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Thyroid Doses and Risk of Thyroid Cancer For Members of Public Exposed to I-131

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November 16, 2005

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Citizens' Monitoring and Technical Assessment Fund*

1.0 INTRODUCTION

The purpose of this report is to estimate radiation doses to the thyroid gland and risk of thyroid cancer incidence for individuals exposed to I-131 in fallout from nuclear weapons tested at the Nevada Test Site (NTS) and in releases from different nuclear facilities operated in the United States. Estimates are produced for individuals living around Oak Ridge, Tennessee, who were exposed both to I-131 from NTS fallout and to I-131 released from the X-10 nuclear facility; for individuals living around Hanford, Washington, who were exposed both to I-131 from NTS fallout and to I-131 released from the Hanford facility; and for individuals living in other regions of the country where they were exposed only to I-131 from NTS fallout. Individuals in the latter group lived mostly in areas of Utah, Montana, and Idaho, where deposition of I-131 is known to have been larger than average deposition across the U.S.

2.0 BACKGROUND

The U.S. government conducted approximately 100 above-ground nuclear bomb tests at the Nevada Test Site (NTS) during the 1950s and 1960s, followed by a number of underground tests starting in 1962. All above-ground tests and a limited number of underground tests conducted before 1971 released a number of radioiodines, including iodine-131 (I-131), into the atmosphere. Most Americans living in the continental United States during the testing period received varying levels of I-131 by consuming contaminated milk and other foods for about two months following each test. Iodine-131 accumulates in the thyroid gland, and the thyroid dose depends largely on age at the time of each test, geographic location, and the type and amount of milk consumed. Some of the largest doses from NTS fallout were received by individuals who lived in Utah, Idaho, Montana and Colorado during the testing period. The main concern regarding I-131 in fallout is the risk of thyroid cancer in exposed people, especially in those who were children at the time of exposure. Thyroid doses from exposure to I-131 and other radioiodines from NTS fallout have been analyzed by the National Cancer Institute (NCI 1997).

People living in the vicinity of certain nuclear facilities, such as X-10 in Oak Ridge, Tennessee, or Hanford near Richland, Washington, received I-131 from operations at these facilities, in addition to I-131 in fallout from nuclear weapons tested at NTS. The main

I-131-producing operations took place from 1944 to 1956 at the X-10 facility in Oak Ridge (Apostoaeci et al. 1999) and from 1944 to 1957 at Hanford (Snyder et al. 1994).

3.0 METHODS

Fourteen individuals living at various locations around the country provided information pertinent for analysis of exposures to I-131. The information received from individuals living in the Oak Ridge, TN area is given in Table OR-1 (Appendix A); information from individuals living in the Hanford, WA area is given in Table H-1 (Appendix B); while information for individuals living in areas other than Hanford or Oak Ridge is provided in Table NTS-1 (Appendix C). These tables include personal information (i.e., gender, date of birth, thyroid disease, and year of diagnosis), residence history, and milk consumption information for each individual. When iodine is released into the environment, the main exposure pathway is consumption of contaminated milk. If a person consumed milk contaminated with I-131, then consumption of other contaminated food items and inhalation of contaminated air will have contributed only a small percentage of the total dose to the thyroid gland from I-131.

Doses to the thyroid gland from exposure to I-131 in fallout from nuclear weapons testing at NTS were estimated using the methodology presented by NCI (1997). These doses can be obtained using a dose and risk calculator developed by NCI and posted on NCI's Internet website (<http://www.cancer.gov/i131>). Doses from exposure to I-131 from operations at the X-10 facility in Oak Ridge, TN, were estimated using the methodology presented by Apostoaeci et al. (1999). Personalized doses due to I-131 releases from X-10 can be obtained using the Interactive Risk and Dose Calculator (IRAD), a prototype dose calculator developed by SENES Oak Ridge, Inc. A scaled-down version of this calculator is available on the Internet at <http://198.144.166.5/irad/>. Thyroid doses for individuals living around Hanford, WA, were obtained using the methodology presented by Snyder et al. (1994). Personalized doses due to I-131 releases from Hanford were obtained using CIDER, a computer code developed by Pacific Northwest Laboratories (PNL).

Starting from the calculated thyroid doses, we estimated the risk of thyroid cancer incidence for each exposed individual. Risk calculations were performed using a specialized calculator developed by SENES Oak Ridge, Inc. (Apostoaeci et al. 2003). This calculator is the basis for the risk part of NCI's online dose and risk calculator (<http://www.cancer.gov/i131>). For

this report, the methodology used for the NCI's dose and risk calculator was updated to include the recent recommendations of the National Research Council (NRC) described in their pre-publication BEIR VII report (NRC 2005). The methodology used in the original NCI risk calculator is based on the assumption that the risk of thyroid cancer is the same for males and females. However, the recent data analysis performed by the BEIR VII committee indicates that the risk for females should be 1.34 times higher and the risk for males should be 1.48 times lower than the risk specified in the original NCI calculator.

For each individual, the following risk quantities are reported.

1. **Baseline Risk** represents the risk of thyroid cancer incidence due to causes other than exposure to I-131. The baseline is obtained using thyroid cancer incidence rates reported by the Surveillance, Epidemiology and End Results (SEER) Program of NCI. Three types of baseline risks were estimated for each individual: a) the risk of getting cancer from today to the end of the expected lifetime, b) the risk of getting cancer from time of exposure to I-131 until the end of the expected lifetime, and c) the risk of getting cancer from birth to the end of the expected lifetime. This quantity is an absolute risk and is expressed as a fraction. For instance: a value listed in the results tables as 1E-03 (1×10^{-3}) represents a risk of 1 chance in 1000.
2. **Excess Relative Risk** represents the risk due to exposure to I-131 relative to the baseline risk. An excess relative risk of 1.0 means that exposure to I-131 doubled the baseline risk.
3. **Excess Future Risk** represents the risk of getting thyroid cancer from today until the end of the expected lifetime due to exposure to I-131. This risk is an absolute risk and is expressed as a fraction. For instance: a value listed in the results tables as 1E-04 (1×10^{-4}) represents a risk of 1 chance in 10,000.
4. **Excess Lifetime Risk** represents the risk of getting cancer from the time of exposure until the end of the expected lifetime, due to exposure to I-131.

This risk is also an absolute risk which is expressed as fraction. For instance: a value of 1E-04 (1×10^{-4}) represents a risk of one chance in 10,000.

5. **Probability of Causation** applies to a person who has already been diagnosed with thyroid cancer, and it represents the probability that the diagnosed cancer was induced by the past exposure to I-131. If a person is currently healthy (i.e., free of thyroid cancer), the probability of causation represents the probability that a future thyroid cancer would have been induced by the past exposure to radiation. A probability of causation greater than 50% is generally considered to suggest that the cancer was, more likely than not, induced by the exposure to I-131. Probability of causation is assumed to be equal to an assigned share, which is defined as the risk in a population due to exposure to I-131 divided by the total risk in the same population (i.e., where the total risk represents the risk due to exposure plus the baseline risk; Land et al. 2003).

The risk quantities presented in this report represent chances of developing thyroid cancer. Relationships between radiation and other non-neoplastic thyroid diseases are not as clearly established as dose-response relationships for thyroid cancer, even though a recent study (Lyon et al. 2005) indicated a positive dose-response for thyroiditis observed in children exposed to I-131 in fallout from nuclear weapons testing at NTS.

All dose and risk estimates are affected by uncertainties introduced by the lack of precise knowledge about the releases of I-131, the transport and bioaccumulation of I-131 in the environment, the amount and type of milk consumed by the individual, and about the magnitude of the dose-response for thyroid disease. The uncertainty was quantified for each dose and risk estimate by using Monte-Carlo methods for propagation of uncertainties.

4.0 RESULTS

Thyroid doses and risk of thyroid cancer incidence for five individuals living in the Oak Ridge, TN, area are presented in Tables OR-2 to OR-21 (Appendix A). Doses and risks for five individuals living around Hanford, WA, are presented in Tables H-1 to H-21 (Appendix B), while doses and risk for four individuals exposed only to NTS fallout are provided in Tables NTS-2 to NTS-13 (Appendix C).

The tables include 95% credibility intervals for estimated doses and risks, which can be said with a high degree of confidence (i.e., subjective degree of belief) to contain the true but unknown dose or risk for a given individual.

A 98% credibility interval is reported for each probability of causation estimate. The limits of this credibility interval are the 1st and 99th percentiles of the distribution describing the uncertainty in the probability of causation. This credibility interval has been chosen because, in the U.S. workers' compensation program (White House 2000), the 99th percentile of the probability of causation is used to make decisions about compensation of claims that radiation caused cancer. That is, if the 99th percentile of the probability of causation is greater than 50%, a worker is eligible to receive compensation under the U.S. workers' compensation program. The use of the 99th percentile is a method that gives the benefit of the doubt to the worker, in the presence of uncertainty in risk estimates.

A summary of thyroid doses is presented in Table 1 (for Oak Ridge, TN area residents), Table 2 for (Hanford, WA area residents), and Table 3 (for Utah, Idaho and Montana residents who were exposed only to NTS fallout).

The largest doses are observed for individuals who lived in areas of high deposition from NTS fallout, especially for NTS-001 and NTS-003. Their doses are also quite uncertain, so the upper bound of the dose can exceed 100 rad. The largest doses for selected individuals from the Oak Ridge, TN, area were found for OR-003 and OR-005, who were infants or very young around 1952. The largest dose for a Hanford individual was obtained for H-004. This person lived relatively close to the Hanford facility (i.e., in Walla Walla, WA), obtained milk from a backyard cow, and, most importantly, was present in the region in 1945, the year of largest releases of I-131 from Hanford.

Lower doses were obtained for individuals who lived further away from the Oak Ridge or Hanford facilities, or who were absent from the region during the period of peak releases. The lowest doses are reported for OR-004 (moved to TN in the summer of 1956), and H-005 (who was born in the summer of 1957).

The risk of thyroid cancer is proportional to the thyroid dose for a given gender and age at exposure. For the same thyroid dose, the risk of thyroid cancer is about two times larger for females than for males, as indicated by the recent BEIR VII analysis. The excess relative risk of thyroid cancer decreases exponentially with increasing age at time of exposure. Within each gender grouping, all males or all females exposed at the same age should have similar risks of thyroid cancer for the same thyroid dose. However, a thyroid dose received early in life produces a significantly larger risk than the same dose received later in life.

Only two out of fourteen individuals analyzed in this report have thyroid cancer (NTS-002 and NTS-004). For both these individuals, the 99th percentile of the probability of thyroid cancer causation (PC) is greater than 50%. For NTS-004, the mean PC is also greater than 50%. This means that, if the current laws for nuclear workers were applicable to members of the public (White House 2000), these individuals could have been eligible to receive compensation.

Table 1 Summary of thyroid doses for individual living in the Oak Ridge, TN area, from exposure to I-131 from NTS fallout and from the X-10 facility

Source of I-131	Thyroid Dose ^a (rad)			
	Lower Bound	Median	Mean	Upper Bound
OR-001				
Oak Ridge (X-10)	0.82	1.7	2.0	4.8
NTS Fallout	3.7	10	13	36
TOTAL	5.3	12	15	39
OR-002				
Oak Ridge (X-10)	0.58	1.6	1.9	5.3
NTS Fallout	2.9	6.6	7.5	18
TOTAL	3.9	8.4	9.4	20
OR-003				
Oak Ridge (X-10)	2.2	4.9	5.5	14
NTS Fallout	5.0	13	16	37
TOTAL	9.4	19	21	44
OR-004				
Oak Ridge (X-10)	0.01	0.07	0.12	0.48
NTS Fallout	0.14	0.86	1.3	5.3
TOTAL	0.21	1.0	1.4	5.4
OR-005				
Oak Ridge (X-10)	2.2	5.1	6.0	15
NTS Fallout	4.6	12	14	37
TOTAL	8.5	19	20	42

^a Thyroid doses from all years of exposure

Table 2 Summary of thyroid doses for individuals living in the Hanford, WA, area, from exposure to I-131 from NTS fallout and from the Hanford facilities

Source of I-131	Thyroid Dose ^a (rad)			
	Lower Bound	Median	Mean	Upper Bound
H-001				
Hanford	- ^b	- ^b	- ^b	- ^b
NTS Fallout	1.8	11	17	71
TOTAL	1.8	11	17	71
H-002				
Hanford	0.65	2.1	2.8	8.9
NTS Fallout	1.7	5.5	7.2	21.9
TOTAL	3.3	8.4	10	25
H-003				
Hanford	0.14	0.57	0.73	2.2
NTS Fallout	2.4	7.6	11	36
TOTAL	2.9	8.3	11	37
H-004				
Hanford	2.2	7.6	9.9	32
NTS Fallout	0.81	3.3	4.7	18
TOTAL	4.8	12	15	40
H-005				
Hanford	0.0004	0.0013	0.0016	0.0044
NTS Fallout	0.87	7.1	13	58
TOTAL	0.87	7.1	13	58

^a Thyroid doses from all years of exposure

^b This person moved to the Hanford, WA, area in 1959 (see Table H-1). The majority of I-131 releases from Hanford occurred before 1957, while only minor releases occurred after 1957. The present methodology (i.e., CIDER computer code) does not allow computation of doses from Hanford releases that occurred after 1957.

Table 3 Summary of thyroid doses for individuals living in areas of high I-131 deposition from NTS fallout

Source of I-131	Thyroid Dose ^a (rad)			
	Lower Bound	Median	Mean	Upper Bound
NTS 001	10	33	45	146
NTS 002	3.9	12	15	43
NTS 003	10	33	52	212
NTS 004	3.5	12	15	37

^a Thyroid doses from all years of exposure

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Appendix A

Estimated Thyroid Doses and Risk of Thyroid Cancer for People Living in the Oak Ridge, Tennessee Area

Table OR-1 Oak Ridge Interviewee Information: Summary table

Number	Gender	DOB	Thyroid disease?	Diagnosis	Year of diagnosis	Month-Year	Residence History	City	Milk consumption*
						State	County		
001	female	Oct 3, 1945	yes	Autoimmune thyroiditis, thyroid nodules, pre-cancerous tumor		October 3, 1945-April 1947	Anderson	Oak Ridge	Breast milk
						April 1947-June 1948	Anderson	Oak Ridge	Cow-4 or more glasses/day
						June 1948-March 1953	Knox	Knoxville	Cow-4 or more glasses/day
						March 1953-August 1958	Hamilton	Cincinnati	Cow-4 or more glasses/day
						August 1958-February 1965	Nelson	Bardstown	Cow-4 or more glasses/day
002	male	Feb 4, 1949	no			February 4, 1949-February 1950	Washington DC		Cow - 1-3 glasses/day
						February 1950-February 1952	Fairfax	Falls Church	Cow - 1-3 glasses/day
						February 1952-February 1969	Anderson	Oak Ridge	Cow - 1-3 glasses/day
003	male	May 1949	no			May 1949-June 1960	Anderson	Oak Ridge	Cow - 4 or more glasses/day
						June 1960-June 1961	Oxfordshire	Drayton	Cow - 1-3 glasses/day
						August 1961-August 1967	Anderson	Oak Ridge	Cow - 1-3 glasses/day
						September 1967 -	New Haven	New Haven	Cow - 1-3 glasses/day

Table OR-1 Oak Ridge Interviewee Information: Summary table (continued)

Number	Gender	DOB	Thyroid disease?	Diagnosis	Year of diagnosis	* Residence History	Milk consumption
004	female	Aug 12, 1946	yes	Thyroid nodules, calcium imbalance	2000	Mexico August 1946-August 1947	Breast milk Los Mochias
						Mexico August 1947-June 1956	Cow - 4 or more glasses/day Los Mochias
						TN Summer 1956-present Roane	Cow - 1-2 glasses/week Dillis
005	female	March 6, 1952	Yes	Enlarged Thyroid, Thyroid antibodies shown to be high	1997	TN March 1952 - March 1953 Anderson	Breast-fed TN
						TN March 1953 - December 1963 Anderson	Cow - 4 or more glasses/day TN
						AUSTRALIA December 1963 - June 1965 June 1965 - June 1970 TN Anderson	Cow - 4 or more glasses/day TN
						TN June 1970 - October 1979 Knox	Cow - 4 or more glasses/day TN

*It was assumed that milk was obtained from commercial sources (i.e. from grocery store) unless otherwise specified.

OR-001

Table OR-2 Thyroid doses from exposure to NTS fallout for OR-001

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0.0042	0.055	0.87
1952	0.33	1.1	3.8
1953	0.63	2.9	17
1954	0	0	0
1955	0.22	0.83	3.9
1956	0	0	0
1957	1.1	3.2	14
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Knox Co. TN; Exposure period: January 1951 to March 1953

Location: Hamilton Co. OH; Exposure period: March 1953 to August 1958

Location: Nelson Co. KY; Exposure period: March 1958 to December 1971

OR-001

Table OR-3 Thyroid doses from exposure to NTS fallout for OR-001 by test shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.00052	0.013	0.33
BUSTER-JANGLE: DOG	11/1/1951	0.00051	0.016	0.5
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.000021	0.00019
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.00059	0.0059	0.059
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00053	0.011	0.23
TUMBLER-SNAPPER: DOG	5/1/1952	0.0023	0.022	0.21
TUMBLER-SNAPPER: EASY	5/7/1952	0.017	0.14	1.1
TUMBLER-SNAPPER: FOX	5/25/1952	0.0031	0.026	0.22
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.033	0.28	2.4
TUMBLER-SNAPPER: HOW	6/5/1952	0.015	0.13	1.1
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.00015	0.004	0.1
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.00022	0.0032	0.047
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.00028	0.0074	0.2
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.00026	0.0055	0.12
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.001	0.02	0.38
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.0026	0.04	0.63
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.033	0.53	8.5
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0026	0.046	0.81
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.042	0.58	8
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0054	0.063	0.73
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.0043	0.058	0.77
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.000021	0.00072	0.025
TEAPOT: TURK	3/7/1955	0.00015	0.004	0.1
TEAPOT: HORNET	3/12/1955	0.0011	0.021	0.41
TEAPOT: BEE and ESS	3/22/1955	0.000015	0.00013	0.0011
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.00022	0.0052	0.12
TEAPOT: POST	4/9/1955	0.0015	0.016	0.17
TEAPOT: MET	4/15/1955	0.0063	0.07	0.78
TEAPOT: APPLE2	5/5/1955	0.02	0.24	2.9
TEAPOT: ZUCCHINI	5/15/1955	0.0025	0.041	0.66
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.0032	0.039	0.47
PLUMBBOB: WILSON	6/19/1957	0.0072	0.058	0.47
PLUMBBOB: PRISCILLA	6/24/1957	0.0067	0.07	0.73

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper Bound
PLUMBBOB: HOOD	7/5/1957	0.015	0.13	1.1
PLUMBBOB: DIABLO	7/15/1957	0.002	0.048	1.1
PLUMBBOB: KEPLER & OWENS	7/24/1957	0.13	1.2	12
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.00072	0.0066	0.061
PLUMBBOB: DOPPLER	8/23/1957	0.00094	0.023	0.56
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0041	0.035	0.3
PLUMBBOB: GALILEO	9/2/1957	0.011	0.11	1.1
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0037	0.043	0.5
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.00082	0.0082	0.082
PLUMBBOB: WHITNEY	9/23/1957	0.0065	0.055	0.46
PLUMBBOB: CHARLESTON	9/28/1957	0.0019	0.015	0.12
PLUMBBOB: MORGAN	10/7/1957	0.000051	0.00047	0.0043
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower Bound	Central estimate	Upper Bound
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout
 Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Knox Co. TN; Exposure period: January 1951 to March 1953

Location: Hamilton Co. OH; Exposure period: March 1953 to August 1958

Location: Nelson Co. KY; Exposure period: March 1958 to December 1971

OR-001

Table OR-4 Thyroid doses from exposure to I-131 released from X-10 Ra/La operations for OR-001

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1944	0	0	0
1945	0.002	0.013	0.11
1946	0.040	0.21	1.06
1947	0.054	0.26	1.49
1948	0.027	0.13	0.75
1949	0.020	0.11	0.51
1950	0.009	0.05	0.23
1951	0.009	0.05	0.22
1952	0.025	0.15	0.86
1953	0.045	0.24	1.09
1954	0	0	0
1955	0	0	0
1956	0	0	0

Estimated using IRAD v.1

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Oak Ridge - Townsite; Exposure period: 1946 to 1948

Location: Knoxville; Exposure period: 1949 to 1953

OR-001

Table OR-5 Summary of dose and risk estimates for OR-001 from exposure to I-131 from NTS fallout and X-10 in Oak Ridge, TN

	Thyroid Dose^a (rad)			
	95% Credibility Interval			
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	0.82	1.7	2.0	4.8
NTS Fallout	3.7	10	13	36
TOTAL	5.3	12	15	39
	Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	1.1E-03	1.9E-03	1.9E-03	2.6E-03
Lifetime - from exposure to the end of lifetime	3.4E-03	5.6E-03	5.6E-03	7.8E-03
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03
	Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	0.01	0.09	0.13	0.50
NTS Fallout	0.05	0.30	0.51	2.4
TOTAL	0.07	0.42	0.67	2.8
	Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	2.9E-05	1.9E-04	3.0E-04	1.3E-03
NTS Fallout	1.1E-04	6.9E-04	1.2E-03	5.1E-03
TOTAL	1.4E-04	9.3E-04	1.5E-03	6.6E-03
	Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	6.9E-05	4.6E-04	7.3E-04	3.0E-03
NTS Fallout	2.4E-04	1.6E-03	2.9E-03	1.3E-02
TOTAL	3.2E-04	2.3E-03	3.9E-03	1.7E-02
	Probability of Causation^f			
	98% Credibility Interval			
	1.0%-ile	Median	Mean ^g	99%-ile
Oak Ridge (X-10)	0.93	7.8	12	45
NTS Fallout	3.0	23	34	74
TOTAL	4.7	30	40	80

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

OR-002

Table OR-6 Thyroid doses from exposure to NTS fallout for OR-002

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0.057	0.46	4.3
1952	0.28	1.2	5.0
1953	0.4	1.1	4.4
1954	0	0	0
1955	0.27	0.8	3.6
1956	0	0	0
1957	0.45	1.2	5.5
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0.00025	0.0023	0.021
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 1-3 glasses of local commercial milk per day

Location: Fairfax Co. VA; Exposure period: January 1951 to February 1952

Location: Anderson Co. TN; Exposure period: February 1952 to December 1971

OR-002

Table OR-7 Thyroid doses from exposure to NTS fallout for OR-002 by test shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.000053	0.00047
BUSTER-JANGLE: CHARLIE	10/30/1951	0.041	0.41	4.1
BUSTER-JANGLE: DOG	11/1/1951	0.00066	0.012	0.22
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.00015	0.0033	0.073
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0003	0.0069	0.16
TUMBLER-SNAPPER: DOG	5/1/1952	0.00018	0.0041	0.096
TUMBLER-SNAPPER: EASY	5/7/1952	0.014	0.12	1.1
TUMBLER-SNAPPER: FOX	5/25/1952	0.0013	0.016	0.19
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.039	0.4	4.2
TUMBLER-SNAPPER: HOW	6/5/1952	0.012	0.12	1.2
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.023	0.25	2.7
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.00068	0.011	0.18
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.00097	0.017	0.3
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.000061	0.00054
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0015	0.025	0.41
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.00093	0.015	0.24
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0061	0.056	0.52
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.00027	0.0058	0.13
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.027	0.22	1.8
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0024	0.021	0.19
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.00046	0.0052	0.058
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.00038	0.006	0.094
TEAPOT: HORNET	3/12/1955	0.0021	0.025	0.3
TEAPOT: BEE and ESS	3/22/1955	0.0024	0.037	0.56
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0026	0.022	0.19
TEAPOT: POST	4/9/1955	0.00095	0.014	0.21
TEAPOT: MET	4/15/1955	0.00084	0.012	0.17
TEAPOT: APPLE2	5/5/1955	0.026	0.26	2.6
TEAPOT: ZUCCHINI	5/15/1955	0.0038	0.048	0.6
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.00074	0.012	0.19
PLUMBBOB: WILSON	6/19/1957	0.0036	0.08	1.8
PLUMBBOB: PRISCILLA	6/24/1957	0.0012	0.011	0.097
PLUMBBOB: HOOD	7/5/1957	0.0077	0.12	1.9

