RFCA Stakeholder Focus Group
REVISED Meeting Agenda

When: **August 22, 2001 3:30 - 6:30 p.m.**

Where: **Broomfield Municipal Hall, Bal Swan and Zang's Spur Rooms**

3:30-3:40	Agenda Review, 6/20/01 and 7/11/01 Meeting Minutes Review, Objectives for this Meeting
3:40-4:00	Summary Description of Land Use Scenarios and Associated Modeling Parameters
4:00-4:20	Briefing on New Results in the RSAL Modeling Matrix
4:20-4:50	RSALs Task 3: Continued Technical Discussion - Pathway Contributions to Model Results
4:50-5:00	Break
5:00-6:00	RSALs Task 3: Continued Technical Discussion - Questions from Focus Group Members
6:00-6:10	Wind Tunnel Technical Review
6:10-6:25	Frame the Policy Discussion for Next Focus Group Meeting
6:25-6:30	Review Meeting
6:30	Adjourn

1/96

RFCA Stakeholder Focus Group
REVISED Meeting Agenda

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4:50-5:00	Break
5:00-5:30	RSALs Task 3: Continued Technical Discussion - Soil Ingestion Rate
5:30-6:00	RSALs Task 3: Continued Technical Discussion - Scenario Parameters - Exposure Frequency and Exposure Duration
6:00-6:20	Frame the Policy Discussion for Next Focus Group Meeting
6:20-6:30	Set Future Agendas and Review Meeting

RFCA Stakeholder Focus Group
Meeting Agenda

6:30 Adjourn

RFCA Stakeholder Focus Group
Attachment A

Title:	Agenda for August 22, 2001 Focus Group Meeting
Date:	August 17, 2001
Author:	C. Reed Hodgin AlphaTRAC, Inc.
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

RFCA Stakeholder Focus Group
August 22, 2001
Meeting Minutes

INTRODUCTION AND ADMINISTRATIVE

A participants list for the August 22, 2001 Rocky Flats Cleanup Agreement (RFCA) Stakeholder Focus Group meeting is included in this report as Appendix A.

Reed Hodgin of AlphaTRAC, Inc., meeting facilitator, reviewed the purpose of the RFCA Focus Group and reinforced the meeting rules. Introductions were made.

AGENDA

Reed, Facilitator, reviewed the agenda:

- Summary Description of Land Use Scenarios and Associated Modeling Parameters
- Briefing on New Results in the RSALs Modeling Matrix
- RSALs Task 3: Continued Technical Discussion - Pathway Contributions to Model Results
- RSALs Task 3: Continued Technical Discussion - Soil Ingestion Rate
- RSALs Task 3: Continued Technical Discussion - Scenario Parameters - Exposure Frequency and Exposure Duration
- Wind Tunnel Discussion

RFCA MEETING MINUTES DATED JUNE 20 AND JULY 11, 2001

There were no comments from the Focus Group regarding the June 20, 2001 meeting minutes.

The RFCAB asked that the July 11, 2001 meeting minutes be amended to reflect the discussion on As Low As Reasonably Achievable (ALARA) analysis and its applicability to Radionuclide Soil Action Level (RSAL) and cleanup levels. This discussion will be reflected in July 11, 2001 Revision 1 meeting minutes and will be sent under separate cover.

SUMMARY DESCRIPTION OF LAND USE SCENARIOS AND ASSOCIATED MODELING PARAMETERS.

Steve Gunderson, Colorado Department of Public Health and Environment (CDPHE), stated that Tom Pentacost provided RESRAD modeling results using 25 mrem/yr dose values for two additional scenarios:

1. Open space user
2. Office user

These results were emailed to Focus Group members recently. Steve indicated that results from the existing binding scenarios continue to establish criteria for the (RSALs).

Susan Griffin, U. S. Environmental Protection Agency (EPA) Toxicologist, commented that the office worker parameters were still being developed and hoped to work on them the week of August 22, 2001. Additionally, Jim Bennetti is working on the RAC scenario (subsistence rancher) to determine how RESRAD model results differ from RAC results. This data should to be available in two weeks.

Steve further added that the RESRAD results for the additional scenarios were high, which is consistent with the RAC modeling results. RSAL values, using a 25 mrem dose limit, are as follows:

1. Open space user (adult): <8,000 pCi/g
2. Open space user (child): ~5,000 pCi/g
3. Office worker: 2,300 pCi/g

CDPHE does not intend on using these risk numbers as the ultimate level; rather, as management and tier discussions are held, these results may have value. The residential and wildlife refuge worker scenarios should continue to be the primary scenarios to establish RSALs.

RSAL'S TASK 3: CONTINUED TECHNICAL DISCUSSION – PATHWAY CONTRIBUTIONS TO MODEL RESULTS

Steve Gunderson, CDPHE, presented preliminary RESRAD model results titled *"Dose Contributions from Individual Exposure Pathways at 95% Probability."* Three scenarios were documented using the 25 mrem dose limit of two radionuclides (Plutonium and Americium).

The scenarios are as follows:

- Residential adult (Pu)
- Residential adult (Am)
- Residential child (Pu)
- Residential child (Am)
- Wildlife Refuge Worker (Pu)
- Wildlife Refuge Worker (Am)

Carl Spreng of CDPHE requested that the title of the document include 100 pCi/g as the standard input value.

Steve further explained that each scenario was modeled using a dose-based value of 100 pCi/g to arrive at a dose consequence for each of the various pathways. Each scenario (i.e., Residential – adult [plutonium]) considers four pathways: external, inhalation, plant ingestion, and soil ingestion. The analysis of the results involves totaling the dose for all four pathways and then calculating a percentage of the total dose for each pathway.

A member of the Focus Group commented that the shift to ingestion from inhalation as the major pathway was difficult to understand.

CDPHE stated that the shift occurred due to new scientific information. One example is a new version of RESRAD, which includes a different air model. Another example is that dose conversion factors (DCF) had been modified and needed to be reflected in model results. The new DCFs (ICRP 72) are based upon a more complete research base. Differences indicate that the DCF for inhalation decreased by a factor of two to five and the revision in the value of the fractional absorption coefficient (f1) for plutonium has the effect of significantly increasing the ingestion dose coefficient. The single value for f1 in ICRP 72 is 50 times higher than the lowest f1 in ICRP 30. For plutonium and

americium, the overall change resulting from the revisions in ICRP 72 is to increase the importance of ingested plutonium over inhaled plutonium.

A member of the Focus Group asked for clarification regarding deposition on plants. Why was deposition on plants ingested rather than inhaled?

Bob Nininger of Kaiser-Hill, Ltd. explained that deposition on plants exceeds 10 microns in size and therefore is too large to enter the inhalation pathway (filtered out by the nose), so ingestion is the next likely pathway.

The Focus Group discussed resources available to those who wish to further understand the new dose conversion factors. The RAC published a report recently (Task 4), and the RAC has a contract with CDPHE to further evaluate the dose reconstruction.

The Focus Group asked for clarification on the mass loading factor in the RESRAD model.

Bob explained that the mass loading for ingestion pathway is 2.5 times higher than the mass loading for the inhalation pathway based on the ICRP 72. Additionally, mass loading in the model for inhalation (PM^{-10}) is calculated at the 95th percentile using a statistical distribution. The statistical distribution of mass loading ranges from 10 $\mu g/m^3$ to 200 $\mu g/m^3$.

Participants of the Focus Group continued to express discomfort with the new DCF and risk values. One participant noted that the research regarding plutonium continues to change assumptions. CDPHE added that one of the biggest distinctions between ICRP 30 and 72 is that ICRP 72 is applicable to environmental exposure to the public as well as exposure to the worker.

The Focus Group further discussed caveats related to parameter sensitivity in the model and pathway analyses. The desire was to use pathway analyses to focus on the most important pathways to evaluate as a group.

Bob commented that a sensitivity analysis has been conducted and the pathway of exposure has remained an overarching and critical parameter.

Reed noted that the data resulting from the new DCF is not a new topic for the Group, and that the results need to be continuously defended through further discussion.

The Focus Group further discussed the implications of the resident rancher scenario. A key point was that impacts on animals through ingestion were negligible and the focus will remain on human health impacts.

The Focus Group discussed the possibility of modeling RESRAD real-time to get a sense of the degree of sensitivity of a parameter, such as mass loading. Bob explained that there is a direct correlation between doubling dose from any pathway and the percentage of total dose. The Group agreed to attend a special session on RESRAD modeling.

The Focus Group closed out this discussion with an important point: the *combination* of the sensitivity of a parameter and *what* the contribution of the pathway indicates are important to the analyses. The Task 3 report may respond to this and the continued work on the scenarios, such as the child via ingestion pathway.

TASK 3 QUESTIONS FROM THE FOCUS GROUP

Soil Ingestion and Exposure Duration

Susan Griffin, EPA, responded to questions regarding soil ingestion. She stated that as a part of establishing RSALs, an analysis of inputs, outputs, and formulas would be conducted. In the event that site-specific data cannot be used as inputs, then national data will be used to develop distributions. From that analysis, a methodology will be drafted to evaluate if the data are representative of the population specific to Rocky Flats, and if the distribution is valid. Currently the focus is on the representativeness of the datasets. Generally, the data sets used do not precisely represent the populations being modeled. This is particularly true for hypothetical scenarios, such as the wildlife refuge worker. The goal is to find a surrogate data set that will adequately represent the population—well enough to have useable results.

One issue remains and that is adequate sample size. This will become an issue for distribution fitting once soil ingestion rate is addressed, but it is not an issue for representativeness.

Empirical data on adult soil ingestion rates from the Calabrese study conducted in 1990 are being used as a starting point for soil ingestion rates. This mass balance study was used to verify the tracer mass balance methodology used in a study of the soil ingestion rate of children. Eight trace elements were measured in 64 children, aged 1 to 3, over a 7-day period. Participants were selected from a stratified random sample of 200 households. The probability distribution developed for probabilistic risk and RSAL calculations is based on the truncated lognormal distribution defined by four parameters:

1. Arithmetic mean (47.5 mg/day)
2. Standard deviation (112 mg/day)
3. Minimum (0 mg/day)
4. Maximum (1000 mg/day)

Susan further reviewed the parameters and described that the decisions will be made based on conservative risk analysis resulting from the ingestion rates, exposure frequencies, and exposure duration outputs.

A concern regarding the conversion of soil ingestion from milligrams per day to grams per year used by the RESRAD model was voiced. Susan further described the probabilistic risk assessment process, which includes a range of distributions from 0 to 1,000 mg/day. The model will pick up different points on the curve based on thousands of repetitions.

Joe Goldfield commented on the small size of the sample population studied by Calabrese, plus the fact that the probability distribution was based on daily ingestion, but is being modeled as an annual intake rate, resulting in data that are justified by the behavior of the curve only. Susan stated that during the risk assessment process, distribution of risk is used to make management decisions. The curve is an information tool and will aid in assigning conservative vs. nonconservative judgments about available data.

Reed added that the challenge is not the range of soil ingestion values, but the task of picking out the appropriate points on the curve and applying those in the calculations.

Susan finalized the discussion on soil ingestion rates for children by stating that the 1997 Calabrese study in Anaconda, Montana will be used because it is geographically similar to the Rocky Flats Site. This study used a tracer approach to eliminate any source errors, so for the purposes of the study, the RSALs Working Group has only looked at the rare earth tracer elements that eliminate source error. Final soil ingestion estimates are based on soil particle size of <250 microns.

In terms of soil ingestion for adults, there are less data. There exists a 1990 study from the University of Massachusetts that can be used to fit distributions for the Rocky Flats study, but there is discomfort in the fit of data to the lognormal distribution. Since there is not a true soil ingestion study for adults, a point estimate may be used. This point estimate for risk assessment was developed by EPA and provides for standard default inputs. The standard default input for residential adults and wildlife workers is 100 mg/day.

The Focus Group deliberated on the appropriateness of the point estimate standard and called for further review on the validity of existing studies. For the purposes of the Rocky Flats study, data were evaluated using the Calabrese and Amherst studies and added the very high results from the Holly study. According to Susan, the scientific community has embraced the Calabrese studies as the best out there to date.

Other comments from the Focus Group follow:

- The small sample size of 6 individuals (Calabrese study) may cause enormous errors;
- Mass loading must have an effect on soil ingestion;
- The risk across all pathways (ingestion and inhalation) is cumulative;
- There is an inhalation risk when calculating soil ingestion;
- The statement, "Sample size was not a factor for evaluating representativeness," violates the principals of statistical sampling;
- It is possible for a small data set to represent another similar population;
- Additional web research must be conducted on soil ingestion rates; and
- The soil ingestion rate for adults should be peer reviewed.

