TRITIUM DEPOSITION IN THE CONTINENTAL UNITED STATES, 1953-83

By Robert L. Michel

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ENGLISH-METRIC EQUIVALENTS

Metric units (International system) used in this report may be converted to inch-pound units by the following conversion factors

Metric Unit	Multiply by	Inch-Pound Unit
centimeter (cm)	0.3937	inch
kilometer (km)	0.6214	mile
meter (m)	3.281	feet
millimeter (mm)	0.0002642	gallon
kilogram (kg)	2.205	pound

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ABSTRACT

Tritium, a bomb-produced radioisotope of hydrogen, is used extensively as a tracer to study hydrologic and oceanographic phenomena. One of the major limitations in its use is the sparsity of data on tritium input from the atmosphere. Since the early 1960's, the U.S. Geological Survey has monitored tritium fallout in precipitation monthly using a network of 14 stations distributed around the United States. Tritium deposition now has been calculated for these stations for the period 1953-83. For years when no data were available at a given station, deposition estimates were obtained by use of the Ottawa correlation. Depositions are given in TU-meters (TU-m) (1 TU = 1 tritium atom per 10^{18} hydrogen atoms) for all stations in the network. Highest cumulative depositions over the period (7,681 TU-m on table 1) were found at the Chicago station, and lowest cumulative depositions were found at Menlo Park (1,350 TU-m on table 1). Approximately 60 percent of all deposition occurred during 1961-65, and greater than 90 percent of the deposition occurred before 1970. Major deposition peaks are found in 1954, 1958, and 1963; a small increase is attributed to nuclear-weapon testing by China in the late 1970's. Greater than 70 percent of the cumulative tritium deposited at network stations during the period 1953-83 would have been lost due to decay by 1983. Yearly maps of tritium deposition have been calculated for the continental United States and were used to construct a cumulative-deposition map for 1953-83. A north-south depositional gradient with regional modifications is apparent. A tongue of high tritium deposition extends from the Midwest into the South. A tongue of low deposition reaches to the North in the arid western States. Total tritium deposition on the continental United States during 1953-83 has been calculated to be 12 $\pm$ 2 kilograms.

INTRODUCTION

Tritium, a radioactive isotope of hydrogen with a half life of 12.43 years has been used extensively as a hydrologic tracer for the past 3 decades (International Atomic Energy Agency, 1981). It is produced naturally in a near steady-state concentration by interactions of cosmic rays with atmospheric molecules. Once produced, it oxidizes rapidly to tritiated water (HTO) and enters the hydrological cycle. HTO has a short residence time in the atmosphere (less than 1 yr) and eventually is removed from the atmosphere in precipitation or through molecular exchange. Fractionation occurs between tritium and hydrogen, particularly during phase changes; but in most hydrologic studies, this effect can be ignored. Because tritium is a part of the water molecule, it follows the pathway of water through its flow and mixing processes exactly, making it an extremely valuable tracer for studying these processes. Knowledge of its radioactive decay and distribution facilitates estimates of timescales for rates of flow and mixing. Natural levels of tritium were about 0.5 TU (Tritium Unit) in the surface ocean and about 1 to 20 TU for continental precipitation (Kaufman and Libby, 1954).

The other factor that makes tritium a useful tracer is its transient nature. In the 1950's and early 1960's, the natural levels of tritium were overwhelmed by the introduction of tritium through nuclear-weapons testing. Tritium concentrations in precipitation increased two to three orders of magnitude, especially in the northern hemisphere, because of the locations of the tests and the break up of the tropopause between 30°-60° N during the spring. The large input was reflected in the tritium content of the continental waters and the surface ocean, where some concentrations rose to the 1,000-TU and 50-TU levels, respectively (Koide and others, 1982). Since the test ban treaty, small amounts of man-made tritium have been released to the environment from nuclear reactors and atomic-weapons tests by nonsignatory nations (Carter and Moghissi, 1977). These releases have a limited effect on tritium concentrations in precipitation and can be considered unimportant for most hydrological studies. Tritium concentrations in present-day (1989) precipitation are tending toward the prebomb or background levels (Michel, 1989). Tritium is best used to study processes that occur on a timescale of 10 to 100 yrs. For timescales much longer than this, the usefulness of tritium from the bomb transient is limited. For systems with much shorter timescales than 10 years, the transient should have passed through the hydrologic system, although the study of present-day tritium concentrations may still yield important information.

For most studies, a knowledge of the input of tritium during the bomb-testing period is important. Tritium concentrations in precipitation vary widely and, commonly, no data are available for a given location. However, tritium depositions for a specific site can be estimated on the basis of data available for other locations.

PURPOSE AND SCOPE

This paper presents the results of analysis of the deposition of tritium at a series of stations where long-term records of tritium in precipitation are available. By using these data and data from Ottawa for periods when data are missing, depositions at these stations through the period of the bomb transient are calculated. The results then are expanded to obtain estimates of cumulative deposition of tritium for all areas of the continental United States.

DATA COLLECTION AND ANALYSIS

In the early 1960's, the U.S. Geological Survey began routine analyses of tritium in precipitation and streamflow at several sites within the continental United States. The precipitation samples were monthly composites (3-month composites at some stations), where the tritium in streamflow was measured in monthly grab samples collected from selected locations. All samples were forwarded to the U.S. Geological Survey Tritium Laboratory in Washington D.C. (in Reston, Va, since 1972), for analysis. Most samples were analyzed by liquid-scintillation counting after enrichment in Ostlund-type glass cells (Ostlund and Werner, 1962). Depending on the tritium concentration expected, some samples were counted by direct liquid-scintillation without enrichment. Precision for most samples was ± 3 percent. This monthly network-sampling program has continued to the present time at most stations, giving continuous tritium flux records for the past 20 to 25 years at many locations. Results of the precipitation sampling up to 1983 have been published by the International Atomic Energy Agency (1981, 1983, and 1986). An analyses of the pre-1970 data also has been published (Stewart and Farnsworth, 1968; Stewart and Wyerman, 1970; and Wyerman and others, 1970). These papers show tritium concentrations in precipitation across the continental United States during the immediate post-bomb period and discuss its concentration in runoff.

During the pre-bomb and early nuclear period, limited tritium data are available for the North American continent. The only continuous long-term data set for this period is from Ottawa, Canada, where measurements are available from 1953 to the present. If a partial long-term tritium record exists at another

North American station, a correlation can be made with the Ottawa record for periods when data were recorded at both sites; this correlation then can be used to fill gaps in the station of interest. The Ottawa correlation has been developed by the International Atomic Energy Agency (1981). A least-squares regression fits an equation of the form

$$C_i = aC_{Ott} + b, \qquad (1)$$

where a and b are obtained from periods where data are available, and C_i and C_{Ott} are tritium concentrations at the station of interest and at Ottawa, respectively. This correlation can be used to estimate tritium concentrations at U.S. Geological Survey stations if data are lacking, which is usually the period 1953-60. All tritium estimates used in this paper are derived from the constants supplied by the International Atomic Energy Agency. Most stations have a correlation coefficient (r) of 0.9 or greater. For years when tritium concentrations are low, the Ottawa correlation does not furnish a reasonable estimate at certain stations (that is, a possible negative concentration). For these cases a minimum tritium concentration equal to the level found in precipitation in the 1980's is used. Because all of these concentrations are low, any error in cumulative deposition introduced by using these estimates will be small compared to the total deposition.

It is possible to calculate tritium deposition at the U.S. Geological Survey network sites for the bomb-testing period of 1953-83 using measured tritium data and the Ottawa correlation. Table 1 is a record of tritium deposition, in TU-meters (TU-m), on a yearly basis for long-term stations in the network. The TU-meter is found by multiplying the precipitation, in meters, measured at a station during the year, by the weighted average tritium concentration for that year:

$$1 \text{ TU-meter} = 3.3 \times 10^{-17} \text{ grams per square centimeter} \qquad (2)$$
$$= 0.32 \text{ picoCuries per square centimeter.}$$

Cumulative totals (1953-83) also are given for each station in the table. Cumulative depositions throughout the network range from a high of more than 7,500 TU-m at Chicago, Ill., to 1,350 TU-m at Menlo Park, Calif.

Certain trends are evident for concentration and total deposition. Because of the nature of tritium input, a north-south gradient exists; largest depositions are found in the north. Large depositions also occur at the mid-continent stations. Depositions at the East Coast sites are greater than depositions at similar latitudes on the West Coast. The latter relation can be attributed to the low rainfall in parts of the West Coast, specifically, Menlo Park, Calif. However, the history of the air masses involved in a storm also has a bearing

on depositional differences. On the West Coast, most storms are oceanic in origin and have spent little time over continental land masses. The tritium concentrations in water from these storms primarily is determined by exchange with the surface ocean, which has a comparatively low concentration of tritium. Tritium concentrations associated with marine water vapor tend to be low. On the East Coast, storms are influenced strongly by air masses traveling across the North American continent. Exchange with, and input of water vapor from, the stratosphere will cause a substantial increase in tritium concentrations and resulting deposition at these latitudes. Deposition also is low in some mid-continent areas, such as Albuquerque, N.M., and Waco, Texas, because of a paucity of precipitation in these areas. Also apparent from the data in table 1 is that most tritium was deposited as a spike during the period immediately following major nuclear-weapons testing (1962-64). Approximately 60 percent of all tritium deposition occurred during the 5 year period 1961-65.

