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RADIOLOGICAL ANALYSIS OF BIOLOGICAL SAMPLES COLLECTED
AT ENIWETOK MAY 16, 1948

Lauren R. Donaldson
Allyn H. Seymour
John R. Donaldson

Applied Fisheries Laboratory
University of Washington
Seattle, Washington

March 1949

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This report is based on work performed under Contract No.
W-28-094-eng-33 with the Atomic Energy Commission.

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Introduction

On May 16, 1948, the day following the Runit Island test, a collection of marine organisms was made from the reef area about one and one-fourth miles north of the test site. This collection was used as a point of reference for the contamination studies planned for later in the season.

Arrangements for the expedition to make the collection were handled by Captain James S. Russell, U.S.N., Test Director, and Colonel James P. Cooney, M.C.

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The collecting area was chosen some distance (one and one-fourth miles) from the target area so as to be outside of the area of greatest fallout but still within the general fallout pattern. Samples of aquatic life were obtained from the waters on both sides of the exposed reef. At low tide the material collected was in water two to four feet deep.

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Some surface activity was undoubtedly lost by this method of handling.

Preparation of Material for Counting

To reduce the material to a convenient form for counting, small samples, usually about one gram in weight, were placed in one-inch stainless steel plates and reduced to an ash. The samples were heated to 120° C on a hot plate to start the reduction. After heating sufficiently to char, a drop of olive oil was added to reduce sputtering and give better distribution of the material on the plate. The trays with the tissue residue were then placed in a muffle furnace and the temperature raised

to 370° C. After two hours of heating the temperature was raised to 500° C and maintained until a white ash was obtained. A drop of nitric acid was then added and the samples set aside to cool. After cooling the plates were mounted on cards and covered with cellophane for counting.

Counting Methods

The beta-gamma activity was determined by counting in a Victoreen unit, the scaler being Model X-327, at the Applied Fisheries Laboratory, University of Washington. Counting was started as soon as material could be returned from the test site, processed and ashed. The first counts were made on May 22, 1948, while other trays were not counted until September 1, 1948.

Some of the counts of activity exceeded the capacity of the scaler. Where such high counts were obtained the amount of material on a plate was reduced or the material set aside to decay before counting. From decay curves the earlier count could be calculated.

The samples were corrected for background, for weight of samples and for geometry. The background counts averaged 17.0 per minute. Using a U.S. Bureau of Standards Ra D + E standard of approximately 108 disintegrations per second the geometry of the unit was calculated as being 18.0 per cent. No correction

The data received in Table 1 are as follows:

uptake of active material by aquatic forms collected about one and one-fourth miles north of Runit Island on the day following the test.

The fish material ashed and counted during late May, based on seven specimens, had the greatest concentration of active

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Expressed as Millimicrocuries per Kilogram of Wet Tissue and Arranged as to Date Counted.

Fish	Tissue:							Gill	Ovary	Soft Parts	Entire Organism	Date Counted
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surgeon	11400	96	847	4050	141000	4240						5-22
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goby										586		6-18
lizard												6-18
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Fish material ashed and counted during mid-June, late August and early September had counts with about the same distribution of activity in the various tissues but with reduced amounts, suggesting a rapid rate of activity decay.

Reduction of Activity by Decay

Selected samples of the May 16 collection from Eniwetok were used to determine the rate of activity decay. Counting started on some of this material on May 22 and is being continued with the latest counts having been made on February 19, 1949. The material used in this study of activity decay is listed in Table II. The beta-gamma counts expressed as counts per minute per gram of wet tissue are recorded in Table III with the essential data plotted in Figure 1.

The data show a very rapid decay of the energy from mid-May to mid-September. From September to mid-February the counts

Table II. Description of samples used for a study of activity decay.

