Review of the ATSDR Report Entitled,

"Preliminary Public Health Assessment for Monticello Mill Tailings (DOE) Monticello, San Juan County, Utah CERCLIS No. UT3890090035, December 28, 1995"

by

The Peer Review Committee
of the
Consortium for Risk Evaluation with Stakeholder Participation

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1. Executive Summary

At the request of the U.S. Department of Energy (DOE) Office of Environmental Management, the Peer Review Committee of the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) evaluated the report "Preliminary Public Health Assessment for Monticello Mill Tailings (DOE) Monticello San Juan County, Utah CERCLIS No. UT3890090035, December 28, 1995," issued in February, 1996, by the Agency for Toxic Substances and Disease Registry (ATSDR), and the committee also reviewed DOE's comments on the report.

In general, the Committee considered the ATSDR assessment to be a reasonably well conceived evaluation of the public health issues relating to the Monticello Uranium Mills Tailings Site. However, the assessment does not distinguish clearly between on-site and off-site contamination, and it was judged to be incomplete in its lack of an adequate evaluation of the concentrations of radionuclides, heavy metals, and other toxic contaminants present in air, soil, water, and other exposure media in and around the site, its lack of an adequate evaluation of the levels at which human exposure to such toxicants has occurred, is now occurring, or may be expected to occur in the future, and its failure to provide adequate information about the location of potentially exposed persons, their activities, and their sources of drinking water in relation to the site. Without evaluating such information it is not possible to assess the magnitude of any associated risks to human health or the benefits to be expected from protective or remedial measures that may be taken.

Thus, although the mill tailings remaining on the site may properly be considered to pose a potential risk to human health, the report does not establish that they "are a public hazard today," given the restrictions on access to the site that are said to be currently in place.

On the basis of our review, the exposure situation appearing to have the greatest potential to pose significant risk to human health results from the use of mill tailings as fill material at vicinity properties, since this may significantly elevate indoor inhalation exposure to radon progeny and exposure to external gamma radiation. Without data characterizing such exposures, both before and after remediation, the associated risks and the effectiveness of any remedial measures cannot be adequately assessed. Such data, however, are not included in the report.

Furthermore, the conclusion in the report that the concentrations of contaminants in Montezuma Creek and the shallow alluvial aquifer pose a threat to health is not supported by adequate assessment of any associated pathways or levels of human exposure.

The report's conclusions that the rates of lung cancer and renal failure may be elevated in the local population are, likewise, based on fragmentary information and must be considered tentative at best.

The report's recommendations and recommended public health actions, which call for continued efforts to monitor levels of contamination in and around the site, to limit human exposure to the contaminants, to investigate any associated health effects, and to remediate contaminated areas, are in accordance with established public health policies and with current DOE operating practices. The recommendations are incompletely developed and vague, however, and they fail to delineate clearly any role for voluntary health agencies and organizations in the educational and remediation activities that are suggested.

Also missing from the recommendations is a clear outline of the specific steps that will (or should be) taken to address stakeholder concerns.

2. Introduction

On December 27, 1996, the Department of Energy (DOE) Office of Environmental Management requested that the Peer Review Committee of the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) conduct a peer review of the report entitled, "Preliminary Public Health Assessment for Monticello Mill Tailings (DOE) Monticello, San Juan County, Utah CERCLIS No. UT3890090035, December 28, 1995," which had been issued by the Agency for Toxic Substances and Disease Registry (ATSDR) in February, 1996. The Committee was also requested to review DOE's comments on the report and to recommend appropriate risk management and public health intervention strategies for addressing the problems relating to the Monticello site, taking into account the feasibility of any such strategies.

The Monticello Mills Tailings site (MMTS) is a 78-acre abandoned uranium and vanadium processing mill on

DOE-owned property in the city of Monticello, Utah. The mill, which went into production during world war II, ceased operation in 1960. Throughout its operation, however, mill tailings were blown by the wind into the city of Monticello, and thousands of tons of mill tailings were used for various purposes, including fill for open lands, backfill around sewer lines, sub-base for sidewalks, backfill against basement foundations, and sand mix in mortar, concrete, and other construction materials.

Between 1961 and 1962, the mill tailings were stabilized, and in 1974 -1975, contaminated soils were removed from the ore-buying stations. In 1975, a fence restricting access to, and removal of, contaminated tailings was constructed; and in 1980, the Monticello Remedial Action Project was established by DOE to assure safe caretaking and remediation of the contaminated facilities. Remedial activities for properties in the vicinity of the MMTS were transferred in 1983 from the Monticello Remedial Action Project to the Monticello Vicinity Properties Project (MVPP), which DOE organized specifically for the purpose. Both the MVPS and the MMTS have since been included on the Environmental Protection Agency's National Priority List , and remediation has proceeded in accordance with Records of Decision for each site.

In 1992, the ATSDR, which is required by law to conduct a public health assessment at each of the sites on the National Priorities List, concluded that remedial action could be expected to remove most of the contaminated soils within the residential community and eliminate concerns about long-term exposure and any associated health effects. More than a thousand of the individually owned properties around the city of Monticello were reported by ATSDR to have been surveyed and characterized for contamination by 1995, with many having been recommended for clean-up, and some already remediated. Not all properties, however, were reported to be addressed by the ongoing remedial activities, for various reasons (e.g., the owners refused remediation, the origin of the contaminants was disputed, the properties were situated outside the 6-mile radius, etc.), with the result that the potential for exposure to low-level radiation in such properties might be projected to persist indefinitely.

As requested by DOE, the CRESP Peer Review Committee has reviewed the aforementioned ATSDR report and accompanying DOE comments. The findings and recommendations resulting from the review are presented herein.

3. The CRESP Peer Review Committee

The CRESP Peer Review Committee comprises a multidisciplinary group of recognized experts drawn from universities and other institutions throughout the U.S. It was organized to provide a source of independent, critical, and knowledgeable evaluation of studies carried out by CRESP scientists or others. The members of the committee (listed in Appendix A), each of whom is a recognized expert in his or her field, were chosen to represent the disciplines of key importance to CRESP's work (i.e., biostatistics, ecology, economics, engineering, environmental chemistry, , epidemiology, ethics, exposure assessment, health physics, industrial hygiene, medicine, occupational medicine, public health, public policy, radiobiology, sociology, and toxicology).

To ensure that the Committee's conclusions are known and perceived to be free of bias, the Committee operates independently of all other CRESP units. In addition, if any member of the Committee may have taken a position on a specific issue under consideration or may otherwise have been involved with the issue in a way that could be construed or perceived to create a conflict of interest, the member is asked to recuse himself or herself from all deliberations relating to the issue in question.

4. General Comments on the ATSDR Report

As a preliminary assessment, the ATSDR report represents a reasonably well conceived evaluation of the public health issues relating to the DOE Monticello Uranium Mills Tailings Site. The assessment is incomplete, however, in that it does not adequately evaluate the concentrations of radionuclides, heavy metals, and other toxicants that are present in air, water, soil, and other exposure media in and around the site, nor does it adequately evaluate the levels at which human exposure to such toxicants has occurred or may be projected to occur. In addition, the title of the report is ambiguous, since the report addresses the Monticello Vicinity Properties Site, as well as the Monticello Mills Tailings Site.

The major conclusion presented in the report -- that the mill "tailings that remain on the site are a public hazard today" -- appears inconsistent with the fact that access to the site is now restricted. It would seem more accurate to state that the tailings constitute a potential risk to human health.

The conclusion that their is a potential for human exposure to low-level radiation from radioactive contamination at off-site locations (some of which may exist in properties that are not being addressed by the current remediation efforts) implies the existence of public health risks that deserve to be defined more clearly. The text fails to distinguish, for example, between the extent of risk reduction that can be expected to result from ongoing remedial actions and the risks that may be associated with unremediated properties or with natural background sources.

The related conclusion -- that Montezuma Creek and the shallow alluvial aquifer are contaminated from site releases and should not, therefore., become used as sources of food or potable water -- is justified on worst-case assumptions; however, the associated risks, if any, are not assessed by critical analysis of the relevant environmental measurement, pathway, and exposure data.