Figure 1 shows the tritium deposition at selected sites occurring in each year from 1953-83 as a percentage of the 1953-83 total, calculated as:

$$\text{Percent} = 100 \times \frac{D_t}{D} \qquad (3)$$

where D_t is the deposition in TU-meters for a given year and D is the total deposition of tritium. Three stations are shown representing the West Coast (Portland, Ore.); the mid-continent area (Lincoln, Neb.); and the East Coast (Boston, Mass.). Three peaks are present (1954, 1958, 1963), representing the fallout from the three major periods of nuclear-weapons testing. The largest peak in the 1963-64 period is more than double the 1958 peak. About 40 percent of all tritium deposition occurred in 1963-64, and more than 75 percent of the cumulative deposition occurred before 1965. After the bomb peak, tritium flux declined quickly until, by 1970, only about 1 percent of the total tritium deposition occurred annually. A small peak occurred in the late 1970's as a result of small nuclear tests by China and France. This is reflected in an increase in total tritium deposition at most stations, but the peak deposition from these tests is less than 5 percent of the previous deposition peak. For many purposes, such as the study of reservoirs with exchange timescales on the order of the tritium transient, deposition can be considered as a spike that occurred in the early 1960's. It should be noted that table 1 lists annual flux by precipitation, but other factors influence the effective tritium input into a system. For any given body of surface water, molecular exchange can be an important source of tritium input. Water molecules from tritium-rich atmospheric water vapor enter the liquid phase at the surface of a water reservoir, whereas water molecules from the surface water go into the vapor phase in an equilibrium

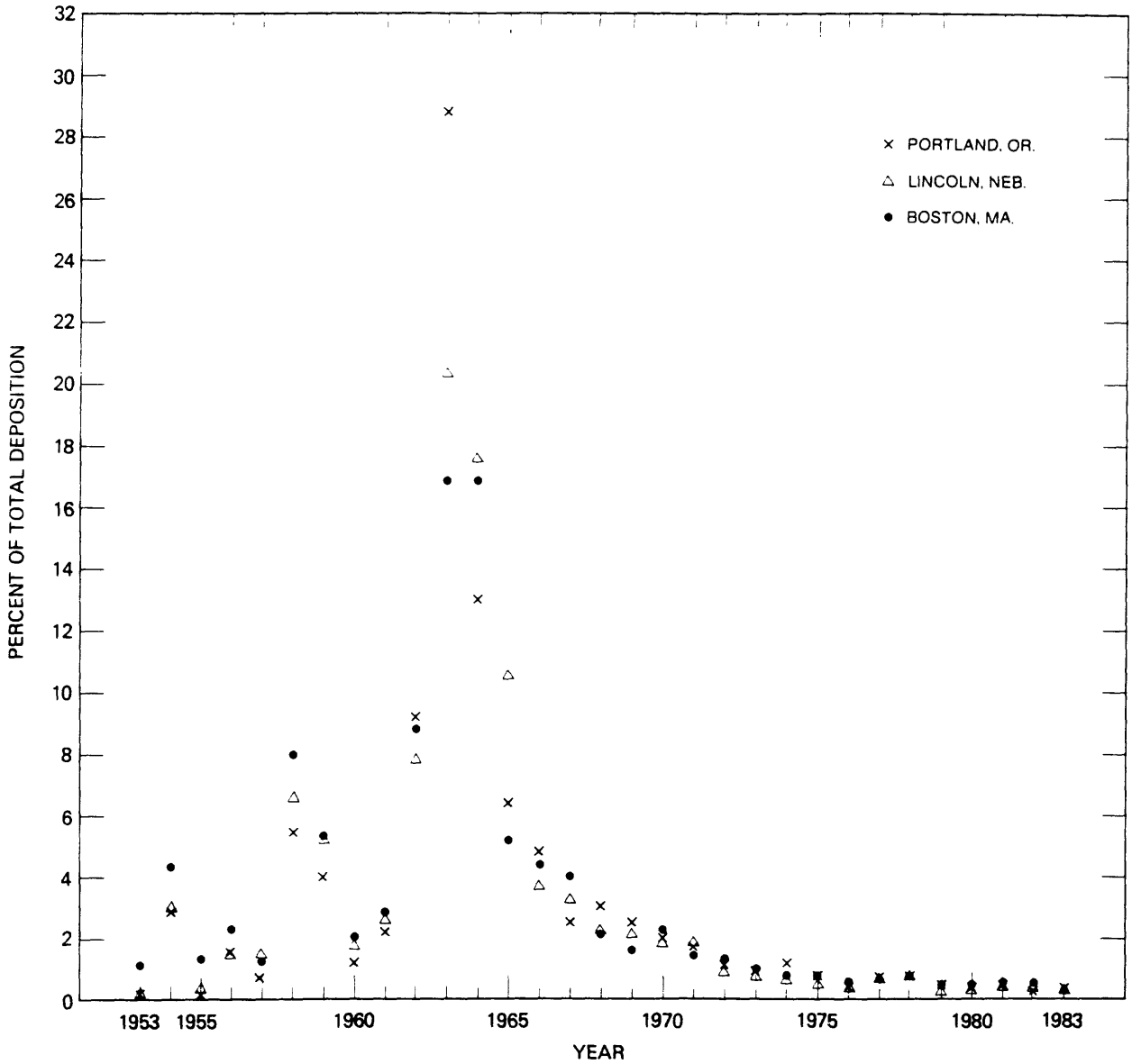

Figure 1: Tritium deposition, as defined by equation 3, by year during 1953-83, as a percentage of total deposition at three network stations.

exchange. Because most surface waters have tritium concentrations lower than that of the overlying atmosphere, a net flux of tritium to the surface water occurs. This process has been shown to be dominant in an ocean setting, where approximately two-thirds of the tritium enters the ocean in this manner (Michel, 1976). Over continents, this process will be less important because of the small fraction of total surface area available for such exchange. Only for basins with a large water surface area would the molecular exchange contribution be important (Simpson, 1970).

Because of its short half-life, decay is a significant factor when studying the tritium transient. On a 30-year timescale, decay modifies the tritium transient substantially. Through decay alone, about 70 percent of all tritium deposited at the network stations since 1953 would have been lost by 1983. The amount of deposited tritium remaining after decay is given at the bottom of Table I. If decay were the only factor influencing the tritium burden, about 50 percent of the remaining tritium would have been deposited during 1961-65. Thus, even with decay, the input is a spike.

TRITIUM DEPOSITION IN THE CONTINENTAL UNITED STATES

From the network data and data of other laboratories, it is possible to construct tritium-deposition patterns over the continental United States since the advent of nuclear testing. To construct the deposition patterns, the United States was divided into a series of boxes 2° in latitude and 5° in longitude (such as, 41°-39°N, by 110°-115°W). To determine the tritium deposition for any box, all that is needed is the amount of precipitation and the weighted tritium concentration for each year. The average rainfall for a box can be obtained from the yearly precipitation records of the National Weather Service. Thus, reasonable estimates of the precipitation in each box can be found.

As noted, the coverage for tritium concentrations is incomplete. In addition to the U.S. Geological Survey stations, other stations have been operated by other laboratories. The data from these stations are available in lists published by the International Atomic Energy Agency. Although records at these stations commonly are less complete than those from the U. S. Geological Survey network, most were active during the period of maximum deposition and the few years following. It was during this period that concentrations and concentration gradients were highest. Thus, these stations recorded data during the most critical period of the bomb transient. Approximately 25 percent of the boxes are directly covered by tritium-monitoring stations during part of the bomb-testing period. A series of Canadian stations also are available to help establish gradients for

tritium concentrations in precipitation. Estimates of tritium concentrations in precipitation can be made for all areas of the United States during the 1953-83 period. Concentration maps for some years have been published previously (Stewart and Farnsworth, 1968). Deposition patterns for the continental United States have been calculated for the period of the bomb transient. Tables 2 to 32 list tritium-flux and precipitation data for 1953-83 on a year-by-year basis for each box. Longitude and latitude

