AMCHITKA RADIOBIOLOGICAL PROGRAM

PROGRESS REPORT

MAY 1971 TO FEBRUARY 1972

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ABSTRACT

Biological and environmental samples were collected periodically at Amchitka from September 1970 to November 1971, before the Cannikin test, and in November and December 1971 and in February 1972 after the Cannikin test. Gamma-emitting radionuclides in the samples were from worldwide fallout or were naturally occurring; none were of Amchitka origin except tritium, previously reported from ponds and test holes near the surface ground zero (SGZ) of the Long Shot nuclear detonation. The peak in fallout radionuclide concentrations in air filters, marine algae, and freshwater plants occurred in the spring of 1971. Iron-55 concentrations in Amchitka fish and canned salmon from the 1971 Bristol Bay pack were within the range of values reported from other parts of the Northern Hemisphere. In situ gamma-spectrum measurements in Amchitka's coastal waters were made before the Cannikin test and on D+1. Only naturally occurring ^{40}K was detected by this method. The limits of detection for all measurements and analyses were far below the radioactivity concentration guide (RCG) values. It is concluded that there was no release of radioactivity as a result of the Cannikin test.

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1. INTRODUCTION

The Amchitka Radiobiological Program, being conducted by the University of Washington's Laboratory of Radiation Ecology, was initiated in July 1970 at the request of the U.S. Atomic Energy Commission, Nevada Operations Office. This program was designed to periodically document the analyses of radionuclides in biological and environmental samples from Amchitka and its environs.

The first progress report (NVO-269-11) covered the period July 1970 to April 1971. This report included the results of radiometric analyses of fish collected in the fall of 1969 and the results of analyses of seawater, freshwater, marine organisms, anadromous fish, freshwater plants, and lichens collected in September 1970. It concluded that artificial or man-made radionuclides did not originate at Amchitka except for tritium which had previously been reported to be present in pond water and test holes near the Long Shot SGZ site. The Long Shot device was detonated in 1965 and the Milrow device was detonated in 1969.

This progress report covers the period May 1971 to February 1972, which includes the Cannikin test (November 6, 1971). Results of sample analyses completed to date are reported here. The samples were collected in February, May, August, October, November, and December 1971 and in February 1972 by both the University of Washington's Laboratory of Radiation Ecology personnel and by other bioenvironmental study groups.

Every three months until October 1972, additional collections will be made. In 1973, samples will be collected semiannually.

Data from the first progress report have been included in some of the tables for convenience of the reader.

Figure 1 shows collection and sampling areas for the program. Figures 2, 3, 4, and 5 present greater detail of the shaded areas shown in Figure 1.

Many fallout radionuclides (^{46}Sc , ^{54}Mn , ^{55}Fe , ^{60}Co , ^{65}Zn , ^{95}Zr , ^{95}Nb , ^{103}Ru , ^{106}Ru , ^{106}Rh , ^{108}mAg , ^{110}mAg , ^{125}Sb , and ^{137}Cs) have been detected at Amchitka in small amounts comparable to concentrations found in other parts of the Northern Hemisphere. The identification of small local releases, especially in the marine environment where there is great dilution and a high natural radiation background from ^{40}K , must rely on the determination of both qualitative and quantitative changes in the radionuclide content of indicator organisms that concentrate radionuclides.

The seaweed Fucus found high in the intertidal zone at Amchitka is a good indicator organism because: 1) it is sessile, 2) it is present throughout the year, 3) large samples can be collected almost without regard to weather on any low tide, and 4) it accumulates radionuclides, including short-lived radionuclides in fresh fallout. Other seaweeds and sponges are also good indicator organisms except that they are more difficult to obtain, especially during the frequent storms at Amchitka.

SHADED AREAS ARE
SHOWN IN DETAIL IN
FIGURES 2, 3, & 4

FIGURE 1. Locations of Collection Sites on
and Near Amchitka Island, Alaska

FIGURE 2. Collection Sites. (Overlay of LLL Chart of January 1971, UTM Coordinates 49-55 and 96-02)

FIGURE 3. Collection Sites. (Overlay of LLL Chart of January 1971, UTM Coordinates 55-60 and 93-99)

FIGURE 4. Collection Sites. (Overlay of LLL Chart of January 1971, UMT Coordinates 42-48 and 02-08)

FIGURE 5. Long Shot Ground Zero Vicinity

In the streams, the moss, Fontinalis, and a higher plant, Ranunculus, are good indicator organisms, present throughout the year at Amchitka.

In the terrestrial environment, the lichen community is known as an excellent long-time accumulator of fallout radionuclides. Koranda (1971) points out that some of the annual grasses are probably better indicators of recent fallout ^{137}Cs ; however, these grasses do not appear to collect as many different radionuclides as does the lichen community.

Table 1 lists the scientific and common names and the wet weight to dry weight ratios of samples that have been collected at various times for radiological analyses, including the marine mammals.

2. METHODS

Essentially all samples were analyzed by gamma-ray spectrometry with 3- by 3-inch NaI(Tl) crystals and 200-channel, pulse-height analyzers. Selected samples were analyzed in greater detail with a Ge(Li) diode system and a 4,096-channel, pulse-height analyzer. Chemical separation and X-ray spectrometry were used for ^{55}Fe determinations. Using these methods, the limits of detection for individual radionuclides are well below the RCG of the radionuclide in drinking water.

The values obtained for concentrations of radionuclides in several Amchitka samples were compared by using NaI(Tl) detectors and the Ge(Li) detector. (The absolute efficiency of the Ge(Li) detector was determined for various gamma-ray energies and sample geometries by counting reference standards of ^{133}Ba , ^{137}Cs , ^{54}Mn , and ^{60}Co .) Discrepancies were found in the values calculated by using these detectors for several radionuclides, while values for some radionuclides, for example ^{137}Cs , were essentially the same.

One discrepancy was in ^{95}Zr - ^{95}Nb values. An investigation revealed that these values were being calculated incorrectly from NaI data in two ways. From February 1969 to March 1972, an incorrect gamma per disintegration value for the composite peak of 1.98 MeV was used instead of the correct value of 0.99 MeV which resulted in a calculated value too small by a factor of 2 (the values given in this report have been corrected accordingly). In addition, even prior to 1969, the assumption was made that ^{95}Zr and ^{95}Nb were in secular equilibrium and the observed ^{95}Zr - ^{95}Nb counting rates were corrected to the time of collection by using the decay correction factor for ^{95}Zr . However, ^{95}Zr and ^{95}Nb reach a transient equilibrium with an equilibrium decay ratio of $^{95}\text{Nb}/^{95}\text{Zr}$ of 2.11. Therefore, at equilibrium the ^{95}Zr - ^{95}Nb activity consists of 32 percent ^{95}Zr and 68 percent ^{95}Nb . If a sample is counted when ^{95}Zr and ^{95}Nb are not in equilibrium, there is no way, using a NaI detector, that the single observed value can be accurately corrected for decay back to the time of collection unless both radionuclides are from a single source of a known date of origin.

Depending on the proximity of a nuclear detonation to the time of counting, ^{95}Zr and ^{95}Nb may or may not be in equilibrium. For example, a Ranunculus sample was collected February 12, 1972, following the Chinese nuclear tests on November 18, 1971 and January 7, 1972. When the sample was counted two months later the $^{95}\text{Nb}/^{95}\text{Zr}$ ratio was 1.3 ± 0.3 at the counting time and 0.8 ± 0.3 corrected to the time of collection. These

ratios are for values calculated from the Ge(Li) data. (The error values are the two-sigma, propagated counting errors for single determinations.) For this particular sample, the Ge(Li) data gave a total $^{95}\text{Zr}+^{95}\text{Nb}$ value corrected to time of collection of 2.7 ± 0.3 pCi/g. On the other hand, the NaI data, with the decay correction improperly done and with the gamma/disintegration factor corrected, gave a value of 3.4 ± 0.2 pCi/g which is 26 percent too high.

A second problem observed was the sensitivity of the computer program for NaI data to the omission of the reference spectrum of a radionuclide present in a sample. Cosmic ray-produced 53-day ^7Be is present in relatively substantial concentrations in some Amchitka plants, but it had not been included in the computer library of reference spectra. In spectra obtained with an NaI detector, ^7Be has a 477 keV gamma which overlaps the 428 keV gamma from ^{125}Sb , the 497 keV gamma from ^{103}Ru , and the 512 keV gamma from ^{106}Ru . A comparison of values calculated from the NaI data and the Ge(Li) data from a Ranunculus sample that contained 4.8 ± 0.3 pCi/g of ^7Be are shown as follows:

Radionuclide	pCi/g, dry Ge(Li)	NaI
^{125}Sb	0.5 ± 0.1	1.5 ± 0.50
^{103}Ru	2.9 ± 0.2	5.3 ± 0.50
^{106}Ru	2.1 ± 0.4	0.7 ± 1.0
^{137}Cs	2.7 ± 0.1	2.64 ± 0.16

Thus, ^7Be present in samples but absent in the reference spectra can result in ^{125}Sb , ^{103}Ru , and ^{106}Ru values which are wrong by a factor of 2 or 3 at these small concentrations.

The data obtained with the NaI detectors will be recomputed with the inclusion of a ^7Be reference spectrum and separate spectra for ^{95}Zr and ^{95}Nb rather than the composite spectrum of the two radionuclides at equilibrium. The corrected values will be presented in the final report. However, the change in values will not affect the conclusions of this progress report.

3. RESULTS

The spring peak in worldwide fallout at Amchitka was evident in the data concerning the air filters (Table 2), the freshwater plants (Tables 3 and 4) and, to a lesser degree, the seaweed, Fucus (Table 5). All of the radionuclides detected were either naturally occurring or from worldwide fallout.

The post-Cannikin concentrations in the freshwater plants and marine algae were either lower than the immediate pre-Cannikin values or about the same; also, the kinds of radionuclides present were unchanged.¹ Preliminary

¹Post-Cannikin air monitoring was done on a daily basis by the Eberline Instrument Corporation and no release of radionuclides of Amchitka origin were detected.

examination of the data from February 1972, collections not included in the tables, also indicates that there were no increases in radionuclide content.

The spring peak in worldwide fallout was not clearly evident in the lichens (Table 6) which are long-term integrators of fallout radionuclides. The low values for the post-Cannikin sample collected in December 1971 are not readily explained. The possibility existed that there was a large difference in the ratio of mass to area from which the sample was collected; however, calculation of these values gave, $0.36\text{g}/\text{cm}^2$ for November and $0.41\text{g}/\text{cm}^2$ for December, a difference which cannot account for the variances in radionuclide concentrations. There was melting snow over the area at the time of the collection, but it is doubtful that this could have had a significant effect. Koranda and Martin (1971 UCRL-72926) report a range of ^{137}Cs concentrations of 8.44 to 39.35 pCi/g in dry samples collected from ten lichen areas at Amchitka in October 1970. Hence, it is possible that in spite of the consistency of values from our previous collections, the December sample represents an extreme value within the range.