The conclusions that the rates of lung cancer and renal failure may be elevated in the local population are based on fragmentary information and must be considered tentative at best. Also speculative is the inference that occupational exposure to radioactive and chemically contaminated dusts may have increased the risks of lung cancer and renal failure in emp loyees of the mill who worked there when it was in operation.

The recommendations for continuation of efforts to monitor levels of contamination, remediate contaminated areas, and limit human exposure to the contaminants are ill-defined but are consistent with accepted public health policy and with current DOE operating practice.

5. Specific Comments on the ATSDR Report

5.1 Foreword

Third paragraph; last line: “is” should be replaced by “are”.

5.2 Summary (Page 1)

This one-page summary of the report’s major findings and conclusions is reasonably clear and complete; however, the statement in the first paragraph that “the tailings that remain on the site are a public health hazard today” may be misleading, since access to the site is restricted. It would seem more accurate to state that the tailings are a potential public health hazard.

Furthermore, the report does not provide a definition of what constitutes a “public health hazard.” Guidance with regard to this question can be obtained from four sources: 1.) EPA Protective Action Guides (i.e., accidental releases that could cause exposures in excess of 1-5 rem whole body from plume exposure and 0.5 rem from the ingestion of food (EPA 92) warrant protective action); 2.) ICRP-60's “system of Protection in Intervention,” which makes a distinction between long-standing problems requiring intervention and emergency conditions requiring intervention (the latter would appear to be consistent with “a public health hazard”); 3.) NCRP Report No. 116, which recommends that exposures of members of the general public from manmade sources (not including medical exposures) should not exceed 100 mrem/yr from continuous exposures and 500 mrem/yr from infrequent exposures; and 4.) EPA Superfund guidance concerning target risk, which states that sites should be remediated to levels representing risks between 1.0 E-06 and 1.0 E-04. Using 500 mrem/yr EDE as the definition of “a public health hazard,” the data (based on scoping calculations provided later in this review) do not appear to support the report’s conclusions.

Finally, the Summary neglects to acknowledge that the potential public health concerns that are mentioned have been, or are being, addressed by DOE, a fact which is important for helping to place them in proper perspective.

5.3 Background (Pages 2-11)

This section of the report provides a clear and straightforward description of the Monticello sites; their demographics, land use, and natural resource use; ATSDR activities related to the sites; and the sources of pertinent health outcome data consulted by ATSDR in making its assessment.

Although a comparison of the background information with that provided in EPA 82 and EPA 89, revealed no obvious inconsistencies, small differences were found between reported values in DOE 96 and the document; for example, 1.4 vs. 2.2 million cubic yards of tailings (page 3). However, such differences

are to be expected and are not significant to the health assessment.

Page 5

The first full paragraph states that a preliminary public health assessment concluded that the Monticello Vicinity Properties were of public health concern because of risks to human health. This section should summarize the basis for this conclusion; i.e., is this statement made because contaminants are in the environment and are, or may be, causing exposures in excess of background, or in excess of radiation protection limits, or in excess of levels warranting intervention, etc? Does the ATSDR make a distinction between a "public health concern" and a "public health hazard?" It seems that the site may be more of a public health concern than a public health hazard.

The last sentence in the third full paragraph on page 5 recommends that workers for the City of Monticello use radiation detectors while conducting municipal improvements requiring the excavation of soil. This recommendation is prudent.[1]

[1]As a rule of thumb, the normalized external dose* from Ra-226 plus progeny in soil is 1.3E-3 mem./hr per pCi/g assuming a relatively large area (>1000 m2) and thick (>20 cm) zone of contamination. It could also be shown that the dose from Ra-226+D from the inhalation of dust and the ingestion of soot is negligible as compared to the external exposure. For example, assuming a heavy construction dust loading of 1800 ug/m3, the normalized inhalation dose would be about 1.8E-5 mem./hr per pCi/g. (Yu et al, 1993 a) report that the maximum respirable dust loading inside a cab of heavy construction equipment during a surface coal mining operation was found to be 1800 ug/m3). The normalized inhalation dose from Th-230, however, can be comparable to the normalized external dose from Ra-226; i.e., the inhalation dose from Th-230 could be as high as 6.8E-4 mem./hr per pCi/g. Also assuming 2000 working hours per year, the worker's normalized annual external exposure would be 2.6 mem./yr per pCi/g of Ra-226+D in soil. Therefore, the concentration of Ra-226+D in soil that could cause an external dose exceeding 100 mem./yr (i.e., the non-radiation worker radiation protection standard set forth in 10 CFR 20, DOE Orders, and EPA Federal Guidance) is about 38 pCi/g. The report does not provide the radionuclide composition and concentrations of the tailings pile. However, EPA 82 (Table 3-1) reveals that the average concentration of Ra-226 in tailings piles at 20 inactive uranium mill tailings sites ranges from 50 to 1000 pCi/g, with a maximum measured concentration of 4200 pCi/g. If large volumes of the tailings were used offsite as backfill, it is possible for worker doses to exceed 100 mem./yr.

*Throughout this review, the concept of a “normalized dose” is used. A normalized dose is the dose to an individual from a specific radionuclide and specific exposure scenario/pathway per unit activity in the media of concern. The normalized dose is expressed in units of mem./yr effective dose equivalent (EDE) per pCi/g of soil or per pCi/L of air or water. The normalized dose is a convenient metric because the doses and risks associated with radioactivity in the environment are directly proportional to the concentration in the media of concern, such as soil or air. As such, once the radionuclide concentration in the media of concern is defined, the doses can be estimated. It is also useful in comparing the relative importance of different exposure pathways and radionuclides.

In addition, before and during a major municipal excavation project, a gamma survey of the site would be appropriate. Such a survey may be used in lieu of personnel dosimetry, such as individual TLDs for workers.

Not including the radionuclide concentrations in the tailings is a shortcoming of the report, since the tailings serve as the primary source of offsite contamination, and this information could be used to assess the upper bound onsite and offsite doses from numerous past and current exposure pathways.

Page 9

In the section on surface water use, it is stated that landowners downstream of the site are permitted to draw irrigation water from Montezuma Creek and that, in addition, the creek provides drinking water for livestock. These facts suggest that the stated uses of the creek represent very likely routes of exposure to site contaminants through agricultural pathways. These likely routes were not evaluated in the assessment.

5.4 Community Health Concerns (Page 12-17)

Page 12

Beginning on page 12, the concerns expressed by the public are presented. Through the use of scoping calculations, such as the example provided above for workers, many of these concerns could be addressed in a more complete manner. For example, knowing the compositions of the ore and the tailings piles, estimates of the exposures and doses to people who visited the site in the past could be provided.[2]

In addition, using standard modeling assumptions, the potential doses from ingestion of vegetables grown in soil containing tailings, ingestion of vegetables contaminated with airborne emissions, inhalation of dust, etc. could have been estimated, and a lot more could have been done to respond to the concerns raised by members of the public.

5.5 Overview of Radiation (Pages 18-21)

General: This section of the report oversimplifies the issue, and it contains a number of statements that are inaccurate or may be misleading.
Page 18, 1st para, line 2: it is incorrect and confusing to state that each group of radiation effects "poses a medical dilemma".

Page 18, 1st paragraph, lines 2-3: it is not clear what is meant by "how human biological qualities are changed distinguishes the two".

Page 18, 2nd paragraph, line 6: "does increase" is too strong; "may increase" would be more accurate.

Page 18, 3rd paragraph, line 1: "believe" and "are" are incorrect; "suspect" and "may" would be more accurate.

Page 18, 4th paragraph, lines 1-2: present data suggest that cancer arises through a multistage process and that a single change in one cell is seldom, if ever, sufficient.

Page 18, 4th paragraph, lines 9-10: the text should be reworded to state that "...radiation may carry an associated risk..." and that "...radiation may produce a higher probability...."

Page 18, last paragraph: the statement that "stochastic effects are cumulative" is somewhat misleading because there is evidence that at low dose rates there are repair mechanisms at work, and the possibility of a threshold or hermetic effects can not be entirely ruled out (UNSCEAR 94).

