QUARTERLY TECHNICAL REPORT 83-B

on

Earthquake Monitoring of Eastern Washington and Northern Oregon

April 1 through June 30, 1983

Geophysics Program

University of Washington

Seattle, Washington

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
UNDER CONTRACT NO. EY-76-S-06-2225
TASK AGREEMENT NO. 39

and

THE U.S. NUCLEAR REGULATORY AGENCY
UNDER CONTRACT NO. NRC-04-81-177

Network Operations

During the second quarter of 1983, there have been further attempts to alleviate phone costs throughout the network by installing VHF radio links. Also, the post-winter field maintenance goes into full operation in spring to repair stations inaccessible during the winter.

Selected stations from the Salem,Oregon network, which had been turned off due to high phone costs were re-routed through radio links to a common phone connection in Washington eliminating interstate telephone costs. Although some of these stations were re-routed last fall, they failed soon after and were inaccessible during the winter. We added the VHO(Mt. Hebo) station to this net while doing repairs on the other sites. KMO,also in this northwest Oregon net, was repaired. It turned out to be a mal-functioning seismometer but was field repairable. This is an important station to have operating, since it is the only self-calibrating station in the area.

The eastern Oregon net was redesigned to repeat through Tygh Ridge and Gordon Butte to Augsperger. Scouting trips to this area with test equipment indicate this routing should work. Several of these stations have been put on at Gordon Butte. Gordon Butte will eventually be a connect point on the BPA microwave system.

Radio links in eastern Washington were improved by reducing RF dropouts and damage from grazing cattle,etc at all installations. The Stanwyck Corporation changed repairmen in May and although the new man is more than capable, he is not familiar with our equipment and therefore requires a little extra time to troubleshoot and repair the equipment. Training continues by telephone. Even though the new man is still learning, field service has been reduced other than normal maintenance and trouble spots like Chelan Butte.

We have had minimal problems with the SLU VCO's which have been installed. Also there have been no problems with the Monitron radios. The pre-amps and voltage converters have improved the quality of the data. Most stations in eastern Washington which were inaccessible during the winter have been repaired.

Data

There were 109 events processed by the network in the Eastern Washington - Northern Oregon region. Of these 39 were known or suspected blasts and 70 were earthquakes. Five of the earthquakes were handpicked from film records because they were missed by the on-line computer system. Table I is the event catalog for this quarter and figures 1-4 show the epicenters for earthquakes separate from blasts in the two areas of interest.

The largest magnitude earthquake was a M=3.0 which occurred on 25 April at 7:48 PST in northeastern Washington near Riverside. There were no felt reports from this earthquake. Seismicity in the Columbia Basin increased over last quarter to levels more characteristic of seismicity over the past few years. The cluster of activity near Lake Chelan continued at a similar rate to the past year's activity.

Only five events were located in northern Oregon this quarter. This is most likely due to the large number of station outages in that region.

Borehole Seismology

During the second quarter of 1983,work continued on the development of computer software to improve the processing of downhole data. Ray tracing and synthetic seismogram programs are being written for the buried source - buried receiver geometry. Two parallel software packages are being developed; one using generalized ray theory(GRT), and a second using asymptotic ray theory(ART). The ART package, which is a modification of an existing Cerveny(1974) program, will allow computation of complex problems(2-D geometries) with reasonable accuracy.

The GRT program is limited to one dimensional models and calculates the full elastic response of the model. The advantage of having the two downhole software packages is that the ART can provide 'quick look' capabilities while the GRT package provides a precise calculation.

Program development also continued for the processing of the VSP data for the Hanford area. A VSP profile is scheduled for this summer in DC7-8. Both seismic velocity and amplitude are being utilized in the inversion programming. Attentuation measurements are a primary goal of the experiment.

