalis</u>	+	1	+	1	1	+	+	1	+	+	+	1
		<u>Cloanthanus</u> sp.	+	+	+	+	+	+	+	+	+	1	+	+
		<u>Coelidia olitoria</u>	1	+	1	+	+	1	+	+	+	+	+	+
		<u>Draeculacephala</u> spp.	+	+	1	+	+	+	+	+	+	1	2	+
		<u>Empoasca fabae</u> complex	10	3	7	5	3	4	+	+	2	4	3	5
		<u>Empoasca</u> spp.	2	1	3	1	+	1	42	14	28	2	1	+
		<u>Erythroneura elegans?</u>	+	2	1	+	1	1	+	+	+	+	+	+
		<u>Erythroneura comes</u> complex	+	1	1	1	1	+	+	+	+	+	+	+
		<u>Erythroneura maculata</u> complex	+	2	3	+	4	+	+	+	+	+	+	+
		<u>Erythroneura nigra</u>	1	+	+	+	+	+	+	+	+	+	+	+
		<u>Erythroneura obliqua</u> complex	+	+	+	+	+	1	+	+	+	+	+	+
		<u>Erythroneura vulnerata</u> complex sp. ^a	3	+	+	+	+	+	+	+	+	+	+	+
		<u>Erythroneura vulnerata</u> complex sp. ^b	2	2	2	1	2	2	+	+	+	+	+	+
		<u>Erythroneura</u> spp.	36	29	92	54	67	30	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Homoptera (continued)															
Cicadellidae (continued)															
			<u>Exitianus exitiosus</u>	+	+	+	+	+	+	3	1	3	3	1	+
			<u>Flexamia</u> sp.	+	+	+	+	+	+	10	5	4	+	+	+
			<u>Graminella nigrifrons</u>	+	+	+	+	+	+	+	1	+	+	+	+
			<u>Gyponana</u> sp.	+	+	+	+	+	+	+	+	+	1	+	+
			<u>Hymetta trifasciata</u>	1	3	+	+	1	1	+	+	+	+	+	+
			<u>Hymetta</u> spp.	+	1	1	4	4	2	+	+	+	+	+	+
			<u>Latulus sayi</u>	+	+	+	+	+	+	34	12	24	1	+	+
			<u>Neokolla hieroglyphica</u>	1	4	2	+	+	+	+	+	+	+	+	+
			<u>Paraphlepsius irroratus</u>	6	1	4	3	+	3	+	+	+	+	+	+
			<u>Paraulacizes irrorata</u>	+	+	2	+	+	1	+	+	+	+	+	+
			<u>Polyamia apicata</u>	+	+	+	+	+	+	+	+	7	+	+	+
			<u>Scaphoideus</u> spp.	+	2	2	+	+	+	+	+	+	+	+	+
			<u>Xestocephalus publicarius</u>	+	+	+	+	+	+	+	2	+	+	+	+
			Genera spp. (mostly numphs)	14	25	17	13	23	21	78	13	81	16	2	5
			Cixiidae												
			<u>Myndus enotatus</u>	20	28	23	4	8	1	+	+	+	+	+	+
			<u>Myndus fulvus</u>	17	24	8	21	21	14	+	+	+	+	+	+
			<u>Myndus</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
			Coccoidea												
			Genera spp.	+	+	+	1	+	1	+	+	2	+	+	+
			Delphacidae												
			<u>Kelisia axialis</u>	+	2	+	+	+	+	+	+	+	+	+	+
			<u>Libernilla ornata</u>	+	+	+	+	+	+	2	4	2	+	+	+
			Genus spp.	+	1	2	+	1	+	3	4	4	+	+	+
			Derbidae												
			<u>Otiocerus degeerii</u>	+	2	+	+	+	+	+	+	+	+	+	+
			Dictyopharidae												
			<u>Phylloscelis atra</u>	+	+	+	+	+	+	+	+	+	2	3	2
			Flatidae												
			<u>Ormenis pruinosa</u>	2	+	+	+	+	+	+	+	+	+	+	+
			<u>Ormenis septentrionalis</u>	+	+	+	+	+	2	+	+	+	+	+	+
			<u>Ormenis venusta</u>	+	1	+	+	+	+	+	+	+	+	+	+
			Issidae												
			<u>Bruchomorpha vittata</u>	+	+	+	?	+	+	50	36	55	14	10	2
			Membracidae												
			<u>Campylenchia latipes</u>	1	+	1	+	+	+	+	+	1	+	1	3
			<u>Publilia reticulata</u>	+	1	22	+	+	1	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Homoptera (continued)															
Membracidae (continued)															
