11. Other General and Specific Comments.

We provide the following general and specific comments to the prepublication report:

a. Please add the following very important general findings that are found on many pages of the prepublication copy to the OVERARCHING FINDINGS, beginning on page 2. Below are two examples of the general findings:

> [M]any if not all of the wells drilled into the regional aquifer under the Hydrogeologic Workplan appear to be compromised in their ability to produce water samples that are representative of ambient groundwater for the purpose of monitoring. p. 79.

> [D]uring this study the committee was presented a good deal of information indicating that most or all wells into the regional aquifer at LANL (R-wells) are flawed for the purpose of monitoring. p. 97.

b. Footnote 2 on page 29 must be revised to reflect that EPA permits the LANL outfalls under the National Pollutant Discharge Elimination System (NPDES).

c. LANL has not stopped the hydraulic driver for contaminant transport in Mortandad Canyon to the regional aquifer. The NAS prepublication copy states, "LANL is currently evaluating a plan to eliminate all effluent releases from the RLWTF at TA-50." p. 32. We note that for decades LANL has been making the same statements about eliminating discharges into Mortandad Canyon, and yet the discharges continue. Witness the December 1979 final environmental impact statement for Los Alamos Scientific Laboratory Site:

> [T]hus it is expected that release of effluents will continue at about present levels for another 4 to 6 years [from the Central Waste Treatment Plant into Mortandad Canyon], after which time there will be no further discharge. All wastes will then be reduced to solid form for handling according to solid waste procedures. p. 4-11.

The NAS committee cannot assume that discharges into Mortandad Canyon will stop as stated in the prepublication copy:

> [T]he committee found that liquid waste discharges, which LANL considers to be sources of the contamination currently detected in groundwater, are generally eliminated or controlled. p. 4.

LANL must stop discharging into Mortandad Canyon because of the huge amount of contaminant inventory already moving through the vadose zone to the regional aquifer. The NAS should so state in any revision to the prepublication copy.

d. Please add "unlined" and "trenches" to the last sentence of the paragraph at the top of page 34 so that it reads: "The waste is usually buried in unlined pits, trenches or shafts." Thank you.

e. The NAS committee introduces Table 3.3, *Chromium Contamination in Groundwater at LANL,* and states that:

> [W]ith the exception of tritium, there are few data to suggest that radioactive contamination have migrated downward from the alluvial groundwater. p. 41.

The data in Table 3.3 does not support the above statement; first, because the table does not include any concentration data, and second, because of the general finding by the NAS committee that:

> [M]any if not all of the wells drilled into the regional aquifer under the Hydrogeologic Workplan appear to be compromised in their ability to produce water samples that are representative of ambient groundwater for the purpose of monitoring. p. 79.

In addition, the above statement does not reflect the facts. We refer the NAS committee to the LANL Site-Wide Environmental Impact Statements for 1999 and 2006 that provide groundwater contaminant data in Appendix C and Appendix F, respectively. Appendix C (1999) provides data about radionuclide contamination in the Los Alamos County drinking water wells. Appendix F (2006) provides data about radionuclide contamination in the drinking water supply wells for Los Alamos County and the City of Santa Fe. Please make the appropriate corrections in any revision of the prepublication copy.

f. The NAS committee must be more specific in urging LANL to conduct isotopic ratio analysis to determine the difference between naturally occurring non-radioactive and radioactive contaminants. p. 44. There have been many instances where delays occurred because LANL did not take the necessary steps to conduct the most sensitive isotopic ratio analyses. Please see the correspondence between CCNS and Gilkeson (as described in comment u. below) and Andrew Phelps of LANL. Phelps 2007.