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper Bound
PLUMBBOB: DIABLO	7/15/1957	0.0012	0.027	0.6
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.0095	0.091	0.87
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0001	0.0023	0.052
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.00061	0.011	0.2
PLUMBBOB: GALILEO	9/2/1957	0.0041	0.033	0.27
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0018	0.023	0.3
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0	0.0	0.0
PLUMBBOB: WHITNEY	9/23/1957	0.0028	0.025	0.22
PLUMBBOB: CHARLESTON	9/28/1957	0.0037	0.065	1.1
PLUMBBOB: MORGAN	10/7/1957	0.0	0.000025	0.00022
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.00025	0.0023	0.021
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper Bound
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 1-3 glasses of local commercial milk per day

Location: Fairfax Co. VA; Exposure period: January 1951 to February 1952

Location: Anderson Co. TN; Exposure period: February 1952 to December 1971

OR-002

Table OR-8 Thyroid doses from exposure to I-131 released from X-10 Ra/La operations for OR-002

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0	0	0
1951	0	0	0
1952	0.028	0.17	1.0
1953	0.051	0.29	1.7
1954	0.050	0.29	1.6
1955	0.025	0.15	0.79
1956	0.034	0.19	0.98

Estimated using IRAD v.1

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 1-3 glasses of local commercial milk per day

Location: Oak Ridge - Townsite; Exposure period: 1952 to 1956

OR-002

Table OR-9 Summary of dose and risk estimates for OR-002 from exposure to I-131 from NTS fallout and X-10 in Oak Ridge, TN.

		Thyroid Dose^a (rad)			
		95% Credibility Interval			
		Median	Mean	97.5%-ile	
Oak Ridge (X-10)	0.58	1.6	1.9	5.3	
NTS Fallout	2.9	6.6	7.5	18	
TOTAL	3.9	8.4	9.4	20	
		Baseline Risk^b			
		2.5%-ile	Median	Mean	97.5%-ile
Future – from today to end of lifetime	5.1E-04	1.0E-03	1.0E-03	1.5E-03	
Lifetime – from exposure to the end of lifetime	9.9E-04	2.0E-03	2.0E-03	3.0E-03	
Lifetime – from birth to the end of lifetime	1.8E-03	2.4E-03	2.4E-03	3.1E-03	
		Excess Relative Risk^c			
		2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	0.01	0.1	0.1	0.5	
NTS Fallout	0.04	0.29	0.45	1.9	
TOTAL	0.1	0.4	0.6	2.1	
		Excess Future Risk^d			
		2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	1.3E-05	9.9E-05	1.6E-04	7.1E-04	
NTS Fallout	6.6E-05	4.0E-04	6.4E-04	2.5E-03	
TOTAL	1.1E-04	5.4E-04	8.1E-04	3.2E-03	
		Excess Lifetime Risk^e			
		2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	1.6E-05	1.3E-04	2.2E-04	1.1E-03	
NTS Fallout	7.7E-05	5.4E-04	8.9E-04	3.4E-03	
TOTAL	1.2E-04	7.5E-04	1.1E-03	4.4E-03	
		Probability of Causation^f			
		98% Credibility Interval			
		1.0%-ile	Median	Mean ^g	99%-ile
Oak Ridge (X-10)	0.76	6.4	10	39	
NTS Fallout	2.7	22	31	71	
TOTAL	5.2	27	36	78	

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

OR-003

Table OR-10 Thyroid doses from exposure to NTS fallout for OR-003

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0.011	0.14	2.1
1952	0.69	3	17
1953	0.97	2.9	12
1954	0.0	0.0	0.0
1955	0.49	1.4	7.5
1956	0.0	0.0	0.0
1957	0.79	2.2	10
1958	0.0	0.0	0.0
1959	0.0	0.0	0.0
1960	0.0	0.0	0.0
1961	0.0	0.0	0.0
1962	0.00025	0.0023	0.021
1963	0.0	0.0	0.0
1964	0.0	0.0	0.0
1965	0.0	0.0	0.0
1966	0.0	0.0	0.0
1967	0.0	0.0	0.0
1968	0.0	0.0	0.0
1969	0.0	0.0	0.0
1970	0.0	0.0	0.0
1971	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses through June 1960 and 1 to 3 glasses after that of local commercial milk per day

Location: Anderson Co. TN; Exposure period: January 1951 to June 1960

Location: United Kingdom; Exposure period: June 1960 to August 1961

Location: Anderson Co. TN; Exposure period: August 1961 to September 1967

Location: New Haven Co. CT; Exposure period: September 1967 to December 1971

OR-003

Table OR-11 Thyroid doses from exposure to NTS fallout for OR-003 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0013	0.029	0.64
BUSTER-JANGLE: DOG	11/1/1951	0.0015	0.045	1.4
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.000058	0.00051
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.00032	0.0075	0.17
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0007	0.017	0.42
TUMBLER-SNAPPER: DOG	5/1/1952	0.00046	0.011	0.26
TUMBLER-SNAPPER: EASY	5/7/1952	0.033	0.3	2.8
TUMBLER-SNAPPER: FOX	5/25/1952	0.0042	0.052	0.65
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.11	1.2	13
TUMBLER-SNAPPER: HOW	6/5/1952	0.026	0.28	3
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.058	0.67	7.8
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0013	0.023	0.39
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0024	0.044	0.82
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.000035	0.00031	0.0027
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0036	0.063	1.1
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.002	0.034	0.58
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.014	0.13	1.2
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.00058	0.013	0.29
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.057	0.48	4.1
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0053	0.049	0.45
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.001	0.012	0.14
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.00061	0.0099	0.16
TEAPOT: HORNET	3/12/1955	0.0038	0.049	0.63
TEAPOT: BEE and ESS	3/22/1955	0.0038	0.06	0.94
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0049	0.045	0.41
TEAPOT: POST	4/9/1955	0.0018	0.027	0.41
TEAPOT: MET	4/15/1955	0.0013	0.019	0.28
TEAPOT: APPLE2	5/5/1955	0.047	0.49	5.1
TEAPOT: ZUCCHINI	5/15/1955	0.0074	0.096	1.2
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.0013	0.021	0.35
PLUMBBOB: WILSON	6/19/1957	0.0061	0.14	3.2
PLUMBBOB: PRISCILLA	6/24/1957	0.002	0.018	0.17
PLUMBBOB: HOOD	7/5/1957	0.014	0.23	3.7

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.0034	0.075	1.7
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.015	0.14	1.3
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.00018	0.0041	0.096
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0011	0.02	0.37
PLUMBBOB: GALILEO	9/2/1957	0.0065	0.055	0.46
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0029	0.039	0.52
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0	0.0	0.0
PLUMBBOB: WHITNEY	9/23/1957	0.0041	0.038	0.35
PLUMBBOB: CHARLESTON	9/28/1957	0.0059	0.11	2
PLUMBBOB: MORGAN	10/7/1957	0.00001	0.000089	0.00078
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.00025	0.0023	0.021
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower Bound	Central estimate	Upper Bound
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses through June 1960 and 1 to 3 glasses after that of local commercial milk per day

Location: Anderson Co. TN; Exposure period: January 1951 to June 1960

Location: United Kingdom; Exposure period: June 1960 to August 1961

Location: Anderson Co. TN; Exposure period: August 1961 to September 1967

Location: New Haven Co. CT; Exposure period: September 1967 to December 1971

OR-003

Table OR-12 Thyroid doses from exposure to I-131 released from X-10 Ra/La operations for OR-003

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower Bound	Central estimate	Upper Bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0.052	0.28	1.4
1950	0.022	0.12	0.64
1951	0.033	0.15	0.67
1952	0.078	0.44	2.5
1953	0.14	0.77	4.2
1954	0.14	0.74	3.6
1955	0.065	0.38	1.9
1956	0.098	0.48	2.4

Estimated using IRAD v.1

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Oak Ridge - Townsite; Exposure period: 1949-1956

OR-003

Table OR-13 Summary of dose and risk estimates for OR-003 from exposure to I-131 from NTS fallout and X-10 in Oak Ridge, TN

	Thyroid Dose^a (rad)			
	95% Credibility Interval			
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	2.2	4.9	5.5	14
NTS Fallout	5.0	13	16	37
TOTAL	9.4	19	21	44
Baseline Risk^b				
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	5.1E-04	1.0E-03	1.0E-03	1.5E-03
Lifetime - from exposure to the end of lifetime	9.9E-04	2.0E-03	2.0E-03	3.0E-03
Lifetime - from birth to the end of lifetime	1.8E-03	2.4E-03	2.4E-03	3.1E-03
Excess Relative Risk^c				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	0.04	0.23	0.36	1.4
NTS Fallout	0.09	0.62	0.93	4.0
TOTAL	0.14	0.84	1.2	4.5
Excess Future Risk^d				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	5.5E-05	3.2E-04	5.1E-04	2.1E-03
NTS Fallout	1.2E-04	8.8E-04	1.3E-03	5.5E-03
TOTAL	1.9E-04	1.2E-03	1.8E-03	6.9E-03
Excess Lifetime Risk^e				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	6.7E-05	4.3E-04	7.0E-04	3.1E-03
NTS Fallout	1.4E-04	1.2E-03	1.8E-03	7.6E-03
TOTAL	2.2E-04	1.6E-03	2.5E-03	1.1E-02
Probability of Causation^f				
98% Credibility Interval				
	1.0%-ile	Median	Mean ^g	99%-ile
Oak Ridge (X-10)	2.7	19	26	64
NTS Fallout	4.1	38	48	83
TOTAL	9.4	46	56	85

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

OR-004

Table OR-14 Thyroid doses from exposure to NTS fallout for OR-004

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0	0	0
1956	0	0	0
1957	0.28	0.85	4.0
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0.00022	0.002	0.018
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses to June 1956 and 1 to 3 glasses after that of local commercial milk per day

Location: Mexico; Exposure period: January 1951 to June 1956

Location: Roane Co. TN; Exposure period: June 1956 to December 1971

OR-004

Table OR-15 Thyroid doses from exposure to NTS fallout for OR-004 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.0	0.0
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: FOX	5/25/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: HOW	6/5/1952	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.0	0.0	0.0
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.0	0.0	0.0
TEAPOT: HORNET	3/12/1955	0.0	0.0	0.0
TEAPOT: BEE and ESS	3/22/1955	0.0	0.0	0.0
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0	0.0	0.0
TEAPOT: POST	4/9/1955	0.0	0.0	0.0
TEAPOT: MET	4/15/1955	0.0	0.0	0.0
TEAPOT: APPLE2	5/5/1955	0.0	0.0	0.0
TEAPOT: ZUCCHINI	5/15/1955	0.0	0.0	0.0
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	.00056	0.0090	0.15
PLUMBBOB: WILSON	6/19/1957	0.0017	0.036	0.76
PLUMBBOB: PRISCILLA	6/24/1957	0.00071	0.0074	0.077
PLUMBBOB: HOOD	7/5/1957	0.0047	0.071	1.1

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.00097	0.02	0.41
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.0046	0.054	0.63
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.000073	0.0017	0.04
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.00035	0.0058	0.096
PLUMBBOB: GALILEO	9/2/1957	0.0027	0.024	0.21
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0011	0.015	0.2
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0	0.0	0.0
PLUMBBOB: WHITNEY	9/23/1957	0.0018	0.019	0.2
PLUMBBOB: CHARLESTON	9/28/1957	0.0032	0.065	1.3
PLUMBBOB: MORGAN	10/7/1957	0.0	0.00002	0.00018
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.00022	0.002	0.018
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses to June 1956 and 1 to 3 glasses after that of local commercial milk per day

Location: Mexico; Exposure period: January 1951 to June 1956

Location: Roane Co. TN; Exposure period: June 1956 to December 1971

OR-004

Table OR-16 Thyroid doses from exposure to I-131 released from X-10 Ra/La operations for OR-004

