AlphaTRAC
Meeting the Challenge of the Atmosphere

January 24, 2002

Dear Stakeholder:

This correspondence transmits copies of handouts and presentations from the December 12, 2001 RFCA Focus Group meeting (Attachment A), including:

- Memorandum from Jeremy Karpatkin of the U.S. Department of Energy (DOE) to the Focus Group regarding the Draft Syllabus and Agenda for Focus Group discussions on end state
- Site Critical Path, Baseline November FY02 Status
- Budget Breakout, and
- Environmental Restoration Budget Breakout.

Attachment B is the handouts and presentations from the January 12, 2002 RFCA Focus Group meeting including:

- Original Process Waste Line (OPWL) Map and Summary
- 1999 Kriging map

Attachment C is the second peer review for the RSALs Task 3 report.

Attachment D is the RSALs Working Group notes for the January 3, 10, and 17, 2002 meetings.

Attachment E is the RSALs Task 4 correspondence between Mary Harlow of the City of Westminster and DOE, the Colorado Department of Public Health and Environment, and the U.S. Environmental Protection Agency.

Sincerely,

C. Reed Hodgin, CCM
Facilitator / Process Manager

1/59

AlphaTRAC, Inc. Sheridan Park 8, Suite 120 8670 Wolff Court Westminster, CO 80031-3692 303 428-5670 Fax: 303 428-5930 info@alphatrac.com

RFCA Stakeholder Focus Group
Attachment A

Title:	1/12/02 RFCA Focus Group meeting handouts and presentations
Date:	January 12, 2002
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

2

December 12, 2001

TO: RFCA Focus Group
FROM: Jeremy Karpatkin
RE: Draft Syllabus and Agenda for Focus Group discussions on end state

Below is a very rough draft proposal for how to organize ourselves over the next several meetings. I put it forward as a first draft; I welcome feedback. For the present, this proposal is only my personal perspective and does not necessarily have the endorsement of DOE or the other RFCA parties. At the end of the syllabus is a set of miscellaneous notes that apply to the overall course of discussions.

I look forward to reviewing this with everyone in more detail at the 12-12 meeting.

Thanks.

Meeting 1 -- Overview, schedule and choices

Timeline
- FY 2002 ER scope
- Overall Sequence of Cleanup 02-06
- When RSAL and End State discussions must close

Funding Overview
- Overall Closure Budget and core project elements
- Overall funding and scope of ER, through closure

Matrix Overview
- Main Options that have been discussed with community to date, including:
  - surface remediation
  - subsurface remediation
  - water quality protection
  - stewardship

Each option will include baseline assumptions and cost difference (plus or minus) compared to baseline

GOAL OF MEETING:
- Understand schedule and cost bounds of discussion
- Get all parties up to speed on options
- Begin brainstorming additional options

INFO NEEDED:
- Budget Info
- Matrix
- ER timeline

Meeting 2: Detailed Discussion of surface contamination and options

-- where is surface contamination
-- where is uncertainty
-- baseline assumptions for cleanup
-- costs and other impacts of increments of removal (for 903 pad)
-- Monitored Retrievable storage in B 371

GOAL of Meeting: understand scope of surface contamination
understand options
feedback on options
additional info needed on options
generate and discuss additional options

INFO Needed:
B 371 diagrams that show gw and sub-basement
IHSS map and list
Kriging map
table that shows impacts of additional increments of cleanup on 903 pad

Meeting 3: Subsurface Contamination

-- Original Process Waste Lines
-- Under Building Contamination
-- Ash Pits
-- T 7
-- Options
-- risk based approach site wide
-- modified pathway approach to subsurface
-- no action on T7 and Ash Pits
-- hot spot removal on T7 and Ash pits

GOALS of meeting:
Understand options
Feedback on options
Generate additional options
Info needs on options

INFO Needed:

OPWL package (map and charts)
GW monitor stations
GW plumes and barriers
B 771 Data
Other data from subsurface

Info on T7
Info on Ash Pits

Meeting 4: Surface Water Protection

-- current regulatory compliance regime
--post closure regime
-- baseline assumptions
-- Options for bridging the apparent gap between the baseline and compliance:
    -- where to measure
    -- when to measure
    -- what to measure
    -- how to measure
    -- modifying the standard

GOALS of the meeting:

understand the "problem"
understand options
identify further info needs
react to the options
generate further options

Info needed:

map of drainages, ponds, PoE's, PoCs.
RFCA language on post closure requirements
Technical basis for .15 standard
summary of elevated readings since 1996

Meeting 5 Stewardship

-- monitoring and maintenance
-- funding
-- 5 year review -- frequency, intensity, public participation
-- technology
-- re-openers

GOAL of meeting:

understand options
community preferences on options
other options

Meeting 6: Packages of options and draft conceptual agreement

-- agencies and community come prepared with specific packages of options to for achieving end state

-- open discussion of packages of options

GOAL of meeting: *reduce number of packages down to reasonable number*
identify community preferences
begin reviewing draft conceptual agreement and RFCA changes

INFO Needed: draft RFCA changes
draft conceptual agreement language
options packages from agencies and community

Meeting 7: Conceptual Agreement

-- review draft RFCA changes and conceptual agreement

-- close on options (either reach agreement or realize we are as close as we are going to get.)

INFO Needed: same as above

General Notes:

1. Issues Not Covered

solar ponds
original landfill
characterization requirements
specifics of HOW we will reach goals discussed (e.g., how active will ponds be managed to achieve any specified enforcement regime.)

2. For all meetings

community ideas for options should be circulated in advance of meeting
info needed for each meeting should be identified in advance and circulated in advance (everyone will see the options at meeting one or before, so they ought to know what info they need well in advance of the meeting where the options will be discussed in detail)

3. Keep the goal in mind

conceptual agreement
modifications to RFCA
on a tight schedule
within constrained funding

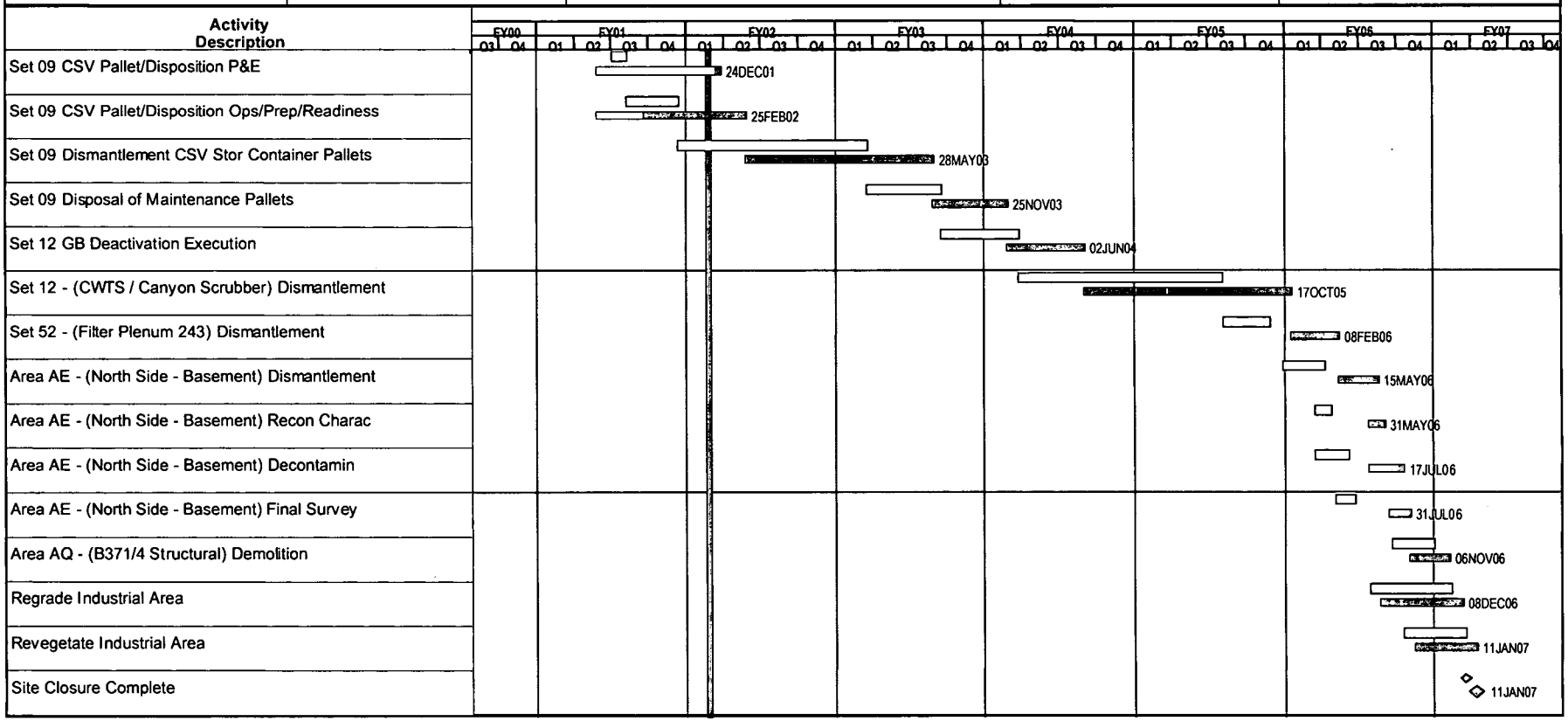
4. A key issue -- how speciifc? How general?

all participants need to think hard about how specific or general this can or needs to be at the end.

Some small group - ideally consisting of some agency people and non agency people -- need to start writing up a very rough draft conceptual agreement and RFCA modification early, just so everyone has some sense of what it looks like. This is less for the content and more to try to capture the kinds of issues and level of detail. Obviously, the specifics cannot be known with certainty until the discussions are well underway, or perhaps near completion.

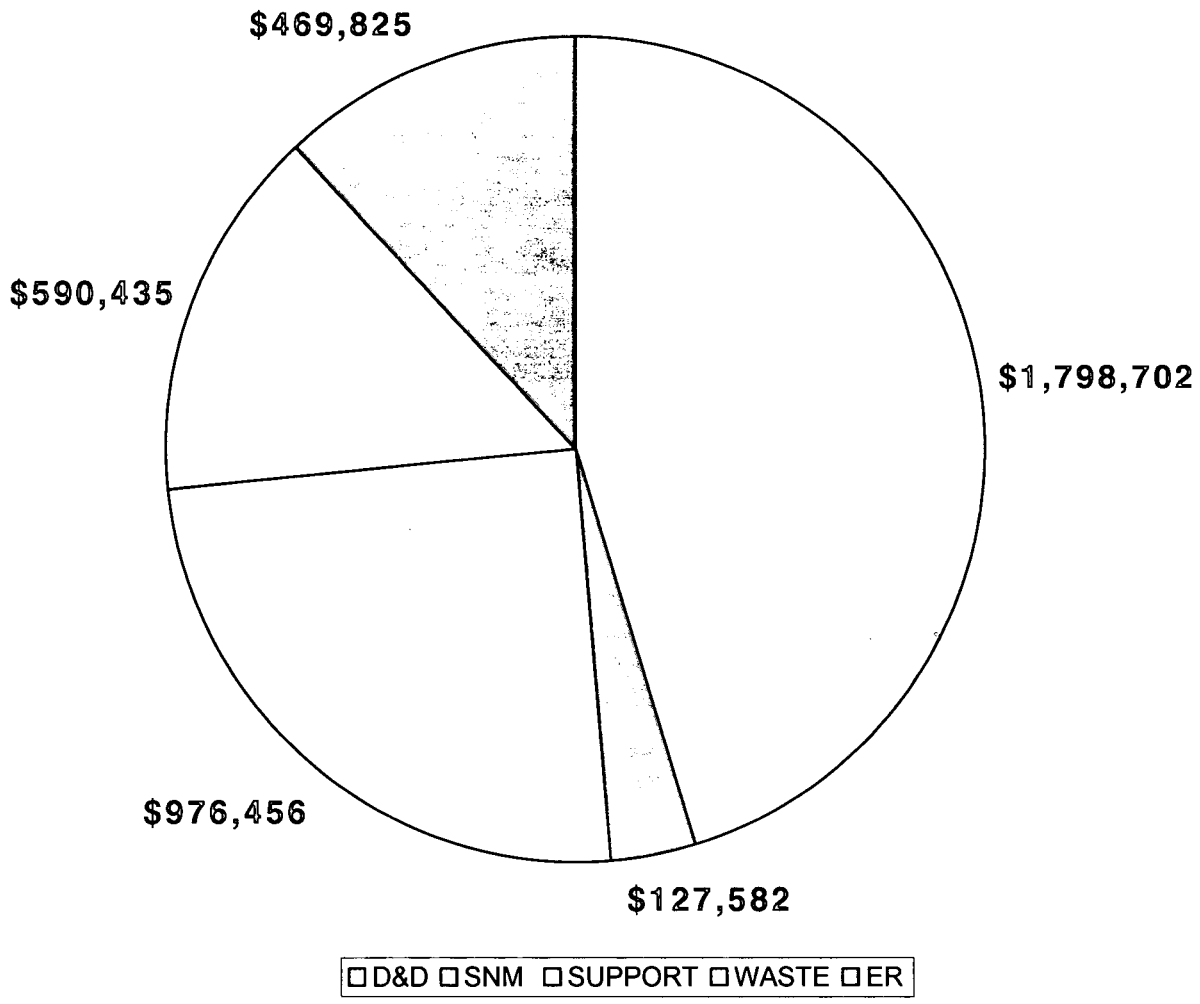
Site Critical Path - Baseline November FY02 Status

