Determining Original Inventory Amount of Radioactive Substances from Unmonitored Radionuclide Emissions

by

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**James T. Hamilton
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Savannah River Site
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1.0 Purpose and Scope

This document is to accompany *Determining Radionuclide Emissions from Unmonitored Sources* (WSRC-TR-95-0378) for determination of the Air Emissions Inventory of the Savannah River Site. The calculation set forth in this document supercedes the original "Back-Calculation of Inventory of Determining Radionuclide Emissions" located in section 5.1.6 of WSRC-TR-95-0378. In the previous calculation there exists a possibility of the denominator becoming zero when the release fraction value is equal to one. To satisfy regulatory requirements a new equation has been developed to determine original inventory amounts from unmonitored radionuclide emissions. The new equation is applicable to point sources, non-point sources, and inactive sources. This document contains a methodology section that explains the equation's derivation. Located in the appendices are two type written examples and four spreadsheet examples. Some redundancy in description of variables and definitions will occur between this document and its predecessor *Determining Radionuclide Emissions from Unmonitored Sources* (WSRC-TR-95-0378).

2.0 Definitions

Radioactivity- The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays, from the nucleus of an unstable isotope. Also, the rate at which radioactive material emits radiation. Measured in units of becquerels or disintegrations per second (Reference 6.1).

Becquerels (Bq)- The unit of radioactive decay, equal to one disintegration per second. Thirty-seven billion (3.7×10^{10}) becquerels is equal to one curie (Ci) (Reference 6.1).

Curie- The basic unit used to describe the intensity of radioactivity in a sample of material. The curie is equal to thirty-seven billion (3.7×10^{10}) disintegrations per second, which is approximately the activity of one gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of thirty-seven billion disintegrations per second. It is named for

Marie and Pierre Curie, who discovered radium in 1898 (Reference 6.1).

Radionuclide- An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified (Reference 6.1).

Half-life- The time in which one half of the atoms of a particular radioactive substance disintegrates into another nuclear form. Measured half-lives vary from millionths of a second to billions of years. Also, called physical or radiological half-life. (Reference 6.1).

Point Source- A point source is an emission source with a well-defined single exhaust point, such as a stack or vent (Reference 6.2).

Non-point sources – Sources without well defined, single exhaust points. (Reference 6.2).

Inactive source- An inactive source is a source in which the process design function is no longer being utilized. An inactive source is in a shutdown mode, typically awaiting decontamination and decommissioning. An inactive source does not lend itself to evaluation by traditional stack sampling and monitoring techniques (Reference 6.2).

3.0 Guides

3.1 Modified NUREG 1400 Method

NUREG 1400 provides examples, methods, and techniques for air sampling that may be useful for implementing the recommendations in Regulatory Guide 8.25, "Air Sampling in the Workplace," and the requirements of 10 CFR Part 20 (Reference 6.3).

NUREG 1400 sets forth guidelines for determining the need for air sampling in the workplace. Workplace air sampling is used to calculate potential worker intake, the control equipment that is necessary to control intake amounts, and warn of elevated levels of airborne radioactive substances. Calculations in NUREG 1400 allow for the determination of airborne radioactive emissions from unmonitored sources. NUREG 1400 has become a vital part in accomplishing the Air Emissions Inventory for

Title V of the Clean Air Act. The Savannah River Site has emission points, which do not meet the requirements for continuous air sample monitoring. These emission points are sampled at least once on an annual, semiannual, or quarterly basis. Using the collected sample data and appropriate NUREG 1400 release fraction guidelines the emissions to the surrounding environment can be determined.

3.2 Release Fraction (R)

The release fraction (R) is the fraction of radioactive material likely to be released into the workplace breathing air, as determined by its physical and chemical form. The NRC has published suitable release fractions; adapted release fractions from 10 CFR 30.72 are presented in Table 3.2.1 (Reference 6.3).

Physical Form	Release Fraction
Gases or Volatile material	1.0
Nonvolatile powders	0.01
Solids, (e.g., uranium fuel pellets, cobalt, or iridium metal)	0.001
Liquids	0.01
Encapsulated Material	0.0

Table 3.2.1. Release Fractions

The values shown in the table are used in the modified NUREG 1400 Method as release fraction values. If any nuclide is heated to a temperature of 100 degrees Celsius or more, boils at a temperature of 100 degrees Celsius or

less, or is intentionally dispersed into the environment (interpreted as the atmosphere), it must be considered to be a gas (per 40 CFR 61 Appendix D 2(b)) (Reference 6.2).