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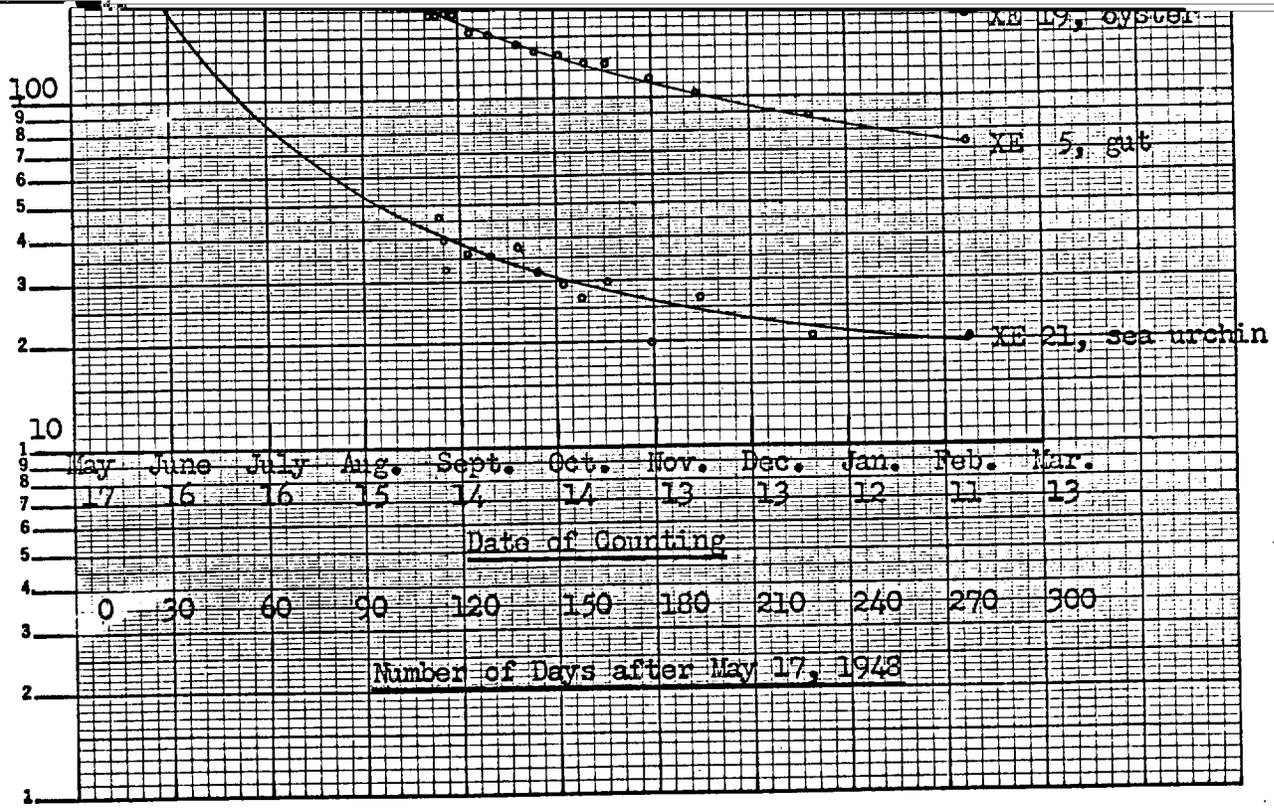
Table III. Beta-Gamma Decay of Selected Samples from May 16, 1948, Eniwetok Collections Expressed as Counts per Minute Per Gram of Wet Tissue.

Date	Sample No.	XE-5	XE-11	XE-19	XE-98	XE-40	XE-15	XE-51	XE-17	XE-20	XE-21	XE-26	XE-97	XE-79	XE-1	IE-3
5-22-48	5934	55980	14004					32542	4096	814					32	868
5-23-48	4857		13082						3533							731
5-24-48	4061											5699	8288			606
5-25-48	3095		9990	19878	15245				2680				8032			515
5-26-48	2668								2213							448
5-27-48																407
6-4-48	1488		6462						1960				4210			259
6-5-48	1390		5934	27500	11878				1287				3662			152
6-7-48	1239		5944		11156				1218				3969			145
6-8-48	1138		4890		9663				1099				2554			145
6-12-48	1013		4020		8215				919				2204			145
6-15-48	945		3833		7420				888				1973	1039		145
6-18-48	852		3499		6894				868				1682			134
6-22-48	789															134
9-1-48							910	2069*				322				6
9-2-48	174													238	20	0
9-7-48	174	3416	571	4215	1210		853	18475	2443	200	47	265	241	207	21	0
9-8-48	175	3292	577	4063	1220		821	15794**	2365	166	39	278	275	214	22	0
9-9-48	176	3195	590	4084	1268		798	16414**	2355	180	32	271	183		14	1
9-10-48		3234	555	3970	1219		775	13290**								
9-11-48		3091	516	3924	1173		758	17218**								
9-13-48		3086	500	3971	1174		759	13109**								
9-14-48		2989	490	3878	1161		703	17815	2144	155	96	246	179	223		
9-17-48	155	2814	460	3618	1062		680	16470	1946	145	96	224	147	140		
9-24-48																
10-1-48							666									
10-2-48	146	2685	431	3491	989			16925	1906	150	38	224	148	162		2
10-8-48	138	2607	397	3332	922		618	15233	1702	135	32	165	119	197		
10-16-48	134	2450	365	3189	849		579	15091	1584	132	29	165	115	138		
10-22-48	127	2341	358	3094	874		555	14260	1537	118	27	180	142	107		
10-30-48	127	2196	320	2959	833		477	19897	1379	113	30	180	136	137		
11-12-48	119	2062	296	2762	711		485	12926	1329	110	20	190	89	101		1
11-27-48	101	1990	256	2613	658		428	11943	1160	94	27	133	88	102		
1-1-49	88	1637	225	2214	556		400	9857	955	80	21	108	65	54		
2-19-49	74	1366	173	1808	443		321	8641	747	66	20	74	44	45		

* hygroscopic, reprocessed.
 ** averaged, 15200.

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of all the samples continued to decrease but at a much slower rate. Fitting a straight line to the last three points of the curve, i.e., for November 27, January 1 and February 19, the half-life period is approximately 180 days.

The slope of the curves at the beginning and at the end tempts one to postulate that the predominant active materials may be Na^{24} and Ca^{45} .

Summary

Marine organisms were collected on May 16, 1948, from the shallow waters of the reef about one and one-fourth miles north of Runit Island for the purpose of determining the beta-gamma radiation.

Samples of about one gram wet weight were reduced to an ash for counting. In the fish samples the skin, muscle, bone, liver, gut and gills were sampled. The entire organism for most invertebrates was used as a sample. A total of 118 samples was prepared and counted.

The greatest concentration of active material was found in the gut, but some distribution of radioactive elements to the tissues had started in the short time (one and one-half days) between the fallout and time of collection.

Decay studies on selected samples show a very rapid rate of initial change. A straight line fitted to the last three points in the decay curves, i.e., for November 27, 1948, January 1, 1949 and February 19, 1949, give a half-life period of approximately 180 days.