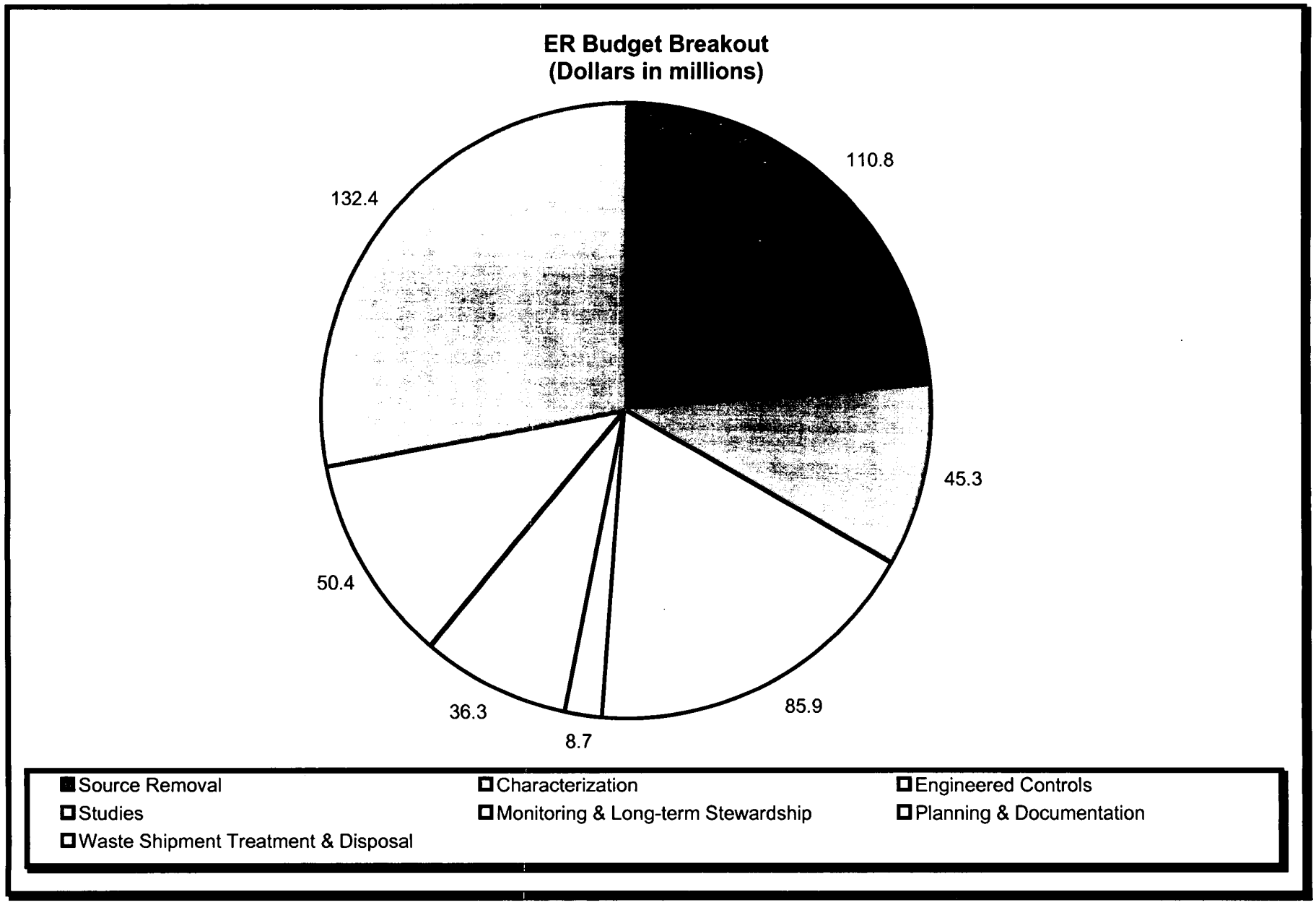
Data Date 26NOV01 Run Date 03DEC01 14:16 Sheet 1 of 1 C202	CPB CPB Status Progress Bar	CLOSURE PROJECT BASELINE STATUS Project Critical Path	KAISER-HILL COMPANY



KAISER-HILL COMPANY, LLC

Rocky Flats Closure Project
Budget Break-Out
($ in thousands)




ER Budget Breakout
(Dollars in millions)
110.8
45.3
85.9
8.7
36.3
50.4
132.4
Source Removal
Characterization
Engineered Controls
Studies
Monitoring & Long-term Stewardship
Planning & Documentation
Waste Shipment Treatment & Disposal

RFCA Stakeholder Focus Group
Attachment B

Title:	1/12/02 RFCA Focus Group meeting handouts and presentations
Date:	January 12, 2002
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

11

RFCA Stakeholder Focus Group
Attachment C

Title:	Second Peer Review for the RSALs Task 3 report
Date:	January 12, 2002
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

REVIEW OF DRAFT TASK 3 REPORTS: CALCULATION OF SURFACE RADIONUCLIDE SOIL ACTION LEVELS FOR PLUTONIUM AND AMERICIUM AND APPENDICES

This document is a review of the interagency Draft Task 3 Report: Calculation of Surface Radionuclide Soil Action Levels for Plutonium and Americium and Appendices, both prepared jointly by the U.S. EPA, U.S. DOE, and Colorado Department of Health and Environment. The documents are dated October 2001.

Primary to this review is an evaluation of the technical merit of the material presented, in particular, methods and parameter values. A secondary consideration was the presentation of the material. In addition, this review specifically addresses 8 questions as part of the Overall Evaluation, and 11 specific questions, all prepared by the Rocky Flats Cleanup Agreement (RFCA) Stakeholders Focus Group. The document from which the questions are drawn is dated 11/08/01 (Revision 0).

OVERALL SUMMARY OF REVIEW

In this section, I summarize the primary findings of my review, however, I encourage the Working Group and Focus Group to read and consider all the comments I provide as there is much more detail, as well as a number of lesser points, discussed in the rest of the review which follows this section.

There are two primary problems in my view. One is a problem with the method used for determining RSALs: the backward calculation method ignores the fact that the dose and risk are correlated with the input variables. When the backward calculation is performed, the correlations are lost (i.e., they are generally ignored as in this case). The failure of the backward calculation has been discussed at some length in the risk assessment literature and its weaknesses should have been recognized by the working group. The proper calculation is the forward calculation which inputs a distribution of soil concentrations and appropriately uses correlations, thereby estimating a distribution of risks. The quantile of the risk distribution which is determined to adequately protect the population (e.g., 95th%) can be related to a particular range of soil concentrations that produced it.

Secondly, there is an overarching problem of the RSAL assessment and that is the inadequate statement of purpose of the probabilistic analysis. *[Identifying phrase removed],* I understand that probabilistic analyses can determine a range of outcomes, but the definition must go beyond that because the distributions have to be determined in a consistent manner with the overall purpose. Is the purpose to determine the range of expected doses and risks in a population (for the scenario) and from that determine the range of soil concentrations that might result in that level of risk? How is uncertainty incorporated (or not) into the scenarios? For scenarios that might include only a single person (such as a resident refuge worker), what do the distributions represent? Uncertainty about mean values? Obviously, variability is not an issue since there might only be a single refuge worker. Lack of clarity on the assessment endpoint is a common problem but it is one that always requires resolution before credible results can be determined.

17

Another significant problem is the interjection of bias by the working group by refusing to assign distributions for variables with sparse data and using, instead, point estimates. Despite claims in the text that bias was avoided, assigning a point estimate to a variable (or uncertain) parameter expresses, by definition, the bias of those assigning the point value.

Another major problem in my view is the unconvincing treatment of variability ***or*** uncertainty. I say "or", because the discussion (Section VI and Table VI-1 through VI-5) is so disastrously confusing, that I have no idea what most of the input distributions and certainly the output distributions, actually represent.

There are a range of other moderately serious problems. For example, the cancer risk factors used (taken in principle from Federal Guidance 13) are for mixed-age population, that is, they are averaged over a distribution of ages. How these risk factors can be used for scenarios where the population is only adult is not apparent to me at all.

Finally, the quality of the presentation material was a great disappointment to me as a reader and reviewer. Symbols in equations used wrong fonts, references in the text to tables were inconsistent with the table headings, tables were presented in a very difficult to read form, etc. The quality of the presentation was much poorer than one would expect for an important function such as external peer review, particularly when considering how long the RSAL activities have been underway. Some important parameter values were not presented at all (at least I could not find them), in particular, the ingestion risk factors discussed on page 46. That made it impossible for me to try and reproduce the calculations of the RSALs. Finally, the reference list is an embarrassing mixture of citation styles, some are listed according the first letter of the first author's first names, some are listed according the first letter of the first author's last name, etc. I would be ashamed of this.

Given the various technical and conceptual problems (aside from a poor presentation), can I determine if the computed RSAL values are appropriate, legitimate, or even useful for the intended purpose? No, I cannot. There is no way to disentangle improper modeling (lack of correlations), mixing uncertainty and variability, and assigning biased point estimates in lieu of distributions. My experience tells me that such failures generally lead to overly conservative conclusions (i.e., too restrictive), but I cannot determine the degree of bias in the findings, nor the direction of the bias.

I recommend the Working Group add some expertise to their group and compute new values of the RSALs in a way that is state-of-the-art and credible to the entire scientific community. Later in the text I mention some names in the field that have published on the subject of the weakness of the backward calculation, but the only company that I know with a complete understanding of making probabilistic risk calculations is SENES Oak Ridge (I am not associated in any way with that company and I believe them to be much more knowledgeable than RAC in this instance). The working group should consider improving this analysis by consultation with some proven experts in modeling and risk analysis. The bottom line, in my view, is that this work in its present form and with quality of presentation, is not convincing or adequately defensible. If it

18

were to be submitted for publication in a scientific journal (even with an improvement in style), it would be rejected (assuming knowledgeable and competent reviewers).

Below are my responses to specific questions asked by the Focus Group.

Have the dose and risk models been set up and used properly for developing RSAL values?

I found an equation for the risk-based RSAL on p. 19 (it is not numbered, but should be). I did not find the parallel equation for a dose-based RSAL. Why not?

The method of computing the risk-based RSAL (p. 19) from an inverted dose or risk equation seems intuitively correct, and it has been used before. However, that method is actually quite problematic and is not the correct way to solve for the RSAL; nor is it state-of-the-art in the risk assessment literature. The basic problem with the backward calculation is as follows. The endpoint (either dose or risk) is correlated with many of the input variables and to correctly determine that endpoint, the correlations between input variables must be included. However, in the back calculation, the endpoint (i.e., the soil concentration) is not correlated with the inputs and thus it is likely (though not correct) that the analyst will ignore (that is, leave out) the correlations between parameters. For this reason, the result is of the backward calculation is not reliable. The working group should have been more familiar with developments over the last few years in the risk assessment field. In particular, some of the publications of Cullen and Frey, Burmaster, and Ferson address the problems of the backward calculation.

Another problem that seems apparent to me is that the cancer risk factors used are not appropriate to persons of specific ages as is the case for some of the scenarios. According to p. 46, the risk factors from the HEAST tables are dependent on Federal Guidance Report 13 (FGR 13). However, the risk factors in FGR13 are averaged over the age distribution of the American population. Hence, it is inappropriate to use them to represent the risk to a particular aged person or even to a range of ages if the range is much less than that of the overall population. Given that the risk factors do not pertain specifically to either children or adults group alone, it is not clear (at least as presented in the Draft report) how the RSALs for child-based or adult-based scenarios could possibly be determined correctly. If there is legitimate explanation, e.g., the age-averaged risk factors are used to "follow" a population of children through all ages, then it has not been explained satisfactorily. Even with that explanation, it is unclear how FGR 13 risk factors could pertain only to scenarios for adults.

Have the appropriate model input parameters been considered in conducting the dose and risk modeling for RSAL determination?

This question is not simple as it potentially pertains to moderately large set of parameter values. However, if the correct pathways of exposure have been considered, and I think they have been, it is likely that the correct (or at least, suitable) parameters have been considered. The issue of whether appropriate values for each parameter have been selected, however, is much more difficult to evaluate. I discuss my views on chosen parameter values in a later question.

Is the sensitivity analysis appropriate for determining which model input parameters are most important to the RSAL modeling?

- The authors of the Task 3 report used the sensitivity analysis capabilities of *Crystal Ball* software to conduct their sensitivity analyses. That software is proven and is well designed. It is an appropriate tool for the task at hand with the usual caveat: the usefulness or appropriateness of the results of calculations depends on the usefulness and/or appropriateness of the model and the input data used.

  In a model that only has parameters multiplied together, sensitivity calculations are intuitive. Those parameters, which are assigned the widest range of possible values, will most significantly affect the outcome. With this understanding, the Stakeholders Focus Group and other public reviewers can judge the sensitivity findings somewhat for themselves. Admittedly, the situation become more complex, and less intuitive when parameters are embedded in mathematical functions, such as exponentials, powers, roots, etc., or when there are additive components of the equation.

  The working group found the most sensitive parameters for the inhalation pathway (Fig. IV-2) to be: 1) Average annual wind speed, 2) Inhalation rate, 3) Mass loading, 4) Indoor dust inhalation shielding factor, and 5) Indoor time fraction. These seem reasonable, notwithstanding my comments on mass loading discussed later on this page.

  The working group found the most sensitive parameters for ingestion pathway (Fig. IV-3) to be: 1) Soil ingestion rate, 2) Indoor time fraction, 3) Thickness of contaminated zone, and 4) Outdoor time fraction (the converse of #2). These seem reasonable.

  The working group found the most sensitive parameters for all pathways (Fig. IV-5) combined to be: 1) Indoor time fraction, 2) Soil ingestion rate, 3) Thickness of contaminated zone, and 4) Depth of soil mixing layer. Again, these seem reasonable.

  Note: The text refers to Fig. IV-4 (2nd paragraph, p. 27), but the figure is labeled Fig. IV-5.

  I agree with the author's comments (top of p. 27), that the more useful metric of model sensitivity is $S_{max-min}$, as it uses the full range of the probability distribution.

- I found a troubling statement on the 2nd paragraph of p. 27: "The working group added 'mass loading for inhalation' to this most sensitive list, because of the great interest in the post-fire scenarios, which could not be realistically tested using the sensitivity analysis protocols defined by the RESRAD code." It is not apparent to me that "interest" has any bearing whatsoever, on mathematical sensitivity. I do not endorse ad hoc decisions of this sort for the following reason. This analysis is technical and in order to be accepted by the public and scientist alike, it needs to be based on objective and sound scientific principles. Group decisions based on "interest" will, by definition, be an exhibit of the group's bias and not be objective.

Moreover, the Working Group could have actually estimated a sensitivity value, albeit one that might be difficult to compare with the other results, by manually inputting different values (particularly the end points of the distribution) of the "mass loading for inhalation" into the RESRAD code and then manually comparing the changes in the output as result of changes in the input. Such a method would not be entirely satisfying since single parameter sensitivity analyses are not directly comparable to the analyses of Crystal Ball when all parameters vary simultaneously. In any case, my argument still stands that "interest" only expresses concern of the end users; it has nothing to do with the mathematical response of the model.

- Finally, it is important to mention that I do not know how the sensitivity calculations may have been adversely affected by the problems I have discussed with the backward calculation.

Are the choices of which model input parameters to treat with probability distributions and which to treat as single values appropriate?

This question pertains primarily to Section IV-4 of the report. This question can first be answered in a general, but succinct, manner: Parameters that are uncertain with respect to the assessment question being asked (e.g. What is the dose or what is the risk to an individual?) should be treated by probability distributions. Likewise, parameters that are variable with respect to the assessment question (for example: What is the distribution of doses among a population) should be treated by probability distributions.

An interesting idea was implemented by the Working Group as described on the bottom of p. 31. The text describes that the Working Group chose to attempt to assign probability distributions for those parameters identified as strongly influencing the calculation of the RSAL. However, that seems to be act of redundancy: To estimate sensitivity, you have to assign probability distributions; hence, why must they be re-assigned *after* the sensitivity analysis identifies the variable as being influential? I assume that I have misinterpreted the text, however, this is but one example of lack of clarity in the written document. Is it possible that the Working Group meant that the influential variables would be studied further to improve the quality of their probability distributions? If so, that almost seems reasonable. But after further consideration, one has to ask, what is the impact on the sensitivity analyses of crudely estimated distributions. Either way, I think the Report has to communicate better on this point.

Have appropriate values been selected for the model input parameters (both single valued) and probability distributions)? This evaluation should consider all of the scenarios treated in the report? It should also consider the emphasis placed on the upper end (~95th percentile) of the resulting RSAL distribution?