At sources where the material is in a variety of physical forms (e.g., liquid, solid, gaseous) and the proportions are not known, the physical form providing the highest emissions estimate is assigned to all materials. Where the proportions are known, an appropriate ratio is used to derive the source term (Reference 6.4).

The release fraction(s) is used in the calculation of back inventory amount to account for the portion of the radioactive substance that has been released, disturbed, evaporated, and/or eroded from the original source location. The release fraction is an additive term to the radioactive decay portion of the radioactive emissions as shown in the derivation located in section 4.0.

Note the use of release fractions (0 & 1) in spreadsheet format causes the propagation of what seems to be strange numbers for back inventory amounts. With some logical interpretation the "strange" numbers have significant meaning. Should "0" be used for a release fraction the air release term becomes null and is no longer part of the calculation. So over the period of time in question the radioactive decay has been determined. Should "1" be used for a release fraction it should be apparent that all of a gas or volatile material will be released to the surrounding environment on the first day.

4.0 Methodology

Variables:

A	=	Activity (Ci) amount at time of sample ($t + 0$)
A ₀	=	Activity (Ci) at time zero ($t = 0$)
t	=	Time in days (from beginning of reference period to end of reference period when sample is taken)
λ	=	Radioactive decay constant in (days ⁻¹)
R	=	Release fraction for applicable physical forms of radioactive substances: (See Table 3.2.1)
A _{release}	=	Air emission portion of radioactive substance
D _{release}	=	Decay emission portion of radioactive substance
B	=	Total released (T_{release}) due to A _{release} and D _{release} calculated in (Ci)
B ₀	=	Back inventory amount (Ci)

Basic Equations:

$$A = A_o * e^{-\lambda t} \quad (D_{\text{release}})$$

$$A_{\text{release}} = A_o * R$$

Known Values:

$$A, t, R, \lambda$$

Assumptions and/or Statement of Facts:

1. Activity measurement at time "t" (A) is a value that takes into account the radioactive decay ($A = A_o * e^{-\lambda t}$) at that particular point in time.
2. It is assumed the samples and calculations take place at the end of the day.

Derivation:

$$(A = A_o * e^{-\lambda t})$$

decay

$$(A_o = A * e^{\lambda t})$$

growth

$$T_{\text{release}} = A_{\text{release}} + D_{\text{release}}$$

$$A_{\text{release}}: \quad A_o * R \quad \text{equivalent to} \quad (A * e^{\lambda t}) * R$$

$$D_{\text{release}}: \quad A = A_o * e^{-\lambda t} \quad (A \text{ is known at time "t"})$$

$$T_{\text{release}} = (A * e^{\lambda t}) * R + A$$

$$(B = B_o * e^{-\lambda t})$$

decay

$$(B_o = B * e^{\lambda t})$$

growth

$$\text{where: } B = T_{\text{release}}$$

$$B_o = (T_{\text{release}}) * e^{\lambda t}$$

$$B_o = [(A * e^{\lambda t}) * R + A] * e^{\lambda t}$$

$$B_o = \text{Original Inventory Amount in (Ci)}$$

5.0 Discussion of Methodology

The basic equation for the premise of the calculation is the first order growth and decay model. Assumption and/or statement of fact number one allows for the derivation of the calculation for back inventory. It is the realization that at the instantaneous point in time when the activity of the radioactive emission is sampled the activity is a measurement of the radioactive decay ($A = A_0 * e^{-\lambda t}$) where "A" is the activity reading. Time "t" will need to be established from some reference datum, perhaps from when emissions began or from when the last sample was pulled, (e.g. yearly for the Air Emissions Inventory). Assumption and/or statement of fact number two is necessary to avoid the problem of fractional components of time (whole units of time are preferred but not absolutely necessary).