The concentrations of gamma-emitting radionuclides in the invertebrates (Tables 7 and 8) and in the fish (Tables 9 and 10) have shown no marked changes. Likewise, the range of values for ^{55}Fe in fish muscle collected in September and October of 1970 (Table 11) is about the same as previously reported for the fish collected in September and October of 1969. The ^{55}Fe concentrations in canned salmon from the 1971 Bristol Bay pack (Table 12) were within the range of values of the 1969 and 1970 fish muscle samples. The comparatively high specific activity values listed in Table 11 are due to low stable iron content rather than high ^{55}Fe content.

The bird samples analyzed thus far contained ^{137}Cs and, at concentrations close to the limits of detection, ^{60}Co (Table 13). The Rock Ptarmigan contained the highest concentrations of ^{137}Cs among the birds; this is probably associated with the Ptarmigan's terrestrial feeding habit. The ^{137}Cs concentrations are generally higher in terrestrial organisms than in marine organisms.

The tritium content of salmon and marine invertebrates (king crab, stone crab, scallop, shrimp) collected in Washington and Alaska in August to September 1971 was compared with the tritium content of similar samples collected near Amchitka Island prior to and following the Cannikin detonation. All samples were analyzed by the U.S. Environmental Protection Agency's National Environmental Research Center in Las Vegas, Nevada (personal communication). Of 63 salmon from areas other than Amchitka, 13 had measurable amounts (limit of detection 300 pCi of ^3H per liter of water) of ^3H ranging from 340 ± 300 to 730 ± 330 pCi/liter. No salmon (18 samples) collected in waters around Amchitka before or after Cannikin had measurable amounts of ^3H . One halibut of four from Amchitka had 430 ± 320 pCi of ^3H /liter. All four salmon collected at Mountain Village on the Yukon River had measurable ^3H (630 ± 330 to 730 ± 330 pCi/liter). One king crab of three from Amchitka had 520 ± 290 pCi ^3H /liter, while no invertebrates (19 samples) from other areas of Alaska had measurable amounts of tritium. Thus, it appears that the ^3H content of marine fish and invertebrates from Amchitka is comparable to, or less than, the ^3H content of samples from other areas of Alaska and is not a result of the Cannikin detonation.

The collection efficiency of the filter-sorption bed, or large-volume water sampler, previously described in NVO-269-11, was determined for ^{95}Zr - ^{95}Nb in seawater and freshwater at Amchitka in August 1971 (Table 14). The concentrations of other radionuclides were too small to determine the collection efficiency.

The sensitivity of the LVWS is dependent on the volume of water sampled which, in turn, is dependent on the amount of particulate matter in the sample; however, with a thousand-liter sample, the limit of detection is in the femtocurie (10^{-15}Ci/liter) range.

Two filter beds were used in series to determine whether radionuclides in solution would be found adsorbed on the Millipore filters of the second bed of the series and to determine the collection efficiency of the Al_2O_3 by the use of the formula², $E = 1 - \frac{B}{A}$ where:

E = efficiency

A = concentration of radionuclide in the first Al_2O_3 in the series.

B = concentration of radionuclide in the second Al_2O_3 in the series.

The efficiency values obtained from four collections have a wide range, 0.57 to 0.82, and a large error due to the low concentrations of ^{95}Zr - ^{95}Nb present. Also, these values are higher than the value of 0.45 reported for ^{95}Zr - ^{95}Nb by Silker, Perkins, and Rieck, 1971.

In the freshwater test at the Long Shot Mud Pit 1, all of the radioactivity was associated with particulate matter which was entirely collected by the first set of millipore filters; therefore, the collection efficiency of the Al_2O_3 could not be determined.

Since it is clear that there is little or no adsorption of the soluble radionuclides on the filters, we are now routinely assembling the filter-sorption beds with one set of millipore filters in parallel and two Al_2O_3 beds in series. Thus, if sufficiently high concentrations of radionuclides are found in the Al_2O_3 beds, it will be possible to calculate the collection efficiency for each radionuclide.

Collections with the filter-sorption beds were made periodically at intertidal and freshwater stations (Tables 15, 16, and 17). The greatest number of radionuclides and the highest concentrations, with the exception of ^{95}Zr - ^{95}Nb , were found in the first samples in the series, collected in September 1970. The ^{95}Zr - ^{95}Nb concentrations in seawater reached a peak in May and August of 1971, and the concentration in freshwater samples reached a peak in August 1971.

²Justification of this formula was checked empirically by tagging approximately 300 gallons each of seawater and freshwater with ^{212}Pb which were pumped through beds identical to those used in the field (Schell, W. R., unpublished data LRE).

Cesium-137 values (personal communication from Gordon Riel, Naval Ordnance Laboratory, Silver Spring, Maryland) for December 1971 were 0.22 ± 0.02 pCi/liter at Duck Cove, 0.16 ± 0.02 pCi/liter at Sand Beach Cove, and 0.15 ± 0.02 pCi/liter at Constantine Harbor. Riel feels that the difference between the Pacific and Bering Water ^{137}Cs concentration is probably real, while the similarity between the harbor and the exposed beach indicates that the harbor flushes rapidly relative to the rate of ^{137}Cs deposition.

As noted in the discussion of collection efficiencies, virtually all of ^{95}Zr - ^{95}Nb activity in the freshwater samples is associated with the particulate matter trapped by the millipore filters. A comparison of the data for Long Shot Mud Pit 1 and Jones Lake for August 1971 shows that the ^{95}Zr - ^{95}Nb levels in the particulate matter at the Long Shot Mud Pit 1 were higher than at Jones Lake by a factor of more than ten.

This difference is probably explained by the fact that the Long Shot Mud Pit 1 is atypical of ponds and lakes at Amchitka in that it contains unusually high amounts of suspended organics (Koob, BMI-171-129; T. J. Birch, personal communication). At the time Mud Pit 1 and Jones Lake were sampled in August 1971, there were heavy rains and runoff from the drainage basins, and obviously much more allochthonous organic material was suspended in the water of the Long Shot Mud Pit 1 than in that of Jones Lake.

An in situ gamma probe (Riel, 1966) was tested and calibrated aboard the M/V Pacific Apollo at Amchitka in August 1971 (Tables 18 and 19). Gamma-emitting radionuclide concentrations in seawater can be measured at sea with this instrument by lowering the detector into the water and recording the gamma spectrum aboard ship. Gamma-emitting radionuclide concentrations can be measured within a few minutes or a few hours, depending on the limits of detection being sought. However, the gamma probe is a less sensitive method than the large-volume water sampler; for example, the limit of detection for ^{95}Zr in seawater with the probe is approximately 1 pCi/liter for a one-hour count.

One-hour counts were made with the in situ probe at four locations in the Bering Sea near C-Site on D+1 day and no gamma activity was detected other than naturally occurring ^{40}K . This result is consistent with the results of large-volume water samples collected on D+3 days at Duck Cove and Sand Beach Cove where the concentrations of ^{95}Zr - ^{95}Nb were less than 1 pCi/liter (Table 15).

4. SUMMARY AND CONCLUSIONS

Biological and environmental samples collected periodically before and after the Cannikin test were analyzed for radionuclide content. The radionuclides found were either naturally occurring or from worldwide fallout, with the exception of tritium previously reported from ponds and test holes near the SGZ of the Long Shot nuclear detonation.

The greatest concentrations of fallout radionuclides in air filters, marine algae, and freshwater plants occurred in the spring of 1971. The post-Cannikin concentrations of radionuclides were either lower than immediate pre-Cannikin values or approximately the same. The concentrations of gamma-emitting radionuclides in one sponge, in two crab livers, and in fish collected after the Cannikin test showed no marked changes. Iron-55 concentrations in Amchitka fish collected in the fall of 1970 and in canned salmon from the 1971 Bristol Bay pack were within the range of values previously reported. Cesium-137 and ^{60}Co were found in the Ptarmigan and sea birds.

Fewer kinds of radionuclides were detected in seawater samples in 1971 than in September 1970. Most of the radioactivity in the ponds and lakes at Amchitka is associated with particulates. Zirconium-95-niobium-95 was the most abundant gamma-emitting radionuclide detected in seawater just prior to the Cannikin test and just after the Cannikin test. Only naturally occurring ^{40}K was detectable before and after the Cannikin test with an in situ gamma probe that has a limit of detection of approximately 1 pCi of ^{95}Zr per liter of seawater.

It was concluded that there was no release of radioactivity as a result of the Cannikin test.

TABLE 1
Scientific And Common Names And Wet Weight to Dry
Weight Ratios of Some Amchitka Island Aquatic Organisms

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>VERTEBRATES</u>				
<u>MAMMALS</u>				
<u>Callorhinus ursinus</u>				
Fur Seal	Liver	2	3.25	0.064
	Muscle	1	3.50	_____
	Bone	1	1.50	_____
<u>Enhydra lutris</u>				
Sea Otter	Liver	1	4.03	_____
	Skin	1	3.14	_____
	Kidney	1	5.00	_____
	Muscle	1	4.28	_____
<u>FISH</u>				
<u>Salvelinus malma</u>				
Dolly Varden	Kidney	2	4.52	0.02
	Muscle	14	3.62	0.70
	Gonad	2	2.94	0.05
	Stomach	1	6.58	_____
	contents			
	Viscera	2	4.20	0.42
	Remains	5	3.51	0.63
	Liver	13	3.24	0.19
<u>Oncorhynchus keta</u>				
Chum Salmon	Muscle	9	3.28	0.19
	Viscera	1	3.90	_____
	Liver	10	3.48	0.37
	Remains	1	2.60	_____
	Whole	2	2.87	0.16
	(eviscerated)			
<u>Oncorhynchus nerka</u>				
Sockeye Salmon	Liver	6	3.25	0.51
	Muscle	8	3.67	0.54
<u>Oncorhynchus gorbuscha</u>				
Pink Salmon	Kidney	1	5.00	_____
	Gonad	1	4.51	_____
	Muscle	1	4.33	_____
	Liver	2	4.49	0.69

See footnotes at end of table, page 19

TABLE 1 (continued)

