LONG-RANGE MONITORING NETWORK FOR AMCHITKA ISLAND, ALASKA

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ABSTRACT

A long-range monitoring network is recommended for nuclear testing on Amchitka Island, Alaska. This network is designed to verify that no radioactivity produced by underground nuclear explosions on Amchitka reaches surface or ocean waters.

Details of the network are presented relative to the individual testing sites where nuclear events have been executed or are anticipated. The network presently includes the Long Shot and Milrow sites. Details of the portion of the network at the Cannikin site cannot be finalized until after the event. It is believed that this portion of the network will be similar to the portion covering Milrow.

LONG-RANGE MONITORING NETWORK FOR AMCHITKA ISLAND, ALASKA¹

I. INTRODUCTION

Teledyne Isotopes has established a series of water sampling stations on Amchitka Island, Alaska. These stations are grouped into three networks established to: 1) determine background levels of radioactivity in surface waters and ocean waters near proposed test sites, 2) verify that no radioactivity produced by underground nuclear explosions on Amchitka reaches surface or ocean waters, and 3) provide long-range monitoring.

This report describes the three existing networks, i.e., Background, Long Shot, and Milrow. A sampling network for the Cannikin event is recommended. Specific portions of each sampling network are considered in the design of a Long Range Monitoring network for Amchitka Island, Alaska.

11. DESCRIPTION OF NETWORKS

A. Background Network. Sampling from this network began in September 1966 with several Long Shot samples, and then was expanded to include other sites starting June 1967. Sampling stations were established at sites B, C, D, E, and F, and included shoreline seeps, ocean water, ponds, and springs. A description of the network and results of radiochemical analyses are presented in NVO-1229-121.² Figure 1 shows the locations of the various test sites on Amchitka Island.

¹ The contents of this report were presented by P. R. Fenske to the AEC Panel of Safety Consultants at the January 12 - 13, 1971, meeting in Las Vegas, Nevada.

² Essington, E. H., Forslow, E. J., Castagnola, D. C. 1970 "Interim Summary of Radiochemical Data for STS "A", Amchitka Island, Alaska, Through June 30, 1969. NVO-1229-121.

Figure 1. Location of various test sites on Amchitka Island, Alaska.

B. Long Shot Network. A close-in surveillance network and an ocean ,network were established specifically for the area near Long Shot after the Milrow event. Figure 2 shows a portion of the surveillance sampling network close to ground zero. Those stations encircled represent the sampling stations recommended for retention as part of the long-range monitoring network. Figure 3 shows the remainder of the stream, seep, shoreline sea water and ocean sampling stations established for Long Shot. **All** of these stations should be considered part of the long-range monitoring network.

The Long Shot monitoring network would include:

3	shoreline seeps
8	shoreline sea water
6	ocean
3	stream
6	ground zero stations (ponds and shallow wells)

A list of the stations is shown in Table 1.

C. Milrow Network. A close-in surveillance network was started about two weeks after the Milrow event. Ponds, seeps, and streams were sampled including shallow wells in peat. Where no standing water could be collected, cores of peat were taken, from which water was extracted for tritium determinations.

Care was taken to locate sampling stations near topographic features where the first appearance of explosion radionuclides would be most likely to occur. Sampling stations are located inside and outside of the collapse zone. Figure 4 shows the location of sampling stations established for Milrow. The stations encircled are those recommended for inclusion as part of the long-range monitoring network

Figure 2. Sampling stations close to Long Shot ground-zero.

Figure 3, Ocean, shoreline, and stream sampling stations for Long Shot.

TABLE 1

LONG SHOT MONITORING STATIONS

<u>Station Type</u>	<u>Station Name</u>	<u>UTM Coordinates</u>	
		<u>Meters-N</u>	<u>Meters-E</u>
Shoreline Seeps	SEEP-3	5701700	652500
	SEEP-4	5701800	653100
	SEEP-5	5700900	654080
Shoreline Sea Water	SEA-1	5703600	652300
	SEA-6	5701798	652959
	SEA-7	5700871	654014
	F-11	5701788	652592
	F-15	5702425	652204
	F-16	5702775	652541
	F-19	5701090	654104
	F-2 1	5703413	652134
Ocean*	F-2 8	5701521	654032
	F-2 9	5702104	652853
	F-3 0	5702138	654013
	F-3 1	5702894	653408
	F-3 2	5703179	652587
	5 1	5702210	654359
Stream	STREAM-A7	5700450	651963
	STREAM-A8	5701350	652288
	STREAM-A9	5701625	651425
Ground Zero	WELL-WL1	5700572	651687
	WELL-WL2	5700499	651691
	DITCH-A2	5700500	651750
	MUDPIT-A3	5700580	651650
	POND-A4	5700600	651500
	POND-A5	5700500	651500

*_____

Refer to Table 5 for latitude/longitude.