[2]For example, a child playing on an uncovered tailings pile could receive a normalized external exposure of about 1.3E-3 mem./hr per pCi/g of Ra-226+D in the pile. There should be abundant information on the Ra-226 composition of the piles that could be used to bound the exposures. If the average Ra-226 concentration in the piles were 1000 pCi/g (see above), the dose to the child would be about 1 mem. for each hour of play time on the pile. The doses from dust inhalation or inadvertent ingestion could similarly be approximated for not only Ra-226+D, but also other radionuclides and non-radiological contaminants.

Page 19, 2nd paragraph: last sentence: the statement that exposures of uranium mill workers would have been below the threshold level for nonstochastic effects may be true for high dose radiation effects but is not true for the chemical toxicity of uranium. The EPA reference dose for uranium is 3 ug/kg/day (IRIS 94).

Page 19, 3rd paragraph: detailed data on threshold doses for high-dose effects are out of place in the context of this report.

Page 19, last paragraph, line 2: the reference cited (No. 11) has been superseded by more recent reports (e.g., NAS, 1990; UNSCEAR, 1988, 1993,1994); what does "those" refer to?

Page 20, 2nd paragraph, line 1: "constant" is incorrect. Furthermore, the discussion regarding latency periods, etc. is based primarily on short-term exposures exceeding 10 rem, well in excess of the exposures to the public at the site; this should be explained in the report. Also, since the site contains both radioactive and non-radioactive hazardous substances, it might be more logical to place the entire radiation effects summary in Appendix C, where the health effects of the chemicals of concern are discussed.

Page 20, 4th paragraph, lines 5-6: this statement implies that a threshold dose for mutations exists.

Page 20, last paragraph, line 1: "normally attributed " is misleading.

Page 21, line 5: the word "may" should be inserted before "affect'.

Page 21, lines 7-9: this statement is too dogmatic; it is uncertain whether radiation poses any risks at the low levels associated with natural background. The discussion should also, however, address radon, since, in theory, indoor radon doses and risks may be limiting at the vicinity properties contaminated with tailings.[3]

5.6 Sources of Contamination (Pages 22 - 26)

In general, the discussion of the sources of contamination, the description of the operation, the types of radionuclides, the properties of the radionuclides, etc. is consistent with other sources of information addressing this topic (i.e., EPA 82; EPA 89a).

It would seem more appropriate to make a distinction between past and present sources of contamination since they lead to very different exposures. The description of the past mill operation is needed to reconstruct past occupational and offsite exposures. A description of the site in its present condition, with its mill tailing piles and restricted access, represents a contamination source leading to very different exposure pathways.

Page 22

[3] For example, as a rule of thumb, the average indoor radon concentration is about 1 pCi/L of indoor air per pCi/g of Ra-226 in soil (if the entire foundation is "submerged" in soil containing Ra-26 - see page 43 of EPA 82). A radon concentration of 1 pCi/L corresponds to about 0.005 WL. In a given year, assuming a person spends half time indoors (page 46 of EPA 82 states that the American public spends approximately 75% of their time indoors, mostly in their homes), the annual exposure to radon progeny is about 0.125 WLM. Assuming 1 rad to the bronchial epithelium per WLM (see page 145 of BEIR 88), the dose to the lung epithelium from indoor radon progeny is about 125 mrad/yr per pCi/g of Ra-226 in soil, or 2500 mem./yr (i.e., applying a QF of 20 for alpha emitters). Applying a tissue weighting factor of 0.12 (see ICRP-60), the EDE is about 300 mem./yr EDE due to indoor radon progeny exposure per pCi/g of Ra-226 in soil. This as compared to about 10 mem./yr EDE per pCi/g of Ra-226 in soil from external radiation assuming 100% occupancy time and no adjustment for shielding while indoors. Adjustment for occupancy time and shield could reduce this normalized dose by about a factor of 4.

The third paragraph states that radon alone accounts for 1-10% of the natural background radiation level. It is not apparent whether this statement refers to external or internal exposures. It would appear that the statement refers to the external gamma radiation field created by radon progeny outdoors. If so, this should be clarified. (Note that, if this statement refers to external gamma radiation, it is consistent with page 20 of NCRP Report No. 77). In addition, if the statement does, in fact, refer to the outdoor external gamma dose from airborne radon progeny, its relevance is unclear. It is the internal dose from inhaling radon progeny, especially indoors, that is of primary concern.

Page 23

The discussion beginning on page 23 describes the types of waste produced during the uranium milling process. This information, together with fate and effects models (see EPA 82), could have been used to bound the potential onsite and offsite exposures that may have occurred in the past. These types of analyses would have allowed the report to be much more responsive to the concerns raised by the public. On page 12, in the third paragraph, line 6, “were” should be replaced by “was.”

Page 24

The second full paragraph states that "because the mill had removed most of the uranium, the tailings are less radioactive than the original ore." This statement is somewhat misleading because the Th-230 and Ra-226, which are potentially much more hazardous than uranium per unit of activity, are still present and in a form which is more hazardous than when the radionuclides were "locked up" in the ore.

5.7 Environmental Contamination and Other Hazards (Pages 27 - 50)

The section is generally deficient because a great deal of the available information is not provided. Specifically, the section should include information on: 1) The radionuclide concentrations in the tailings piles; 2) indoor radon levels at vicinity properties; 3) contamination levels observed in meat, milk, and vegetables; 4) the results of the annual environmental radiological surveillance programs that are required by DOE to be prepared and published, including onsite and offsite TLD readings, air particulate sampling, radon sampling, and radon flux measurements; 5) the results of urinalysis, whole body counts, and personnel dosimetry of workers, which should provide insight into the magnitude of exposures to workers, which should be much larger than the exposures of the public (This information will be useful in bounding the doses and risks at the site); and 6) statistical analysis of the measurement data to show the likelihood of the maximum measured values.

The section reads as if radiological measurements were not made until the site was placed on the NPL. In fact, these sites were monitored from their inception under a radiological surveillance program required by DOE orders.

Page 27

The 4th full paragraph states that the reported contamination levels are compared to levels that are believed to be without adverse health effects, and that these comparison values were selected to protect the most sensitive segment of the population. The comparison values employed in the report were reviewed from this perspective. The comparison levels for radionuclides used in the various tables are as follows:

Radionuclide	Media	Comparison Value	Comments

Ra-226	Soil onsite and offsite	5 pCi/g (40 CFR 192)	For the public offsite, this corresponds to a lifetime cancer risk of 5E-3 including indoor Rn, and about 1E-3 not including indoor radon. For workers onsite, this corresponds to a lifetime cancer risks of 1.6E-3 and 2.8E-4, with and without indoor radon, respectively. (see EPA 94 Table 3-1)
Ra-226	Drinking water	15 pCi/L (40 CFR 141)	This corresponds to 14.4 mrem/yr and a lifetime risk cancer of about 1E-4. (Based on a Ra-226 slope factor of 1.2E-10 lifetime risk per pCi ingested)
U-238	Drinking water	15 pCi/L (extrapolated from 40 CFR 192)	This corresponds to 2.8 mrem/yr and a lifetime risk of about 1.2E-5. (Based on a U-238 slope factor of 1.6E-11 lifetime risk per pCi ingested)
Radon	Outdoor offsite	0.9 pCi/L (40 CFR 192)	This corresponds to a lifetime risk of about 5E-3. (Based on 2.4E-4 cancers/WLM)

The comparison values were obtained or extrapolated from EPA regulations, and, as such, they are appropriate for use in this manner. However, as can be seen, the health risks associated with each comparison value are quite different and, in some cases, in excess of the 1E-4 lifetime risk criteria adopted by CERCLA. This apparent internal inconsistency in the degree of protectiveness inherent in the comparison values is problematical but probably unavoidable.

Another problem associated with the comparison values is that the values were not selected by EPA specifically to protect the most sensitive members of the population, as stated on page 27. The risk assessment supporting the values is based on members of the population with average radiosensitivity. However, this approach to standards setting was considered adequate due to the conservative assumptions employed in their derivation.

Page 29

Assuming that the site is under institutional control, the contamination levels cited on page 29 of the report (i.e., 20 pCi/g) do not represent a public hazard. In addition, as indicated above, using a dose rate of 1.3E-3 mrem/hr per pCi/g for Ra-226 in soil, the external dose rate is 0.026 mrem/hr. Even assuming 2000 hours per year of exposure, the annual dose is 52 mrem/yr, which is less than the non-occupational exposure limit. As such, this would indicate that the site does not pose a public health hazard, at least with respect to onsite direct radiation exposures.