CATALOG

Apr 1983

DAY	TIME	SEC	LAT	LON	DEPTH	MAG	NS/NP	RMS	Q	MODEL	TYPE
1	1: 6	60.52	46 13.83	122 37.40	10.31#	1.9	25/35	0.21	BB	P1	
1	1:51	14.03	46 11.21	122 18.72	10.43	-0.2	17/23	0.24	BB	S1	
4	10:15	56.70	46 17.38	123 14.13	22.92	1.4	27/30	0.19	AC	P1	
4	20:37	47.20	46 22.77	122 30.24	0.05*	1.0	17/18	0.20	BC	S1	
4	23:51	58.98	46 4.96	122 29.69	0.09*	1.4	25/30	0.20	BC	S1	
6	0:41	57.52	47 42.85	121 26.82	7.09	1.5	4/06	0.09	BD	P1	H
6	12: 7	46.12	47 45.01	120 0.15	0.07*	2.2	21/22	0.55	CB	N1	
8	1:10	21.44	47 39.91	120 7.11	10.28	0.6	5/09	0.14	BD	N1	
12	3:43	44.21	47 32.08	120 39.05	0.32#	1.7	19/22	0.28	BC	N1	
12	21:18	20.12	46 33.43	118 43.54	0.08*	2.0	6/09	0.65	DD	E1	H
13	0:24	57.43	47 31.92	120 39.26	6.93	1.8	8/13	0.29	BC	N1	H
13	16:38	44.67	46 2.98	118 15.29	0.03*	2.6	16/16	0.89	DD	E1	
13	23:44	42.25	48 52.00	120 50.29	11.04	2.2	6/10	0.57	DD	C1	
17	21:58	31.93	46 25.81	122 22.47	9.19	1.4	10/17	0.08	AB	S1	
19	6:25	34.32	46 30.75	121 24.34	0.08*	0.9	19/21	0.20	BC	C1	
19	8: 3	43.59	46 25.72	122 28.34	19.31	0.4	12/20	0.16	BB	S1	
19	21:10	27.26	46 14.08	122 28.88	0.08*	1.4	15/20	0.10	AC	S1	X
20	20:55	39.48	46 8.01	122 34.65	0.07*	1.6	25/31	0.24	BC	S1	P
22	0:23	19.68	46 26.13	122 23.72	15.02	1.1	11/18	0.16	AA	S1	
22	11:31	61.58	46 23.50	119 33.63	18.69	1.3	9/11	0.11	AB	E1	
24	1:42	36.29	46 17.35	119 30.17	7.20	1.3	9/11	0.20	BC	E1	
24	13:20	37.26	46 31.63	121 24.38	3.87*	2.7	45/46	0.19	BC	C1	
24	14:37	50.39	46 30.73	121 23.29	1.10	0.7	5/07	0.15	BD	C1	
25	12:11	27.58	46 50.53	119 43.40	1.02	0.9	5/07	0.04	AD	E1	

25	15:48	20.30	48 38.35	119 35.04	0.04*	3.0	7/09	0.29	DD	N1	
26	19:20	23.06	46 31.09	121 24.71	5.67$	0.9	22/25	0.49	BC	C1	
27	8:57	46.87	45 41.16	122 48.58	18.13	2.1	24/26	0.19	BC	P1	
27	20:15	-2.15	48 8.97	118 13.50	0. *	2.2	13/16	0.60	DD	N1	P
27	20:45	50.80	46 8.85	122 27.66	0.04*	1.3	14/18	0.26	BB	S1	P
27	22:21	58.14	46 13.01	122 19.66	0.34	1.4	19/19	0.14	BA	S1	P
28	17:45	48.84	48 11.18	121 23.53	2.46	2.0	8/09	0.13	AC	C1	
30	22: 1	9.52	46 59.84	121 29.27	5.54	1.6	13/18	0.25	BC	C1	

May 1983

DAY	TIME	SEC	LAT	LON	DEPTH	MAG	NS/NP	RMS	Q	MODEL	TYPE
2	21:24	22.35	46 5.66	119 35.21	0.07*	2.0	8/08	0.26	CD	E1	P
3	19:21	51.43	46 6.61	119 34.36	0.08*	1.7	8/08	0.24	DD	E1	P
6	2:47	50.79	46 37.61	120 27.38	8.00	2.1	16/17	0.36	BB	C1	
9	1:34	17.12	47 0.10	121 29.26	5.68	2.0	17/23	0.30	BC	C1	
9	10:19	50.42	46 48.91	119 25.46	0.06*	2.0	23/27	0.32	BA	E1	
9	13: 2	25.76	46 16.03	122 26.83	15.71	0.4	10/16	0.13	AB	S1	
10	0:27	47.76	45 59.00	122 9.32	9.26	0.5	5/08	0.09	AD	S1	P
10	6: 7	-3.19	46 29.85	122 43.54	20.30$	0.4	14/22	0.32	BC	P1	
10	18:39	41.11	46 16.24	122 22.27	0.75	0.3	17/21	0.18	BA	S1	P
10	18:59	23.05	48 36.24	119 28.12	4.70	1.9	5/08	0.15	BD	N1	
10	22:36	16.69	48 17.41	121 25.64	1.72	1.5	10/13	0.47	BD	P1	P

