# Estimation of Doses to Specified Individuals

*Contents: The manner in which any individual, without any scientific background, can calculate her or his own thyroid dose from $^{131}I$ in NTS fallout, using the information available in the report, is demonstrated using examples.*

This chapter illustrates how the data provided in the preceding Chapters as well as in the Annexes can be used to calculate doses to any specified individual.

Individual doses present considerable variability according to environmental parameters, pattern of production and distribution of milk and of other foodstuffs, dietary habits, and biological characteristics. Realistic estimates of doses to specific individuals can, therefore, only be made if information is available on the individuals considered (e.g., age, sex, place of residence, source of milk, and milk consumption rate). The manner in which doses to specified individuals can be calculated if person-specific information is available will be illustrated using examples.

As indicated in **Chapter 8**, the thyroid dose, D, resulting from fallout received by an individual from a particular exposure route from a given test can be estimated as the product of:

- The time-integrated $^{131}I$ concentration, IC, in the foodstuff considered (for ingestion) resulting from that test and consumed by that individual (nCi d $L^{-1}$ for milk and nCi d $kg^{-1}$ for other foodstuffs) or in ground-level air (for inhalation) (nCi d $m^{-3}$).
- The foodstuff consumption rate, CR, (L $d^{-1}$ for milk or kg $d^{-1}$ for other foodstuffs) or the breathing rate, BR, ($m^3$ $d^{-1}$) of that individual for a period of a few weeks following the test considered.
- The thyroid dose conversion factor, DCF, appropriate for that individual (mrad per nCi).

For ingestion of milk or other foodstuff, the equation can be written as:

$$D_{food} = IC_{food} \times CR_{food} \times DCF \qquad (9.1)$$

For inhalation, the equation is:

$$D_{inh} = IC_{air} \times BR \times DCF \qquad (9.1)$$

The total individual thyroid dose resulting from the deposition of $^{131}I$ on the ground after a given test is obtained by adding the dose from inhalation and the doses from the ingestion of the foodstuffs considered (cows' milk, goats' milk, mothers' milk (for infants), cottage cheese, eggs, and leafy vegetables). The total individual thyroid dose from all tests is obtained by adding the total individual thyroid doses calculated for each test.

The estimation of the thyroid dose to a specified individual from a given test requires the knowledge of:

- The time-integrated concentrations, IC, of $^{131}I$ in cows' milk, goats' milk, cottage cheese, eggs, leafy vegetables, mothers' milk (only for infants), and ground-level air in the county of residence of the individual considered at the time of the test. These time-integrated concentrations are found in tables provided in the Annexes, where they are expressed in nCi d $L^{-1}$ for milk, in nCi d $kg^{-1}$ for other foodstuffs, and in nCi d $m^{-3}$ for ground-level air. There are separate entries for each county of the contiguous United States and an individual needs only to look up the results corresponding to her or his county of residence at the time of the test.

- The consumption rates of cows' milk, goats' milk, and mothers' milk (only for infants), expressed in L $d^{-1}$, of cottage cheese, eggs, and leafy vegetables, expressed in kg $d^{-1}$, as well as the breathing rate, expressed in $m^3$ $d^{-1}$, of the individual at the time of the test. This information is to be provided by the individual or by another knowledgeable person (e.g., relative or friend) who could supply estimates of those quantities. Average values for the 10 post-natal age and sex groups are given in *Table 7.4.*[1]

- The appropriate thyroid dose conversion factor, DCF, expressed in mrad per nCi. It may be available for those individuals who underwent thyroid irradiation for medical reasons. In most cases, however, the value of the thyroid dose conversion factor appropriate for the individual is not available and use of the estimated average thyroid dose conversion factors, DCF, presented in *Table 6.7* (and also in *Table 6.8*) of **Chapter 6** for the 14 age and sex groups is recommended.

It should be noted that the scientific notation was used in most of the tables that need to be consulted. This was done in order to minimize the number of pages in the Annexes as the scientific notation allows results that differ by factors of billions or more to be written with the same format. For example, a value of "5.6E + 2" may be found in a table. This means that "5.6", which is the number before "E + ", should be *multiplied* "2" times (i.e., twice) by 10; in other words:

5.6E + 2 = 5.6 × 10 × 10 = 560.