Page 29, 3rd paragraph: there is an indication that surface soil sampling has been limited since the distribution of other radioactive materials or nonradioactive hazardous chemicals could be traced by the mapping of radium-226. This question is left dangling but should be resolved for the benefit of the reader.

Page 31

Table 3 should include the Ra-226 and Th-230 concentrations in the tailings piles in order to estimate the possible upper-end past and current doses and health risks to the public. In addition, this table should include some measure of central tendency and data variability (i.e. geometric mean and 95% confidence interval) for all measured concentrations. This would indicate the likelihood of the maximum exposure. Lastly, the table contains no comparison values for Cr, Cu, Pb, and Ni. Following the example EMEG

calculations in Appendix A of ATSDR - Public Health Assessment Guidance Manual (ATSDR 92), comparison values for all but Pb could be calculated. EPA OSWER guidance for lead in soil based upon blood lead modeling recommends 400 mg/kg soil lead as the maximum safe level. This concentration could be used as the comparison value for Pb.

The bottom of page 31 indicates that the average Ra-226 concentration in soil from windblown contamination is 27 pCi/g (this is not entirely consistent with the statement on page 29 that the average Ra-226 concentration in onsite soil is 20 pCi/g). For a thin layer of contamination, the normalized dose is much lower than for thick layers of contamination. Using RESRAD 5.6, the annual dose above background for a typical residential scenario, where the average Ra-226 concentration in the top 1 cm of soil is assumed to be 27 pCi/g, is likely to be less than 50 mrem/yr from external exposure and less than 100 mrem/yr from indoor radon. Considering that natural background contributes an average of 55 mrem/yr EDE from external exposure and 200 mrem/yr EDE from indoor radon (see page 15 of NCRP Report No. 93), it is difficult to conclude that this contamination represents a public health hazard. However, the contamination is above cleanup criteria and should be remediated. This type of analysis should be included in the report. Also, in the last sentence, it is not clear whether the radium-226 concentrations referred to are net or gross values. This should be clarified.

Page 33

Table 4, like Table 3, should include a measure of central tendency and variability for the concentration data. In addition, there are no comparison values for six of the ten listed elements even though calculational methods are available to determine EMEGs, RMEGs or CREGs for each. The comparison value of 12 ppm for arsenic is inconsistent with the comparison value of 0.4 ppm used in Table 3. There is no reason given why there should be a difference. In addition, the comparison values for uranium and vanadium appear incorrect. Using the EMEG approach in ATSDR (92) and the RfD for uranium and vanadium of 0.003 and 0.007 mg/kg/day, respectively, the resulting comparison values are 2100 ppm for uranium and 4900 ppm for vanadium.

The discussion beginning on page 33 addresses surface water, and indicates that drinking water is not drawn down gradient from the site. As such, the report concludes that the contamination found in surface water down gradient does not represent a public health hazard. However, the report is correct in expressing concern that the water could be used for drinking purposes. As such, the report should present a "what if" analysis to determine the magnitude of the dose a person would receive if he were to obtain drinking water down gradient from the site. Table 5 indicates that the maximum historical ground water contamination down gradient from the site was 13 pCi/L of Ra-226 and 399.8 pCi/L of U-238 and U-234. These levels are not associated with doses that could be considered hazardous to public health (i.e., 500 mrem/yr EDE, see above discussion for the basis for this criterion). Again, this type of analysis should be provided in the report.

Page 36 (Table 5)

Table 5 should also include the median concentrations and the 95% confidence intervals to depict the likelihood of the maximum value. Several measurement values are reported to 5 significant figures. No present day analytical methodology will result in this accuracy and precision.

Page 37

The second full paragraph on this page states that downstream selenium concentrations have exceeded comparison values regularly. The values in Table 5 contradict this statement. Both the maximum and historical maximum selenium values are below the MCL.

The last paragraph on this page justifies the inclusion of nitrate as a contaminant of concern because of its elevated levels offsite, onsite, and upstream of the site. From the maximum concentrations reported in Table 5, it is very difficult to determine whether levels are truly elevated over the MCL or the data set

is just highly variable. Reporting the median values and their 95% confidence intervals would allow one to determine if nitrate values are indeed elevated.

Page 38

In many respects, the situation with regard to radionuclide contamination of ground water is similar to that of surface water contamination. The alluvial aquifer down gradient from the site is contaminated, but it is not used for drinking water. If it were used, the doses would not exceed levels that could be considered hazardous.

Page 41 (Table 6)

Two issues in this table need to be addressed. Table 6 contains some concentrations reported to 4 and 5 significant figures. This level of accuracy and precision cannot be reached with present day techniques. The comparison value for vanadium is below the detection limit for this element.

Page 42, last line: words are missing.

Page 43

The measured offsite outdoor radon concentrations presented in Table 7 are consistent with the results of investigations performed at other mill tailings sites (see EPA 82, EPA 89a). These levels, though clearly above natural background, do not constitute a public health hazard. This is especially true when one realizes that typical background indoor radon levels are about 1 pCi/L (see DOE 90, page 23).

Page 47

The top of page 47 refers to exposures due to the use of tailings as backfill and construction materials at offsite vicinity properties. The exposures that could result from such uses include direct radiation and indoor radon. These exposures have the potential to be limiting. For example, if large quantities of tailings at 1000 pCi/g of Ra-226 were used as fill around the basements of homes, the external doses could be well in excess of 500 mrem/yr and the indoor radon levels could be on the order of hundreds of pCi/L. Such exposures would constitute a public health hazard. It is surprising that no data are provided characterizing the radiation fields and indoor radon levels at vicinity properties, given the importance of this source of exposure and the fact that, in 1995, engineering design packages were developed for 14 vicinity properties, remediation on 81 properties was completed, and completion reports for 75 properties were filed (DOE 96).

The bottom of this page states that detected concentrations of particulate contamination were not significantly higher than ambient background concentrations. The definition of significant must be explained. The word significant implies a statistical analysis.

Page 48

The bottom of page 48 presents airborne radionuclide particulate concentrations in the vicinity of the site. The measured values could have easily been converted to dose using Federal Guidance Report No. 11 (EPA 88) dose conversion factors and converted to risk using EPA slope factors, which, in turn, could have been used to be more responsive to public concerns.

Page 49

The top of page 49 presents estimates of past airborne emissions from the mill. Estimates of the offsite airborne concentrations and doses due to these emissions should be calculated using standard atmospheric transport and dosimetry models.

Section E states that no data are available characterizing the radionuclide concentrations in onsite and offsite food.

The routine environmental radiological surveillance programs at the site would have been expected, however, to include sampling and analysis of local produce.

5.8 Pathways Analyses (Pages 51-59)

General: This section discusses the limited information available in the broadest possible analytic framework in order to avoid overlooking any exposure pathway. The generally available information for the Monticello area (both on- and off-site) is evaluated superficially. The section is of limited value because it falls to distinguish adequately between pathways of remote possibility of relevance and those that are more likely to result in excessive exposures, and it fails to provide estimates of the doses and risks from all the important pathways. It also does not cite recent relevant analyses cited in the DOE Staff Commentary, or the recent clean-up activities that are changing some of the exposure pathways.

Page 51

The last full paragraph refers to the pathway model provided in Figure 18 of the report. The model is comprehensive and, if the report attempted to model all the pathways using available data, the report would have been much more complete and responsive to the concerns raised by the public. As described above, many of the more important pathways were not modeled, including direct radiation and indoor radon at vicinity properties and ingestion of vegetables obtained from local gardens. Figure 19, which presents the most important pathways today, appears to have left out the potentially most important pathway; i.e., indoor radon at vicinity properties where tailing were used as backfill around basements. The text does, however, refer to inhaling radon deposited on soil.

Page 52 (Table 11)

Table 11 is incomplete. Based on the soil values in Table 3 and 4, arsenic should be included in the compounds list for onsite and offsite surface soils. Arsenic was detected well above the comparison values as listed in the tables. The path name should also include onsite air and external radiation, and offsite external radiation. This is underscored by the fact that ATSDR stated that perhaps the most significant pathways to the average person today in the community are the ones that lead to inhaling radon gas and receiving direct radiation from radioactive material in the soil. It also stated later on page 53 that measured gamma radiation exposure rates near the site boundary were 200-300 mrem/yr above background.