1) I will discuss the last question first, i.e., about the 95th percentile. The choice of the preferred percentile from the output distribution is really function of the assessment question and how the model is setup. As I understand it, the regulatory structure calls for the assessment to determine the soil concentration that should not be exceeded to protect the "reasonably maximally exposed

individual." Whether one agrees with that kind of risk management is a personal decision and not one to be discussed here. More important is the question of what quantile (percentile) of the output distribution refers to the imaginary "reasonably maximally exposed individual"? Is it the 75th%, 90th% 95th%, 99th%, 99.5th % ? That question cannot be answered with certainty but it can be stated with certainty that the answer depends on your belief in what behaviors describe the "reasonably maximally exposed individual" and on what input distributions you decide upon. Hence, the emphasis put upon the 95th% is one of convenience and one of convention. I cannot dispute the choice of the 95th%, but neither could I dispute the choice of the 85th% or any other percentile. In general, the higher percentile chosen, the more conservative (i.e., restrictive) will be the conclusions reached about permissible soil concentrations. Similarly, the higher the percentile chosen, the greater the cost to cleanup (sometimes rising exponentially with linear decrements in the allowed soil concentration) and the more destructive (to the environment) are the remediation options. Sometimes, the best choice is not to destroy the environment by extreme remediation measures, but to isolate the source of contamination from the public. These are strictly policy decisions and are not my charge to discuss.

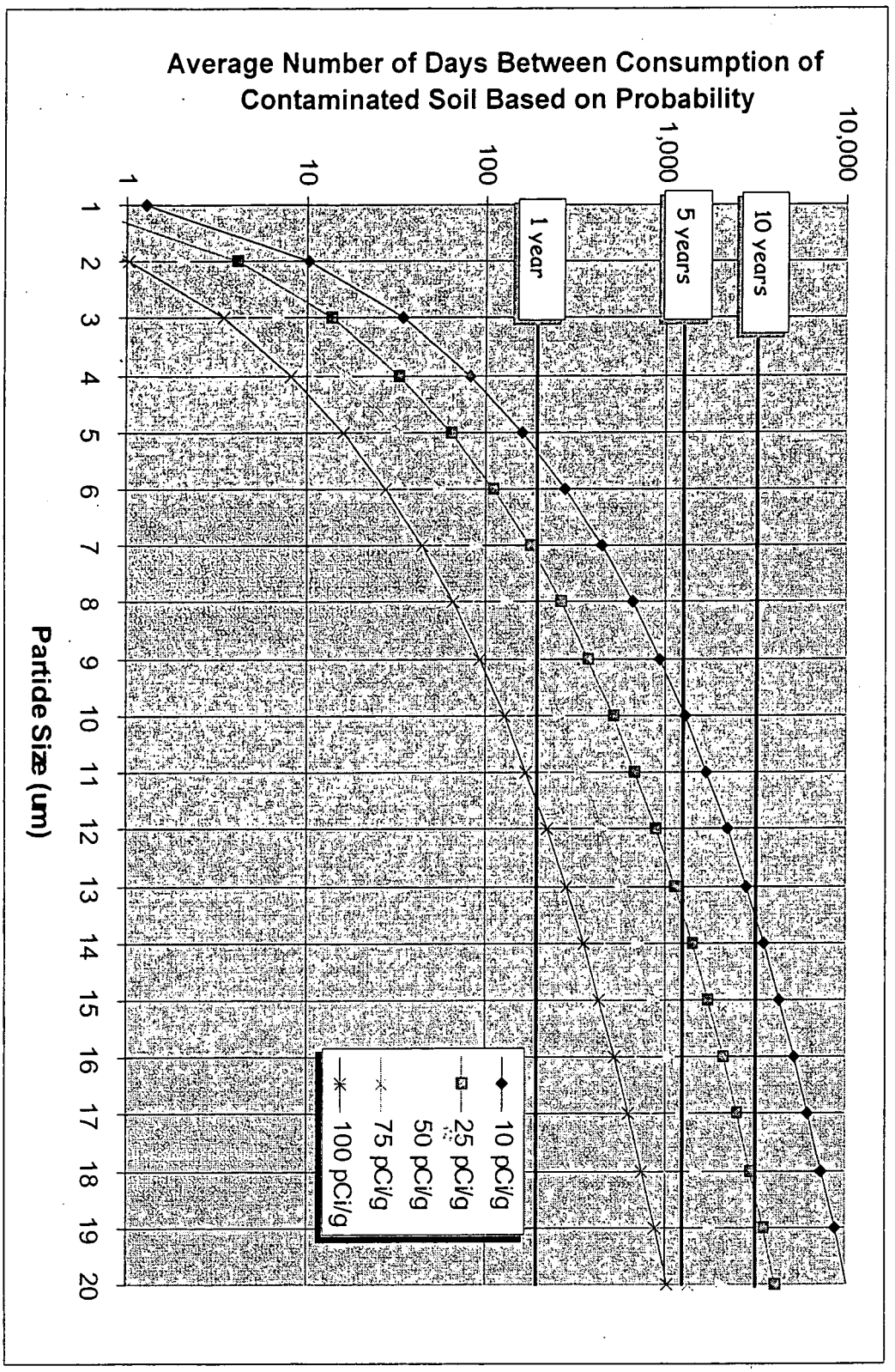
2) A point discussed on p. 35 is of concern to me. It states: "A management decision was made to not develop probabilistic RSALs for the open space and office worker scenarios. These RSALS are based on point approach only..." As a reviewer, I feel compelled to ask: What was the basis for this decision? Why was there not more explanation given for the basis of that decision? Does the decision produce RSAL values for those 2 scenarios that are compatible (in terms of scientific credibility and in terms of equal protection from unnecessary risk) with the probabilistically determined RSAL values? I would think the last of the above questions I posed would be difficult to answer. For that reason, the "management decision" may not have been a wise one. It is quite difficult to support a decision without any evidence. In this case, to acquire the evidence, one would have to complete the probabilistic RSAL calculation. Of course, that would eliminate the need to answer the question or to further consider doing the point estimate RSAL calculations.

3) In the following bullet items, I note a few instances where I think greater thought should be given to the chosen values of parameters. However, I have not undertaken a totally comprehensive review of all chosen parameter values for the following reason. The general problems with the backward calculation method used to determine these RSALs (as I discuss in my opening remarks) strongly calls into question the validity of the calculations. The issue of the choice of individual parameter values is of secondary importance.

- Sensitivity calculations have indicated that the soil ingestion rate is very influential to the determination of the RSAL. But little, or no attention, has been give to whether the contamination in soil is uniform enough (on a micro-scale) to be adequately described by a single concentration value. Certainly if one samples soil in large enough volumes, a stable mean value can be determined among replicate volumes (at least within a small area where the average does not significantly diminish due to increasing distance from the source). However, analysis of soil for Pu is rarely made on samples of large mass. Typically, only a few grams of soil are analyzed because the soil must be dissolved in acid to allow for radiochemical separation and preparation of the sample to be measured by alpha spectrometry. One exception was the work of Webb et al. (1997) in which

sample masses of 50 grams were analyzed for plutonium. The problem is that when soil is analyzed for plutonium, little or no information is available on the uniformity of contamination among aliquots equal in mass to the daily intake by people. In other words, what is the uniformity of replicate 50 mg samples? To determine that would require many replicate analyses which would have to be repeated at different distances (because the particle sizes of Pu reaching different distances as a result of wind dispersion would differ) and hence, would be cost-prohibitive. One can argue that if soil is consumed over enough days, only the average contamination level is of interest and the differences in replicate 50 mg samples is inconsequential. That is true unless the inhomogeneity is so great that one might have an intake on a single day equal to a year of ingesting soil uniformly contaminated.

Soil contaminated with actinides is always, or very nearly so, inhomogeneously contaminated. This is primarily a result of the insoluble nature of plutonium and as a result of the sources of contamination (fires, milling fragments, etc.). The lower the soil concentration, and the large the average particle size, the greater the inhomogeneity. If there are moderately large particles of Pu present in the soil (e.g., a few microns in size to say 20 microns), the contamination of replicate soil aliquots of 50 mg will vary widely. Here are some examples. If the average Pu particle size is 5 microns (equal to ~80 pCi) and the average concentration (based on at least 50 grams) is 25 pCi/g, then only one out of about 64 replicate aliquots of soil (each equal to 50 mg) would have any contamination. That means that by chance, one would consume contaminated soil only once in 64 days. The situation becomes more extreme for larger particles or for lower soil concentrations. If the average concentration is 10 pCi/g, then contaminated soil would only be consumed by chance once in every 159 days. If the particle size is 10 micron (637 pCi) and the average contamination equal to 25 pCi/g, one would consume contaminated soil by chance only once in 510 days. These relationships are summarized in the following graphic.


Average Number of Days Between Consumption of Contaminated Soil Based on Probability
10,000
1,000
100
10
1
10 years
5 years
1 year
10 pCi/g
25 pCi/g
50 pCi/g
75 pCi/g
100 pCi/g
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Partide Size (um)

Does this make a difference to the long-term risk calculations? The answer to the above question depends on a number of factors. First, the surface to volume ratio for larger particles would be less compared to small particles; hence, a smaller percentage of the radioactivity from larger particles would be solubilized in the gut compared to smaller particles and would result in a smaller proportion of the ingested radioactivity being absorbed into the blood stream. Current ICRP dose factors do not consider the differences in solubility of small versus large particles, but all studies on the solubility kinetics of particles indicate that solubility is substantially reduced with increasing particle size. Any particles, if ingested, would only have about 24 hours (as they pass through the digestive system) to be dissolved and larger particles, would contribute a smaller proportion of their total activity by virtue of their lower surface to volume ratio. Second, the risk to an individual changes (generally decreases) as their age increases, so longer times between successive intakes (in the extreme case of large particles) would probably result in less risk. This discussion is provided not to make the case that the calculations were wrong, but to give an indication that some of the more subtle considerations have yet to be made. This is one area that requires more data and further consideration if risk calculations are intended to be realistic.

- The disagreement between governmental agencies (p. 48 of the draft document with regard to the proper absorption category (M or S) for dose conversion factors is an example where the specification of uncertainty could have been (and should have been) used to characterize the degree of belief held the different agencies.

- Page 50: It is stated that the americium:plutonium activity ratio was determined to be 0.1527 (expressed to 4 significant digits!). The authors ought to have reviewed this ratio as determined by the other investigators, expressed the ratio in an appropriate number of significant digits, and estimated the confidence interval on the mean value of the ratio. For comparison, Hulse et al. (1999) gives a value of 0.18 for on-site locations and 0.36 for off-site locations. Page 281 of Hulse et al. appropriately reviews the determinations of the Am:Pu ratio by various investigators.

- The decision to use a building shielding factor of 0.4 rather than 0.8 (page 4 of Appendices) is a good decision in my view. The effectiveness of buildings to shield gamma radiation may be even greater depending on the size and construction of the building and where one assumes the receptor is located in the building.

- The discussion of page 7 (Appendices) stating that the wind-tunnel measurements indicate the erosion potential would decrease quickly after a fire is reasonable, I believe. The initial assumptions in an earlier evaluation of the RSALs (by a contractor) ignored that likelihood. Furthermore, the likelihood of drought occurring about 20% of the time (p. 9, Appendices) seems like a realistic assumption.

- Assumptions regarding the soil ingestion rate occupied much space in the text and given the weaknesses in the data, I didn't think such a lengthy discussion is needed. There are other comprehensive evaluations in the literature (see for example, NCRP Report 129, 1999). However, the values chosen (p. 13 Appendices) for children, particularly the estimates of central tendency, seem to be quite reasonable given the available data.

However, I am skeptical of how long the maximum consumption value (1000 mg/d) might actually be sustained by a child. Consumption of that level for any extended duration would likely lead to gastric distress, hence, values that high seem questionable. Page 21 refers to Table 1, though I cannot find a Table 1 (more evidence of poor document quality control).

The soil ingestion rate chosen for adults does not seem reasonable, primarily because it is a single value, but also because it is relatively high. The ingestion rate value chosen is higher than the mean for children and I contend that the working group cannot substantiate those values as realistic. The working group again claims that insufficient data is reason enough to use a point estimate, but as I discuss elsewhere, using a point estimate when data is sparse violates the entire purpose of uncertainty analysis. Moreover, was there not a PDF used for sensitivity analysis? So, why not here? Furthermore, why is the minimum for adults 30 mg/day (p-age 28 Appendices) when the minimum is zero for children? Figure A-6 provides support that zero intake is plausible since that data straddle zero mg/day. (Note: Figure A-7 is off the page and useless and the text on page 32 is continued from some unknown location!)

Is there evidence that the calculations were performed and results compiled with sufficient care and quality to ensure useable results?

I think my statements above attest to my opinion that the calculations do not satisfy the required technical requirements to ensure useable results. No further elaboration is needed here as my specific criticisms are detailed in other sections.

Equally as frustrating is the poor presentation with lack of quality control over the document and printing.

Are the resulting RSAL values consistent with your professional expectations and the outcomes of other such analyses, given the modeling method and input parameters used?

Given that this question is of interest, I am quite surprised not to see reference to the National Council of Radiological Protection and Measurements (NCRP) Report No. 129. The primary purpose of that report is to provide screening limits (in Bq/kg) that can be used to form reasonable judgments (e.g., the need for site specific assessments, or possibly remediation) based on soil radionuclide levels. The report even references the area adjacent to the Rocky Flats plant (p. 2) as an example of where such screening limits would be useful. The readers of this review should be aware, however, that the NCRP report cautions (p.8) that the guidance it provides is more conservative (stringent) than values proposed by EPA or NRC for regulatory purposes and the conservative nature of the values provided would result in greater amounts of soil being removed than would be necessary with realistic, site-specific calculations.

The screening limits presented in the NCRP report are based on limiting the maximum effective dose to an individual to 25 mrem/yr but the calculation. The calculations were similar to those conducted by the Working Group in that the NCRP assigned uncertainty distributions to parameters of pathway models and calculated the dose using the Monte Carlo method. The screening limit reported corresponded to the 95th percentile of the dose uncertainty distribution.

Of course, if any other dose limit is preferred, the screening limits (in Bq/kg) could be scaled up or down by a simple ratio of the new limit to 25 mrem/yr (eq. 2.2, p,. 27, NCRP Report 129. The table below presents the screening limits from the NCRP report for ^{239}Pu for various scenarios. Short descriptive definitions of the scenarios are presented below the table. The limits reported by NCRP in Bq/kg have been converted to pCi/g for the purposes of this review. Considerable conservatism was intentionally built into these calculations because there intent is only indicate the need for a site-specific assessment. Hence, they not indicate in any way that the Rocky Flats calculaions are not protective.

NCRP (1999) screening limits (Bq/kg) for ^{239}Pu based on 25 mrem/yr maximum dose

Scenario (see definitions below)	NCRP Calculated Screening Limit (pCi/g)	Rocky Flats Working Group values (pCi/g) for 25 mrem annual dose – scenarios matched as closely as possible
AG	13	45, Resident rancher
PV	192	209, Rural resident adult
PS	16	–
RV	23	–
RS	8	–
SU	32	–
SN	51	–
CC	13	–

AG = agricultural sites used primarily for food production, no children
PV = sites of heavily vegetated pasture, no dwellings or children, but allows for land (farm) workers, includes grazing animals
PS = sites of sparsely vegetated pasture, particularly arid, includes grazing animals
RV = heavily vegetated rural sites, includes open fields and forests, some food production (primarily gardens), allows for children and adults
RS = sparsely vegetated rural sites, similar to RV
SU = suburban sites, allows for minor food production (gardens), allows for children and adults
SN = no food suburban sites, applicable to parks, schools, developed recreational areas
CC = construction, commercial, industrial sites, high soil disturbance, no dwellings, no children

Do you believe that the reported analyses and resulting RSAL values form an appropriate technical basis for developing the RSAL policy framework for cleanup at Rocky Flats?