OTHER QUESTIONS POSED BY THE FOCUS GROUP

Plant Uptake

Bob Nininger of Kaiser-Hill stated the plant uptake calculations in the RESRAD model are maximized, meaning that the model calculates risk values based on total immersion of the plant in plutonium and americium contaminated soil. Surface dilution and resuspension are not considered; rather a soil bulk value was used for mass loading, which is slightly higher than surface contamination.

Algae and Downstream Water Sources

According to Bob, modeling efforts do not consider migration of plutonium and actinide from the ponds to an offsite location. As it stands, exposure from the ponds is much lower than an onsite worker being exposed to plutonium from multiple pathways. CDPHE stated that surface water standards may be difficult to understand

since it is not completely clear how to assign risk values to dissolved plutonium. Studies will continue to be evaluated to form the basis for management decisions.

Surface water going offsite is not a part of the RSAL calculations. It is a separate issue and needs to be dealt with.

The Focus Group agreed that several topics were still pending, including:

- Mass loading,
- Exposure frequency,
- Exposure duration,
- Modeling methodology, and
- The need for a wind tunnel presentation.

The group discussed the wind tunnel studies. A decision was made to establish a peer review process of the wind tunnel project. Reed stated he helped design the wind tunnel and wanted to abstain from choosing the technical experts for peer review. The Focus Group concurred.

It was decided that a review group would meet with Christine Bennett, Facilitation Administrative Process, to discuss potential peer reviewers for the wind tunnel studies.

Final comments included the schedule for the Task 3 report. The report still needed peer review, and the 45-day public comment period. The report should be available for public comment in November 2001. Additionally, further characterization of under building contamination and old process wastelines is underway. Preliminary results have been published on Buildings 886, 123, and 771. Kaiser-Hill will continue to conduct a detailed investigation, while providing adequate documentation.

ADJOURN

The meeting adjourned at 6:40 p.m.

RFCA Stakeholder Focus Group
September 5, 2001
Participants List

NAME		ORGANIZATION / COMPANY
David	Abelson	RFCLOG
Melissa	Anderson	RFCLOG
Christine	Bennett	AlphaTRAC, Inc.
Kent	Brakken	U.S. DOE - RFFO
Lane	Butler	Kaiser-Hill Company, LLC
John	Corsi	Kaiser-Hill Company, LLC
Carol	Deck	Kaiser-Hill Co, LLC
Rick	DiSalvo	US DOE - RFFO
Sam	Dixion	City of Westminster
Joe	Goldfield	RFSALOP
Aaron	Grider	Jefferson County
Jerry	Henderson	RFCAB
Reed	Hodgin	AlphaTRAC, Inc.
Victor	Holm	RFCAB
Jeremy	Karpatkin	US DOE - RFFO
Ken	Korkia	RFCAB
Joe	Legare	DOE
Joshua	Levin	Decision Research
Ann	Lockhart	CDPHE
Carol	Lyons	City of Arvada
Sandi	MacLeod	U.S. DOE
Tom	Marshall	Rocky Mountain Peace and Justice Center
LeRoy	Moore	RMPJC
Bob	Nininger	Kaiser-Hill Company, LLC
Patricia	Powell	U.S. DOE - RFFO
Carla	Rellergert	Weston
Mark	Sattelberg	US Fish and Wildlife Service
Kathy	Schnoor	City of Broomfield
Joel	Selbin	
Carl	Spreng	CDPHE
Noelle	Stenger	RFCAB

Dose Contributions from Individual Exposure Pathways at 95% Probability - PRELIMINARY

Scenario	Radionuclide	Pathway	Dose (mrem/yr)	% of Total Dose
Residential - adult	Pu	External	1.15E-02	0%
		Inhalation	4.83E-01	9%
		Plant Ingestion	2.22E+00	40%
		Soil Ingestion	2.85E+00	51%
		TOTAL	5.56E+00	
Residential - adult	Am	External	1.75E+00	5%
		Inhalation	4.06E-01	1%
		Plant Ingestion	3.40E+01	89%
		Soil Ingestion	2.26E+00	6%
		TOTAL	3.84E+01	
Residential - child	Pu	External	1.15E-02	0%
		Inhalation	4.61E-01	6%
		Plant Ingestion	4.63E-01	6%
		Soil Ingestion	6.60E+00	88%
		TOTAL	7.54E+00	
Residential - child	Am	External	1.75E+00	11%
		Inhalation	4.28E-01	3%
		Plant Ingestion	7.81E+00	50%
		Soil Ingestion	5.77E+00	37%
		TOTAL	1.58E+01	
Wildlife Refuge Worker	Pu	External	4.37E-03	0%
		Inhalation	3.66E-01	14%
		Soil Ingestion	2.21E+00	86%
		TOTAL	2.58E+00	
Wildlife Refuge Worker	Am	External	6.64E-01	24%
		Inhalation	3.08E-01	11%
		Soil Ingestion	1.76E+00	64%
		TOTAL	2.73E+00	

RFCA Stakeholder Focus Group
Attachment B

Title:	August 22, 2001 RFCA Focus Group meeting presentations
Date:	August 30, 2001
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

NOTES FROM RSALs WORKING GROUP MEETING ON 8/09/01

ITEMS COVERED ON 8/9:

1. Feedback from Focus Group Meeting.
2. Task 3 report outline.
3. Outstanding parameter values for open space, office worker and resident rancher scenarios.
4. Use of ICRP 30.
5. Further QA & peer review needed.

ACTIONS

Action Item	Who	When	Notes
Revise and send out DCF history paper	Jim Benetti	8/16/01	
Provide 903 Pad Pu/Am ratios & explanation to WG	Carl Spreng	8/16/01	
Perform RESRAD runs for office worker and open space scenarios	Tom Pentecost	8/16/01	
Provide values already concurred on to Susan, Phil, Tom & WG to complete tables for running office worker and open space scenarios	Diane Niedzwiecki Carl Spreng	8/13/01	
Ask Richard Graham to write up equivalent paper to Jim's paper focusing on slope factors	Tim Rehder	8/16/01	
Send sum of ratios equation to Jim for review	Tim Rehder Jim Benetti	8/16/01	
Perform RAGS run for open space and office worker scenarios, send to Sandi	Phil Goodrum	8/16/01	Sandi will forward to Working Group
Complete and send out RAGS breakdown by radionuclide of relative percentage by pathway	Phil Goodrum	8/16/01	Sandi will forward to Working Group
Send out spreadsheet with justifications to Sandi	Phil Goodrum	8/16/01	Sandi will forward to Working Group
Look back over runs and get relative pathway numbers	Tom Pentecost	8/16/01	

Look over justifications and supporting documentation received for physical parameters, identify gaps	Tricia Powell	8/16/01	
Figure out distribution for mass loading from supporting information from RAC run	Bob Nininger	8/15/01	
Send revised template for scenario write-ups to WG	Sandi MacLeod	8/16/01	
Run RESRAD for Resident Rancher scenario	Jim Benetti	8/23/01	

Please Note: All components of Task 3 Report should be submitted to Tricia Powell by COB September 7, 2001

DECISIONS

1. We will use the 903 Pad Am/Pu ratios to present examples of sum of ratio values. In practice we will use site specific data for the sum of ratios for individual areas of the site.
2. Will use 100 days per year at 2.5 hours per visit for calculating outdoor time fraction for open space.
3. Will use all deterministic values for running resident rancher scenario, as well as office worker and open space scenarios (using 95th percentile value for mass loading for these two).

NEXT MEETING: THURSDAY, 8/16/01, 8:30 a.m., at CDPHE (Room B2G – west end of 2nd floor of Bldg. B)

Agenda Items:

1. Review results of office worker and open space RESRAD runs.
2. Discuss plan for Uranium runs.
3. Go through action item table.
4. Discuss further peer review needs/options.
5. Discuss who will answer questions received from the Focus Group on the calculations.

NOTES FROM RSALs WORKING GROUP MEETING ON 8/16/01

ITEMS COVERED ON 8/16:

1. Results of office worker and open space RESRAD runs.
2. Working group review of risk spreadsheet.
3. Office worker scenario write-up for Task 3 report.
4. Resident rancher RESRAD run.
5. Further peer review needed.

ACTIONS

Action Item	Who	When	Notes
Re-run sensitivity analysis for risk calculations.	Susan Griffin or Tom Pentecost	after review of risk spreadsheet is complete	
Review risk spreadsheet	Diane Niedzwiecki, Tom Pentecost, working group	8/23/01	
Revise office worker scenario write-up	Mark Aguilar	8/23/01	
Provide 903 Pad Pu/Am ratios & explanation to WG	Carl Spreng	8/23/01	
Ask Richard Graham to write up equivalent paper to Jim's paper, focusing on slope factors	Tim Rehder	8/23/01	
Perform RAGS run for open space and office worker scenarios, send to Sandi	Phil Goodrum	8/23/01	Sandi will forward to Working Group
Complete and send out RAGS breakdown by radionuclide of relative percentage by pathway	Phil Goodrum	8/23/01	Sandi will forward to Working Group
Send out spreadsheet with justifications to Sandi	Phil Goodrum	8/23/01	Sandi will forward to Working Group
Perform benchmarking and run RESRAD for resident rancher scenario	Jim Benetti	8/30/01	

Please Note: All components of Task 3 Report should be submitted to Tricia Powell by COB September 7, 2001

DECISIONS

1. The working group will continue to use RESRAD 6.0 (RESRAD 6.1 is now available, but is not significantly different than version 6.0).
2. We will use mass loading inputs that we developed in the resident rancher RESRAD run. An RME deterministic value will be used.

NEXT MEETING: THURSDAY, 8/23/01, 8:30 a.m., at ROCKY FLATS, B060

Agenda Items:

1. Discuss working group review of risk spreadsheet
2. Review and discuss risk calculations for all scenarios
3. Discuss final office worker scenario write-up.
4. Discuss plan for Uranium runs.
5. Go through action item table.
6. Discuss who will answer questions received from the Focus Group on the calculations.

RFCA Stakeholder Focus Group
Attachment C

Title:	RSALs Working Group Notes for August 9 and 16, 2001
Date:	August 17, 2001
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

RFCA Stakeholder Focus Group
Attachment D

Title: Articles of Interest:

- The Denver Post Perspective, August 12, 2001: "Coming Clean at Rocky Flats, Wildlife Refuge Does not Shortchange Cleanup,"
- The Denver Post Perspective, August 12, 2001: "Fed Plan is Weak; Subsistence Farmer Scenario the Way to Go," and
- The Rocky Mountain News, August 11, 2001 : "South Carolina Says No to Flats Plutonium."

Date: August 17, 2001

Author: C. Reed Hodgin
AlphaTRAC, Inc.

Phone Number: (303) 428-5670

Email Address: cbennett@alphatrac.com

RFCA Stakeholder Focus Group
Attachment E

Title:	Preliminary Surface Plutonium Dose & Risk Calculations - Updated Matrix
Date:	August 17, 2001
Author:	Steve Gunderson Colorado Department of Public Health and Environment
Phone Number:	(303) 692-3367
Email Address:	steve.gunderson@state.co.us

August 17, 2001

Preliminary Surface Plutonium Dose & Risk Calculations for Potential Future Land Users at Rocky Flats – 95 percentile (pCi/g)

Land Use Scenario	Risk Levels			25-mrem annual dose
	10^{-4}	10^{-5}	10^{-6}	
Wildlife refuge worker	512	51	5	875**
Rural Resident – adult	190	19	2	223**
Rural Resident– child				250**
Open Space User – adult	*	*	*	8540
Open Space User – child				4922
Office Worker	*	*	*	2329
RAC Resident Rancher	*	*	*	•

**** Dose value exceeds 1 X 10^{-4} risk**

*** To be Completed**

August 31, 2001

Dear Stakeholder:

The Rocky Flats Cleanup Agreement (RFCA) Stakeholder Focus Group will meet at the Broomfield Municipal Center at One DesCombes Drive on September 5, 2001 from 3:30 to 6:30 p.m.

The agenda for the September 5, 2001 meeting is enclosed (Attachment A). We will discuss the following topics:

- Frame the Policy Discussion for Next Focus Group Meeting

The RSALs Working Group met August 23 and 30, 2001. The action items and notes resulting from the meetings are enclosed as Attachment B.

If you need additional information to prepare you for the Focus Group discussion on August 22, 2001, please contact Christine Bennett of AlphaTRAC, Inc. at 303 428-5670 (cbennett @alphatrac.com). Christine will help to find the appropriate resource for you.