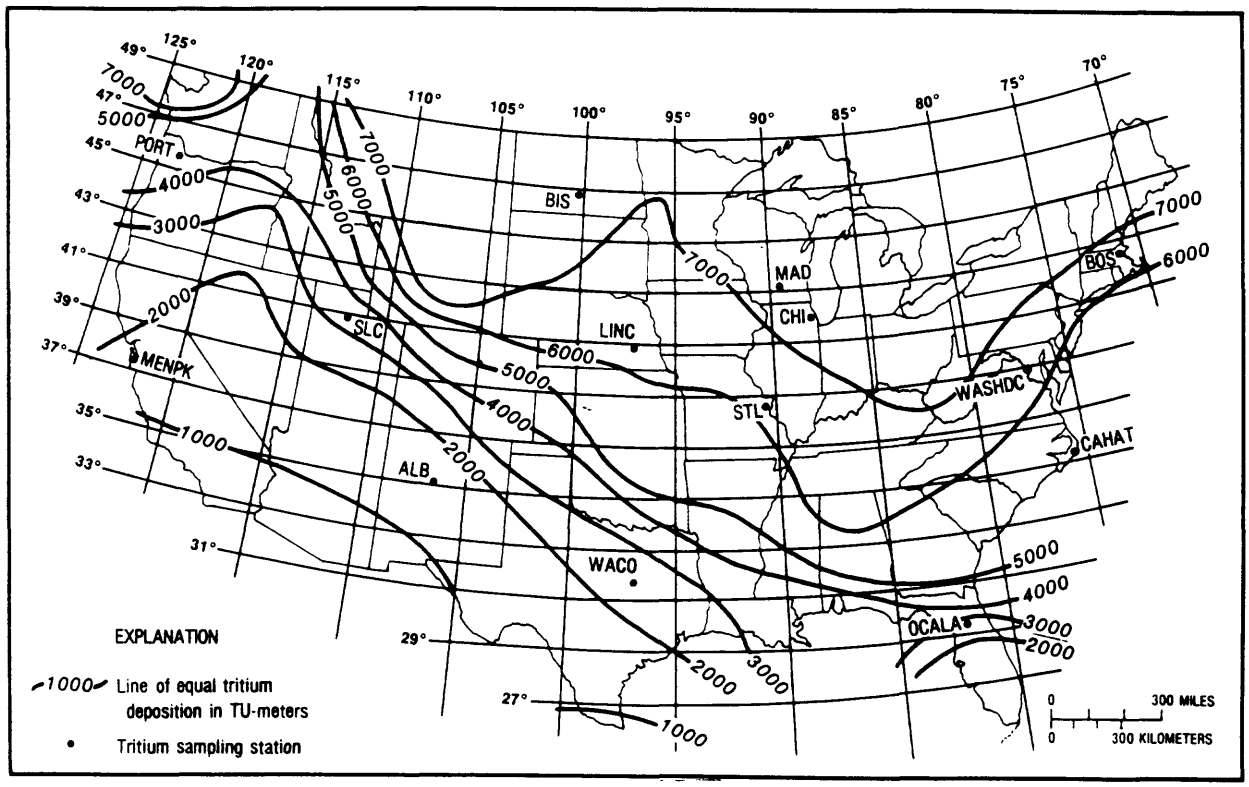

Figure 2: Cumulative deposition on the continental United States, 1953-1983. Station abbreviations listed below. Alb.=Albuquerque, New Mexico; Bis.=Bismark, North Dakota; Bos.=Boston Massachusetts; CaHat.=Cape Hatteras, North Carolina; Chi.=Chicago, Illinois; Linc.=Lincoln, Nebraska; Mad.=Madison, Wisconsin; MenPk.=Menlo Park, California; Ocala=Ocala, Florida; Port.=Portland, Oregon; StL.=Saint Louis, Missouri; SLC=Salt Lake City, Utah; Waco=Waco, Texas; Wash. DC= Washington DC.

boxes displayed across the page represent the continental United States. The deposition for that year is given in each box in TU-

meters, and the precipitation is given in millimeters. To obtain the tritium concentration, one would divide the deposition by the precipitation and multiply by 1,000.

Figure 2 is a cumulative-deposition map, in TU-meters, for 1953-83. As with concentration, there is a strong north-south gradient in deposition; the highest fallout is in the North. Precipitation patterns produce differences between concentration and fallout patterns. This is most evident in the Northwest, where high precipitation rates result in high deposition rates. The arid conditions of the southwestern United States result in low deposition, despite high tritium concentrations produced by the continental effect. This is evident from the tongue of low deposition extending into the Great Basin from the Southwest. A tongue of high deposition is present in the midwest, extending to the Gulf Coast, that results from high precipitation rates in this region. With some exceptions, tritium deposition in the continental United States shows a Southwest to Northeast gradient across the country. In most of the midwestern and eastern United States, cumulative tritium deposition during the peak of the bomb-testing period exceeded 5,000 TU-m (approximately 1.5 $\mu Cu/m^2$ (microcuries per square meter)).

The accuracy of these deposition values depends on the accuracy of both the precipitation values and the tritium concentrations. The accuracy of precipitation data has been discussed by others (see, for example, Zawadzki, 1973; Gupta, 1986). It is known that precipitation can vary over small distances depending on storm track and microclimatic effects. However, the average of the stations is believed to give a reliable estimate of the wetfall for the area.

Error in the measured tritium concentrations is about 3 to 4 percent. Uncertainty in tritium concentrations for periods where extrapolation is necessary will be higher. However lines of constant tritium concentration appear to have well-defined and reproducible patterns on a continental scale; variations due to microclimatic factors are less than those related to precipitation. Thus, it is likely that the uncertainty in the precipitation data is higher than that in the tritium data.

From these data, the total deposition of bomb tritium on the continental U.S. can be calculated. It is found that 12 ± 2 kg (kilograms) of tritium fell out as precipitation on the 48 conterminous States during the bomb-testing period of 1953-83. As earlier noted, a small additional amount also was deposited in some water bodies by molecular exchange. Because of decay, evapotranspiration, and runoff, only a fraction of this tritium is still present in continental waters.

SUMMARY

Cumulative tritium deposition has been calculated at a series of network stations for the period 1953-83. For years when no data are available, the Ottawa correlation was used. Approximately 60 percent of all tritium deposition occurred during the 1961-65 and 90 percent of all bomb tritium deposition had occurred before 1971. Deposition ranged from a high of almost 7,700 TU-m (24.6 Ci/m^2) at Chicago, Ill., to a low of 1,350 TU-m (4.3 Ci/m^2) at Menlo Park, Calif. Total deposition was highest at stations in the Midwest and East, and deposition was lowest in the South and Southwest. Deposition maps were constructed that show deposition patterns of bomb tritium over the continental United States. With some exceptions, a Southwest-to-Northeast gradient in total deposition was observed; highest totals are in the Northeast. Total deposition of tritium on the continental United States during 1953-83 is approximately 12 kg.

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Table 1

ANNUAL TRITIUM FLUX AT US GEOLOGICAL SURVEY STATIONS

Alb.=Albuquerque, New Mexico; Bis.=Bismark, North Dakota; Bos.=Boston Massachusetts; CaHat.=Cape Hatteras, North Carolina; Chi.=Chicago, Illinois; Linc.=Lincoln, Nebraska; Mad.=Madison, Wisconsin; MenPk.=Menlo Park, California; Ocala=Ocala, Florida; Port.=Portland, Oregon; StL.=Saint Louis, Missouri; SLC=Salt Lake City, Utah; Waco=Waco, Texas; Wash. DC= Washington DC. Numbers in parenthesis indicate depositions calculated using a correlation with Ottawa tritium data.

Year	Alb.	Bis.	Bos.	CaHat.	Chi.	Linc.
53	(50)	(20)	(87)	(10)	(8)	(16)
54	(26)	(210)	(317)	(123)	(283)	(210)
55	(8)	(32)	(97)	(13)	(6)	(21)
56	(5)	(129)	(174)	(64)	(81)	(104)
57	(38)	(70)	(94)	(49)	(66)	(102)
58	(27)	(304)	(567)	(259)	(281)	(447)
59	(115)	(230)	(377)	(144)	(498)	(334)
60	(27)	(92)	(146)	72	94	(119)
61	(42)	(105)	(204)	78	196	(168)
62	57	607	(637)	555	618	532
63	359	2017	1202	1185	1948	1362
64	316	1140	1204	651	1086	1196
65	114	771	368	214	645	710
66	49	350	317	166	378	242
67	48	216	287	101	204	222
68	51	193	149	101	103	145
69	51	141	116	77	209	143
70	32	138	156	83	184	125
71	34	79	110	89	99	120
72	14	56	96	51	98	62
73	20	32	63	33	77	56
74	13	32	53	38	77	32
75	15	50	50	25	72	28
76	8.4	18	37	26	39	22
77	9.1	39	45	21	65	43
78	13	45	40	28	60	46
79	6.2	18	31	22	37	27
80	5.2	19	25	21	(32)	17
81	7.6	19	30	31	(43)	24
82	5.4	16	31	27	(48)	20
83	3.2	9	22	25	(46)	15
TOTAL	1524	7197	7131	4382	7681	6720

Table 1 cont.

Year	Mad.	MenPk.	Ocala	Port.	StL.	SLC
53	(15)	(15)	(18)	(6)	(20)	(8.4)
54	(236)	(45)	(84)	(104)	(137)	(117)
55	(19)	(26)	(15)	(6)	(37)	(16)
56	(134)	(34)	(47)	(55)	(113)	(74)
57	(88)	(40)	(43)	(26)	(111)	(69)
58	(293)	(102)	(215)	(198)	(355)	(316)
59	(430)	(105)	(178)	(142)	(211)	(206)
60	(139)	(27)	(62)	(42)	(93)	(62)
61	(164)	13	52	(80)	(166)	(87)
62	(505)	106	166	(331)	(543)	(493)
63	1673	211	764	1036	1123	1281
64	1136	123	565	471	1112	1158
65	649	62	254	229	381	452
66	292	34	165	173	293	137
67	231	48	91	91	185	195
68	153	18	77	108	93	168
69	224	35	73	90	167	110
70	138	35	67	71	108	118
71	97	38	28	61	127	96
72	69	13	35	39	67	33
73	64	19	32	34	63	41
74	70	12	28	41	52	36
75	60	13	22	26	38	40
76	24	20	23	15	19	18
77	48	20	14	25	39	34
78	58	72	24	26	52	44
79	29	27	18	16	18	15
80	28	17	13	18	22	14
81	30	9.5	15	16	28	19
82	(32)	11	13	8	31	13
83	(32)	9.4	13	9	21	11
TOTAL	7160	1350	3208	3591	5835	5481

Table 1 cont.