May 1983

DAY	TIME	SEC	LAT	LON	DEPTH	MAG	NS/NP	RMS	Q	MODEL	TYPE
11	20:20	27.14	45 39.07	122 49.66	0.05*	2.6	24/26	0.24	BC	P1	
12	6:33	-1.21	48 40.49	119 30.83	0.06*	1.7	7/10	0.56	DD	N1	
12	8:59	42.73	46 40.14	120 55.38	6.32	1.7	14/17	0.16	BC	C1	
12	19:39	43.62	47 41.47	120 16.95	0.47#	1.8	9/13	0.24	BB	N1	
13	0: 7	19.09	46 5.87	119 35.68	0.10*	2.0	6/06	0.45	DD	E1	P
13	19: 0	8.12	45 54.19	119 58.95	0.04*	2.3	24/24	0.47	CC	E1	P
13	22: 4	67.08	46 14.16	122 18.61	1.29	1.2	18/25	0.18	AB	S1	X
14	22:26	55.98	46 23.33	122 23.87	16.91	0.2	13/17	0.09	AA	S1	
16	11:47	45.33	46 49.47	119 21.32	0.07*	2.7	29/30	0.39	BA	E1	
16	19:28	48.47	46 48.95	119 21.70	0.05*	0.8	6/08	0.06	AC	E1	
17	3:46	44.02	46 30.81	121 19.73	8.29	0.8	6/07	0.27	DD	C1	
17	15:27	75.04	46 9.74	122 23.74	10.14	1.0	24/31	0.27	BA	S1	
18	20:32	28.82	48 11.56	121 25.07	3.03	1.4	9/10	0.35	CC	P1	P
19	1:26	32.04	46 11.22	122 27.37	14.42	0.3	13/20	0.15	AB	S1	
19	11:18	12.99	46 49.00	119 25.33	3.19	0.4	6/10	0.22	BC	E1	
19	20:12	47.02	45 57.92	122 49.57	0.02*	2.0	4/05	0.05	CD	S1	H
21	1:11	15.01	47 17.17	121 26.05	10.00$	2.8	46/48	0.28	BB	C1	
21	2:56	71.16	46 49.14	119 21.55	0.37	0.5	8/12	0.15	BB	E1	
21	7: 8	59.13	46 18.02	122 18.75	9.24	1.9	26/33	0.15	AA	S1	
21	19:16	22.81	46 17.77	122 19.14	10.53	0.6	19/24	0.13	AA	S1	
24	21:58	39.82	45 58.35	122 8.46	7.37	0.6	5/06	0.08	AD	S1	P
25	9:40	21.60	48 21.72	121 19.95	6.17$	2.4	19/20	0.85	DC	P1	
26	0: 4	58.55	45 46.87	122 15.94	5.35	2.0	17/18	0.18	AC	C1	P
26	0: 5	-1.60	45 45.82	122 16.75	12.40$	2.1	6/09	0.24	CD	P1	H
26	2:30	33.68	46 0.99	119 16.76	0.09*	1.5	7/07	0.14	BC	E1	

26	8:22	64.04	46 50.02	119 21.37	0.10*	0.8	6/07	0.06	AD	E1	
27	0: 8	44.96	45 59.13	122 6.73	0.06*	0.5	5/06	0.21	CD	S1	P
27	21:22	62.83	46 16.46	122 25.14	16.79	0.1	10/16	0.14	AC	S1	
29	13:47	38.92	47 1.43	120 54.67	9.34	1.6	20/24	0.24	AC	C1	