You may call either Christine or me if you have any questions, comments, or suggestions concerning the RFCA Stakeholder Focus Group or the upcoming meeting.

Sincerely,

C. Reed Hodgin, CCM
Facilitator / Process Manager

{Insert for Appendix A: Justification and supporting documents for all selected input values}

Exposure Duration (ED)

1. Rural Resident

Brief Description

Exposure duration (ED) refers to the number of years that a resident is present at the same residence. For the rural resident land use scenario, both children and adults comprise the population of concern, and exposure is assumed to begin at birth. Census data provide representations of a cross-section of the population at specific points in time, but the surveys are not designed to follow individual families through time (U.S. EPA, 1998). The U.S. EPA Exposure Factors Handbook (EPA, 1998) summarizes the key studies on population mobility. These studies use a variety of methods to estimate residential tenures, including, 1) calculate the average current and total residence times; 2) model current residence time; and 3) estimate the residential occupancy period. Each of the key studies and methodologies provides similar estimates as summarized in Table A1.

Table A1. Summary of Key Studies for Residential Exposure Duration, based on U.S. EPA (1998), Table 15-174.

Study	Summary Statistics (years)	Methodology
Isreali and Nelson, 1992	mean = 4.6 1/6 of a lifetime of 70 years, or 11.7 years	average current and total residence times
US Bureau of the Census, 1993	50th percentile = 9 years 90th percentile = 33 years	current residence time
Johnson and Capel, 1992	mean = 12 years 90th percentile = 26 years 95th percentile = 33 years 99th percentile = 47 years	residential occupancy period

Probability Distribution

For this analysis, a probability distribution was generated from the empirical distribution function reported by Johnson and Capel (1992) for n = 500,000 simulated individuals (both male and female) given in Table A2.

Table A2. Empirical cumulative distribution function for residential occupancy period reported by Johnson and Capel (1992), based on U.S. EPA (1998), Table 15-167.

Percentile*	Years	Percentile	Years
0.05	2	0.95	33
0.10	2	0.98	41

0.25	3	0.99	47
0.50	9	0.995	51
0.75	16	0.998	55
0.90	26	0.999	59

* the maximu m observed value was 87 years.

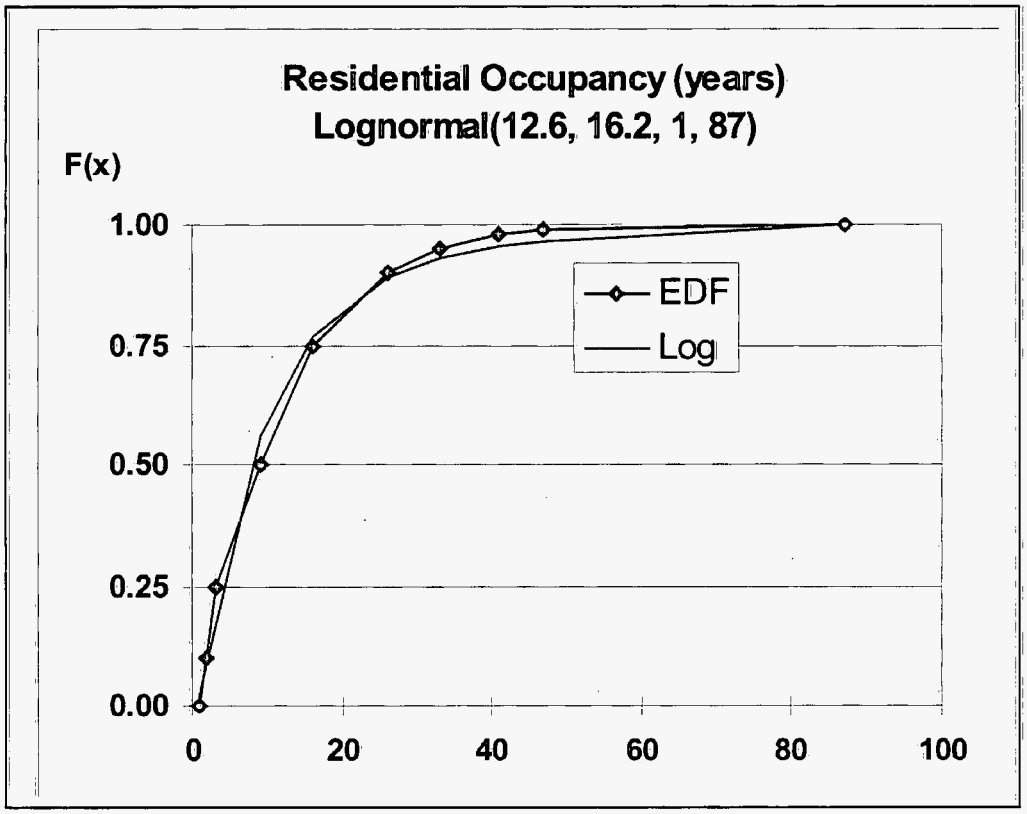


Figure A1. Comparison of ECDF and truncated lognormal distribution for residential occupancy period (ED, years).

These data were fit to a lognormal distribution using least squares regression to estimate the arithmetic mean of 12.6 years and standard deviation of 16.2 years. A comparison of the EDF to the fitted lognormal distribution is given by Figure A1. Truncation limits of 1 and 87 are based on professional judgment that the maximum observed values are plausible bounds given the large sample size of the survey. The corresponding probability distribution function is shown in Figure A2.

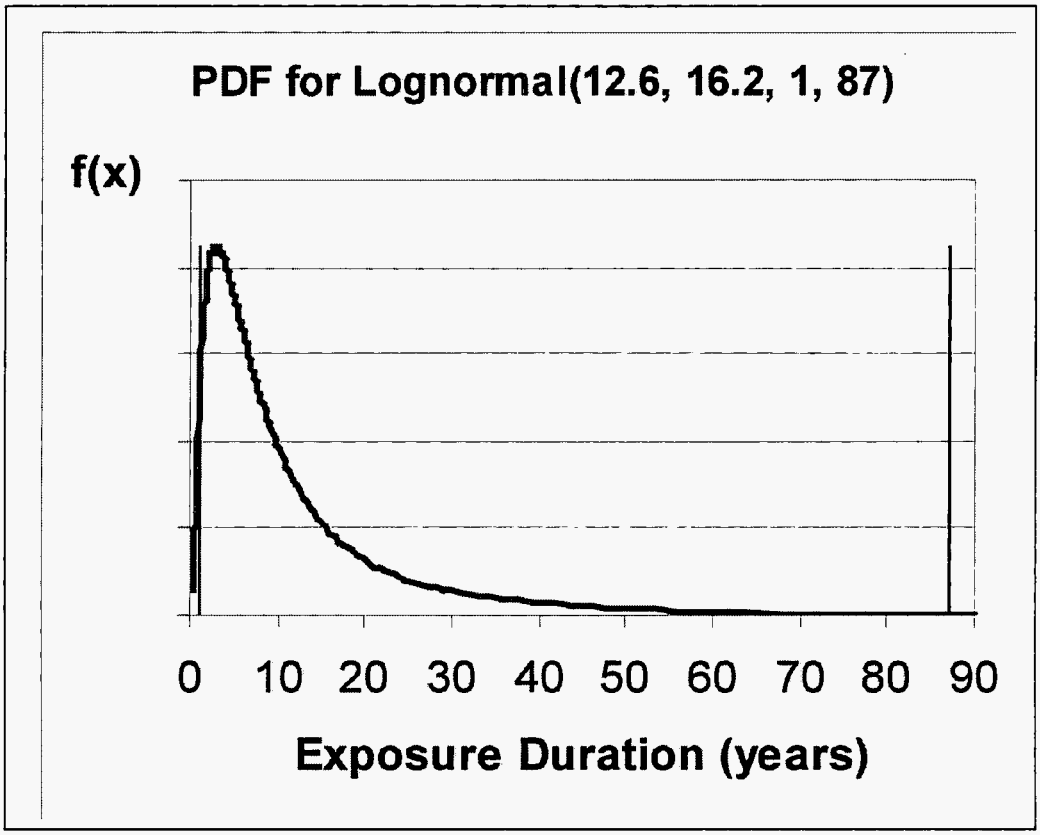


Figure A2. Probability density function (PDF) and cumulative distribution function (CDF) views of the lognormal distribution for exposure duration (years) for the rural resident.

Given reliable fit to the empirical distribution function the following lognormal distribution was selected to represent variability in exposure duration among rural residential populations:

ED ~ Truncated Lognormal (12.6, 16.2, 1, 87) years

The parameters for the truncated lognormal distribution are as follows:

- arithmetic mean 12.6 years
- arithmetic standard deviation 16.2 years
- minimum 1 year
- maximum 87 years

This use of truncation limits on this distribution does have a moderate effect on the parameter estimates used in the Monte Carlo simulation. The maximum value of 87 years truncates the distribution at the 99.3rd percentile, while the minimum value truncates the distribution at the 1.9th percentile. These truncation limits have the combined effect of reducing the mean to 12.0 years (4.8%) and reducing the standard deviation to 12.3 years (24.1%). This change reflects the relative high coefficient of variation for this distribution (CV = stdev/mean = 1.3), however, the maximum of 87 years is considered to be a reasonable approximation of an individual who lives at the same residence their entire life.

The 50th, 90th, 95th and 99th percentiles of this distribution are 7.7, 27.4, 39.3, and 77.0 years.

Justification for Input Variable

The is relatively high confidence in the data set and probability distribution used to characterize variability in residential exposure duration. The standard RME point estimate for use in Superfund risk assessments (for cancer) is 30 years, which is approximately the 91st percentile of this distribution.

1. Wildlife Refuge Worker

Brief Description

For the wildlife refuge worker scenario, exposure duration represents the number of years that a refuge worker spends on site. National survey data on occupational activity patterns are maintained by the U.S. Bureau of Labor Statistics. The Superfund default reasonable maximum exposure estimate for both full time and part-time workers is 25 years, based on the 95th percentile of the number of years worked at the same location reported in 1990.

There are a wide range of reported job tenures among different categories of occupations. The U.S. EPA Exposure Factors Handbook (1998, Table 15A-7) summarizes data reported by Carey (1988) for 109 million adults (16+ years). The median job tenure for the entire survey (all ages, male and female) is 6.6 years, however this varies by occupation and age. Examples of some of median job tenure for selected occupations are given in Table A3.

Table A3. Median job tenure for selected occupations based on Carey (1988) as reported by U.S. EPA (1988), Table 15A-7.

Occupation	Median Tenure (yrs)	Occupation	Median Tenure (yrs)
Barbers	24.8	Health Technologists and Technicians	6.3
Farmers, except horticulture	21.1	Supervisors; Ag Operations	5.2
Construction Inspectors	10.7	Machine Operators	4.5
Administrators and Officials, Public Admin	8.9	Biological Technicians	4.4
Surveying and Mapping Technicians	8.6	Animal Caretakers, except farm	3.5
Science Technicians	7.0	Information Clerks	2.7

The major limitation in using these data to estimate ED for risk assessment is that they reflect time spent in an occupation rather than time spent at a particular job site. In addition, these data reflect median job tenures, and whereas the complete distribution of tenures within a category are of interest. Ideally a sub-category representative of wildlife refuge workers at one site would be used to estimate exposure duration. Such occupation-specific information has been obtained by the U.S. Fish and Wildlife Service in a National Wildlife Refuge Survey, in which wildlife refuge workers were interviewed from three refuges (Crab Orchard, IL; Malheur, OR; and Minnesota Valley, MN). Data for 80 wildlife refuge workers are summarized in the RMA (1994). Of these workers, 33 values reflect incomplete tenures, and 47 values reflect completed tenures. The responses allow for estimates of years spent at one refuge, regardless of whether job activities changed. While the sample size is relatively small, the estimates are similar to that of the national survey data, and provide a more occupation-specific data set for the exposure scenario characterized in this analysis.