			<u>Tylopelta americana</u>	+	+	+	1	+	+	+	+	+	+	+	
			Genus spp. (nymphs)	+	+	2	+	+	+	+	+	+	+	+	
			Pseudococcidae												
			Genus spp.	+	2	+	+	+	+	+	+	+	+	+	
			Psyllidae												
			<u>Livia vernalis</u>	+	+	+	+	+	+	1	+	+	+	+	
Thysanoptera															
Aeolothripidae															
			<u>Aeolothrips bicolor</u>	+	+	+	+	+	+	6	4	5	+	+	+
Phlaeothripidae															
			Genera spp.	2	2	+	2	+	+	8	3	18	19	7	10
Thripidae															
			<u>Anaphothrips obscurus</u>	+	+	+	+	+	+	9	+	+	+	+	+
			<u>Aptinothrips rufus</u>	+	+	+	+	+	+	7	4	8	2	4	2
			<u>Chirothrips crassus</u>	+	+	+	+	+	+	+	+	3	+	+	+
			<u>Echinothrips americanus</u>	1	1	1	+	1	+	+	+	+	+	+	+
			<u>Frankliniella tritici</u>	+	+	+	+	+	+	+	1	3	3	2	3
			<u>Scirtothrips niveus</u>	1	2	+	+	+	+	+	+	+	+	+	+
			<u>Sericothrips baptisiae</u>	+	+	+	+	+	+	4	+	2	10	1	1
			<u>Thrips helianthi</u>	+	+	+	1	+	+	+	+	+	+	+	+
			Thrips spp.	+	+	4	+	1	2	+	27	21	15	2	2
Neuroptera															
Chrysopidae															
			<u>Chrysopa rufilabris</u>	+	2	1	3	1	1	+	+	+	+	+	+
			Chrysopa spp. (larvae)	5	2	4	2	3	1	+	+	1	+	+	+
Coniopterygidae															
			<u>Coniopteryx vicina</u>	+	+	+	+	1	+	+	+	+	+	+	+
			Coniopteryx vicina ? (larvae)	1	1	+	+	5	3	+	+	+	+	+	+
Hemerobiidae															
			<u>Hemerobius humulinus</u>	+	+	1	+	+	+	+	+	+	+	+	+
Lepidoptera															
Aegeriidae															
			<u>Synanthidon sp.</u>	+	+	+	+	+	+	+	+	+	1	+	+
Amatidae															
			<u>Scepsis fulvicollis</u>	+	+	+	+	+	+	1	+	+	+	+	+
Arctidae															
			Genus sp. (larvae)	+	1	1	+	2	+	+	+	+	+	+	+
Eriocranidae															
			Genus sp. (larva)	+	+	1	+	+	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Lepidoptera (continued)															
Geometridae															
			Genus spp. (larvae)	7	7	13	3	7	6	+	+	+	1	2	4
Hesperidae															
			Genus spp. (larvae)	+	+	1	+	1	+	+	+	+	+	+	+
Limacodidae															
			Genus sp. (larvae)	+	+	+	1	2	+	+	+	+	+	+	+
Megalopygidae															
			Genus sp. (larva)	+	+	+	+	1	+	+	+	+	+	+	+
Noctuidae															
			Genus spp. (larvae)	+	+	3	+	1	2	+	+	+	3	+	3
Noctuoidae															
			Genera spp.	3	4	1	2	+	3	2	1	2	2	1	+
Notodontidae															
			<u>Cerura</u> sp. (larva)	+	+	+	+	+	+	+	+	+	+	+	+
			<u>Heterocampa</u> sp. (larvae)	+	+	+	1	+	+	+	+	+	+	+	+
			<u>Schizura</u> sp. (larvae)	+	+	1	+	+	2	+	+	+	+	+	+
			Genus spp. (larvae)	5	3	2	5	3	2	+	+	+	+	+	+
Nymphalidae															
			Genus spp. (larvae)	2	5	7	1	3	2	+	+	+	+	+	+
Pyralidae															
			Genus sp. (larva)	+	1	+	+	+	+	+	+	+	+	+	+
Sphingidae															
			Genus sp. (larva)	+	+	+	+	1	+	+	+	+	+	+	+
Tortricidae															
			Genus spp. (larvae)	4	+	4	7	3	6	+	2	+	1	+	1
Unknown															
			Genus spp. (larvae)	4	1	8	1	3	2	+	+	+	+	1	1