However, if the value found in the table were "5.6E − 2", then "5.6", which is the number before "E − ", should be *divided* "2" times by 10 (i.e., twice); in other words:

5.6E-2 = 5.6 / 10 / 10 = 0.056.

Finally, if the number after "E + " or "E − " is 0, as in "5.6E + 0", then the number before "E + " or "E − " remains unchanged; in other words:

5.6E+0 = 5.6 and 5.6E-0 = 5.6.

The following sequence of numbers illustrates the range of values that can be found in the Tables and shows why the scientific notation is used to save space:

5.6E−9 = 0.0000000056
5.6E−8 = 0.000000056
5.6E−7 = 0.00000056
5.6E−6 = 0.0000056
5.6E−5 = 0.000056
5.6E−4 = 0.00056
5.6E−3 = 0.0056
5.6E−2 = 0.056
5.6E−1 = 0.56
5.6E−0 = 5.6
5.6E+0 = 5.6
5.6E+1 = 56
5.6E+2 = 560
5.6E+3 = 5600
5.6E+4 = 56000
5.6E+5 = 560000
5.6E+6 = 5600000
5.6E+7 = 56000000
5.6E+8 = 560000000
5.6E+9 = 5600000000

[1] In order to assist the reader in the estimation of the consumption rates, for the purpose of this report it can be assumed that a typical glass of milk contains about 0.2 L and that a typical egg weighs about 0.05 kg.

## 9.1. EXAMPLES OF EXPOSURE SCENARIOS FOR HYPOTHETICAL PERSONS

To illustrate the manner in which individual exposures can be estimated, the following examples are provided in which results presented in tables in the Annexes are used in conjunction with "hypothetical personal data". Data should be supplied by the individual or a person having knowledge of the relevant information. It is assumed, in these example calculations, that the values used for all quantities are known with certainty. In fact, the uncertainties attached to some of the values may be very large, but a proper uncertainty analysis of thyroid dose estimates for specific individuals would be beyond the scope of this chapter and is not discussed in this report. It is the subjective opinion of the authors that the estimated total thyroid doses, D, obtained for specific individuals with this method have uncertainties within a factor of about 5. In other words, if the dose estimate obtained using this procedure is equal to D, the real value of the dose received by the individual is estimated to range between D / 5 and D x 5.

### *9.1.1. Example 1 of Individual Thyroid Dose Calculation*

The following evaluation is for a hypothetical female conceived on July 20, 1952 and born on April 20, 1953. This evaluation is divided into segments that are related to the times of: her birth, changes of age group, and changes of residence. Each step requires retrieval of information from one or more Annexes containing results of this analysis. The Annexes are listed near the end of the Table of Contents. Each is designated by a two-letter code, for the test series, and a number. For example, BJ.5 refers to the fifth of the Annexes for the Buster-Jangle test series. That test was named Sugar. The contents of the tables in the Annex are indicated by codes: M, for milk, and C, for concentrations of $^{131}I$ in other foodstuffs and air. The concentrations of $^{131}I$ in cows' milk following test Sugar are found in *Table BJ/5/M.* The steps in the analysis are described below:

From July 20, 1952 to March 17, 1953, while the subject was a fetus, no tests were conducted at the NTS and, therefore, there was no exposure of the subject.

Between March 17, 1953 and April 20, 1953, the date of birth, the mother resided in Cleburne County, Alabama, and drank milk obtained from a local grocery store (hypothetical personal data). During that period, six tests of the Upshot-Knothole series were detonated. Because the mother consumed milk obtained from a store, the volume-weighted average concentration of $^{131}I$ is considered the best estimate for her source of milk. Cows' milk concentrations for those tests are in the Annexes for the Upshot-Knothole (UK) series. The volume-weighted average time-integrated milk concentrations are in the sixth column of the milk, M, tables. The following volume-weighted time-integrated milk concentrations of $^{131}I$ in cows' milk in Cleburne County, Alabama, are found on page 1 of the relevant tables. The results are shown below:

13 nCi d $L^{-1}$ from test Annie on 3-17-53 from *Table UK/6/C*

5.8 nCi d $L^{-1}$ from test Nancy on 3-24-53 from *Table UK/2/M*

0.36 nCi d $L^{-1}$ from test Ruth on 3-31-53 from *Table UK/3/M*

0.28 nCi d $L^{-1}$ from test Dixie on 4-6-53 from *Table UK/4/M*

1.6 nCi d $L^{-1}$ from test Ray on 4-11-53 from *Table UK/5/M*

3.0 nCi d $L^{-1}$ from test Badger on 4-18-53 from *Table UK/6/M*

These yield a total time-integrated concentration of about 24 nCi d $L^{-1}$ in milk consumed by the mother during pregnancy. The mother reported a milk consumption rate of 0.9 L $d^{-1}$ during the last three months of her pregnancy (hypothetical personal data). The thyroid dose conversion factor for the 30-39 week old fetus is 1.7 mrad per nCi of $^{131}I$ ingested by the mother (from *Table 6.7*). The resulting dose to the fetal thyroid from the tests identified above is estimated to be:

$$D_{milk} = IC_{milk} \times CR_{milk} \times DCF = 24 \text{ nCi d } L^{-1} \times 0.9 \text{ L } d^{-1} \times 1.7 \text{ mrad nCi}^{-1}$$
$$= 37 \text{ mrad}$$

The mother did not consume other contaminated foodstuffs during this period. However, the tests were sources of airborne $^{131}I$ contamination in the county where she lived. From the corresponding tables of $^{131}I$ in other foodstuffs and air, the following time-integrated concentrations in air were found:

0.0051 nCi d $m^{-3}$ from test Annie on 3-17-53 from *Table UK/1/C*

0.0076 nCi d $m^{-3}$ from test Nancy on 3-24-53 from *Table UK/2/C*

0.0001 nCi d $m^{-3}$ from test Ruth on 3-31-53 from *Table UK/3/C*

0.00035 nCi d $m^{-3}$ from test Dixie on 4-6-53 from *Table UK/4/C*

0.00090 nCi d $m^{-3}$ from test Ray on 4-11-53 from *Table UK/5/C*

0.0019 nCi d $m^{-3}$ from test Badger on 4-18-53 from *Table UK/6/C*

By adding the concentrations listed above, the total time-integrated air concentration during this period, $IC_{inh}$, was estimated to be about 0.016 nCi d $m^{-3}$. Individuals typically do not know their average breathing rates. The value of 18 m3 $d^{-1}$ from *Table 7.4* was used as the breathing rate, BR, for the mother in this example. The dose to the fetal thyroid from inhalation of contaminated air by the mother is estimated to be:

$$D_{inh} = IC_{inh} \times BR \times DCF$$
$$= 0.016 \text{ nCi d m}^{-3} \times 18 \text{ m}^3 \text{ d}^{-1} \times 1.7 \text{ mrad nCi}^{-1}$$
$$= 0.49 \text{ mrad}$$

At the time the girl was born, her family was moving to a farm in the same county. Between April 20, 1953 and July 20, 1953, while she was less than 3 months old, the (hypothetical) girl lived on the farm in Cleburne County, Alabama, and drank 0.1 L $d^{-1}$ of milk produced on the farm (milk of category 1). That milk was contaminated as the result of five tests in the Upshot-Knothole series. The median estimates of time-integrated concentrations of $^{131}I$ in milk from those tests are given in the second column of the milk (M) tables for those tests. The following estimates were found:

17 nCi d $L^{-1}$ from test Simon on 4-25-53 from *Table UK/7/M*

0.0 nCi d $L^{-1}$ from test Encore on 4-25-53 from *Table UK/8/M*

54 nCi d $L^{-1}$ from test Harry on 4-25-53 from *Table UK/9/M*

2.4 nCi d $L^{-1}$ from test Grable on 4-25-53 from *Table UK/10/M*

0.84 nCi d $L^{-1}$ from test Climax on 4-25-53 from T*able UK/11/M*

The total time-integrated concentration of $^{131}I$ in milk of category 1 during this period was about 74 nCi d $L^{-1}$.