Probability Distribution

The following probability distribution is recommended for use in risk equations that are based on U.S. EPA Risk Assessment Guidance for Superfund (RAGS) in order to characterize *interindividual* variability in exposure duration among wildlife refuge workers:

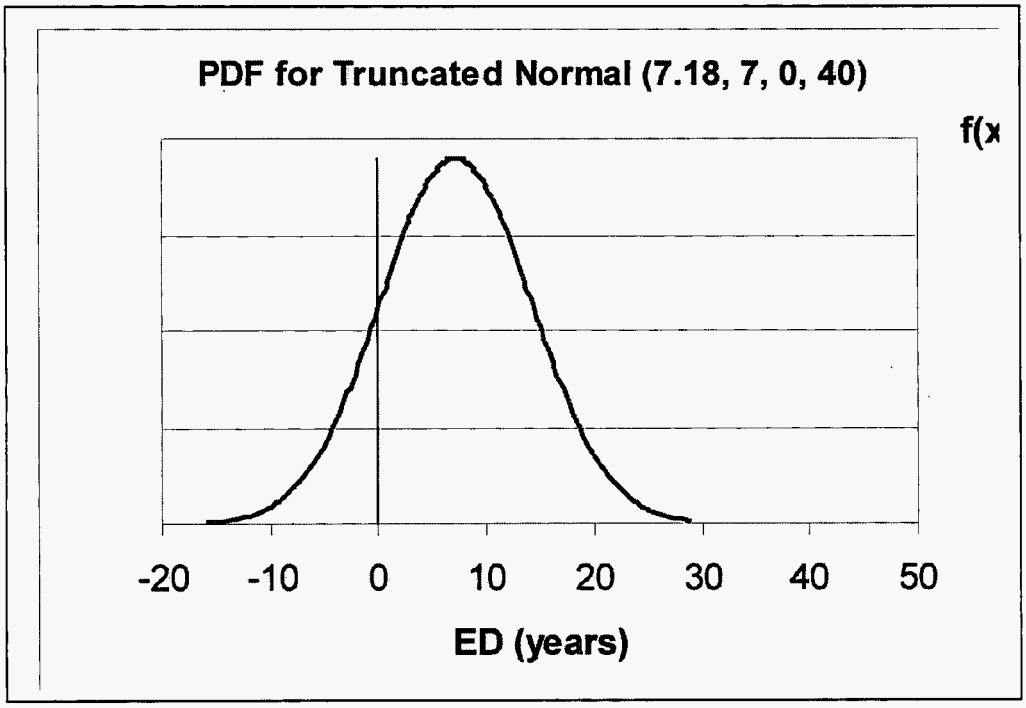
ED ~ Truncated Normal (7.18, 7, 0, 40) years

The truncated normal distribution is defined by four parameters:

- arithmetic mean 7.18 years
- arithmetic standard deviation 7 years
- minimum 0 years
- maximum 40 years

The probability distribution (PDF and CDF) is shown in Figure A3. Given that a normal distribution has infinite lower upper tails, it is reasonable to truncate the distribution at a plausible bounds. A minimum of 0 was chosen to avoid negative values, and a maximum of 40 years was chosen to be approximately 5 standard deviations from the mean, so as to minimize the effect on the parameter estimates in the Monte Carlo simulation. The effect of the truncation limit is to alter the original parameter estimates (mean, standard deviation) to (9.1, 5.6), an increase of 27% in the mean and reduction of 27% in the standard deviation. It is clear from Figure A3 that the truncation limit reduces a significant fraction of the low-end values; in such cases, it is generally preferable to use an alternative distribution that requires less truncation (e.g., lognormal). This was not done for this analysis given that the data were not reported in a manner that would allow for exploration of alternative PDFs.

The 50th, 90th, 95th, and 99th percentiles of this distribution are 7.2, 16.2, 18.7, and 23.5 years,



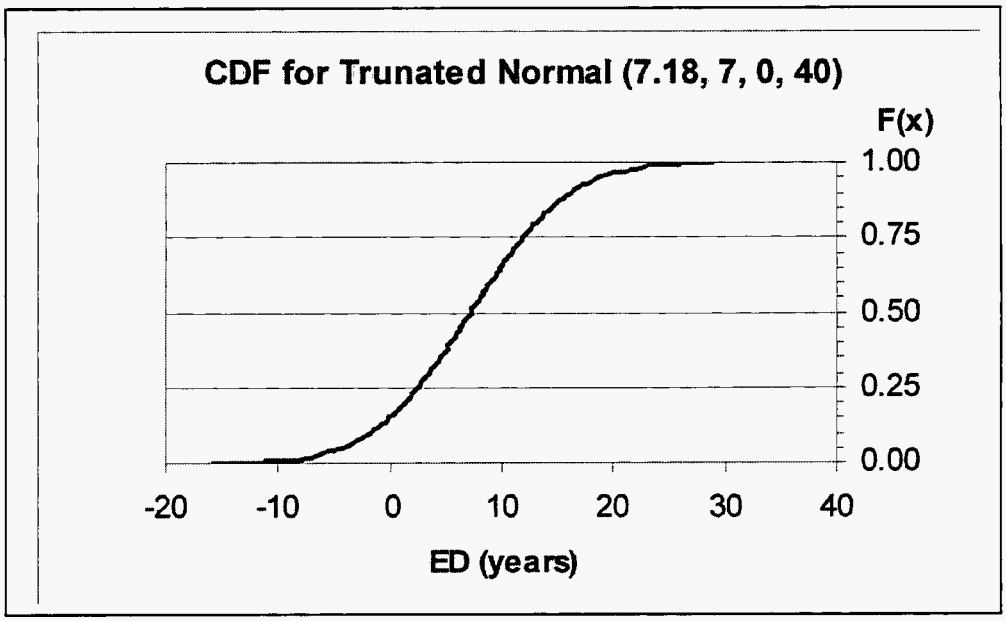


Figure A.3. Probability density function (PDF) and cumulative distribution function (CDF) views of the truncated normal distribution for exposure duration (years) for the wildlife refuge worker.

Justification for Input Variable

The use of a truncated normal distribution is supported by the data reported by U.S. Fish and Wildlife on wildlife refuge workers in three different locations. Data from Carey et al. (1988) for the U.S. population suggest that the highest median tenure at one job is less than 30 years, and the median tenure of all occupations is 6.6 years. The tenure for biological technicians is reported to be 4.4. years. The use of a normal distribution is professional judgment given the reported arithmetic mean and standard deviation for n = 33 biological refuge workers (or 80 tenures). The U.S. Fish and Wildlife Service fit the normal distribution to these data, although an alternative bounded distribution (e.g., beta, lognormal) may be preferable given the significant fraction of low-end values that are truncated below 0.

{Insert for Appendix A: Justification and supporting documents for all selected input values}

Exposure Frequency (EF)

1. Rural Resident

Brief Description

Exposure frequency (EF) refers to the number of days per year that a resident is present at home, rather than at work or on vacation. Given that the toxicity endpoint is a long-term average exposure (the endpoint of concern is cancer), this input variable will represent a long-term average time at the residence. For the rural resident land use scenario, it is assumed that if an individual is at home, they may be exposed via one or more exposure pathways for 24 hours per day (see Exposure Time). For this analysis, no distinction is made between exposure frequencies for men and women, or for children and adults. The maximum number of days per year is 365 days.

The U.S. EPA Exposure Factors Handbook (EPA, 1998) summarizes survey data on population mobility for the U.S. population. The sample sizes for the major studies are very large (n > 1000), reflecting national surveys. The difficulty in estimating population activity patterns and mobility from a survey is that it represents a snapshot in time, and there is uncertainty in determining the total duration that an individual will reside at the same house (see Exposure Duration). Extrapolations to a long time periods are required since personal diaries cover short periods of time. However, there is less uncertainty associated with estimating the days per year that an individual spends time at home.

The Superfund default central tendency estimate for residential exposure frequency is 234 days/year, which corresponds to the fraction of time spent at home (64%) for both men and women based on a study of time use patterns summarized in 1990. In other words, the available data suggest that, on average, individuals spend approximately two-thirds of the year at home.

Probability Distribution

For this analysis, a probability distribution was generated from the central tendency estimate given by U.S. EPA exposure factors handbook (234 days/year) and professional judgment regarding a plausible range among a residential population. The maximum value of 350 days was selected to reflect an average of approximately two weeks per year spent away from home, either on family vacation or business travel. A minimum of 175 days/year was selected to reflect a minimum of approximately 50% of the year spent at home.

Given reliable information regarding the central tendency, and plausible estimate for the minimum and maximum, the following triangular distribution was selected to represent variability in exposure frequency among rural residential populations:

EF ~ Triangular (175, 234, 350) days/year

The parameters for the triangular distribution are as follows:

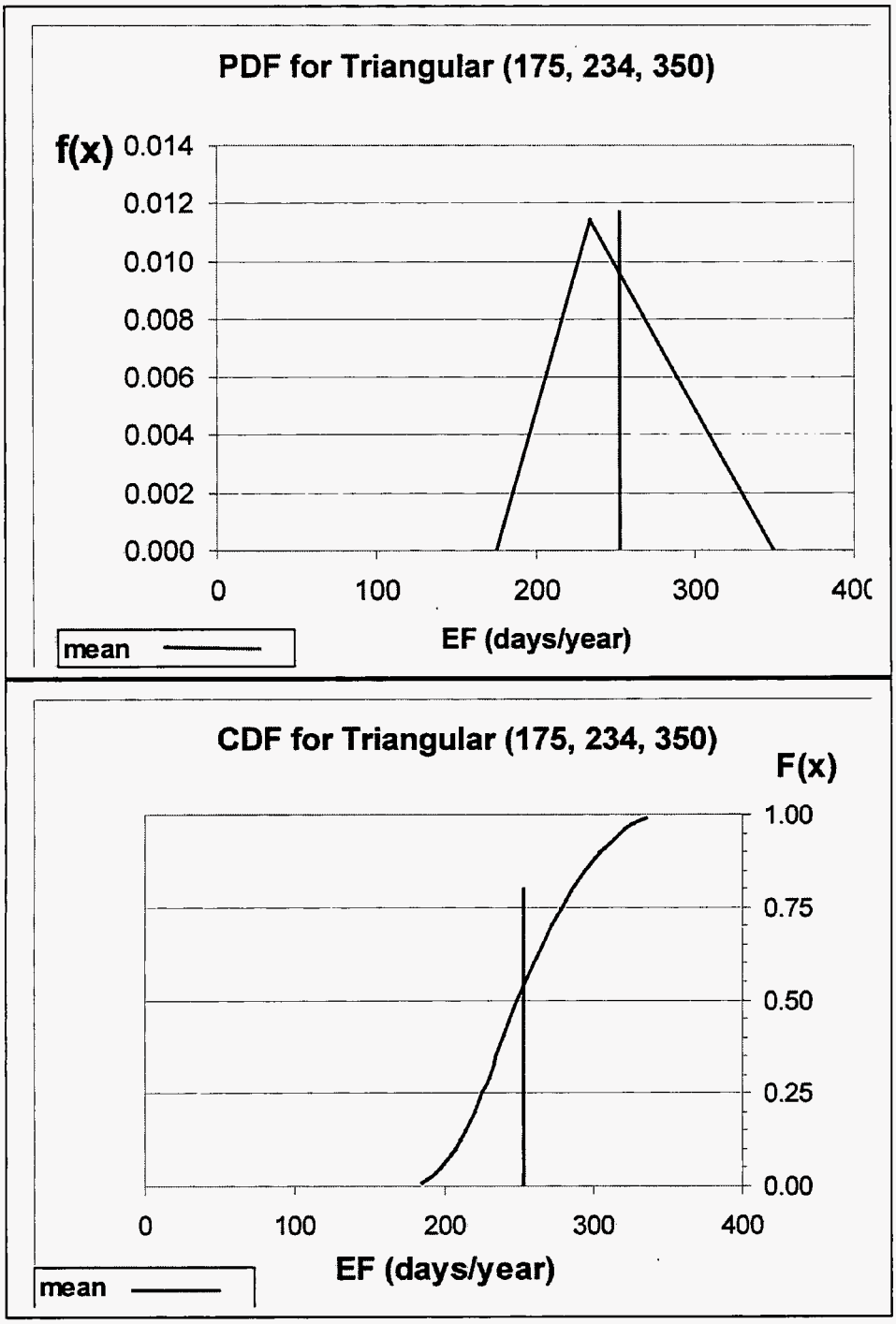
- minimum 175 days/year
- mode 234 days/year
- minimum 350 days/year

The mode characterizes the "most likely" value and will equal the mean for distributions that are symmetrical. Figure A1 presents the probability density and cumulative distribution views for this distributions. The mean, 90th, 95th and 99th percentiles are 253, 305, 318, and 336 days/year.

Justification for Input Variable

The triangular distribution is a reasonable approximation for the "true" distribution for exposure frequency given that the variable is truncated at the high end by definition (i.e., 365 days per year). It may be possible to obtain the original survey data results that formed the basis for the central tendency estimate (CTE) recommended by EPA for use in Superfund risk assessments. However, it is expected that use of an alternative right-skewed (and truncated) distribution would yield very similar percentile estimates, and would therefore have only a minor effect on the risk estimates.