Coleoptera															
Anobiidae															
			<u>Caenocara tenuipalpa?</u>	1	+	+	+	+	+	+	+	+	+	+	+
Bruchidae															
			<u>Acanthoscelidae longistilus</u>	+	2	1	+	+	+	+	+	+	+	+	+
			<u>Meibomeus musculus</u>	+	+	1	+	+	+	+	+	+	+	+	+
Buprestidae															
			<u>Pachyscelus purpurens</u>	+	+	+	+	+	1	+	+	+	+	+	+
Cantharidae															
			<u>Chauliognathus pennsylvanicus</u>	+	+	+	+	+	+	+	1	+	+	+	+
Carabidae															
			<u>Notiophilus novemstriatus</u>	+	+	+	+	+	1	+	+	+	+	+	+
Chrysomelidae															
			<u>Altica</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
			<u>Blepharida rhois</u>	+	+	+	1	+	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Coleoptera (continued)															
Chrysomelidae (continued)															
			<u>Chaetocnema confinis</u>	+	3	2	+	1	+	+	+	+	+	+	
			<u>Chaetocnema pulicaria</u>	+	1	+	1	1	1	4	2	4	9	6	13
			<u>Diabrotica undecimpunctata</u>	+	3	3	+	3	+	1	1	+	1	+	8
			<u>Epitrix fuscata</u>	+	+	+	+	+	+	+	+	+	+	+	1
			<u>Epitrix sp.</u>	+	+	+	1	+	+	+	+	+	+	+	+
			<u>Longitarsis sp.</u>	+	+	+	+	+	+	+	+	+	1	+	
			<u>Microrhopala vittata</u>	+	+	+	+	+	3	+	+	+	+	+	+
			<u>Paria cancellagilvipes</u>	2	+	+	+	+	+	+	+	+	+	+	+
			<u>Paria spp.</u>	1	1	3	+	+	+	+	+	+	+	+	+
			Genus spp. (larvae)	+	2	+	+	+	+	1	+	+	+	+	1
Cleridae															
			<u>Hydrocera humeralis</u>	+	+	+	+	+	2	+	+	+	+	+	+
			Genus spp. (larvae)	+	+	+	1	+	+	+	+	+	+	+	+
Coccinellidae															
			<u>Psyllobora vigintimaculata</u>	+	+	+	2	+	2	+	+	+	+	+	+
			<u>Scymnus xanthespis?</u>	1	+	+	+	+	+	+	+	+	+	+	+
			<u>Scymnus spp.</u>	+	+	1	+	1	+	+	+	+	+	+	+
			Genus sp. (larva)	+	+	+	1	+	+	+	+	+	+	+	+
Curculionidae															
			<u>Apions spp.</u>	1	12	+	1	2	+	+	+	+	+	+	+
			<u>Centrinites strigicollis</u>	+	+	+	+	1	+	+	+	+	+	+	+
			<u>Conotrachelus sp.</u>	+	+	+	+	1	+	+	+	+	+	+	+
			<u>Curculio sulcatulus</u>	+	+	+	+	+	1	+	+	+	+	+	+
			<u>Cyrtepidomus castaneus</u>	1	3	+	11	+	1	+	+	+	+	+	+
			<u>Geraeus picumnus</u>	+	+	+	+	+	+	+	2	+	+	+	+
			<u>Hypera punctata</u>	+	+	+	+	+	+	+	1	+	+	+	+
			<u>Pandeletius hilaris</u>	1	+	+	+	2	1	+	+	+	+	+	+
			<u>Smicronyx sp.</u>	+	+	+	+	+	+	+	+	+	+	+	2
			Genus sp. (larvae)	+	1	1	+	+	+	+	+	+	+	+	+
Euglenidae															
			<u>Zonantes fasciatus</u>	+	+	+	+	+	1	+	+	+	+	+	+
			<u>Zonantes subfasciatus</u>	2	1	4	+	+	+	+	+	+	+	+	+
Lamperidae															
			<u>Lucidota corrusca</u>	+	+	+	1	+	+	+	+	+	+	+	+
Lathridiidae															
			<u>Cartodere sp.</u>	+	+	+	+	+	+	+	+	2	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4					
				1	2	3	1	2	3	1	2	3	1	2	3			
Insecta	(continued)																	
	Coleoptera	(continued)																
		Lathridiidae	(continued)															
			Corticaria sp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
