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9 TRI-VALLEY CARES, NUCLEAR  
WATCH OF NEW MEXICO, MARYLIA KELLEY,  
10 JANIS KATE TURNER, TARA DORABJI,  
HENRY C. FINNEY and CATHERINE SULLIVAN  
11

12 IN THE UNITED STATES DISTRICT COURT  
13 FOR THE NORTHERN DISTRICT OF CALIFORNIA  
14

15 TRI-VALLEY CARES, NUCLEAR ) Civ. No. C-0-3-3926 SBA  
WATCH OF NEW MEXICO, MARYLIA )  
16 KELLEY, JANIS KATE TURNER, TARA ) **REPLY DECLARATION OF**  
DORABJI, HENRY C. FINNEY and ) **MARION FULK**  
17 CATHERINE SULLIVAN, )  
18 )

19 Plaintiffs, )

Judge: Hon. Sandra B. Armstrong

20 v. )  
21 )

22 UNITED STATES DEPARTMENT OF )  
ENERGY, NATIONAL NUCLEAR )  
23 SECURITY ADMINISTRATION, )  
LAWRENCE LIVERMORE NATIONAL )  
24 LABORATORY, and LOS ALAMOS )  
25 NATIONAL LABORATORY, )  
26 )

26 Defendants. )  
27 )  
28

1 I, Marion M. Fulk, declare as follows:

2 1. I am a Chemical Physicist, retired from the University of California, Lawrence  
3 Livermore National Laboratory (LLNL) in 1984, where I served for 18 years as a staff  
4 scientist in chemical physics and material sciences. At LLNL most of my work was  
5 classified, and it included both classified and unclassified studies of radioactive rainout  
6 and aerosols, their dynamics, initiation, and growth. At LLNL, I studied problems  
7 associated with aerosolized particles and their capture by High Efficiency Particulate Air  
8 Filters, commonly called HEPA filters. As attested in greater detail in my initial  
9 declaration before this court, I have worked professionally on these issues for the  
10 University of California and the Department of Energy (DOE) and its predecessor  
11 agencies, including the Atomic Energy Commission, since my work at the University of  
12 Chicago in Chicago, Illinois, where I conducted research on biological systems beginning  
13 in 1945.

14  
15 2. I have personal knowledge of the following and could and would competently  
16 testify thereto if called upon to do so. The information contained in this declaration is  
17 based on unclassified sources and knowledge.

18 3. My initial declaration in this case, dated February 10, 2004, and my subsequent  
19 declaration, dated April 19, 2004, provide information on HEPA filters and potential  
20 scenarios for worker and off-site exposure to bio-agents such as live anthrax, Q fever,  
21 botulism, plague and other pathogens that may be handled in the LLNL Biosafety Level 3  
22 (BSL-3) facility.

23  
24 4. I have reviewed the declarations of Robert Hull and Gordon Miller filed in response  
25 to my declarations.

26 5. Robert Hull devotes a single paragraph to my declarations (at paragraph 11). Hull  
27 addresses my “concerns about the adequacy of HEPA filters” by raising the question of  
28 when HEPA filters are required in BSL-3 facilities and when they are not. In that regard,

1 Hull quotes from the Centers for Disease Control and Prevention (CDC) / National  
2 Institutes of Health (NIH) Biosafety in Microbiological and Biomedical Laboratories, or  
3 BMBL (4th edition, May 1999): “The outside exhaust must be dispersed away from  
4 occupied areas and air intakes, or the exhaust must be HEPA-filtered.” Hull’s use of this  
5 quote suggests that he believes the LLNL BSL-3 may not need HEPA filters. Yet, the  
6 LLNL BSL-3 will be located in the center of the LLNL main site. The main site is a very  
7 dense concentration of approximately 500 buildings occupied by over 10,000 workers.  
8 Homes and apartments in the City of Livermore are built up to the LLNL fence line. As  
9 there is no unoccupied area in which to vent the outside exhaust from the LLNL BSL-3,  
10 HEPA filtration of the exhaust air is required.

12 6. Hull, at paragraph 11, quotes also from the CDC/NIH guidance report titled,  
13 Primary Containment for Biohazards: Selection, Installation and use of Biological Safety  
14 Cabinets (2nd edition, September 2000): “At BSL-3 and BSL-4, exhaust laboratory air  
15 must be directly exhausted since it is considered potentially contaminated.” The guidance  
16 further specifies that HEPA filters are required for all BSL-4 facilities and for BSL-3  
17 facilities “when a high level of aerosol containment is required.” In my professional  
18 judgment, since the LLNL BSL-3 facility will include three BSL-3 labs, one of which will  
19 be devoted to aerosol challenges of small animals, and since the LLNL BSL-3 facility may  
20 utilize large quantities of potentially lethal pathogens (not only the maximum 10 liters  
21 listed in the DOE Environmental Assessment (EA) for the facility, but up to 100 liters, as I  
22 will describe below), the CDC/NIH guidance requires HEPA filters, as does the  
23 aforementioned BMBL.

25 7. Gordon Miller, in his declaration, acknowledges the issues I had raised based on my  
26 four decades of experience with aerosols, HEPA filter vulnerabilities, problems and  
27 contaminant release scenarios. Miller underscores much of the substance of my previous  
28 declarations by acknowledging that HEPA filter operational damage and failure, HEPA

1 filter tearing, HEPA filter age-related brittleness, HEPA filter clogging by water and/or  
2 particulate matter and HEPA filter blow out are all "recognized" conditions at LLNL  
3 (paragraph 4). