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77 BEALE STREET • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211

December 23, 1975

Mr. Gordon K. Dicker, Chief
Environmental Projects Branch 2
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Dockets 50-275-OL
50-323-OL

Dear Mr. Dicker:

I am enclosing one copy of an internal memorandum containing environmental information and amplification of the memorandum concerning the thermal physical model which I transmitted to you by letter dated November 11, 1975.

Very truly yours,

Philip A. Crane, Jr.

Enclosure
CC w/enc.: ASLB
Parties

14376

Engineering Research
411

Diablo Canyon Nuclear Power Plant
Environmental Information and
Supplementary Thermal Physical
Model Assessment

December 19, 1975

MEMORANDUM:

In my memorandum of October 30, 1975, which was transmitted by Mr. P. A. Crane's letter of November 11, 1975 to NRC, it was stated that the moderate downcoast ocean current condition prevailing on September 18, 1974, was simulated during model dye tests. The prototype ocean current during mid-September 1974 was typical of the downcoast ocean currents that have been observed during the late Upwelling and Oceanic oceanographic seasons (August-October) and reported for many years, commencing with the Environmental Report (ER) and in succeeding supplements (Marine Environmental Investigations at Diablo Canyon, 1969-1971, Environmental Report Supplement No. 2, Volume II (ER-2); Environmental Investigations at Diablo Canyon, 1972-73 (ER-4); and Environmental Investigations at Diablo Canyon, 1974 (ER-5)). Particular attention is invited to the current and drogue data for September 22, 1974, shown in Chapter IV of ER-5 as Figure 457203, because it is near in time to the prototype dye study period of September 18, 19, 20, 1974.

The model ocean current was not adjusted to correspond in magnitude, direction, or time variability over segments of the model ocean surface, to any particular set of ocean current data. It was set to be typical and average for the many Fall seasons observed in the past. This procedure was selected not only because it was experimentally feasible, but also because it provided a reproducible basis for comparing thermal experimental results from tests under differing tidal, wave, and thermal loading conditions. Only two model ocean current magnitudes were used, "moderate" and "strong," and both were established parallel to the coast. For these reasons, model and prototype dye test results are "typical" in the areas outside Diablo Cove. Inside Diablo Cove, where the hydraulic discharge influence dominates the water dynamics, the prototype and model studies are directly comparable.

The magnitude of the ocean currents which actually occurred during the prototype and model dye tests may be derived from the dye test data themselves. Under the influence of a moderate ocean current, and away from the discharge-dominated current regimes inside Diablo Cove (model and prototype), dye motion downcoast is dominated by fluid transport, not diffusion mixing. Using this technique, model dye downcoast transport appeared to be about .25-.30 knot (prototype equivalent), while prototype dye transport was about .18-.22 knot. This disparity, as explained above, is not considered to be disagreement, but instead to be indicative of the general agreement of the

selected model ocean current with the typical current that prevailed during the prototype dye test. This general agreement in current intensity accounts for the observation that the location and distribution of the dye was essentially the same for the model and prototype at the end of three hours. It is from these considerations that confidence is achieved in the model's ability to predict representative thermal plumes in the waters outside Diablo Cove. Inside Diablo Cove, the model thermal predictions are expected to be found more representative of receiving water isotherms under various tide, wave, and heat load conditions because of the dominance of the hydraulic plume.

Supplementary environmental information is contained in attachments:

1. Preliminary data from studies of biological impingement on intake screens during cooling water system operation at Diablo Canyon.

2. Abstract summary of investigations into the temperature tolerance of juvenile bull kelp.

3. Abstract summary of investigations into the delayed mortality of organisms entrained in the cooling water system of an operating power plant.

4. Abstract summary of investigations into the abundance of larval fish and fish eggs in the nearshore and offshore waters near Diablo Canyon.

R. F. CAYOT

RFC/JTWells:sm

Attachments

PRELIMINARY REPORT ON FISH IMPINGEMENT AT DIABLO CANYON

A study on the numbers and kinds of fish impinged on the travelling screens during operation of the cirulating water system of the Diablo Canyon Nuclear Power Plant Unit 1 was started on December 10, 1975. The travelling screens, consisting of monel wire with 3/8-inch square openings, were operated for 15 minutes every two hours. High pressure screen wash water, sprayed on the screens during operation, carried accumulated fish and debris to a sump lined with a 3/8-inch mesh basket. This basket was lifted once a day for removal of the fish debris, and other organisms. A list of the numbers, species, and sizes of fish impinged for the period December 10-19, 1975 is given on the attached tables.

TABLE 1. NUMBERS AND LENGTH FREQUENCIES OF FISH IMPINGED ON TRAVELLING SCREENS AT DIABLO CANYON, DEC. 10-19, 1975

SPECIES		DEC. 10	DEC. 11	DEC. 12	DEC. 13	DEC. 14	DEC. 15	DEC. 16	DEC. 17	DEC. 18	DEC. 19	TOTALS	LENGTH FREQUENCIES, IN mm (Standard Length unless noted)
					72 hr. collection								
Torpedo californica	California Electric Ray						2					2	
Platyrhinoides triseriata	Thornback			1			1		1			3	1- 640mm
Raja binoculata	Big Skate						1					1	
Hydrolagus colliei	Ratfish									1		1	450mm TL
Engraulis mordax	Northern Anchovy										1	1	
Spirinchus starksi ~~Spir stark~~	Night Smelt								1	6	1	8	80 to 97mm
Porichthys notatus	Plainfin Midshipman			1			2	1		1	1	5	163 to 260 mm
Atherinopsis affinis	Topsmelt									1		1	240mm
Aulorhynchus flavidus	Tubesnout										2	2	131, 137 mm
Sebastes mystinus	Blue Rockfish									2		2	75, 122 mm
Sebastes paucispinus	Bocaccio	1	1									2	
Artedius lateralis	Smoothhead Sculpin		1							1	1	3	32 to 56mm
Sciaenidae (unid.)	croaker							1				1	80mm
Hyperprosopon argenteum	Walleye Surfperch	3							1		1	5	70-79 mm
Brachyistius frenatus	Kelp Surfperch									1		1	66 mm
Damalichthys vacca	Pile Surfperch									1		1	124 mm
Pholididae (unid.)	gunnel						1					1	
TOTALS		4*	2	2			7**	2	3	13***	7***	40	

* Represents collection for previous 7-day period
** Represents collection for previous 3-day period
*** Represents collections during very windy days with large quantities of drift seaweed.

