

Spreadsheet Formulas for the Wilcoxon Rank Sum Test and Power Calculation

Wilcoxon Rank Sum Test, per NUREG-1505

13.3 (For this calculation, LBGR = 3w for 2002 Igloo Background)

(Reference Dataset - 2002 Igloo Alpha Phoswich)

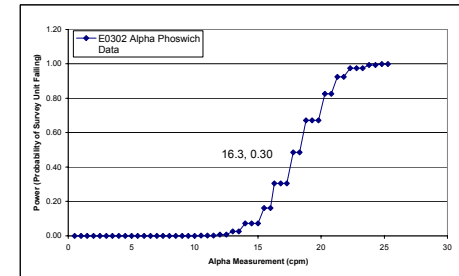
DATA	AREA	ADJUSTED DATA	RANKS	SURVEY AREA RANKS
13	R	13	167.5	C
17	R	17	176	C
12	R	12	165	C
4	R	4	133	C
18	R	18	177	C
9	R	9	159	C
8	R	8	156	C
16	R	16	174.5	C
4	R	4	133	C
7	R	7	153.5	C
4	R	4	133	C
9	R	9	159	C
14	R	14	169.5	C
5	R	5	143.5	C
14	R	14	169.5	C
12	R	12	165	C
16	R	16	174.5	C
11	R	11	162.5	C
15	R	15	172	C
6	R	6	151	C
5	R	5	143.5	C
4	R	4	133	C
1	R	1	59.5	C
9	R	9	159	C
12	R	12	165	C
15	R	15	172	C
15	R	15	172	C
6	R	6	151	C
11	R	11	160	C
8	R	8	156	C
3	R	3	114.5	C
3	R	3	114.5	C
3	R	3	114.5	C
4	R	4	133	C
6	R	6	151	C
11	R	11	162.5	C
5	R	5	143.5	C
5	R	5	143.5	C
3	R	3	114.5	C
2	R	2	86	C
3	R	3	114.5	C
4	R	4	133	C
4	R	4	133	C
5	R	5	143.5	C
3	R	3	114.5	C
5	R	5	143.5	C
2	R	2	86	C
2	R	2	86	C
5	R	5	143.5	C
2	R	2	86	C
5	R	5	143.5	C
5	R	5	143.5	C
3	R	3	114.5	C
2	R	2	86	C
5	R	5	143.5	C
8	R	8	156	C
8	R	8	156	C
2	R	2	86	C
3	R	3	114.5	C
86	R	86	179	C
2	R	2	86	C
1	R	1	59.5	C
5	R	5	143.5	C
3	R	3	114.5	C
2	R	2	59.5	C
0	R	0	38.5	C
0	R	0	38.5	C
2	R	2	86	C
1	R	1	59.5	C
2	R	2	86	C
3	R	3	114.5	C
1	R	1	59.5	C
0	R	0	38.5	C
0	R	0	38.5	C
0	R	0	38.5	C
1	R	1	59.5	C
0	R	0	38.5	C
1	R	1	59.5	C
0	R	0	38.5	C
0	R	0	38.5	C
3	R	3	114.5	C
3	R	3	114.5	C
1	R	1	59.5	C
2	R	2	86	C
1	R	1	59.5	C
13	R	13	167.5	C
3	R	3	114.5	C
2	R	2	86	C
1	R	1	59.5	C
2	R	2	86	C