Based on the concerns I have expressed in my opening statement and afterwards, it is not possible that I endorse the values presented as entirely credible. I can say, however, that the values do not look unusual with respect to other calculations I have seen. Because of the high cost of remediation in terms of dollars and environmental damage, I reiterate my recommendations to involve some more qualified experts in probabilistic risk analyses before these computed values are used as the technical basis for decision making.

Are the scenarios adequately and accurately described?

The scenarios appear to be reasonably well described, but given the more important issues I have discussed, I did not dwell on the scenario descriptons.

The report seems to discount both surface water and groundwater as significant pathways. How do you assess this assertion?

The evaluation of the working group that attributes little dose or risk due to surface and groundwater pathways, agrees well (to be the best of my knowledge) with the state of knowledge. As mentioned, plutonium has low solubility, and the maximum size of the particles than can be transported by attachment to colloids, significantly restricts the amount of activity that can be transported via water. One could argue that water transport is poorly understood or quantified, though I believe there should be little argument, that its potential as a significant dose or risk pathway is minimal even with the uncertainty.

How do you evaluate the adequacy of the mass loading calculation?

A mass loading model describes what is actually a complex physical phenomenon. Like other complex phenomenon (resuspension, for example), nothing surpasses data that is representative for the situation under assessment. In the absence of good data, a model is the alternative. Since this area is not my primary area of expertise, I prefer to make some simple observations and raise some questions. First, as I mention elsewhere, the recovery curves following a fire (Figure A-1) make sense to me. Having witnessed the grasslands in northern Colorado, one does expect rather quick recovery of grasslands which quickly dampens any transient increase in resuspension potential. One particular part of the discussion was unclear to me, that being the RESRAD Inhalation area factor. I found this discussion to be unclear and hence, I could not evaluate its validity.

Are the data used regarding the soil ingestion rate for a child sufficient for developing appropriate RSALs at Rocky Flats?

Since it is not possible to acquire more data on child soil ingestion rates in the short-term, the only reason to discuss the adequacy of the available data would be to consider if there is reason to widening the (subjective) estimates of uncertainty if one believed that the data were not inclusive of all likely values. The analysis provided in the draft report is not inconsistent with analyses of soil intakes rates by other authors, and I conclude that the data while not precise, is adequate for the purpose. I question whether the maximum value (1,000 mg/d) could really be sustained by a child for any considerable length of time, but this is a separate question. I reiterate that I think the ingestion rates have been adequately quantified for the intended purposes.

During a modeling workshop sponsored in April, some experts emphasized the need to maintain a strict separation between uncertainty and variability in the RSAL calculations? Do you feel this is important? If so, has the Working Group done an adequate job of distinguishing between the two?

It is my opinion that to understand the results from probabilistic calculations, one needs to retain the identity of the input data. This means "yes", it is necessary to maintain the separation between variability and uncertainty. An understanding of why this is necessary is one of the larger steps made in the last decade in probabilistic risk analyses, and it is a step backwards to ignore it. The value in maintaining variability separately is that a distribution of expected doses can be determined for a population using variability information, and the confidence interval on any percentile of the distribution can be estimated using uncertainty information. To do that, a 2-dimensional analysis must be conduced whereby separation is maintained. However, as described on p. 55 of the draft report, that was not done in this work. In fact, p. 55 states that no

attempt was made to quantify uncertainty, despite all of the entries in Tables VI-1 through VI-5 that state where/when "uncertainty" was considered in the assessment. The confusion to the reader (even to myself) from the written discussion makes it near to impossible to know exactly what was done in terms of maintaining separation.

Is it appropriate to treat highly uncertain scenario parameters, such as exposure frequency and exposure duration, probabilistically? Even within the Working Group, there was some disagreement on the propriety of doing so. What is considered the best practice for these parameters within the field of risk assessment?

Probabilistic means that a probability is assigned to describe the likelihood for each alternative value. If the assessment question asks for the distribution of doses among a population, and each person has a different exposure frequency and a different exposure duration, then "yes", it does make sense to assign a distribution. In that case, the distribution describes the variation (not likelihood) among members of the population. Conversely, if the assessment question asks for the dose (or risk) to an individual, and the true exposure frequency and exposure duration for that person is unknown, then "yes", it also makes sense to assign a distribution, but in this case, the distribution represents the likelihood of different values for that single person. This is an example of where the distribution that is assigned must be specified as variability (for a population) or uncertainty (for an individual). I see no reason for disagreement on this point if the assessment question is clearly stated (something not done in this work). The only reason not to assign a distribution is if there is no variation (totally unlikely) among individuals in a population or if the values are precisely known (also totally unlikely) for a given individual.

Would exposure via soil ingestion be expected to increase, much like mass loading, under a post-fire scenario? If so, is there any way the Working Group could have modified their modeling approach to reasonably account for the increase?

Interesting question. From a behavioral point of view, the purposeful intake rate of soil (leading to the highest values in the soil ingestion rate distribution) would likely be less following a fire since the palatability of soil would likely be reduced following a fire. Anyone having tasted burnt material would understand that. Inadvertent intake might be enhanced IF there was increased resuspension that led to swallowing soil (rather than leading to inhalation). My opinion is that inhalation of soil might increase after a fire, but not soil ingestion. Swallowing of resuspended soil generally only occurs when the amount of soil impacting the face and mouth is extremely large and it cannot be kept from entering the mouth. That is an uncomfortable situation and would generally be avoided by most people. The second part of the question should be: "Would the amount of radioactivity ingested be greater following a fire?" Removing ground coverage as a consequence of fire could allow more of the fine particles on the soil surface to be resuspended under moderately windy conditions. However, again, I believe that would lead only to a temporary (until vegetation began to cover the bare ground) increase in inhalation and to a lesser degree, ingestion.

The Task 3 Report makes a strong case for the mass-balance technique of estimating incidental soil ingestion, identifying 3 studies that have been done based on this method. Do you agree with the rational for using Anaconda data alone to build a child soil ingestion distribution (App. A., p. 20)?

Maintaining mass-balance is a concept that scientists appreciate. It implies that the experiment was conducted carefully and it makes conceptual sense to account for all the material. For that reason it appears that the Anaconda study was selected. Building a distribution based on the most carefully collected data makes always makes sense. But the question is, would including other data also make sense? Other investigators could argue that even less precise data should be considered in making assumptions, if one is careful to weight them less than the precise data. There is no single right or wrong way to make assumptions for an assessment such as this. My belief from seeing the distribution (Figure A-4) of soil intake values is that even if one considered other data (and weighting it less because of the lack of mass-balance), the end results (the distribution of intake rates) would not be dramatically different. Moreover, the distribution decided upon is not inconsistent with independent publications (e.g., NCRP Report 129, 1999) and for that reason, I think the analysis was appropriate.

The Rural Resident scenario applies to both children and adults. Risk is calculated over a period of years, part of which time is considered to be during childhood. This parameter is called exposure duration. It appears that, for each Monte Carlo realization, the first six years of exposure are assumed to be child exposure and anything over 6 years is adult exposure. Do you believe this has been done properly, or should the ratio of child to adult exposure have kept constant regardless of the magnitude of the exposure duration parameter? Have the age-adjusted distributions used for this scenario been derived properly?

In my view, there is not single right or wrong way to model the transition from childhood to adulthood. There is always a range of detail that can incorporated into a model. The decision to simplify, or add detail should depend on the sensitivity of the model to the simplification or to the refinement, and the quality of the data that is required for the refinement. A model that is too detailed for the available input data does not add any information. So, the question that was asked above should be restated: *Is the model sensitive to the assumptions regarding the transition from childhood to adulthood to the degree that adding more detail would make an appreciable difference in the outcome? And, are there appropriate data to use if the transition from child to adult was made (for example) continuous, rather than abruptly changing at 6 years of age?* To answer the first question, we can look at the sensitivity analysis. Many of the assumptions of the Rural Resident scenario do not appear in the list of most sensitive parameters. Some, like the contaminated fraction of plant food, appear as moderately sensitive parameters. Hence, some improvement in realism might be gained if the change from childhood to adulthood was continuous rather than abrupt. But I cannot state with certainty if such a model really mimics reality any better. Even in the best of cases, models are only a rough representation of reality. My view is that because body size changes smoothly (not linearly) with age, that ingestion rates and dose factors (at least those that depend on organ size) also change smoothly (not necessarily linearly) with age. For that reason, I would probably have interpolated available data to make a smooth change in pathway parameters that depend on age. That would be my preference as the risk assessor, but it is not the only appropriate way to do things.

The exposure frequency distribution for the Rural Resident appears to be based on an average of a dataset, rather than the data themselves. The central tendency estimate 234 days per year from EPA guidance is used as the mean of a triangular distribution. Using professional judgment, it was truncated at 175 and 350 days per year. Is it appropriate to use a central tendency estimates as the sole data point for a distribution?

Let me answer the question this way: If the distribution represents variability as claimed in Section VI, then data must be used to determine the distribution endpoints. However, my guess is that some people have exposure frequency durations of less than 175 days per year, so I question the validity of the lower endpoint. But if the distribution is the uncertainty on the mean value of a population, then the range might be reasonable because the uncertainty on the mean is assuredly less than the overall variation in the population. I find this question difficult to answer because of the lack of clarity of the overall assessment question as well as a lack of clarity on what the Working Group intended for the distribution represent. The question raised can be answered more definitively if a rigorous definition of the distribution is provided.

Following on the last question, we have been told that a triangular distribution implies that the parameter is poorly characterized. Yet, the Task 3 Report says, "It may be possible to obtain original survey data results that formed the basis for the central tendency estimate..." (App. A, p. 52). This was not done because the Working Group concluded it "would have only a minor effect on the risk estimates." Do you agree with their conclusions?

This question, like the ones that preceded it, continue to question the correctness of distributions assumed by the Working Group and I continue to have difficulty in answering because the definition (i.e., pure variability, uncertainty of individual values, uncertainty of a mean, etc.) of each distribution is not definitively provided. In general, a triangular distribution is used when there is little data (it does not imply there is little data) to better characterize a distribution. But to use a triangular distribution does imply that the central tendency is known, that reasonable endpoints are known, and that the endpoints are much less probable than the central value. In actuality, there is little difference between a symmetrical triangular distribution and a normal distribution truncated at the triangular endpoints. Similarly, there is little difference between a right-skewed triangular distribution and a lognormal distribution truncated at the endpoints of the triangular distribution. Hence, I agree with the Working Group that refining this single distribution will have little effect on model output, particularly since the model output is affected by a number of other variables as well.

Other Questions/Comments. Please consider the following.

Page 6: I have never heard of the notion of pathways being considered "complete, i.e., "capable of transferring harmful effects form radionuclides in surface soils to exposed individuals." There are a couple of problems here beyond the notion of "completeness" and the fact that this definition is not widely accepted. Harmful effects cannot be transferred, only the radionuclides can be transferred. If the individuals are exposed, then would not the pathway be "complete" by definition?

Page 9: *[Identifying phrase removed.]* I have never heard of pathways described as "conduits." This is not correct. Pathways are a series of natural (and manmade) mechanisms and/or phenomenon that are responsible for movement of radioactive materials and/or radiation from a source to a receptor. There is no reason in this document to change conventional jargon and invent new definitions.

Page 9: Similarly, I have never heard of "active pathways." All pathways should be "realistic," that is, they should describe transport mechanisms and phenomenon within the limits of knowledge. Sensitivity analyses will determine which pathways need to be included in

calculations and which do not significantly affect the outcome. If mechanistic explanations are not available to represent pathways, then empiric relationships can be used to describe pathways. The main point is that if the pathways are not realistic, there is no reason to define them for a given exposure situation, but I have never heard of "active" or "inactive" pathways, and certainly have never heard of defining pathways in terms of whether they realistically contribute to dose or risk. Again, there is no reason to change the conventional radiecological definitions for this one task.

Page 9: Next to last paragraph. It is not clear whether the assumption that the "surrounding areas" of the residential site are uniformly contaminated is realistic. Possibly this assumption simplifies calculations but even so, that is not what is important. Basing RSALs on realistic models of transport phenomenon is what is important. If one chooses to ignore difficult to model scenarios, there is hardly any reason for conducting the exercise. The authors should confirm the assumption about uniform contamination and better convince the reader that it is true. There is quite a bit of published literature (e.g., Litaor 1999, Hulse et al., 1999, Webb et al. 1997) that indicates the ground contamination changes (decreases) significantly with increasing distance from the 903 pad, so I am highly skeptical of the validity of this assumption. Page 1 of the Appendices discusses that the assumption of uniform contamination is simplistic though the working group claims the assumption to be reasonable and conservative. Such a claim is insufficient to ensure that bias is not interjected as a consequence.

Page 18: There is discussion of actinide migration in surface water and that particles are transported attached to colloids <0.45 micron pore size filter. Yet, there is no discussion on the activity of particles of that size. It should be noted that a ^{239}Pu particle of 0.45 micron diameter has an activity 0.058 pCi. The activity of smaller particles would decrease sharply with decreasing diameter (because the mass is proportional to r^3). For example, a particle of half the diameter (i.e., 0.225 micron) would have an activity 0.0073 pCi. Stating the activity of these particles is useful to the reader in understanding the very small amount of activity that can be transported via particles in water.

Page 19: The equation for the RSAL based on risk provides no units for the parameters. This is an example of terribly sloppy technical writing. In addition, the multiplication signs (usually specified by an 'x' or asterisk) show in the document as left-pointing arrows. Couldn't this have been checked and corrected before distributing for peer review? One would never consider submitting a document with such poor form to a journal for publication.

In addition, the paragraph above the equation uses the wrong terminology. It says "The dose assessment method then multiplies the amount of exposure by a dose conversion factor...". First of all, there is no equation shown for the "dose assessment method." Second, it is activity ingested (measured in pCi or Bq) that is multiplied by the dose conversion factor. In radiation dosimetry, the term "exposure" refers to the ionization of air, so the word "exposure" was inappropriately used in this context. The same misuse of the word "exposure" for intake occurs on p. 46, 2nd paragraph, last sentence.

Page. 20: Here it is noted that "point estimates" of dose conversion factors and cancer slope factors were used because of EPA advice. I think this is really bad advice. If one looks at the amount of uncertainty on internal dose estimates (particularly for alpha emitters) and on the

cancer risks following exposure to alpha emitters, all other sources of uncertainty are seen to be very small and relatively meaningless. The EPA guidance seems to be based on the notion that too little information is available to determine distributions, but that idea refers to the problem of characterizing "variability." Uncertainty is nearly always subjective, that is, it simply expresses the degree of belief based on whatever evidence is at hand. Hence, uncertainty distributions can and should be determined. This is particularly the case when data is sparse. Otherwise, you falsely express that your belief in the values used is extremely high and that alternative values are unlikely. That is completely wrong as all dosimetrists understand that, in fact, dosimetry and risk analysis for alpha emitters, is the most (not the least) uncertain of all radiation types. I consider using point estimates for the most uncertain parameters to be not only poor judgment, not at all within the state-of-the art, and to be a major failing of the work presented here.

Page 29 on: I found several other instances in section IV-3 (Note: what happened to Section IV-2? I can't find it.) where I could not understand the material presented. For example, under the discussion of "The Area of the Contaminated Zone", the report states: "The working group chose a contaminated area large enough to *saturate* this pathway; that is, to cause its influence to be as great as possible." What does "saturate" mean? What does it mean to "cause its influence to be as great as possible"? Finally, is this more evidence that the Working Group made ad hoc decisions based on their "interest", rather than on scientific evidence? I really do not understand what this is about.