Page 53

The first paragraph refers to exposures of mill tailings remediation workers to chromium and lead. It is not apparent that worker exposure is within the mandate of ATSDR. The role of ATSDR with regard to past and present worker exposure should be better explained.

Although no measurements have been made of the levels of chromium, lead, and other toxic material in soil onsite, estimates could be made of the potential exposures to workers using standard modeling assumptions. For example, it is safe to assume that, during site work, the dust loading could range up to a few mg/m3 (the TLV for nuisance dust is 10 mg/m3 and for respirable dust is 3mg/m3). It could also be assumed that a significant fraction of this dust loading will contain respirable particles of trace metals at a concentration comparable to that in the tailings listed in Table 3 (page 31). In this way, exposure and risk estimates for workers could be provided.

Page 54, last sentence of paragraph one of Section B2: the word “retrieval” should be changed to “removal and personal use.”.

Page 55

The first paragraph states that indoor radon measurements have not been evaluated, but indoor radon exposures at vicinity properties that used tailing as backfill have the potential to be the limiting source of

offsite exposure. The report is of limited use without this information.

Page 58, 3rd paragraph, last 2 lines: words are duplicated.

5.9 Public Health Implications (Pages 60- 68)

5.9.1 Radiological Contaminants (Pages 60-62)

Page 60, 2nd paragraph: The statement that "outdoor exposure to radon is generally much less hazardous than indoor exposure..." is premised on the assumption that radon progeny are not present outdoors. This is not the case. When radon is emitted from a tailings pile, the radon progeny grow in quickly (within a half hour, the progeny could approach 50% equilibrium). Hence, during low wind speed conditions, progeny could grow in before the radon is transported far from the site and diluted to levels that are indistinguishable from background.

The last sentence of this paragraph refers to radon gas as 8 times as dense as ambient air. Though radon has a high atomic weight relative to the molecules that make up air, the atoms are so widely dispersed in air that radon does not exhibit the aggregate behavior of a heavier-than-air gas. Hence, the density of radon does not affect its transport and dispersion in the atmosphere; i.e., it doesn't settle to the ground as would high concentrations of, let us say, chlorine gas.

Page 60, 3rd paragraph: The large amount of indoor radon measurements data referred to need to be included in this report.

Page 61, last 2 paragraphs: the ratios of radium-226 concentrations (pCi/g) for the average and maximum to respective doses (mrem/yr) are not the same. This implies some degree of inaccuracy in the numerical values.

The most important information would be the alpha emissions indoors in houses built on foundations containing tailing material. These data have been obtained but not apparently analyzed by ATSDR, EPA, NAREL. It would be useful to see these data. Outdoor exposure to radium-226 is excluded as a source of concern.

Page 61, last sentence: this sentence states that, for an average soil concentration of 27 pCi/g of Ra-226, the annual dose is 0.05 mrem/yr, and for the maximum concentration of 7156 pCi/g, the annual dose is 14.4 mrem/yr. This statement apparently refers to the exposure from soil ingestion at 100 mg/d, assuming a person is exposed 1 hour per day, 5 days per week. Using these assumptions (i.e., 100 mg/day soil ingestion rate, 250 days per year), and Federal Guidance Report No. 11 dose conversion factors, the ingestion dose is 0.03 mrem/yr per pCi/g. Hence, assuming an average concentration of 27 pCi/g, the dose should be about 1 mrem/yr, and the maximum dose should be 236 mrem/yr. There appears to be an error in the report. (Unless the daily soil ingestion rate was prorated downward due to exposure being limited to 1 hour per day. If so, this should be explained.)

For external exposure, assuming the depth of contamination is 6 inches (see page 29 of the report), the external dose rate is about 1E-3 mrem/hr per pCi/g of Ra-226. Hence, assuming 1 hour per day exposure, 250 days per year, the annual dose from external exposure to the average soil concentrations would be about 7 mrem/yr. This should be reported in this section.

Page 62, lines 1-2: the specific nature of the dose limit or standard should be defined or identified. Also, the reference used is one from the ICRP rather than one, such as the EPA, which references the applicable radiation standard to members of the public in the United States.

Page 62, 2nd paragraph: the text states that uranium in soil is not likely to enter the food chain and bioconcentrate to levels of concern because the uranium concentration in soil was low. This may be true for soil and sediment downstream from the mill but may not necessarily be true for mill tailings used as

fill on residential property. Simple scoping calculations suggest that the mill tailings used as fill have the potential to yield uranium intakes greater than EPA's RfD. The table below shows that the daily uranium intake through soil ingestion and the ingestion of garden vegetables grown on the tailings slightly exceeds the RFD.

PATHWAY	URANIUM INTAKE (mg/kg/d)*
Soil Ingestion	7.1 E-04
Garden Vegetable	3.4 E-03
Total	4.1 E-03
RFD	3.0 E-03

* - Calculated assuming the following model parameters:
Uranium concentration in tailings = 500 mg/kg (EPA 82)
Soil ingestion rate = 1.0 E-04 kg/day
Body weight = 70 kg
Soil to plant concentration ratio = 2.5 E-03 (Yu et al, 1993 b)
Vegetable ingestion rate = 0.19 kg/day (EPA 89b)

The bottom of the second full paragraph states that, if people used the contaminated alluvial aquifer as their sole source of drinking water for their entire lifetimes, they could have a moderately increased risk of cancer from the radiological properties of uranium. The report cites uranium concentrations of 533 pCi/L to as high as 2870 pCi/L. Using the EPA slope factors, the normalized risk for U-238 in drinking water is about 8E-7 lifetime risk of cancer per pCi/L. Assuming 533 pCi/L, the lifetime risk is 4.3E-4. We agree that this represents a small to moderate risk. Note, however, that this risk exceeds the CERCLA criteria of 1E-6 to 1E-4.

5.9.2 Nonradiological Contaminants (Pages 62-67)

General: There are four tables on pages 31, 33, 36 and 41 in which maximum concentrations of non-radioactive chemicals in milltailings or in ground water and sediment are presented, and additional discussion of nonradioactive chemicals is presented in Appendix C. It is not stated when these samples were collected, how many samples were collected, what the methods of analysis were, what the range of levels was, and what the mean or median levels were. Comparison levels are also given. It appears that these comparison levels are not local levels. It is possible that the local levels in a mining area would be quite different from levels in other areas. Although potential pathways of exposure are discussed, it is unclear whether these potential exposure scenarios are realistic, as noted above.

Apparently the population in the immediate vicinity of the site is quite sparse; however, little specific information is given. The authors discuss exposure in general terms. This approach is not very informative. For instance, "Thallium might be present in off-site soil at concentrations above 0.2 ppm and might, therefore, be sufficient to cause adverse health effects in children who exhibit pica behavior -- i.e. children who ingest non-nutritive substances, such as soil. This substance which ranged up to 3 ppm in soil on site, was below the limit of quantitation of 2 ppm in off-site soil." This rather speculative sentence is not informative and lacks clarity. It is not explained why the authors think that levels of thallium are above 0.2 ppm or why 0.2 ppm is important.

In Appendix C additional information is given on thallium. Apparently the EPA has calculated an RFD of 0.00009 mg thallium as the sulfate per kg b.w./day. The authors then present a hypothetical scenario in which a 10 kg child eats 5 grams of dirt with 0.2 ppm thallium. According to the authors the resulting dose would be the RFD that was calculated by the EPA in IRIS. However, the RFD is not considered to represent a dose which would result in adverse health effects, nor might doses somewhat above that

level. Furthermore, the uncertainty factor of 3,000 used by the EPA in calculating the RFD is very large because the available data base does not provide any chronic animal studies. However, children would not be exposed for their entire life, and somewhat higher doses than the RFD such as 2 ppm in soil would not result in adverse effects in the children. Furthermore, the form thallium is in would affect its degree of absorption and its toxicity.

Similarly, 22 ppm of lead in soil represent soil background levels.