Retrospective Power Curve Calculation

From Example in Section 10.5 of NUREG-1505

p1 and *p2* pull data from Table 10-3 sheet

		C		Measurement	(C-LBGR)/SD	Weighted	p1	p2	E(Wmm)	Vmr(Wmm)	SD(Wmm)	z	Power
Count	3.0	0.5	-1.071	-1.000	0.198378	0.089894	891.324	38971.48	197.412	8.466657	0.00		
SD	4.0	1.0	-1.021	-0.989	0.215338	0.098892	921.716	206.882	427.176	8.600707	0.00		
Median	2.0	0.5	-0.987	-1.000	0.218338	0.089894	982.521	279.718	206.682	8.466657	0.00		
	3.0	2	-0.945	-0.900	0.23975	0.113202	1078.875	44564.68	215.5377	7.80031	0.00		
Count	150	2.5	-0.904	-0.900	0.23975	0.113202	1078.875	44564.68	215.5377	7.80031	0.00		
SD	12.0	3	-0.861	-0.875	0.23975	0.113202	1078.875	44564.68	215.5377	7.80031	0.00		
Median	3.0	3.5	-0.820	-0.800	0.262259	0.12892	1180.166	50125.49	223.8872	7.05699	0.00		
	4.0	4	-0.778	-0.800	0.262259	0.12892	1180.166	50125.49	223.8872	7.05699	0.00		
	4.5	4.5	-0.736	-0.700	0.310309	0.164691	1396.391	56882.12	238.7093	5.712995	0.00		
	5.0	5.0	-0.691	-0.691	0.310309	0.164691	1396.391	56882.12	238.7093	5.712995	0.00		
Count	3225.5	5.5	-0.653	-0.700	0.310309	0.164691	1396.391	56882.12	238.7093	5.712995	0.00		
	6.0	6	-0.611	-0.600	0.335687	0.18476	1510.592	60032.31	245.0419	5.09869	0.00		
	6.5	6.5	-0.569	-0.600	0.335687	0.18476	1510.592	60032.31	245.0419	5.09869	0.00		
Median	16.3	7.0	-0.527	-0.625	0.361837	0.206268	1628.207	62742.55	255.4546	4.518716	0.00		
	7.5	7.5	-0.485	-0.500	0.361837	0.206268	1628.207	62742.55	255.4546	4.518716	0.00		
	8.0	8	-0.443	-0.400	0.388649	0.229172	1748.921	65052.72	255.0544	3.964704	0.00		
	8.5	8.5	-0.402	-0.400	0.388649	0.229172	1748.921	65052.72	255.0544	3.964704	0.00		
	9.0	9	-0.360	-0.400	0.388649	0.229172	1748.921	65052.72	255.0544	3.964704	0.00		
	9.5	9.5	-0.318	-0.300	0.416002	0.253419	1872.009	66909.18	258.6681	3.43346	0.00		
	10.0	10	-0.276	-0.300	0.416002	0.253419	1872.009	66909.18	258.6681	3.43346	0.00		
	10.5	10.5	-0.234	-0.200	0.443769	0.27893	1998.961	68268.01	261.2815	2.920892	0.00		
	11.0	11	-0.192	-0.200	0.443769	0.27893	1998.961	68268.01	261.2815	2.920892	0.00		
	11.5	11.5	-0.151	-0.100	0.471814	0.291932	2153.163	69906.42	262.862	2.42322	0.01		
	12.0	12	-0.109	-0.100	0.471814	0.291932	2153.163	69906.42	262.862	2.42322	0.01		
	12.5	12.5	-0.067	-0.100	0.471814	0.291932	2153.163	69906.42	262.862	2.42322	0.01		
	13.0	13	-0.025	0.000	0.5	0.333333	2250	69374.3	263.308	1.936801	0.03		
	13.5	13.5	0.017	0.000	0.5	0.333333	2250	69374.3	263.308	1.936801	0.03		
	14.0	14	0.059	0.100	0.528186	0.361978	2376.837	69906.42	262.862	1.458174	0.07		
	14.5	10.0	0.100	0.100	0.528186	0.361978	2376.837	69906.42	262.862	1.458174	0.07		