Figure 4. Sampling stations close to Milrow ground-zero.

for Milrow. Shoreline and ocean water sampling stations were also established. These are shown in Figure 5, with some of the more distant land-based sampling stations. **All** stations shown in Figure 5 except B-5 and B-20 should be sampled as part of the long-range surveillance network.

The Milrow monitoring network should include:

1	shoreline seep
15	shoreline sea water
18	ocean
3	stream
10	ground zero stations (ponds, seeps, shallow wells, and streams).

A list of the Milrow long-range monitoring network sampling stations is shown in Table 2.

D. Cannikin Network. The post-Cannikin network should be designed similar to the Milrow network. Review of film clips, photographs, and on-site inspection will be necessary to determine the location and numbers of sampling stations needed. However, the ocean portion of the network may be generally similar to that established for Milrow.

The Cannikin surveillance and monitoring network should include:

2	shoreline seeps
12-14	shoreline sea water
15-20	ocean
4	stream
10-15	ground zero stations

Figure 5. Ocean, shoreline, and stream sampling stations for Milrow.

TABLE 2

MILROW MONITORING STATIONS

<u>Station Type</u>	<u>Station Name</u>	<u>UTM Coordinates</u>	
		<u>Meters-N</u>	<u>Meters-E:</u>
Shoreline Seeps	SEEP-2	5698300	649400
		PACIFIC OCEAN	
Shoreline Sea Water	F-4	5696010	651652
	F-5	5696178	651066
	F-6	5696175	650950
	SEA-4	5696389	650866
	F-7	5696949	651003
	F-8	5697122	650571
	F-9	5697457	650406
	F-10	5697891	650431
	F-12	5698094	649960
	F-13	5698258	649258
	F-14	5698336	648733
		BERING SEA	
	F-20	5699948	654159
	SEA-11	5699254	654743
	SEA-12	5698242	655026
	SEA-13	5697883	655425
		PACIFIC OCEAN	
Ocean*	17	5693958	649162
	18	5695506	648184
	19	56969.10	648604
	20	5696680	648008
	F-27	5698084	647522
	I	5695409	651187
	J	5695574	650504
	K	5696258	649554
	L	5697376	649751
		BERING SEA	
	52	5701386	656824
	53	5700407	657164
	54	5698528	656333
	55	5699411	659034
	F-33	5700018	655493
	F-34	5699116	656353
	F-35	5699141	657204
	F-36	5698476	655619
	F-37	5698239	657020

*

Refer to Table 5 for latitude/longitude.

TABLE 2 (Continued)

<u>Station Type</u>	<u>Station Name</u>	<u>UTM Coordinates</u>	
		<u>Meters-N</u>	<u>Meters-E</u>
Stream	STREAM-B16	5696850	651150
	STREAM-B17	5697975	650500
	STREAM-B2 1	5698775	653875
Ground Zero	POND-B1	5697625	652150
	POND-B2	5698436	651800
	POND-B3	5698297	651622
	POND-B11	5698574	651851
	WELL-W11	5698324	651686
	WELL-W13	5697894	651815
	WELL-W17	5698073	651884
	SEEP-B13	5698028	651766
	STREAM-B6	5697906	651748
	POND-B15	5697994	651562

Once established, the Cannikin network should be modified to reduce the number of stations to be included in the long-range monitoring network. This modification is expected to take place about D + 1 year, drawing on data and other observations taken during the sampling and analyses period.

111. REFERENCE STATIONS

Reference for all sites is provided by the pond and shallow wells at A site and E site, an additional four stations, and the three ocean background stations off D site in the Pacific. These are listed in Table 3.