Paged 31: The statement that inhalation rate is linearly related to dose and risk is true under certain, but not all, conditions. It is true when the particle size remains constant, which only may apply to the same location and under the same wind speed conditions. Some qualification is needed here.

Page 34: The statement that the information on intake rates of soil for adults is too sparse to determine a distribution is flat-out wrong unless you mean there is too little data to confidently characterize variability. There is never too little information to subjectively estimate uncertainty. In fact, it is imperative to estimate uncertainty when there is little information! Substituting the soil intake rate for the maximally exposed adult from the agricultural setting to the wildlife refuge worker is alright, but only if you then state the wildlife refuge worker is based on the intakes of the agricultural setting. These kinds of assumptions cannot be made for convenience and then forgotten. Every assumption made tailors the scenario in a particular way and the authors must (assuming they act responsibly) redefine the scenario with each new assumption.

Pages 36 to 41: The presentation of tables IV-3 and IV-4 is really confusing and needlessly sloppy. The tables, which are continued on multiple pages, read from right to left, but then are continued on the page to the right. This introduces one more needlessly confusing style to the presentation. Moreover, pages that are continued do not have column headings shown so that the reader has to refer back to the first page. The problem is then compounded when Table IV-4 begins (and worse, the title for that table is shown on the bottom of page 39). Reading these tables is a real irritation and again, they are not a professional presentation. Also, the parameters of each distribution are shown in parentheses but the definitions are not presented (e.g., min, median, max, etc.).

Page 53: This page illustrates how poorly understood the objectives of the assessment have been clarified, even to the Working Group. It is stated below Table V-6 that the computed soil concentrations for each risk level (10^{-4}, 10^{-5}, 10^{-6}) are not exact, but are uncertain. Is that true and what does that mean? The statement can only be true if the distribution characterizes only variability. Otherwise, it means that the uncertainties are uncertain! Whenever such a conundrum surfaces in uncertainty analysis, it is usually because the assessment question was never stated properly with the needed clarity, and that variability and uncertainty are either intermingled or confused. If the distribution of soil concentrations represented pure variability (which it does not), a 2-dimensional analysis could place error bounds around any particular soil concentration and hence, around the related risk value (notwithstanding the problem I already discussed concerning the failure of the backward calculation).

Page 53: first paragraph, last sentence. The claim is made that the working group tried not to interject bias and then states that when the uncertainty was so great (when data was sparse), the working group used conservative point estimates. This illustrates two problems. First, when data is sparse data, the need is greatest for a distribution of value since the true values are unknown. The working group did the opposite and used point estimates. Second, the two sentences are conflicting. Forcing uncertain variables to take on single values (point estimates), by definition, interjects bias.

Page 55 and 56. The heart of the matter regarding the necessity to distinguish between uncertainty and variability is finally addressed on these pages, but at stage when the problem has become very confused, even to the most sophisticated reader. And the section does little to clarify. Section VI states that the distributions were intended to characterize "for the most part", inter-individual variability. Two paragraphs later it states, "no attempt was made in this assessment to quantify uncertainty." Then the entire next page and a half discusses sources of uncertainty, and Tables VI-1 through VI-5 (presented with the same poor formatting of reading from right to left, with successive pages located to the right) take 26 pages to specify how which assumptions consider "scenario uncertainty", "parameter uncertainty", "model uncertainty" (and even variability). What do the authors think I might conclude from such a confusing presentation? In summary, the authors have failed to convince me there is any consistency in their methods and little real understanding of how to cope with some of the more subtle issues of probabilistic analyses.

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NCRP. Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies. Report No. 129. Bethesda, MD: National Council of Radiological Protection and Measurements. 1999.

Webb, S.B.; Ibrahim, S.A.; Whicker, F.W. A three-dimensional spatial model of plutonium in soil near Rocky Flats, Colorado. Health Physics 73(2): 340-349, 1997.

RFCA Stakeholder Focus Group
Attachment D

Title:	RSALs Working Group notes for the January 3, 10, and 17, 2002 meetings
Date:	January 24, 2002
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

NOTES FROM RSALs WORKING GROUP MEETING ON 1/3/02

ITEMS COVERED ON 1/3:

1. Discussed parameters for uranium dose and risk calculations (finalized all except plant uptake factor).
2. Discussed plant uptake factor.

ACTIONS

Action Item	Who	When	Notes
Provide wildlife refuge worker scenario data (including level of effort for tasks & area of contamination).	Carl Spreng	1/10/02	
Determine if EPA Headquarters will review the Task 3 report.	Tim Rehder	1/10/02	
Provide distribution for plant uptake factor.	Phil Goodrum, Susan Griffin	1/10/02	
Perform dose & risk calculations for uranium for surface RSALs.	Working Group		After parameters are finalized.

DECISIONS

1. Perform and report RESRAD runs for uranium, but recognize the limitations of RESRAD for depleted uranium (it does not consider kidney toxicity).
2. Use five acres as the uranium area of contamination for the wildlife refuge worker scenario. Also assume that the wildlife refuge worker spends 100% of both inside and outside time in the contaminated area.
3. Use five acres as the uranium area of contamination for the rural resident scenario.
4. Calculate RSAL values for each isotope of uranium (U234, U235, and U238), and then calculate sum of ratios for depleted uranium and enriched uranium.
5. Apply the hot spot methodology from the approved Sampling and Analysis Plan to the uranium RSALs.

NEXT MEETING: THURSDAY, 1/10/02, 8:30 a.m., at Rocky Flats B060

Agenda Items:

1. Discussion with Ward Whicker on plant uptake factor.
2. Finalize plant uptake factor.
3. Go through action items.

NOTES FROM RSALs WORKING GROUP MEETING ON 1/10/02

ITEMS COVERED ON 1/10:

1. Discussed plant uptake factor.
2. Discussed wildlife refuge worker data table.

ACTIONS

Action Item	Who	When	Notes
Provide Rocky Flats soil types in areas of uranium contamination.	Carl Spreng	1/17/02	
Provide soil types used in plant uptake studies for comparison to Rocky Flats soil types.	Phil Goodrum	1/17/02	
Determine if EPA Headquarters will review the Task 3 report.	Tim Rehder	1/17/02	
Review and provide feedback to Diane on wildlife refuge worker data table.	Working Group	1/17/02	
Perform dose & risk calculations for uranium for surface RSALs.	Working Group		After parameters are finalized.

DECISIONS

1. Tentatively decided to use the 95th percentile value from Phil's Figure 3 (0.06) as the plant uptake value. Will finalize this decision on 1/17/02 after the information from the first two actions above is analyzed.

NEXT MEETING: THURSDAY, 1/17/02, 8:30 a.m., at the EPA Conference Center

Agenda Items:

1. Finalize plant uptake factor.
2. Using information in Diane's wildlife refuge worker data table, revisit Decision #2 from the 1/3/02 meeting ("Use five acres as the uranium area of contamination for the wildlife refuge worker scenario. Also assume that the wildlife refuge worker spends 100% of both inside and outside time in the contaminated area.").
3. Assign responsibilities for performing dose and risk calculations.
4. Discuss how to address comments on the Task 3 report and make sure all working group members have copies of all comments.
5. Go through action items.

NOTES FROM RSALs WORKING GROUP MEETING ON 1/17/02

ITEMS COVERED ON 1/17:

1. Discussed plant uptake factor, soil types & applicability of work conducted by Phil.
2. Discussed Area of Contamination.
3. Discussed wildlife refuge worker data table.
4. Discussed how to address comments on Task 3 Rpt

ACTIONS

Action Item	Who	When	Notes
Compile all comments, send hard copies to work group members, develop table itemizing comments except for peer review comments	Steve Gunderson	1/24/02	
Annotate/identify major issues from peer review comments	Diane N.	1/24/02	
Determine if EPA Headquarters will review the Task 3 report.	Tim Rehder	1/24/02	
Review and provide comments to Diane on wildlife ref. wkr data table.	Working Group	1/24/02	
Perform dose & risk calculations for uranium for surface RSALs.	Susan & Phil – risk, Jim- dose	1/31/02	

DECISIONS

1. Decided to use distributions for plant uptake factor for clay from Phil's work, based on the agreement that this is a sensitive parameter. The uncertainties will be discussed in the uncertainty section of the report.
2. Use five acres as the uranium area of contamination for the wildlife refuge worker scenario. Also assume that the wildlife refuge worker spends 100% of both inside and outside time in the contaminated area. The uncertainties associated with this approach will also be address in the uncertainty section of the report.

NEXT MEETING: THURSDAY, 1/24/02, 8:30 a.m., at CDPHE, Bldg A, CARSON ROOM

Agenda Items:

1. Discuss Task 3 report peer review comments.
2. Discuss point estimates in wildlife refuge worker scenario.
3. Go through action items.

4. Go through Steve's table of other Task 3 rpt comments, identify individuals for developing responses.

Please note: Diane N's new phone number at CDPHE is (303) 692-3383

RFCA Stakeholder Focus Group
Attachment E

Title:	RSALs Task 4 correspondence between Mary Harlow of the City of Westminster and DOE, the CDPHE, and the EPA
Date:	January 24, 2002
Email Address:	ANelson@ci.westminster.co.us

WESTMINSTER

May 22, 2001

City of Westminster
Department of
Public Works
and Utilities

4800 West 92nd Avenue
Westminster, Colorado
80031

303-430-2400
FAX 303-650-1643

Steve Gunderson
Colorado Department of Public Health & Environment
4300 Cherry Creek Drive, South
Denver, Colorado 80246-1530

Tim Rehder
Environmental Pr tection Agency
USEPA Region 8
999 18th Street, Suite 500
Denver, Colorado 80202

Joseph Legare
U.S. Department of Energy
Rocky Flats Field Office
10808 Highway 93, Unit A
Golden, Colorado 80403-8200

Dear Messrs. Gunderson, Rehder and Legare:

Staff has reviewed Task 4, New Scientific Information predecisional draft prepared for the RSAL working group. Since this document will not be professionally peer reviewed, the City believes that it is important to provide written, formal comments to your respective agencies on this task. Westminster requests written, timely replies either from each of the agencies or from the RSAL working group relative to the recommendations and issues raised in this letter.

The Task 4 report contains several writing styles. Part of it is narrative, part editorializing, personal opinion and another part scientific review. The document needs to be rewritten in a consistent format. Personal opinions and editorializing should not be included in this document.

The purpose statement for this task indicates that the report is being prepared to "summarize the new scientific information that was reviewed by the working group and to recommend whether the information should be considered in the current RSALs process, based on potential impact to the RSAL's. Some important areas that were not included in this report are new scientific information related to breathing and soil ingestion rates as well as the following studies; Walnut Creek Source Characterization, CDPHE speciation of Uranium, NTS on plutonium migration in groundwater. Westminster suggests that these studies be incorporated into the revised task report.

Fires

It would have been helpful to include in the report research on the time required to revegetate burned areas as well as to address erosion concerns after a fall fire. The impacts of drought and a prairie fire should also have been addressed.

The document states that both qualitative and quantitative post-fire monitoring was performed at the locations of the buffer zone fires that occurred in the year 2000. Since this is a new scientific information report the specific qualitative and quantitative monitoring that occurred should be listed in this document.

The statement that "the monitoring of the burned areas after these fires showed that the fires did not create areas of completely bare ground." A distinction needs to be made in the statement that the two fires (controlled burn and lightening induced fire) were closely monitored. The wind tunnel was put in place soon after the controlled burn but the equipment was not put in place until two weeks after the lightening caused fire in September 2000. That information needs to be included in this discussion of fire.

2000 Prescribed Burn Wind Tunnel Study

This study needs to be peer reviewed in order to lend credibility to the study. Work that has been performed in the past at Rocky Flats related to microburst events from storm activity should also be included.

42

2000 Wildfire Wind Tunnel Study

The wind tunnel testing did not start immediately after the fire. This caveat needs to be added to the document. Two weeks post fire may not provide a representative measurement of resuspension in the area immediately after the fire occurred.

Los Alamos National Laboratory

Comparing Rocky Flats to Los Alamos, Hanford, Idaho National Laboratories is like comparing apples to oranges. The document notes this also. Therefore it is recommended that the document reference the three fires and note that there is no direct correlation between these fires and Rocky Flats.

There should be a separate heading for the DOE Fire Safety and Preparedness Commission. Two or three lines describing the work of the Commission should be added. The information related to this commission is currently part of the review of the Idaho National Laboratory fire and should be removed to stand-alone.

Additionally, the paragraph ends with a statement that the panel will take two years to review the fires and that when the report has been finalized the agencies should review it for any relevant information. Perhaps a better statement would be that the information from this study should be taken into consideration during future annual RFCA reviews.

Air Calculations

This paragraph is written in editorial format and not in a scientific manner. The differences in the models reviewed should be spelled out. The paragraph contains a sentence that sates that "This report focuses on these different air calculations and concludes that although the old RESRAD results in more restrictive RSAL's, the new RESRAD is based on more realistic and defensible assumptions." This sentence does not provide the reader of this document with any information as to what the more realistic and defensible assumptions are. These should be spelled out.

A reference to the Radian report and its conclusions is not sufficient. The conclusions from the report should be spelled out.

Actinide Migration Evaluation Studies

The discussion paragraph notes that the results show conclusively that the 903 Pad soils contain plutonium in the tetravalent oxidation state, or plutonium dioxide. This oxidation state is generally insoluble and relatively immobile in soils, sediments and water." This statement should be rewritten to include information from page 4 of the Summary Report of the Actinide Migration Evaluation for RFETS, June 2000, which states that "data clearly indicate that physical (particulate) transport is the dominant mechanism for plutonium migration at RFETS. The current description should also include a statement of how the plutonium moves in the environment through storm events, etc. The way the paragraph is written now, the reader gets the impression that the plutonium is immobile. Perhaps this paragraph and the second paragraph on page 6 should be combined.

Page 6, second paragraph, states "the School of Mines study concluded that natural organic materials play an important role as the glue that holds the soil particles together. Destruction of the organic material results in movement of the actinides to smaller sizes of soil particles. This understanding is important in evaluating ways to control actinide mobility because small particles tend to be more mobile than larger ones." These studies need to be blended in one paragraph. The reader is given the impression that colloids are relatively immobile. The second paragraph on page 6 should become the first paragraph in order for the document to flow properly.

On page 6, first paragraph, this paragraph should become the second paragraph. The title of the specific article in the study referenced should be included in the discussion.

The Nevada Test Site study on the movement of colloids in groundwater has application to Rocky Flats and should be included in this document. The Contaminant Travel Times section on page 16 should be included in this discussion as well as reference to the sites study of the aseptic wells where plutonium contamination in the phento curie range has been found. The justification for this addition is the fact that it has been found that at the Nevada Test Site colloidal transport of plutonium in groundwater is occurring much more rapidly than originally thought by scientists.

Soil Erosion and Surface Water Sediment Transport

This paragraph does not adequately discuss the purpose of the report or the models used as tools for designing the remediation and environmental management strategies. This information should be included.

Air Transport and Deposition

List out the various proposed future use scenarios in the document.

Uranium in Groundwater

It would seem appropriate to reference and outline the findings of the Colorado Department of Public Health and Environment study on natural occurring and man made plutonium at the site.

Also, the uranium under the solar ponds is man made and attenuated at this point in time, but has the potential to move at some point in the future. This information should be included in the document.

Actinide Contaminated Concrete

The document needs to include a discussion of concrete rubble being used for fill and also that foundations may be left in place after closure. Including this information in the document serves to frame this discussion. It should also be indicated in this paragraph that Los Alamos National Laboratories is providing the investigation of the concrete.