	1	15	0.142	0.100	0.528186	0.361978	2376.837	69906.42	262.862	1.458174	0.07		
	1.5	15.5	0.181	0.200	0.556231	0.391392	2503.04	68268.01	261.2815	2.920892	0.16		
	1.6	16	0.226	0.200	0.556231	0.391392	2503.04	68268.01	261.2815	2.920892	0.16		
	16.3	0.251	0.300	0.300	0.583998	0.421415	2627.991	66909.18	258.6681	5.010865	0.30		
	16.8	0.293	0.300	0.300	0.583998	0.421415	2627.991	66909.18	258.6681	5.010865	0.30		
	17.0	0.331	0.300	0.300	0.583998	0.421415	2627.991	66909.18	258.6681	5.010865	0.30		
	17.8	0.376	0.400	0.400	0.611351	0.451875	2751.08	65053.54	255.056	0.350566	0.49		
	18.3	0.418	0.400	0.400	0.611351	0.451875	2751.08	65053.54	255.056	0.350566	0.49		
	18.8	0.460	0.500	0.500	0.636163	0.482593	2891.734	62743.37	250.4863	0.445537	0.67		
	19.0	0.501	0.500	0.500	0.636163	0.482593	2891.734	62743.37	250.4863	0.445537	0.67		
	19.8	0.544	0.500	0.500	0.636163	0.482593	2891.734	62743.37	250.4863	0.445537	0.67		
	20.0	0.586	0.600	0.600	0.664313	0.513387	2989.409	60033.13	245.0166	0.93574	0.83		
	20.8	0.627	0.600	0.600	0.664313	0.513387	2989.409	60033.13	245.0166	0.93574	0.83		
	21.3	0.661	0.600	0.600	0.689891	0.544073	3103.61	56982.12	238.7093	1.43888	0.92		
	21.8	0.711	0.700	0.700	0.689891	0.544073	3103.61	56982.12	238.7093	1.43888	0.92		
	22.3	0.753	0.800	0.800	0.714196	0.574469	3213.882	53656.47	231.6387	1.95885	0.97		
	22.8	0.795	0.800	0.800	0.714196	0.574469	3213.882	53656.47	231.6387	1.95885	0.97		
	23.3	0.837	0.800	0.800	0.714196	0.574469	3213.882	53656.47	231.6387	1.95885	0.97		
	23.8	0.878	0.900	0.900	0.737741	0.604402	3319.835	50125.49	223.8872	2.49991	0.99		
	24.3	0.920	0.900	0.900	0.737741	0.604402	3319.835	50125.49	223.8872	2.49991	0.99		
	24.8	0.962	1.000	1.000	0.76025	0.637302	3421.125	44564.68	215.5377	3.0667	1.00		
	25.3	1.004	1.000	1.000	0.76025	0.637302	3421.125	44564.68	215.5377	3.0667	1.00		
	25.8	1.046	1.000	1.000	0.76025	0.637302	3421.125	44564.68	215.5377	3.0667	1.00		
	26.3	1.088	1.100	1.100	0.781662	0.662216	3517.479	42717.6	206.6824	3.66429	1.00		
	26.8	1.129	1.100	1.100	0.781662	0.662216	3517.479	42717.6	206.6824	3.66429	1.00		
	27.3	1.171	1.200	1.200	0.801928	0.689812	3608.676	38971.48	197.412	4.29332	1.00		
	27.8	1.213	1.200	1.200	0.801928	0.689812	3608.676	38971.48	197.412	4.29332	1.00		
	28.3	1.255	1.300	1.300	0.821015	0.716331	3694.568	35276.61	187.8207	4.97513	1.00		
	28.8	1.297	1.300	1.300	0.821015	0.716331	3694.568	35276.61	187.8207	4.97513	1.00		
	29.3	1.339	1.300	1.300	0.821015	0.716331	3694.568	35276.61	187.8207	4.97513	1.00		
	29.8	1.381	1.400	1.400	0.821015	0.716331	3694.568	35276.61	187.8207	4.97513	1.00		
	30.3	1.422	1.400	1.400	0.821015	0.716331	3694.568	35276.61	187.8207	4.97513	1.00		



Based on the number of measurements and the observed standard deviation, a survey unit with a median measurement equal to the background median plus the LBGR (16.3) will have a 0.30 probability that the survey unit will **correctly** fail (i.e., the null hypothesis that the difference between the survey unit median and the background median is less than the LBGR [i.e., the survey unit is indistinguishable from background] is rejected).

3	R	3	114.5	0
3	R	3	114.5	0
3	R	3	114.5	0
3	R	3	114.5	0
2	R	2	86	0
0	R	0	38.5	0
2	R	2	86	0
2	R	2	86	0
1	R	1	59.5	0
0	R	0	38.5	0
3	R	3	114.5	0
1	R	1	59.5	0
1	R	1	59.5	0
0	R	0	38.5	0
1	R	1	59.5	0
2	R	2	86	0
3	R	3	114.5	0
2	R	2	86	0
1	R	1	59.5	0
2	R	2	86	0
3	R	3	114.5	0
4	R	4	133	0
3	R	3	114.5	0
1	R	1	59.5	0
3	R	3	114.5	0
5	R	5	143.5	0
3	R	3	114.5	0
3	R	3	114.5	0
1	R	1	59.5	0
2	R	2	86	0
2	R	2	86	0
3	R	3	114.5	0
1	R	1	59.5	0
2	R	2	86	0
4	R	4	133	0
2	R	2	86	0
2	R	2	86	0
2	R	2	86	0
1	R	1	59.5	0
0	R	0	38.5	0
1	R	1	59.5	0
3	R	3	114.5	0
1	R	1	59.5	0
7	R	7	153.5	0
0	R	0	38.5	0
2	R	2	86	0
1	R	1	59.5	0
2	R	2	86	0
0	R	0	38.5	0
0	R	0	38.5	0
1	R	1	59.5	0
2	R	2	86	0
1	R	1	59.5	0
0	R	0	38.5	0
0	R	0	38.5	0
34	R	34	178	0
3	R	3	114.5	0
5	S	-8.3	28.5	28.5
1	S	-12.3	7	7
0	S	-13.3	2	2
2	S	-11.3	13.5	13.5
3	S	-10.3	19	19
3	S	-10.3	19	19
0	S	-13.3	2	2
1	S	-12.3	7	7
2	S	-11.3	13.5	13.5
2	S	-11.3	13.5	13.5
1	S	-12.3	7	7
5	S	-8.3	28.5	28.5
4	S	-9.3	24.5	24.5
0	S	-13.3	2	2
1	S	-12.3	7	7
3	S	-10.3	19	19
4	S	-9.3	24.5	24.5
3	S	-10.3	19	19
4	S	-9.3	24.5	24.5
4	S	-9.3	24.5	24.5
4	S	-9.3	24.5	24.5
1	S	-12.3	7	7
2	S	-11.3	13.5	13.5
2	S	-11.3	13.5	13.5
1	S	-12.3	7	7
1	S	-12.3	7	7
3	S	-10.3	19	19
23	S	9.7	161	161
2	S	-11.3	13.5	13.5
Sum =			16290	598

* This spreadsheet is originally designed to work with a set of twenty measurements, 10 from the survey unit (S) and 10 from the background reference area (R).
If a different number of measurements have been performed, it is necessary to modify the spreadsheet to account for the change in the number of measurements.

of R: 150 *n*
of S: 30 *m*
Avg Rank R: 105
Avg Rank S: 20

For m or n greater than 20, the critical value (k) can be calculated for Scenario B from

$$\frac{m(n+m+1)}{2} + z\sqrt{\frac{nm(n+m+1)}{12}}$$

z = 97.5% percentile of standard normal distribution = 1.960

$k = 3225.6$

Since the sum of survey unit ranks is less than the critical value, the null hypothesis that the difference between the survey unit median and the background median is less than the LSGR (i.e., the survey unit is indistinguishable from background) is accepted and the survey unit passes Scenario B

Spreadsheet Formulas for the Wilcoxon Rank Sum Test and Power Calculation

Wilcoxon Rank Sum Test, per NUREG-1508

LBGR 40.5 (For this calculation, LBGR = 3w for 2002 Igloo Background)
(Reference Dataset - 2002 Igloo Beta Phoswich)