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower bound	Central Estimate	Upper bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0	0	0
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0	0	0
1956	0.011	0.071	0.36

Estimated using IRAD v.1

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 1-2 glasses of local commercial milk per day

Location: Dillis, Roane Co.; Exposure period: 1956

OR-004

Table OR-17 Summary of dose and risk estimates for OR-004 from exposure to I-131 from NTS fallout and X-10 in Oak Ridge, TN

		Thyroid Dose^a (rad)			
		95% Credibility Interval			
	2.5%-ile	Median	Mean	97.5%-ile	
Oak Ridge (X-10)	0.01	0.07	0.12	0.48	
NTS Fallout	0.14	0.86	1.3	5.3	
TOTAL	0.21	1.0	1.4	5.4	
		Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile	
Future - from today to end of lifetime	1.1E-03	1.9E-03	1.9E-03	2.6E-03	
Lifetime - from exposure to the end of lifetime	3.2E-03	5.5E-03	5.5E-03	7.5E-03	
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03	
		Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile	
Oak Ridge (X-10)	0.0002	0.002	0.005	0.031	
NTS Fallout	0.002	0.02	0.05	0.24	
TOTAL	0.003	0.03	0.05	0.27	
		Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile	
Oak Ridge (X-10)	3.7E-07	4.2E-06	1.2E-05	7.0E-05	
NTS Fallout	4.8E-06	5.0E-05	1.1E-04	5.3E-04	
TOTAL	7.0E-06	5.8E-05	1.2E-04	6.4E-04	
		Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile	
Oak Ridge (X-10)	8.5E-07	9.8E-06	3.0E-05	1.8E-04	
NTS Fallout	1.0E-05	1.1E-04	2.5E-04	1.4E-03	
TOTAL	1.5E-05	1.3E-04	2.8E-04	1.6E-03	
		Probability of Causation^f			
		98% Credibility Interval			
	1.0%-ile	Median	Mean ^g	99%-ile	
Oak Ridge (X-10)	0.01	0.18	0.51	4.4	
NTS Fallout	0.15	2.2	4.3	23	
TOTAL	0.21	2.4	4.8	24	

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

OR-005

Table OR-18 Thyroid doses from exposure to NTS fallout for OR-005

Year	Thyroid Dose (cSv)		
	Lower bound	Central Estimate	Upper bound
1951	0.004	0.048	0.67
1952	0.25	0.89	4.5
1953	0.9	2.9	12
1954	0	0	0
1955	0.85	3.1	14
1956	0	0	0
1957	0.79	2.2	10
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0.00091	0.0084	0.077
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Anderson Co. TN; Exposure period: June 1951 (includes in utero exposures) to December 1963

Location: Australia; Exposure period: December 1963 to June 1965

Location: Anderson Co. TN; Exposure period: June 1965 to June 1970

Location: Knox Co. TN; Exposure period: June 1970 to December 1971

OR-005

Table OR-19 Thyroid doses from exposure to NTS fallout for OR-005 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.00057	0.012	0.25
BUSTER-JANGLE: DOG	11/1/1951	0.0005	0.014	0.39
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.000088
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0001	0.0026	0.053
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00026	0.0053	0.13
TUMBLER-SNAPPER: DOG	5/1/1952	0.00013	0.0033	0.074
TUMBLER-SNAPPER: EASY	5/7/1952	0.01	0.1	0.95
TUMBLER-SNAPPER: FOX	5/25/1952	0.00099	0.012	0.14
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.026	0.3	3.7
TUMBLER-SNAPPER: HOW	6/5/1952	0.01	0.085	0.91
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.058	0.67	7.8
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0013	0.023	0.39
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0024	0.044	0.82
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.000035	0.00031	0.0027
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0036	0.063	1.1
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.002	0.034	0.58
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.014	0.13	1.2
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.00058	0.013	0.29
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.057	0.48	4.1
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0053	0.049	0.45
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.001	0.012	0.14
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.0011	0.019	0.32
TEAPOT: HORNET	3/12/1955	0.0074	0.096	1.2
TEAPOT: BEE and ESS	3/22/1955	0.0077	0.12	1.9
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0097	0.089	0.82
TEAPOT: POST	4/9/1955	0.0034	0.053	0.83
TEAPOT: MET	4/15/1955	0.0025	0.037	0.54
TEAPOT: APPLE2	5/5/1955	0.092	0.96	10
TEAPOT: ZUCCHINI	5/15/1955	0.015	0.19	2.5
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.0013	0.021	0.35
PLUMBBOB: WILSON	6/19/1957	0.0061	0.14	3.2
PLUMBBOB: PRISCILLA	6/24/1957	0.002	0.018	0.17
PLUMBBOB: HOOD	7/5/1957	0.014	0.23	3.7

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
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Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.0034	0.075	1.7
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.015	0.14	1.3
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.00018	0.0041	0.096
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0011	0.02	0.37
PLUMBBOB: GALILEO	9/2/1957	0.0065	0.055	0.46
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0029	0.039	0.52
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0	0.0	0.0
PLUMBBOB: WHITNEY	9/23/1957	0.0041	0.038	0.35
PLUMBBOB: CHARLESTON	9/28/1957	0.0059	0.11	2
PLUMBBOB: MORGAN	10/7/1957	0.00001	0.000089	0.00078
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.00091	0.0084	0.077
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Anderson Co. TN; Exposure period: June 1951 (includes in utero exposures) to December 1963

Location: Australia; Exposure period: December 1963 to June 1965

Location: Anderson Co. TN; Exposure period: June 1965 to June 1970

Location: Knox Co. TN; Exposure period: June 1970 to December 1971

OR-005

Table OR-20 Thyroid doses from exposure to I-131 released from X-10 Ra/La operations for OR-005

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower bound	Central Estimate	Upper bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0	0	0
1951	0	0	0
1952	0.11	0.65	3.4
1953	0.16	0.75	4.6
1954	0.19	1.1	4.3
1955	0.089	0.50	2.4
1956	0.12	0.78	3.8

Estimated using IRAD v.1

Central estimate is the median value of the distribution of dose values.

Doses from consumption of an average 4-6 glasses of local commercial milk per day

Location: Oak Ridge - Townsite; Exposure period: 1952 to 1956

OR-005

Table OR-21 Summary of dose and risk estimates for OR-005 from exposure to I-131 from NTS fallout and X-10 in Oak Ridge, TN

Thyroid Dose^a (rad)				
95% Credibility Interval				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	2.2	5.1	6.0	15
NTS Fallout	4.6	12	14	37
TOTAL	8.5	19	20	42
Baseline Risk^b				
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	6.6E-04	1.9E-03	1.8E-03	2.9E-03
Lifetime - from exposure to the end of lifetime	1.5E-03	4.2E-03	4.1E-03	6.5E-03
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03
Excess Relative Risk^c				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	0.04	0.29	0.49	2.4
NTS Fallout	0.07	0.66	1.0	4.2
TOTAL	0.14	1.0	1.5	5.9
Excess Future Risk^d				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	1.1E-04	8.6E-04	1.4E-03	7.3E-03
NTS Fallout	2.2E-04	2.0E-03	3.1E-03	1.3E-02
TOTAL	4.0E-04	2.9E-03	4.5E-03	1.8E-02
Excess Lifetime Risk^e				
	2.5%-ile	Median	Mean	97.5%-ile
Oak Ridge (X-10)	1.3E-04	1.1E-03	2.1E-03	1.1E-02
NTS Fallout	2.5E-04	2.5E-03	4.3E-03	1.9E-02
TOTAL	3.9E-04	3.9E-03	6.4E-03	2.7E-02
Probability of Causation^f				
98% Credibility Interval				
	1.0%-ile	Median	Mean ^g	99%-ile
Oak Ridge (X-10)	2.8	22	33	78
NTS Fallout	5.2	40	51	87
TOTAL	10	50	60	90

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

Appendix B

Estimated Thyroid Doses and Risk of Thyroid Cancer for People Living in the Hanford, Washington Area

Table H-1 Hanford Interviewee Information: Summary table

Name/Number	Gender	DOB	Thyroid disease	Diagnosis	Year of diagnosis	month-year	Residence History			Milk ^a consumption
							State	County	City	
H-001	male	Oct 6, 1954	no			October 1954- August 1959	MT	Cascade	Great Falls	Cow—1-3 glasses/day
						August 1959- August 1960	WA	Spokane	Spokane	Cow-1-3 glasses/day
						August 1960- September 1969	WA	Stevens	Chewelah	Cow-4 or more glasses/day
H-002	female	Oct. 26, 1950	Yes	Autoimmune Thyroiditis	1988	October 1950 - May 1959	WA	Benton	Richland	Cow - 4 or more glasses/day
						May 1959 June 1968	CA	Santa Clara	San Jose	Cow - 4 or more glasses/day
						June 1968 - June 1970	Madrid, SPAIN			
H-003	male	Jan. 22, 1940	yes	hyper-thyroid	1959	January 1940 - Sept. 1944	MO	Cape Girardeau	Cape Girardeau	Cow - 4 or more glasses/day
						Sept. 1944 - May 1945	ID	Kootenai	Spirit Lake	Cow - 4 or more glasses/day
						June 1945 - July 1955	MO	Cape Girardeau	Cape Girardeau	Cow - 4 or more glasses/day
						August 1955 - Sept 1957	OR	Jackson	Medford	Cow - 4 or more glasses/day
						Sept 1957 - Sept 1959	OR	Lane	Eugene	Cow - 4 or more glasses/day

Thyroid Doses and Risk of Thyroid Cancer
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Name/Number	Gender	DOB	Thyroid disease	Diagnosis	Year of diagnosis	Residence History			Milk ^a Consumption	
						Month-Year	State	County		City
H-004	male	July 4, 1941	no			July 1941 - January 1942	OR	Multnomah	Portland	Breast milk
						January 1942 - June 1953	WA	Walla Walla	Walla Walla	Backyard cow 1-3 glasses/day & buttermilk 1-3 glasses/day
						June 1953 - Sept 1954	OR	Lane	Eugene	Cow - 1-3 glasses/day & buttermilk 1-3 glasses/day
						Sept 1954 - August 1959	OR	Multnomah	Portland	Cow - 1-3 glasses/day & buttermilk 1-3 glasses/day
H-005	Female	7/1/1957	no			July 1957 - present	ID	Kootenai	Coeur d'Alene	Cow - 1-3 glasses/day

^a Commercial milk

H-001

Table H-2 Thyroid doses from exposure to NTS fallout for H-001

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0.093	0.47	3.7
1956	0	0	0
1957	3.5	9.6	51
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 1 to 3 glasses through August 1960 and 4 or more glasses after that of local commercial milk per day

Location: Cascade Co. MT; Exposure period: October 1954 to August 1959

Location: Spokane Co. WA; Exposure period: August 1959 to August 1960

Location: Stevens Co. WA; Exposure period: August 1960 to September 1969

H-001

Table H-3 Thyroid doses from exposure to NTS fallout for H-001 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.0	0.0
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: FOX	5/25/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: HOW	6/5/1952	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.0	0.0	0.0
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.000046	0.0011	0.026
TEAPOT: HORNET	3/12/1955	0.00009	0.0021	0.049
TEAPOT: BEE and ESS	3/22/1955	0.0	0.0	0.0
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.00018	0.0038	0.082
TEAPOT: POST	4/9/1955	0.000018	0.00013	0.00096
TEAPOT: MET	4/15/1955	0.0017	0.019	0.21
TEAPOT: APPLE2	5/5/1955	0.00052	0.0082	0.13
TEAPOT: ZUCCHINI	5/15/1955	0.027	0.31	3.6
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.014	0.18	2.2
PLUMBBOB: WILSON	6/19/1957	0.02	0.32	5
PLUMBBOB: PRISCILLA	6/24/1957	0.0032	0.062	1.2