June 1983

DAY	TIME	SEC	LAT	LON	DEPTH	MAG	NS/NP	RMS	Q	MODEL	TYPE
1	23:22	48.46	46 6.93	119 33.28	0.07*	1.7	10/10	0.15	CC	E1	X
3	3:46	5.01	46 13.61	119 2.09	0.04*	1.5	5/06	0.75	DD	E1	
4	17: 3	59.62	46 49.45	119 33.40	0.84*	0.6	5/09	0.10	AD	E1	
4	21:11	68.71	46 49.51	119 33.24	0.62$	0.8	5/08	0.14	BD	E1	
5	1:41	-2.25	44 49.30	120 29.21	0.04#	2.4	10/13	1.40	DD	E1	
6	16:43	53.90	45 33.37	122 47.50	9.76	2.1	19/26	0.16	AD	P1	
6	22:49	69.67	46 11.23	121 54.83	1.96	1.4	17/21	0.17	BD	S1	P
7	22:56	29.37	46 5.87	119 34.88	0.05*	1.8	14/14	0.36	CC	E1	P
9	19:16	6.27	46 53.18	120 46.20	15.45	1.3	7/10	0.20	BB	C1	
9	19:44	63.16	47 19.10	121 20.09	1.67	1.8	21/24	0.30	BC	C1	
10	18:16	72.81	46 13.02	122 21.18	0.09*	0.8	13/16	0.17	AC	S1	P
10	18:19	67.95	47 39.77	120 16.73	3.77	2.7	25/27	0.35	BA	N1	
10	21:26	18.67	48 5.88	118 58.65	0.08*	2.6	16/17	0.28	BC	N1	X
10	22:53	49.04	46 4.48	119 37.54	0.08*	1.7	7/09	0.53	CD	E1	X
12	9:27	33.76	46 31.83	121 24.60	10.61$	0.3	4/06	0.36	DD	C1	
14	16:14	34.59	47 53.27	121 27.42	4.64$	1.5	11/13	0.29	BC	P1	
14	21:11	56.42	47 32.57	118 47.71	0.09*	2.6	20/21	0.61	BC	N1	P
14	23:14	17.94	45 46.12	122 21.88	6.78	2.0	24/25	0.32	BC	C1	P
15	22:18	44.05	46 12.71	122 20.38	0.30	0.5	12/14	0.14	AB	S1	X

June 1983

DAY	TIME	SEC	LAT	LON	DEPTH	MAG	NS/NP	RMS	Q	MODEL	TYPE
16	18:55	50.47	47 52.84	118 7.02	0.07*	0.9	10/10	0.42	CD	N1	X
17	22:28	44.91	46 7.11	119 38.41	14.70	2.0	7/07	0.54	DD	E1	X
17	23: 9	19.58	48 5.59	118 58.69	0.09*	2.8	17/19	0.30	BC	N1	X
19	21:47	64.44	47 32.04	120 38.51	2.62	1.4	17/20	0.26	BC	N1	
21	5:21	30.15	46 31.04	121 23.80	1.09	1.0	10/12	0.27	BD	C1	
21	16:46	-4.55	45 54.03	119 58.22	0.05*	2.0	17/17	0.40	CC	E1	P
22	22: 5	15.50	46 11.93	122 19.94	0.06*	0.5	12/16	0.18	BB	S1	X
22	22:21	65.99	46 6.89	119 39.80	0.06*	1.7	6/07	0.49	DD	E1	X
23	7:13	65.75	46 42.15	121 29.34	0.64*	0.9	6/09	0.16	BC	C1	
23	18:14	16.57	48 9.68	118 16.69	0.07*	2.0	8/11	0.60	DD	N1	P
23	23:40	58.32	47 58.15	118 56.78	5.06	1.3	7/09	0.28	BD	N1	P
24	20:32	60.55	46 11.97	122 19.78	0.26	0.6	13/14	0.23	BB	S1	X
24	20:43	10.05	45 45.68	122 21.36	8.57	1.9	16/18	0.24	BC	C1	P
25	23:27	60.53	47 39.70	120 17.08	4.52	1.2	5/08	0.17	BD	N1	
26	9:16	70.06	46 21.10	121 52.57	12.51	1.8	22/28	0.12	AC	C1	
27	17:18	3.25	47 54.61	118 7.48	0.04*	1.5	18/18	0.77	DD	N1	X
28	20:33	8.60	47 11.56	119 14.51	4.68	1.2	8/09	0.34	CC	E1	P
28	23: 1	7.63	46 4.01	119 35.11	0.04*	1.8	13/13	0.40	DD	E1	X