Use of 350 days/year as a high-end truncation limit is viewed as a reasonably conservative estimate of exposure frequency in the absence of site-specific



A.1. Probability density function (PDF) and cumulative distribution function (CDF) views of the triangular distribution for exposure frequency (days/year) for the rural resident

1. Wildlife Refuge Worker

Brief Description

For the wildlife refuge worker scenario, exposure frequency represents the average number of days per year that a refuge worker spends on site. National survey data on occupational activity patterns are maintained by the Bureau of Labor Statistics. The Superfund default central tendency and reasonable maximum exposure estimates for both full time and part-time workers is 219 days/year and 250 days/year, respectively. The 250 days/year reflects an individual who works 5 days per week for 50 weeks of the year (thereby taking a single 2-week vacation, for example). These estimates are based on national survey data of the U.S. population from 1991.

Since it is likely that different occupations may reflect substantially different activity patterns, ideally a sub-category representative of wildlife refuge workers would be used to estimate exposure frequency. Such occupation-specific information has been obtained by the U.S. Fish and Wildlife Service in a National Wildlife Refuge Survey, in which wildlife refuge workers were interviewed from three refuges (Crab Orchard, IL; Malheur, OR; and Minnesota Valley, MN). Data for 33 wildlife refuge workers are summarized in the RMA (1994). The responses allow for estimates of either hours per day or days per year. While the sample size is relatively small, the estimates are similar to that of the national survey data, and provide a more occupation- specific data set for the exposure scenario characterized in this analysis.

Probability Distribution

The following probability distribution is recommended for use in risk equations that are based on U.S. EPA Risk Assessment Guidance for Superfund (RAGS) in order to characterize *interindividual* variability in exposure frequency among wildlife refuge workers:

EF ~ Truncated Normal (225, 10.23, 200, 250) days/year

The truncated normal distribution is defined by four parameters:

- arithmetic mean 225 days/year
- arithmetic standard deviation 10.23 days/year
- minimum 200 days/year
- maximum 250 days/year

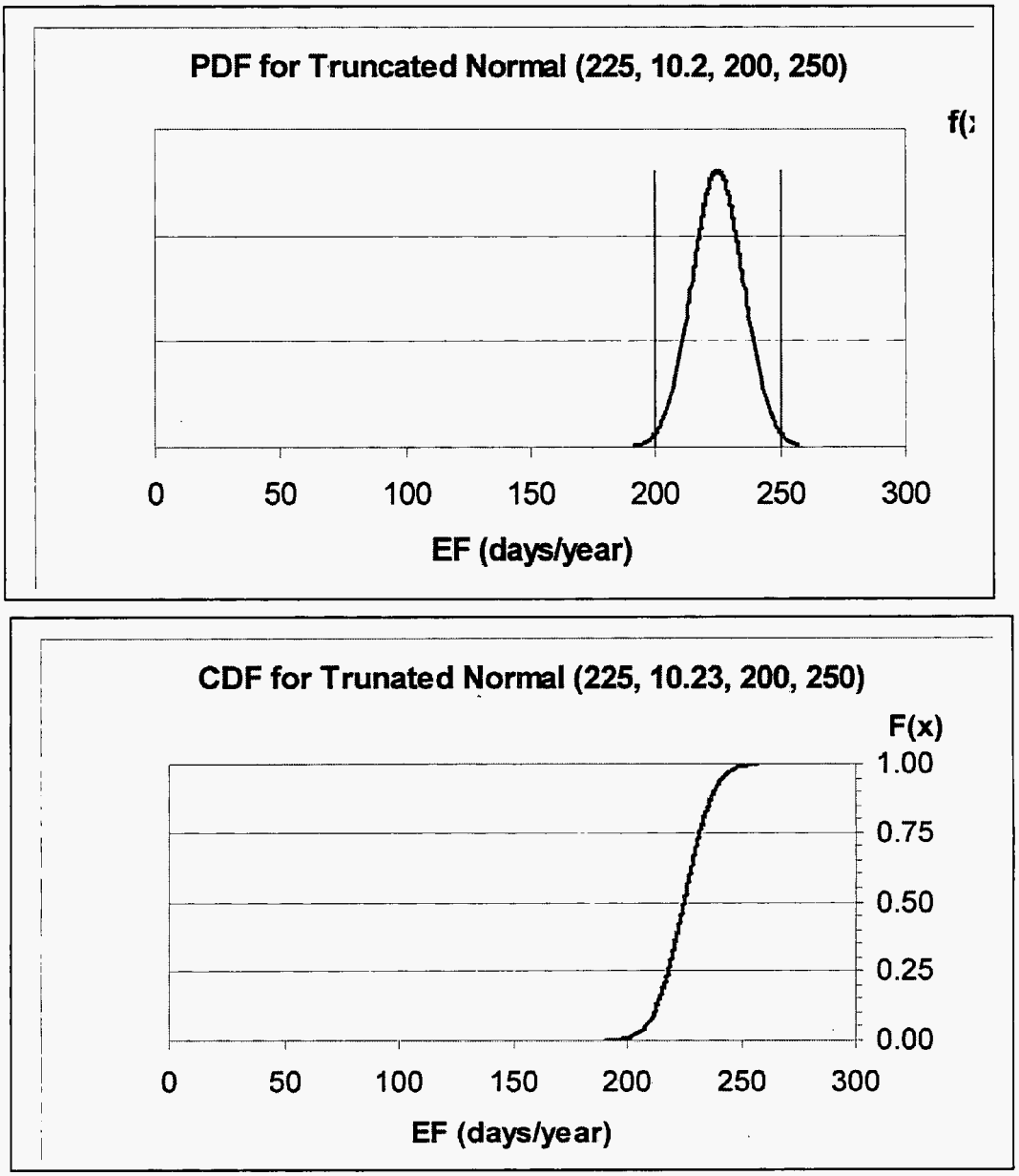


Figure A.2. Probability density function (PDF) and cumulative distribution function (CDF) views of the truncated normal distribution for (adult) exposure frequency (days/year) for the wildlife refuge worker.

The probability distribution (PDF and CDF) is shown in figure A2. Given that a normal distribution has infinite lower and upper tails, it is reasonable to truncate the distribution at plausible bounds. The affect of the truncation limit is to alter the original parameter estimates (mean, standard deviation) that is effectively used in a Monte Carlo simulation. For this analysis, the coefficient of variation (CV = stdev / mean) is very low (0.05), so truncating at 200 and 250 days/year has a minimal effect. These truncation limits remove 0.7% of the tail at both ends, and due to the symmetrical shape, there is no change in the mean or standard deviation.

Justification for Input Variable

The use of a normal distribution is supported by the data reported by U.S. Fish and Wildlife on wildlife refuge workers in three different locations. The arithmetic mean (225 days/year) is slightly greater than the central tendency estimate reported by the Bureau of Labor Statistics for all occupations (219 days/year). The maximum value of 250 days/year is consistent with the RME estimate recommended for use at Superfund sites, and may be viewed as a reasonable upper bound for individuals who work week days only, and take two weeks of vacation per year. The lower bound of 200 days per year suggests that the range among different workers at the refuge is relatively narrow (i.e., 50 days).

Rocky Flats Field Office
Looking Toward the Future

Response to Peer Reviewer's Comments on the Rocky Flats Cleanup Agreement (RFCA) Radionuclide Soil Action Level (RSAL) Working Group (RWG)

Task 2 Report
Computer Model Selection

June 6, 2001

Rocky Flats Field Office
Looking Toward the Future

Received Comments from Four Peer Reviewers

- Two anonymous people hired by AlphaTrac
- Victor Holm (Received 9/12/00, response 9/28/00)
- LeRoy Moore

Rocky Flats Field Office
Looking Toward the Future

Two Anonymous Peer Reviewer's

- ✗ First Reviewer's basic conclusion "The use of the newest version of RESRAD is sound and is justified by the analysis."
- ✗ Second Reviewer's basic conclusion "The overall approach is basically sound and appropriate, but there are two critical deficiencies."
  - ✓ The report ignores the CERCLA regulatory requirements for risk
  - ✓ The requirement that the model be in the public domain is unnecessarily restrictive

Rocky Flats Field Office
Looking Toward the Future

Agency's Comment - 1st Deficiency

- ✗ The Task 1 Report explains the roles of EPA and NRC
- ✗ Task 1 report says that any RSAL will have to meet the protective requirements of both the NRC and EPA
- ✗ The RSAL will be calculated using Dose and Risk

Rocky Flats Field Office
Looking Toward the Future

Agency's Comment - 2nd Deficiency

- Benchmarking is the industry standard for demonstrating a new computer codes validity
- Can only occur if the executable code is available in the public domain and available to many different users
- RAC precluded the use of MEPAS because it could not obtain code

Rocky Flats Field Office
Looking Toward the Future

Other Peer Review Findings

✗ Needs more background information

- ✓ Conceptual Site Model
- ✓ Explain Probabilistic vs. Deterministic
- ✓ Need for Executive Summary
- ✓ And the most important……

Rocky Flats Field Office
Looking Toward the Future

Criterion, not Criteria

Rocky Flats Field Office
Looking Toward the Future

Conclusion

- Will make revisions to add background information, explain more detail
- No major changes to Criteria
- Agency's proceeding using RESRAD 6.0 as the best computer code
- Final Task 2 Revision June 29, 2001

Victor Holm
[redacted]
Sept 14, 2001

RAC's Mass Loading Values After a Fire.

Several weeks ago I identified a serious problem in the RAC procedure for calculating the mass loading. The values used by RAC for mass loading (the amount dust in the air) are unprecedented anywhere in the world. In fact they appear to be physically impossible. I sent a letter to John Till. In his reply he clarified the method used by RAC. After studying the reply and reading some of the scientific papers referenced in the reply, I am more that ever convinced that the RAC approach exaggerates the inhalation dose following a fire.

RESRAD assumes that if is the only source of mass loading in the air is the contaminated soil then the concentration of Pu in the air is the same as the soil concentration. Several studies have suggested that it might be possible under certain circumstances for the Pu in air to be different than the Pu in soil. The ratio of these two values is called the enhancement factor or EF. Using this concept, RESRAD would always use an EF of 1.0. RAC believes that this factor can, in some instances, become quite large, perhaps, greater than a thousand. They admit they have almost no evidence of how or even if this happens. They quote a few studies that show this effect; but, the results have a high uncertainty. The studies were not designed to actually measure the EF. A recent study that may not have been available to RAC did measure the EF directly at a number of Pu contaminated sites. The results under undisturbed conditions actually show most values of EF are less than 1.0.

Table 1

Site	EF	Contaminating Event
Nevada test site		
Area 5	0.87	Safety Shot
Area 11	1.04	Safety Shot
Area 18	.024	Nuclear Shot
Area 20	.002	Nuclear Shot
Bikini Atoll	.80	Nuclear fallout
South Carolina field 1	.21	Processing Facility
South Carolina field 2	.49	Processing Facility
California	.73	Sewage Sludge

Note: The nuclear shots resulted in glass beads being formed that contained the Pu therefore they may not be representative of conditions at Rocky Flats.

The study also investigated the effect on the EF if the area was disturbed. Table 2 gives the results.

Table 2

Type of disturbance	EF	Site
Soil thawing in springtime	6.5	NTS Area 5
Bulldozer blading	3.9	Bikini Atoll
Soil vacuum cleanup	3.6	NTS Area 11
Wildfire, removing grasses	3.5	NTS Area 20
Raked off desert pavement	2.2	NTS Area 18
Soil dried and eroded for 2 weeks	0.8	South Carolina

Note: These are temporary increases during the disturbance. Conditions quickly returned to normal after the disturbance.

I respect RAC's attempt to use enhancement factors instead of the RESRAD default factor of one. I believe that in the absence of adequate data they chose factors that were much too high. Recent wind tunnel data from both the NTS and Rocky Flats is providing much better data. This data indicates that EF's of less than 10 are to be expected. RAC used EF's as high as 7500. I continue to maintain that such values are not supported by the available data. In summary I am not conceding that my concerns in this matter were unfounded. RAC spent many hours developing this method and I am sure that RAC still feels there values are justified. I respect their opinion.

John Till himself on the first page agrees with me that the RAC methodology is only a tool and that the values RAC chose for EF's were only estimates. If RAC was insisting that the calculated RSAL number was actually the threshold of acceptable risk then we might be at an impasse. On the contrary, RAC has always maintained that the RSALOP was placing too much emphasis on one number. This point was made several times during the meetings. They expressed their doubts on page 13-2 of the report and now John Till has repeated them.