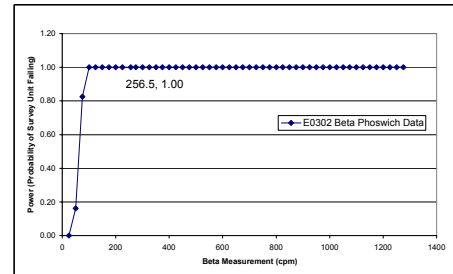
DATA	AREA	ADJUSTED DATA	RANKS	SURVEY AREA RANKS
234	R	234	133.5	0
255	R	255	154	0
272	R	272	162.5	0
206	R	206	90	0
283	R	283	169	0
199	R	199	74.5	0
235	R	235	135	0
202	R	202	80	0
220	R	220	109.5	0
215	R	215	102.5	0
183	R	183	48.5	0
225	R	225	117	0
213	R	213	99	0
243	R	243	141	0
203	R	203	82	0
252	R	252	151	0
197	R	197	67	0
226	R	226	118.5	0
220	R	220	109.5	0
181	R	181	44.5	0
222	R	222	112	0
231	R	231	127.5	0
241	R	241	139	0
228	R	228	121	0
277	R	277	166	0
260	R	260	159	0
387	R	387	178	0
216	R	216	105	0
596	R	596	180	0
163	R	163	23	0
155	R	155	13	0
171	R	171	33.5	0
228	R	228	121	0
196	R	196	64.5	0
237	R	237	137	0
172	R	172	35.5	0
253	R	253	152.5	0
216	R	216	105	0
191	R	191	61	0
231	R	231	127.5	0
204	R	204	85	0
231	R	231	127.5	0
162	R	162	21.5	0
171	R	171	33.5	0
197	R	197	67	0
246	R	246	144	0
166	R	166	25	0
198	R	198	70	0
169	R	169	30.5	0
162	R	162	21.5	0
256	R	256	155	0
233	R	233	131.5	0
179	R	179	39.5	0
260	R	260	159	0
248	R	248	146.5	0
212	R	212	98	0
211	R	211	97	0
229	R	229	123.5	0
430	R	430	179	0
134	R	134	7	0
334	R	334	175	0
168	R	168	27	0
205	R	205	87	0
170	R	170	32	0
210	R	210	96	0
274	R	274	164	0
243	R	243	141	0
229	R	229	123.5	0
159	R	159	17	0
187	R	187	53.5	0
202	R	202	80	0
224	R	224	116	0
168	R	168	27	0
185	R	185	51	0
173	R	173	37	0
233	R	233	131.5	0
169	R	169	30.5	0
182	R	182	46	0
200	R	200	77.5	0
168	R	168	27	0
240	R	240	138	0
215	R	215	102.5	0
181	R	181	44.5	0
197	R	197	67	0
214	R	214	100.5	0
216	R	216	105	0
199	R	199	74.5	0
249	R	249	148	0
209	R	209	94	0
138	R	138	9	0
199	R	199	74.5	0
189	R	189	59	0
246	R	246	146.5	0

Retrospective Power Curve Calculator

From Example in Section 10.5 of NUREG-1505

p1 and p2 pull data from Table 10-3 sheet

	C	Measurement	(C-LBGR)/SD	Rounded	p1	p2	E(Wmw)	Var(Wmw)	SD(Wmw)	z	Power
Count	Survey Unit Stats	25	-0.279	-0.300	0.416002	0.253419	1872.009	66909.18	258.6681	3.43346	0.00
SD		50	0.171	0.200	0.556231	0.391392	2503.04	68268.01	261.2815	0.983981	0.16
Median	Reference Stats	75	0.621	0.600	0.664313	0.513387	2989.409	60033.13	245.0166	-0.93574	0.83
Count		100	1.072	1.100	0.781662	0.662216	3517.479	42717.6	206.6824	-3.06429	1.00
SD		125	1.522	1.500	0.838901	0.741698	3775.055	31683.57	177.9988	-5.70183	1.00
Median		150	1.972	2.000	0.910445	0.848608	4097.003	16497.03	128.4408	-10.4084	1.00
		175	2.422	2.400	0.945062	0.908982	4266.279	8542.986	92.42827	-16.2953	1.00
		200	2.873	2.900	0.976143	0.956616	4392.644	3184.926	56.43515	-28.9271	1.00
		225	3.323	3.300	0.988174	0.977981	4446.783	1275.474	35.71378	-47.2268	1.00
		250	3.773	3.800	0.993336	0.98741	4470.012	597.8393	24.46075	-69.9314	1.00
		275	4.223	4.200	0.997861	0.995497	4489.475	149.3452	12.22069	-141.509	1.00
		300	4.674	4.700	0.997661	0.995497	4489.475	149.3452	12.22069	-141.509	1.00
		325	5.124	5.100	0.999796	0.999599	4499.082	6.616729	2.5723	-676.028	1.00
		350	5.574	5.600	0.999796	0.999599	4499.082	6.616729	2.5723	-676.028	1.00
		375	6.024	6.000	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		400	6.474	6.500	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		425	6.925	6.900	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		450	7.375	7.400	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		475	7.825	7.800	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		500	8.275	8.300	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		525	8.726	8.700	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		550	9.176	9.200	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		575	9.626	9.600	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		600	10.076	10.100	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		625	10.527	10.500	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		650	10.977	11.000	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		675	11.427	11.400	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		700	11.877	11.900	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		725	12.328	12.300	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		750	12.778	12.800	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		775	13.228	13.200	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		800	13.678	13.700	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		825	14.129	14.100	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		850	14.579	14.600	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		875	15.029	15.000	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		900	15.479	15.500	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		925	15.930	15.900	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		950	16.380	16.400	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		975	16.830	16.800	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1000	17.280	17.300	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1025	17.731	17.700	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1050	18.181	18.200	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1075	18.631	18.600	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1100	19.081	19.100	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1125	19.532	19.500	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1150	19.982	20.000	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1175	20.432	20.400	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1200	20.882	20.900	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1225	21.332	21.300	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1250	21.783	21.800	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00
		1275	22.233	22.200	0.999989	0.999978	4499.951	0.0494	0.222262	-7827.77	1.00