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>VERTEBRATES</u> (continued)				
<u>Oncorhynchus kisutch</u> Coho Salmon	Liver	2	3.52	0.58
	Muscle	1	3.83	_____
	Gonad	1	4.30	_____
<u>Oncorhynchus tshawytscha</u> King Salmon	Muscle	2	2.94	0.20
	Liver	1	3.06	_____
<u>Lepidopsetta bilineata</u> Rock Sole	Liver	5	4.08	0.56
	Muscle	5	4.62	0.34
	Remains	2	3.90	0.01
	Gonad	1	5.70	_____
	Kidney	1	5.30	_____
<u>Hippoglossus stenolepis</u> Halibut	Kidney	1	4.90	_____
	Gonad	1	5.30	_____
	Remains	1	4.50	_____
	Muscle	4	4.01	0.58
	Liver	2	3.63	0.04
	Skin	1	2.47	_____
<u>Theragra chalcogramma</u> Alaskan Pollack	Muscle	9	5.08	0.44
Walleye Pollack	Liver	5	1.51	0.11
	Skin	5	3.42	0.24
<u>Sebastes alutus</u> Ocean Perch	Muscle	3	4.37	0.05
	Liver	2	2.89	0.15
	Gonad	1	2.90	_____
	Skin	1	2.80	_____
<u>Gadus macrocephalus</u> Pacific Cod	Liver	12	3.00	0.77
	Muscle	13	5.47	0.28
	Skin	3	3.36	0.27

See footnotes at end of table, page 19

TABLE 1 (continued)

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>VERTEBRATES</u> (continued)				
<u>Sebastes ciliatus</u>				
Dusky Rockfish	Liver	1	2.62	
	Muscle	2	4.42	0.08
	Remains	2	3.26	0.05
	Gonad	1	4.30	
<u>Hexagrammos lagocephalus</u>				
Rock Greenling	Liver	5	3.43	0.41
	Muscle	7	4.83	0.14
	Viscera	2	2.13	0.04
	Remains	6	4.08	0.87
	Kidney	3	5.22	0.12
	Gonad	3	5.42	0.42
	Skin	1	3.10	
	Whole (eviscerated)	1	4.40	
<u>Coryphaenoides sp.</u>				
Rattail	Liver	2	1.35	0.014
<u>Atheresthes stomias</u>				
Arrowtooth Flounder	Liver	1	3.28	
<u>Gasterosteus sp.</u>				
Stickleback	Evis. whole	2	3.76	0.75
	Viscera	1	2.54	
<u>Bathylagus stilbuis</u>				
California Smooth Tongue	Entire	1	4.17	
<u>Stenobranchius leucopsaurus</u>				
Northern Lampfish	Entire	1	3.12	
<u>BIRDS</u>				
<u>Haematopus bachmani</u>				
Black Oystercatcher	Liver	1	3.36	
	Muscle	1	3.96	
<u>Uria lomvia</u>				
Thick-billed Murre	Muscle	1	1.67	
	Liver	1	3.31	

See footnotes at end of table, page 19

TABLE 1 (continued)

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>VERTEBRATES</u> (continued)				
<u>Cepphus columba</u>				
Pigeon Guillemot	Muscle	2	4.15	0.42
	Liver	2	3.33	0.24
<u>Lagopus mutus</u>				
Rock Ptarmigan	Liver	4	3.52	0.32
	Muscle	4	3.54	0.08
<u>Philacte canagica</u>				
Emperor Goose	Liver	2	3.15	0.08
	Muscle	2	3.21	0.14
<u>Larus glaucescens</u>				
Glaucous-winged Gull	Liver	1	3.11	—
	Muscle	1	3.58	—
<u>Troglodytes troglodytes</u>				
Wren (Winterwren)	Entire (2)	1	3.43	—
<u>Cyclorhynchus psittacula</u>				
Parakeet Auklet	Entire (2)	2	3.41	0.09
<u>Erolia ptilocnemis</u>				
Rock Sandpiper	Entire (2)	1	3.44	—
<u>Aethia pusilla</u>				
Least Auklet	Entire (2)	1	3.55	—
<u>Sterna paradisaea</u>				
Arctic Tern	Entire (2)	1	3.33	—
<u>Anas crecca</u>				
Common Teal	Muscle	1	3.74	—
	Liver	1	3.08	—
<u>Lunda cirrhata</u>				
Tufted Puffin	Muscle	1	3.41	—
	Liver	1	1.96	—

See footnotes at end of table, page 19

TABLE 1 (continued)

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>INVERTEBRATES</u>				
<u>Acanthomysis</u> Mysids	Entire	2	8.41	4.7
Plankton	Entire	2	20.98	2.72
Sponge (rust)	"	1	6.1	_____
(yellow)	"	1	4.5	_____
(buff)	"	1	4.9	_____
(green)	"	1	9.5	_____
<u>Euphausiids</u> Krill	Entire	1	5.2	_____
<u>Medusae</u> (Cyanea)	"	1	26.8	_____
(Aurellia)	"	1	10.1	_____
<u>Pecten</u> sp. Scallop	Soft parts	1	5.9	_____
Basket Star	Soft parts	1	4.51	_____
" "	Gonads	1	4.37	_____
" "	Remains	1	2.41	_____
<u>Gonatus</u> Pelagic Squid	Entire	1	5.41	_____
<u>Stronglocentrotus</u> sp. Urchin	Test	3	2.41	0.07
	Gonad	2	5.87	0.38
	Soft parts	2	6.19	1.97
<u>Octopus</u> sp. Octopus	Viscera	1	5.25	_____
	Evis. whole	1	6.42	_____
<u>Littorina</u> sp. Snail	Entire	5	2.16	0.20
<u>Thais</u> sp. Snail	Soft parts	1	4.0	_____
	Shell	1	1.2	_____
<u>Mytilus</u> sp. Mussel	Soft parts	3	6.21	0.92
	Shell	4	1.08	0.05

See footnotes at end of table, page 19

TABLE 1 (continued)

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>INVERTEBRATES</u> (continued)				
<u>Isopoda</u>	Entire	2	3.04	0.07
<u>Amphipoda</u> (Gammaridae)	Entire	2	4.42	0.01
<u>Parolithodes</u> sp. King Crab	Muscle	3	6.63	0.51
	Viscera	1	7.10	
	Exoskeleton	2	2.30	0.71
	Hepatopancreas	2	3.92	0.04
	Gonad	1	2.02	
<u>Lithodes aequispina</u> False King Crab	Exoskeleton	13	2.17	0.12
	Hepatopancreas	15	4.62	1.89
	Muscle	16	6.79	0.78
	Eggs	8	1.94	0.099
	Remainder	13	4.57	1.12
<u>Chionectes tanneri</u> Tanner Crab	Muscle	3	4.91	0.53
	Exoskeleton	2	2.40	0.23
	Hepatopancreas	2	4.71	1.70
	Remainder	2	4.55	1.65
<u>Erimacrus isenbeckii</u> Horse Crab	Exoskeleton	1	2.52	
	Hepatopancreas	1	6.67	
	Remainder	1	3.95	
<u>MARINE ALGAE</u>				
<u>Hypophyllum sessile</u> Marine algae	Entire	9	7.77	2.38
<u>Fucus distichus</u> Marine algae	Entire	12	4.94	1.4
<u>Halosaccion glandiforme</u> Marine algae	Entire	9	7.23	1.00
<u>Alaria</u> sp. Marine algae	Entire	17	5.95	0.99

See footnotes at end of table, page 19

TABLE 1 (continued)

Species (1)	Tissue	No. of Samples	Wet/Dry Ratio	Standard Deviation
<u>MARINE ALGAE</u> (continued)				
<u>Porphyra</u> sp. Marine algae	Entire	1	4.5	_____
<u>Corallina</u> sp. Coralline algae	Entire	1	2.1	_____
<u>Constantina</u> sp. Marine algae	Entire	_____	_____	_____
<u>Ulva</u> sp. Marine algae	Entire	4	8.54	0.86
<u>Thalassophyllum</u> sp. Marine algae	Entire	_____	_____	_____
<u>Laminaria longipes</u> Marine algae	Entire	5	5.30	0.25
<u>FRESHWATER PLANTS</u>				
Periphyton Pond algae	Entire	2	7.27	2.40
<u>Cladophora</u> sp. Filamentous algae	Entire	1	5.1	_____
<u>Fontinalis</u> sp. Moss	Entire	4	4.83	0.89
<u>Ranunculus</u> sp. Freshwater plant	Entire	3	12.2	4.10
<u>LAND PLANTS</u>				
<u>Cladonia</u> sp. Lichens	Entire	6	3.75	0.87

(1) Names are from "Common and Scientific Names of Fishes from the United States and Canada" (Third Edition), 1970 American Fisheries Society Special Pub. No. 6

(2) Less head, feathers, and skin

TABLE 2
Some Gamma-Emitting Radionuclides in Air Filters at Ground
Level at The Amchitka Island Base Camp

Date	10^3m^3	Gamma-Emitting Radionuclides (pCi/thousand cubic meters)		
		$^{95}\text{Zr}-^{95}\text{Nb}$	^{103}Ru	^{137}Cs
Oct 2 - 16, 1970	25.7	3 ± 1.80	3.60 ± 0.46	0.99 ± 0.24
Oct 16 - 30, 1970	26.2	3.10 ± 0.24	5 ± 0.64	1.10 ± 0.34
Oct 30 - Nov 13, 1970	25.8	0.73 ± 0.06	1.60 ± 0.18	0.36 ± 0.11
Nov 13 - 27, 1970	25.5	1.50 ± 0.08	3.20 ± 0.34	0.38 ± 0.10
Nov 27 - Dec 11, 1970	25.7	2.70 ± 0.11	3.80 ± 0.38	0.73 ± 0.15
Dec 11 - 25, 1970	21.8	0.79 ± 0.05	1.50 ± 0.17	0.63 ± 0.08
Dec 25, 1970 - Jan 8, 1971	26.6	1.40 ± 0.07	2.60 ± 0.28	1.10 ± 0.11
Jan 8 - 22, 1971	26.0	0.92 ± 0.05	2.60 ± 0.09	0.32 ± 0.07
Jan 22 - Feb 6, 1971	28.0	0.92 ± 0.14	2.40 ± 1.10	0.30 ± 0.07
Feb 6 - 20, 1971	26.2	0.92 ± 0.12	1.60 ± 0.41	0.21 ± 0.14
Feb 20 - Mar 6, 1971	26.4	3 ± 0.11	3.60 ± 0.40	0.55 ± 0.12
Mar 6 - 19, 1971	24.1	7.30 ± 0.20	7.90 ± 0.86	0.86 ± 0.14
Mar 19 - Apr 2, 1971	26.3	6.50 ± 0.23	4.40 ± 0.64	0.61 ± 0.24
Apr 2 - 16, 1971	26.4	11 ± 0.22	5.60 ± 0.66	0.92 ± 0.24
Apr 16 - 30, 1971	26.3	10.70 ± 0.44	4.20 ± 0.99	2.20 ± 0.56
Apr 30 - May 15, 1971	27.5	10.90 ± 0.33	6.10 ± 0.79	1.10 ± 0.30
May 15 - 28, 1971	25.1	9.20 ± 0.26	4.30 ± 0.55	0.92 ± 0.29
May 28 - June 11, 1971	26.0	9.90 ± 0.35	4.30 ± 0.61	1.10 ± 0.34
June 11 - 25, 1971	26.3	9.20 ± 0.23	3.20 ± 0.47	0.79 ± 0.26
June 25 - July 11, 1971	30.0	5.20 ± 0.12	1.60 ± 0.27	0.54 ± 0.13
July 11 - 24, 1971	24.5	2.80 ± 0.07	1.10 ± 0.18	0.34 ± 0.09
July 24 - Aug 7, 1971	26.1	2.80 ± 0.07	1.10 ± 0.18	0.32 ± 0.10
Aug 7 - 21, 1971	26.9	1.90 ± 0.06	0.79 ± 0.15	0.25 ± 0.09
Aug 21 - Sep 4, 1971	17.2	4 ± 0.14	1.90 ± 0.35	0.58 ± 0.20
Sep 4 - 17, 1971	16.3	6.60 ± 0.26	3.40 ± 0.60	1.20 ± 0.37
Sep 17 - Oct 2, 1971	19.2	3.80 ± 0.21	3.20 ± 0.57	0.88 ± 0.31
Oct 2 - 16, 1971	17.2	2 ± 0.16	2.70 ± 0.48	0.76 ± 0.27
Oct 16 - 29, 1971	16.5	1.90 ± 0.19	3.10 ± 0.54	0.85 ± 0.38
Oct 29 - Nov 12, 1971	17.8	1.70 ± 0.16	2.80 ± 0.46	0.73 ± 0.33
Feb 23 - 28, 1972	5.3	0.79 ± 0.34	-----	1 ± 0.80
Feb 28 - Mar 3, 1972	8.9	0.43 ± 0.09	-----	-----