			Melanophthalma sp.	3	10	6	5	7	4	2	+	+	+	+	+	+	+	+
			Genus spp.	1	+	+	1	+	+	+	+	+	+	+	+	+	+	+
			Genus spp. (larvae)	+	+	+	+	+	+	+	+	+	+	+	+	25	36	39
		Mordellidae																
			Mordella discoidea	+	+	+	1	+	+	+	+	+	+	+	+	+	+	+
			Genus sp. (larvae)	+	+	1	+	+	1	+	+	+	+	+	+	+	+	+
		Orthoperidae																
			Arthrolips decolor	+	+	+	+	+	+	+	+	+	+	+	+	25	47	45
			Arthrolips sp.	+	+	+	+	+	+	+	+	+	+	+	3	1	5	
			Corylophodes marginicollis	+	+	+	+	+	1	+	+	+	+	+	+	+	+	+
		Phalacridae																
			Genus sp. a.	+	+	1	+	+	+	+	+	+	+	+	+	+	+	+
			Genus sp. b.	+	+	+	+	1	+	+	+	+	+	+	+	+	+	+
		Scaphidiidae																
			Scaphisoma distincta	+	+	+	+	+	+	+	+	+	+	1	+	+	+	+
		Scolytidae																
			Chramerus hicoloriae	+	1	+	+	+	+	+	+	+	+	+	+	+	+	+
			Hypothenemus dissimilis	+	+	1	+	+	+	+	+	+	+	+	+	+	+	+
			Hypothenemus interstitialis	+	+	2	+	+	+	+	+	+	+	+	+	+	+	+
			Pseudopityophthorus minutissimus	+	+	+	+	+	1	+	+	+	+	+	+	+	+	+
			Scolytus multistriatus	+	+	+	+	+	+	+	+	+	1	+	+	+	+	+
		Staphylinidae																
			Stenus humilis	+	+	+	+	+	+	+	+	+	+	1	+	+	+	+
			Genus sp.	+	+	1	+	+	+	+	+	+	+	+	+	+	+	+
		Tenebrionidae																
			Paratenetus punctatus	+	+	1	+	+	+	+	+	+	+	+	+	+	+	+
		Unknown																
			Genus spp. (larvae)	+	3	+	+	+	+	7	2	4	+	+	6	10	+	+
		Diptera																
			Anthomyiidae															
			Hylemya sp.	+	1	+	+	+	1	+	+	+	+	+	1	+	+	+
			Pegomyia sp.	1	+	+	1	+	+	+	+	+	+	+	+	+	+	+
			Genus sp.	+	+	+	+	+	+	+	+	+	+	+	+	1	+	+
		Bibionidae																
			Genus sp.	+	+	+	1	+	+	+	+	+	+	+	+	+	+	1
		Bombyliidae																
			Systoechus sp.	+	+	+	+	+	+	+	+	+	+	+	+	+	1	+
		Calliphoridae																
			Lucilia illustris	+	+	+	1	+	+	+	+	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	Genus and species	F-1			F-4			Pr-1			Pr-4		
				1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)															
Diptera (continued)															
			Cecidomyiidae												
			Genus spp.	3	8	5	+	5	3	4	+	+	+	1	+
			Chironomidae												
			Genus spp.	+	+	1	1	1	+	14	31	16	3	2	1
			Chloropidae												
			<u>Meromyza americana</u>	+	+	+	+	+	+	+	+	2	+	+	+
			Genus spp.	+	+	1	1	1	1	31	19	18	2	+	7
			Clusiidae												
			<u>Clusa lateralis</u>	+	+	+	+	1	+	+	+	+	+	+	+
			Culicidae												
			Genus spp.	+	2	1	1	2	1	+	+	+	+	+	+
			Cyclorrhaphae												
			Genera spp. (larvae)	+	2	+	+	+	+	7	5	4	+	3	2
			Dolichopodidae												
			Genus spp.	4	3	6	+	3	1	1	+	2	+	1	+
			Drosophilidae												
			<u>Chymomyza amoena</u>	5	3	1	+	1	2	+	+	+	+	+	+
			Genus sp.	+	1	1	1	+	+	+	1	1	+	+	+
			Empididae												
			Genus sp.	1	1	+	+	+	+	+	+	+	+	+	+
			Heleomyzidae												
			Genus sp.	1	+	+	+	+	+	+	+	+	+	+	+
			Muscidae?												