Based on the number of measurements and the observed standard deviation, a survey unit with a median measurement equal to the background median plus the LBGR (256.5) will have a 1.0 probability that the survey unit will correctly fail (i.e., the null hypothesis that the difference between the survey unit median and the background median is less than the LBGR [i.e., the survey unit is indistinguishable from background] is rejected).

317	R	317	174	0
337	R	337	176	0
281	R	281	168	0
222	R	222	112	0
199	R	199	74.5	0
187	R	187	53.5	0
232	R	232	130	0
188	R	188	56.5	0
246	R	246	144	0
204	R	204	85	0
286	R	286	171.5	0
199	R	189	59	0
264	R	264	161	0
206	R	206	90	0
204	R	204	85	0
202	R	202	80	0
188	R	188	56.5	0
280	R	280	167	0
226	R	226	118.5	0
196	R	196	64.5	0
259	R	259	157	0
234	R	234	133.5	0
183	R	183	48.5	0
272	R	272	162.5	0
369	R	369	177	0
286	R	286	171.5	0
223	R	223	114.5	0
206	R	206	90	0
206	R	206	90	0
251	R	251	150	0
111	R	111	2	0
253	R	253	152.5	0
222	R	222	112	0
230	R	230	125	0
276	R	276	165	0
246	R	246	144	0
260	R	260	159	0
228	R	228	121	0
236	R	236	136	0
164	R	164	24	0
223	R	223	114.5	0
179	R	179	39.5	0
218	R	218	107	0
189	R	189	59	0
200	R	200	77.5	0
172	R	172	35.5	0
156	R	156	15	0
243	R	243	141	0
257	R	257	156	0
214	R	214	100.5	0
250	R	250	149	0
231	R	231	127.5	0
219	R	219	108	0
206	R	206	90	0
180	R	180	43	0
299	R	299	173	0
129	R	129	5	0
195	S	154.5	12	12
173	S	132.5	6	6
196	S	155.5	14	14
187	S	146.5	11	11
324	S	283.5	170	170
185	S	144.5	10	10
235	S	194.5	62	62
176	S	135.5	8	8
220	S	179.5	41.5	41.5
238	S	197.5	69	69
209	S	168.5	29	29
248	S	207.5	93	93
167	S	126.5	4	4
214	S	173.5	38	38
153	S	112.5	3	3
223	S	182.5	47	47
200	S	159.5	18.5	18.5
225	S	184.5	50	50
202	S	161.5	20	20
236	S	195.5	63	63
228	S	187.5	55	55
239	S	198.5	71.5	71.5
250	S	209.5	95	95
226	S	185.5	52	52
239	S	198.5	71.5	71.5
200	S	159.5	18.5	18.5
244	S	203.5	83	83
199	S	158.5	16	16
220	S	179.5	41.5	41.5
125	S	84.5	1	1
Sum =		16290	1274	