The girl did not drink any other type of contaminated milk nor did she eat any eggs, cottage cheese, or leafy vegetables during her first months of life. However, the air that she breathed was also contaminated. The estimated time-integrated concentration levels are given in the tables of concentrations, C, of other foodstuffs and air in the Annexes for these tests.

0.019 nCi d $m^{-3}$ from test Simon on 4-25-53 from *Table UK/7/M*

0.0 nCi d $m^{-3}$ from test Encore on 4-25-53 from *Table UK/8/M*

0.068 nCi d $m^{-3}$ from test Harry on 4-25-53 from *Table UK/9/M*

0.0038 nCi d $m^{-3}$ from test Grable on 4-25-53 from *Table UK/10/M*

0.00016 nCi d $m^{-3}$ from test Climax on 4-25-53 from *Table UK/11/M*

The total time-integrated concentration of $^{131}I$ in air in Cleburne County during this time is about 0.09 nCi d $m^{-3}$. For an infant that age (< 3 mo), a breathing rate of 2 $m^3$ d-1 (*Table 7.4*) is a good estimate. The thyroid dose conversion factor for that age is 15 mrad per nCi (*Table 6.7*). The estimated dose to the child's thyroid during this period is:

$$D = D_{milk} + D_{inh} = (IC_{milk} \times CR_{milk} + IC_{inh} \times BR) \times DCF$$
$$= (74 \text{ nCi d L}^{-1} \times 0.1 \text{ L d}^{-1} + 0.09 \text{ nCi d m}^{-3} \times 2 \text{ m}^3 \text{ d}^{-1})$$
$$\times 15 \text{ mrad nCi}^{-1}$$
$$= (7.4 + 0.18) \times 15 = \sim 110 \text{ mrad}$$

No further testing occurred during the remainder of the time the girl lived in Cleburne County. In November 1953, the family moved to Orangeburg County, South Carolina. She resided there until January 1981, which is after the end of the tests considered in this analysis. During the periods when the girl was 6-8 months old and 9-11 months old, there were no tests at the NTS and she was not exposed to $^{131}I$ from that source.

Between the ages of 1 and 4 (April 20, 1954 to April 20, 1958) she was exposed to fallout $^{131}I$ from 11 tests in the Teapot series, conducted in 1955, and from 18 tests of the Plumbbob series, conducted in 1957. During this period, she drank cows' milk purchased at a local store that obtained milk produced in the same county (milk of category 2). Because the girl was exposed in the same location to all tests in these two series, the summary, S, tables for those test series can be used to obtain the total concentrations for all the tests. The total estimated time-integrated concentrations of $^{131}I$ in milk of category 2 in Orangeburg County, South Carolina, for the Teapot series and the Plumbbob series are given in *Table TP/S/M* and *Table PB/S/M,* respectively. From those tables:

87 nCi d $L^{-1}$ due to tests of the Teapot series

430 nCi d $L^{-1}$ due to tests of the Plumbbob series

The sum of these estimates gives the total time-integrated milk concentration of 517 nCi d $L^{-1}$ for the period that the girl was aged 1 to 4 years. Her total intake from milk consumption is estimated to be 517 nCi d $L^{-1}$ x 0.5 L $d^{-1}$ = 258 nCi.

During this period the girl did not consume milk from other sources but she did eat cottage cheese, eggs, and leafy vegetables. Her (hypothetical) parents estimated that she consumed, on average, 20 g per day (0.02 kg $d^{-1}$) of cottage cheese, 10 g per day (0.01 kg $d^{-1}$) of egg, and 30 g per day (0.03 kg $d^{-1}$) of leafy vegetables. To find the estimated time-integrated concentrations of $^{131}I$ in these foods, the Teapot and Plumbbob Summary *Tables TP/S/C* and *PB/S/C*. The same tables provide the time-integrated concentrations of $^{131}I$ in air in the county. *Table 9.1* contains the information obtained from the tables. The consumption rates estimated by the parents and the breathing rate from *Table 7.4* are also given in *Table 9.1*. Estimated intakes of $^{131}I$ from these foods and air are shown at the bottom of the columns. The total intake from these pathways is 32 nCi.