			Genus sp.	+	1	+	+	+	+	+	+	+	+	+	1
			Mycetophilidae												
			Genus spp.	4	1	1	4	+	3	1	+	+	1	+	1
			Nematocerae												
			Genus spp.	4	5	9	6	7	2	35	32	29	7	5	5
			Otitidae												
			Genus sp.	+	+	+	+	+	+	1	+	1	1	+	+
			Phoridae												
			Genus sp.	+	1	6	4	+	+	+	+	+	+	+	+
			Pipunculidae												
			<u>Pipunculus</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
			Genus sp.	+	+	+	+	1	+	+	+	+	+	+	+
			Platypezidae												
			<u>Platypeza</u> sp.	1	+	+	+	+	+	+	+	+	+	+	+
			Psilidae												
			<u>Loxocera cylindrica</u>	1	+	+	+	+	1	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	F-1			F-4			Pr-1			Pr-4		
			1 ^a	2	3	1	2	3	1	2	3	1	2	3
Insecta (continued)														
Diptera (continued)														
		Sarcophagidae												
		<u>Ravinia guerula?</u>	+	+	+	+	+	+	+	1	+	+	+	+
		Scatopsidae												
		Genus sp.	+	+	+	+	+	+	+	+	+	3	3	3
		Sciaridae												
		Genus sp.	+	4	+	+	4	1	3	+	4	2	2	2
		Sciomyzidae												
		<u>Limnia</u> sp.	+	+	+	+	1	+	+	+	+	+	+	+
		Schizophora												
		Genus sp.	+	2	6	+	2	3	+	2	2	5	4	1
		Simuliidae?												
		Genus sp.	+	+	+	+	+	+	+	1	+	+	+	+
		Sphaeroceridae												
		Genus sp.	1	+	+	+	+	1	+	+	+	+	+	+
		Stratiomyidae												
		<u>Sargus cuprarius</u>	+	2	+	+	+	+	+	+	+	+	+	+
		Syrphidae												
		<u>Ocyrtamus fuscipennis</u>	+	+	+	1	+	+	+	+	+	+	+	+
		<u>Toxomerus marginatus</u>	+	1	1	+	+	2	+	+	+	+	+	+
		<u>Toxomerus politus</u>	+	1	+	1	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	+	1	+	+	+	+	+
		Tachinidae												
		<u>Cholomyia inaequipis</u>	+	+	1	+	+	+	+	+	+	+	+	+
		Genus sp.	1	+	+	+	+	+	+	+	+	+	+	+
		Tipulidae												
		Genus sp.	1	4	3	1	2	+	1	+	+	2	+	+
		Unknown												
		Genus spp.	2	2	+	+	1	+	+	1	+	+	+	+
		Hymenoptera												
		Apidae												
		<u>Bombus americanorum</u>	+	+	+	+	+	+	+	+	+	1	+	+
		Bethylidae												
		<u>Pristocera</u> sp.	4	2	1	+	2	+	+	+	+	+	+	+
		Brachonidae												
		Genus spp.	11	6	5	6	6	2	1	+	1	1	1	1
		Chalcididae												
		<u>Eurytoma</u> sp.	+	+	+	1	+	+	+	+	+	+	+	+
		<u>Perilampus</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
		Genus sp.	+	+	+	+	+	1	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	F-1			F-4			Pr-1			Pr-4		
			1 ^a	2	3	1	2	3	1	2	3	1	2	3
		Genus and species												
Insecta	(continued)													
	Hymenoptera	(continued)												
		Chalcidoidea												
		Genera spp.	51	47	21	22	25	16	31	27	22	7	7	10