* This spreadsheet is originally designed to work with a set of twenty measurements, 10 from the survey unit (S) and 10 from the background reference area (R).
If a different number of measurements have been performed, it is necessary to modify the spreadsheet to account for the change in the number of measurements.

of R: 150 *n*
of S: 30 *m*
Avg Rank R: 100
Avg Rank S: 42

For m or n greater than 20, the critical value (k) can be calculated for Scenario B from

$$\frac{m(n+m+1)}{2} + z\sqrt{\frac{nm(n+m+1)}{12}}$$

z = 97.5% percentile of standard normal distribution = 1.960

$k = 3225.6$

Since the sum of survey unit ranks is less than the critical value, the null hypothesis that the difference between the survey unit median and the background median is less than the LSGR (i.e., the survey unit is indistinguishable from background) is accepted and the survey unit passes Scenario B

Quantile Test

per Section 7 of NUREG-1505

n (Survey) 30

m (Ref) 150

alpha/2 0.025

From Table A.7

 r 6 k 4 α 0.025If k of the r largest ranks are from the survey unit, the null hypott
(30,100) in Table A.7

Alpha Phoswich Ranks

Sorted Ranks Location

2 S

2 S

2 S

7 S

7 S

7 S

7 S

7 S

7 S

13.5 S

13.5 S

13.5 S

13.5 S

13.5 S

13.5 S

19 S

19 S

19 S

19 S

19 S

24.5 S

24.5 S

24.5 S

24.5 S

24.5 S

24.5 S

24.5 S

28.5 S

28.5 S

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

38.5 R

59.5 R

59.5 R

59.5 R

59.5 R

59.5 R

59.5 R

59.5 R

59.5 R

59.5 R

59.5 R

Beta Phoswich Ranks

Sorted Ranks Location

1 S

2 R

3 S

4 S

5 R

6 S

7 R

8 S

9 R

10 S

11 S

12 S

13 R

14 S

15 R

16 S

17 R

18.5 S

18.5 S

20 S

21.5 R

21.5 R

23 R

24 R

25 R

27 R

27 R

27 R

29 S

30.5 R

30.5 R

32 R

33.5 R

33.5 R

35.5 R

35.5 R

37 R

38 S

39.5 R

39.5 R

41.5 S

41.5 S

43 R

44.5 R

44.5 R

46 R

47 S

48.5 R

48.5 R

50 S

51 R

52 S

53.5 R

53.5 R

55 S

56.5 R

56.5 R

E0302 Alpha-Beta Ph Quantile

59.5	R	59	R
59.5	R	59	R
59.5	R	59	R
59.5	R	61	R
59.5	R	62	S
59.5	R	63	S
59.5	R	64.5	R
59.5	R	64.5	R
59.5	R	67	R
59.5	R	67	R
59.5	R	67	R
59.5	R	69	S
59.5	R	70	R
59.5	R	71.5	S
86	R	71.5	S
86	R	74.5	R
86	R	74.5	R
86	R	74.5	R
86	R	74.5	R
86	R	77.5	R
86	R	77.5	R
86	R	80	R
86	R	80	R
86	R	80	R
86	R	82	R
86	R	83	S
86	R	85	R
86	R	85	R
86	R	85	R
86	R	87	R
86	R	90	R
86	R	90	R
86	R	90	R
86	R	90	R
86	R	93	S
86	R	94	R
86	R	95	S
86	R	96	R
86	R	97	R
86	R	98	R
86	R	99	R
86	R	100.5	R
114.5	R	100.5	R
114.5	R	102.5	R
114.5	R	102.5	R
114.5	R	105	R
114.5	R	105	R
114.5	R	105	R
114.5	R	107	R
114.5	R	108	R
114.5	R	109.5	R
114.5	R	109.5	R
114.5	R	112	R
114.5	R	112	R
114.5	R	112	R
114.5	R	114.5	R
114.5	R	114.5	R
114.5	R	116	R
114.5	R	117	R
114.5	R	118.5	R
114.5	R	118.5	R
114.5	R	121	R
114.5	R	121	R