**Table 9.1.** Summary of intakes of other foods and air for example 1

| Test series | Table number | Estimated time-integrated concentrations | | | |
|---|---|---|---|---|---|
| | | Cottage cheese (nCi d kg$^{-1}$) | Eggs (nCi d kg$^{-1}$) | Leafy vegetables (nCi d kg$^{-1}$) | Air (nCi d m$^{-3}$) |
| Teapot | TP/S/C | 84 | 82 | 55 | 0.040 |
| Plumbbob | PB/S/C | 423 | 402 | 430 | 0.23 |
| Totals | | 507 | 484 | 485 | 0.27 |
| Consumption rates | | 0.02[a] | 0.01[a] | 0.03[a] | 7[b] |
| Estimated intakes (nCi) | | 10 | 4.8 | 15 | 1.9 |

[a] In kg d$^{-1}$, as estimated by the (hypothetical) parents.
[b] Average value (m$^3$ d$^{-1}$) from *Table 7.4.*

Using the thyroid dose conversion factor of 8.2 mrad nCi$^{-1}$ from *Table 6.7*, the thyroid dose for ages 1-4 was estimated to be:

$$D = D_{milk} + D_{other} = (258 \text{ nCi} + 32 \text{ nCi}) \times 8.2 \text{ mrad nCi}^{-1}$$
$$= 2378 \text{ mrad} \sim 2.4 \text{ rad}$$

The total radiation exposure of the hypothetical girl is summarized in the following *Table 9.2.* The estimated thyroid dose obtained using this procedure is about 2.5 rad. The actual dose is believed to be between:

2.5 rad / 5 = 0.5 rad and
2.5 rad × 5 = 12 rad.

### *9.1.2. Example 2 of Individual Thyroid Dose Calculation*

The hypothetical individual for the second example is a male, conceived on February 1, 1956 and born on November 1, 1956. This example is used to illustrate a tabular approach to data collection and calculations of doses during various periods of the individuals life. This example begins with a residential history.

The child's parents lived within a city in Kings County, New York. The child was born there and lived there until he was 9 months old. At that time, August 1, 1957, the family moved to Nassau County, New York, where he resided until 1981. This information has been compiled in *Table 9.3*, together with the birth date and approximate date of conception. Other dates are also listed; these correspond to the age ranges upon which the dose conversion factors (*Table 6.7*) are based. Because the dose conversion factors are averaged over certain ages, the residence history must correspond to these periods.

Examination of the times of the tests, shown in the list near the end of the Table of Contents, can save some effort in the compilation of data on milk and food consumption rates. For this example, it can be seen that no tests are listed between February 1, 1956 (approximate date of conception) and May 1, 1957, when the baby was just 6 months old.

Between May 1, 1957 and August 1, 1957, the boy drank cows' milk, purchased at a market in the city, at the rate of 0.8 L d$^{-1}$ but he did not drink other types of milk or eat other contaminated foods. After moving to Nassau County on August 1, 1957 (at age 9 months), the boy drank milk from a backyard cow (0.5 L d$^{-1}$) and a glass of goats' milk each day (~0.2 L d$^{-1}$). His parents recalled that he consumed very little cottage cheese, eggs, or leafy vegetables as an infant or young child. These (hypothetical) consumption data have also been entered into *Table 9.3.* Review of the estimated concentrations for Nassau County, New York, revealed that, although there were numerous tests conducted later at the NTS, there were not appreciable levels of NTS fallout in Nassau County after November 1, 1957. For that reason, additional (hypothetical) details of the individual's life are not presented.

**Table 9.2.** Dose summary table for example 1.

| Age | County | Estimated thyroid dose |
|---|---|---|
| In utero | Cleburne, AL | 37 mrad |
| < 3 months | Cleburne, AL | 110 mrad |
| 3-5 months | Cleburne, AL | 0 |
| 6-8 months | Orangeburg, SC | 0 |
| 9-11 months | Orangeburg, SC | 0 |
| 1-4 years | Orangeburg, SC | 2378 mrad |
| 5-27 years | Orangeburg, SC | |
| | Total: | 2525 mrad or ~ 2.5 rad |
| | Uncertainty range: | 0.6 to 12 rad |

Review of the residential history (*Table 9.3*) shows that tests during two time periods must be considered in the assessment of the exposure of this child. They are May 1,1957 to August 1, 1957 and August 1, 1957 to November 1, 1957. Data for these age periods (7 and 8) are recorded in exposure history tables for those age periods (*Tables 9.4* and *9.5,* respectively). The consumption rates also are given in these tables, as is the computed total intakes for each period.

The thyroid dose calculation for this child is summarized in *Table 9.6.* The total dose is estimated to be 2980 mrad, or about 3 rad. The estimated uncertainty range is a factor of 5 in either direction, or 0.6 rad to 15 rad.

**Table 9.3.** Residential history.

| Age range | Age group | County of residence | Starting date | Milk consumption rates (L/d) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **As a fetus** | | | **Conception: Approx. Feb. 1, 1956** | **Cows' milk** | **Goats' milk** | | **Cottage cheese** | **Eggs** | **Leafy vegetables** |
| 10 - 19 wk | 2[a] | Kings County, NY | | NT[b] | NT | | NT | NT | NT |
| 20 - 29 wk | 3[a] | Kings County, NY | | NT | NT | | NT | NT | NT |
| 30 - 39 wk | 4[a] | Kings County, NY | | NT | NT | | NT | NT | NT |
| **As an infant** | | | **Birth: Nov. 1, 1956** | **Cows' Milk** | **Goats' Milk** | **Mother's Milk** | **Cottage Cheese** | **Eggs** | **Leafy Vegetables** |
| <3 months | 5 | Kings County, NY | Nov. 1, 1956 | NT | NT | NT | NT | NT | NT |
| 3 - 5 months | 6 | Kings County, NY | Feb. 1, 1957 | NT | NT | NT | NT | NT | NT |
| 6 - 8 months | 7 | Kings County, NY | May 1, 1957 | 0.8 (VW) | 0 | 0 | 0 | 0 | 0 |
| 9 - 11 months | 8 | Nassau County, NY | Aug. 1, 1957 | 0.5 (BYC) | 0.2 | 0 | 0 | 0 | 0 |
| **As a child** | | | | **Cows' Milk** | **Goats' Milk** | | **Cottage Cheese** | **Eggs** | **Leafy Vegetables** |
| 1 - 4 years | 9 | Nassau County, NY | Nov. 1, 1957 | NTAL[c] | NTAL | | NTAL | NTAL | NTAL |
| 5 - 9 years | 10 | Nassau County, NY | Nov. 1, 1961 | NTAL | NTAL | | NTAL | NTAL | NTAL |
| 10 - 14 years | 11 | Nassau County, NY | Nov. 1, 1966 | NTAL | NTAL | | NTAL | NTAL | NTAL |
| 15 - 19 years | 12 | Nassau County, NY | Nov. 1, 1971 | NTAL | NTAL | | NTAL | NTAL | NTAL |
| **As an adult** | 13 | Nassau County, NY | Nov. 1, 1976 | NTAL | NTAL | | NTAL | NTAL | NTAL |

[a] Residence and food consumption rates of the mother.

[b] Data not needed; no tests during this period.

[c] No test that affected this location.

