

QUARTERLY REPORT
BIOCIDE BY-PRODUCTS IN AQUATIC ENVIRONMENTS

Period Covered: January 1 - March 31, 1980

Principal Investigator: Roger M. Bean

Over the past three years, a program to determine the nature and effects of products from the low-level chlorination of natural waters has been conducted. The purpose of the efforts planned for FY 1980 is to validate the results obtained from the previous chemical and biological studies by sampling at least four nuclear power plants. Samples of chlorine-treated cooling water effluent as well as sediment and appropriate organisms in the power station discharge plume will be analyzed and compared with samples not immediately effected by the discharge. The samples will be analyzed using methods adapted for this use during the conduct of the previous work.

Site Visits

Five nuclear power plants were tentatively identified, in concert with NRC Staff, as potential sites for the sampling program:

1. Donald C. Cook, located on Lake Michigan in Michigan.
2. Duane Arnold, located on the Cedar River in Iowa.
3. Beaver Valley, located on the Ohio River in Pennsylvania.
4. Millstone, located on the Atlantic Ocean in Connecticut.
5. Salem Units 1 and 2, located on the Delaware Bay in New Jersey.

Contact has been established with the first four plants. Three of these appear to be excellent locations for field sampling; however, personnel at the D. C. Cook plant informed us that chlorination of cooling water has not been practiced at that facility for the past six months, and there are no immediate plans to chlorinate in the future. At the other three stations, persons have been identified who can act as liaison for our sampling program, and who can assist us during our preliminary site inspection visit. The site inspection visits are planned for the week of April 28th. Millstone will be visited April 29, Beaver Valley on April 30, and Duane Arnold on May 1st. The Salem facility has not been approached to date. Tentative plans are to coordinate a preliminary visit to that facility (if acceptable) with a sampling trip to one of the other plants. A list of persons contacted is provided in Table 1,

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together with a list of additional personnel who may be available to assist us.

The sampling team consists of two Scientists at PNL in addition to the Principal Investigator; Dale C. Mann, chemist, Environmental Chemistry Section and Duane Neitzel, biologist, Freshwater Sciences Section. The mixture of disciplines represented is important for ensuring adequate sample documentation, and sample representativeness. The entire team will be involved during the site inspection visits.

Table 1: Persons Associated with Power Plant Visits

Donald C. Cook (Lake Michigan, MI)

Bob Masse (Resident Inspector) *

Duane Boid (B. Masse's Supervisor) *

Informed us of chlorination practices

Duane Arnold (Cedar Rapids, Iowa)

Tom Kevern (NRC - Washington) *

Don Mineck (Chief Engineer) *

Keith Young (in Radiation Health) *#

Tom Essig (NRC official, Region III)

Beaver Valley (Shippingport, PA)

Don Beckman (Resident Inspector) *

Jim Werling (Plant Superintendent) *

Jim Wenkhous (Chemist) *#

Fred Bissert

Bob Bores (NRC Official Region I)

Millstone (Hartford, Conn.)

Tom Shedloski (Resident Inspector) *

John Opeka (Station Superintendent) *

Dr. William Renfro (Mgr. Environmental Programs) *#

Regie Rogers

* Has been contacted by phone

Will serve as liaison for sampling program.

Salem (Delaware Bay, New Jersey)

Norm Millis

Bob Douglas (at Corporate Hq.)

Sampling

Although final plans for taking samples at the nuclear power stations cannot be made before actual site inspection, some consideration has been given to overall strategy. The chlorination practices of many facilities involve only short periods of chlorination at intermittent intervals. Therefore, our sampling plan must include the ability to collect all the water samples required during a relatively short period of time. Thus, storage containers must be available for both chlorinated and control water, which can accommodate about fifty gallons of water sample while the relatively slow process of XAD-2 sampling is conducted. The inertness of the walls of the container are important. The steel walls of a 55 gal. drum could act as a catalyst, and produce undesirable chlorination reactions: A plastic liner may contribute many impurities such as plasticizers to the system. Our first solution was to procure a 55 gal. drum lined with a Teflon material, baked out at about 200°C. Preliminary tests by analyzing a treated barrel full of purified water with the XAD-2 resin adsorption method indicated that the Teflon liner would be suitable for sampling; however, rust developed along the seam between bottom and sides. A new baked-out polyvinyl fluoride lined formulation is being manufactured which should correct this problem.

During the sampling phase, we plan to obtain the following water quality data: pH, DO, turbidity, alkalinity, temperature, and total residual oxidant. We also plan to obtain samples for total carbon and inorganic carbon, as well as anions (particularly bromide ions) in the control water. For organics, we will obtain samples for purge-and-trap analysis, and will obtain solvent extracts of water acidified to very low pH (1-2) in order to determine phenols if possible. We will also take the usual series of XAD-2 samples for trace analysis of lipophilic organohalogen. Sediments and organisms will be taken from the discharge plume and outside the plume in those cases where good representative samples are available. Sediments will be sampled using a coring device, in replicate, if possible.