YR	Waco	Wash. DC
53	(4)	(13)
54	(32)	(117)
55	(4)	(28)
56	(18)	(72)
57	(27)	(55)
58	(175)	(329)
59	(125)	(139)
60	(27)	(65)
61	76	(73)
62	244	555
63	561	1198
64	280	824
65	219	339
66	117	264
67	65	184
68	68	146
69	58	165
70	44	137
71	30	133
72	18	85
73	23	55
74	25	60
75	24	67
76	17	30
77	11	45
78	12	44
79	14	42
80	8	22
81	13	38
82	8	31
83	5	35
TOTAL	2352	5159

Table 2. - Tritium deposition and precipitation in the U.S. during 1953.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	29 2430	9.6 440	18 450	22 370	24 480	17 500	23 650						
47	12 1210	13 580	10 260	20 360	22 490	18 600	23 820	26 880				17 840	
45	13 1300	7.0 350	8.2 230	20 360	18 460	18 640	18 740	18 700	27 770	18 760	21 1060	22 1230	
43	8.3 920	5.2 260	10 290	14 320	14 350	12 490	12 610	17 730	17 660	20 890	21 1290		
41	8.9 1120	2.3 140	5.2 190	12 300	12 400	9.8 490	9.6 600	14 770	14 720	16 1010	19 1320		
39	1.6 220	0.8 66	3.7 170	6.0 200	6.7 260	10 580	7.9 560	11 800	13 950	12 1030			
37	0.8 150	0.8 92	3.8 240	3.2 150	5.4 300	12 860	12 1200	11 1130	9.1 910	10 1270			
35		0.7 100	0.9 90	1.8 130	3.1 260	4.9 540	8.8 1100	11 1360	10 1250	9.6 1370			
33		0.4 87	0.5 72	1.0 110	2.9 360	5.2 650	8.3 1180	10 1450	10 1460				
31					1.9 310	4.4 740	8.5 1420	9.9 1650	9.6 1600				
29						2.4 600			6.2 1550				
27						1.2 290			4.9 1650				
25													

Table 3. - Tritium deposition and precipitation in the U.S. during 1954.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	240 2010	100 410	170 390	270 380	220 400	130 340	180 510						
47	120 1130	98 410	130 310	190 280	220 450	130 360	220 740	290 770				270 1300	
45	100 1020	46 200	89 220	210 340	190 420	150 480	180 730	280 890	300 750	240 960	240 1200	270 1400	
43	77 860	38 180	88 230	110 210	120 300	150 550	190 900	290 1130	270 900	210 970	210 1180		
41	93 1160	34 180	64 210	90 210	83 240	160 670	160 890	160 820	200 1010	140 820	150 510		
39	29 420	26 180	57 230	59 190	80 300	110 570	120 790	140 940	170 1100	110 840			
37	16 260	16 160	61 340	28 130	70 350	91 540	110 880	120 1190	100 1010	110 1230			
35		22 310	12 110	18 120	46 310	70 540	86 960	97 1080	69 770	83 1040			
33		15 240	12 760	16 160	28 280	44 490	74 920	63 790	53 760				
31					30 310	34 740	62 420	86 650	48 100				
29						23 460			54 1080				
27						22 560			63 1570				
25													

LONGITUDE (°W)

Table 4. - Tritium deposition and precipitation in the U.S. during 1955.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N) \ LONGITUDE (°W)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	48 2400	18 500	30 460	40 360	28 310	27 440	41 820						
47	23 1260	19 530	23 350	44 420	35 440	22 440	35 780	40 810				27 770	
45	19 1210	11 310	14 230	60 600	26 370	19 410	21 520	29 650	32 590	37 910	28 920	27 890	
43	11 780	8.2 280	17 300	29 340	26 430	18 440	17 580	28 810	38 850	35 990	34 1310		
41	14 1180	6.1 230	10 230	19 290	17 340	15 440	23 800	26 860	34 970	25 960	20 980		
39	5.1 510	4.0 200	5.3 150	6.9 140	15 390	20 660	18 770	26 1070	25 1060	21 1040			
37	3.1 380	3.4 210	8.8 320	4.8 140	10 340	20 840	22 1120	22 1220	17 960	15 1080			
35		2.9 290	4.5 250	4.0 160	7.8 320	15 730	17 1080	16 1170	12 860	18 1500			
33		1.4 180	3.4 240	3.1 170	4.6 290	8.8 630	14 1180	12 1030	12 980				
31					2.7 270	6.9 690	13 1330	17 1700	10 1150				
29						4.7 590			9.2 1140				
27						3.4 480			4.9 1040				
25													

Table 5. - Tritium deposition and precipitation in the U.S. during 1956.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	110 / 1910	43 / 330	81 / 350	87 / 240	80 / 280	82 / 430	79 / 470						
47	55 / 1100	63 / 520	68 / 310	90 / 260	86 / 430	76 / 450	99 / 660	120 / 680				78 / 780	
45	51 / 1010	34 / 310	46 / 220	130 / 390	77 / 330	78 / 520	90 / 690	110 / 700	150 / 810	120 / 970	91 / 910	90 / 1000	
43	37 / 820	29 / 290	50 / 260	70 / 260	65 / 320	59 / 450	51 / 510	77 / 640	140 / 930	110 / 1000	84 / 1050		
41	38 / 960	16 / 200	31 / 210	51 / 230	49 / 290	51 / 470	48 / 600	70 / 780	120 / 1110	83 / 1040	78 / 1110		
39	11 / 320	7.0 / 120	15 / 130	16 / 99	33 / 230	44 / 480	53 / 750	68 / 980	100 / 1280	61 / 1020			
37	5.1 / 170	5.0 / 110	16 / 200	10 / 94	28 / 280	41 / 580	57 / 960	57 / 1150	52 / 1040	51 / 1140			
35		8.7 / 250	3.6 / 72	7.2 / 100	13 / 190	27 / 540	60 / 1330	57 / 1270	40 / 990	45 / 1120			
33		3.4 / 110	3.7 / 93	5.5 / 140	9.7 / 220	16 / 400	41 / 1030	52 / 1290	39 / 1110				
31					3.8 / 110	16 / 520	31 / 1050	50 / 1650	40 / 1330				
29						10 / 500			20 / 1000				
27						6.4 / 420			15 / 980				
25													

Table 6. - Tritium deposition and precipitation in the U.S. during 1957.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	75 1510	46 460	65 360	78 280	64 290	100 640	100 680						
47	41 920	54 540	58 340	120 430	72 360	85 610	93 780	91 610					74 930
45	48 1060	30 330	44 280	120 490	87 460	84 640	71 710	96 800	140 850	75 750	62 780	47 670	
43	37 930	24 300	65 430	100 490	100 600	81 740	60 750	100 1000	100 870	78 860	56 790		
41	40 1150	16 220	37 310	81 470	72 510	69 760	59 850	91 1140	93 1040	57 820	40 800		
39	14 460	8.5 170	19 210	40 310	69 620	67 960	67 1120	90 1500	66 1110	52 1050			
37	6.6 270	7.1 180	32 450	22 240	38 470	56 1120	79 1750	69 1530	58 1280	50 1250			
35		11 370	8.7 190	16 270	22 430	42 1060	72 1790	58 1450	45 1120	45 1270			
33		7.7 310	7.0 230	11 280	19 480	42 1190	48 1590	40 1350	40 1340				
31					18 700	33 1330	40 1610	42 1690	41 1630				
29						19 960			31 1560				
27						12 820			25 1670				
25													

Table 7. - Tritium deposition and precipitation in the U.S. during 1958.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N) \ LONGITUDE (°W)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	390 1940	210 530	330 430	280 230	210 220	370 530	290 490						
47	210 1070	230 570	270 370	440 380	270 320	250 420	350 680	390 640				380 960	
45	210 1090	130 340	160 240	390 370	320 410	200 370	210 460	300 560	340 530	450 1000	350 950	380 1080	
43	170 980	85 240	180 290	320 350	310 450	280 600	250 670	300 680	360 720	410 1020	350 1170		
41	170 1220	58 190	93 170	230 320	270 440	330 830	300 960	310 850	390 1030	300 1010	360 1430		
39	77 640	29 120	69 160	79 140	200 430	290 890	280 1100	300 1060	350 1190	290 1170			
37	44 440	45 250	110 360	77 190	180 510	200 790	290 1300	240 1080	210 960	210 1180			
35		57 440	41 210	64 260	94 390	95 500	240 1400	170 1020	190 1110	240 1610			
33		28 280	32 210	79 440	79 490	120 810	180 1300	180 1300	160 1130				
31					78 710	100 1040	140 1280	170 1540	140 1290				
29						74 1060			89 1280				
27						60 1210			86 1720				
25													

Table 8. - Tritium deposition and precipitation in the U.S. during 1959.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N) \ LONGITUDE (°W)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	500 2390	230 500	360 440	380 290	400 400	330 460	380 600						
47	210 1070	240 530	260 330	340 270	280 310	270 420	370 670	560 870				370 920	
45	160 870	100 250	140 180	300 260	300 370	360 630	380 840	490 900	670 950	420 930	390 990	360 1040	
43	100 610	73 190	200 280	310 310	300 400	390 780	390 990	490 1060	540 980	420 1060	330 1100		
41	110 760	47 150	120 210	230 290	250 400	300 750	330 940	330 900	400 1000	280 950	280 1130		
39	44 340	25 100	64 140	120 200	220 430	270 770	270 900	320 1080	290 980	260 1050			
37	18 180	19 110	110 370	100 250	160 470	340 1220	290 1210	290 1200	270 1170	200 1360			
35		25 190	43 210	67 260	82 330	170 840	260 1360	230 1260	240 1340	200 1360			
33		15 150	22 150	21 130	120 690	140 850	170 1140	210 1400	230 1550				
31					72 600	110 1040	190 1690	220 1800	210 1720				
29						66 940			120 1780				
27						29 580			95 1900				
25													