		Cynipidae												
		Genus spp.	8	4	2	1	2	+	+	1	+	+	+	+
		Encyrtidae												
		Genus sp.	+	+	+	1	+	1	+	+	+	+	+	+
		Eulophidae												
		<u>Euplectrus</u> sp.	+	+	1	+	+	+	+	+	+	+	+	+
		<u>Tetrastichus</u> sp.	2	+	+	+	+	2	+	+	+	+	+	+
		Genus spp.	+	+	1	+	+	1	+	3	+	+	+	+
		Eupelmidae												
		<u>Eupelmus</u> sp.	+	+	+	+	+	+	+	1	+	+	+	+
		Genus sp.	+	+	+	+	+	+	+	+	2	+	+	1
		Formicidae												
		<u>Aphaenogaster</u> <u>fulva</u>	+	+	+	+	+	1	+	+	+	+	+	+
		<u>Crematogaster</u> <u>cerasi</u>	4	1	2	1	+	+	+	+	+	+	+	+
		<u>Crematogaster</u> <u>clara</u>	+	+	+	+	+	+	+	2	+	+	+	+
		<u>Crematogaster</u> <u>lineolata</u>	3	+	1	1	+	1	+	+	+	+	+	+
		<u>Crematogaster</u> sp.	+	+	2	+	+	+	+	+	+	+	+	+
		<u>Formica</u> <u>fusca</u>	+	+	2	1	+	+	+	+	+	+	+	+
		<u>Lasius</u> sp.	+	+	+	+	+	+	+	+	+	+	+	1
		<u>Leptothorax</u> <u>ambiguus</u>	20	9	8	2	+	+	+	+	+	+	+	+
		<u>Monomorium</u> <u>minimum</u>	+	+	+	+	+	+	+	+	1	+	+	+
		<u>Prenolepis</u> <u>imparis</u>	5	4	5	15	9	4	+	+	+	+	+	+
		<u>Solenopsis</u> <u>molesta</u>	+	+	+	+	+	+	1	2	+	+	+	+
		<u>Tetramorium</u> <u>caespitum</u>	1	3	1	2	+	+	+	+	+	+	1	+
		Ichneumonidae												
		<u>Gelis</u> sp.	1	+	+	+	+	+	+	+	+	+	+	+
		Genus spp.	1	1	2	+	+	1	1	+	+	+	+	+
		Mymaridae												
		Genus spp.	5	4	+	+	+	+	11	8	17	5	7	1
		Ormyridae												
		<u>Ormyrus</u> sp.	1	+	+	+	+	1	+	+	+	+	+	+
		Pompilidae												
		Genus sp.	+	1	+	+	+	+	+	+	+	+	+	+
		Pteromalidae												
		Genus sp.	+	+	+	+	+	+	+	3	+	+	+	+
		Tiphidae												
		Genus sp.	+	+	+	+	1	+	+	+	+	+	+	+

TABLE 3.3.5-2 (continued)

Class	Order	Family	F-1			F-4			Pr-1			Pr-4		
			1 ^a	2	3	1	2	3	1	2	3	1	2	3
		Genus and species												
Insecta	(continued)													
	Hymenoptera	(continued)												
	Unknown													
	Genera	spp.	+	2	1	1	2	+	+	5	+	+	+	+

^asamples of 50 sweeps each.

+ not observed.

TABLE 3.3.5-3

COMPARISON OF INVERTEBRATE SPECIMENS COLLECTED BY
 PERMANENT STUDY PLOT AND TRANSECT DURING
 THE SPRING AND FALL SAMPLING PERIOD,
 1974 ON THE CALLAWAY PLANT SITE,
 CALLAWAY COUNTY, MISSOURI

<u>Transect</u>	Spring			
	<u>F-1</u>	<u>F-4</u>	<u>Pr-1</u>	<u>Pr-4</u>
1	143	130	319	539
2	326	92	485	41
3	<u>149</u>	<u>54</u>	<u>115</u>	<u>126</u>
Total	618	276	919	706
Grand Total			2519	

<u>Transect</u>	Fall			
	<u>F-1</u>	<u>F-4</u>	<u>Pr-1</u>	<u>Pr-4</u>
1	436	355	1677	934
2	535	392	974	796
3	<u>490</u>	<u>336</u>	<u>1899</u>	<u>751</u>
Total	1461	1083	4550	2481
Grand Total			9575	