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: HOOD	7/5/1957	0.029	0.36	4.5
PLUMBBOB: DIABLO	7/15/1957	0.0075	0.14	2.6
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.15	2.6	44
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0091	0.08	0.71
PLUMBBOB: DOPPLER	8/23/1957	0.0049	0.082	1.4
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.00072	0.016	0.36
PLUMBBOB: GALILEO	9/2/1957	0.0059	0.1	1.7
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.013	0.15	1.7
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0094	0.16	2.7
PLUMBBOB: WHITNEY	9/23/1957	0.0031	0.037	0.45
PLUMBBOB: CHARLESTON	9/28/1957	0.016	0.3	5.6
PLUMBBOB: MORGAN	10/7/1957	0.000039	0.00092	0.022
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 1 to 3 glasses through August 1960 and 4 or more glasses after that of local commercial milk per day

Location: Cascade Co. MT; Exposure period: October 1954 to August 1959

Location: Spokane Co. WA; Exposure period: August 1959 to August 1960

Location: Stevens Co. WA; Exposure period: August 1960 to September 1969

H-001

Table H-4 Thyroid doses from exposure to I-131 released from Hanford operations for H-001

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0	0	0
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0	0	0
1956	0	0	0
1957	0	0	0

Estimated using CIDER computer code
 Central estimate is the median value of the distribution of dose values
 Doses from consumption of 1 - 3 glasses of local commercial milk per day
 Location: Great Falls, MT; Exposure period: 1954 to 1956

H-001

Table H-5 Summary of dose and risk estimates for H-001 from exposure to I-131 from NTS fallout and Hanford

	Thyroid Dose (rad)^a			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	-	-	-	-
NTS Fallout	1.8	11	17	71
TOTAL	1.8	11	17	71
	Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	6.0E-04	1.2E-03	1.2E-03	1.8E-03
Lifetime - from exposure to the end of lifetime	9.8E-04	2.0E-03	2.0E-03	2.9E-03
Lifetime - from birth to the end of lifetime	1.8E-03	2.4E-03	2.4E-03	3.1E-03
	Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	-	-	-	-
NTS Fallout	0.05	0.52	1.2	6.4
TOTAL	0.05	0.52	1.2	6.4
	Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	-	-	-	-
NTS Fallout	8.1E-05	8.4E-04	1.9E-03	1.1E-02
TOTAL	8.1E-05	8.4E-04	1.9E-03	1.1E-02
	Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	-	-	-	-
NTS Fallout	9.8E-05	1.1E-03	2.3E-03	1.3E-02
TOTAL	9.8E-05	1.1E-03	2.3E-03	1.3E-02
	Probability of Causation^f			
	1.0%-ile	Median	Mean ^g	99%-ile
Hanford	-	-	-	-
NTS Fallout	2.6	34	54	91
TOTAL	2.6	34	54	91

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

H-002

Table H-6 Thyroid doses from exposure to NTS fallout for H-002

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0.00039	0.0052	0.086
1952	0.26	1.1	7.9
1953	0.3	1.3	9.6
1954	0.0	0.0	0.0
1955	0.13	0.52	2.7
1956	0.0	0.0	0.0
1957	0.24	0.87	4.2
1958	0.0	0.0	0.0
1959	0.0	0.0	0.0
1960	0.0	0.0	0.0
1961	0.0	0.0	0.0
1962	0.0	0.0	0.0
1963	0.0	0.0	0.0
1964	0.0	0.0	0.0
1965	0.0	0.0	0.0
1966	0.0	0.0	0.0
1967	0.0	0.0	0.0
1968	0.0	0.0	0.0
1969	0.0	0.0	0.0
1970	0.0	0.0	0.0
1971	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Benton Co. WA; Exposure period: January 1951 to May 1959

Location: Santa Clara Co. CA; Exposure period: May 1959 to June 1968

Location: Madrid, Spain; Exposure period: June 1968 to June 1970

H-002

Table H-7 Thyroid doses from exposure to NTS fallout for H-002 by shot

c	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.00003	0.00099	0.032
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.000057	0.0017	0.05
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: BAKER	4/15/1952	0.00026	0.0065	0.16
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00064	0.016	0.4
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.0039	0.044	0.49
TUMBLER-SNAPPER: FOX	5/25/1952	0.0078	0.091	1.1
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.0022	0.03	0.4
TUMBLER-SNAPPER: HOW	6/5/1952	0.03	0.45	6.8
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.000025	0.00076	0.023
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.007	0.11	1.7
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.00049	0.0086	0.15
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.00079	0.023	0.67
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0051	0.11	2.4
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.0012	0.029	0.71
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.012	0.23	4.4
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.00049	0.012	0.29
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.00027	0.0079	0.23
TEAPOT: HORNET	3/12/1955	0.000057	0.0013	0.03
TEAPOT: BEE and ESS	3/22/1955	0.000082	0.003	0.11
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.00054	0.0092	0.16
TEAPOT: POST	4/9/1955	0.00056	0.014	0.35
TEAPOT: MET	4/15/1955	0.0085	0.085	0.85
TEAPOT: APPLE2	5/5/1955	0.0022	0.031	0.44
TEAPOT: ZUCCHINI	5/15/1955	0.0029	0.059	1.2
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.0025	0.044	0.77
PLUMBBOB: WILSON	6/19/1957	0.00078	0.013	0.22

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: PRISCILLA	6/24/1957	0.00016	0.003	0.057
PLUMBBOB: HOOD	7/5/1957	0.0017	0.035	0.74
PLUMBBOB: DIABLO	7/15/1957	0.0	0.0	0.0
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.00052	0.0081	0.13
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0	0.0	0.0
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0	0.0	0.0
PLUMBBOB: GALILEO	9/2/1957	0.00037	0.0033	0.029
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.00016	0.0014	0.012
PLUMBBOB: FIZEAU	9/14/1957	0.0011	0.028	0.68
PLUMBBOB: NEWTON	9/16/1957	0.0	0.0	0.0
PLUMBBOB: WHITNEY	9/23/1957	0.0064	0.11	1.9
PLUMBBOB: CHARLESTON	9/28/1957	0.0028	0.047	0.78
PLUMBBOB: MORGAN	10/7/1957	0.00061	0.013	0.28
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Benton Co. WA; Exposure period: January 1951 to May 1959

Location: Santa Clara Co. CA; Exposure period: May 1959 to June 1968

Location: Madrid, Spain; Exposure period: June 1968 to June 1970

H-002

Table H-8 Thyroid doses from exposure to I-131 released from Hanford operations for H-002

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0.018	0.059	0.22
1951	0.44	1.9	8.8
1952	0.013	0.03	0.16
1953	0.009	0.02	0.087
1954	0.0051	0.016	0.057
1955	0.014	0.034	0.14
1956	0.0025	0.0066	0.029
1957			

Estimated using CIDER computer code

Central estimate is the median value of the distribution of dose values

Doses from consumption of an average of 4-6 glasses of local commercial milk per day from birth

Location: Richland, WA; Exposure period: October 1950-December 1956

H-002

Table H-9 Summary of dose and risk estimates for H-002 from exposure to I-131 from NTS fallout and Hanford

		Thyroid Dose (rad)^a			
		95% Credibility Interval			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	0.65	2.1	2.8	8.9	
NTS Fallout	1.7	5.5	7.2	21.9	
TOTAL	3.3	8.4	10	25	
		Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile	
Future - from today to end of lifetime	8.9E-04	1.9E-03	1.9E-03	2.8E-03	
Lifetime - from exposure to the end of lifetime	2.2E-03	4.7E-03	4.6E-03	6.9E-03	
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03	
		Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	0.02	0.12	0.23	1.2	
NTS Fallout	0.03	0.27	0.47	2.1	
TOTAL	0.06	0.42	0.69	2.9	
		Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	4.0E-05	3.1E-04	6.3E-04	3.1E-03	
NTS Fallout	7.6E-05	7.2E-04	1.3E-03	5.4E-03	
TOTAL	1.5E-04	1.2E-03	1.9E-03	7.8E-03	
		Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	6.7E-05	5.2E-04	1.1E-03	5.3E-03	
NTS Fallout	1.2E-04	1.2E-03	2.2E-03	9.2E-03	
TOTAL	2.4E-04	1.9E-03	3.3E-03	1.4E-02	
		Probability of Causation^f			
		98% Credibility Interval			
	1.0%-ile	Median	Mean ^g	99%-ile	
Hanford	1.1	11	19	64	
NTS Fallout	1.6	21	32	71	
TOTAL	4.0	30	41	78	

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

H-003

Table H-10 Thyroid doses from exposure to NTS fallout for H-003

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0.0094	0.047	0.42
1952	0.45	2.3	17
1953	0.53	2	14
1954	0	0	0
1955	0.17	0.71	3.9
1956	0	0	0
1957	0.077	0.33	2.1
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Cape Girardeau Co. MO; Exposure period: January 1951 to July 1955

Location: Jackson Co. OR; Exposure period: August 1955 to September 1957

Location: Lane Co. OR, Exposure period: September 1957 to September 1959

H-003

Table H-11 Thyroid doses from exposure to NTS fallout for H-003 by shot

c Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.000057	0.0014	0.034
BUSTER-JANGLE: CHARLIE	10/30/1951	0.00079	0.012	0.18
BUSTER-JANGLE: DOG	11/1/1951	0.00035	0.0077	0.17
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.000068	0.0021	0.065
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.00033	0.0094	0.27
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00042	0.0087	0.18
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.0092	0.14	2.1
TUMBLER-SNAPPER: FOX	5/25/1952	0.0033	0.043	0.55
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.1	1.3	16
TUMBLER-SNAPPER: HOW	6/5/1952	0.0053	0.059	0.66
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.00085	0.015	0.26
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.00057	0.014	0.34
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.000016	0.00046	0.013
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.000015	0.00031	0.0062
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.00089	0.016	0.29
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.0017	0.03	0.54
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.034	0.59	10
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.00045	0.0082	0.15
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.038	0.39	4
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0015	0.015	0.15
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.00076	0.0091	0.11
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.000025	0.00081	0.026
TEAPOT: TURK	3/7/1955	0.00017	0.0033	0.063
TEAPOT: HORNET	3/12/1955	0.00042	0.008	0.15
TEAPOT: BEE and ESS	3/22/1955	0.0	0.0	0.0
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.00063	0.014	0.31
TEAPOT: POST	4/9/1955	0.00044	0.0071	0.11
TEAPOT: MET	4/15/1955	0.0041	0.048	0.56
TEAPOT: APPLE2	5/5/1955	0.02	0.2	2
TEAPOT: ZUCCHINI	5/15/1955	0.0056	0.087	1.4
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.00007	0.0007	0.007
PLUMBBOB: WILSON	6/19/1957	0.0	0.0	0.0

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: PRISCILLA	6/24/1957	0.000066	0.0013	0.025
PLUMBBOB: HOOD	7/5/1957	0.0015	0.014	0.13
PLUMBBOB: DIABLO	7/15/1957	0.0	0.0	0.0
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.00011	0.0019	0.032
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0	0.0	0.0
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0	0.0	0.0
PLUMBBOB: GALILEO	9/2/1957	0.00011	0.0021	0.041
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.000036	0.00071	0.014
PLUMBBOB: FIZEAU	9/14/1957	0.0015	0.015	0.15
PLUMBBOB: NEWTON	9/16/1957	0.0	0.0	0.0
PLUMBBOB: WHITNEY	9/23/1957	0.002	0.041	0.82
PLUMBBOB: CHARLESTON	9/28/1957	0.0045	0.071	1.1
PLUMBBOB: MORGAN	10/7/1957	0.00013	0.0036	0.096
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Cape Girardeau Co. MO; Exposure period: January 1951 to July 1955

Location: Jackson Co. OR; Exposure period: August 1955 to September 1957

Location: Lane Co. OR, Exposure period: September 1957 to September 1959

H-003

Table H-12 Thyroid doses from exposure to I-131 released from Hanford operations for H-003

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1944	1.2E-06	9.2E-05	0.00059
1945	0.14	0.57	2.3
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0	0	0
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0	0	0
1956	0	0	0
1957	0	0	0

Estimated using CIDER computer code

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Spirit Lake, ID; Exposure period: September 1944 to May 1945

H-003

Table H-13 Summary of dose and risk estimates for H-003 from exposure to I-131 from NTS fallout and Hanford