It is unclear why the authors present a lengthy discussion of higher levels of lead in soil in Appendix C. For instance, the sentences in the appendix--"If as in the case of residents living near the Monticello Mill Site there are no lead exposures from additional pathways young children are probably protected by keeping barren soil near them below 100 ppm and adults are probably protected from increases in their blood lead levels by keeping soil lead concentrations below 120-133 ppm. These concentrations are well above the maximum soil concentration found near Monticello."--which are then referenced to an unpublished government document by Xinteras. However, a great deal of published literature exists in which soil lead levels of 500-1000 ppm do not make a contribution to blood lead levels in children. Adults do not generally ingest soil to such an extent that they would absorb measurable levels of lead. This whole discussion in the document is really irrelevant since the soil levels are very low. In addition, it provides rather limited and biased information.

Page 63: the text discusses chromium and surmises that the Cr would not be mostly Cr-VI, based upon the duration of time it has been present. However, Cr-VI does survive in soil, and indeed soil has extensive oxidizing capacity, which favors the maintenance of Cr-VI rather than its reduction.

Page 64: Arsenic was identified as a contaminant of concern for the tailings piles (Page 30) and for offsite soil deposited on the Montezuma Creek flood plain (Page 32). This element, however, was not evaluated for its public health implications for soil, and no reason is given why it is missing from the soils evaluation.

Scoping calculations could have been made to determine if arsenic in tailings or flood plain soil represents a potential health hazard, as illustrated below[4].

[4] If the following model parameters are assumed:

Arsenic concentration in mill tailings = 179 mg/kg
Soil ingestion rate = 1.0 E-04 kg/day
Soil to plant concentration ratio = 0.04 (RESRAD)
Garden vegetable ingestion rate = 0.019 kg/day (EPA 89)
Cattle fodder intake rate = 68 kg/day (RESRAD)
Feed to beef transfer factor = 2.0 E-03 d/kg (RESRAD))
Milk ingestion rate = 0.25 l/day (RESRAD)
Beef ingestion rate = 0.175 kg/day (RESRAD)
Feed to milk transfer factor = 1.0 E-04 d/l (RESRAD

the projected daily intakes (shown in the table below) have the potential to be a health concern if the tailings are used as soil where residential farming exists. Although,according to Appendix C, daily intakes of less than 250 ug will not alter blood arsenic levels, the calculations show the daily intake of arsenic from the tailings to exceed 250 ug. The flood plain soil, on the other hand, is reported to contain arsenic at levels 15 times less than the tailings, indicating that arsenic is not a concern in this offsite soil.

PATHWAY	ARSENIC INTAKE (ug/kg)*

Also, the report should state more clearly whether the ground water is used as drinking water at all. Also if it is used, it should be stated whether any dilution by other sources of water has occurred. The EPA MCL for arsenic in drinking water should be given. Chronic arsenic poisoning could occur even at levels below those which cause acute symptoms.

The discussion about children swimming in tailing ponds in the past is irrelevant to the present situation. Sentences such as "That concentration of arsenic is not known although it might have reached or exceeded the level of l48,000 ug/L reported in ground water in western mining areas" is purely speculative, provides no useful information, and should be deleted, together with the rest of that paragraph since at the present time no bathing occurs.

Pages 65-67: Molybdenum, selenium and nitrates

The issue of swimming in tailing ponds is raised again for selenium and molybdenum, even though it occurred only in the past. The paragraphs referring to swimming should, therefore, be deleted or modified. The issue of people tapping into the alluvial aquifer is raised for nitrates, molybdenum and selenium. If this is a realistic scenario, then additional information should be provided. What are the levels of these chemicals in the aquifer at the present time? How deep is the aquifer? What is the possibility of bacterial contamination of the aquifer? The nitrate levels given in the tables are quite high but it is unclear whether these are present levels and how representative they are. The potential hazard from nitrates can not be adequately evaluated based on the information provided. The nitrate contamination should be investigated further and additional information should be provided. It should also be determined whether other sources of nitrate exist and what their contribution is. Finally, if there is a true potential for exposure to nitrates in well water, area physicians should be surveyed to determine whether they have seen cases of methemoglobinemia in infants in the recent past.

The paragraph on page 67 on sulfur oxides, sulfurous acid and sulfuric acid is also information from the past which is irrelevant to the present situation and should be deleted.

5.10 Health Outcome Data Evaluation (Pages 68-75)

General: This section as written deals primarily with workers and is not directly relevant to the determination of the hazard presented by the site to the surrounding community, although many of the mill employees probably lived in Monticello. The discussion should, therefore, be put into perspective. In addition, the discussion of health outcome data for workers should include the results of urinalysis and whole-body counts.

The discussion on pages 70 and 71 regarding cancer incidence also raises questions whether some of the observed cancers may be attributable to past mill operations. Because of the slow clearance rate of

Soil Ingestion	17.9
Garden Vegetables	136
Beef Ingestion	170
Milk Ingestion	12
TOTAL	336
COMPARISON INTAKE	250

uranium and radium from the body, if individuals inhaled or ingested large quantities of uranium or radium in the past (sufficient to significantly increase the risk of cancer), urinalysis might yield positive results. A series of "reverse calculations" would help to determine whether follow-up urinalysis could be productive. A "reverse calculation" would entail estimating that quantity of inhaled or ingested radioactivity in the past that could have contributed significantly to the probability of causation of cancer. Then a determination could be made whether that intake rate at that time could have resulted in a body burden that would contribute to detectable levels, above background, of uranium and/or radium in urine at the present time. If so, urinalysis could provide useful information in assessing causation of cancer.

Page 68, 2nd paragraph, lines 3-4: what is the "rate" that is being referred to?

Page 68, 2nd paragraph, last sentence: this statement deserves to be documented in greater detail.

Page 70, 2nd paragraph, lines 4-5: the health data available for Monticello are of limited significance, owing to the small size of the population, the fact that San Juan County is not typical of Utah, and the fact that disease distributions for Utah tend to be dominated by those for the large population of Salt Lake City.

Page 70, 3rd paragraph, lines 4 and 10: what is the significance of the "percent rate change' numbers shown?

Page 70, 4th paragraph: is the difference in percentage of cancer cases attributable to ethnic, socio-economic, or other differences?

Page 71, 1st paragraph, line 7: the figure "2.5" is confusing and needs to be defined more clearly.

Page 71, 2nd paragraph: there is an indication that a "leaking underground storage tank" may have been involved with leukemia clustering. This discussion should be clarified or deleted.

Page 73, 2nd paragraph: was the difference in rates of renal failure statistically significant?

Page 74, penultimate line: "been" should be deleted.

5.11 Community Health Concerns Evaluation (Pages 76-88)

The section (pp. 76-79) on community concerns regarding exposure is not well organized, mixes occupational and resident concerns, and fails to document statements adequately with references or calculations based on findings by the agency. For example, on p. 78 the paragraph that begins "Workers at the Monticello..." is poorly documented. In the preceding paragraph the reference is from 1958, which is pertinent, but are there not any other more recent references that deserve to be cited?

Also, the report treats "risk" and "hazard" as fundamentally physical concepts and does not adequately account for the fact that risk results through the interaction of physical hazards with human behaviors. Thus, there is virtually no social analysis of the site(s), including future growth and land use patterns. The report conveys only a vague impression of human activities at the site(s). When specific human behaviors are mentioned (e.g., drinking water use or children with pica), there is no indication of the prevalence or significance of the potentially risky behaviors, either now or in the past or future.

Further, the report is written as a largely technical document and makes insufficient efforts to present the information in a manner accessible to stakeholders. Accordingly, it does not address their specific concerns as described on pages 12-17 and 76-88. The report could be made more responsive to stakeholder concerns by taking steps such as the following:

a. Clearly characterize the affected community (or communities), now and in the past. Summarize where and how exposure is occurring at present, through which types of land uses, and to how many people. If people exposed in the past are still at risk, indicate who they are and why they are (or may be) still at risk. If there are substantial differences in risk levels to particular exposed groups (e.g., workers, children), then this should also be indicated.

b. Provide, both in the executive summary and in body of report, a clear indication of the relative significance of

different routes of exposure, both now and in the past. This will also help address this committee's concern that the level of analysis in the report is not always commensurate with the degree of significance of the hazard (e.g., low attention to the risk of indoor radiation from contaminated soil; low attention to possible changes in current land or water use patterns).

c. In connection with each exposure route and type of hazard, provide some assessment of its relative significance, e.g., by comparison with background rates of disease or exposure.

d. Clearly state which risk reduction efforts can be undertaken with respect to different routes of exposure. Is medical monitoring advised or recommended for any groups exposed now or in the past?

e. Consider providing a summary of the report's major conclusions in a separate section aimed at a non-technical readership, including affected citizens and other stakeholders.

5.11.1 Exposure Concerns

Page 77, 2nd paragraph: the text states that exposure to children who were observed playing on the tailings was well within the public dose limits. The report should demonstrate how ATSDR came to this conclusion. For example, if the Ra-226 concentration in piles is an average of 1000 pCi/g, the external dose rate to children playing on the pile would be about 1 mrem/hr. Hence, if the children played more than 100 hours per year on the piles, their doses could exceed 100 mrem/yr, i.e., the non-occupational exposure standard. Without information on the Ra-226 concentration in the tailings, or the radiation fields at the surface of the tailings, it is not possible to evaluate the validity of this statement.

Page 78, 1st paragraph, last line: words are missing.

Page 78, last paragraph: The paragraph states "we can check samples..." then on the next page it states "The occupants of those areas should prudently keep their radiation exposures as low as..." Does this mean ATSDR has a job to do, has not done it, and then tells occupants to avoid radiation exposure? Who is the audience for this report? It is difficult to follow this discussion. Furthermore, food chain transmission is hypothetical at this time. It is not known how much of various radionuclides the local crops take up.

5.11.2. Specific Health Outcome Concerns (Pages 79-81)

General: For individuals who are concerned that they, or their family, may have been exposed to elevated levels of radioactivity, consideration should be given to the use of urinalysis since radium and uranium are readily detectable even if the exposures occurred many years in the past. However, caution must be used in interpreting the results because natural background levels of uranium and radium in urine are variable and could lead to false positives.

Page 79, last paragraph, line 1: high-dose radiation has been observed to cause heart disease.

Page 80, 4th paragraph, sentence 2: the statement that during the operation of the uranium mill conditions were "most likely" dusty should be much more positive since the balance of the report discusses mill operations as extremely dusty, above applicable standards, etc.

Page 80, last paragraph: The BEIR committee performed an extensive review of the combined effects of alpha radiation and smoking. This review can be found in BEIR IV, Health Risk of Radon and Other Internally Deposited Alpha Emitters, National Academy of Science, 1988.

Page 81, line 5: "determined" is too strong a term; the study cited (reference No. 85) merely suggested an inverse relationship.

Page 82, 4th paragraph, last line: insert "additional" before "options."

5.11.3 Remediation Concerns (Pages 81-88)

Page 85, penultimate line: There are typographical errors in this line.

Page 89, line 4: it is said that persons working on the site are required to be monitored each time they leave the site. This wording should be clarified to indicate the specific nature of such monitoring. Most workers are monitored during their work at a site.

5.12 Conclusions (Page 89)

The Conclusions are not clearly drawn. The first sentence stating that the MMTS is a public health hazard is not adequately justified. Although the MMTS is a potential hazard, based on the presence of the mill tailings, it is not evident from the data presented that it, in fact, now constitutes a hazard to the public in the region.

The text also fails to draw a clear distinction between the extent of risk reduction that can be accomplished by ongoing and committed remedial actions, and the risks that will remain because of exposures associated with private properties not to be remediated, or with natural background sources.

Half of the Conclusions section is devoted to historic worker exposures and corrosive stack emissions. These have real historic interest but questionable relevance to current and future exposures.

The penultimate paragraph in the Conclusions (page 89) states that there is an increased level of lung cancer in Monticello compared to the rest of San Juan County (RR = 2.5, Conf. Int. 1.03-5.8) (Page 71), but goes on to list the great uncertainties in its estimation associated with other, unmeasured risk factors for lung cancer. In view of the very low incidence of lung cancer among the very heavily exposed mill workers in the NIOSH study (page 690), the firm conclusion that lung cancer is in excess in Monticello does not seem to be supported by an examination of all of the data presented.

The conclusion that the potential for human exposure to low-level radiation may result from radioactive contamination at off-site locations (some of which may exist in properties that are not being addressed by the current remediation efforts) implies the existence of public health risks which deserve to be defined so as to indicate the extent of risk reduction that can be expected to result from ongoing remedial actions.

The related conclusion -- that Montezuma Creek and the shallow alluvial aquifer are contaminated from site releases and should not, therefore, become used as sources of food or potable water -- may be justified on worst-case assumptions but is not supported by critical analysis of the relevant environmental measurement, pathway and exposure data.

5.13 Recommendations (Page 90)

General: If the DOE remedial action is an appropriate one as to content and schedule, its implementation should be mentioned as a recommendation on page 90. Also, Recommendations (page 90) list desirable actions based on the assumption that a hazardous condition currently exists in the community, or is likely to occur during future construction or remedial activities. Some of the recommendations are well justified by the contents of the report, but others lack adequate support. For example, #5 calls for sampling (and analyzing?) crops grown in the Montezuma Creek floodplain, but the DOE Grand Junction comments maintain that no crops are grown there. We could not find data in the report supporting a need for #4, calling for citizens not to consume foods grown in their yards. Are there data to support this recommendation? Likewise, it is not clear that there are data supporting the continued analysis of residential concentrations and tailing pile emissions of radon that are called for in #7 and #8.

Page 90, Recommendation 5: the actions to be taken as a result of sampling food crops should be specified.

Page 90, Recommendation 8: it is not clear how data on radon releases from the tailings piles are

going to be useful in the determination of whether or not off-site concentrations of radon are at levels of public health concern. This matter requires additional discussion.

5.14 Public Health Actions (Pages 91-93)

The purpose of the Public Health Action Plan (pages 91-93), as required by the Comprehensive Environmental Response, Compensation Act, and Liability Act of 1980, is to address adverse human health effects which may result from exposure to hazardous substances. Specifically, ATSDR is mandated by the Superfund Act (SARA) to perform a preliminary health assessment at each NPL site, taking into account such factors as: 1) the nature and extent of contamination at and around the site, 2) the existence of potential pathways of human exposure to the contaminants, 3) the size and potential susceptibility of the community within the pathway of likely exposure and the recommended exposure limits for the toxicants in question, and, 5) existing morbidity and mortality data on disease that may be associated with the observed levels of exposure (NAS, 1991 ATSDR, 1992). Prompted by this mandate, the public health actions proposed herein mirror those conducted by ATSDR at many other NPL sites; e.g., by 1990, the agency had conducted 1151 health assessments at NPL sites, finding hazardous substances to have been released at 85 percent of the sites, 15 percent of which were judged to merit further public health investigation (NAS, 1991).

The extent to which each of the factors enumerated above can be evaluated at a given waste site may be limited by social, technical, and/or resource constraints; however, all of the factors can usually be addressed to varying degrees with existing methods and resources (NAS, 1991). The Assessment must, therefore, seek to address each of these factors appropriately if it is to meet the requirements of SARA and respond adequately to the needs and concerns of stakeholders

It is noteworthy, therefore, that the Public Health Action Plan presented herein is not a clear, concise, or orderly delineation of the activities that will (or should) be pursued to assess the levels of current or past exposures, or to prevent the occurrence (and, failing that, the progression) of disease or dysfunction which may result from exposure to the radioactive tailings and other contaminants. The plan is so general (vague) that it is difficult to determine whether (when translated into action), it will interrupt exposure or otherwise reduce the public health risk.

Health Studies (Pages 91-92)

In summary, although the plan should identify sequential steps which will be taken to address the public health issues posed by the site, it fails to identify with any degree of specificity the types of health studies that are needed and will be conducted as part of the public health action program.

The section should also state clearly whether the studies will be designed to: a) describe the health status of the exposed population by enumerating the occurrence of disease, obtaining the relative frequencies within the group and discovering important trends; b) explain the etiology of the disease by determining factors that "cause" specific diseases or trends; c) predict the number of disease occurrences and the distribution of health status within the target population; and/or d) control the distribution of disease in the population, by prolongation of life with the disease or otherwise improving the health status of "afflicted" persons. Implied in a), b), c), and d) are two different goals or levels at which studies may be conducted: understanding and intervention.