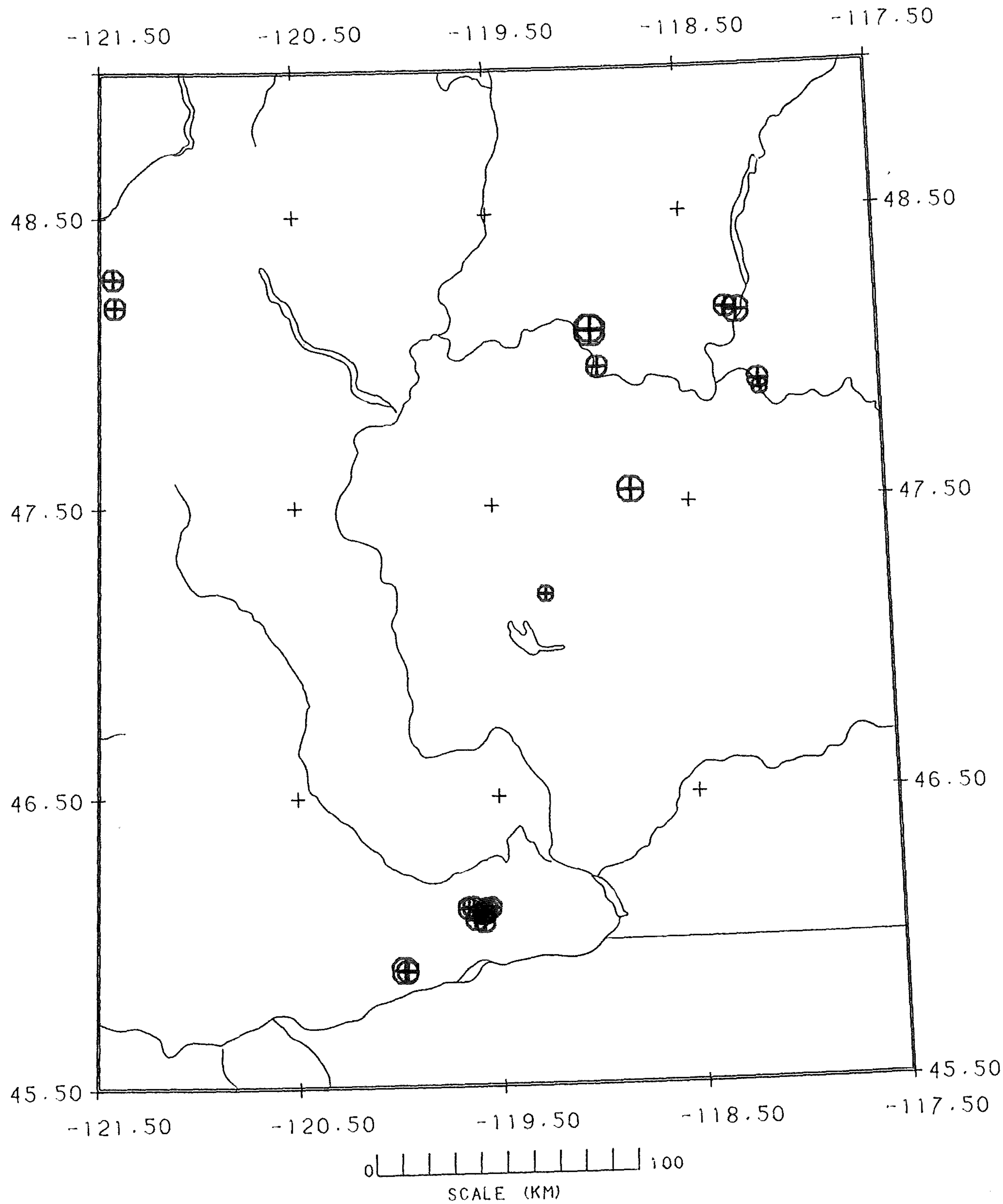

Figure 1. Eastern Washington known or probable explosions Apr-Jun 1983.