TABLE 3
Gamma-Emitting Radionuclides in The Freshwater
Moss Fontinalis Collected at Amchitka Island

Location And Date	Gamma-Emitting Radionuclides (pCi/g,dry) (1)						
	^{40}K	^{60}Co	^{95}Zr - ^{95}Nb	^{103}Ru	^{106}Ru - ^{106}Rh	^{125}Sb	^{137}Cs
Clevenger Creek							
September 1970	9.2 ± 1.4	0.11 ± 0.08	5.2 ± 0.3	1.7 ± 0.3	-----	2.4 ± 0.6	8.3 ± 0.3
February 1971	1.3 ± 0.7	0.06 ± 0.04	1.5 ± 0.1	1.1 ± 0.2	1.4 ± 0.5	0.9 ± 0.2	2.2 ± 0.1
May 1971	8.6 ± 1.6	0.15 ± 0.09	11.5 ± 0.5	3.3 ± 0.9	3.8 ± 1.2	2.9 ± 0.6	4.1 ± 0.2
November 1971 (2)	6.7 ± 1.1	0.14 ± 0.06	4.4 ± 0.2	2 ± 0.4	2 ± 0.7	2.1 ± 0.4	4 ± 0.2
December 1971	6.8 ± 0.6	0.06 ± 0.03	1 ± 0.1	0.8 ± 0.2	0.9 ± 0.3	1.1 ± 0.2	3.6 ± 0.1
Bridge Creek							
February 1971	4.9 ± 1.3	0.19 ± 0.07	3.4 ± 0.2	1.6 ± 0.3	2.2 ± 0.8	1.1 ± 0.4	2.8 ± 0.1
May 1971	11 ± 0.2	0.15 ± 0.09	13.8 ± 0.5	3.7 ± 1	6.1 ± 1.4	3.2 ± 0.7	7.4 ± 0.3
November 1971 (2)	5.5 ± 0.6	0.91 ± 0.04	3.2 ± 0.1	1.1 ± 0.3	1.8 ± 0.4	1.1 ± 0.2	2.1 ± 0.1
December 1971	7.9 ± 1.5	-----	2.7 ± 0.3	1.3 ± 0.6	1.9 ± 1.1	2.2 ± 0.5	5.2 ± 0.3
Duck Cove Creek							
February 1971	3.3 ± 0.7	0.06 ± 0.04	2.2 ± 0.1	1.9 ± 0.3	0.6 ± 0.5	1.3 ± 0.3	1.3 ± 0.1
May 1971	7.6 ± 1.3	0.14 ± 0.07	10.2 ± 0.4	3.1 ± 0.5	2.9 ± 1.1	2.5 ± 0.5	3.2 ± 0.2
November 1971 (2)	8.4 ± 0.7	0.05 ± 0.04	2.5 ± 0.1	1.2 ± 0.3	1.5 ± 0.5	2 ± 0.2	3.1 ± 0.1
December 1971	7.3 ± 1.2	0.11 ± 0.04	1.6 ± 0.2	1.2 ± 0.4	1.4 ± 0.7	2.2 ± 0.4	2.8 ± 0.2

(1) Values corrected for decay to date of collection. The error values are two sigma, propagated, counting errors for single samples.

(2) Pre-Cannikin

TABLE 4
Gamma-Emitting Radionuclides in The Freshwater
Plant Ranunculus Collected at Amchitka Island

Location And Date	Gamma-Emitting Radionuclides (pCi/g, dry) (1)						
	⁴⁰ K	⁶⁰ Co	⁹⁵ Zr- ⁹⁵ Nb	¹⁰³ Ru	¹⁰⁶ Ru- ¹⁰⁶ Rh	¹²⁵ Sb	¹³⁷ Cs
Clevenger Creek							
September 1970	22 ± 1	0.06 ± 0.04	2 ± 0.1	0.35 ± 0.08	-----	0.2 ± 0.2	0.56 ± 0.05
February 1971	24 ± 1	0.19 ± 0.08	1.6 ± 0.2	0.5 ± 0.4	2.4 ± 0.8	0.6 ± 0.4	1.4 ± 0.1
May 1971	15 ± 0.2	0.19 ± 0.07	5.9 ± 0.3	1.2 ± 0.6	2.7 ± 0.8	2 ± 0.5	3.1 ± 0.2
November 1971 (2)	24 ± 4	neg.	1.1 ± 0.6	1.9 ± 1.5	neg.	ns	1.7 ± 0.4
December 1971	16 ± 1	-----	0.5 ± 0.1	0.5 ± 0.4	-----	0.6 ± 0.3	1.7 ± 0.1
Bridge Creek							
February 1971	13 ± 2	-----	3.9 ± 0.3	2.6 ± 0.6	-----	1.4 ± 0.7	3.2 ± 0.2
May 1971	18 ± 2	-----	5.8 ± 0.3	1.4 ± 0.6	1.7 ± 0.9	0.9 ± 0.4	3.2 ± 0.2
November 1971 (2)	19 ± 1	-----	2.6 ± 0.2	1.2 ± 0.5	1.1 ± 0.07	1.3 ± 0.4	2.9 ± 0.1
December 1971	23 ± 1	0.10 ± 0.07	0.82 ± 0.4	0.6 ± 0.4	-----	0.8 ± 0.3	1.7 ± 0.1
Duck Cove Creek							
February 1971	7.1 ± 0.8	-----	1 ± 0.1	1.1 ± 0.2	-----	0.6 ± 0.2	0.92 ± 0.06
May 1971	15 ± 1	-----	2.1 ± 0.2	-----	0.9 ± 0.7	0.4 ± 0.3	1.3 ± 0.1
November 1971 (2)	22 ± 1	neg.	1.7 ± 0.2	0.5 ± 0.4	1.1 ± 0.60	1.5 ± 0.3	1.7 ± 1
December 1971	26 ± 1	-----	0.92 ± 0.07	0.8 ± 0.2	-----	0.8 ± 0.1	1.7 ± 0.1
Clevenger Lake Outlet							
September 1970	28 ± 1	-----	2.4 ± 0.06	0.7 ± 0.08	-----	0.5 ± 0.1	-----
November 1971 (2)	6.7 ± 1	-----	1.4 ± 0.1	0.8 ± 0.3	-----	0.4 ± 0.3	1.1 ± 0.1
December 1971	11 ± 1	0.06 ± 0.03	1.30 ± 0.09	0.6 ± 0.2	1.2 ± 0.3	0.4 ± 0.2	1.2 ± 0.1

(1) Values corrected for decay to date of collection. The error values are two sigma, propagated, counting errors for single samples.

(2) Pre-Cannikin

TABLE 5
Some Gamma-Emitting Radionuclides in Marine Algae
Collected at Amchitka Island

Genus	Collection Site	Collection Date	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)		
				⁴⁰ K	⁹⁵ Zr- ⁹⁵ Nb	¹³⁷ Cs
Fucus	Constantine Harbor	Sept 1970	100	32 ± 0.7	0.46 ± 0.06	0.12 ± 0.04
"	" "	Feb 1971	249	44 ± 0.5	0.14 ± 0.04	-----
"	" "	May 1971	354	28 ± 0.8	0.98 ± 0.07	0.07 ± 0.04
"	Duck Cove	Sept 1970	235	25 ± 0.4	0.32 ± 0.02	0.08 ± 0.05
"	" "	Jan 1971	253	30 ± 0.5	0.18 ± 0.06	-----
"	" "	May 1971	373	33 ± 0.3	0.58 ± 0.03	0.05 ± 0.01
"	" "	Dec 1971	50	30 ± 0.8	0.14 ± 0.08	-----
"	IA-2 or 3	Sept 1970	350	23 ± 0.4	0.38 ± 0.02	0.07 ± 0.03
"	" "	Jan 1971	274	38 ± 0.6	0.20 ± 0.05	-----
"	" "	May 1971	362	35 ± 0.8	0.90 ± 0.08	0.05 ± 0.04
"	" "	July 1971	50	27 ± 1.0	0.6 ± 0.3	0.06 ± 0.06
"	" "	Nov 1971 (2)	50	34 ± 1.1	0.37 ± 0.09	-----
"	" "	Dec 1971	50	29 ± 1.2	0.20 ± 0.09	-----
Alaria	Constantine Harbor	Sept 1970	71	66 ± 0.6	0.44 ± 0.02	0.05 ± 0.03
"	Duck Cove	Sept 1970	190	60 ± 0.3	0.54 ± 0.02	-----
"	" "	Oct 1970	158	38 ± 0.4	0.38 ± 0.04	-----
"	" "	Jan 1971	239	55 ± 1.1	0.28 ± 0.09	-----
"	" "	Feb 1971	248	57 ± 1.1	0.18 ± 0.07	-----
"	" "	May 1971	226	80 ± 1.8	0.82 ± 0.19	-----
"	IA-2 or 3	Oct 1970	349	60 ± 0.9	1.3 ± 0.1	-----
"	" "	Jan 1971	242	59 ± 1.1	0.31 ± 0.11	-----
"	" "	May 1971	197	74 ± 0.8	0.90 ± 0.06	-----

See footnotes at end of table, page 24

TABLE 5 (continued)

Genus	Collection Site	Collection Date	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)		
				^{40}K	^{95}Zr - ^{95}Nb	^{137}Cs
Laminaria	Duck Cove	Sept 1970	348	69 ± 1.4	0.44 ± 0.08	0.12 ± 0.06
"	" "	Oct 1970	100	69 ± 1.2	1.24 ± 0.24	0.11 ± 0.06
"	" "	May 1971	296	64 ± 1.3	0.67 ± 0.11	-----
Halosaccion	Duck Cove	Sept 1970	181	15 ± 0.4	0.68 ± 0.02	0.07 ± 0.02
"	IA-2 or 3	Sept 1970	211	14 ± 0.4	0.64 ± 0.06	0.08 ± 0.03
Porphyra	" "	Sept 1970	156	18 ± 0.4	1.10 ± 0.02	-----
Corallina	" "	Sept 1970	100	49 ± 0.4	0.66 ± 0.04	0.04 ± 0.04
Constantina	Duck Cove	Sept 1970	273	32 ± 0.6	0.86 ± 0.06	0.11 ± 0.03
Thalasio- phyllum	" "	Sept 1970	100	18 ± 0.5	0.64 ± 0.06	0.08 ± 0.03
Hypophyllum	" "	Sept 1970	146	41 ± 0.9	0.24 ± 0.04	0.08 ± 0.05
"	" "	Sept 1970	350	15 ± 0.2	0.42 ± 0.02	0.03 ± 0.01
Hedophyllum	" "	Oct 1970	441	37 ± 0.6	0.32 ± 0.04	0.05 ± 0.03

(1) The error values are two sigma, propagated, counting errors for single samples.