Table 9. - Tritium deposition and precipitation in the U.S. during 1960.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	130 1860	58 450	70 310	87 230	100 360	92 480	87 510						
47	63 1050	63 520	49 220	73 210	89 360	73 430	92 610	180 1050					96 960
45	56 1120	33 300	49 230	67 210	85 390	87 580	88 680	130 840	120 650	90 750	97 970	99 1100	
43	41 910	26 260	49 260	56 210	53 280	97 750	100 940	120 910	100 690	110 980	90 1130		
41	46 1160	15 180	28 190	56 270	59 370	84 770	72 800	93 930	92 830	79 990	70 1000		
39	12 350	6.3 100	21 170	23 150	48 370	71 790	64 800	78 970	79 990	62 1030			
37	9.7 320	8.0 180	24 300	20 180	71 710	79 990	74 1140	72 1100	61 1010	57 1260			
35		7.8 220	5.2 87	16 210	32 450	44 730	58 1150	57 1140	52 1160	59 1480			
33		5.4 180	5.2 130	12 230	19 370	37 820	48 1210	52 1310	49 1220				
31					17 500	37 1060	41 1180	47 1340	56 1610				
29						24 1200			34 1690				
27						10 670			24 1620				
25													

Table 10. - Tritium deposition and precipitation in the U.S. during 1961.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	190 2140	88 490	110 340	120 210	100 250	130 450	160 630						
47	110 1210	89 520	90 280	160 300	100 280	100 420	120 560	180 700				160 970	
45	100 1260	41 250	90 290	180 370	99 310	130 550	130 700	170 780	230 750	160 860	130 870	140 980	
43	55 790	35 230	87 310	140 340	120 420	150 740	180 1150	180 990	170 780	150 930	130 1050		
41	53 880	22 170	44 200	110 360	120 480	140 850	170 1200	160 1050	170 1080	130 1030	110 1130		
39	17 340	5.7 57	34 200	55 250	82 430	140 1030	150 1230	160 1340	130 1220	100 1110			
37	6.5 160	8.2 100	44 340	39 240	72 480	130 1090	110 1220	120 1320	110 1200	76 1080			
35		8.5 170	10 110	25 220	37 340	63 700	90 1130	110 1610	95 1350	80 1330			
33		4.7 120	10 170	14 200	37 530	70 1000	100 1740	100 1700	74 1240				
31					29 580	43 950	78 1740	95 2110	49 1080				
29						28 800			33 950				
27						20 660			28 1140				
25													

Table 11. - Tritium deposition and precipitation in the U.S. during 1962.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	700 1740	300 430	520 350	970 370	930 460	880 680	800 730						
47	400 100	350 500	460 330	1100 420	680 380	760 640	670 750	990 660				720 920	
45	350 920	190 290	330 260	840 350	960 600	790 790	550 700	820 630	1100 620	680 760	780 980	820 1180	
43	290 840	160 260	380 310	720 340	680 480	560 660	550 790	790 720	960 640	760 850	670 960		
41	340 1130	120 210	280 260	310 180	390 360	530 700	490 810	700 820	1000 920	750 940	670 1110		
39	140 490	89 200	150 180	150 140	350 390	510 820	460 870	740 1130	930 1240	620 1040			
37	75 300	57 140	200 310	100 130	360 510	480 880	450 1000	720 1430	650 1180	610 1530			
35		120 370	45 99	75 140	210 380	400 790	480 1190	490 1290	450 1120	500 1460			
33		53 190	43 120	94 210	150 310	380 880	350 1090	330 1090	410 1280				
31					100 250	320 840	320 1170	260 1140	310 1230				
29						160 530			200 1100				
27						93 410			150 1260				
25													

Table 12. - Tritium deposition and precipitation in the U.S. during 1963.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	2600 / 1440	1300 / 390	1800 / 350	2000 / 310	2300 / 440	1600 / 380	2300 / 630						
47	1500 / 970	1300 / 440	1600 / 340	2300 / 390	2100 / 460	1400 / 410	1900 / 620	2100 / 610				2000 / 1000	
45	1200 / 1010	900 / 340	1800 / 410	2400 / 460	2000 / 480	1500 / 510	1500 / 590	2000 / 650	1900 / 540	1600 / 660	1600 / 790	1600 / 980	
43	830 / 830	770 / 370	1400 / 360	1300 / 300	1500 / 420	1400 / 530	1600 / 780	1900 / 710	1700 / 590	1600 / 760	1200 / 830		
41	940 / 1180	530 / 310	770 / 270	890 / 250	1100 / 360	1300 / 590	1200 / 650	1600 / 740	1400 / 690	1200 / 820	940 / 850		
39	360 / 510	210 / 170	500 / 220	490 / 180	690 / 280	1100 / 600	1000 / 690	1200 / 810	1400 / 880	1000 / 870			
37	200 / 360	190 / 210	530 / 310	390 / 180	770 / 380	1200 / 690	1000 / 840	1500 / 1290	1200 / 1000	1100 / 112			
35		220 / 320	220 / 180	300 / 190	460 / 290	730 / 520	790 / 720	1400 / 1440	1200 / 1180	1200 / 1300			
33		120 / 200	170 / 180	150 / 120	410 / 320	560 / 460	780 / 860	810 / 1010	980 / 1160				
31					290 / 290	560 / 630	910 / 1130	920 / 1310	1000 / 1480				
29						330 / 470			630 / 114				
27						280 / 480			540 / 120				
25													

Table 13. - Tritium deposition and precipitation in the U.S. during 1964.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	1300 2240	870 550	1500 510	1400 290	1600 400	1300 460	1600 680						
47	600 1080	890 590	1100 370	2000 430	1400 390	1100 470	1500 710	1900 800				1200 780	
45	640 1280	530 400	830 300	1800 400	1200 360	930 420	1100 600	1400 640	1200 620	940 630	1100 780	1200 880	
43	410 920	430 360	930 360	1100 250	940 290	1300 700	1400 850	1600 870	1400 760	1100 800	1000 780		
41	520 130	280 280	730 320	760 220	770 270	1200 710	1200 840	1300 820	1500 1000	1200 910	1100 970		
39	160 410	55 69	400 220	480 180	740 320	1300 890	1100 890	1400 1090	1300 1000	950 950			
37	82 230	69 120	480 340	350 180	580 340	930 930	990 1240	1400 1390	1200 1160	980 1230			
35		94 190	140 150	250 190	270 270	490 810	590 1170	1000 1610	1200 1660	880 1470			
33		60 130	150 250	110 140	150 250	310 780	570 1620	760 1690	840 1690				
31					260 640	210 830	330 1340	610 1740	750 2150				
29						130 700			310 1350				
27						72 400			280 1460				
25													

Table 14. - Tritium deposition and precipitation in the U.S. during 1965.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	490 1410	240 370	550 420	820 410	840 440	790 610	750 750						
47	270 900	290 480	450 380	820 410	930 550	570 520	880 980	610 720				570 760	
45	250 880	160 300	280 260	550 290	680 460	540 600	720 960	650 920	560 750	540 680	520 690	500 720	
43	180 700	130 280	360 360	540 340	690 530	690 890	740 1140	690 1130	620 960	560 800	450 690		
41	190 860	110 270	240 300	600 460	540 540	620 950	630 1110	580 1060	520 880	460 760	400 740		
39	84 420	53 170	160 270	270 300	400 530	540 980	510 1000	520 1050	430 840	370 750			
37	51 300	53 210	240 590	150 240	290 530	310 700	370 940	430 1070	420 1000	360 1020			
35		94 470	85 280	90 240	100 260	200 620	300 990	340 1100	380 1130	390 1460			
33		92 480	52 210	40 140	97 360	190 860	230 1080	270 1070	310 1200				
31					78 440	140 960	160 970	250 1340	320 1670				
29						71 710			150 1170				
27						43 540			110 1420				
25													

Table 15. - Tritium deposition and precipitation in the U.S. during 1966.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N) \ LONGITUDE (°W)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	430 1720	180 360	380 400	340 260	260 240	340 480	350 650						
47	230 1000	210 470	190 220	380 320	420 420	330 500	360 720	370 760				320 710	
45	190 970	83 210	100 140	310 280	470 500	330 550	290 610	300 660	250 560	380 750	390 860	410 1020	
43	160 820	62 210	140 220	270 270	300 360	260 490	360 850	380 920	310 770	340 830	340 940		
41	160 930	34 130	77 150	170 230	180 280	200 440	260 650	300 820	290 840	290 920	320 1080		
39	56 350	33 170	66 190	87 160	140 280	150 400	290 830	360 1120	310 1020	240 960			
37	26 170	19 110	88 350	52 150	140 390	200 670	270 920	290 1130	150 1130	200 1120			
35		39 240	37 180	40 170	82 360	170 750	240 1210	270 1340	220 1220	250 1670			
33		25 180	31 200	42 240	75 420	130 780	250 1480	220 1390	210 1420				
31					62 440	100 800	230 1640	210 1470	220 1660				
29						46 920			70 1000				
27						36 910			71 1420				
25													