BULL KELP TEMPERATURE TOLERANCE STUDY

Investigations of the response of juvenile sporophytes of bull kelp, Nereocystis luetkeana, collected from Diablo Cove were conducted at Morro Bay Power Plant in June-August 1974. The studies consisted of:

1. A pilot study in which juvenile sporophytes (6-14 inches in length) were held for 66 hours in two 6000-gallon flow-through test tanks at Morro Bay ambient seawater temperatures and at a +15°F treatment temperature.

2. A ten-day study in which juvenile sporophytes in four 6000-gallon test tanks were exposed to fluctuating Morro Bay ambient temperature ranges.

3. A 25-day study in which sporophytes were held in filtered and unfiltered Morro Bay seawater at ambient temperatures to determine the effects of diatom settlement.

Results

1. Ambient tank temperatures averaged 58.6°F during the pilot study while treatment tank temperatures averaged 73.6°F. Sporophytes held in the ambient tanks showed a slight bleaching of the pigment in the tips of the blades. Plants in the treatment tank showed severe bleaching in the blades, stipes and pneumatocysts after 24 hours. One hundred percent mortality was assumed in this tank after 66 hours.

2. Temperature in the four tanks ranged between 55°-70°F and averaged 61.6°F during the 10-day study. Slight bleaching was noted in the blade tips after 65 hours. Bleaching continued throughout the 162-hour period, affecting blades, stipes, and pneumatocysts, ultimately leading to tissue degeneration. However, heavy layers of aggregating diatoms on the plants' tissues precluded relating the bleaching exclusively to the ambient temperature regime.

3. The third phase of the study investigated the role of diatom settlement in tissue bleaching. Temperatures in the unfiltered tanks ranged between 54.5-65.5F and averaged 60.3°F. Temperatures in the filtered tank ranged between 56-67.5°F and averaged 61.7°F. Plants in the unfiltered tank showed signs of blade tip bleaching after Day 2, three days earlier than plants in the filtered tanks. Bleaching continued in both unfiltered and filtered tanks developing into stipe and pneumatocyst degeneration. By Day 25, mortality was assumed in 60 percent of the plants in the unfiltered tanks and 50 percent of the plants in the filtered tanks.

Preliminary analysis of the results indicate that tissue bleaching in the blades, leading to subsequent tissue degeneration in the young plants, began when temperature regimes averaged approximately 62°F for several hours.

DELAYED MORTALITY OF ENTRAINED COPEPODS AT MORRO BAY POWER PLANT, PRELIMINARY RESULTS

Entrainment mortality of an adult copepod, Acartia clausi (Copepoda), was studied at Morro Bay Power Plant, California, on June 8-13, 1974 to determine if power plant and plume entrainment causes long-term delayed mortality. Copepods were net-captured at the intake and discharge of this once-through cooling water system. Copepods from both samples were placed into ambient and discharge temperature (8.8C Δt) flow-through incubation chambers. Five replicate samples were used for each test group. Copepod mortalities were recorded each day over a five-day period, and the mortality curves for each test were compared. When background and immediate entrainment mortalities were eliminated, the mortality rates for both intake and discharge collected copepods responded similarly at both ambient and discharge temperatures, suggesting that delayed entrainment mortality is nonexistent at Morro Bay Power Plant over this five-day period.

SUMMARY OF INVESTIGATION INTO THE ABUNDANCE OF LARVAL FISH AND FISH EGGS NEAR DIABLO CANYON

A seasonal distribution and abundance study of larval fish and fish eggs was conducted from March 1974 to May 1975 in the nearshore waters of Diablo Canyon. A students t-test was used to test differences in larval fish and fish egg densities, and physical and chemical parameters from the inshore and offshore stations, 300 m and 1550 m southwest of the perimeter of Diablo Cove, respectively.

A total of 6,030 larval fish and 9,839 fish eggs were collected over 28 biweekly sampling periods, and 168 individual samples. The yearly mean inshore larval fish and fish egg densities were $0.330/m^3$ and $0.704/m^3$, respectively, and offshore densities, $0.384/m^3$ and $0.583/m^3$, respectively. There were no statistically significant differences in larval fish and fish egg densities, and physical and chemical parameters between the inshore and offshore stations. Their seasonal distributions showed a classical pattern; fish egg abundances peaked after upwelling and larval fish abundances peaked after that of fish eggs. The larval fish densities reported herein are 3.0 to 3.5 times that reported by Ahlstrom (1965)[1] taken on CalCOFI Station Lines 73 and 77 within 75 miles of Pt. Arguello on quarterly cruises, 1950-1960.

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[1] Ahlstrom, E. H. 1965. A report on evaluation of fish resources of the Pt. Arguello Area. Part 1. Fish larvae of the Pt. Arguello area. Bureau of Commercial Fisheries. Agreement AT (49-7)-2428 for Div. Biol. and Medicine, US AEC: 118 p.