IV. SAMPLING SCHEDULE

Table 4 shows the recommended sampling schedule. Just prior to Cannikin, samples should be collected from all long-range monitoring stations at Long Shot and Milrow, the background stations at Site C and the reference stations. Just after Cannikin the new post-Cannikin stations near ground zero and along the Pacific and Bering shorelines should be established and sampled. When time permits during the first 2 - 3 weeks after Cannikin, the land-based portion of the Long Shot and Milrow networks should be sampled. During the first 2 - 3 weeks after Cannikin, field observations and photographs would be used to establish likely positions for ocean stations. These would be set up and sampled about four weeks after Cannikin. During the sampling period at D + 4 weeks, all established long-range monitoring stations should be sampled. After D + 64 weeks the full network should be sampled once each year.

TABLE 3

REFERENCE STATIONS

<u>Station Type</u>	<u>Station Name</u>	<u>UTM Coordinates</u>	
		<u>Meters-N</u>	<u>Meters-E</u>
Ocean	23	*	*
	24	*	*
	25	*	*
Land	POND-E3	5712500	636200
	WELL-W20	5712650	636200
	POND-AA1	5695186	663162
	WELL-W21	5695390	663120

Latitude and longitude coordinates are given in Table 5.

V. SAMPLING PROCEDURES

Procedures for collection of land-based samples are described in NVO-1229-121.

The sampling procedures and necessary equipment specified in the following paragraphs are for collection of samples from ocean locations. These locations must be reached by a small seaworthy craft with shallow draft, capable of operating within 0.1 mile of the shore and out to about 4 - 5 miles from shore.

The program calls for samples to be collected according to the schedule in Table 4 and yearly thereafter. Figure 6 shows the location of the ocean sampling points for Milrow, Long Shot, and background, and are grouped according to location. Table 5 lists sampling stations for each of these groups.

Every effort should be made to take successive samples from as near as possible to the exact locations listed in Table 5 and those finally established for Cannikin. Sample stations within about one mile of shore should be within 25 meters of the stated location, and those in excess of one mile should be within about 100 meters. Note that while every effort should be made to re-occupy the exact location, it is better to know with precision the point where the actual sample is taken.

A small vessel is not likely to be equipped with adequate navigation equipment, so that auxiliary means must be utilized. Station location can be made by land-based radio beacons or visual sightings. During the June 1970 sampling there were sufficient clear days to complete the program within several days. At that time, boat positions were verified by a land-based surveying party. The best system for

TABLE 4

SAMPLING SCHEDULE CALENDAR

D - 2 weeks	Cannikin site background stations, Milrow/Long Shot monitoring stations
D	Cannikin Event
D+ 1 (2)	Set up sampling stations around Cannikin GZ. Collect first samples from all Cannikin stations and all land and shoreline monitoring stations
D+ 4	All stations
D+ 8	Cannikin land/shoreline stations
D+ 16	All stations
D+ 32	Cannikin land/shoreline stations
D+ 64	All stations

Once every year thereafter - all stations.

Figure 6. Ocean sampling station grouping.

TABLE 5
OCEAN SAMPLING STATIONS

<u>General Area</u>	<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Sampling Depths</u> [*] (meters)
MILROW PACIFIC (Group-1)	I	51°23'30"	179°10'23"	1,(6)
	J	51 23 36	179 09 48	1,(15)
	K	51 23 59	179 09 00	1,20
	L	51 24 35	179 09 12	1,(8)
	F-27	51 25 00	179 07 18	1,(8)
	17	51 22 45	179 08 36	1,20,40,(60)
	18	51 23 36	179 07 48	1,(24)
	19	51 24 21	179 08 12	1,(24)
	20	51 24 18	179 07 41	1,20,(30)
	9 stations 21 samples			
D-SITE PACIFIC (Group-2)	23	51°29'08"	179°00'47"	1,20,(34)
	24	51 28 25	178 59 45	1,20,(40)
	25	51 27 27	178 58 18	1,20,40,(90)
	3 stations 10 samples			
MILROW BERING (Group-3)	F-33	51°25'55"	179°14'13"	1,b
	F-34	51 25 25	179 14 56	1,b
	F-35	51 25 25	179 15 40	1,b
	F-36	51 25 05	179 14 17	1,b
	F-37	51 24 56	179 15 29	1,b
	52	51 26 38	179 15 24	1,20,40,(78)
	53	51 26 06	179 15 40	1,20,40,(66)
	54	51 25 06	179 14 54	1,(30)
	55	51 25 32	179 17 15	1,20,40,(80)
	9 stations 24 samples			
LONG SHOT BERING (Group-4)	F-28	51°26'45"	179°13'00"	1,b
	F-29	51 27 05	179 12 00	1,b
	F-30	51 27 05	179 13 00	1,b
	F-31	51 27 30	179 12 30	1,b
	F-32	51 27 40	179 11 48	1,b
	51	51 27 07	179 13 18	1,20,(34)
6 stations 13 samples				

