DSAR-2.10

Site and Environs

Environmental Radiation Monitoring

Rev 1

Safety Classification:

Safety

Usage Level:

Information

Change No.:	**EC 70064**
Reason for Change:	**Reduce the Milk sampling frequency and deletion of Sediment samples.**
Preparer:	**J. Hoffman**

Fort Calhoun Station

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2.10 Environmental Radiation Monitoring

2.10.1 General

The environmental monitoring program is designed to provide data concerning the types and amount of radioactivity present in the environment of the Fort Calhoun Station. The preoperational program was designed to assess environmental conditions before the arrival of fuel. Subsequent analysis during the decommissioning program is being used to demonstrate that plant decommissioning efforts do not have a significant effect on the environment.

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2.10.2 Preoperational Survey Program

The purpose of the preoperational survey program was to determine the base level of existing radioactivity to which future analytical results can be compared; the program extended for four consecutive years. The monitoring program was developed in cooperation with the regulatory agencies of Nebraska and Iowa and the Fish and Wildlife Service of the United States Government Department of the Interior.

Specific radionuclide and/or gross radioactivity analyses were performed on the selected samples. Table 2.10-1 summarizes the types of samples and analyses included in the preoperational program.

Table 2.10-1 - Gross and Specific Radionuclide Analyses

	Gross α	**Gross β-γ**	**γ-Spec**	**Sr-90**	**H-3**	**K-40**	**I-131**	**Cs-137**
Surface Water	X	X	X	X		X		
Well Water	X	X	X	X		X		
Mud and Silt	X	X	X					
Aquatic Biota		X	X	X			X	
Milk		X	X	X		X	X	X
Vegetation		X	X	X		X	X	
Air Particulate	X	X	X					
Wildlife	X	X	X	X			X	

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2.10.3 Preoperation Survey Results

2.10.3.1 Trial Monitoring Period

The first nine months of the program, starting in September 1968, was a trial period designed to verify the availability of adequate sample types and to select and test analytical procedures.

Results obtained during the trial period were preliminary. The trial period results are included in this report because they describe the background conditions and illustrated the preoperational surveillance program. No significant peaks were evident in any of the gamma scans performed on samples.

Water

Surface water samples were collected at six stations: one at the Desoto National Wildlife Refuge Lake area and five from the Missouri River at sampling stations located above and below the plant site, including the municipal water supplies at Omaha, Nebraska, and Council Bluffs, Iowa.

Well waters were sampled at eleven wells within a four-mile radius of the plant. Table 2.10-2 is a summary of the surface and well water data.

Table 2.10-2 - Average Radioactivity of Well and Surface Waters November 1968 - June 1969

Activity Concentration, pc/liter		
	Well Water (11 Samples)	**Surface Water (6 Samples)**
Alpha	0.0	0.7
Beta-Gamma	10.9	26.2
Strontium 90	0.1	1.3
Tritium	550	1000

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Mud and Silt

Mud and silt samples were taken from the Missouri River downstream of the plant. No alpha radiation was detectable; the analysis for beta-gamma gross activity showed 18 picocuries per kilogram for the mud and silt.

Aquatic Biota

The basis for sampling aquatic biota was formulated from specific recommendations of the Nebraska Game, Forestation and Parks Commission. The fish species selected were chosen because their food habits include organisms within many of the lower trophic levels and because they are important from the standpoint of sport and commercial fishing.

The food habits and radioactivity of the fish samples, which were taken from the Missouri River, are shown in Table 2.10-3.

Table 2.10-3 - Food Habits and Radioactivity of Missouri River Fish
October 1968 - June 1969

Specie	Food Habits	(β-γ)-(K-40) nc/kg	K-40 nc/kg	Sr-90 pc/kg
Flathead Catfish #	Fish	3.2	2.6	0.0
Flathead Catfish *	Insects	7.8	10.6	0.0
Channel Catfish #	Fish	3.2	6.7	100.00
Channel Catfish *	Insects	1.6	6.5	0.0
Carp	Omnivorous	8.5	8.4	24.0
Paddlefish	Plankton	---	---	---
Buffalo	Algae and Insects	4.6	9.5	0.0
Shad	Plankton	---	---	---

Greater than 10 inches long
* Less than 10 inches long

The paddlefish is difficult to collect but was included where possible because it feeds exclusively on plankton; the shad and buffalo with food habits similar to the paddlefish are acceptable substitutes. During its lifetime, the flathead catfish remains within approximately one mile of its origin and is therefore, sampled downstream of the plant site. Catfish and carp are the most abundant of the commercial fish varieties.

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The Missouri River has a sand bottom which moves with the water flow; therefore, benthos and other bottom organisms are extremely scarce. Joint efforts with the Nebraska Game Commission to obtain sufficient samples for analysis of periphyton have failed; a cooperative study continues as a separate project.

Milk

Milk from large Grade A milk producers in the local milk shed was sampled in cooperation with the Omaha Douglas County Health Department. The dairy herds of these Grade A milk producers are located downwind of the plant site. Radioactivity levels in the milk samples analyzed are shown in Table 2.10-4.