(2) Pre-Cannikin

TABLE 6
Fallout Radionuclides In Lichens Collected at Clam Lake, Amchitka Island

Collection Date	Grams dry Sample	Fallout Radionuclides (pCi/g, dry) (1)						
		^{54}Mn	^{60}Co	^{95}Zr - ^{95}Nb	^{103}Ru	^{106}Ru - ^{106}Rh	^{125}Sb	^{137}Cs
Sept 1970	308	0.11 ± 0.07	0.05 ± 0.04	4.8 ± 0.4	-----	5.7 ± 0.5	3.8 ± 0.5	18 ± 0.3
Oct 1970	650	0.14 ± 0.05	0.07 ± 0.04	2.9 ± 0.2	-----	3.6 ± 0.4	2.4 ± 0.4	13.5 ± 0.3
Oct 1970	248	0.16 ± 0.08	0.10 ± 0.06	4.4 ± 0.4	-----	5.8 ± 0.6	4.1 ± 0.6	20 ± 0.4
Feb 1971	100	-----	0.10 ± 0.09	1.4 ± 0.2	-----	4.0 ± 0.7	4.3 ± 0.7	27 ± 0.5
May 1971	100	-----	0.10 ± 0.06	3.9 ± 0.2	2.2 ± 0.7	1.1 ± 0.9	3.8 ± 0.5	26 ± 0.4
Nov 1971 (2)	302	0.16 ± 0.03	0.10 ± 0.03	2 ± 0.1	0.85 ± 0.28	1.6 ± 0.5	3.8 ± 0.3	20 ± 0.2
Dec 1971	416	0.09 ± 0.02	0.05 ± 0.02	0.90 ± 0.05	0.64 ± 0.12	0.74 ± 0.25	1.4 ± 0.1	8 ± 0.09

(1) The error values are two sigma, propagated, counting errors for single samples.

(2) Pre-Cannikin

TABLE 7
Some Gamma-Emitting Radionuclides in Invertebrates Collected at Amchitka Island

Collection Date	Specimen No.	Collection Site	Organism	Tissue	Grams Dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry)*	
						⁴⁰ K	⁹⁵ Zr+ ⁹⁵ Nb
May 1971	245	IA-3	Littorina	Entire	177	2.9 ± 0.3	0.10 ± 0.04
September 1971	576	Off C-Site	Plankton	"	50	12 ± 1	-----
"	605	" "	"	"	50	15 ± 1	-----
"	730	Off Bat Island	Urchin	Soft Parts	20	14 ± 1	1.1 ± 0.5
"	755	Off C-Site	"	"	30	11 ± 1	1.8 ± 0.3
"	798	Off East Cape	Plankton	Entire	50	11 ± 1	-----
October 1971	454	Off Kiriloff Pt.	Scallop	Soft Parts	25	15 ± 4	1.9 ± 0.4
"	"	" " "	"	Shell	51	-----	-----
"	479	Off Bat Island	Tanner Crab	Muscle	9	14 ± 3	-----
"	480	" " "	" "	Skeleton	21	6.1 ± 1.1	-----
"	485	" " "	" "	"	16	3.2 ± 0.9	0.4 ± 0.1
"	"	" " "	" "	Remainder	27	9.9 ± 1.6	0.4 ± 0.2
"	487	" " "	Horse crab	Muscle	20	19 ± 2	0.4 ± 0.2
"	"	" " "	" "	Skeleton	33	6.8 ± 0.6	-----
"	"	" " "	" "	Remainder	19	7.5 ± 1.5	0.4 ± 0.2
"	551	" " "	Urchin	Soft Parts	44	9.3 ± 0.7	0.48 ± 0.08
"	"	" " "	"	Test	62	3 ± 0.4	0.16 ± 0.04
"	555	" " "	"	Gonad	10	11 ± 1	-----
"	"	" " "	"	Soft Parts	25	12 ± 1	0.5 ± 0.1
"	"	" " "	"	Test	50	2.2 ± 0.5	0.18 ± 0.08
"	581	Off Sea Otter Pt.	Scallop	Soft Parts	20	17 ± 2	0.8 ± 0.3
"	728	Off Kiriloff Pt.	"	"	8	9.5 ± 2.1	-----

See footnote at end of table, page 27

TABLE 7 (continued)

Collection Date	Specimen No.	Collection Site	Organism	Tissue	Grams Dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry)*	
						⁴⁰ K	⁹⁵ Zr+ ⁹⁵ Nb
October 1971	756	St. Makarius	Urchin	Soft Parts	16	12 ± 1	-----
" "	758	Off C-Site	"	"	15	12 ± 1	1.9 ± 0.6
" "	760	Crown Reefer Pt.	"	Gonad	11	10 ± 2	-----
" "	"	" " "	"	Soft Parts	44	9.3 ± 0.7	0.48 ± 0.08
December 1971	727	Duck Cove	Sponge, green	Entire	50	9 ± 0.8	0.36 ± 0.08
April 1972	32003	Duck Cove	" "	"	50	15 ± 0.68	0.08 ± 0.06
June 1972	32039	" "	" "	"	"	9.7 ± 0.37	0.25 ± 0.05
" "	32058	Sand Beach Cove	" "	"	10	7.1 ± 1.7	0.52 ± 0.21
" "	32060	" " "	Mussel	Soft Parts	25	-----	-----

* The error values are two sigma, propagated, counting errors for single samples.

TABLE 8
Gamma-Emitting Radionuclides in Crab, Lithodes Aequispina,
Collected at Amchitka Island

Collection Date	Specimen No.	Tissue	Grams Dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)			
				⁶⁰ Co	⁶⁵ Zn	⁹⁵ Zr- ⁹⁵ Nb	¹³⁷ Cs
October 1971	446	Muscle	16.8	0.4 ± 0.09	-----	2.6 ± 0.6	2.4 ± 0.4
" "	"	Eggs	15.0	-----	-----	-----	0.2 ± 0.1
" "	451	Muscle	25.1	0.3 ± 0.1	0.4 ± 0.30	0.3 ± 0.1	0.2 ± 0.1
" "	"	"Liver" (2)	13.4	-----	-----	0.4 ± 0.2	0.3 ± 0.1
" "	456	Muscle	27.0	0.28 ± 0.08	0.5 ± 0.30	0.3 ± 0.1	0.2 ± 0.1
" "	"	"Liver"	18.5	-----	0.4 ± 0.2	0.1 ± 0.1	-----
" "	"	Eggs	22.7	-----	-----	-----	-----
" "	"	Remainder	51.1	-----	-----	-----	-----
" "	462	Muscle	22.5	0.3 ± 0.1	-----	0.3 ± 0.1	0.2 ± 0.1
" "	"	Skeleton	40.0	0.31 ± 0.09	0.5 ± 0.3	0.4 ± 0.1	0.2 ± 0.1
" "	"	Remainder	23.9	-----	-----	-----	-----
" "	466	Muscle	17.0	-----	-----	-----	-----
" "	"	Eggs	21.1	-----	-----	-----	0.08 ± 0.07
" "	"	Skeleton	40.1	0.21 ± 0.07	0.5 ± 0.3	0.2 ± 0.1	0.16 ± 0.09
" "	476	Skeleton	40.5	-----	-----	-----	-----
" "	500	Muscle	28.5	-----	-----	-----	-----
" "	"	"Liver"	5.0	-----	-----	-----	-----
" "	"	Eggs	18.3	0.18 ± 0.07	-----	-----	-----
" "	"	Remainder	50.0	-----	-----	-----	-----

See footnotes at end of table, page 29

TABLE 8 (continued)

Collection Date	Specimen No.	Tissue	Grams Dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)			
				^{60}Co	^{65}Zn	^{95}Zr - ^{95}Nb	^{137}Cs
October 1971	506	Muscle	28.9	-----	-----	0.3 ± 0.1	-----
" "	"	Remainder	50.0	0.06 ± 0.05	-----	-----	-----
" "	515	Skeleton	47.9	0.13 ± 0.04	-----	0.14 ± 0.08	-----
Nov. 18, 1971 (3)	666	"Liver"	13.4	0.11 ± 0.09	0.6 ± 0.3	0.4 ± 0.2	-----
" " " (3)	670	"Liver"	23.8	0.12 ± 0.06	-----	0.2 ± 0.1	-----

(1) The error values are two sigma, propagated, counting errors for single samples.