g. Some congressional or regulatory authority must require that DOE/LANL retract the following reports. Like the NAS prepublication copy, many of these reports contain both factual information and misinformation derived from bad data, or scientifically invalid interpretations. These reports include:

i. Synthesis Report
ii. All versions of the Well Screen Analysis Report, all approved by NMED
iii. All versions of the Workplan for R-well Rehabilitation and Replacement
iv. LANL annual environmental surveillance reports
v. Nylander Hydrogeologic Workplan history
vi. All of the LANL characterization well geochemistry reports
vii. The LANL report dated June 25, 2004 by P. Shanahan of the RACER Project, which was written to discredit the "whistleblower" activities of Robert H. Gilkeson

viii. The LANL report by Bitner et al., *i.e.,* – LANL Report LA-UR-04-6777, September 2004, that was written to discredit the "whistleblower" activities of Robert H. Gilkeson

h. Please acknowledge that Figure 5.2, *Reactive contaminant capture barrier,* on page 86 of the prepublication copy is general knowledge as demonstrated in the:

i. EPA report about well construction. Figure 4, p. 22, Ford, R., S.D. Acree, and R.R. Ross. 2006.
ii. Geochemistry textbook by Langmuir, D., 1997. *Aqueous Environmental Geochemistry.* Prentice-Hall, Inc., Upper Saddle River, New Jersey.
iii. Geochemistry text book by Stumm, W., and J. J. Morgan, 1996. *Aquatic Chemistry. 3rd Edition.* John Wiley and Sons, Inc., New York.
iv. Paper by Walker, S.E. 1983. "Background Ground-Water Quality Monitoring: Well Installation Trauma." In: *Proceedings of the Third National Symposium of Aquifer Restoration and Ground-Water Monitoring,* May 25-27, 1983, Columbus, Ohio, and
v. Paper by Puls, R.W., and M.J. Barcelona, 1989. *Groundwater Sampling for Metals Analyses.* Report Number EPA/540/4-89/001. U.S. Environmental Protection Agency, Ada, Oklahoma.

i. Please accurately report that LANL discovered the hexavalent chromium contamination above state and federal standards in well R-28 in January 2004 and did not report it to NMED for almost two years. p. 46, Sidebar 3.3 *Chromium Contamination in Groundwater at LANL.* Please note that in September 2006, NMED proposed to fine LANL $795,000 for the delay in reporting.

j. Please correct the mistake in Sidebar 3.3 *Chromium Contamination in Groundwater at LANL* that lists 6.62 ug/L as the background concentration of chromium, when in fact, the prepublication copy describes the poor knowledge of the LANL scientists for the background concentration of chromium:

> [I]n another important example, the mean Cr concentration in a filtered sample representative of the background in the regional aquifer is given as 4.083 _g/L with a standard deviation of 5.948 _g/L (Table 4.2-4a). The same report (Table 4.1-2) cites the MDL as being either 2 or 10 _g/L depending on the particular analytical method used. Thus the actual mean Cr background concentration is not established. All that can be inferred is that the true background level is somewhere in the 1-10 _g/L range. p. 95.

Please make appropriate corrections and be consistent throughout the prepublication report, or any revision thereto, about the background levels for chromium.

k. Please correct the contradictory statements that run through the prepublication copy. Below are several examples:

> As noted at the beginning of this chapter, the committee answered the question: "Is the laboratory following established scientific practices in assessing the quality of its groundwater monitoring data?" with a qualified yes. The committee found that LANL has in place the proper data quality procedures to generate sound data from groundwater monitoring—with the caveat that water samples are indeed representative of the actual groundwater. [Emphasis Added.] However, it is not clear how such procedures are actually carried through in LANL's use and reporting of sampling data and its uncertainties, as will be discussed in this section. p. 91.

In fact, the finding in comment j. above that the LANL scientists have poor knowledge of the background concentration of chromium is evidence that LANL is not following established scientific practices in assessing the quality of its groundwater monitoring data. The evidence and contradiction continue in the following discussion:

> While the Background Investigation Report shows good statistical data compilation focused on well-documented QA/QC approaches, gaps remain. The report is not clear on how the QAPP procedures were actually followed and implemented, and in fact it does not reference the QAPP. The report also contains discrepancies in terms of documenting the actual analytical methods used and the respective MDL and PQL for the analyses. One example is for Cs-137. The background investigation report (Table 4.2-4a) gives a Cs-137 concentration of 1.1 pCi/L without specifying the MDL or PQL. Notably, 1.1 pCi/L is below the PQL for Cs-137 that LANL cites elsewhere—8 pCi/L in the Integrated Groundwater Monitoring Plan. p. 95.

It is a serious mistake for the NAS committee to use the phrase "with the caveat that water samples are indeed representative of the actual groundwater." In fact, a general finding in the prepublication copy is that:

> During this study the committee was presented a good deal of information indicating that most or all wells into the regional aquifer at LANL (R-wells) are flawed for the purpose of monitoring. p. 97.