Located in Appendix A is the spreadsheet calculation for back inventory amounts. This spreadsheet calculation along with the accompanying graph enabled the derivation of the equation for calculating back inventories. The circular calculation assumes an original inventory amount (B_0) and works backward to find the necessary steps that must take place in order to determine the inventory amount; given only the current amount (A). The graph shows one exponential growth curve (pink) and two exponential decay curves (blue & yellow). The pink curve is the amount of radioactive substance(s) that has decayed and been released due to the air release fraction. The blue and yellow curves indicate the amount of radioactive substance(s) left after decay and the air release fraction. The yellow exponential decay curve is the graph of the formula derived in section 4.0 "Methodology". The blue and pink curves are graphs of the circular calculation formulas in Appendix A. Interpretation of the graph indicates the newly derived formula (Formula B) is representative of the circular calculation for determining back inventory amounts. Also, within Appendix A there are three additional spreadsheet examples of the new back inventory calculation. Each example shows the calculation being preformed with a different air release fraction.

Appendix B offers two typewritten examples with applications of the new back inventory calculation.

6.0 References

6.1 Nuclear Regulatory Commission. "Glossary of Nuclear Terms." <http://www.nrc.gov/NRC/EDUCATE/GLOSSARY/index.html>, (March 31, 1999).

6.2 Martha C. Thompson. *Determining Radionuclide Emissions from Unmonitored Sources*. WSRC-TR-95-0378, Revision 1, Westinghouse Savannah River Company, Aiken, SC 29808 (July 1999).

6.3 E.E. Hickey, G.A. Stoetzel, et, al. *Air Sampling in the Workplace*. NUREG 1400, USNRC, Washington, DC (September 1993).

6.4 *Savannah River Site Unmonitored Source Evaluations and Schedule for Confirmatory Measurements*. ESH-ESG-910667, Westinghouse Savannah River Company, Aiken, SC 29808 (December 1991).

APPENDIX A

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T =	365	
T1/2 =	10658	days
k =	6.5E-05	
Rf	10.001	
Q =	100	Ao

Strontium 90

Days	Rate	Total	A	Ao	Formula B
1	0.1	0.1	99.9935	99.9935	99.99991
2	0.099994	0.199989	99.79362	99.99351	99.90642
3	0.099994	0.299987	99.69383	99.99352	99.81301
4	0.099994	0.399984	99.59414	99.99352	99.71970
5	0.099994	0.499975	99.49455	99.99353	99.62647
6	0.099495	0.59847	99.39507	99.99354	99.53333
7	0.099395	0.697865	99.29568	99.99354	99.44028
8	0.099296	0.79716	99.19639	99.99355	99.34731
9	0.099196	0.896357	99.0972	99.99355	99.25443
10	0.099097	0.995454	98.99811	99.99356	99.16164
11	0.098998	1.094452	98.89912	99.99357	99.06893
12	0.098899	1.193351	98.80022	99.99357	98.97631
13	0.0988	1.292151	98.70143	99.99358	98.88378
14	0.098701	1.390853	98.60273	99.99359	98.79133
15	0.098603	1.489456	98.50414	99.99359	98.69898
16	0.098504	1.58796	98.40564	99.9936	98.60670
17	0.098406	1.686365	98.30724	99.99361	98.51451
18	0.098307	1.784673	98.20894	99.99361	98.42241
19	0.098209	1.882882	98.11074	99.99362	98.33040
20	0.098111	1.980992	98.01263	99.99363	98.23847
21	0.098013	2.079005	97.91463	99.99363	98.14663
22	0.097915	2.17692	97.81672	99.99364	98.05487
23	0.097817	2.274736	97.71891	99.99364	97.96320
24	0.097719	2.372455	97.6212	99.99365	97.87161
25	0.097621	2.470076	97.52358	99.99366	97.78011
26	0.097524	2.5676	97.42606	99.99366	97.68870
27	0.097426	2.665026	97.32864	99.99367	97.59737
28	0.097329	2.762355	97.23132	99.99368	97.50613

10617	2.44E-06	99.99756	0.002438	100	0.00487
10618	2.44E-06	99.99756	0.002436	100	0.00487
10619	2.44E-06	99.99757	0.002433	100	0.00486
10620	2.43E-06	99.99757	0.002431	100	0.00486
10621	2.43E-06	99.99757	0.002428	100	0.00485
10622	2.43E-06	99.99757	0.002426	100	0.00485
10623	2.43E-06	99.99758	0.002424	100	0.00485
10624	2.42E-06	99.99758	0.002421	100	0.00484
10625	2.42E-06	99.99758	0.002419	100	0.00484
10626	2.42E-06	99.99758	0.002416	100	0.00483
10627	2.42E-06	99.99759	0.002414	100	0.00483
10628	2.41E-06	99.99759	0.002411	100	0.00482
10629	2.41E-06	99.99759	0.002409	100	0.00482
10630	2.41E-06	99.99759	0.002407	100	0.00481
10631	2.41E-06	99.9976	0.002404	100	0.00481
10632	2.4E-06	99.9976	0.002402	100	0.00481
10633	2.4E-06	99.9976	0.002399	100	0.00480
10634	2.4E-06	99.9976	0.002397	100	0.00480
10635	2.4E-06	99.99761	0.002395	100	0.00479
10636	2.39E-06	99.99761	0.002392	100	0.00479
10637	2.39E-06	99.99761	0.00239	100	0.00478
10638	2.39E-06	99.99761	0.002387	100	0.00478
10639	2.39E-06	99.99761	0.002385	100	0.00477
10640	2.39E-06	99.99762	0.002383	100	0.00477
10641	2.38E-06	99.99762	0.00238	100	0.00476
10642	2.38E-06	99.99762	0.002378	100	0.00476
10643	2.38E-06	99.99762	0.002376	100	0.00476
10644	2.38E-06	99.99763	0.002373	100	0.00475
10645	2.37E-06	99.99763	0.002371	100	0.00475
10646	2.37E-06	99.99763	0.002368	100	0.00474
10647	2.37E-06	99.99763	0.002366	100	0.00474
10648	2.37E-06	99.99764	0.002364	100	0.00473
10649	2.36E-06	99.99764	0.002361	100	0.00473
10650	2.36E-06	99.99764	0.002359	100	0.00472
10651	2.36E-06	99.99764	0.002357	100	0.00472
10652	2.36E-06	99.99765	0.002354	100	0.00472
10653	2.35E-06	99.99765	0.002352	100	0.00471
10654	2.35E-06	99.99765	0.00235	100	0.00471
10655	2.35E-06	99.99765	0.002347	100	0.00470
10656	2.35E-06	99.99765	0.002345	100	0.00470
10657	2.34E-06	99.99766	0.002343	100	0.00469
10658	2.34E-06	99.99766	0.00234	100	0.00469

T1/2 =	10658	10658	T1/2 =	52	52	T1/2 =	13	13
k =	6.504E-05	6.504E-05	k =	0.0133298	0.0133298	k =	0.053319	0.053319
Rf	0.01	0.001	Rf	0.01	0.001	Rf	0	1
Ao =	100	100	Ao =	100	100	Ao =	100	100
A =	50	50	A =	50	50	A =	50	50
Strontium 90			Strontium 89			Cesium 136		
Days	Formula B	Formula B	Days	Formula B	Formula B	Days	Formula B	Formula B
1	50.50332	50.05326	1	51.18446	50.72230	1	52.73830	108.3648
2	50.50663	50.05652	2	51.87829	51.40364	2	55.62657	117.5128
3	50.50995	50.05978	3	52.58161	52.09414	3	58.67302	127.5235
4	50.51327	50.06303	4	53.29457	52.79393	4	61.88631	138.4846
5	50.51659	50.06629	5	54.01729	53.50313	5	65.27558	150.4936
6	50.51990	50.06955	6	54.74992	54.22186	6	68.85047	163.6582
7	50.52322	50.07281	7	55.49259	54.95026	7	72.62114	178.0977
8	50.52654	50.07607	8	56.24544	55.68846	8	76.59832	193.9443
9	50.52986	50.07933	9	57.00861	56.43658	9	80.79331	211.3444
10	50.53318	50.08259	10	57.78225	57.19477	10	85.21804	230.4603
11	50.53650	50.08585	11	58.56651	57.96315	11	89.88510	251.4717
12	50.53982	50.08911	12	59.36153	58.74187	12	94.80775	274.5779
13	50.54314	50.09238	13	60.16746	59.53107	13	100.00000	300.0000
14	50.54646	50.09564	14	60.98447	60.33087	KEY: T1/2 = Radioactive 1/2 life (days) k or λ = Radioactive decay constant (days ⁻¹) Rf = Release fraction Ao = Original Inventory Amt. (Ci) A = Amt. @ sample time "t" (Ci)		
15	50.54978	50.09890	15	61.81269	61.14144			
16	50.55310	50.10216	16	62.65230	61.96291			
17	50.55642	50.10542	17	63.50344	62.79543			
18	50.55974	50.10868	18	64.36629	63.63916			
19	50.56306	50.11195	19	65.24101	64.49423			
20	50.56638	50.11521	20	66.12777	65.36080			
21	50.56970	50.11847	21	67.02672	66.23904			
22	50.57302	50.12173	22	67.93805	67.12909			
23	50.57634	50.12500	23	68.86194	68.03112			
24	50.57967	50.12826	24	69.79855	68.94528			
25	50.58299	50.13152	25	70.74807	69.87175			
26	50.58631	50.13479	26	71.71068	70.81068			
27	50.58963	50.13805	27	72.68656	71.76225			
28	50.59296	50.14131	28	73.67591	72.72662			
29	50.59628	50.14458	29	74.67891	73.70397			
30	50.59960	50.14784	30	75.69576	74.69448			
31	50.60293	50.15111	31	76.72665	75.69832			
32	50.60625	50.15437	32	77.77178	76.71566			
33	50.60957	50.15764	33	78.83136	77.74671			
34	50.61290	50.16090	34	79.90558	78.79163			
35	50.61622	50.16417	35	80.99467	79.85062			
36	50.61955	50.16744	36	82.09882	80.92386			
37	50.62287	50.17070	37	83.21826	82.01155			
38	50.62620	50.17397	38	84.35319	83.11389			
39	50.62952	50.17723	39	85.50386	84.23106			