(2) Hepatopancreas

(3) Post-Cannikin

TABLE 9
¹³⁷Cs and ⁴⁰K in Marine Fish Collected at Amchitka Island

Collection Date	Specimen No.	Collection Site	Common Name (Size mm)	Tissue	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)	
						⁴⁰ K	¹³⁷ Cs
May 1971	241	Constantine Harbor	Greenling (270-310)	Muscle	100	16 ± 0.48	0.07 ± 0.03
"	"	"	"	Liver	31	11 ± 0.58	0.06 ± 0.04
"	"	"	"	Bone	33	7.7 ± 0.75	-----
"	"	"	"	Stomach cont.	22	13 ± 2.1	-----
"	"	"	"	Viscera	50	13 ± 0.66	0.11 ± 0.04
"	"	"	"	Gonad	42	8.6 ± 0.74	0.08 ± 0.05
"	"	"	"	Remainder	100	7.2 ± 0.47	0.07 ± 0.03
"	248	"	Greenling (215-270)	Muscle	100	15 ± 0.50	0.66 ± 0.03
"	"	"	"	Liver	12	9 ± 2.6	-----
"	"	"	"	Bone	12	9.5 ± 1.4	-----
"	"	"	"	Stomach cont.	9	16 ± 3.0	0.33 ± 0.22
"	"	"	"	Viscera (2)	25	12 ± 1.3	0.18 ± 0.08
"	"	"	"	Gonad	13	11 ± 2.2	-----
"	"	"	"	Remainder (3)	100	7.8 ± 0.50	0.05 ± 0.03
"	268	IA-2	Greenling (235-300)	Muscle	100	16 ± 0.41	0.10 ± 0.03
"	"	"	"	Liver	13	9 ± 2.2	-----
"	"	"	"	Bone	15	7 ± 1.3	-----
"	"	"	"	Stomach cont.	13	13 ± 2.8	0.35 ± 0.20
"	"	"	"	Viscera	40	13 ± 0.78	0.05 ± 0.05
"	"	"	"	Gonad	16	9.4 ± 1.4	-----
"	"	"	"	Remainder	100	8.8 ± 0.58	0.08 ± 0.04
"	275	"	Greenling (260-305)	Muscle	100	14 ± 0.43	0.06 ± 0.03
"	"	"	"	Liver	20	12 ± 1.5	0.16 ± 0.10
"	"	"	"	Bone	22	8 ± 1.0	0.11 ± 0.08
"	"	"	"	Stomach cont.	23	12 ± 1.1	-----
"	"	"	"	Viscera	27	13 ± 1.2	-----
"	"	"	"	Gonad	37	8.6 ± 0.78	0.07 ± 0.03
"	"	"	"	Remainder	100	8.3 ± 0.64	-----

See footnotes at end of table, page 33

TABLE 9 (continued)

Collection Date	Specimen No.	Collection Site	Common Name (Size mm)	Tissue	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)	
						⁴⁰ K	¹³⁷ Cs
May 1971	282	IA-2	Greenling	Muscle	100	14 ± 0.39	0.06 ± 0.03
"	"	"	(235-255)	Liver	11	16 ± 15	-----
"	"	"	"	Bone	9	9.4 ± 1.4	-----
"	"	"	"	Stomach cont.	16	15 ± 1.9	0.21 ± 0.13
"	"	"	"	Viscera	17	14 ± 1.4	-----
"	"	"	"	Gonad	17	11 ± 0.93	-----
"	"	"	"	Remainder	100	8.9 ± 0.46	0.08 ± 0.03
Aug 1971	591	Bering Sea	Halibut	Muscle	50	20 ± 0.79	-----
"	"	(Off C-Site)	(670)	Liver	8	21 ± 4.2	0.68 ± 0.30
"	594	"	Halibut	Muscle	50	18 ± 0.74	0.06 ± 0.05
"	"	"	(1230)	Liver	58	8.1 ± 0.49	0.08 ± 0.03
"	597	"	Halibut	Muscle	50	16 ± 0.82	-----
"	"	"	(1070)	Liver	25	15 ± 1.9	0.24 ± 0.14
"	600	"	Halibut	Muscle	50	19 ± 0.83	0.19 ± 0.05
"	"	"	(1170)	Liver	53	9.3 ± 0.48	0.08 ± 0.03
"	673	"	Halibut	Muscle	38	19 ± 1.1	-----
"	675	"	Halibut	Muscle	50	19 ± 0.71	0.08 ± 0.04
"	677	Pacific Ocean (Off C-Site)	Halibut	Muscle	44	19 ± 0.87	0.18 ± 0.06
Oct 1971	360	Bering Sea (51°30'N 179°20'E)	Rattail (915)	Liver	49	2.2 ± 0.46	0.10 ± 0.04
"	556	Pacific Ocean (4)	Ocean Perch (195-220)	Muscle	50	14 ± 0.54	0.05 ± 0.03
"	"	"		Liver	6	(no data)	(no data)

See footnotes at end of table, page 33

TABLE 9 (continued)

Collection Date	Specimen No.	Collection Site	Common Name (Size mm)	Tissue	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)		
						⁴⁰ K		¹³⁷ Cs
Oct 1971	561	Pacific Ocean (4)	Ocean Perch (245-285)	Muscle	50	14	± 0.62	0.09 ± 0.03
"	"	"	"	Liver	25	11	± 0.87	0.07 ± 0.06
"	571	"	Ocean Perch (210-240)	Muscle	50	13	± 0.67	-----
"	"	"	"	Liver	7	9.3	± 0.40	-----
"	606	"	Ocean Perch (270-280)	Muscle	50	14	± 0.94	0.09 ± 0.06
"	"	"	"	Liver	22	8.5	± 0.97	0.11 ± 0.07
"	640	"	Pacific Cod (520)	Muscle	50	16	± 0.84	-----
"	644	"	Pacific Cod (590)	Liver	42	3.7	± 0.76	-----
"	646	"	Pacific Cod (700)	Liver	50	3.8	± 0.44	-----
"	748	"	Pollack (420-440)	Muscle	50	15	± 0.51	-----
"	"	"	"	Liver	50	3.1	± 0.45	-----
Nov 1971 (5)	577	Bering Sea (51°27'N 179°28'E)	Lantern Fish	Entire	50	6.3	± 0.52	0.06 ± 0.04
"	579	"	Smelt	Entire	23	11.8	± 1.8	-----
"	678	Pacific Ocean (51°26.8'N 179°16'E)	Pacific Cod (480)	Muscle	50	17	± 0.62	0.15 ± 0.04
"	680	Pacific Ocean (4)	Pacific Cod (380)	Muscle	50	19	± 0.93	0.09 ± 0.06

See footnotes at end of table, page 33

TABLE 9 (continued)

Collection Date	Specimen No.	Collection Site	Common Name (Size mm)	Tissue	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (1)		
						⁴⁰ K		¹³⁷ Cs
Nov 1971 (5)	682	Pacific Ocean (4)	Pacific Cod (440)	Liver	50	10	± 1.5	-----
"	708	"	Rock Sole (300)	Muscle	31	18	± 0.92	-----
"	710	"	Rock Sole (290)	Muscle	31	15	± 0.68	-----
"	712	"	Rock Sole (320)	Muscle	29	18	± 0.80	-----
"	714	"	Rock Sole (360)	Muscle	50	17	± 0.71	0.11 ± 0.05
"	715	"	Rock Sole (300-330)	Muscle	46	15	± 0.75	0.09 ± 0.05

(1) The error values are two sigma, propagated, counting errors for single samples.

(2) Viscera less liver and stomach content.

(3) Portion remaining after removal of samples for individual tissues.

(4) These fish were caught within the area bounded by 179°09'E to 179°21'E longitude and 51°14'N to 51°15.5'N latitude in the Pacific Ocean off Amchitka.

(5) Post-Cannikin

TABLE 10
 ^{137}Cs and ^{40}K in Salmon Collected
 in The Bering Sea Off Amchitka Island (1)

Collection Date	Specimen No.	Common Name	Fish Size (mm)	Tissue	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (2)	
						^{40}K	^{137}Cs
Aug 31, 1971	366	Chinook	780	Liver	25	10 ± 1	0.11 ± 0.07
Aug 31 - Sep 10, 1971	"	"	"	Muscle	50	11 ± 0.75	0.05 ± 0.05
"	391	"	680	"	50	7.6 ± 0.65	-----
Sep 2 - 30, 1971	356	Chum	705	Liver	23	7.2 ± 1.2	-----
"	"	"	"	Muscle	50	12 ± 0.94	0.07 ± 0.06
"	362	"	548	Liver	10	12 ± 1.6	0.16 ± 0.12
"	"	"	"	Muscle	50	9.2 ± 0.55	0.08 ± 0.04
"	367	"	507	"	50	13 ± 0.79	-----
"	370	"	385	"	50	13 ± 0.68	0.08 ± 0.04
"	371	"	498	"	50	9 ± 0.69	-----
"	374	"	409	"	50	11 ± 0.61	-----
"	379	"	510	"	50	10 ± 0.78	-----
"	381	"	376	Liver	17	11 ± 1.8	-----
"	"	"	"	Muscle	50	13 ± 0.81	0.09 ± 0.05
"	384	"	375	"	50	14 ± 0.64	-----
"	389	"	400	"	50	13 ± 1.4	-----
"	394	"	423	"	50	11 ± 0.69	0.07 ± 0.05
"	396	"	670	"	50	9.6 ± 0.49	0.12 ± 0.05
"	399	"	509	"	50	11 ± 0.73	-----
"	401	"	394	Liver	14	12 ± 1.1	0.13 ± 0.08
"	"	"	"	Muscle	50	12 ± 0.71	-----
"	518	"	483	"	50	13 ± 0.76	0.08 ± 0.05
"	524	"	395	"	50	12 ± 0.78	-----
"	527	"	378	"	50	12 ± 0.86	-----
"	538	"	480	"	50	9.5 ± 0.65	-----
"	540	"	429	Liver	12	11 ± 1.3	0.17 ± 0.10
"	"	"	"	Muscle	50	9.2 ± 0.60	-----

See footnotes at end of table, page 35

TABLE 10 (continued)

Collection Date	Specimen No.	Common Name	Fish Size (mm)	Tissue	Grams dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry) (2)		
						⁴⁰ K		¹³⁷ Cs
Sep 9, 1971	406	Pink	568	Muscle	50	15	± 0.75	0.10 ± 0.04
Nov 15 - 21, 1971 (3)	651	Sockeye	400	"	50	15	± 0.84	0.07 ± 0.05
"	653	"	370	"	50	14	± 0.64	-----
"	655	"	390	"	50	12	± 0.57	-----
"	659	"	390	"	50	12	± 0.77	-----
"	661	"	510	"	50	13	± 0.51	0.04 ± 0.03
"	663	"	470	"	50	13	± 0.56	0.08 ± 0.04

(1) With the exception of Chinook No. 391 (Pacific Ocean, 51°15.5'N 178°59.5'E) and Pink No. 406 (Kirilloff Bay), the fish mentioned in this table were caught in the area bounded by 179°22.5'E - 179°9.5'E longitude and 51°30.4'N - 51°35.2'N latitude in the Bering Sea.

(2) The error values are two sigma, propagated, counting errors for single samples.