*

Value in parenthesis is approximate depth to bottom also to be sampled.
b = bottom not previously determined.

the adverse conditions encountered at Amchitka ~~is~~ the portable Radist Navigation equipment manufactured by Teledyne Hastings-Radist. Use of this equipment would require surveying and construction of small permanent footings at several points along each shore adjacent to the sampling nets. During operation, shore units would be placed on these footings to serve as reference points for the boat unit.

For each of the ocean stations, two or more samples should be collected. The near-surface sample would be collected from a depth of about one meter, and the near-bottom sample within about one meter of the bottom. Where noted in Table 5 that the ocean floor is below 20 to 40 meters, additional intermediate samples should be collected from depths of 20 and 40 meters. In certain instances, to be noted prior to each sample run, multiple samples may be required from specific sampling points and depths. Subsurface samples can be collected by means of a modified Van Dorn bottle or equivalent. Near-surface samples may be collected by bucket or the modified Van Dorn bottle. The sampler can be lowered with a winch and gasoline powered generator acquired by AEC specifically for this program. These **units** have been installed on the Amchitka 23' inboard-outboard boat.

At the time and point of collection, temperatures and salinity values should be determined. Any small unit to measure salinity, temperature, and depth (STD) can be used, or salinity may be measured in the laboratory if such unit is unavailable. Temperatures of the surface water may be read by thermometer at the time of sampling. The small STD unit offered by CM² is ideal for the Amchitka work. The sensor may be attached to the sampler for precise measurement of temperature, salinity, and depth as the sample is collected.

During any sampling run, all samples must be taken within the shortest possible time span. Because of weather and logistics problems,

there may be delays in the sampling, but a strong effort should be made to complete the sampling within about two weeks.

One-quart amber glass bottles (or equivalent) can be used for the sampling effort. All surfaces of sampling gear in contact with the sample must be thoroughly washed with water from the sampling point before obtaining the sample. This includes the sample bottle and cap and any funnel used to load the bottle.

The bottle containing the water sample is sealed with the cap, and a length of plastic 3/4-inch-wide electrician's tape is wrapped around the cap and bottle neck both to hold the cap in place and to provide an additional seal against leakage.

VI. DISCUSSION

To provide adequate coverage over the expected discharge zones, a large number of ocean samples are recommended for collection. Although all ocean samples should be analyzed, it may be necessary to reduce the number of analyses to about one-fifth, picking at random from each site one-fifth of the locations. Should any assay indicate upward trend in tritium radioactivity, additional samples from the current set must be assayed, plus samples from the same location collected during earlier excursions. Unless a capability is maintained to recognize such trends it would be advisable to analyze all samples collected.

Should radioactivity above background be found in any one of the land-based samples collected, additional samples must be analyzed to determine the point of origin of the radioactivity. Additional sampling stations may need to be installed to determine the extent of the release.

All ocean and shoreline sea water samples should be analyzed by "low-level gas counting techniques" as described in NVO-1229-121. All land-based samples can be analyzed by liquid scintillation counting and spot checked by low-level gas counting. Should a sample assay greater than about 300 T.U. by liquid scintillation counting, the level of tritium must be confirmed by low-level gas counting techniques. This procedure offers a means of screening samples by a technique just able to detect background levels of tritium for Amchitka.

Background tritium assays by low-level techniques gave a mean value of 140 T.U. $\pm$ 46 T.U. (1sigma). Three sigma will include 99.7 of the cases so that any low-level tritium assay above 278 T.U. would be suspect of representing non-background conditions.

The sampling networks described should not be considered final. As new information becomes available regarding ground-water discharge features, alteration of surface hydrologic environment, or as the needs of the AEC change, the networks should be reviewed for possible modification.