Table 2.10-4 - Radioactivity in Milk January - March, 1969

	Fresh Milk		**Preserved Milk**		
	I-131 pc/1	**Cs-137 pc/1**	**(β-γ)-(K-40) nc/1**	**K-40 nc/1**	**Sr-90 pc/gm Calcium**
Farm A	0	0	0.53	0.73	1.0
Farm B	0	0	0.81	0.74	1.0
Farm C	0	0	0.71	0.78	0.9

Vegetation

Foods normally consumed by the general population constitute the vegetation samples. Six stations with a total of ten varieties of food were sampled during the 1968 growing season. The variation in analytical results is shown in Table 2.10-5.

Table 2.10-5 - Radioactivity in Vegetation October, 1968

	Maximum nc/kg	**Minimum nc/kg**
Alpha	0.0	0.0
Beta-Gamma minus K-40	14.0	0.3
K-40	39.2	3.2
Sr-90	0.143	0.000
H-3	6	0

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Air Particulate

Airborne particulate matter was collected at the plant site on 0.45 micron pore size filters; the filter was removed from the sampler and counted after the radioactivity had decayed for at least seventy-two hours. The air volume passed through the filter was approximately 1,000 cubic feet. None of the 32 samples analyzed showed any indication of alpha activity; the average beta-gamma concentration was 0.26 pc/m^3 with a maximum of 0.78 pc/m^3 and a minimum of 0.08 pc/m^3.

Background radiation readings measured with a Geiger-Mueller survey meter at sixteen stations around the plant site were all in the 0.00-0.02 mr/hr range. Results of the combination film badge-thermoluminescent dosimeters, at eleven stations, were all less than 30 mrem per quarter.

Wildlife

A wild rabbit sample was included to represent wildlife normally consumed in the area. These rabbits are free to wander, but they normally remain in the immediate vicinity. The radioactive content was 20 picocuries of Strontium-90 per gram of calcium in the femur and no iodine-131 was detectable in the thyroid.

2.10.3.2 Preoperational Monitoring Period

Following the trial period, the formal preoperational surveillance monitoring program was started in July, 1969, and continued for three years. This formal preoperational survey was an intensified continuation of the trial period already discussed. The program included soil samples and vegetation which are stored for possible future analyses.

The preoperational program results were documented for future reference and comparison; they defined the pre-operational background levels. Future background conditions may vary due to influences such as fallout from nuclear testing; however, the continuing environmental survey programs will provide adequate data to document changes in the background conditions.

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2.10.4 Decommissioning Survey Program

The purpose of the decommissioning survey program is to provide public assurance that the Fort Calhoun contribution to naturally existing radioactivity is negligible. The program verifies the effectiveness of the waste disposal systems and radiological safety procedures incorporated in the plant.

Since plant operations began, samples similar to those taken during the preoperational program have continued to be collected routinely. The samples which would show changes in radioactivity first, primarily water and air, are sampled most frequently. CH-ODCM-0001, Offsite Dose Calculation Manual, contains a list of the current types of samples being taken, their location and sampling frequency.

Deviations from the monitoring program may occur concerning sample location sites. If samples are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of equipment or participants ceasing participation in the program, corrective actions will be taken. Alternate samples and/or alternate sample locations will become part of the program as soon as practical.

A land use survey is required to be conducted once every 24 months in order to identify changes in the use of the unrestricted area. As a result of this census, locations other than those presently sampled may be identified as potential higher exposure pathways and will be added to the environmental program.

Direct Radiation (TLD)

Quarterly TLDs are analyzed for ambient gamma after each respective replacement. Emergency TLDs are replaced annually or would be collected after a Site Area or General Emergency.

Air Monitoring

Air particulate samples are analyzed by gross beta count weekly. A gamma spectral analysis is performed on a quarterly composite of the weekly samples. Iodine cartridges at the air particulate stations are analyzed for I-131 on a weekly basis.

Water

A gamma scan is performed on monthly surface water composites. In addition, quarterly composites of surface water samples undergo analysis for tritium.

Environmental sample analyses are performed to provide compliance with 10 CFR 20 and to differentiate plant releases from natural or other sources of environmental radiation. Local public regulatory agencies who have assisted in the development of the environmental monitoring program are informed of survey results.

During plant decommissioning, waste discharges will continue to be analyzed prior to release and are continuously monitored during release. In the event that a radiation monitor is inoperable, grab samples will be taken in accordance with the ODCM. The amount of radioactivity released is documented as a standard plant operating procedure. The environmental monitoring program is an independent survey verifying that the operating procedure for waste releases is effective and plant decommissioning efforts do not have a significant effect on the environment. In the unlikely event of an accidental release, samples will be collected and analyzed at all applicable environmental stations. Additional samples may also be obtained to better evaluate the magnitude of such a release.

Milk

Monthly samples of milk are collected within a five mile radius of the plant and analyzed by gamma scan.

Fish

Samples of fish are collected once per season (May to October). *The fish selected for analysis are:

Category	**Species**	**Size**	**Basic Food Habits**
1	Goldeye (adult) Small or Bigmouth Buffalo (adult)	N/A N/A	Carnivorous (insects)
2	Flathead Catfish (adult) Freshwater Drum	>10" length N/A	Carnivorous (fish)
3	Carp (adult)	N/A	Omnivorous (insects, plants, fish)
4	Gizzard Shad (adult)	N/A	Planktonic/ Carnivorous (drift, single cell organisms, insects)
*Species obtained may vary if desired fish are unavailable or are considered a rare or protected species. A Gamma scan analysis is performed on fish samples.			