John Till on page 6 of his reply repeats four warnings about RSAL's that he made several years ago.

1. SAL's leave out of account the particular remediation strategy that would supposedly bring the site into compliance with whatever criteria are agreed upon. In doing so, they ignore the financial, human, and environmental costs of remediation, which could differ significantly for different strategies.
2. When they are applied to an extremely inhomogeneous spatial distribution of pollutant such as Pu at RF, SALs have an inherent distortion, because as defined they can only represent a transfer function that corresponds to the site before any remediation has been done. The post-remediation transfer function for RF, which is the one that needs to be considered, would be quite different.
3. Most laypeople (and some scientists and engineers) do not appreciate the limitations of SALs and tend to misinterpret them.
4. A SAL furnishes a single number, and in a political dispute, each faction is irresistibly tempted to demand maximization or minimization of that number (according to its point of view), without regard to other constraints of the decision

process. This is one reason we stressed a range of possible SALs rather than a single value at the end of our study.

I could not have said it better; in fact, I have repeatedly said it. We are spending too much time discussing breathing rate and are not enough time discussing what we are going to do with the number. Regardless of the RSAL number; people that understand the process will tell you that there is a lot of uncertainty when it comes to estimating the future risk to low level contamination at Rocky Flats. I am very suspicious of anyone who says they know the risk.

The working group has provided us with a range of numbers. The RAC estimate is well within that range. I suggest we accept the Working Groups report and move on united in recommending the best possible cleanup for Rocky Flats.

RFCA STAKEHOLDER FOCUS GROUP

TECHNICAL QUESTIONS REGARDING TASK 3: DOSE AND RISK MODELING PARAMETERS AND RESULTS

August 22, 2001 Focus Group Meeting

SOIL INGESTION

Annual soil ingestion rates for a child at or near zero seem to be included in the distribution. How is this appropriate for a child playing outdoors in the warmer months? Are there data to support the conclusion (Henderson)?

Is there a consensus among professionals on how best to meet the challenge of limited data on which to base adult soil ingestion factors (insufficient data to use a distribution)? Has the Working Group compared their approach with other sites where a soil-intrusive scenario was used to determine the cleanup level (Henderson)?

PLANT UPTAKE

How has plant uptake of Americium been considered in the modeling (Harlow)?

Is Pu and Am transport in algae leaving the site in/on surface water being considered (Harlow)?

How has the biological availability and mobility of Am in soil systems been considered (Harlow)?

How have differences in uptake between native grasses and other plants been considered (Harlow)?

How has the effect of weathering on plant uptake been considered (Harlow)?

MASS LOADING

Is a sophisticated dust resuspension model being developed for the Actinide Migration Evaluation work? If so, could it be used to benchmark the RSAL results for the inhalation pathway (Henderson)?

Please explain and provide the rationale for the approach being taken regarding the frequency of a major grass fire at Rocky Flats (in comparison to the approach used by RAC) (Moore).

Given that the wind tunnel technology, including its methods of measurement or calibraton, has not been peer-reviewed, what data are being used for the fire calculation? If the peer reviewing cannot be completed in time, what will the agencies do? If the peer reviewing suggests major changes must be made in the wind tunnel technology before it can produce reliable results, what will the agencies do? If the peer reviewing concludes that the wind tunnel technology cannot produce reliable data for the RSAL calculations, what will the agencies do (Moore)?

What are the diurnal variations in particulate concentration? Do your exposure scenarios adequately account for the increased concentrations that occur when the receptor is predominantly being exposed? (Ciolek)

Provide all data used to come up with the "seed" value for the mass loading. Explain why higher averaged values were dismissed (Ciolek).

Why does the function used in the Monte Carlo simulation of adult soil ingestion use a maximum value of 100 mg/day when the mean and median values in the Calabrese 1990 study occur at or above 100 mg/day in 3 of the 12 experiments (Ciolek)?

How was the enhancement factor for topsoil disturbance chosen and why is it appropriate (Ciolek)?

Show how you have incorporated the effects of mechanical disturbance of soil in your mass loading calculations. How does it match the

effects of mechanical plowing/tilling, construction, road traffic, localized digging, etc. (Ciolek)?

EXPOSURE FREQUENCY AND DURATION

What is the assumed annual time on site for the wildlife refuge worker? How much of this time is assumed to be spent outdoors? What duration (number of years in this work at RF) is assumed (Moore)?

Are less conservative values being used for exposure frequency and duration than for less important parameters, and, if so, why is this appropriate (Henderson)?

MODELING METHODOLOGY

Show how you came up with the RSAL based on the "not to exceed 25-mRem/yr dose" (including all assumptions) (Ciolek).

Explain why the source is not a temporal parameter (Ciolek).

What is the influence precipitation events have on the final RSAL and how would that change if you looked at a larger statistical sample of climate along the Front Range (Ciolek)?

How are possible dependencies (correlations) between parameters being considered in the modeling (e.g., higher breathing rates when soil is being disturbed) (Ciolek)?

Are the agencies in their present calculations using a
Safety factor to account for uncertainties and limited knowledge in the modeling process? If so, what factor is used and how is it employed in the calculation? If not, what is being done to account for the uncertainties and for
what is not known (Moore)?

Please explain in detail why the most conservative approach is or is not being taken for each of the most sensitive parameters. Are you able to show the difference between a most-conservative approach across the board and any other approach? Explain what is meant by "an unrealistically conservative result." (per Bob Nininger at 8/8 Focus Group meeting). If the agencies have decided to counter the conservative tendency for particular parameters, what counter measures have they taken? How have they decided what measures to take? How have they decided which parameters to select for such counter measures? Why will the end result be anything other than an unrealistically non-conservative result (Moore)?

TREATMENT OF AMERICIUM

According to RESRAD, radiation exposure decreases over time. Please explain and show how and why this is true of Pu in the RF environment (regarding ingrowth of Am over time) (Moore).

POLICY QUESTIONS

What are the nine CERCLA criteria to consider in making cleanup/remediation decisions (Moore)?

Why are modeling calculations being performed for multiple scenarios if the agencies are going to use only the wildlife refuge worker scenario in setting the RSAL (Moore)?

What criteria will the agencies employ in making a selection among the results for use in the final RSAL (Moore)?

DEVELOPMENT OF RISK-BASED SOIL ACTION LEVELS AT ROCKY FLATS

SUSAN GRIFFIN, PhD, DABT
TOXICOLOGIST
U.S. EPA, Region 8

Dose vs. Risk

- Absorbed Dose
  - Mean energy imparted by ionizing radiation to matter per unit mass (D=e/m)
- Risk
  - An estimation of the qualitative and quantitative potential (expressed as a probability) for an event to occur. (i.e., a one in a million probability of an individual coming down with cancer)

Dose vs. Risk

- Dose
  - A dose equivalent (such as 15 mrem) needs to be placed within the context of existing information relating dose with known cancer effects
  - Risk
  - Risk already includes a comparison between site-specific exposures and a known toxicity benchmark
  - EPA is required to perform an evaluation of risk at all CERCLA sites

Risk Assessment Guidances For Superfund

- National Academy of Sciences. 1983. *Risk Assessment in the Federal Government: Managing the Process*
- U.S. EPA. 1989. *Risk Assessment Guidance for Superfund: Volume 1. Human Health Evaluation Manual*
- U.S. EPA. 1991a. *Human Health Evaluation Manual, Part B. Development of Risk-based Preliminary Remediation Goals*
- U.S. EPA, 1991b. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*
- U.S. EPA 1992. *Guidance on Risk Characterization for Risk Managers and Risk Assessors*

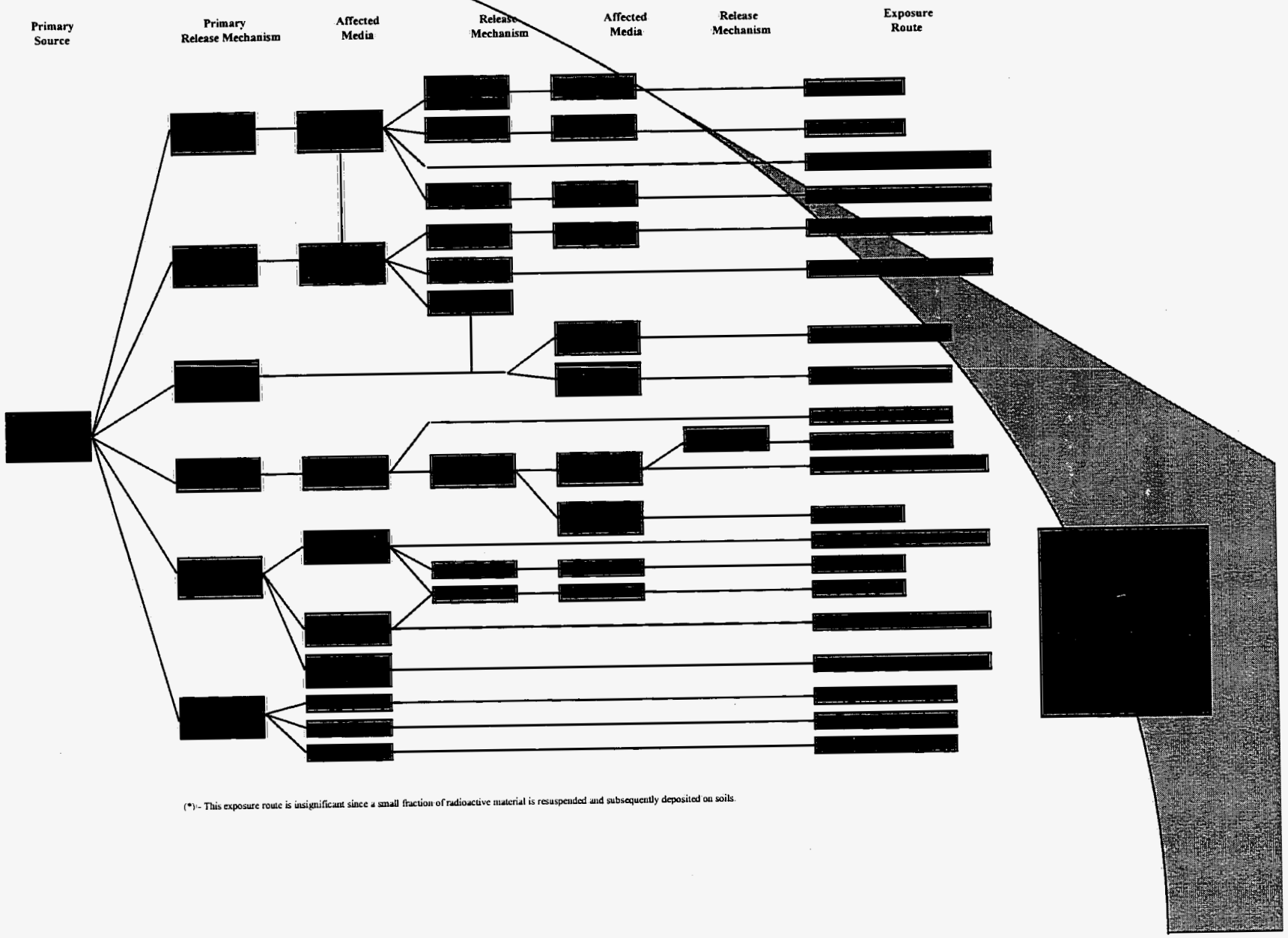
Site Conceptual Models

- Risk assessments are expected to look at both current and probable future land uses at a site.
  - Once the risk assessment is completed, risk decision makers (including stakeholders) will choose the most likely land use and the appropriate remediation strategy