Table 16. - Tritium deposition and precipitation in the U.S. during 1967.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	330 / 2190	100 / 350	230 / 380	210 / 230	190 / 320	150 / 330	220 / 550						
47	130 / 930	130 / 450	190 / 340	350 / 410	180 / 340	150 / 380	190 / 540	260 / 690				250 / 940	
45	110 / 880	65 / 240	140 / 290	370 / 460	240 / 480	140 / 400	200 / 660	250 / 850	270 / 760	250 / 840	240 / 940	280 / 1120	
43	95 / 790	63 / 250	190 / 400	300 / 420	200 / 420	190 / 650	170 / 790	200 / 1010	230 / 840	270 / 960	250 / 1070		
41	120 / 1090	58 / 280	120 / 300	220 / 390	220 / 500	220 / 900	180 / 930	160 / 910	180 / 820	200 / 970	220 / 1140		
39	58 / 530	21 / 110	86 / 300	90 / 240	150 / 460	200 / 940	190 / 1130	190 / 1180	220 / 1140	160 / 960			
37	34 / 340	33 / 220	91 / 410	65 / 240	98 / 390	140 / 800	140 / 1070	160 / 1230	210 / 1230	120 / 1070			
35		47 / 430	32 / 210	39 / 200	72 / 400	82 / 680	110 / 1290	160 / 1610	180 / 1380	110 / 1070			
33		28 / 280	27 / 220	20 / 140	40 / 360	57 / 710	90 / 1290	97 / 1220	120 / 1070				
31					28 / 360	55 / 840	78 / 1300	110 / 1510	120 / 1350				
29						46 / 920			70 / 1000				
27						36 / 910			71 / 1420				
25													

Table 17. - Tritium deposition and precipitation in the U.S. during 1968.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	240 2420	91 410	180 460	150 260	160 330	210 520	260 740						
47	130 1350	110 550	120 330	230 440	210 480	170 530	270 910	290 960				140 800	
45	130 1410	50 280	130 360	220 450	180 490	190 690	210 900	160 770	200 790	220 960	180 980	170 1040	
43	63 740	55 320	130 400	140 310	110 350	170 750	160 890	130 920	160 930	200 950	150 980		
41	79 1050	36 260	95 340	97 250	85 330	130 750	110 820	110 900	130 1030	170 920	140 900		
39	28 430	5.1 46	48 210	61 200	91 430	140 940	100 930	100 1090	100 1000	120 890			
37	14 240	12 140	46 270	52 240	62 360	110 910	130 1320	85 1000	83 970	94 1050			
35		11 160	19 170	41 270	58 450	74 780	120 1540	87 1160	85 1140	77 960			
33		6.0 93	11 130	30 300	48 530	69 860	72 1210	62 1030	59 910				
31					33 440	66 1100	65 1310	54 1090	73 1330				
29						52 1150			50 1240				
27						30 750			68 1960				
25													

LONGITUDE (°W)

Table 18. - Tritium deposition and precipitation in the U.S. during 1969.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	220 / 1830	73 / 350	120 / 340	120 / 240	140 / 320	160 / 470	180 / 600						
47	100 / 950	100 / 500	110 / 330	180 / 380	160 / 380	140 / 450	180 / 630	190 / 680				170 / 1010	
45	110 / 1120	58 / 310	69 / 230	130 / 290	130 / 340	160 / 590	160 / 630	190 / 740	200 / 750	190 / 780	200 / 1120	200 / 1400	
43	82 / 910	44 / 270	86 / 320	120 / 290	120 / 340	160 / 720	200 / 920	220 / 980	190 / 820	190 / 890	170 / 1140		
41	110 / 1360	40 / 270	68 / 270	140 / 400	160 / 510	140 / 700	210 / 1180	170 / 940	160 / 910	140 / 840	160 / 1140		
39	45 / 600	56 / 430	59 / 300	78 / 280	120 / 440	150 / 860	160 / 1110	150 / 1080	130 / 990	150 / 1170			
37	29 / 480	26 / 260	60 / 370	62 / 280	120 / 610	100 / 750	120 / 1020	140 / 1250	130 / 1150	99 / 1100			
35		33 / 410	23 / 180	43 / 270	81 / 540	88 / 800	110 / 1250	120 / 1560	89 / 1110	120 / 960			
33		22 / 300	17 / 170	14 / 110	66 / 600	68 / 900	79 / 1130	66 / 1020	87 / 1240				
31					68 / 840	60 / 920	73 / 1330	85 / 1550	90 / 1800				
29						40 / 870			55 / 1380				
27						28 / 700			57 / 1890				
25													

Table 19. - Tritium deposition and precipitation in the U.S. during 1970.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	170 / 1840	67 / 440	110 / 420	110 / 280	170 / 440	140 / 460	140 / 580						
47	94 / 1100	95 / 630	79 / 320	150 / 400	150 / 430	110 / 430	140 / 670	160 / 780				170 / 960	
45	92 / 1230	53 / 380	81 / 340	170 / 470	140 / 400	140 / 630	150 / 810	140 / 780	150 / 780	180 / 970	170 / 920	170 / 1050	
43	59 / 910	49 / 380	83 / 380	100 / 300	100 / 340	120 / 600	160 / 980	170 / 1050	140 / 870	150 / 900	140 / 940		
41	84 / 1410	30 / 270	63 / 320	84 / 280	92 / 340	120 / 730	150 / 1040	130 / 980	140 / 970	150 / 990	130 / 920		
39	33 / 610	8.8 / 93	34 / 200	54 / 210	74 / 320	100 / 720	110 / 970	130 / 1250	110 / 1030	110 / 910			
37	16 / 320	13 / 180	52 / 370	38 / 180	46 / 250	100 / 860	100 / 1170	100 / 1160	79 / 930	87 / 1150			
35		27 / 410	21 / 190	24 / 160	38 / 270	37 / 410	77 / 1090	80 / 1240	79 / 1130	87 / 1340			
33		14 / 240	17 / 190	18 / 150	29 / 290	44 / 680	58 / 1170	64 / 1270	65 / 1310				
31					35 / 470	43 / 860	55 / 1370	72 / 1590	75 / 1680				
29						40 / 1010			44 / 1090				
27						20 / 670			40 / 1340				
25													

Table 20. - Tritium deposition and precipitation in the U.S. during 1971.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	157.4 / 2248	70.4 / 469	74.6 / 355	49.4 / 190	92.4 / 440	110.4 / 581	110.4 / 631						
47	65.2 / 1185	98.0 / 726	62.2 / 296	98.0 / 426	79.3 / 387	99.7 / 554	126.6 / 844	119.6 / 854				108.0 / 809	
45	69.8 / 1395	40.3 / 322	85.4 / 427	84.1 / 401	93.8 / 469	93.8 / 536	114.0 / 760	93.8 / 670	93.4 / 667	135.1 / 932	130.9 / 935	142.8 / 1058	
43	32.5 / 722	31.1 / 345	83.2 / 462	53.1 / 259	91.8 / 510	110.0 / 647	118.0 / 814	99.6 / 738	103.3 / 765	125.4 / 896	127.0 / 1016		
41	40.5 / 901	17.1 / 285	48.6 / 324	38.7 / 215	61.4 / 361	128.2 / 801	99.7 / 712	100.8 / 775	110.4 / 849	146.3 / 1084	139.8 / 1165		
39	11.5 / 255	5.1 / 93	38.9 / 268	37.1 / 218	61.4 / 384	118.7 / 741	111.0 / 854	125.6 / 1048	132.3 / 1058	145.8 / 1166			
37	7.8 / 174	6.5 / 130	41.5 / 346	34.4 / 215	69.7 / 498	129.4 / 665	129.1 / 1123	116.5 / 1165	168.7 / 1208	97.3 / 1297			
35		20.9 / 279	6.8 / 91	20.6 / 206	34.7 / 385	69.9 / 699	123.3 / 1233	102.8 / 1370	108.5 / 1447	94.9 / 1460			
33		9.9 / 220	9.3 / 186	9.2 / 184	23.4 / 468	39.6 / 786	75.7 / 1514	73.9 / 1477	75.3 / 1506				
31					21.0 / 467	25.4 / 634	37.7 / 1255	33.3 / 1331	28.4 / 1422				
29						32.8 / 938			25.2 / 1095				
27						21.1 / 703			31.6 / 1263				
25													

Table 21. - Tritium deposition and precipitation in the U.S. during 1972.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LATITUDE (°N) \ LONGITUDE (°W)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	104.3 2317	31.0 344	49.3 352	51.0 319	68.4 456	58.8 452	59.2 493						
47	45.2 1130	48.5 606	33.5 279	63.6 454	53.7 385	58.2 485	74.2 856	85.6 856				93.7 1107	
45	48.3 1239	19.2 274	32.9 329	41.2 343	53.4 445	73.8 671	74.2 742	70.7 785	81.5 815	107.1 1190	92.7 1091	98.8 1235	
43	26.3 712	14.3 238	32.0 355	35.3 321	45.7 415	66.4 738	90.1 1001	130.0 1182	93.8 938	105.9 1246	104.7 1396		
41	33.9 968	8.7 174	21.5 269	32.2 307	50.6 482	63.5 794	69.1 864	87.3 919	89.8 1122	93.6 1248	88.0 1257		
39	11.0 365	2.2 62	19.0 271	15.3 191	42.6 533	51.9 692	63.7 849	96.3 1284	102.2 1363	82.8 1380			
37	4.6 183	4.3 142	23.5 470	15.8 226	30.7 438	48.2 803	64.2 1175	68.0 1510	51.1 1279	46.1 1317			
35		4.0 152	9.7 276	11.5 256	26.4 528	23.7 593	57.2 1143	50.5 1328	43.5 1243	46.1 1310			
33		4.1 165	6.9 230	6.9 229	13.2 439	17.5 701	41.0 1365	46.7 1333	38.1 1567				
31					8.9 447	15.2 662	36.9 1477	42.0 1399	47.0 1567				
29						20.0 1001			27.9 1116				
27						16.6 834			33.0 1651				
25													