E0302 Alpha-Beta Ph Quantile

114.5	R	121	R
114.5	R	123.5	R
114.5	R	123.5	R
114.5	R	125	R
114.5	R	127.5	R
114.5	R	127.5	R
114.5	R	127.5	R
133	R	127.5	R
133	R	130	R
133	R	131.5	R
133	R	131.5	R
133	R	133.5	R
133	R	133.5	R
133	R	135	R
133	R	136	R
133	R	137	R
143.5	R	138	R
143.5	R	139	R
143.5	R	141	R
143.5	R	141	R
143.5	R	141	R
143.5	R	144	R
143.5	R	144	R
143.5	R	144	R
143.5	R	146.5	R
143.5	R	146.5	R
143.5	R	148	R
143.5	R	149	R
151	R	150	R
151	R	151	R
151	R	152.5	R
153.5	R	152.5	R
153.5	R	154	R
156	R	155	R
156	R	156	R
156	R	157	R
159	R	159	R
159	R	159	R
159	R	159	R
161	S	161	R
162.5	R	162.5	R
162.5	R	162.5	R
165	R	164	R
165	R	165	R
165	R	166	R
167.5	R	167	R
167.5	R	168	R
169.5	R	169	R
169.5	R	170	S
172	R	171.5	R
172	R	171.5	R
172	R	173	R
174.5	R	174	R
174.5	R	175	R
176	R	176	R
177	R	177	R
178	R	178	R
179	R	179	R
180	R	180	R

0 of top 6 from S

0 of top 6 from S

If the r -th largest measurement is among a group of tied (equal-in-value) measurements, increase r to include the tied measurements. Also increase k by the same amount (EPA 230-R-94-004).

$r=7$

$k=5$

0 of top 7 from S

thesis is rejected.

Reproduction of Table 10-3 from NUREG-1505

(C-LBGR)/SD	p1	p2
-6.0	0.00001	0
-5.0	0.000204	0.00001
-4.0	0.002339	0.000174
-3.5	0.006664	0.000738
-3.0	0.016947	0.00269
-2.5	0.03855	0.008465
-2.0	0.07865	0.023066
-1.9	0.089555	0.027714
-1.8	0.101546	0.033114
-1.7	0.114666	0.039348
-1.6	0.12895	0.046501
-1.5	0.144422	0.054656
-1.4	0.161099	0.063897
-1.3	0.178985	0.074301
-1.2	0.198072	0.085944
-1.1	0.218338	0.098892
-1.0	0.23975	0.113202
-0.9	0.262259	0.12892
-0.8	0.285804	0.146077
-0.7	0.310309	0.164691
-0.6	0.335687	0.18476
-0.5	0.361837	0.206266
-0.4	0.388649	0.229172
-0.3	0.416002	0.253419
-0.2	0.443769	0.27893
-0.1	0.471814	0.305606
0.0	0.5	0.333333
0.1	0.528186	0.361978
0.2	0.556231	0.391392
0.3	0.583998	0.421415
0.4	0.611351	0.451875
0.5	0.638163	0.482593
0.6	0.664313	0.513387
0.7	0.689691	0.544073
0.8	0.714196	0.574469
0.9	0.737741	0.604402
1.0	0.76025	0.633702
1.1	0.781662	0.662216
1.2	0.801928	0.6898
1.3	0.821015	0.716331
1.4	0.838901	0.741698
1.5	0.855578	0.765812
1.6	0.87105	0.788602
1.7	0.885334	0.810016
1.8	0.898454	0.830022
1.9	0.910445	0.848605
2.0	0.92135	0.865767
2.1	0.931218	0.881527
2.2	0.940103	0.895917
2.3	0.948062	0.908982
2.4	0.955157	0.920777
2.5	0.96145	0.931365
2.6	0.967004	0.940817
2.7	0.971881	0.949208
2.8	0.976143	0.956616
2.9	0.979848	0.963118
3.0	0.983053	0.968795
3.1	0.985811	0.973725
3.2	0.988174	0.977981
3.3	0.990188	0.981636
3.4	0.991895	0.984758
3.5	0.993336	0.98741
4.0	0.997661	0.995497
5.0	0.999796	0.999599
6.0	0.999989	0.999978