Site Conceptual Models

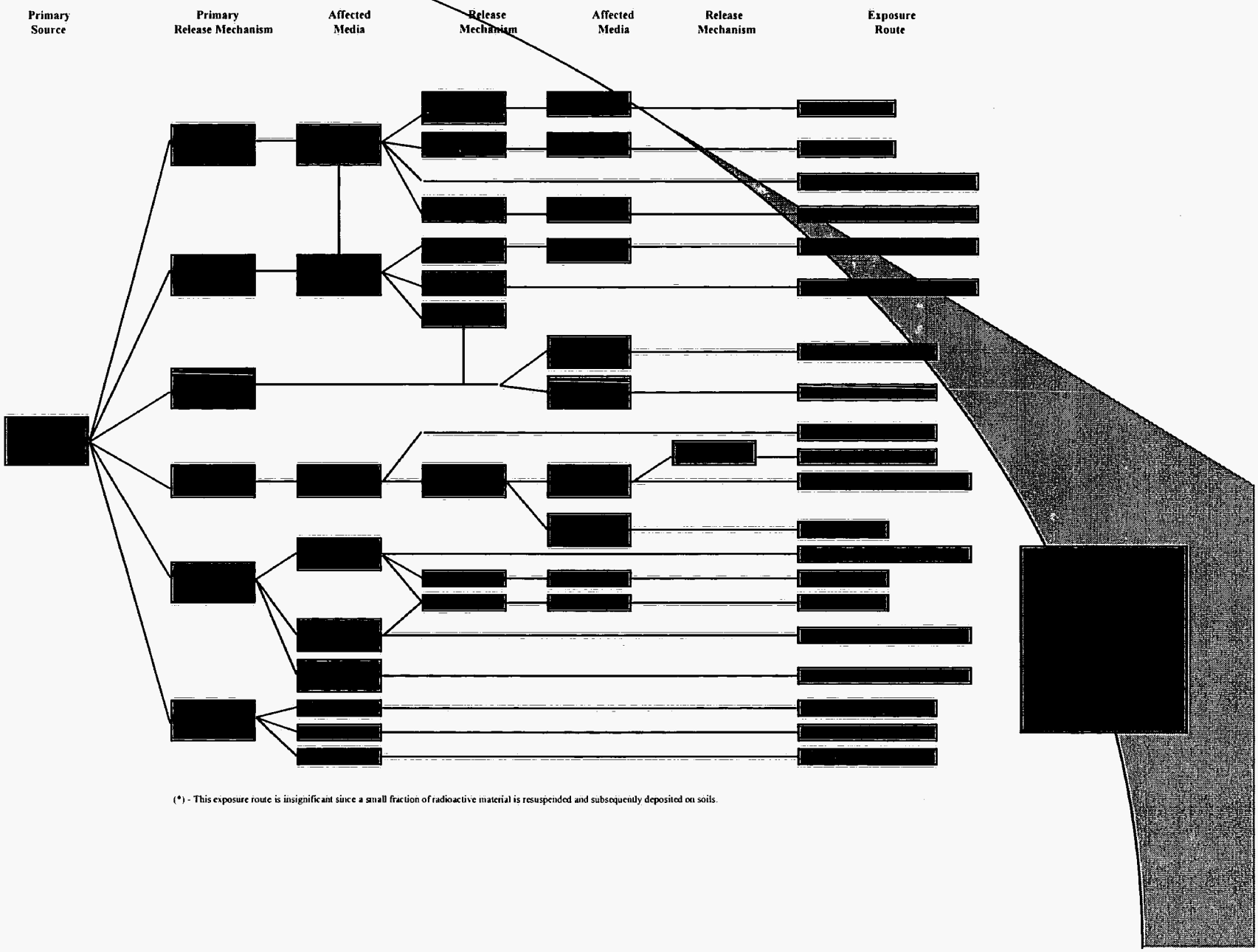
- Definition of a site conceptual model
  - A graphical illustration of where the contamination originates, how it moves through the environment, and how humans come into contact with the contaminated media
  - Value of a site conceptual model
  - Illustrates which pathways are important (and which are not)
  - Illustrates which pathways are complete
  - Guides and focuses data collection
  - Illustrates where remediation efforts will be most effective

Residential Site Conceptual Model



(*)- This exposure route is insignificant since a small fraction of radioactive material is resuspended and subsequently deposited on soils.

Wildlife Worker



(*) - This exposure route is insignificant since a small fraction of radioactive material is resuspended and subsequently deposited on soils.

Exposure Assessment

Definition

Estimation of the magnitude, frequency, duration, and routes of exposure

- Routes of exposure
- Ingestion of soil/sediment
- Ingestion of homegrown produce
- Inhalation of particulates
- External gamma irradiation

Exposure Assessment

Assessing magnitude and duration of exposure

Ingestion of radionuclides in residential soil

$$PRG = TR/SF \times IR \times 1 \times 10^{-3} \times EF \times ED$$

PRG = preliminary remediation goal

TR = target cancer risk

SF = soil ingestion slope factor

EF = exposure frequency

ED=exposure duration

EXPOSURE ASSESSMENT

- External exposure to radionuclides in soil

- $PRG = TR/Sf_e x(EF/365)xEDxACFx\ [ET_o + (ET_i xGSF)]$

- PRG = preliminary remediation goal
- TR = target cancer risk
- SFe = external slope factor
- EF = exposure frequency
- ED = exposure duration
- ACF = area correction factor
- ETo, ET_i = exposure time fraction outdoors, indoors
- GSF = gamma shielding factor

EXPOSURE ASSESSMENT

- What values are input to the parameters?
  - CERCLA law requires EPA to base human health remedial decisions on an estimate of the Reasonable Maximum Exposure (RME)
  - The intent of the RME is to estimate a conservative exposure case that is within the range of possible exposures
  - If adequate site-specific data is available it should be used in the exposure assessment
  - If not, EPA recommends the use of standard RME default values (USEPA, 1991a)

TOXICITY ASSESSMENT/ RISK CHARACTERIZATION

- The preliminary remediation goal includes a toxicity benchmark (i.e., cancer slope factors) in addition to the exposure assessment
- Cancer slope factors for radionuclides represent lifetime excess cancer risk per unit intake (risk/pCi)
- Slope factors are available for the ingestion, inhalation, and external exposure pathways
- Updated slope factors are available on EPA's web site

RISK CHARACTERIZATION

Risk is described as a probability of coming down with cancer over a lifetime as a result of chronic exposure to a contaminant

Risk can be expressed as a one in a million chance of cancer, as a 0.000001 chance, or in scientific notation 1×10^{-6}

In the Superfund program action is typically not warranted unless cumulative carcinogenic risks exceed 1×10^{-4}, unless there are adverse environmental impacts or ARARs are exceeded (USEPA, 1991b)

State regulatory agencies may have other programmatic guidance

RISK CHARACTERIZATION

In addition to a quantitative estimate of risk, an assessment should discuss what we know, what we don't know, and how it impacts the outcome(e.g., Does the model include the pathways of exposure and exposed populations at a site? What are the limitations of the data used to develop parameter inputs?

SUMMARY

- Development of preliminary remediation goals begins with the site conceptual model
- Equations and models should include all complete and significant exposure pathways identified in the site conceptual models
- In a point estimate approach, inputs to the parameters should represent an RME individual
- In addition to a quantitative estimate of risk, the uncertainty surrounding the risk estimate should be discussed

TYPES OF MODEL INPUTS

- Model: $Y = f(A,B,C,D)$
- A, B, C, and D are model inputs
- Each input can be either
  - Constant
  - Variable

BODY WEIGHT OF MEN
Summary Statistics

N = 1000

Mean = 69.7 kg

Stdev = 15.2 kg

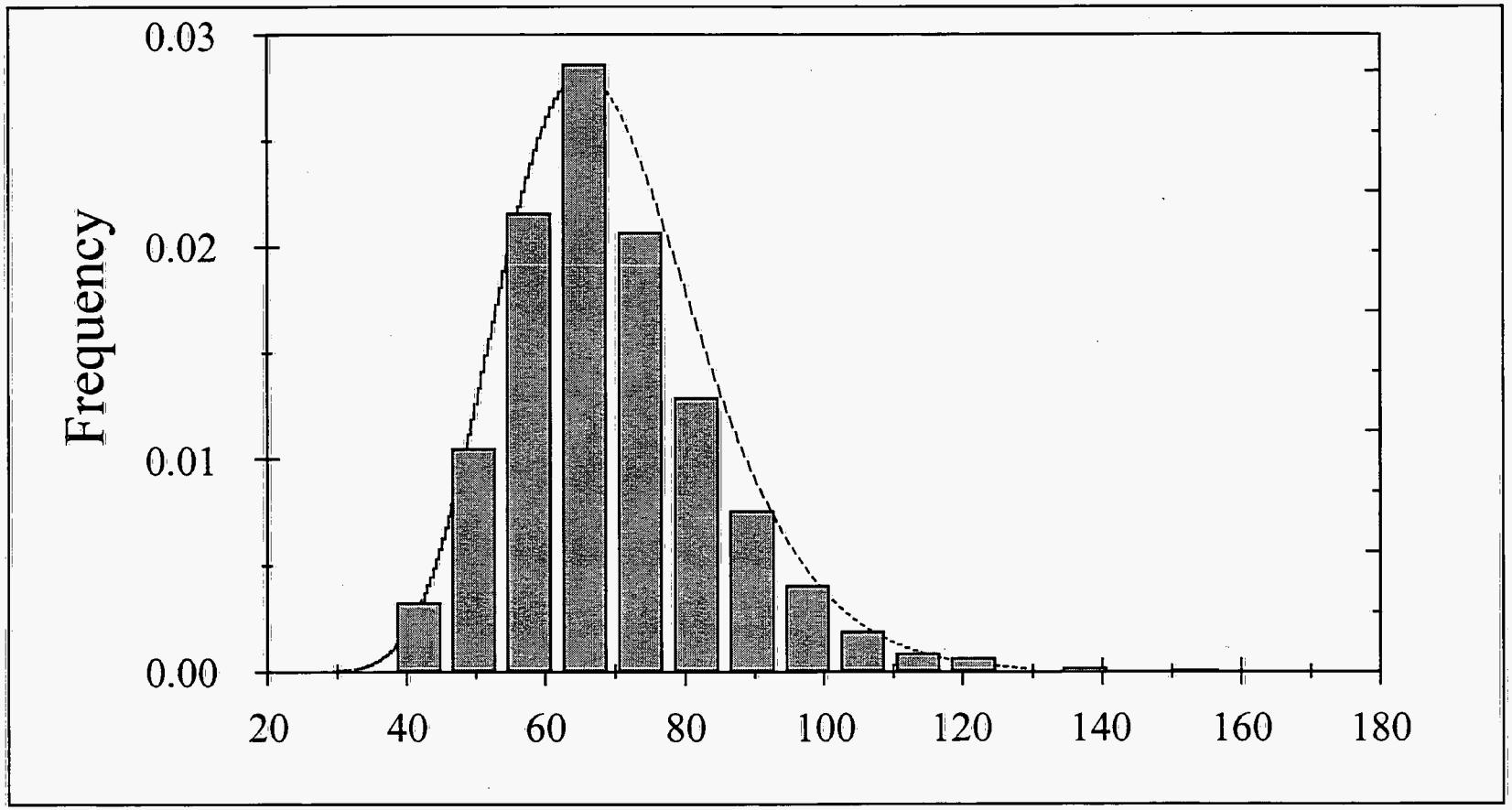
Min = 38 kg

Max = 157 kg

95th percentile = 98 kg

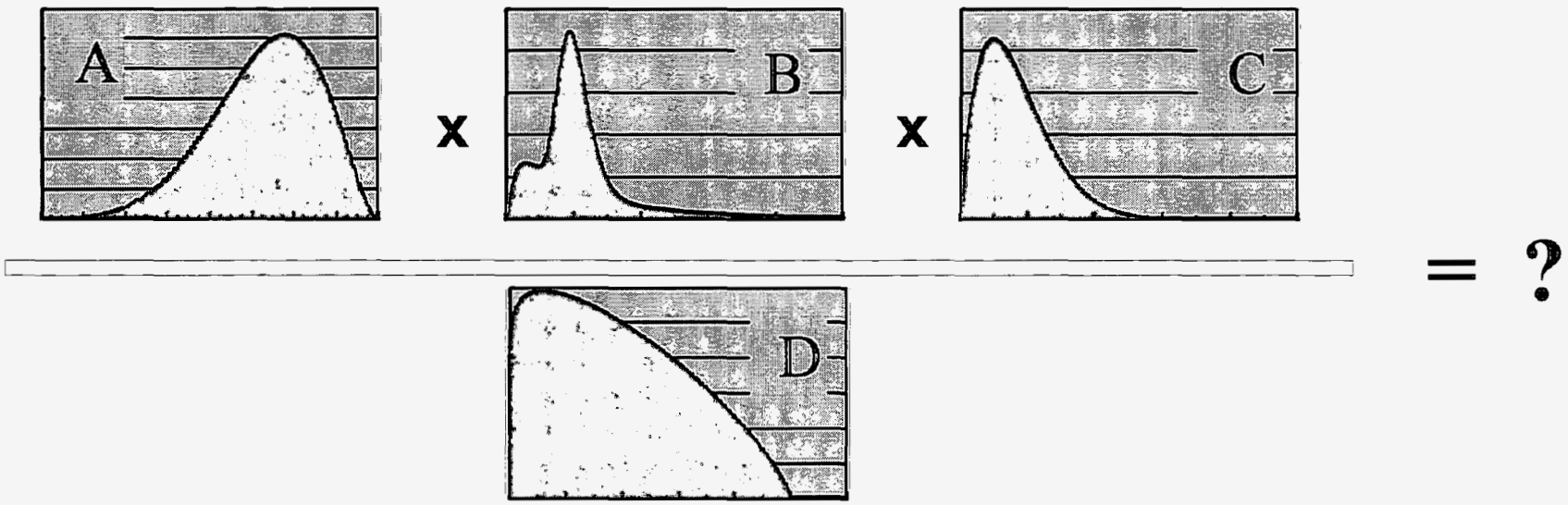
BODY WEIGHT OF MEN
Histogram

BODY WEIGHT OF MEN
Probability Density Function



Problem: How Do You Get the Result?

$$Y = \frac{A\,H\,B\,H\,C}{D}$$



Does the RME Risk exceed the Target Risk?