Table 22. - Tritium deposition and precipitation in the U.S. during 1973.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	70.5 1763	32.6 435	33.6 305	36.4 291	35.4 308	54.7 547	64.5 717						
47	36.9 1055	42.5 607	1735 194	47.2 429	30.9 281	45.0 450	58.2 727	60.3 804				75.8 1083	
45	43.2 1309	19.2 274	29.5 347	38.4 384	48.8 488	46.3 579	67.4 899	60.3 862	57.3 764	67.6 1040	77.4 1191	86.3 1328	
43	29.8 992	15.9 245	36.1 451	42.2 469	46.4 487	63.1 841	83.0 1186	87.6 1095	64.3 857	63.6 1010	67.4 1123		
41	40.7 1452	15.0 250	25.1 335	33.4 393	50.2 558	58.5 1063	86.0 1323	75.3 1159	65.5 1092	65.7 1095	62.3 1132		
39	17.3 690	10.8 196	20.0 266	16.6 208	37.9 505	65.4 1307	78.5 1308	67.3 1345	66.9 1217	57.5 1045			
37	10.3 412	10.3 205	27.8 348	18.4 245	19.8 395	56.7 1418	61.7 1543	75.1 1668	60.8 1352	35.6 1187			
35		10.6 425	7.7 153	12.9 277	12.9 311	23.4 780	66.2 1890	65.5 1637	56.3 1608	46.6 1553			
33		3.8 190	2.9 116	4.8 191	9.5 378	21.8 990	49.9 1664	61.1 1745	39.0 1361				
31					10.1 507	20.6 1028	49.3 1972	56.5 1884	56.3 2011				
29						21.5 1133			25.5 1274				
27						12.8 752			19.3 1289				
25													

Table 23. - Tritium deposition and precipitation in the U.S. during 1974.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	118.8 2376	44.8 407	48.4 372	52.6 329	44.6 343	69.9 635	55.4 616						
47	44.2 1164	53.0 530	36.7 306	48.2 344	32.6 272	45.5 455	53.6 596	62.7 738				53.6 894	
45	47.9 1294	17.1 214	29.7 270	37.3 311	27.4 249	34.4 382	51.8 609	65.7 821	64.4 805	82.7 1103	57.2 954	60.8 1106	
43	28.2 816	10.9 155	29.8 298	26.7 254	26.3 263	40.6 478	64.0 780	74.1 926	70.0 875	65.3 933	56.9 1034		
41	32.5 1017	7.3 121	20.9 220	26.8 208	29.3 345	35.5 473	56.0 862	73.9 1055	72.2 1032	67.4 1037	57.2 1003		
39	11.0 368	5.4 136	15.5 163	15.2 190	23.1 330	53.1 759	52.0 1040	63.1 1051	69.5 1264	44.8 895			
37	8.0 321	4.4 177	20.8 320	12.7 211	24.3 441	62.7 1254	62.4 1387	59.8 1623	64.0 1600	40.4 1155			
35		8.8 382	7.3 208	10.0 251	20.6 542	24.7 706	47.1 1472	45.6 1424	34.7 1155	43.3 1443			
33		6.1 207	4.2 167	10.6 354	21.2 731	26.2 936	36.8 1470	35.5 1419	30.1 1157				
31					12.1 447	23.0 920	33.3 1515	34.0 1545	30.2 1371				
29						19.9 866			26.7 1034				
27						9.9 452			20.4 1357				
25													

Table 24. - Tritium deposition and precipitation in the U.S. during 1975.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	127.1 2542	51.3 540	60.0 536	49.0 408	45.5 479	63.5 668	55.5 653						
47	48.4 1209	42.4 471	47.6 501	56.7 515	51.9 546	50.9 565	59.3 741	71.0 946				39.8 795	
45	42.5 1148	25.5 360	30.9 343	43.9 439	35.4 443	46.3 618	60.8 760	65.2 932	68.7 981	57.6 1048	52.2 1044	55.7 1237	
43	28.7 821	21.6 288	34.7 385	28.3 314	23.5 335	40.2 618	50.2 717	70.1 1001	60.3 1005	65.8 1197	56.5 1255		
41	38.1 1154	11.9 238	17.7 295	22.0 314	22.7 413	28.9 577	42.0 934	63.8 1063	47.9 1065	64.6 1291	58.5 1393		
39	10.1 338	2.6 65	9.3 232	9.8 196	16.9 338	33.6 747	38.0 1086	62.6 1391	42.5 1416	61.8 1374			
37	9.2 461	3.5 118	14.1 353	6.0 172	17.5 437	34.2 977	41.9 1310	49.0 1634	40.3 1342	38.6 1286			
35		4.8 230	2.9 115	4.7 187	10.2 340	24.6 820	32.1 1145	43.8 1624	46.4 1499	32.5 1501			
33		3.6 213	1.7 100	3.2 158	14.2 569	18.5 739	32.6 1630	35.2 1760	35.9 1794				
31					10.9 472	18.7 935	24.9 1467	34.2 2104	34.6 1728				
29						14.2 784			14.5 1117				
27						12.3 726			9.7 1073				
25													

Table 25. - Tritium deposition and precipitation in the U.S. during 1976.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	41.7 1668	14.3 285	34.2 380	27.6 276	21.0 233	15.8 225	27.8 555						
47	19.0 758	10.2 256	20.7 243	30.5 321	21.2 283	12.8 213	22.6 452	27.8 617				55.6 1235	
45	18.3 797	9.2 262	21.5 286	29.0 322	27.0 386	15.6 284	18.8 418	26.7 572	31.8 707	47.0 1175	38.6 965	42.0 1051	
43	8.2 408	5.0 198	19.0 293	22.3 279	22.8 326	21.6 431	29.4 654	42.5 944	31.8 796	39.1 1117	42.3 1057		
41	8.0 444	4.3 173	11.9 216	17.8 237	18.9 289	22.4 448	25.5 637	26.9 768	23.3 776	30.6 1020	28.9 825		
39	3.1 185	2.4 118	10.2 203	10.2 166	24.5 409	25.1 550	19.4 664	21.6 864	23.8 952	23.9 956			
37	4.9 291	3.3 194	13.7 342	9.4 145	18.6 371	26.4 660	25.1 1004	29.7 1236	25.8 1073	21.2 1060			
35		4.5 300	5.1 202	6.6 132	16.1 402	25.6 854	27.3 1093	32.2 1398	29.1 1267	29.4 1471			
33		4.3 285	2.5 127	6.5 258	11.2 449	17.0 850	25.1 1256	24.2 1211	27.5 1376				
31					13.4 669	21.0 1048	17.6 1173	22.5 1500	24.4 1624				
29						15.7 1050			11.8 1179				
27						15.7 1045			9.0 1284				
25													

Table 26. - Tritium deposition and precipitation in the U.S. during 1977.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	61.9 1996	23.7 395	39.6 396	32.0 278	34.1 341	73.9 821	60.6 808						
47	31.2 1040	17.1 311	27.8 309	34.8 316	42.4 471	53.4 712	61.9 884	64.0 915				57.9 1053	
45	30.8 1025	14.4 287	26.3 225	40.0 444	56.2 661	52.4 698	52.3 804	52.7 786	50.3 719	55.7 1013	59.2 1183	73.4 1467	
43	17.8 636	8.6 214	24.6 328	26.3 329	34.0 453	58.9 951	52.6 957	70.7 1087	56.6 943	62.4 1248	52.9 1175		
41	20.3 811	6.7 190	18.5 309	15.2 203	23.2 386	43.8 876	48.0 960	50.5 1009	41.3 917	41.6 925	45.5 1138		
39	6.8 271	4.1 136	9.3 186	9.8 164	21.5 430	42.9 1073	39.3 1123	49.5 1237	41.0 1026	37.8 944			
37	4.2 209	3.4 136	14.2 355	10.0 200	15.0 376	31.2 890	28.0 933	42.5 1415	28.9 1155	20.9 1045			
35		8.6 373	2.4 80	7.0 201	10.3 344	13.3 532	28.6 1145	37.8 1511	21.9 1097	19.7 1314			
33		5.1 234	4.5 186	13.2 550	5.8 251	12.2 608	27.7 1387	29.3 1467	16.7 1114				
31					8.3 416	11.2 562	23.4 1557	22.8 1522	16.2 1243				
29						12.5 831			11.7 972				
27						10.0 668			13.8 1383				
25													

Table 27. - Tritium deposition and precipitation in the U.S. during 1978.

]Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	59 1470	36.5 487	54.7 456	65.6 437	64.9 519	64.3 443	57.4 638						
47	31 890	28.0 373	30.3 289	74.8 598	45.3 431	50.6 506	54.8 731	72.5 967				50.5 842	
45	34 973	21.1 362	26.3 263	66.6 605	39.5 395	49.6 496	62.7 896	61.4 877	44.2 631	50.9 849	57.1 1039	55.6 926	
43	28 805	17.5 792	36.3 363	33.6 320	43.1 430	42.9 572	58.1 830	61.5 879	49.9 831	48.1 961	42.5 945		
41	38 1094	10.7 267	22.1 295	24.9 249	25.4 338	54.0 772	57.7 962	54.3 905	50.8 1015	48.2 1073	50.4 1121		
39	22.6 566	7.3 244	23.6 332	14.5 193	21.5 359	40.8 680	49.0 979	62.5 1250	55.8 1240	50.5 1122			
37	16.6 552	7.6 302	24.9 497	11.6 232	15.7 448	44.1 881	48.4 1210	47.5 1188	32.1 1070	37.3 1244			
35		16.8 671	9.7 378	9.8 279	10.1 405	21.0 599	41.2 1647	29.7 1186	19.6 979	27.8 1110			
33		9.9 493	5.1 254	6.2 312	8.8 439	14.3 572	24.5 1223	21.6 1081	19.8 990				
31					7.4 490	15.7 787	21.8 1210	33.8 1879	25.2 1375				
29						18.8 1044			17.3 1156				
27						12.3 683			17.9 1378				
25													

Table 28. - Tritium deposition and precipitation in the U.S. during 1979.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	34.1 1706	21.8 364	23.4 292	21.5 215	22.9 286	35.5 507	27.9 557						
47	19.7 987	17.8 356	18.4 263	19.5 217	19.4 299	29.2 487	39.5 789	46.8 1039				35.0 1062	
45	28.3 1133	15.3 340	13.4 224	23.3 311	21.3 355	30.6 612	37.1 824	30.7 767	29.3 651	31.7 933	39.1 1185	46.6 1553	
43	28.3 809	11.4 285	11.0 245	21.8 364	25.1 502	29.9 747	33.6 884	40.6 1014	34.4 860	37.8 1145	35.3 1177		
41	40.7 444	6.3 173	6.5 216	18.6 237	26.8 289	24.7 448	23.5 637	30.5 768	40.1 776	43.3 1020	36.2 825		
39	22.5 500	2.0 67	6.7 192	6.8 195	17.4 497	24.2 805	23.3 933	41.5 1383	37.7 1257	35.6 1320			
37	8.9 295	5.2 194	9.8 328	5.4 214	11.2 448	24.4 1060	33.7 1533	38.7 1761	29.6 1347	25.2 1402			
35		8.5 339	4.3 173	5.3 263	7.5 373	11.6 772	27.7 1630	30.0 1667	23.9 1407	21.4 1424			
33		5.9 295	3.6 189	2.7 148	6.1 404	11.1 852	29.7 2121	24.0 1601	20.1 1433				
31					4.6 356	11.4 953	20.3 1845	20.4 1855	19.9 1806				
29						12.3 1122			14.2 1578				
27						7.8 717			10.2 1463				
25													

Table 29. - Tritium deposition and precipitation in the U.S. during 1980.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	37.4 1871	17.3 432	30.1 463	19.4 254	21.6 332	21.1 384	22.5 499						
47	21.1 1053	15.2 422	25.7 467	21.5 330	20.8 415	17.6 460	23.1 659	27.8 794				30.6 827	
45	24.3 1155	11.6 351	19.8 439	18.5 337	19.6 436	16.2 406	24.1 689	26.6 832	23.4 724	30.3 843	28.7 777	30.1 861	
43	14.4 654	9.9 320	15.4 385	14.2 315	13.6 340	19.4 554	23.7 790	32.4 983	27.4 856	36.0 883	29.8 850		
41	25.3 1013	7.4 295	10.4 324	12.1 302	16.9 484	16.2 522	23.8 882	25.2 840	23.4 781	26.5 882	28.7 870		
39	12.1 403	3.9 176	7.8 312	7.0 201	13.0 432	16.7 668	16.1 733	22.8 910	25.5 1018	22.2 889			
37	6.0 301	3.7 185	10.5 475	4.6 185	7.9 329	14.7 733	20.5 1027	24.9 1244	19.5 976	20.6 1028			
35		7.4 438	3.1 154	4.5 224	7.0 389	11.2 658	17.5 971	25.7 1511	12.5 1090	20.4 1132			
33		4.9 380	2.7 182	2.8 186	9.1 608	8.4 562	21.1 1507	19.1 1467	14.8 1060				
31					5.0 359	9.0 695	18.8 1711	17.1 1706	13.3 1329				
29						10.0 768			13.5 1689				
27						5.0 553			8.6 1310				
25													

Table 30. - Tritium deposition and precipitation in the U.S. during 1981.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	31.5 1853	14.0 379	32.4 589	16.7 239	16.6 277	24.6 447	28.1 561						
47	18.5 1086	15.6 446	19.8 396	22.4 344	20.7 376	23.6 446	34.0 680	32.1 802				45.3 1193	
45	22.2 1234	12.9 392	17.6 360	22.3 372	19.4 357	21.6 431	36.4 808	27.9 753	30.1 814	33.0 892	41.9 1132	40.6 1161	
43	17.2 956	9.6 309	16.7 348	18.9 344	25.6 492	33.2 663	33.0 826	33.1 946	32.0 888	33.4 902	32.1 916		
41	26.3 1383	6.5 218	11.4 254	13.6 271	22.1 441	33.6 747	38.0 1085	37.1 1061	31.9 912	31.5 876	31.0 938		
39	10.5 524	3.0 120	11.6 330	9.9 225	18.5 421	32.9 867	33.2 1108	28.0 1000	25.8 922	28.9 825			
37	6.1 319	2.9 163	12.3 409	8.3 219	14.7 490	28.9 963	25.6 1023	27.3 1049	26.6 1022	30.6 1093			
35		5.1 301	3.1 171	6.4 212	14.4 601	16.0 800	17.4 1163	20.4 1199	26.8 1070	27.0 1127			
33		3.9 260	2.9 194	5.8 290	12.1 607	14.8 988	16.1 1149	17.4 1163	23.0 1149				
31					11.8 696	13.9 1162	12.2 1216	12.8 1278	14.3 1097				
29						11.3 1132			10.6 1061				
27						6.9 768			8.8 1361				
25													

Table 31. - Tritium deposition and precipitation in the U.S. during 1982.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	28.6 1904	13.1 438	14.2 472	17.3 345	19.5 433	20.5 513	24.2 690						
47	11.1 1105	11.8 436	9.3 373	20.1 447	18.3 457	18.1 488	27.1 822	32.5 929				33.1 946	
45	14.4 1443	8.0 335	13.5 450	15.5 370	23.0 660	24.4 740	27.9 930	24.8 828	26.8 765	29.8 851	31.6 404	30.0 1000	
43	9.5 952	6.8 339	11.4 455	16.5 413	16.5 516	26.6 886	30.2 1043	32.6 1086	23.8 792	31.0 938	29.7 989		
41	14.8 1479	5.8 342	7.7 383	10.7 288	15.6 520	24.0 958	34.2 1220	30.1 1114	31.4 1046	29.3 915	25.1 836		
39	9.3 771	4.0 264	5.2 346	6.3 180	12.1 482	19.1 830	31.7 1269	32.0 1280	26.3 1050	32.3 1076			
37	4.2 420	2.9 238	6.6 549	5.1 170	11.3 471	18.1 907	29.7 1483	27.3 1364	25.3 1264	24.8 1241			
35		3.8 382	3.0 252	3.8 188	7.7 387	15.0 1000	23.4 1557	25.8 1717	18.8 1250	21.9 1459			
33		3.1 329	2.4 244	2.8 279	6.3 417	8.5 771	18.9 1889	16.3 1633	14.2 1292				
31					3.0 303	6.8 676	12.2 1527	12.3 1753	11.3 1614				
29						6.3 699			8.6 1436				
27						5.1 642			8.7 1730				
25													

Table 32. - Tritium deposition and precipitation in the U.S. during 1983.

[Number above line is tritium deposition in TU-meters; number below line is precipitation amount, in millimeters.]

LONGITUDE (°W)

LATITUDE (°N)	125	120	115	110	105	100	95	90	85	80	75	70	65
49	15.8 1972	9.8 575	10.1 404	9.0 256	7.3 242	12.5 500	14.6 634						
47	10.1 1260	7.4 460	9.0 390	8.3 275	13.4 334	12.4 516	17.3 866	17.9 896				22.4 1178	
45	12.1 1516	7.1 470	10.3 516	11.6 464	9.8 393	12.7 575	18.1 903	15.4 813	15.2 799	19.1 909	26.5 1393	30.3 1685	
43	11.4 1425	6.5 465	10.2 512	5.1 253	10.4 471	15.1 757	17.5 970	21.0 1220	19.3 917	23.5 1173	23.8 1320		
41	18.1 2014	5.1 393	6.9 393	8.9 445	9.6 480	12.5 697	17.5 974	20.1 1006	24.2 1212	25.1 1255	20.8 1224		
39	8.3 33	2.5 207	4.0 266	4.2 280	6.6 440	14.4 957	19.7 1039	22.7 1197	19.0 998	36.4 1216			
37	5.5 614	2.8 316	5.8 484	2.9 191	5.0 334	12.2 938	16.7 1113	17.2 1148	18.1 1204	20.1 1341			
35		6.5 809	3.3 325	2.4 197	4.4 403	6.4 641	11.5 1146	17.2 1719	12.7 1267	15.0 1502			
33		3.3 477	2.8 346	2.0 203	2.9 321	5.0 626	15.4 1921	18.6 1856	10.9 1362				
31					2.9 361	6.0 863	12.5 1784	14.6 2092	14.8 1639				
29						7.8 1115			9.1 1511				
27						3.6 714			9.1 1820				
25													