	Thyroid Dose (rad)^a			
	95% Credibility Interval			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	0.14	0.57	0.73	2.2
NTS Fallout	2.4	7.6	11	36
TOTAL	2.9	8.3	11	37
	Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	6.34E-04	9.37E-04	9.51E-04	1.27E-03
Lifetime - from exposure to the end of lifetime	1.92E-03	2.84E-03	2.88E-03	3.84E-03
Lifetime - from birth to the end of lifetime	1.8E-03	2.4E-03	2.4E-03	3.1E-03
	Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	0.002	0.02	0.03	0.14
NTS Fallout	0.01	0.11	0.25	1.1
TOTAL	0.02	0.14	0.28	1.2
	Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	1.65E-06	1.74E-05	3.16E-05	1.46E-04
NTS Fallout	1.24E-05	1.17E-04	2.60E-04	1.25E-03
TOTAL	1.76E-05	1.41E-04	2.92E-04	1.31E-03
	Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	4.63E-06	4.61E-05	8.68E-05	3.96E-04
NTS Fallout	3.14E-05	3.23E-04	7.08E-04	3.50E-03
TOTAL	4.33E-05	3.84E-04	7.95E-04	3.58E-03
	Probability of Causation^f			
	98% Credibility Interval			
	1.0%-ile	Median	Mean ^g	99%-ile
Hanford	0.11	1.6	2.9	16
NTS Fallout	0.90	9.9	20	70
TOTAL	1.1	12	22	72

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

H-004

Table H-14 Thyroid doses from exposure to NTS fallout for H-004

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0.00064	0.0057	0.069
1952	0.12	0.49	4
1953	0.069	0.3	1.9
1954	0	0	0
1955	0.036	0.11	0.42
1956	0	0	0
1957	0.34	1.5	10
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	0	0	0
1964	0	0	0
1965	0	0	0.00008
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0.00014	0.0091
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of backyard cow milk through June 1953, and 1 – 3 glasses of local commercial milk per day after that.

Location: Walla Walla Co. WA; Exposure period: January 1951 to June 1953

Location: Lane Co. OR; Exposure period: June 1953 to September 1954

Location: Multnomah Co. OR; Exposure period: September 1954 to August 1959

H-004

Table H-15 Thyroid doses from exposure to NTS fallout for H-004 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.00022	0.0039	0.069
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.000056	0.00056	0.0056
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: BAKER	4/15/1952	0.00011	0.0023	0.047
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00016	0.0028	0.049
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.00078	0.013	0.22
TUMBLER-SNAPPER: FOX	5/25/1952	0.0015	0.014	0.13
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.0033	0.047	0.67
TUMBLER-SNAPPER: HOW	6/5/1952	0.017	0.24	3.3
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.00021	0.0045	0.095
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0013	0.012	0.12
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.00025	0.0038	0.058
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.00012	0.0025	0.052
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0016	0.031	0.61
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.00033	0.0047	0.067
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0055	0.083	1.3
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.00011	0.0019	0.033
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.000041	0.0013	0.041
TEAPOT: HORNET	3/12/1955	0.0	0.0	0.0
TEAPOT: BEE and ESS	3/22/1955	0.00052	0.0046	0.041
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0013	0.015	0.17
TEAPOT: POST	4/9/1955	0.00014	0.0021	0.031
TEAPOT: MET	4/15/1955	0.0044	0.032	0.24
TEAPOT: APPLE2	5/5/1955	0.00022	0.003	0.041
TEAPOT: ZUCCHINI	5/15/1955	0.00018	0.0028	0.042
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.00015	0.0018	0.021
PLUMBBOB: WILSON	6/19/1957	0.00024	0.0042	0.074

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: PRISCILLA	6/24/1957	0.000052	0.001	0.019
PLUMBBOB: HOOD	7/5/1957	0.001	0.011	0.12
PLUMBBOB: DIABLO	7/15/1957	0.0	0.0	0.0
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.02	0.36	6.3
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0	0.0	0.0
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0	0.0	0.0
PLUMBBOB: GALILEO	9/2/1957	0.00011	0.0021	0.041
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0	0.000017	0.00016
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.000019	0.00017
PLUMBBOB: NEWTON	9/16/1957	0.0019	0.03	0.47
PLUMBBOB: WHITNEY	9/23/1957	0.0072	0.13	2.3
PLUMBBOB: CHARLESTON	9/28/1957	0.007	0.11	1.7
PLUMBBOB: MORGAN	10/7/1957	0.0014	0.023	0.37
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.00008

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.00014	0.0091

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of backyard cow milk through June 1953, and 1 – 3 glasses of local commercial milk per day after that.

Location: Walla Walla Co. WA; Exposure period: January 1951 to June 1953

Location: Lane Co. OR; Exposure period: June 1953 to September 1954

Location: Multnomah Co. OR; Exposure period: September 1954 to August 1959

H-004

Table H-16 Thyroid doses from exposure to I-131 released from Hanford operations for H-004

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1944	0.00001	0.0014	0.0094
1945	1.34	5.94	29.81
1946	0.21	0.87	3.53
1947	0.03	0.12	0.58
1948	0.00	0.01	0.03
1949	0.00	0.02	0.06
1950	0.01	0.02	0.12
1951	0.03	0.17	1.07
1952	0.0008	0.004	0.029
1953	0.0003	0.0009	0.0084
1954	0	0	0
1955	0	0	0
1956	0	0	0
1957	0	0	0

Estimated using CIDER computer code

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 1 - 3 glasses of backyard cow milk and of 1 – 3 glasses of buttermilk per day

Location: Walla Walla, WA; Exposure period: January 1944 to June 1953

H-004

Table H-17 Summary of dose and risk estimates for H-004 from exposure to I-131 from NTS fallout and Hanford

	Thyroid Dose (rad)^a			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	2.2	7.6	9.9	32
NTS Fallout	0.81	3.3	4.7	18
TOTAL	4.8	12	15	40
	Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	6.49E-04	9.69E-04	9.83E-04	1.31E-03
Lifetime - from exposure to the end of lifetime	1.86E-03	2.77E-03	2.81E-03	3.74E-03
Lifetime - from birth to the end of lifetime	1.8E-03	2.4E-03	2.4E-03	3.1E-03
	Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	0.03	0.23	0.44	2.1
NTS Fallout	0.004	0.04	0.09	0.45
TOTAL	0.04	0.30	0.54	2.4
	Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	2.66E-05	2.60E-04	4.80E-04	2.33E-03
NTS Fallout	4.62E-06	5.12E-05	1.01E-04	4.78E-04
TOTAL	4.25E-05	3.20E-04	5.87E-04	2.66E-03
	Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile
Hanford	6.66E-05	6.35E-04	1.23E-03	5.61E-03
NTS Fallout	1.11E-05	1.30E-04	2.60E-04	1.29E-03
TOTAL	1.05E-04	8.18E-04	1.50E-03	6.74E-03
	Probability of Causation^f			
	1.0%-ile	Median	Mean ^g	99%-ile
Hanford	1.4	19	31	74
NTS Fallout	0.32	4.3	8.5	35
TOTAL	2.2	23	35	77

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

H-005

Table H-18 Thyroid doses from exposure to NTS fallout for H-005

Year	Thyroid Dose (cSv)		
	90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0	0	0
1956	0	0	0
1957	1.7	7.1	42
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	0	0	0
1964	0	0	0
1965	0	0.000057	0.0005
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0.00035	0.025
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of an average amount of local commercial milk per day

Location: Kootenai Co. ID; Exposure period: July 1957 to December 1971

H-005

Table H-19 Thyroid doses from exposure to NTS fallout for H-005 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.0	0.0
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: FOX	5/25/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: HOW	6/5/1952	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.0	0.0	0.0
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.0	0.0	0.0
TEAPOT: HORNET	3/12/1955	0.0	0.0	0.0
TEAPOT: BEE and ESS	3/22/1955	0.0	0.0	0.0
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0	0.0	0.0
TEAPOT: POST	4/9/1955	0.0	0.0	0.0
TEAPOT: MET	4/15/1955	0.0	0.0	0.0
TEAPOT: APPLE2	5/5/1955	0.0	0.0	0.0
TEAPOT: ZUCCHINI	5/15/1955	0.0	0.0	0.0
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.001	0.023	0.51
PLUMBBOB: WILSON	6/19/1957	0.0	0.000011	0.00012

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: PRISCILLA	6/24/1957	0.00006	0.0013	0.028
PLUMBBOB: HOOD	7/5/1957	0.0074	0.083	0.93
PLUMBBOB: DIABLO	7/15/1957	0.0	0.0	0.0
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.12	1.9	30
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0	0.0	0.0
PLUMBBOB: DOPPLER	8/23/1957	0.0	0.0	0.0
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0	0.0	0.0
PLUMBBOB: GALILEO	9/2/1957	0.00063	0.011	0.19
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.000014	0.0001	0.00074
PLUMBBOB: FIZEAU	9/14/1957	0.000016	0.00012	0.00088
PLUMBBOB: NEWTON	9/16/1957	0.011	0.15	2.1
PLUMBBOB: WHITNEY	9/23/1957	0.04	0.65	10
PLUMBBOB: CHARLESTON	9/28/1957	0.043	0.59	8.1
PLUMBBOB: MORGAN	10/7/1957	0.0075	0.11	1.6
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.000057	0.0005
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.00035	0.025

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of an average amount of local commercial milk per day

Location: Kootenai Co. ID; Exposure period: July 1957 to December 1971

H-005

Table H-20 Thyroid doses from exposure to I-131 released from Hanford operations for H-005

Year	Thyroid Dose (cSv)		
	95% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1944	0	0	0
1945	0	0	0
1946	0	0	0
1947	0	0	0
1948	0	0	0
1949	0	0	0
1950	0	0	0
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0	0	0
1956	1.6E-05	5.8E-05	2.8E-04
1957	4.1E-04	1.2E-03	4.4E-03

Estimated using CIDER computer code

Central estimate is the median value of the distribution of dose values.

Doses from consumption of 1 - 3 glasses of local commercial milk per day

Location: Coeur d'Alene, ID; Exposure period: July – December 1957

H-005

Table H-21 Summary of dose and risk estimates for H-005 from exposure to I-131 from NTS fallout and Hanford

		Thyroid Dose (rad)^a			
		95% Credibility Interval			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	0.0004	0.0013	0.0016	0.0044	
NTS Fallout	0.87	7.1	13	58	
TOTAL	0.87	7.1	13	58	
		Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile	
Future - from today to end of lifetime	1.42E-03	2.85E-03	2.78E-03	3.90E-03	
Lifetime - from exposure to the end of lifetime	2.66E-03	5.34E-03	5.21E-03	7.30E-03	
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03	
		Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	0.00001	0.0001	0.0002	0.0008	
NTS Fallout	0.05	0.58	1.5	7.9	
TOTAL	0.05	0.58	1.5	7.9	
		Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	4.36E-08	3.72E-07	6.64E-07	2.90E-06	
NTS Fallout	1.57E-04	2.05E-03	5.06E-03	2.65E-02	
TOTAL	1.57E-04	2.05E-03	5.06E-03	2.65E-02	
		Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile	
Hanford	6.58E-08	5.43E-07	9.96E-07	4.53E-06	
NTS Fallout	2.24E-04	2.98E-03	7.75E-03	4.00E-02	
TOTAL	2.24E-04	2.98E-03	7.75E-03	4.00E-02	
		Probability of Causation^f			
		98% Credibility Interval			
	1.0%-ile	Median	Mean ^g	99%-ile	
Hanford	0.0008	0.011	0.019	0.14	
NTS Fallout	2.8	37	60	93	
TOTAL	2.8	37	60	93	

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

Appendix C

Estimated Thyroid Doses and Risk of Thyroid Cancer for People Exposed to Fallout from the Nevada Test Site

Table NTS-1 NTS Interviewee Information: Summary Table

Name/Number	Gender	DOB	Thyroid disease?	Diagnosis	Year of diagnosis	month-year	State	County	City	Milk consumption
001	male	Sept 1948	no			September 1948-1953	UT	Salt Lake	Salt Lake City	Cow-4 or more glasses/day
						1953-1956	CA	Orange	Huntington Beach	Cow-4 or more glasses/day
						1956-1961	UT	Salt Lake	Salt Lake City	Cow-4 or more glasses/day
						1961-1968	ID	Oneida	Malad	Cow-4 or more glasses/day
002	female	1937	yes	Thyroid Cancer	1990	1937-1937	UT	Salt Lake	Salt Lake City	Breast milk
						1937-1968	UT	Salt Lake	Salt Lake City	Cow-4 or more glasses/day
003	female	May 1951	no			May 1951-May 1952	UT	Carbon	Price	Breast milk
						May 1952-1971	UT	Carbon	Price	Cow-4 or more glasses/day
004	female	July 1955	yes	Papillary Carcinoma of Thyroid	1985	July 1955-August 1955	MO	Jasper	Joplin	Breast milk
						August 1955-December 1955	CO	Denver	Denver	Breast milk
						December 1955-August 1957	OK	Payne	Stillwater	Cow-4 or more glasses/day
						August 1957-present	UT	Salt Lake	Salt Lake City	Cow-4 or more glasses/day

NTS-001

Table NTS-2 Thyroid doses from exposure to NTS fallout for NTS-001

Year	Thyroid Dose (cSv)		
	Lower bound	Central Estimate	Upper bound
1951	0.0035	0.046	0.76
1952	3.3	15	79
1953	1.1	5.9	50
1954	0	0	0
1955	0.042	0.14	0.87
1956	0	0	0
1957	2.3	5.1	14
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0	0	0
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Assumed a residential move in July 1953 since Interviewee did not specify what month move was made.