Another example of contradictory statements is found in the following discussion:

> The committee encountered instances of inconsistency in data reporting. Table C-4 (Appendix C) in the Integrated Groundwater Monitoring Plan (LANL, 2006a) gives the MDL for total chromium as 1 _g/L and the PQL as 5 _g/L. The indicates a more precise knowledge of the MDL than the range of <0.503 to <7.4 _g/L reported on the WQDB. While the Integrated Plan reports both total chromium (Cr) and hexavalent chromium (Cr^{6+}), it gives the analytical method only for total Cr. One does not know the analytical method used for Cr^{6+} nor the MDL and PQL values for the method. Explaining how data are obtained is as important as reporting the data themselves.
>
> In addition, LANL reports MDL and PQL values that are not appropriately rounded, and thus give an impression of accuracy and precision that do not truly exist. For example, the MDL for Cr of 0.503 _g/L on the WQDB should be rounded to 0.5 _g/L. In the Integrated Plan (Table

4.2-4a) the background chromium concentration in regional groundwater reported as 4.083 _g/L should be rounded to 4.0 or 4.1 _g/L.

While the above discussion assumes that representative groundwater samples are collected for subsequent analysis, it is essential to remember that there is debate regarding this assumption, especially related to multi-screen wells. [Emphasis Added.] Thus, as part of a sound QAPP, results from these suspect wells should be flagged as such. A good deal of misinformation can result if publicly available databases or compilations of LANL monitoring data do not identify the soundness of all data reported according to the data quality objectives that are clearly spelled out in the QAPP. p. 93.

There are no assumptions or debate in the general finding in the prepublication copy that:

During this study the committee was presented a good deal of information indicating that most or all wells into the regional aquifer at LANL (R-wells) are flawed for the purpose of monitoring. p. 97.

Another example of a contradictory statement about this same issue:

There is general agreement that the use of bentonite clay and organic additives has compromised the ability of at least some groundwater wells to yield water samples that are truly representative of the ambient, undisturbed groundwater conditions (LANL, 2005d; Ford et al., 2006; Ford and Acree, 2006; NMED, 2006). p 85.

The statement "at least some" is inaccurate and a contradiction to the general finding that "most or all" of the R-wells are flawed for the purpose of monitoring.

l. There are several instances in the prepublication copy of the NAS report where the committee's approach moves away from that of a neutral scientific review. For example:

The committee was not hesitant to accept LANL's motto: "The World's Best Science Protecting America" at face value. pp. 3, 103.

The purpose of the NAS review is to evaluate the ability of LANL science to protect America by addressing its plans and practices for groundwater protection. Accepting LANL's self-advertisement at face value and without hesitation demonstrates bias on the part of the NAS committee. Please remove the LANL advertisement from any revision of the prepublication copy.

This bias leads to exaggerations of LANL accomplishments. An example is found in the statement below:

The committee found that LANL's current conceptualization of the site's groundwater system into alluvial, intermediate-perched, and regional components, along with the importance of

> these components for understanding the flow system within and below wet canyons, are major accomplishments. p. 5.

The recognition of alluvial, intermediate-perched, and regional components for hydrogeologic settings in arid climates is well understood and taught in introductory classes in the earth sciences. This conceptualization is <u>not</u> a major accomplishment of the LANL scientists. Please make the correction in any revision of the prepublication copy.

m. On many pages, the prepublication copy describes the "evolution" of the ability of the LANL scientists and DOE managers to drill and install characterization wells. For example:

> Well drilling and completion methods are continuing to evolve. p.79.
>
> In meetings with the committee, LANL emphasized that well design, drilling methods, and well development—particularly for the approximately 1000-foot-deep wells that reach the regional aquifer—are evolving (Broxton, 2006). p. 80.
>
> The drilling work itself, however, had a long and difficult evolution, including technical problems, unexpected high cost, and inconsistent objectives. p. 80.
>
> The changes and evolution of LANL's drilling program are in keeping with the development of any major scientific undertaking; indeed such evolution is essential. One cannot know all the answers at the outset and learns as the program progresses. p. 91.