**Table 9.4.** Exposure history - age period 7.

| | County of residence | Age period 7 (6-8 months) | | Estimates of consumption of cows' milk | | | | | Data from annex table | Estimates of consumption of other milk types and other foodstuffs | | | | | | Data from annex table |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start | End | Test date | Annex number | Name of test | Sources | Concentration (nCi d/L) | | Goats' milk (nCi d/L) | Mother's milk (nCi d/L) | Cottage cheese (nCi d/kg) | Eggs (nCi d/kg) | Leafy vegetables (nCi d/kg) | Air (nCi d/m3) | |
| 7.1 | Kings County, NY | May 1, 1957 | Aug 1, 1957 | May 28, 1957 | PB.1 | Boltzman++ | VW[a] | 2.5 | PB/1/M | NC[b] | NC | NC | NC | NC | 0 | PB/1/C |
| | | | | June 18, 1957 | PB.2 | Wilson | VW | 15 | PB/2/M | NC | NC | NC | NC | NC | 0.0058 | PB/2/C |
| | | | | June 24, 1957 | PB.3 | Priscilla | VW | 4.1 | PB/3/M | NC | NC | NC | NC | NC | 0.0011 | PB/3/C |
| | | | | July 5, 1957 | PB.4 | Hood | VW | 5.2 | PB/4/M | NC | NC | NC | NC | NC | 0.0054 | PB/4/C |
| | | | | July 15, 1957 | PB.5 | Diablo | VW | 45 | PB/5/M | NC | NC | NC | NC | NC | 0.028 | PB/5/C |
| | | | | July 24, 1957 | PB.6 | Kepler+ | VW | 15 | PB/6/M | NC | NC | NC | NC | NC | 0.014 | PB/6/C |
| 7.2 | No other residence for age period 7 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Total time-integrated concentrations, age period 7: | | | | | | | | *(nCi d/L)* 86.8 | | *(nCi d/L)* 0 | *(nCi d/L)* 0 | *(nCi d/kg)* 0 | *(nCi d/kg)* 0 | *(nCi d/kg)* 0 | *(nCi d/m³)* 0.054 | |
| Consumption rates for age period 7: | | | | | | | | *(L/d)* 0.8 | | *(L/d)* 0 | *(L/d)* 0 | *(kg/d)* 0 | *(kg/d)* 0 | *(kg/d)* 0 | *(m³/d)* [c] 4 | Total of intakes *(nCi)* 69.6 |
| $^{131}$I intakes for age period 7: | | | | | | | | *(nCi)* 69.4 | | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0.22 | |

\+ Combined with other tests *(Table 3.9)*.

[a] Sources of cows' milk: CF, consumed on farm where produced (category 1); RF, retailed from farm where produced (category 2); VW, volume-weighted average for county (e.g., purchased at market); BYC, milk from a backyard cow (not a dairy cow).