(3) Post-Cannikin

TABLE 11
Iron-55 in Fish Collected at Amchitka Island, September-October 1970

Specimen No.	Collection Location	Species	Size (mm)	N*	Tissue	Iron-55 (pCi)	
						g dry	mg Fe
001	51°29'N 179°18'E	Halibut	220-465	26	Muscle Liver	0.117 2.48	12.7 13.4
046	Off C-Site	Halibut	442	1	Liver	2.44	12.4
064	Duck Cove	Greenling	166-205	13	Muscle Liver Kidney Gonad	0.39 15.3 16.6 3.17	17 30.6 35.4 10.2
069	" "	Greenling	220-260	15	Muscle Liver Gonad	0.25 2.02 16.2	9.8 4.8 88.5
075	" "	Greenling	260-300	15	Muscle Liver Kidney Gonad	0.52 14.9 9.01 17.9	16.8 18.4 24.8 44.7
081	" "	Greenling	305-363	12	Muscle Liver Kidney Gonad	0.55 4.51 7.76 11.1	14.1 6.84 22.4 30.7
082	" "	Rockfish	328-364	3	Muscle Liver Kidney	1.81 28.9 21.7	137 51.2 54.5
090	Constantine Harbor	Rockfish	215-280	8	Muscle Liver Kidney	1.85 12.4 20.8	187 37.8 69.6

See footnote at end of table, page 37

TABLE 11 (continued)

Specimen No.	Collection Location	Species	Size (mm)	N*	Tissue	Iron-55(pCi)	
						g dry	mg Fe
099	Silver Salmon Creek	Greenling	285-345	5	Muscle	2.06	0.93
					Liver	4.66	6.04
					Kidney	30	32.7
107	Square Bay	Dolly Varden	295-330	4	Muscle	1.64	101
					Liver	6.36	78.4
113	Duck Cove	Dolly Varden	215-360	18	Muscle	1.63	89.1
					Liver	3.11	---
121	" "	Pink Salmon	521	1	Liver	55	65.1
123	" "	Silver Salmon	709	1	Liver	21.1	83.8
129	Constantine Harbor	Sole	---	20	Muscle	1.69	188
135	"	Sole	165-220	26	Muscle	1.82	182
					Liver	1.41	4.95
					Kidney	16.1	45.7
					Gonad	23.2	516

* Number of fish in pooled sample

TABLE 12
Iron-55 in Canned Salmon from The 1971 Bristol Bay Pack

Specimen No.	Collection Location	Species	Iron-55 (pCi)	
			g dry*	mg Fe
411	Ugashik	Sockeye	0.97 ± 0.03	24.1 ± 0.74
412	"	"	0.90 ± 0.03	26.6 ± 0.85
413	Egegik	"	0.85 ± 0.04	24.2 ± 1.01
414	"	"	1.18 ± 0.03	26.5 ± 0.68
415	Naknek	"	0.61 ± 0.03	16.7 ± 0.83
416	"	"	1.02 ± 0.04	31.7 ± 1.20
417	"	Chum	1.30 ± 0.04	35.1 ± 1.13
418	"	"	1.23 ± 0.03	34.8 ± 0.008
419	Nushagak	Chinook	0.46 ± 0.02	15.2 ± 0.82
420	"	"	0.52 ± 0.03	23.6 ± 1.4
421	"	"	0.54 ± 0.03	23.7 ± 1.3
422	"	"	0.75 ± 0.07	24.3 ± 1.2
423	"	Sockeye	0.63 ± 0.03	18.9 ± 0.78
424	"	"	1.10 ± 0.03	25.2 ± 0.70
425	"	"	0.64 ± 0.03	19.7 ± 0.76
426	"	"	1.24 ± 0.04	26.8 ± 0.87
427	"	Chum	1.14 ± 0.03	26.5 ± 0.68
428	"	"	1.24 ± 0.03	37.0 ± 0.92
429	"	"	1.30 ± 0.03	36.1 ± 0.93
430	"	"	0.71 ± 0.03	21.9 ± 0.87
431	Togiak	Chinook	0.75 ± 0.03	26.2 ± 1.1
432	"	"	1.05 ± 0.03	28.4 ± 1.7
433	"	"	0.45 ± 0.02	20.8 ± 0.97
434	"	"	0.71 ± 0.03	20.6 ± 0.82
435	"	Sockeye	1.34 ± 0.04	34 ± 1.04
436	"	"	1.03 ± 0.03	32 ± 0.82
437	"	"	1.19 ± 0.03	35.6 ± 0.89
438	"	"	1.06 ± 0.03	33.7 ± 0.90
439	"	Chum	1.58 ± 0.04	32.4 ± 0.83
440	"	"	1.06 ± 0.03	30.3 ± 0.90
441	"	"	1.29 ± 0.04	33.3 ± 0.89
442	"	"	-----	-----

* Values corrected for decay to September 1, 1971

TABLE 13
Some Gamma-Emitting Radionuclides in Birds Collected at Amchitka Island

Specimen No.	Collection Date	Common Name	Tissue	Grams Dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry)*		
					^{40}K	^{60}Co	^{137}Cs
290	December 1970	Black Oyster Catcher	Muscle	42	11 $\pm$ 1.1	----	-----
			Liver	6	13 $\pm$ 4	----	-----
			Bone	26	2.5 $\pm$ 0.6	----	-----
			Feathers	--	----	----	-----
294	"	Rock Ptarmigan	Muscle	50	11 $\pm$ 1.2	----	0.25 $\pm$ 0.08
			Liver	3	----	----	-----
			Bone	13	2.7 $\pm$ 1.2	0.09 $\pm$ 0.08	0.19 $\pm$ 0.09
			Feathers	21	2.1 $\pm$ 1.5	0.30 $\pm$ 0.10	0.24 $\pm$ 0.13
298	"	Emperor Goose	Muscle	100	8.8 $\pm$ 0.6	0.08 $\pm$ 0.03	-----
			Liver	10	7.3 $\pm$ 2.5	----	-----
			Bone	60	3 $\pm$ 0.3	0.05 $\pm$ 0.02	-----
303	"	"	Muscle	100	9.5 $\pm$ 0.6	0.04 $\pm$ 0.03	-----
			Liver	21	7.5 $\pm$ 1.1	----	-----
			Bone	50	1.9 $\pm$ 0.6	----	-----
			Feathers	141	1.7 $\pm$ 0.2	----	0.04 $\pm$ 0.01
766	July 1971	Pigeon Guillemot	Muscle	28	12 $\pm$ 0.8	----	0.06 $\pm$ 0.06
			Liver	12	10 $\pm$ 1.5	0.2 $\pm$ 0.1	-----
			Feathers	26	2 $\pm$ 1	----	-----
791	June 1971	Herring Gull	Muscle	47	8.3 $\pm$ 0.6	----	0.09 $\pm$ 0.05
			Liver	14	7.6 $\pm$ 1.1	----	-----
793	April 1971	Rock Ptarmigan	Muscle	36	11 $\pm$ 0.7	----	1.20 $\pm$ 0.05
			Feathers	28	1.2 $\pm$ 0.7	0.10 $\pm$ 0.05	0.13 $\pm$ 0.06
795	"	"	Muscle	40	12 $\pm$ 0.6	----	1.70 $\pm$ 0.05
			Feathers	26	----	----	0.15 $\pm$ 0.05

See footnote at end of table, page 40

TABLE 13 (continued)

Specimen No.	Collection Date	Common Name	Tissue	Grams Dry Sample	Gamma-Emitting Radionuclides (pCi/g, dry)*		
					^{40}K	^{60}Co	^{137}Cs
800	April 1971	Rock Ptarmigan	Muscle	38	11 $\pm$ 0.7	----	0.96 $\pm$ 0.05
811	June 1971	Pigeon Guillemot	"	25	12 $\pm$ 0.9	----	0.09 $\pm$ 0.06
819	January 1971	Common Teal	"	16	15 $\pm$ 1	0.09 $\pm$ 0.07	0.48 $\pm$ 0.07

* The error values are two sigma, propagated, counting errors for single samples.

TABLE 14
Efficiency of Filter-Sorption Beds for Collection of $^{95}\text{Zr} + ^{95}\text{Nb}$
from Seawater And Pond Water at Amchitka Island, August 1971

Location	Liters Sampled	Filter-Sorption Beds (1) (pCi/Liter) (2)				Collection Efficiency of
		Bed A		Bed B		Al ₂ O ₃ (pCi/Liter) (2)
		Filter	Al ₂ O ₃	Filter	Al ₂ O ₃	(1-B/A) (3)
Constantine (3) Harbor Dock (Station 1)	1395	0.0038 ± 0.0016	0.052 ± 0.0074	Background	0.0094 ± 0.0050	0.82 ± 0.10
"	"	0.0038 ± 0.0012	0.044 ± 0.0080	"	0.0137 ± 0.0088	0.69 ± 0.21
51°27.6' North 179°13.0' East (Station 2)	1786	0.0044 ± 0.0014	0.064 ± 0.0048	"	0.024 ± 0.0064	0.63 ± 0.10
51°26.6' North 179°14.3' East (Station 3)	2832	0.0038 ± 0.0006	0.040 ± 0.0024	"	0.0171 ± 0.0036	0.57 ± 0.09
Long Shot Mud Pit 1	63	4.7 ± 0.10	Background	"	Background	-----

(1) Beds A and B were connected in series with the water flowing first through Bed A, then through Bed B.

(2) The error values are two sigma, propagated, counting errors for single samples.

(3) Samples collected the morning and afternoon of the same day.

TABLE 15
Gamma-Emitting Radionuclides in Samples Collected
with A Filter-Sorption Bed from Intertidal Areas

Location and Date	Liters Sampled	Fraction (2)	Gamma-Emitting Radionuclides (pCi/g/Liter) (1)			
			^{60}Co	^{65}Zn	$^{95}\text{Zr}+^{95}\text{Nb}$	^{110}mAg
Constantine Harbor						
September 17, 1970	2002	Part.	0.093 ± 0.003	0.128 ± 0.015	----	0.106 ± 0.004
" " "	"	Sol.	0.143 ± 0.009	1.181 ± 0.067	----	0.041 ± 0.013
" " "	"	Part.	0.024 ± 0.001	0.041 ± 0.005	----	0.030 ± 0.002
" " "	"	Sol.	0.054 ± 0.005	0.508 ± 0.030	0.034 ± 0.025	0.021 ± 0.010
February 12, 1971	2675	Part.	----	----	----	----
" " "	"	Sol.	----	----	----	----
" 14, "	2546	Part.	----	----	----	----
" " "	"	Sol.	----	----	----	----
May 20, 1971	950	Part.	----	----	0.007 ± 0.002	0.006 ± 0.003
" " "	"	Sol.	----	----	0.046 ± 0.014	----
" " "	"	Part.	----	----	0.013 ± 0.003	----
" " "	"	Sol.	----	0.005 ± 0.003	0.046 ± 0.013	----
August 14, 1971	1395	Part.	0.003 ± 0.001	----	0.004 ± 0.002	----
" " "	"	Sol.	0.007 ± 0.005	----	0.052 ± 0.007	----
" " "	"	Part.	0.001 ± 0.001	----	0.004 ± 0.001	----
" " "	"	Sol.	----	----	0.044 ± 0.008	----
November 3, 1971 (3)	5974	Part.	----	----	0.0007 ± 0.0006	----
" " "	"	Sol.	----	----	0.011 ± 0.004	----
December 2, 1971	524	Part.	----	----	----	----
" " "	"	Sol.	----	----	----	----
February 16, 1972	1190	Part.	----	----	0.007 ± 0.002	----
" " "	"	Sol.	----	----	----	----