Actinide Pathway Report

This report will not be completed until sometime this year. Why is it included in this document since it cannot be quoted and has not been reviewed by the working group in this RSAL review process?

Upcoming Activities

This is a newsy paragraph but does not play a role in this document which is supposed to be looking at new scientific information. I would suggest deleting this section.

Other Studies and Reports

Why is the ongoing BEIR study included in this report? If there is no pertinent information to report then it should not be included. This report is supposed to cover the new scientific information that was reviewed by the working group as part of their work.

Long-term Stewardship

The paper notes that the National Research Council study on long-term stewardship summary statement on page 17 indicates that the report recommends the use of a planning decision-making approach called "long-term institutional management." This management tool calls for tradeoffs between contaminant reduction, contaminant isolation and stewardship measures including institutional controls during cleanup. This is not my interpretation of this section of the report. Page 8 of the National Research Council Report includes a section on Designing and Implementing a Site's Institutional Management Systems by use of such tools as Defense in depth, Complentarity, Foresight, Accountability, Transparency, Feasibility, Stability through time, Iteration, follow through and feasibility. Please provide a page and line reference for the conclusion that the writer has come to that this report calls for tradeoffs between contaminant reduction, contaminant isolation and stewardship measures (including institutional controls) during cleanup and also the conclusion that all three of these factors should be considered and implemented. In the working group meetings attended by Westminster staff, the working group did not discuss policy documents. The City does not understand why this section belongs in a new science information document. Please justify.

U.S. General Accounting Office Report on Radiation Standards

Once again, this document is to address new science not personal opinion. The statement in the second paragraph on page 18 states that "These conclusions are relevant to current radiation standards rather than to the RSALs that are currently being calculated. However, the RSALs process should take the lessons learned from these conclusions and strive to set action levels that are scientifically defensible."

The last sentence in the first paragraph in this section sates that "the report concludes that the EPA and the Nuclear Regulatory Commission are not in agreement on these standards, and that a lower standard results in higher cleanup costs." This statement does not apply to this new scientific information document and should be removed.

It is well known and not "new science or information" that the short term costs of a lower cleanup may be high, however, these costs must be weighed against protecting human health and the environment and the long-term costs of institutional controls to the taxpayer and surrounding local governments.

This document should be rewritten to cover the new science information requested in this letter as well as the comments from the focus group. It should be written as a review of the new information that was brought to the working group for discussion.

The RSAL review is very important to our City. Since we are downstream and downwind we will live with the legacy of the cleanup. The current RSAL review must be scientifically credible and the task documents produced by the working group must be prepared in a manner that reflects the professionalism of the agency staffs working on this important RSAL review process.

Thank you for the opportunity to comment on this RSAL Task 4 document.

Sincerely,

Mary Harlow
Rocky Flats Coordinator

Colorado Department of Public Health and Environment

AUG 14 2001

01-DOE-01443

RECEIVED
AUG 21 2001
PUBLIC WORKS AND UTILITIES

Ms. Mary Harlow
Rocky Flats Coordinator
City of Westminster
Department of Public Works and Utilities
4800 W. 92nd Ave.
Westminster, CO 80031

Dear Ms. Harlow:

Thank you for your comments, dated May 22, 2001, on the "New Scientific Information That May Impact Radionuclide Soil Action Levels at Rocky Flats" report. Enclosed are our responses to those comments. Although some changes have been made to the report based on your comments, we are not providing a copy of the revised report at this time. This is due to the fact that revisions to the report have not been completed. We are still working on comments received at the May 9, 2001, Rocky Flats Cleanup Agreement Stakeholder Focus Group meeting. After the revisions are complete, the revised report will be provided to you, as well as to the Focus Group.

If you have any questions, please call one of us or Sandi MacLeod at (303) 966-3367.

Sincerely,

Joseph A. Legare Date	Steven Gunderson Date	Timothy Rehder Date
Assistant Manager for Environment and Infrastructure	RFCA Project Coordinator	Rocky Flats Team Lead
U.S. Department of Energy	Colorado Department of Public Health and Environment	U.S. Environmental Protection Agency
Rocky Flats Field Office		

Enclosure

cc w/Enc:
S. MacLeod, FC, RFFO

48

RESPONSE TO CITY OF WESTMINSTER COMMENTS
RADIONUCLIDE SOIL ACTION LEVELS TASK 4
NEW SCIENTIFIC INFORMATION

Comment: "The Task 4 report contains several writing styles. Part of it is narrative, part editorializing, personal opinion and another part scientific review. The document needs to be rewritten in a consistent format. Personal opinions and editorializing should not be included in this document."

Response: The intent of the New Scientific Information report is to present a factual summary of the information reviewed by the working group, as well as a recommendation on whether the information should be considered in the current RSALs process. It is not intended to editorialize or provide personal opinions. Changes have been made throughout the report to clarify this intent.

Comment: "Some important areas that were not included in this report are new scientific information related to breathing and soil ingestion rates as well as the following studies; Walnut Creek Source Characterization, CDPHE speciation of Uranium, NTS on plutonium migration in groundwater. Westminster suggests that these studies be incorporated into the revised task report."

Response:

a. Information related to breathing and soil ingestion rates: Information has been added to the report on recent soil ingestion studies that were considered by the working group.
b. Walnut Creek source characterization study: More recent studies are more applicable than this older study. However, the recent studies are not complete. The agencies will review the final studies during future annual reviews of the RSALs.
c. CDPHE speciation of uranium: This information is included on pages 13 - 14 of the original New Scientific Information report; however, it is not clearly indicated as such. Therefore, the "Uranium in Groundwater" section has been revised to include additional information from the study and to identify more clearly that the information is from this study.
d. NTS study on plutonium migration in groundwater: A paragraph titled "Migration of Plutonium in Groundwater at the Nevada Test Site" has been added to the Actinide Migration Evaluation Studies section of the report.

Comment: "**Fires:** It would have been helpful to include in the report research on the time required to revegetate burned areas . . . ."

Response: The available information on this subject comes from the prescribed burn wind tunnel study and is referenced in the New Scientific Information report. Page 5 states that ". . . the burned area had revegetated to a large extent after three months . . . ."

Comment: "**Fires:** It would have been helpful . . . to address erosion concerns after a fall fire."

Response: This subject was addressed on page 4 of the report: ". . . after a rainfall immediately following the September 1996 fire, Site ecologists visited the burn area to determine if there had been visible erosion of soil or water transport of ashed material. No visible water-wash of ash or soil was detected."

Comment: "**Fires:** The impacts of drought and a prairie fire should also have been addressed."

Response: The impact of a prairie fire was discussed in the "Fires" section of the report. Information on a Colorado drought report has been added to the New Science report.

Comment: "**Fires:** The document states that both qualitative and quantitative post-fire monitoring was performed at the locations of the buffer zone fires that occurred in the year 2000. Since this is a new scientific information report the specific qualitative and quantitative monitoring that occurred should be listed in this document."

Response: First, the qualitative and quantitative monitoring was performed on all Buffer Zone fires listed in the table on page 3 of the report, not just the fires that occurred in 2000. Second, the monitoring that is referenced on page 3 of the report is discussed in narrative format on pages 3 and 4 of the report. The qualitative observations are discussed first, followed by the quantitative data.

Comment: "**Fires:** A distinction needs to be made in the statement that the two fires (controlled burn and lightening [sic] induced fire) were closely monitored. The wind tunnel was put in place soon after the controlled burn but the equipment was not put in place until two weeks after the lightening [sic] caused fire in September 2000. That information needs to be included in this discussion of fire."

Response: First, the wind tunnel studies were performed on the wildfire that occurred in July 2000, not in September. Second, the section of the report titled "2000 Wildfire Wind Tunnel Study" states that the fire occurred on July 10, 2000, and the wind tunnel testing was started on August 22, 2000. Therefore, the report makes it clear that the wind tunnel testing did not start immediately after the fire in this area. Additionally, the wildfire testing was not intended to describe recovery, as the prescribed burn testing did. Instead, it was designed to examine radionuclide resuspension due to wind erosion.

50

Comment: "**2000 Prescribed Burn Wind Tunnel Study:** This study needs to be peer reviewed in order to lend credibility to the study."

Response: The agencies have supported the RFCA Stakeholder Focus Group peer review process from the outset. The agencies agree that it is appropriate for the wind tunnel studies to be subject to a peer review. The current peer review process includes a peer review of Task 3, which is where the wind tunnel study data will be used. The ongoing practice of the Focus Group has been to identify for the peer reviewers key issues the Focus Group believes ought to be addressed. It is possible that this process may need to be augmented in some manner to properly review the wind tunnel studies. The agencies will work with the community to develop an appropriate peer review process for the wind tunnel studies and for Task 3 as a whole. The agencies do not believe that this issue should be resolved unilaterally by the RFCA parties. Rather, the agencies and the community should collaborate through the Focus Group to develop a suitable peer review process, building on the existing process that seems to be working satisfactorily.

Comment: "**2000 Prescribed Burn Wind Tunnel Study:** Work that has been performed in the past at Rocky Flats related to microburst events from storm activity should also be included."

Response: On June 21, 2001, in a presentation to the working group, Dr. Chatten Cowherd stated that as a result of microbursts, resuspended soil moves as a horizontal layer and, therefore, can be replicated by the wind tunnel. The wind tunnel studies described in this report, therefore, did replicate and consider microbursts.

Comment: "**2000 Wildfire Wind Tunnel Study:** The wind tunnel testing did not start immediately after the fire. This caveat needs to be added to the document."

Response: This section of the report currently states that the wildfire occurred on July 10, 2000, and the wind tunnel testing was started on August 22, 2000. Therefore, it already indicates that the testing did not start immediately after the fire.

Comment: "**2000 Wildfire Wind Tunnel Study:** Two weeks post fire may not provide a representative measurement of resuspension in the area immediately after the fire occurred."

Response: Although this was the main purpose of the controlled burn wind tunnel study, it was not the main intent of the wind tunnel study related to the wildfire. The main purpose of the wildfire testing was to determine how the specific activity of plutonium in soil would compare with the specific activity in windblown dust resuspended from that same soil. The testing in the wildfire case was used secondarily to evaluate the erosion potential a period of time after a fire. This section of the report has been revised to clarify this information.

Comment: "**Los Alamos National Laboratory:** Comparing Rocky Flats to Los Alamos, Hanford, Idaho National Laboratories is like comparing apples to oranges. The document notes this also. Therefore it is recommended that the document reference the three fires and note that there is no direct correlation between these fires and Rocky Flats."

Response: The language in the report that relates to these three fires has been revised to clearly state that there is not a direct correlation between the data from these fires and Rocky Flats.

Comment: "**Los Alamos National Laboratory:** There should be a separate heading for the DOE Fire Safety and Preparedness Commission. . . . The information related to this commission is currently part of the review of the Idaho National Laboratory fire and should be removed to stand-alone."

Response: The suggested heading has been added to the report, which has separated the discussion of the commission from the discussion of the Idaho National Engineering and Environmental Laboratory fire.

Comment: "**Los Alamos National Laboratory:** Two or three lines describing the work of the Commission should be added."

Response: Information is not available on the work that the commission has performed to date. Only the goals and schedule of the commission, which are already in the report. are available.

Comment: "**Los Alamos National Laboratory:** Additionally, the paragraph ends with a statement that the panel will take two years to review the fires and that when the report has been finalized the agencies should review it for any relevant information. Perhaps a better statement would be that the information from this study should be taken into consideration during future annual RFCA reviews."

Response: The last sentence in this paragraph has been changed to read: "However, relevant information from this commission should be reviewed during future annual reviews of the RSALs."

52

Comment: "**Air Calculations:** This paragraph is written in editorial format and not in a scientific manner."

Response: The intent of this section was to summarize the information and conclusions in Radian's referenced report. The intent was not to editorialize or make additional conclusions. Therefore, the language in this section of the report has been revised to clarify the intent and reduce the impression of editorializing.

Comment: "**Air Calculations:** The differences in the models reviewed should be spelled out. The paragraph contains a sentence that sates [sic] that 'This report focuses on these different air calculations and concludes that although the old RESRAD results in more restrictive RSAL's, the new RESRAD is based on more realistic and defensible assumptions.' This sentence does not provide the reader of this document with any information as to what the more realistic and defensible assumptions are. These should be spelled out. A reference to the Radian report and its conclusions is not sufficient. The conclusions from the report should be spelled out."

Response: The purpose of the New Scientific Information report is to summarize new information that was reviewed by the working group and to recommend whether the information should be considered in the current RSALs process (see page 1 of the report). A reference list is provided in the report for all information discussed, so that the reader and the working group can easily access more detailed information in the referenced works. In many cases, the documents have been distributed through AlphaTRAC to the RFCA Stakeholder Focus Group, and additional copies are available. This allows the New Scientific Information report to be a concise and manageable report, and also to provide access to the detailed information for those who are interested. It would be inconsistent with the purpose of the New Scientific Information report to repeat the details of Radian's report. Therefore, Radian's conclusions are summarized and it is recommended that the working group consider them in the current RSALs process.

Comment: "**Actinide Migration Evaluation Studies:** The discussion paragraph notes that 'the results show conclusively that the 903 Pad soils contain plutonium in the tetravalent oxidation state, or plutonium dioxide. This oxidation state is generally insoluble and relatively immobile in soils, sediments and water.' This statement should be rewritten to include information from page 4 of the Summary Report of the Actinide Migration Evaluation for RFETS, June 2000, which states that 'data clearly indicate that physical (particulate) transport is the dominant mechanism for plutonium migration at RFETS.'"

Response: The first sentence in this section of the report ("Actinide Transport and Solubility") states essentially this same thing. However, the sentence has been revised for clarity.

Comment: "**Actinide Migration Evaluation Studies:** The current description should also include a statement of how the plutonium moves in the environment through storm events, etc."

Response: This information is included in the report that is referenced in the next section of the report ("Soil Erosion and Surface Water Sediment Transport").

Comment: "**Actinide Migration Evaluation Studies:** The way the paragraph is written now, the reader gets the impression that the plutonium is immobile."

Response: The conclusion of this section is that plutonium is generally insoluble and moves through physical transport mechanisms. It is not intended to say that plutonium is completely immobile. A concluding sentence has been added to this section of the report to clarify this.

Comment: "**Actinide Migration Evaluation Studies:** Perhaps this paragraph and the second paragraph on page 6 should be combined. Page 6, second paragraph, states 'the School of Mines study concluded that natural organic materials play an important role as the glue that holds the soil particles together. Destruction of the organic material results in movement of the actinides to smaller sizes of soil particles. This understanding is important in evaluating ways to control actinide mobility because small particles tend to be more mobile than larger ones.' These studies need to be blended in one paragraph. . . . The second paragraph on page 6 should become the first paragraph in order for the document to flow properly. On page 6, first paragraph, this paragraph should become the second paragraph."

Response: The agencies have chosen not to change the flow of these paragraphs. Other changes made to this section in response to other comments have helped to clarify the meaning.

Comment: "**Actinide Migration Evaluation Studies:** The reader is given the impression that colloids are relatively immobile."

Response: The report states that small particles tend to be more mobile than larger ones. It does not state, nor was it intended to mean, that particles are immobile. It is simply stating that small particles are more mobile than larger particles.

Comment: "**Actinide Migration Evaluation Studies:** The title of the specific article in the study referenced should be included in the discussion."