Additional follow-up actions should include using the existing data to derive bounding exposures and risks for a broader range of exposure scenarios and pathways. In addition, criteria should be developed for performing follow-up surveys, including urinalysis, indoor radon measurements, and gamma surveys of vicinity properties.

Without further definition of the action plan, its value and implementation potential cannot be adequately evaluated.

Education (Page 92)

Education is proposed as an activity of the public health action plan. Here again is a lack of specificity.

It would appear that ATSDR has sufficient information on which to develop an education and information dissemination plan without conducting a needs assessment. There is a body of data in the report which could help

formulate assumptions. For example, community concerns have been identified (page 77), and exposure pathways have been analyzed--all of which could form the basis for a risk communication strategy without an extensive needs assessment.

There is ample evidence that the dissemination of information on hazardous substances is a very useful tool for disease prevention--primary and secondary. Information from surveillance programs and from epidemiologic research can serve as a shaper of health behavior and attitudes toward environmentally provoked diseases; however, the inherent inefficiency in behavior modification should be recognized. For example, it is far more effective to limit exposure to hazardous substances than to modify the behavior of each exposed individual. Programs of behavioral modification are, nevertheless, potentially useful adjuncts to primary prevention of environmentally provoked diseases.

Also missing from the Public Health Action Plan is a clearly delineated role for voluntary health agencies and organizations in the education program.

In addition, is not clear as to the meaning of the following statements on page 92:

1) "Special needs groups such as children, minorities, and the elderly" will be noted.

   Does this mean that these groups are at highest risk and will be given special or more intensive attention than other groups?

2) "Site specific preventative health education needs will be categorized for either rapid response or extended follow-up."

   What type of follow-up, counseling, treatment, etc.?

3) The "rapid response, mechanism."

   This needs further elaboration.

4) The structure and focus of ATSDR "monitoring of ongoing activities and occurrences in the Monticello Area."

   These are not clearly enough defined.

Remediation

The remediation plans (pages 92-93) appear to be sound and consistent with present scientific and technical knowledge of remediation of procedures; however, they should be described further and referenced in the report (pages 81-88), so as to be placed in better perspective.

5.15 References

Several references are incomplete; e.g., No. 41 on page 97.

5.16 Appendix A. Population Data (Pages 104-106)

The population of Monticello differs from that of the surrounding county in ethnicity and economic level.

5.18 Appendix C. Additional Toxicological Information (Pages 111-127)

Page 111, last line: "effects" should be changed to "affects."

Page 112

The last sentence on the page states that the stochastic effects of the intake of radium "are more of a concern in

situations involving minimal uptake of the radionuclide." The primary effects of radium are the stochastic effects, and, the higher the intake, the higher the probability of a stochastic effect (see BEIR IV Report).

Page 116

The health implications of vanadium in soil are missing from this section.

5.19 Appendix D. Offer Community Concerns Evaluation (pp 128-135)

Question 2: Page 131
What does this answer mean? The steps being taken, the measurements to be done, and the timetable for answers should be listed. The current answer is almost a "non answer."

Question 3: is answered in a proper manner.

Question 4: This question could be answered in a manner that names the laws and provides more information about them.

5.20 Appendix E. Uranium Mill Workers Exposures and Long-Term Health Effects

Page 139, 2nd paragraph, lines 9-11: the basis for the suggestion of elevated rates of nonmalignant respiratory disease and chronic renal disease in former uranium mill workers should be clarified.

5.21 Appendix F. Site Location Figures

Details in many of the figures are illegible.

6. Review of Consolidated Comments from the DOE (contained in a Letter from Donna Parang - ORNL Center for Risk Management, dated February 16, 1996).

In general, the comments are well founded.

A. As noted above, the title of the report is inaccurate, since the report refers to the MVPS as well as the MMTS.

B. The report should include the more recent data, as noted.

C. We concur with comment C that it is inappropriate to refer to the site as a public health hazard. There must be a more accurate way to refer to a site that requires cleanup, has been and is currently under institutional control, and in which the record shows that the exposures to the public in the past and currently do not appear to be in excess of levels that could be considered hazardous to public health, but do require attention.

D. We agree that the statement regarding the incidence of renal failure and cancer at the site could be misconstrued. However, at the same time, we see value in reporting the data, which should be presented clearly, without implying attribution.

E. Although ATSDR does not address radiation worker exposure, it, nevertheless, could help to bound exposures and place the potential for public exposure into context.

F. This comment appears reasonable. More information regarding the remedies being implemented to control or eliminate any potential for exposure could help to alleviate public concerns. However, at the same time, it would be difficult for ATSDR to officially endorse the program. At best, it could take a position that the planned activities address the issues and that, following remediation, one will be in a better position to know the degree to which they

are effective in accomplishing their goals.

G. This request is reasonable.

H. We agree that a clear distinction needs to be made between site-related and background levels of contamination, and that some simple statistical analysis of the measurement data is needed. Median values and confidence limits will put the reported maximum values into perspective.

I. We question the need to employ elaborate statistical methods in comparing measured values with comparison values. The comparison values are generally regulation-based and are high enough to be unambiguous with respect to background. From a scientific perspective, statistical analysis is warranted; however, in a report intended for public information, the level of analysis provided in the document is appropriate. Nevertheless, where appropriate, the variability and uncertainty in background and its significance with respect to interpreting the measured data should be simply described and discussed, without inordinate statistical analysis. This comment applies even more strongly to the epidemiological and clinical data.

J. We concur with this comment.

K. We agree that the outdoor radon concentrations are negligible and should be described as such. It is surprising that tables of outdoor measurements are provided but not indoor measurements.

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9. Appendix B. Review of ATSDR Report Against Guidance Manual

This appendix presents a brief review of the degree to which the "Preliminary Public Health Assessment for Monticello Mill Tailings (DOE), Monticello, San Juan County, Utah, CERCLIS No. UT3890090035, December 28, 1995" is consistent with the guidelines set forth in the ATSDR "Public Health Assessment Guidance Manual, March 1992 (PB92-147164).

1. Page 2-3 of the Manual states that a Preliminary Health Assessment, as opposed to a Health Assessment, is prepared for sites for which site characterization is incomplete or for which no summary of relevant health outcome or environmental data exists. This document is a Preliminary health Assessment. However, a ROD has been signed, and remediation is underway or complete at many properties. As such, the document presumablyshould not be "preliminary."

2. The report addresses each of the 6 steps in the health assessment process as delineated in Section 2.5 of the Manual. However, steps 5 and 6, concerning the public health implications of the site and providing conclusions and recommendations, are not complete or entirely well founded due to the incomplete data set and the incomplete review and analysis of the exposure pathways.

3. The report was prepared in accord with the format delineated in Section 2.6 of the Manual.

4. The checklist provided in Table 3-1 of the Manual was filled out (copy on pages 34 and 35). As may be noted, out of the 51 categories of information, 33 categories are addressed (indicated by Y), 16 categories are not addressed (indicated by N), and 1 category is not applicable (indicated by NA). Though most of the categories of information are addressed, the report fails in characterizing the number of individuals that may have been or are currently exposed to different levels of radioactivity or radiation. In this respect, the report is deficient.

5. In general, the format and content of a health assessment, as delineated in the Manual, is more comprehensive and detailed than the health assessment under review. For example, Section 7.1.4 of the Manual provides guidance regarding sensitive subpopulations, past exposures, worker exposures, and remedial worker exposures. Considering the history of the site, a great deal of information should be available regarding these concerns. However, the report provides minimal coverage of these topics.

6. One of the deficiencies of the health assessment is the fact that the report makes minimal use of fate and effects models to assess past, present, and future impacts. This may be explained by the fact that the Guidance Manual, specifically Appendix D, provides models for deriving exposures and risks, given information on the contaminant concentration in air, soil, water, and food <u>at the point of exposure</u>. It does not provide guidance for contaminant transport, dispersion, deposition, or bioaccumulation from its source to receptors at some distance from the source.

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