[b] NC means no consumption

[c] Inhalation rate from *Table 7.4*

**Table 9.5.** Exposure history - age period 8.

| | County of residence | Age period 8 (9-11 months) | | Estimates of consumption of cows' milk | | | | | Data from annex table | Estimates of consumption of other milk types and other foodstuffs | | | | | | Data from annex table |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start | End | Test date | Annex number | Name of test | Sources | Concentration (nCi d/L) | | Goats' milk (nCi d/L) | Mother's milk (nCi d/L) | Cottage cheese (nCi d/kg) | Eggs (nCi d/kg) | Leafy vegetables (nCi d/kg) | Air (nCi d/m3) | |
| 8.1 | Nassau County, NY | Aug. 1, 1957 | Nov. 1, 1957 | Aug 7, 1957 | PB.7 | Stokes | BYC[a] | 0.0 | PB/7/M | 0.0 | NC[b] | NC | NC | NC | 0.0 | PB/7/C |
| | | | | Aug 7, 1957 | PB.8 | Shasta | BYC | 0.0 | PB/8/M | 0.0 | NC | NC | NC | NC | 0.0 | PB/8/C |
| | | | | Aug 18, 1957 | PB.9 | Doppler | BYC | 0.85 | PB/9/M | 8.3 | NC | NC | NC | NC | 0.0030 | PB/9/C |
| | | | | Aug. 23, 1957 | PB.10 | Franklin Prime | BYC | 0.0 | PB/10/M | 0.0 | NC | NC | NC | NC | 0.0 | PB/10/C |
| | | | | Aug 30, 1957 | PB.11 | Smoky | BYC | 15 | PB/11/M | 150 | NC | NC | NC | NC | 0.0038 | PB/11/C |
| | | | | Aug 31, 1957 | PB.12 | Galileo | BYC | 28 | PB/12/M | 270 | NC | NC | NC | NC | 0.0080 | PB/12/C |
| | | | | Sep 6, 1957 | PB.13 | Wheeler++ | BYC | 4.9 | PB/13/M | 47 | NC | NC | NC | NC | 0.0073 | PB/13/C |
| | | | | Sep 14, 1957 | PB.14 | Fizeau | BYC | 0.0 | PB/14/M | 0.0 | NC | NC | NC | NC | 0.0 | PB/14/C |
| | | | | Sep 16, 1957 | PB.15 | Newton | BYC | 6.9 | PB/15/M | 72 | NC | NC | NC | NC | 0.0047 | PB/15/C |
| | | | | Sep 23, 1957 | PB.16 | Whitney | BYC | 1.4 | PB/16/M | 15 | NC | NC | NC | NC | 0.0045 | PB/16/C |
| | | | | Sep 28, 1957 | PB.17 | Charleston | BYC | 14 | PB/17/M | 150 | NC | NC | NC | NC | 0.0047 | PB/17/C |
| | | | | Oct 7, 1957 | PB.18 | Morgan | BYC | 0.0 | PB/18/M | 0.0 | NC | NC | NC | NC | 0.0 | PB/18/C |
| 7.2 | No other residence for age period 8 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Total time-integrated concentrations, age period 8: | | | | | | | | *(nCi d/L)* 72.1 | | *(nCi d/L)* 712 | *(nCi d/L)* 0 | *(nCi d/kg)* 0 | *(nCi d/kg)* 0 | *(nCi d/kg)* 0 | *(nCi d/m³)* 0.024 | |
| Consumption rates for age period 8: | | | | | | | | *(L/d)* 0.5 | | *(L/d)* 0.2 | *(L/d)* 0 | *(kg/d)* 0 | *(kg/d)* 0 | *(kg/d)* 0 | *(m³/d)*[c] 6 | Total of intakes *(nCi)* 178 |
| $^{131}$I intakes for age period 8: | | | | | | | | *(nCi)* 36.0 | | *(nCi)* 142 | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0 | *(nCi)* 0.14 | |

\+ Combined with other tests *(Table 3.9)*.

[a] Sources of cows' milk: CF, consumed on farm where produced (category 1); RF, retailed from farm where produced (category 2); VW, volume-weighted average for county (e.g., purchased at market); BYC, milk from a backyard cow (not a dairy cow).

[b] NC means no consumption

[c] Inhalation rate from *Table 7.4*

**Table 9.6.** Dose summary table for example 2.

| Age period | DCF (mrad nCi-1) | County of residence | $^{131}$I intake (nCi) | Thyroid dose (mrad) |
|---|---|---|---|---|
| **In utero** | | Kings, NY | | |
| 10-19 weeks | 1.6 | Kings, NY | 0 | 0 |
| 20-29 weeks | 5.0 | Kings, NY | 0 | 0 |
| 30-39 weeks | 6.6 | Kings, NY | 0 | 0 |
| **As an infant** | | Kings, NY | | |
| < 3 months | 15 | Kings, NY | 0 | 0 |
| 3-5 months | 13 | Kings, NY | 0 | 0 |
| 6-8 months | 12 | Kings, NY | 70 | 840 |
| 9-11 months | 12 | Nassau, NY | 178 | 2140 |
| **As a child** | | | | |
| 1-4 years | 8.2 | Nassau, NY | 0 | 0 |
| 5-9 years | 4.1 | Nassau, NY | 0 | 0 |
| 10-14 years | 2.7 | Nassau, NY | 0 | 0 |
| 15-19 years | 1.9 | Nassau, NY | 0 | 0 |
| **As an adult male** | 1.3 | Nassau, NY | 0 | 0 |
| | | | Total: | 2980 |