Response: The title of the article ("Reaction of Plutonium Dioxide with Water: Formation and Properties of PuO_{2+x}") is included in the reference list at the end of the

54

report. The reference to the specific entry in the list is included in the text immediately following mention of the article.

Comment: "**Actinide Migration Evaluation Studies:** The Nevada Test Site study on the movement of colloids in groundwater has application to Rocky Flats and should be included in this document."

Response: A paragraph titled "Migration of Plutonium in Groundwater at the Nevada Test Site" has been added to the Actinide Migration Evaluation Studies section of the report.

Comment: "**Actinide Migration Evaluation Studies:** The Contaminant Travel Times section on page 16 should be included in this discussion . . . ."

Response: The section titled "Contaminant Travel Times" has been moved to this section on actinide migration evaluation studies.

Comment: "**Actinide Migration Evaluation Studies:** . . . should be included in this discussion as well as reference to the site's study of the aseptic wells where plutonium contamination in the phento curie [sic] range has been found."

Response: A section on this sampling has been added to the report.

Comment: "**Soil Erosion and Surface Water Sediment Transport:** This paragraph does not adequately discuss the purpose of the report . . . . This information should be included."

Response: Language has been added to the New Scientific Information report to clarify the purpose of the report discussed in this section.

Comment: "**Soil Erosion and Surface Water Sediment Transport:** This paragraph does not adequately discuss . . . the models used as tools for designing the remediation and environmental management strategies. This information should be included."

Response: Since the purpose of the New Scientific Information report is only to summarize the information reviewed by the working group, the details from the soil erosion and surface water sediment report are not repeated in this report. Instead, a reference to the report is given so that interested readers can access the details.

55

Comment: "**Air Transport and Deposition:** List out the various proposed future use scenarios in the document."

Response: This would be inconsistent with the purpose of the New Scientific Information report, which is to simply summarize the information reviewed by the working group. The intent of the report is not to repeat all of the detailed information that is available elsewhere. Some examples of the future use scenarios are given in the New Scientific Information report, and a reference is given to the air transport and deposition report so that interested readers can access the rest of the information.

Comment: "**Uranium in Groundwater:** It would seem appropriate to reference and outline the findings of the Colorado Department of Public Health and Environment study on natural occurring and man made plutonium at the site."

Response: We believe that this comment refers to uranium, rather than plutonium. This information on uranium is included on pages 13 - 14 of the original New Scientific Information report; however, it is not clearly indicated as such. Therefore, the "Uranium in Groundwater" section has been revised to include additional information from the study and to identify more clearly that the information is from this study.

Comment: "**Uranium in Groundwater:** Also, the uranium under the solar ponds is man made and attenuated at this point in time, but has the potential to move at some point in the future. This information should be included in the document."

Response: The preliminary information from the Actinide Migration Evaluation group is that uranium has not moved much from where it was deposited in the solar ponds, and that it has been rendered relatively immobile by precipitation from uranyl nitrate. Further studies and evaluation of this subject are not yet completed, so there is no new information to include in the New Scientific Information report. Any new information that develops will be considered in future RSALs reviews.

Comment: "**Actinide Contaminated Concrete:** The document needs to include a discussion of concrete rubble being used for fill and also that foundations may be left in place after closure."

Response: This section of the report has been revised to include a statement about these topics.

56

Comment: "**Actinide Contaminated Concrete:** It should also be indicated in this paragraph that Los Alamos National Laboratories is providing the investigation of the concrete."

Response: This information has been added to the report.

Comment: "**Actinide Pathway Report:** This report will not be completed until sometime this year. Why is it included in this document since it cannot be quoted and has not been reviewed by the working group in this RSAL review process?"

Response: The working group reviewed the status of this report to determine whether any new scientific information was currently available for use in the RSALs process. The New Scientific Information report includes the results of this review, which show that no information is currently available. This give the reader the confidence that the working group did not forget this information; it is simply not available at this time.

Comment: "**Upcoming Activities:** This is a newsy paragraph but does not play a role in this document which is supposed to be looking at new scientific information. I would suggest deleting this section."

Response: This section has been deleted.

Comment: "**Other Studies and Reports:** Why is the ongoing BEIR study included in this report? If there is no pertinent information to report then it should not be included. This report is supposed to cover the new scientific information that was reviewed by the working group as part of their work."

Response: The working group was asked several times during this process if any new information was available from the BEIR study. Therefore, the working group reviewed the status of the study and determined that no new information is currently available. Because the group performed this review, and because several people expressed interest in the BEIR study, it is included in the report so that all readers will know the status.

Comment: "**Long-term Stewardship:** Please provide a page and line reference for the conclusion that the writer has come to that this report calls for tradeoffs between contaminant reduction, contaminant isolation and stewardship measures (including institutional controls) during cleanup and also the conclusion that all three of these factors should be considered and implemented."

Response: See the 3rd paragraph on page 3 of the referenced National Research Council report: "This study uses the term *long-term institutional management* to refer to a planning and decision-making approach that strives to achieve an appropriate balance in

the way it employs contaminant reduction measures, engineers barriers that isolate residual contaminants from the human environment and retard their migration, and places reliance on institutional controls and other stewardship measures." Also see the 1st paragraph under the heading "What is Long-Term Institutional Management of Waste Sites?" on page 4 of the report: "It represents the framework in which tradeoffs among contaminant reduction, reliance on contaminant isolation, and stewardship measures are made."

Comment: "**Long-term Stewardship:** In the working group meetings attended by Westminster staff, the working group did not discuss policy documents. The City does not understand why this section belongs in a new science information document. Please justify."

Response: This National Research Council report should be included in the New Scientific Information report because it includes both science and policy information, and it is directly relevant to the RSALs. It is important to document that the information in the report should be considered by the agencies when choosing a final RSAL from the numerous values that will be calculated.

Comment: "**U.S. General Accounting Office Report on Radiation Standards:** Once again, this document is to address new science not personal opinion. The statement in the second paragraph on page 18 states that 'These conclusions are relevant to current radiation standards rather than to the RSALs that are currently being calculated. However, the RSALs process should take the lessons learned from these conclusions and strive to set action levels that are scientifically defensible.'"

Response: The last two sentences in this section have been revised to read: "Therefore, there is no relevant information from this report to consider in the RSALs process."

Comment: "**U.S. General Accounting Office Report on Radiation Standards:** The last sentence in the first paragraph in this section sates [sic] that 'the report concludes that the EPA and the Nuclear Regulatory Commission are not in agreement on these standards, and that a lower standard results in higher cleanup costs.' This statement does not apply to this new scientific information document and should be removed."

Response: The New Scientific Information report is merely stating the goals and respective conclusions of the report that was reviewed by the working group. It is not giving an opinion of the working group or the agencies. After this statement, the New Scientific Information report has been revised to state that there is no relevant information from this report to consider in the RSALs process.

58

Comment: "This document should be rewritten to cover the new science information requested in this letter as well as the comments from the focus group."

Response: The report is in the process of being revised in response to the comments referenced above. Requested changes that were not made are described in this response to comments, as well as the response to the Focus Group comments (which is not yet complete).

Comment: "It should be written as a review of the new information that was brought to the working group for discussion."

Response: The purpose of the report is to summarize the new scientific information that was reviewed by the working group, which is how the report was originally intended to be written. Revisions that have been made to the report as a result of these comments has clarified this purpose even further.

59/59

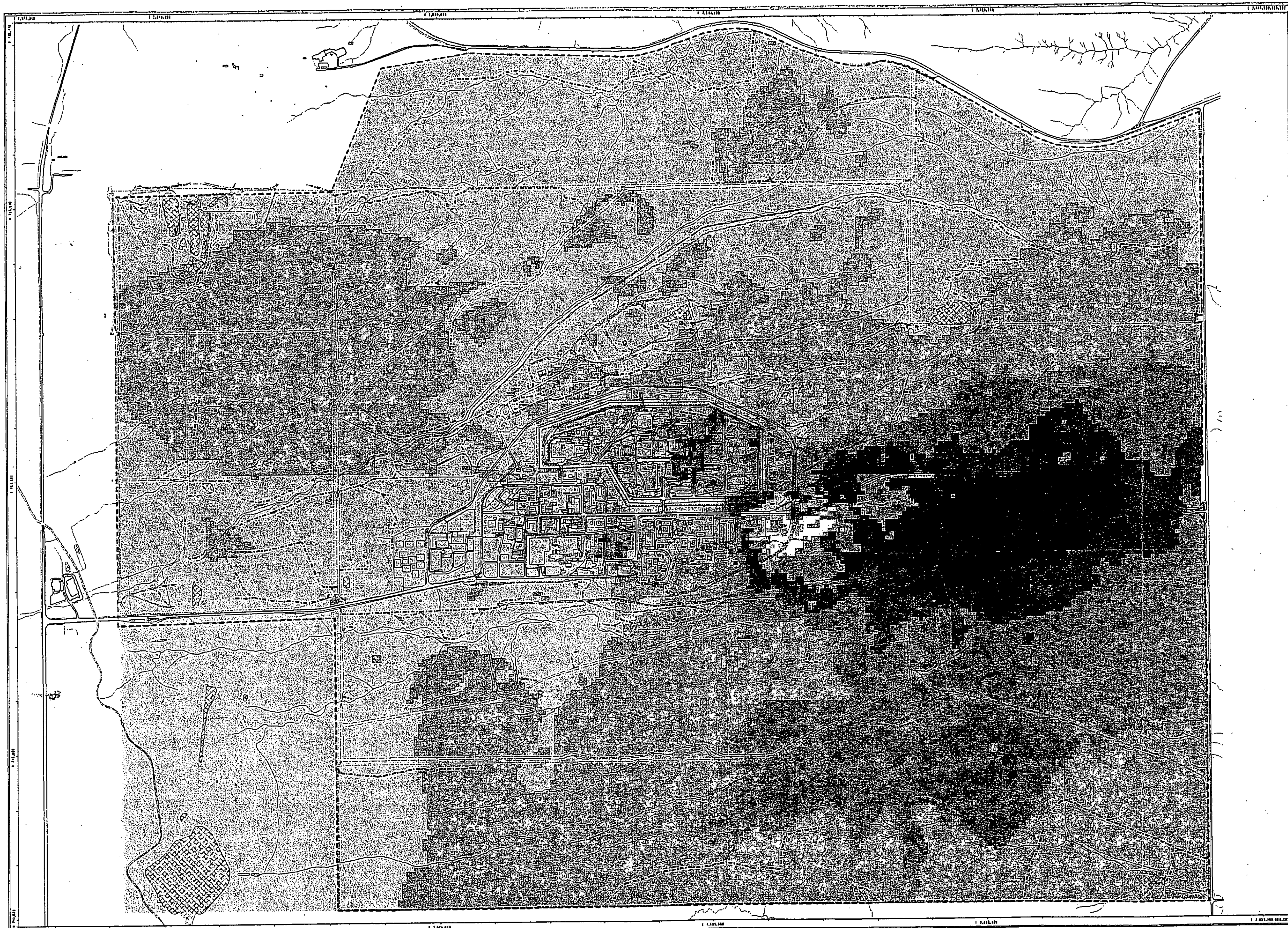

Figure B-11

Pu-239 Isoplot (pCi/g)
(1999 Kriging Analysis)

EXPLANATION

- < = 0.1
- > 0.1 and < = 1.0
- > 1.0 and < = 5.0
- > 5.0 and < = 10.0
- > 10.0 and < = 25.0
- > 25.0 and < = 100.0
- > 100.0 and < = 252.0
- > 252.0 and < = 1429.0
- > 1429.0 and < = 10000.0
- > 10000.0

Standard Map Features

- Solar Evaporation Ponds (SEP)
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/95
Data Source:
Pu-239 Kriging data approved by Win Chromec (RMRS, 303-966-4530).

Scale = 1:21330
1 inch represents approximately 1778 feet

500 0 1000 2000 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

GIS Dept. 303-966-7707

Prepared by:
DynCorp
THE ART OF TECHNOLOGY

Prepared for:

15

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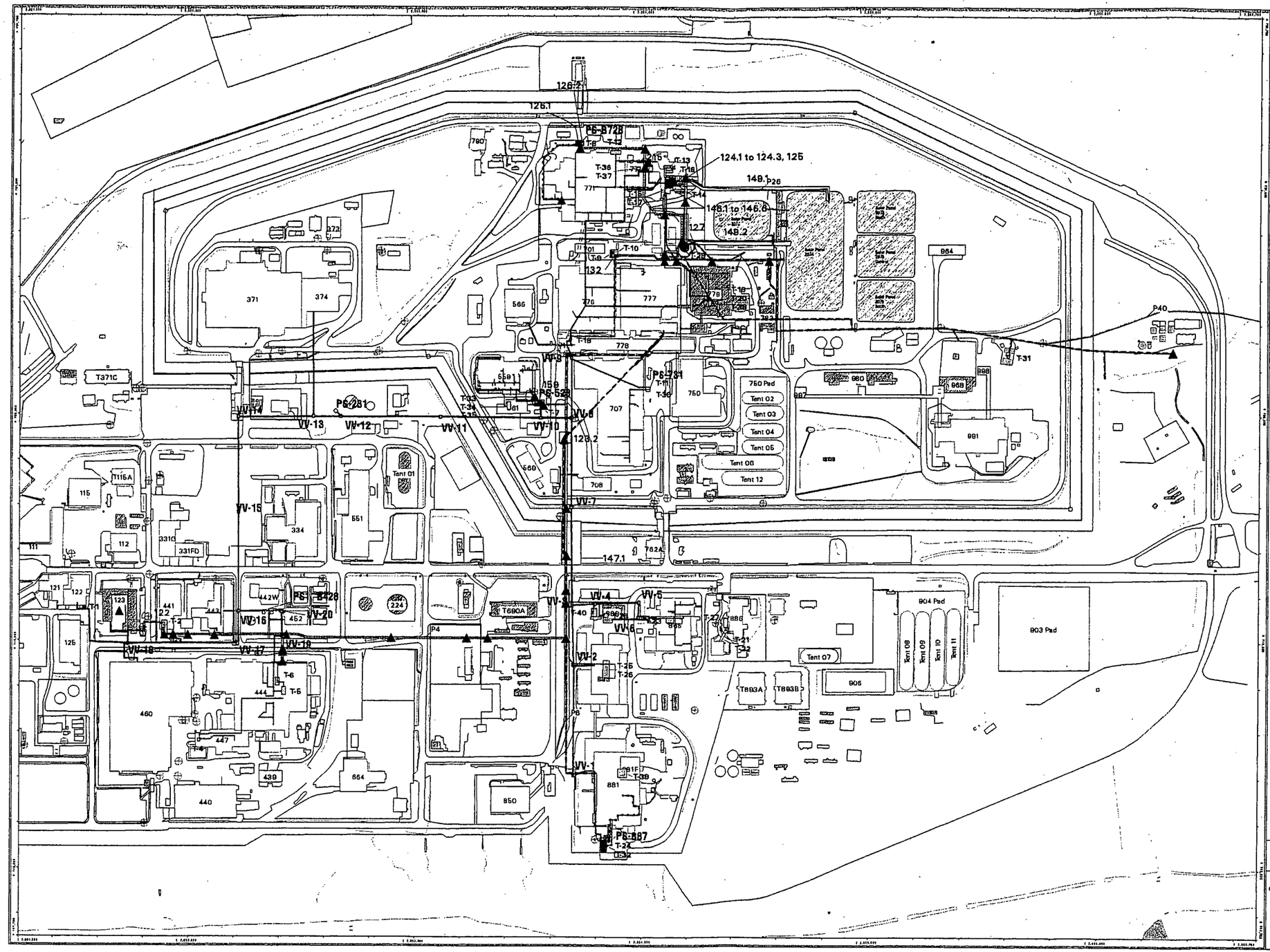
*** Draft ***

Figure 13
Original Process Waste Lines



EXPLANATION

- Tanks of Concern
- Foamed and Stabilized Tanks (Source Removed - Interim Status)
- Remaining Tanks
- Process Waste IHSS Locations (Former OU 5 IHSSs)
- Original Process Waste Lines
- Location of Original Process Waste Lines that may have been removed
- Pipe Currently In Use
- Pipe Made of Vitrified Clay
- Cannot Verify if Pipe Exists
- Leaks Along the Pipe
- Pipe Failed Pressure Test
- Known Leaks
- Manholes
- Approximate Location of New Process Waste Lines
- Valve Vault Locations

NOTE:

VV = Valve Vault
PS = Pumping Station

The Original and New Process Waste line locations shown on this are approximate and should not be used for determining the line location when performing excavation work.