There is no discussion in the prepublication copy of the scientific gains made by the LANL scientists and the DOE managers over the ten-year period of installing 40 characterization wells at a cost of $1 million to several million dollars for each well. The NAS committee cannot defend LANL's drilling program as a <u>major scientific undertaking</u> without listing the scientific contributions that this very expensive program has produced to advance the installation of reliable characterization wells. In fact, quite the opposite is true. On many pages, the NAS committee contradicts itself when it describes the <u>overall failure</u> of the LANL drilling program:

> During this study the committee was presented a good deal of information indicating that most or all wells into the regional aquifer at LANL (R-wells) are flawed for the purpose of monitoring. p. 97.

Furthermore, the record shows that the first reliable monitoring wells in the regional aquifer below the LANL site were installed in 2007 because of the diligence of "whistleblower" Robert H. Gilkeson in convincing the LANL scientists and DOE managers to use the <u>dry</u> air-rotary reverse circulation casing advance drilling methods for R-wells R-35a and R-35b that he first recommended in 1997. Please correct the misrepresentation in the prepublication copy about the "evolution" of the drilling program by LANL/DOE. The only evolution was an ongoing mission to reduce the

cost for installing characterization wells with properties that mask the detection of the LANL contaminants.

n. The prepublication copy misrepresents the efforts of LANL scientists and DOE managers to use appropriate drilling methods to meet the data quality requirements for reliable data on hydrologic properties and detection of contaminants. For example:

> Aware of the challenges in carrying out the Hydrogeologic Workplan, LANL sought and received independent technical advice. Early in the program, LANL commissioned Schlumberger[5] to review LANL's drilling methods and management. In general the review (Schlumberger, 2001) recommended that LANL develop better knowledge and use of industry practices. p. 18.

Schlumberger[R] is a company that has expertise in the drilling of oil wells. The drilling methods recommended by Schlumberger[R] allowed the screened intervals in all of the LANL characterization wells to be invaded with organic drilling additives and/or bentonite clay muds that mask the detection of many LANL contaminants in the water produced from the wells. The expert advice is presented in the 2006 Nylander report is as follows:

- Observations by the Schlumberger[R] expert:
  - The client [LANL scientists] has a limited knowledge of standard drilling operations;
  - Science comes first and costs are secondary;
  - Regulators have potential veto power for drilling and characterization, and they are not particularly cost sensitive;
  - Casing advance is the only drilling method used for maintaining hold [sic] stability;
- Recommendations of the Schlumberger[R] expert:
  - Hire or contract a drilling expert who will represent the interests of the Laboratory;
  - Work with drilling fluid companies to develop a mud program that will enhance wellbore stability and respect, as well as possible, the need for representative groundwater samples [Emphasis Added.];
  - Conduct a workshop where drilling, drilling fluids [Emphasis Added.], testing and completion technologies used in private industry are presented to LANL staff;
  - Document lessons learned from past wells and use them to improve efficiency;
  - Institute a daily report that monitors costs. pp. 75 – 76, LA-UR-06-7522, December 2006.

The record shows that the Schlumberger[R] expert strongly recommended only fluid assisted drilling methods that allowed the invasion of the screened intervals with organic drilling additives and bentonite clay drilling muds that have well known properties to mask the detection of the LANL contaminants produced by nuclear weapons research and manufacture.

From the Nylander report:

> Several pertinent specific recommendations contained in the report include
> - Develop drilling fluids program with contingencies to address potential of borehole stability problems; and
> - Use casing advance drilling technique as last resort for hole stability problems because of

potential to stick casing and lose the hole." [Emphasis Added.] p. 77.

The above recommendations show a preference to use mud-rotary drilling methods and little concern for collecting representative water samples. Instead of quality work, the mission was to control costs and maintain the schedule with the NMED for installation of the wells. As detailed by Gilkeson (2007) in his case history, the casing advance drilling methods were used many times as a last resort because the conventional mud rotary drilling methods did not prevent the boreholes from collapse. Indeed, the high costs for many wells were because the open-hole drilling methods failed.

o. The prepublication copy misrepresents the decision to use the air-rotary reverse circulation casing advance drilling methods with only air as a drilling fluid for the installation of LANL monitoring wells R-35a and R-35b into the regional aquifer to chase the hexavalent chromium plume. The prepublication copy presents the position that it was possible to use the "risky" casing advance drilling method because of the detailed characterization data that was available from three nearby R-wells (R-8, R-9 and R-12) drilled under the LANL Hydrogeologic Workplan. p. 87.