Advantages and Disadvantages of Point Estimate Approaches

Advantages	Disadvantages
Uses conservative assumptions to ensure protection of human health	Results in a single point estimate of risk, which may be viewed as a "bright line"
Useable as a screening method	Provides little insight regarding variability and uncertainty in risks
Employs consistent approach and standardized reporting methods	Provides fewer incentives for collecting better or more complete information
Easily understood and communicated	Addresses uncertainty in a qualitative manner
Requires less time to complete; not resource intensive	Uses less information on exposure and toxicity, which may lead to greater uncertainty
Based on standard equations and exposure assumptions	

POINT ESTIMATE APPROACH
Upper Bound (RME)

Assume target RME = 95th percentile
(this is a risk management choice)

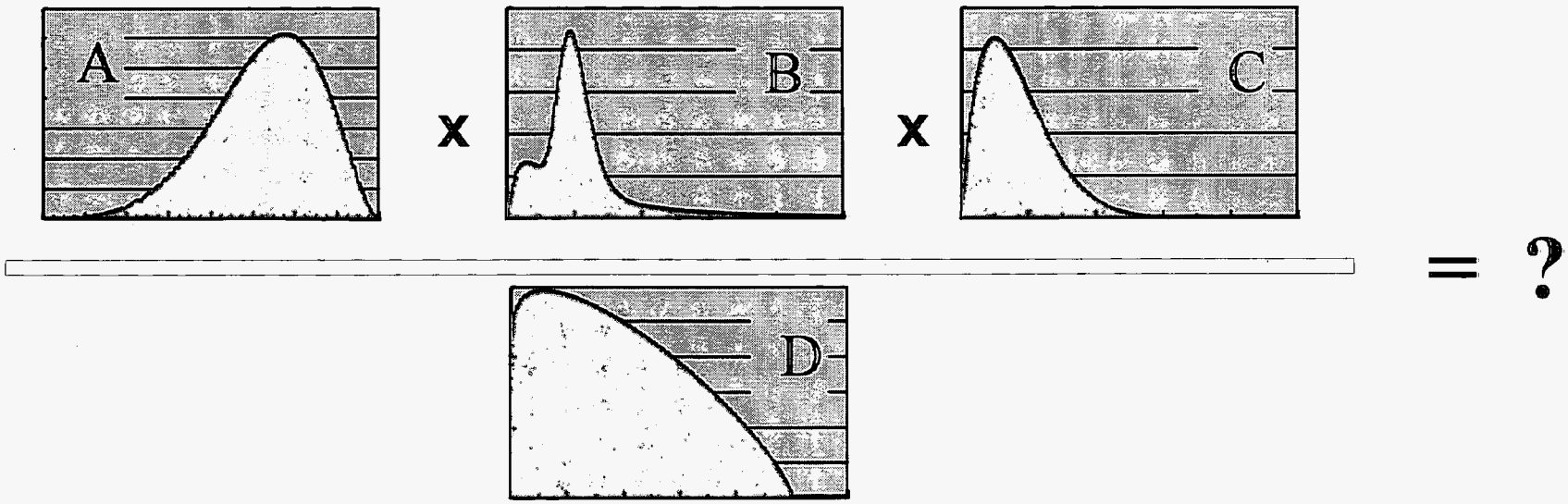
How do you calculate the 95th?

$$Y_{95} \neq f(A_{95}, B_{95}, C_{95}, D_{95})$$

$$Y_{95} \approx f(A_{mean}, B_{95}, C_{mean}, D_{95}) \quad (maybe)$$

Problem: How Do You Get the Result?

$$Y = \frac{A\,H\,B\,H\,C}{D}$$



Does the RME Risk exceed the Target Risk?

Advantages and Disadvantages of Probabilistic Approach

Can make more complete use of site data to characterize variability and uncertainty in risk	Sufficient information may be lacking on variability and uncertainty for important exposure variables
Quantitative data on the uncertainty in exposure variables can be modeled and may support statistical confidence limits on risk assessments	May require more time and resources to select and fit probability distributions
Sensitivity analysis can identify pathways and parameters which strongly influence the risk outcome	May convey false sense of accuracy unless the exposure models and distributions are representative of site conditions
Can identify data gaps for further evaluation/data collection	May introduce inconsistency in risk estimates across sites due to different choices of distributions and risk percentile

Soil Ingestion Rate (IR_{s_child}), Children (ages 1 - 7 years)

Brief Description of Methodology and Empirical Data

FECAL TRACER METHODOLOGY FOR ESTIMATING SOIL INGESTION RATE

Empirical estimates of soil ingestion rates (IR_{soil}) in children have been made by backcalculating the mass of soil and/or dust a subject would need to ingest to achieve a tracer element mass measured in collected excreta (i.e., feces and urine) (Calabrese et al., 1996). The general expression for the trace element ("tracer") mass balance is given by Equation 1:
where $[tracer]_{out}$ is the average daily tracer mass (□g) measured in feces and urine, $[tracer]_{in,\ non\text{-}soil}$ is the average daily tracer mass measured in non-soil ingesta (i.e., food, water, toothpaste, and medicines), and $[tracer]_{in,\ soil}$ is the estimated average daily tracer mass in ingested soil. Dividing all terms by the measured tracer concentration in soil (□g/g) yields an estimate of the average daily soil ingestion rate, as given by Equation 2:
EMPIRICAL DATA

Calabrese et al. (1997a) - Eight trace elements (Al, Si, Ti, Ce, Nd, La, Y, and Zr) were measured in a mass-balance study of 64 children ages 1 to 3 years over 7 consecutive days during September. Participants were selected from a stratified simple random sample of approximately 200 households from 6 geographic areas in and around Anaconda, MT. A single composite soil sample was collected from up to 3 outdoor play areas identified by parents as locations where subjects spent the most time. Similarly, indoor dust samples were vacuumed from floor surfaces that parents reported to be common play areas during the study. Duplicate food and fecal tracer element samples were collected for 448 and 339 subject-days, respectively. A total of 64 subject-week estimates of IR_{soil} were made; subject-day estimates of IR_{soil} have recently been published (Stanek and Calabrese, 1999; 2000; Schulz, 2001). Three trace elements (Ce, La, and Nd) were not used to estimate IR_{soil} because soil concentrations of these elements were found to vary by particle size (Calabrese et al., 1996). For each subject-week, a maximum of 5 estimates of IR_{soil} were made, each estimate corresponding to a unique trace element. Final soil ingestion estimates are based on soil particle size < 250 □m (as opposed to 2 mm).
Three seminal studies, briefly summarized below, used this mass-balance approach and were considered appropriate for quantifying variability and uncertainty in IR_{soil}. Pathways for non-soil/non-food intake of tracers (e.g., inhalation and dermal absorption) and excretion (e.g., sweat and hair) were not measured in these studies and are thought to be minor components of the overall tracer mass balance (Barnes, 1990).

Probability Distribution

The following probability distribution was developed for use in probabilistic risk and RSAL calculations:

IRs_child ~ Truncated Lognormal (47.5, 112, 0, 1000) mg/day

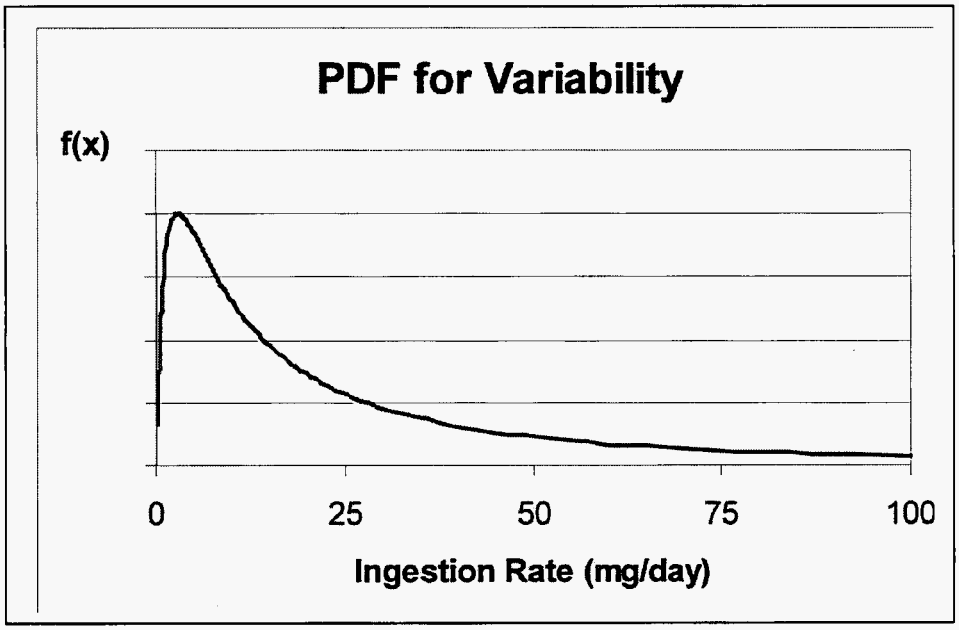
The truncated lognormal distribution is defined by four parameters:

- arithmetic mean 47.5 mg/day
- standard deviation 112 mg/day
- minimum 0 mg/day
- maximum 1000 mg/day

FINAL SELECTION OF PROBABILITY DISTRIBUTION FOR SOIL INGESTION RATE

The Anaconda data is generally considered to be more representative of the potentially exposed population of children at the Rocky Flats:

- a mass balance approach was used wherein tracers were measured going into the children (food, water, toothpaste, medicine) and going out of the children (feces, urine)
- tracers used to develop the soil estimates were selected based on minimizing outside source error, such as tracers with high concentrations in food)
- soil was sieved at 250 □m, a more representative size fraction for particle adherence to hands;
- the geography and climate of Anaconda is more representative of the geography and climate of Rocky Flats (as compared to Amherst, MA)



Summary Statistics	IRsd (mg/day)
mean	47.5
stdev	112
50th %ile	18.5
75th %ile	46.8
90th %ile	107.5
95th %ile	177.0
95.8th %ile	200.0
99th %ile	450.7
Max	1000

Figure A.1. Probability density function (PDF) and cumulative distribution function (CDF) views of the probability distribution for child soil ingestion rate (mg/day).

WIND TUNNEL TECHNICAL REVIEW -

A POSSIBLE APPROACH

Reed Hodgin

Objectives for the Wind Tunnel Review

- Determine if the wind tunnel technology is appropriate for developing wind resuspension values for use in setting the RSAL

- Determine if the results of the wind tunnel experiments are being used appropriately in the RSAL modeling

NOT Just Another Peer Review

- Will involve examining the technical basis for the wind tunnel methodology and its application

- Thus a technical review of a methodology rather than a peer review of a report

A Possible Approach

- Focus Group (or subgroup) selects a panel of 3 - 4 technical reviewers
- Background materials are submitted to review panel for preparation

A Possible Approach

- Review panel is convened along with Dr. Cowherd and RSAL Working Group experts for 2-day review session in Denver
  - (what if Mr. Rau or other international expert is selected?)

- Panel holds discussions with each other and with Dr. Cowherd and RSAL Working Group experts on Day 1

A Possible Approach

- Panel draws conclusions on evening of Day 1

- Panel completes deliberations and writes findings (including majority / minority reports) on Day 2

A Possible Approach

- Panel briefs the Focus Group and interested community on evening of Day 2

26/26

A Caution

- The Wind Tunnel Technical Review is NOT funded by anyone at this time

- Could this effort drive the schedule for establishing the RSAL? Could this affect any cleanup work schedules?