Standard Map Features

- Buildings and other structures
- Demolished buildings
- Solar Evaporation Ponds (SEPs)
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Paved roads
- Underground tunnels

DATA SOURCE BASE FEATURES:
Rocky Flats/Fernald as Subsurface Sites (RFES), DOE, 1992, With Recent and Subsequent Updates.
The GIS Original Process Waste Lines (OPWL) were digitized from AutoCAD files which were generated by IT Corporation from the OU-5 Work Plan, Nov. 1992
The GIS Links associated with the Original Process Waste Lines (OPWL) were derived from DXF files which were generated by IT Corporation from the OU-5 Workplan, Feb. 1992.
Buildings, fences, bridges/culverts, roads and other structures from 1994 aerial flyovers data compiled by EG&G REE, Las Vegas. Digitized from the orthophotographs, 1/95

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Scale = 1 : 8520
1 inch represents 4601 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum : NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

GIS Dept. 303-966-7707

Prepared by: DynCorp — THE ART OF TECHNOLOGY

Prepared for: KAISER-HILL COMPANY

MAP ID: SK-0383

December 03, 2001

NT_Svr w:/projects/fy2k/2k-0383/opwl_fig13_b-size.aml

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12

OPWL Summary

LINE NAME	YEAR INSTALLED/ ABANDONED	LINE COMPOSITION	DEPTH TO PIPE	DOCUMENTED FAILED PRESSURE TEST	SECTIONS IN USE 1=RCRA/2=Deluge	CONTAMINANTS Acids	Bases	Solvents	Rads	Metals	Other	LEAKS Documented	Soil Excavated	OTHER Location of Releases (Notes)
P1	68/82	3" pe inside 4" steel	5'	No	Yes(1)	X	X	X	X	X	X	No		(Indications that E/W portion between manholes removed and ends plugged.)
P2	52/82	4" cast iron		No		X	X	X	X	X	X	Yes	No	Beneath B123
P3	52/82	4" vitrified clay		No		X	X	X	X	X	X	No		(Pipes in first manhole cut off and plugged.)
P4	52/81	4" cast iron	3.5'	2.5 gph / 37 psig	{NSC}	X	X	X	X	X	X	Yes	No	S of B441; between B441 & B443; S of B443; N of B661; driveway of B663, joints leaking
P5	52/81	4" cast iron	4'	2.5 gph / 37 psig	{NSC}	X	X	X	X	X	X	Yes	No	N of B444 (Some drawings indicate line was flushed, cleaned, sealed and then abandoned.)
P6	53/80	3" sl steel inside 10" vitrified clay	5' - 6'	No	{NSC}	X	X	X	X	X	X	Yes		Intersections with P4, 9, 10, 11, & near B881.
P7	52/NA	2" pe inside 4" stainless steel	10'	No	Yes(1)	X	X	X	X	X	X	No		(Southern end replaced with 6" stainless steel.)
P8	52/80	DOES NOT EXIST												
P9	57/84	3" steel & 1.5" stainless steel	8' - 10'	No		X	X	X	X	X	X	Yes		Intersection of P9 & P6.
P10	68/82	3" stainless steel	3' - 6'	No		X	X	X	X	X	X	Yes		Intersection with P6 & at west end of line. Pipes beneath B865 capped and abandoned.
P11	52(75)/84	3" ribbed hose inside 10" vitrified clay	8' - 10'	27 gph / 20 psig		X	X	X	X	X	X	Yes		Intersection with P6 & at both ends of the pipeline.
P12	52/75	3" sl steel inside 10" vitrified clay		27 gph / 20 psig		X	X	X	X	X	X	Yes	No	Acid & steam destroyed clay outershell N of Central Ave. On map, 12/13 may have been switched.
P13	75/84	3" ribbed hose inside 4" fiberglass		No		X	X	X	X	X	X	Yes		At valve vault 7 west of 707.
P14	52/68	3" sl steel inside 10" vitrified clay		No		X	X	X	X	X	X	Yes	No	At P12 and elbow connection; S of 777 (Portions below 707 & 777 may have been removed.)
P15	68/84	3" sl steel inside 10" vitrified clay		27 gph / 20 psig		X	X	X	X	X	X	No		Pressure test in '71 detected 27 gph at 20 psig leak.
P16	68/82	3" PVC	10'	No		X	X	X	X	X	X	Yes		At P16 and Holding Tank T7 intersection (P16 may also be located under Bldg. 865 per dwg. 304908-D13 E5 Util. Map 10/17/91.)
P17	68/82	3 & 4" glass/4" PVC (inside 6" glass) *	7'	No		X	X	X	X	X	X	Yes	Yes	*and 4" ss/4" pe pipe. Where above slab removed. Old Pyrex leaking pipe below 559 aip.
P18	68/82	DOES NOT EXIST												
P19	68/84	3" stainless steel		No		X	X	X	X	X	X	No		(Portion between 707 & 731 reportably removed.)
P20	68/84	3" stainless steel		No		X	X	X	X	X	X	Yes		P20/21 intersection and at valve vault SW of B703.
P20.1	68/77	1" black or cast iron		No								No		
P21	52/84	3" stainless steel		No		X	X	X	X	X	X	Yes		P20/P21 intersection and at valve vault SW of B703.
P22	52/82	6" cast iron		No		X	X	X	X	X	X	Yes		P22/P23 & P22/24 intersections and at T-8.
P23	69/82	10" fiberglass or stainless steel		No	Yes(2)	X	X	X	X	X	X	Yes		P23/22 intersection and at T-8.
P24	66/82	6" cast iron		15 gph / 20 psig		X	X	X	X	X	X	Yes		P24/22 & P24/25 intersections, both ends of line, at valve, between & N of B771 & 774. Leaked at junction.
P25	72/82	3" stainless steel, cast iron, & steel	5'	22 gph / 20 psig		X	X	X	X	X	X	Yes		P25/24 & P25/34 intersections, at valve vault N of T-29, at N end of line, and beneath B771C. Section N of 771C to P24 once P34. All valves suspected of leaking.
P26	72/70s	2 lines: both 1.5" PVC or one 1.5" ss		No		X	X	X	X	X	X	Yes	Yes	N of B774 at flange joint S of road SE of B774.
P27	52/82	3" cast iron & 3" stainless steel	5'	No		X	X	X	X	X	X	Yes		P27/28 intersection, section between B774 & T-29, and section between B777 & 779.
P28	52/82	3" cast iron & 3" stainless steel	5'	14 gph / 20 psig		X	X	X	X	X	X	Yes		P27/28 intersection, section between B774 & T-29, and section between B777 & 779.
P29	52/82	4" cast iron & 4" stainless steel	5'	45 gph / 20 psig		X	X	X	X	X	X	Yes		Leak of 45 gph at 20 psig detected in 1971.
P30	57/82	2", 3", 4", & 6" steel pipe		No	Yes(2)	X	X	X	X	X	X	No		
P30.1	57/81	3" stainless steel		No		X	X	X	X	X	X	No		
P30.2	81/82	3" stainless steel		No		X	X	X	X	X	X	No		
P31	52/83	52/ 3: 1/5", 1" & 2" ss; '61/ 2: 2" & 3" PVC		No		X	X	X	X	X	X	No		(Pipe contained within tunnel which is reported to be highly contaminated.)
P32	57/82	6" vc, 4 & 6" cast iron, 4 & 6" steel		No		X	X	X	X	X	X	No		
P33	52/72	3" steel		No		X	X	X	X	X	X	No		(Western section removed in early 1960s.)
P34	52/72	3" steel or stainless steel		No		X	X	X	X	X	X	Yes		P34/33 & P34/25 intersections.
P34.1	52/65	3" black iron		No		X	X	X	X	X	X	No		(May have been removed for construction activities.)
P35	52/82	1 or 2 - 3" steel pipes		No		X	X	X	X	X	X	Yes		P35/25 and at valve vault N of T-29.
P36	65/82	3" PVC & stainless steel	5'	No		X	X	X	X	X	X	Yes		P36/20 intersection and at valve vault W of Pond 207-A.
P37	57/82	3" steel, PVC, & vitrified clay		Valves N of 777 leak		X	X	X	X	X	X	Yes		W Pond 207A, S Pond 207B, P37/20,36 & 38 X's, valves N B777. (Several sections may have been removed.)
P38	52/82	6" (old) & 10" vitrified clay	3' - 5'	No		X	X	X	X	X	X	Yes		W of Pond 207-A. (Realigned in the 60s: Some or all of original line may still exist.)
P39	52/82	6" vitrified clay	10'	No		X	X	X	X	X	X	Yes		East end and at outfall.
P40	72/82	6" fiberglass	10'	No		X	X	X	X	X	X	Yes		Under Perimeter Rd to Pond B-2, edge of B-2. (Minimal aboveground sections remain.)
P41	57/82	2" & 3" vc, black iron, ss, & cast iron	5'	No		X	X	X	X	X	X	No		
P41.1	57/69	3" black iron		No		X	X	X	X	X	X	No		
P42	57/82	3" cast iron or 3" stainless steel		All valves S of T29 leak		X	X	X	X	X	X	Yes		W and under 779. Starts at Tanks 19, 20, and 38. Ends at valve vault SW of T29. (Part of P42 was orginally P37. Pipeline was replaced and became part of P42.)
P43	69/82	3" steel	5'	No		X	X	X	X	X	X	Yes		W of T29. Runs S-N. Starts at P41, connects to P35, 27, 28, 46 to vv at T29. Leaks at both valve vaults.
P44	69/82	3" steel	5'	No		X	X	X	X	X	X	Yes		W of T29. Runs parallel to P43. Starts at P44, 58 and ends at P37. Leaks at both valve vaults. (Parts were once P59.)
P45	66/unknown	6" vitrified clay		No		X	X	X	X	X	X	Yes		South of T29. Starts at 703, runs SE along T29 and ends at manhole NE of T29. Releases reported along west end of pipe.
P46	52/82	3" steel	5'	No		X	X	X	X	X	X	No		N of T29, parallel to P35. (Sloped for gravity flow to Pond 207-C.)

OPWL Summary

LINE NAME	YEAR INSTALLED/ ABANDONED	LINE COMPOSITION	DEPTH TO PIPE	DOCUMENTED FAILED PRESSURE TEST	SECTIONS IN USE 1=RCRA/2=Deluge	CONTAMINANTS						LEAKS		OTHER
						Acids	Bases	Solvents	Rads	Metals	Other	Documented	Soil Excavated	Location of Releases (Notes)
P47	Unknown	3" cement asbestos	5'	No		X	X	X	X	X	X	No		Exits Pond 207C near SE corner, ends at valve vault W of 207A. (May be reverse osmosis brine pipe not OPWL.)
P48	Unknown	Cast iron		No		X	X	X	X	X	X	No		Existence questionable, may have started at 788 south to P36.
P49	Unknown	8" cast iron	aboveground	No		X	X	X	X	X	X	No		(Aboveground between 207C and 207A. Portion may have been removed to construct 788A.)
P50	Unknown	8" cast iron	aboveground	No		X	X	X	X	X	X	No		(Aboveground between 207A and 207B. Does not connect with any other lines.)
P51	57/78	4" & 6" black iron		No					X		X	No		(Beneath western end of 778. Used to transfer laundry waste. Sections removed and plugged w/ cement.)
P52	Unknown	4" unknown material		No		X	X					No		(Does not connect with process waste transfer system. Located S and under 443. Unknown uses.)
P53	52/76	2" stainless steel		No		X	X	X	X	X	X	Yes		Between 881/887. Entire line identified as a reported release. (Labeled a nitrate drain. Unclear where line enters 887.)
P54	52/unknown	3" stainless steel/2.5 " PVC	10'	No	Yes (1) {YSC}	X	X	X	X	X	X	Yes		S of 881 to 887. Entire line identified as reported release. Testing showed no leaks between 887 and 883. (Sections removed in '76 and realigned.)
P55	52/76	4" stainless steel	4'	No		X	X	X	X	X	X	No		(Between 881/887. Gravity flow used for laundry waste.)
P56	83/90	3 ea 1" PVC and 2 ea 2" plastic	in tunnel	No	Yes (1)	X	X	X	X	X	X	No		(Part of five pipes in tunnel between 771/774. No reported releases but located in highly contaminated tunnel.)
P57		DOES NOT EXIST												
P58	52/69	3" black iron	7'	No		X	X	X	X	X	X	No		(S and E of 703. Starts at intersection of P20 and P21. May have been abandoned in place.)
P59	52/69	3" black iron	7'	No		X	X	X	X	X	X	No		(E of 703, starts at valve vault N of T29. Ends at P37. May have been abandoned in place. Parts of it became P44.)
P60	52/70	4" black iron or vitrified clay	8'	No		X	X	X	X	X	X	No		(NE of T29, starts at valve vault N of T29, ends at Pond 207C. Transferred treated water.)
P61	52/82	4" vitrified clay	5'	No		X	X	X	X	X	X	No		(NW of T29, starts at valve vault N of T29 ending at manhole NE of T29.)
P62	76/90	1 ea 2.5 PVC, 1 ea 1.5 PVC		No	Possible - see notes	X	X	X	X	X	X	No		(Starts at 559 to 561 [piping is PVC]. From 561 to end at 528 piping is stainless steel. Connects 559 to T7. Comment from OU9 Tech Memo [1994] says pipe may be brought back in service for Phase II activities. Cannot verify info at this time.)
P63	63/unknown	2" and 3" steel pipe		No					X		X	No		(Located at 886 in two locations. One exits SW of 886 and ends at 828. Second exits W of 886 and intersects with first pipe. Not identified as an OPWL.)
P64	63/unknown	1" or 2" stainless steel in 8" or 6" Schedule 40 steel		No					X			No		(W of 886. Consists of six lines between 886 and 828. Used as a process transfer line for rooms 101 and 103. Connects to T21 in 828.)
P65	63/66	2" ductile iron pipe		No					X		X	No		(NW of 828 at tank vault, ends at sanitary sewer lift station E of 865. Used to transfer wastes from 101 and 103 in 886.)
P66	77/unknown	2" in 4" stainless steel		No					X		X	No		(W of 886 and ends at 828. Used to transfer waste in 103.)

pe = polyethylene pipe
sl = Saran lined

ss = stainless steel
vc = vitrified clay

{YSC} Secondary Containment

{NSC} No Secondary Containment