40	50.63285	50.18050	40	86.67046	85.36328
41	50.63617	50.18377	41	87.85324	86.51075
42	50.63950	50.18703	42	89.05243	87.67366
43	50.64283	50.19030	43	90.26826	88.85224
44	50.64615	50.19357	44	91.50096	90.04668
45	50.64948	50.19684	45	92.75079	91.25722
46	50.65281	50.20011	46	94.01798	92.48405
47	50.65613	50.20337	47	95.30278	93.72741
48	50.65946	50.20664	48	96.60545	94.98752
49	50.66279	50.20991	49	97.92625	96.26460
50	50.66612	50.21318	50	99.26543	97.55889
51	50.66944	50.21645	51	100.62325	98.87061
52	50.67277	50.21972	52	102.00000	100.20000
53	50.67610	50.22299			
54	50.67943	50.22626			
55	50.68276	50.22953			
56	50.68609	50.23280			
57	50.68942	50.23607			
58	50.69275	50.23934			
10592	101.5545	99.76998			
10593	101.5613	99.77648			
10594	101.5680	99.78298			
10595	101.5747	99.78948			
10596	101.5815	99.79599			
10597	101.5882	99.80249			
10598	101.5950	99.80899			
10599	101.6017	99.81550			
10600	101.6084	99.82200			
10601	101.6152	99.82851			
10602	101.6219	99.83501			
10603	101.6286	99.84152			
10604	101.6354	99.84803			
10605	101.6421	99.85453			
10606	101.6489	99.86104			
10607	101.6556	99.86755			
10608	101.6623	99.87405			
10609	101.6691	99.88056			
10610	101.6758	99.88707			
10611	101.6826	99.89358			

NOTE

These examples should be read in the following manner.

For example:

Strontium-89 the measured activity(A) on day 8 is equal to 50 Ci the back inventory amount(Ao) is 56.2 Ci with a $R_f = 0.01$.

Strontium-90 the measured activity(A) on day 10658 is equal to 50 Ci the back inventory amount(Ao) is 102 Ci with a $R_f = 0.001$.

10614	101.7028		99.91311
10615	101.7095		99.91962
10616	101.7163		99.92613
10617	101.7230		99.93265
10618	101.7298		99.93916
10619	101.7365		99.94567
10620	101.7433		99.95218
10621	101.7500		99.95870
10622	101.7568		99.96521
10623	101.7635		99.97173
10624	101.7703		99.97824
10625	101.7770		99.98476
10626	101.7838		99.99127
10627	101.7905		99.99779
10628	101.7973		100.00431
10629	101.8040		100.01082
10630	101.8108		100.01734
10631	101.8175		100.02386
10632	101.8243		100.03038
10633	101.8310		100.03689
10634	101.8378		100.04341
10635	101.8445		100.04993
10636	101.8513		100.05645
10637	101.8580		100.06297
10638	101.8648		100.06949
10639	101.8715		100.07602
10640	101.8783		100.08254
10641	101.8850		100.08906
10642	101.8918		100.09558
10643	101.8986		100.10210
10644	101.9053		100.10863
10645	101.9121		100.11515
10646	101.9188		100.12168
10647	101.9256		100.12820
10648	101.9323		100.13473
10649	101.9391		100.14125
10650	101.9459		100.14778
10651	101.9526		100.15430
10652	101.9594		100.16083
10653	101.9661		100.16736
10654	101.9729		100.17389
10655	101.9797		100.18041
10656	101.9864		100.18694
10657	101.9932		100.19347
10658	102.0000		100.20000