See footnotes at end of table, page 44

TABLE 15 (continued)

Location and Date	Liters Sampled	Fraction (2)	Gamma-Emitting Radionuclides (pCi/g/Liter) (1)			
			^{60}Co	^{65}Zn	$^{95}\text{Zr}+^{95}\text{Nb}$	^{110}mAg
Constantine Harbor						
April 18, 1972	1520	Part.	----	0.006 ± 0.004	----	----
" " "	"	Sol.	----	0.004 ± 0.003	0.023 ± 0.021	----
Duck Cove						
May 21, 1971	931	Part.	----	----	0.026 ± 0.002	----
" " "	"	Sol.	----	----	----	----
November 4, 1971 (3)	391	Part.	----	----	----	----
" " "	"	Sol.	----	----	0.0005 ± 0.0005	----
November 9, 1971 (4)	420	Part.	----	----	----	----
" " "	"	Sol.	----	----	0.0007 ± 0.0007	----
December 3, 1971	380	Part.	----	----	----	----
" " "	"	Sol.	----	----	0.039 ± 0.035	----
February 17, 1972	353	Part.	----	----	0.040 ± 0.007	----
" " "	"	Sol.	----	----	----	----
April 14, 1972	513	Part.	----	0.018 ± 0.013	----	----
" " "	"	Sol.	----	----	----	----
IA-2						
November 9, 1971 (4)	566	Part.	----	0.023 ± 0.014	0.0012 ± 0.0010	----
" " "	"	Sol.	----	----	----	----
December 4, 1971	479	Part.	----	----	----	----
" " "	"	Sol.	----	0.039 ± 0.028	0.04 ± 0.03	----

See footnotes at end of table, page 44

TABLE 15 (continued)

Location and Date	Liters Sampled	Fraction (2)	Gamma-Emitting Radionuclides (pCi/g/Liter) (1)			
			^{60}Co	^{65}Zn	$^{95}\text{Zr}+^{95}\text{Nb}$	^{110}mAg
IA-2						
February 18, 1972	832	Part.	----	----	----	----
" " "	"	Sol.	----	----	----	----
April 20, 1972	589	Part.	----	----	0.030 ± 0.010	----
" " "	"	Sol.	----	----	----	----

(1) The error values are two sigma, propagated, counting errors for single samples.

(2) Particulate (Part.) - That portion retained by the 0.3 micron porosity filter.

Soluble (Sol.) - That portion which passes through the filter and is adsorbed by the Al_2O_3 .

(3) Pre-Cannikin

(4) Post-Cannikin

TABLE 16
Gamma-Emitting Radionuclides in Samples Collected with
A Filter-Sorption Bed from Lakes on Amchitka Island

Location and Date	Liters Sampled	Fraction (2)	Gamma-Emitting Radionuclides (pCi/Liter) (1)			
			^{60}Co	^{65}Zn	$^{95}\text{Zr} + ^{95}\text{Nb}$	^{137}Cs
Jones Lake						
February 15, 1971	152	Part.	-----	-----	0.30 ± 0.02	0.06 ± 0.01
" " "	"	Sol.	-----	-----	-----	-----
May 1971	266	Part.	-----	-----	0.20 ± 0.01	-----
" " "	"	Sol.	-----	-----	0.11 ± 0.03 (3)	-----
August 1971	76	Part.	-----	-----	0.34 ± 0.12	-----
" " "	"	Sol.	-----	-----	-----	-----
October 31, 1971	619	Part.	-----	0.02 ± 0.01	0.013 ± 0.005	0.03 ± 0.02
" " "	"	Sol.	0.02 ± 0.01	-----	0.02 ± 0.01	-----
December 2, 1971	277	Part.	-----	-----	0.03 ± 0.01	-----
" " "	"	Sol.	-----	-----	-----	-----
February 1972	109	Part.	0.02 ± 0.01	0.060 ± 0.045	0.13 ± 0.02	-----
" " "	"	Sol.	-----	-----	-----	-----
Lake DK-45						
November 1, 1971 (4)	201	Part.	-----	-----	0.16 ± 0.03	-----
" " "	"	Sol.	0.04 ± 0.01	-----	-----	-----
December 5, 1971	98	Part.	-----	-----	0.08 ± 0.03	-----
" " "	"	Sol.	-----	-----	-----	-----
February 19, 1972	375	Part.	-----	0.020 ± 0.018	0.097 ± 0.008	0.012 ± 0.010
" " "	"	Sol.	-----	-----	-----	-----

See footnotes at end of table, page 46

TABLE 16 (continued)

Location and Date	Liters Sampled	Fraction (2)	Gamma-Emitting Radionuclides (pCi/Liter) (1)			
			^{60}Co	^{65}Zn	$^{95}\text{Zr}+^{95}\text{Nb}$	^{137}Cs
Cannikin Lake						
April 21, 1972	10.5	Part.	----	----	----	----
" " "	"	Sol.	----	----	----	----

- (1) The error values are two sigma, propagated, counting errors for single samples.
- (2) Particulate (Part.) - That portion retained by the 0.3 micron porosity filter.
Soluble (Sol.) - That portion which passes through the filter and is adsorbed by the Al_2O_3 . Traces of ^{103}Ru , ^{106}Ru - ^{106}Rh , and ^{144}Ce - ^{144}Pr were identified in some samples from both lakes, but quantitative determinations have not been made.
- (3) The field notes say that there was a slight break in one of the millipore filters; hence, it is possible that particulate matter was trapped in the Al_2O_3 .
- (4) Pre-Cannikin

TABLE 17
Gamma-Emitting Radionuclides in Samples Collected
with A Filter-Sorption Bed from the Long
Shot Mud Pit 1 on Amchitka Island

Date	Liters Sampled	Fraction (2)	Gamma-Emitting Radionuclides (pCi/Liter) (1)			
			^{60}Co	^{65}Zn	$^{95}\text{Zr}-^{95}\text{Nb}$	^{137}Cs
September 1970	477	Part.	0.041 ± 0.004	0.067 ± 0.017	0.11 ± 0.01	0.018 ± 0.005
" "	"	Sol.	0.62 ± 0.14	----	----	----
February 15, 1971	832	Part.	----	----	0.045 ± 0.005	----
" " "	"	Sol.	----	----	----	----
May 1971	950	Part.	----	----	0.422 ± 0.009	----
" "	"	Sol.	----	----	0.02 ± 0.007	----
August 1971	63	Part.	----	----	4.70 ± 0.10	0.09 ± 0.06
" "	"	Sol.	----	----	----	----
" "	99	Part.	----	----	4.08 ± 0.15	----
" "	"	Sol.	----	----	----	----
October 31, 1971	89	Part.	----	----	0.72 ± 0.09	0.13 ± 0.09
" " "	"	Sol.	----	----	----	----
December 3, 1971	66	Part.	----	----	0.22 ± 0.04	----
" " "	"	Sol.	----	----	----	----
February 1972	125	Part.	----	----	0.24 ± 0.03	----
" "	"	Sol.	----	----	----	----

(1) The error values are two sigma, propagated, counting errors for single samples.

(2) Particulate (Part.) - That portion retained by the 0.3 micron porosity filter.
Soluble (Sol.) - That portion which passes through the filter and is adsorbed by the Al_2O_3 . Traces of ^{103}Ru , ^{106}Ru - ^{106}Rh , and ^{144}Ce - ^{144}Pr were identified in some samples, but quantitative determinations have not been made.

TABLE 18
Efficiency of the In Situ Probe And
Reproducibility of Measurements for
⁴⁰K (1) in Seawater Near
Amchitka Island, August 1971

Station No.	⁴⁰ K net c/m (2)	Salinity (3)	⁴⁰ K pCi/liter (4)	Efficiency c/m/pCi/liter
2	52.8 ± 0.6	33.6	311	0.170
3	52.9 ± 0.6	33.5	310	0.170
4	53.8 ± 0.6	33.5	310	0.174
5	53.0 ± 0.6	33.5	310	0.171
6	52.8 ± 0.6	33.4	310	0.170
7 (5)	50.6 ± 0.5	33.5	310	0.163
8	52.0 ± 0.5	33.4	310	0.168
9	53.2 ± 0.6	33.6	311	0.171
10	54.4 ± 0.6	33.6	311	0.175
11	52.8 ± 0.6	33.4	310	0.170
Avg ± SD	52.8 ± 1.0	33.5 ± 0.08	310 ± 0.7	0.170 ± 0.003

Counts at Station 1 (Constantine Harbor Boat Dock)

Date	Time Count Started	Minutes Counted	⁴⁰ K net c/m (1)
August 5, 1971	2115	525	54.2 ± 0.3
August 7, 1971	1650	780	54.1 ± 0.3
August 9, 1971	0650	730	54.9 ± 0.3
" " "	1907	672	53.8 ± 0.3
August 10, 1971	1755	180	54.8 ± 0.6
" " "	2055	180	54.9 ± 0.6
" " "	2355	180	55.0 ± 0.6
August 11, 1971	0255	180	54.8 ± 0.6
Avg ± SD	----	---	54.56 ± 0.46

- (1) No other radionuclides were detected.
- (2) The error values are one sigma counting errors for individual determinations.
- (3) Measured with an ST probe, parts per thousand.
- (4) Calculated from salinity values.
- (5) The spectrum was degraded because of an error in operation of the pulse height analyzer.

TABLE 19
Stations for In Situ Gamma-Spectrum
Measurements, Amchitka Island

Station No.	Date	Time Started	Water Depth (meters)	Gamma Probe Depth	Latitude N	Longitude E
1	(1)	(1)	----	12	----	----
2	August 6, 1971	0825	22	15	51°27.6'	179°13'
3	" " " (2)	1300	40	38	51°26.6'	179°14.3'
4	August 7, 1971 (3)	0800	57	46	51°7.1'	179°14'
5	" " " "	1215	64	55	51°27'	179°15.3'
6	August 8, 1971 (4)	0940	18	12	51°23.1'	179°8.5'
7	" " " "	1410	70	64	51°22.7'	179°6.9'
8	" " " "	1820	27	23	51°25.2'	179°4.3'
9	" " " "	2220	70	64	51°24'	179°3'
10	August 10, 1971	0825	25	21	51°29.2'	179°8.5'
11	" " " "	1245	27	24	51°30'	179°6.5'

(1) Gamma counts were made on August 5, 7, 9, and 10, 1971. See Table 18 for information.

(2) Strong offshore current; cable angle on ST probe 45°-60°.

(3) Very strong offshore current; could not keep ST probe down.

(4) ST probe angle 30°-50°.

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