Lower doses are expected if he moved earlier in the calendar year

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Salt Lake Co. UT; Exposure period: January 1951 to September 1953

Location: Orange Co. CA; Exposure period: September 1953 to September 1956

Location: Salt Lake Co. UT; Exposure period: September 1956 to September 1961

Location: Oneida Co. ID; Exposure period: September 1961 to December 1971

NTS-001

Table NTS-3 Thyroid doses from exposure to NTS fallout for NTS-001 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central Estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.000077	0.00068
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0018	0.036	0.72
BUSTER-JANGLE: UNCLE	11/29/1951	0.00012	0.0021	0.038
TUMBLER-SNAPPER: ABLE	4/1/1952	0.001	0.019	0.35
TUMBLER-SNAPPER: BAKER	4/15/1952	0.00037	0.0033	0.029
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00057	0.0089	0.14
TUMBLER-SNAPPER: DOG	5/1/1952	0.00053	0.0064	0.077
TUMBLER-SNAPPER: EASY	5/7/1952	0.47	4.9	51
TUMBLER-SNAPPER: FOX	5/25/1952	0.042	0.45	4.9
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.042	0.54	7
TUMBLER-SNAPPER: HOW	6/5/1952	0.32	3.2	32
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.000066	0.00058
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.073	1.4	27
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.000058	0.0011	0.021
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0000097	0.000086
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.00082	0.014	0.24
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0035	0.05	0.71
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.13	1.7	23
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.027	0.29	3.1
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.0022	0.024	0.26
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.00041	0.0085	0.18
TEAPOT: HORNET	3/12/1955	0.000028	0.0005	0.009
TEAPOT: BEE and ESS	3/22/1955	0.00011	0.00098	0.0086
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.000087	0.0012	0.017
TEAPOT: POST	4/9/1955	0.000013	0.00023	0.0039
TEAPOT: MET	4/15/1955	0.0026	0.033	0.41
TEAPOT: APPLE2	5/5/1955	0.00094	0.017	0.31
TEAPOT: ZUCCHINI	5/15/1955	0.00069	0.008	0.093
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.022	0.24	2.6
PLUMBBOB: WILSON	6/19/1957	0.0042	0.044	0.46
PLUMBBOB: PRISCILLA	6/24/1957	0.000049	0.00043	0.0038
PLUMBBOB: HOOD	7/5/1957	0.0078	0.081	0.84

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.034	0.38	4.3
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.018	0.19	2
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.032	0.29	2.7
PLUMBBOB: DOPPLER	8/23/1957	0.038	0.39	4
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.026	0.23	2
PLUMBBOB: GALILEO	9/2/1957	0.028	0.3	3.2
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0024	0.024	0.24
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0076	0.082	0.88
PLUMBBOB: WHITNEY	9/23/1957	0.0035	0.042	0.51
PLUMBBOB: CHARLESTON	9/28/1957	0.0035	0.061	1.1
PLUMBBOB: MORGAN	10/7/1957	0.00084	0.0074	0.065
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Assumed a residential move in July 1953 since Interviewee did not specify what month move was made. Lower doses are expected if he moved earlier in the calendar year

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Salt Lake Co. UT; Exposure period: January 1951 to September 1953

Location: Orange Co. CA; Exposure period: September 1953 to September 1956

Location: Salt Lake Co. UT; Exposure period: September 1956 to September 1961

Location: Oneida Co. ID; Exposure period: September 1961 to December 1971

NTS-001

Table NTS-4 Summary of dose and risk estimates for NTS-001 from exposure to I-131 from NTS fallout

	Thyroid Dose^a (rad)			
	2.5%-ile	95% Credibility Interval		97.5%-ile
		Median	Mean	
NTS Fallout	10	33	45	146
Baseline Risk^b				
	2.5%-ile	Median	Mean	97.5%-ile
Future – from today to end of lifetime	5.0E-04	1.0E-03	1.0E-03	1.5E-03
Lifetime – from exposure to the end of lifetime	1.0E-03	2.1E-03	2.0E-03	3.1E-03
Lifetime – from birth to the end of lifetime	1.8E-03	2.4E-03	2.4E-03	3.1E-03
Excess Relative Risk^c				
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	0.21	1.4	2.5	12
Excess Future Risk^d				
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	3.0E-04	2.0E-03	3.5E-03	1.7E-02
Excess Lifetime Risk^e				
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	4.2E-04	2.8E-03	5.3E-03	2.5E-02
Probability of Causation^f				
	98% Credibility Interval			
	1.0%-ile	Median	Mean ^g	99%-ile
NTS Fallout	14	59	72	94

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

NTS-002

Table NTS-5 Thyroid doses from exposure to NTS fallout for NTS-002

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower bound	Central Estimate	Upper bound
1951	0.0013	0.017	0.28
1952	0.82	3.9	22
1953	0.29	1.6	13
1954	0	0	0
1955	0.21	0.76	4.7
1956	0	0	0
1957	0.76	1.7	5.6
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0.024	0.21	2.2
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0.000072	0.0012	0.02
1967	0	0	0
1968	0	0.000061	0.0013
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Salt Lake Co. UTAH; Exposure period: January 1951 to December 1968

NTS-002

Table NTS-6 Thyroid doses from exposure to NTS fallout for NTS-002 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central Estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.000028	0.00026
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.00063	0.013	0.27
BUSTER-JANGLE: UNCLE	11/29/1951	0.000048	0.00084	0.015
TUMBLER-SNAPPER: ABLE	4/1/1952	0.00027	0.0052	0.099
TUMBLER-SNAPPER: BAKER	4/15/1952	0.000091	0.00084	0.0077
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.00016	0.0025	0.039
TUMBLER-SNAPPER: DOG	5/1/1952	0.00014	0.0017	0.021
TUMBLER-SNAPPER: EASY	5/7/1952	0.12	1.3	14
TUMBLER-SNAPPER: FOX	5/25/1952	0.01	0.12	1.4
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.01	0.14	1.9
TUMBLER-SNAPPER: HOW	6/5/1952	0.074	0.8	8.6
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.000017	0.00016
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.022	0.41	7.6
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.000018	0.00034	0.0063
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0	0.000022
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.00023	0.0039	0.067
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.00098	0.014	0.2
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.029	0.42	6
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0068	0.076	0.85
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.00054	0.0063	0.073
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.0048	0.091	1.7
TEAPOT: HORNET	3/12/1955	0.0	0.000018	0.00017
TEAPOT: BEE and ESS	3/22/1955	0.000084	0.0016	0.031
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.00016	0.0027	0.046
TEAPOT: POST	4/9/1955	0.0019	0.034	0.61
TEAPOT: MET	4/15/1955	0.00063	0.011	0.19
TEAPOT: APPLE2	5/5/1955	0.0063	0.11	1.9
TEAPOT: ZUCCHINI	5/15/1955	0.011	0.11	1.1
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.0061	0.076	0.95
PLUMBBOB: WILSON	6/19/1957	0.0011	0.014	0.17
PLUMBBOB: PRISCILLA	6/24/1957	0.000012	0.00013	0.0014
PLUMBBOB: HOOD	7/5/1957	0.0022	0.026	0.31

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central Estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.0093	0.12	1.5
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.0046	0.057	0.71
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0086	0.093	1
PLUMBBOB: DOPPLER	8/23/1957	0.01	0.12	1.4
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.0063	0.068	0.73
PLUMBBOB: GALILEO	9/2/1957	0.0076	0.095	1.2
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.00065	0.0076	0.088
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.0022	0.027	0.34
PLUMBBOB: WHITNEY	9/23/1957	0.00091	0.013	0.19
PLUMBBOB: CHARLESTON	9/28/1957	0.001	0.02	0.39
PLUMBBOB: MORGAN	10/7/1957	0.0002	0.0022	0.024
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.00093	0.012	0.15
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.012	0.16	2.2
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.000072	0.0012	0.02

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.000061	0.0013
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.000073	0.0014	0.027

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Salt Lake Co. UTAH; Exposure period: January 1951 to December 1968

NTS-002

Table NTS-7 Summary of dose and risk estimates for NTS-002 from exposure to I-131 from NTS fallout

		Thyroid Dose (rad)^a 95% Credibility Interval		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	3.9	12	15	43

		Baseline Risk^b		
	2.5%-ile	Median	Mean	97.5%-ile
Future – from today to end of lifetime	1.1E-03	1.5E-03	1.5E-03	2.0E-03
Lifetime – from exposure to the end of lifetime	5.2E-03	6.9E-03	7.0E-03	9.1E-03
Lifetime – from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03

		Excess Relative Risk^c		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	0.02	0.19	0.34	1.7

		Excess Future Risk^d		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	3.9E-05	3.0E-04	5.5E-04	2.8E-03

		Excess Lifetime Risk^e		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	1.6E-04	1.3E-03	2.4E-03	1.2E-02

		Probability of Causation^f 98% Credibility Interval		
	1.0%-ile	Median	Mean ^g	99%-ile
NTS Fallout	1.7	16	25	69

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

NTS-003

Table NTS-8 Thyroid doses from exposure to NTS fallout for NTS-003

Year	Thyroid Dose (cSv)		
	Lower bound	Central estimate	Upper bound
1951	0	0	0.000011
1952	0.87	3.4	19
1953	2.6	14	130
1954	0	0	0
1955	0.69	2.8	16
1956	0	0	0
1957	1.4	4.6	16
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0.0078	0.084	0.91
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	0	0	0
1968	0.000012	0.00021	0.0038
1969	0	0	0
1970	0	0	0
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Carbon Co. UT; Exposure period: April 1952 to December 1971

NTS-003

Table NTS-9 Thyroid doses from exposure to NTS fallout for NTS-003 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central Estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.0	0.0
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.000011
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0022	0.032	0.51
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0002	0.0028	0.039
TUMBLER-SNAPPER: DOG	5/1/1952	0.00088	0.0098	0.11
TUMBLER-SNAPPER: EASY	5/7/1952	0.0063	0.068	0.73
TUMBLER-SNAPPER: FOX	5/25/1952	0.13	1.4	15
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.059	0.66	7.4
TUMBLER-SNAPPER: HOW	6/5/1952	0.0038	0.039	0.4
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.00015	0.0013	0.011
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.00007	0.0013	0.024
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.00027	0.0024	0.021
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.00066	0.011	0.18
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0065	0.09	1.2
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	1.1	12	130
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.045	0.47	4.9
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.016	0.17	1.8
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.00084	0.0074	0.065
TEAPOT: TURK	3/7/1955	0.0059	0.11	2
TEAPOT: HORNET	3/12/1955	0.00028	0.0025	0.022
TEAPOT: BEE and ESS	3/22/1955	0.0	0.0	0.0
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.00082	0.017	0.35
TEAPOT: POST	4/9/1955	0.0026	0.05	0.95
TEAPOT: MET	4/15/1955	0.018	0.32	5.8
TEAPOT: APPLE2	5/5/1955	0.012	0.22	4.1
TEAPOT: ZUCCHINI	5/15/1955	0.047	0.51	5.5
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.011	0.13	1.5
PLUMBBOB: WILSON	6/19/1957	0.0089	0.092	0.96
PLUMBBOB: PRISCILLA	6/24/1957	0.0	0.0	0.0
PLUMBBOB: HOOD	7/5/1957	0.0096	0.1	1