NOTE:

The use of release fractions (0 & 1) in spreadsheet format causes the propagation of what seems to be strange numbers for back inventory amounts. With some logical interpretation the "strange" numbers have significant meaning. Should "0" be used for a release fraction the air release term becomes null and is no longer part of the calculation. So over the period of time in question the radioactive decay has been determined. Should "1" be used for a release fraction it should be apparent that all of a gas or volatile material will be released to the surrounding environment on the first day. (see Cesium-136 example)

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APPENDIX B

DISCLAIMER

Examples provided in this appendix are solely for the purpose of learning and performing the back inventory calculation. Any similarities to actual occurrences or processes that have occurred, occur, or will occur on the Savannah River Site are purely coincidental. The history and technical accuracy of the examples may not necessarily be correct, BUT it is the methodology the examples demonstrate that is important.

Example 1:

A lab technician prepares a solution containing Pu-239 in an Erlenmeyer flask. The unstoppered flask is placed in an operating fume hood. What was the original inventory amount in the solution after 1 year? At time "t" the activity was measured at 10 curies. Remember to use the appropriate air release fraction.

Known Values: A = 10 Ci
T_{1/2} = 24,400 years or 8,906,000 days
R = 0.01 (liquids)
t = 365 days

STEP ONE: Determine radioactive decay constant.

$$(\lambda \text{ or } k) = \frac{\ln 2}{8906000} \quad \text{yields} \quad 7.78 \times 10^{-8} \text{ days}^{-1}$$

STEP TWO: Determine the back inventory amount.

$$B_0 = \left((Ae^{\lambda t})R + A \right) e^{\lambda t}$$

$$B_0 = \left((10e^{7.78 \times 10^{-8} \times 365})0.01 + 10 \right) e^{7.78 \times 10^{-8} \times 365}$$

$$B_0 = 10.1 \text{ Ci}$$

Should you wish to find the inventory amounts in grams (g) use the specific activity of the radionuclide in question.

Example 1a: SpA of Pu-239 = 6.13×10^{-2} (Ci/g)

$$\text{Mass of Pu-239 in solution} = \frac{10.1}{6.13 \times 10^{-2}}$$

$$\text{Mass of Pu-239 in solution} = 164.763 \text{ g}$$

Example 2:

Strontium 90 is present in a fuel pellet. The fuel pellet is exposed to the surrounding environment for a period of 10 years. What is the original inventory amount of Strontium 90 in the fuel pellet? At time "t" the activity was measured at 100 curies. Remember to use the appropriate air release fraction.

Known Values: A = 100 Ci
T_{1/2} = 28.1 years or 10658 days
R = 0.001 (solids)
t = 3650 days

STEP ONE: Determine radioactive decay constant.

$$(\lambda \text{ or } k) = \frac{\ln 2}{10658} \quad \text{yields } 6.504 \times 10^{-5} \text{ days}^{-1}$$

STEP TWO: Determine the back inventory amount.

$$B_0 = ((Ae^{\lambda t})R + A)e^{\lambda t}$$

$$B_0 = ((100e^{6.504 \times 10^{-5} \times 3650})0.001 + 100)e^{6.504 \times 10^{-5} \times 3650}$$

$$B_0 = 126.955 \text{ Ci}$$

Should you wish to find the inventory amounts in grams (g) use the specific activity of the radionuclide in question.

Example 2a: SpA of Strontium 90 = 141 (Ci/g)

$$\text{Mass of Sr-90 in fuel pellet} = \frac{126.955}{141}$$

$$\text{Mass of Sr-90 in fuel pellet} = 0.9 \text{ g}$$

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