Two of the nearby wells installed in the regional aquifer are wells R-9 and R-12 where LANL/DOE earlier made the mistake to claim that the drill casing was abandoned because of the risky casing advance drilling method. The third nearby well is well R-8 where the attempt to drill the first borehole with open hole methods was a failure with the abandonment of open hole drilling equipment in a borehole drilled to a total depth of 1022 feet below ground surface (bgs). Mistakes in drilling the second R-8 borehole with casing advance drilling methods resulted in the abandonment of 500 feet of stuck drill casing.

In fact, the earlier drilling history at the three nearby R-wells had no bearing on the recommendation by whistleblower R.H. Gilkeson for DOE/LANL to use the dry air-rotary reverse circulation casing advance drilling method for wells R-35a and R-35b. Instead, the recommendation was because of the well known fact by professionals in the monitoring well industry that the dry air-rotary reverse circulation casing advance drilling method is not risky, but is the superior method for installing characterization wells in the complex hydrogeologic setting at the LANL site.

p. In the prepublication copy, Table 5.1, *Drilling methods that are potentially applicable to well construction at LANL,* does not identify the superior advantages of the new powerful dual rotary drill rigs for installing the LANL characterization wells with the dry air-rotary reverse circulation casing advance drilling method. p. 82. The dual rotary drilling rigs are not mentioned in the table. The advantages of the dry air-rotary reverse circulation casing advance method that are described in Attachment 3 of our comments are not mentioned in the table. Please modify Table 5.1 with the characterization advantages described in Attachment 3 of our comments. In addition, Table 5.1 does not identify the overall failure of the mud-rotary drilling methods for the installation of characterization wells across the complex LANL site.

q. The prepublication report makes the following recommendation:

> ***Recommendation:*** *LANL should plan and conduct future characterization drilling and monitoring well drilling as separate tasks. For monitoring locations where characterization data are unavailable, LANL should consider drilling simple test holes to obtain this data before attempting to install the monitoring well(s).* p. 98.

The NAS committee does not describe how the "simple test holes" are to be drilled or what value the "simple holes" bring to the acquisition of characterization data. In fact, characterization of the *in situ* properties of the vadose zone is best accomplished by drilling boreholes with the dry air-rotary reverse circulation casing advance drilling method. Further, the success of the drilling operations at the R-35a and R-35b wells proves that the best value-added economy is to do the characterization and also the monitoring well installation in the same borehole.

r. The prepublication copy describes the importance of vapor contaminant transport to the groundwater below legacy waste disposal sites atop dry mesas. p. 61. MDA L is a legacy waste disposal site where hundreds of 55-gallon drums filled with solvents are buried in deep shafts. There is a very large vapor plume of solvent contaminants in the vadose zone deep below MDA L. However, MDA L is not included in Table 3.2, *Nine out of 25 Principal Material Disposal Areas at LANL,* which is a list of the legacy waste disposal sites that the LANL scientists consider to "have a significant potential to contaminate groundwater." p. 34. Please add MDA L to Table 3.2.

s. On page 44 sporadic is misspelled as "sporatic." Please spell check the Final Report.

t. Page 120 in the References Section of the prepublication copy has two mistakes for the reference cited below:

> LANL. 2006g. Response to Concerns About Selected Regional Aquifer Wells at LANL. LA-UR-06-6777. Los Alamos, N.M.: Environmental Stewardship Division-Environmental Remediation and Surveillance Program.

The correct date is 2004 and the correct LANL report no. is LA-UR-04-6777. Please correct the mistake and carefully check all of the references for errors.

u. In order to provide a complete picture of *Citizens' Concerns for Radionuclides Reported in Drinking Water,* Sidebar 5.3, please add as a reference the March 20, 2007 response of CCNS and Gilkeson to the Phelps letter, along with the attachments. Please also add the CCNS and Gilkeson response to the References Section on page 116. We emailed the CCNS and Gilkeson response to John Wiley on March 20, 2007.