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central Estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.022	0.23	2.4
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.0	0.0	0.0
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.0073	0.076	0.79
PLUMBBOB: DOPPLER	8/23/1957	0.024	0.26	2.8
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.095	1.1	13
PLUMBBOB: GALILEO	9/2/1957	0.0072	0.081	0.91
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.00061	0.0054	0.048
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.011	0.12	1.3
PLUMBBOB: WHITNEY	9/23/1957	0.0	0.0	0.0
PLUMBBOB: CHARLESTON	9/28/1957	0.0007	0.011	0.17
PLUMBBOB: MORGAN	10/7/1957	0.00018	0.0016	0.014
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.0078	0.084	0.91
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.0	0.0	0.0

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.000012	0.00021	0.0038
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0	0.0	0.0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Carbon Co. UT; Exposure period: April 1952 to December 1971

NTS-003

Table NTS-10 Summary of dose and risk estimates for NTS-003 from exposure to I-131 from NTS fallout

		Thyroid Dose^a (rad) 95% Credibility Interval		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	10	33	52	212
		Baseline Risk^b		
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	7.8E-04	1.9E-03	1.8E-03	2.9E-03
Lifetime - from exposure to the end of lifetime	1.8E-03	4.3E-03	4.3E-03	6.8E-03
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03
		Excess Relative Risk^c		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	0.23	1.7	3.6	20
		Excess Future Risk^d		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	6.3E-04	4.7E-03	1.0E-02	5.9E-02
		Excess Lifetime Risk^e		
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	8.3E-04	6.5E-03	1.6E-02	9.9E-02
		Probability of Causation^f 98% Credibility Interval		
	1.0%-ile	Median	Mean ^g	99%-ile
NTS Fallout	14	63	78	97

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.

NTS-004

Table NTS-11 Thyroid doses from exposure to NTS fallout for NTS-004

Year	Thyroid Dose (cSv) 90% Credibility Interval		
	Lower bound	Central estimate	Upper bound
1951	0	0	0
1952	0	0	0
1953	0	0	0
1954	0	0	0
1955	0.21	1.2	8.4
1956	0	0	0
1957	3.5	8.2	26
1958	0	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0.078	0.67	6.8
1963	0	0	0
1964	0	0	0
1965	0	0	0
1966	0.00017	0.0026	0.039
1967	0	0	0
1968	0	0.00013	0.0025
1969	0	0	0
1970	0.0001	0.002	0.038
1971	0	0	0

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Jasper Co. MO; Exposure period: July 1955 to August 1955

Location: Denver Co. CO; Exposure period: August 1955 to December 1955

Location: Payne Co. OK; Exposure period: December 1955 to August 1957

Location: Salt Lake Co. UT; Exposure period: August 1957 to December 1971

NTS-004

Table NTS-12 Thyroid doses from exposure to NTS fallout for NTS-004 by shot

Series name: Shot name	Date	Thyroid Dose (cSv)		
		Lower bound	Central Estimate	Upper bound
RANGER: BAKER	1/28/1951	0.0	0.0	0.0
RANGER: BAKER-2	2/2/1951	0.0	0.0	0.0
RANGER: FOX	2/6/1951	0.0	0.0	0.0
BUSTER-JANGLE: BAKER	10/28/1951	0.0	0.0	0.0
BUSTER-JANGLE: CHARLIE	10/30/1951	0.0	0.0	0.0
BUSTER-JANGLE: DOG	11/1/1951	0.0	0.0	0.0
BUSTER-JANGLE: EASY	11/5/1951	0.0	0.0	0.0
BUSTER-JANGLE: SUGAR	11/19/1951	0.0	0.0	0.0
BUSTER-JANGLE: UNCLE	11/29/1951	0.0	0.0	0.0
TUMBLER-SNAPPER: ABLE	4/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: BAKER	4/15/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: CHARLIE	4/22/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: DOG	5/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: EASY	5/7/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: FOX	5/25/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: GEORGE	6/1/1952	0.0	0.0	0.0
TUMBLER-SNAPPER: HOW	6/5/1952	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ANNIE	3/17/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: NANCY	3/24/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RUTH	3/31/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: DIXIE	4/6/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: RAY	4/11/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: BADGER	4/18/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: SIMON	4/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: ENCORE	5/8/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: HARRY	5/19/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: GRABLE	5/25/1953	0.0	0.0	0.0
UPSHOT-KNOTHOLE: CLIMAX	6/4/1953	0.0	0.0	0.0
TEAPOT: WASP	2/18/1955	0.0	0.0	0.0
TEAPOT: MOTH	2/22/1955	0.0	0.0	0.0
TEAPOT: TESLA	3/1/1955	0.0	0.0	0.0
TEAPOT: TURK	3/7/1955	0.000057	0.0014	0.034
TEAPOT: HORNET	3/12/1955	0.000042	0.00082	0.016
TEAPOT: BEE and ESS	3/22/1955	0.000048	0.0016	0.053
TEAPOT: APPLE1 and WASP PRIME	3/29/1955	0.0012	0.023	0.43
TEAPOT: POST	4/9/1955	0.0011	0.015	0.2
TEAPOT: MET	4/15/1955	0.0043	0.075	1.3
TEAPOT: APPLE2	5/5/1955	0.0094	0.23	5.6
TEAPOT: ZUCCHINI	5/15/1955	0.009	0.14	2.2
PLUMBBOB: BOLTZMANN, FRANKLIN, LASSEN	5/28/1957	0.021	0.31	4.6
PLUMBBOB: WILSON	6/19/1957	0.0068	0.1	1.5
PLUMBBOB: PRISCILLA	6/24/1957	0.014	0.17	2.1
PLUMBBOB: HOOD	7/5/1957	0.0028	0.028	0.28

Thyroid Doses and Risk of Thyroid Cancer
For Members of Public Exposed to I-131

SENES Oak Ridge, Inc.
November 2005

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central Estimate	Upper bound
PLUMBBOB: DIABLO	7/15/1957	0.0064	0.082	1.1
PLUMBBOB: KEPLER and OWENS	7/24/1957	0.0072	0.081	0.91
PLUMBBOB: STOKES	8/7/1957	0.0	0.0	0.0
PLUMBBOB: SHASTA	8/18/1957	0.059	0.57	5.5
PLUMBBOB: DOPPLER	8/23/1957	0.074	0.77	8
PLUMBBOB: FRANKLIN PRIME	8/30/1957	0.0	0.0	0.0
PLUMBBOB: SMOKY	8/31/1957	0.052	0.46	4.1
PLUMBBOB: GALILEO	9/2/1957	0.054	0.58	6.3
PLUMBBOB: WHEELER, COULOMB B and LAPLACE	9/6/1957	0.0047	0.047	0.47
PLUMBBOB: FIZEAU	9/14/1957	0.0	0.0	0.0
PLUMBBOB: NEWTON	9/16/1957	0.014	0.16	1.8
PLUMBBOB: WHITNEY	9/23/1957	0.0066	0.082	1
PLUMBBOB: CHARLESTON	9/28/1957	0.0066	0.12	2.2
PLUMBBOB: MORGAN	10/7/1957	0.0017	0.015	0.13
HARDTACK-PHASE II: EDDY	9/19/1958	0.0	0.0	0.0
HARDTACK-PHASE II: HIDALGO	10/5/1958	0.0	0.0	0.0
HARDTACK-PHASE II: QUAY	10/10/1958	0.0	0.0	0.0
HARDTACK-PHASE II: LEA	10/13/1958	0.0	0.0	0.0
HARDTACK-PHASE II: VESTA	10/17/1958	0.0	0.0	0.0
HARDTACK-PHASE II: RIO ARRIBA	10/18/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SOCORRO	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: WRANGELL	10/22/1958	0.0	0.0	0.0
HARDTACK-PHASE II: SANFORD	10/26/1958	0.0	0.0	0.0
UNDERGROUND TEST ERA: ANTLER	9/15/1961	0.0	0.0	0.0
UNDERGROUND TEST ERA: DANNY BOY	3/5/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PLATTE	4/14/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: EEL	5/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: DES MOINES	6/13/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SEDAN	7/6/1962	0.0034	0.038	0.43
UNDERGROUND TEST ERA: JOHNIE BOY	7/11/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: SMALL BOY	7/14/1962	0.047	0.55	6.4
UNDERGROUND TEST ERA: BANDICOOT	10/19/1962	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIKE	3/13/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: SULKY	12/18/1964	0.0	0.0	0.0
UNDERGROUND TEST ERA: PALANQUIN	4/14/1965	0.0	0.0	0.0
UNDERGROUND TEST ERA: PIN STRIPE	4/25/1966	0.00017	0.0026	0.039

Series name: Shot name	Date	Thyroid Dose (cSv)		
		90% Credibility Interval		
		Lower bound	Central estimate	Upper bound
UNDERGROUND TEST ERA: CABRIOLET	1/26/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: BUGGY	3/12/1968	0.0	0.0	0.0
UNDERGROUND TEST ERA: SCHOONER	12/8/1968	0.0	0.00013	0.0025
UNDERGROUND TEST ERA: BANE BERRY	12/18/1970	0.0001	0.002	0.038

Estimated using NCI's I-131 Thyroid Dose/Risk Calculator for NTS Fallout

Central estimate is the median value of the distribution of dose values.

URL: <http://ntsi131.nci.nih.gov>

Doses from consumption of 4 or more glasses of local commercial milk per day

Location: Jasper Co. MO; Exposure period: July 1955 to August 1955

Location: Denver Co. CO; Exposure period: August 1955 to December 1955

Location: Payne Co. OK; Exposure period: December 1955 to August 1957

Location: Salt Lake Co. UT; Exposure period: August 1957 to December 1971

NTS-004

Table NTS-13 Summary of dose and risk estimates for NTS-004 from exposure to I-131 from NTS fallout

	Thyroid Dose (rad)^a			
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	3.5	12	15	37

	Baseline Risk^b			
	2.5%-ile	Median	Mean	97.5%-ile
Future - from today to end of lifetime	1.3E-03	2.6E-03	2.6E-03	3.6E-03
Lifetime - from exposure to the end of lifetime	2.5E-03	5.3E-03	5.1E-03	7.3E-03
Lifetime - from birth to the end of lifetime	4.7E-03	6.1E-03	6.2E-03	7.9E-03

	Excess Relative Risk^c			
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	0.08	0.68	1.1	4.4

	Excess Future Risk^d			
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	2.7E-04	2.2E-03	3.5E-03	1.5E-02

	Excess Lifetime Risk^e			
	2.5%-ile	Median	Mean	97.5%-ile
NTS Fallout	4.2E-04	3.3E-03	5.5E-03	2.2E-02

	Probability of Causation^f			
	1.0%-ile	Median	Mean ^g	99%-ile
NTS Fallout	4.9	40	52	85

^a Dose to thyroid gland from all years of exposure.

^b Risk of thyroid cancer incidence due to causes other than considered exposures to I-131.

^c Risk of thyroid cancer incidence due to exposure to I-131 relative to the baseline risk of thyroid cancer incidence.

^d Risk of developing thyroid cancer due to exposure to I-131 from today to the end of expected lifetime.

^e Risk of developing thyroid cancer due to exposure to I-131 from exposure to the end of expected lifetime.

^f For a person already diagnosed with thyroid cancer, this quantity represents the probability that the diagnosed thyroid cancer was induced by the past exposure to I-131. For a person currently free of thyroid cancer, it represents the probability that a future thyroid cancer would have been induced by the past exposure to I-131.

^g Probability of causation obtained using the mean value of the excess relative risk.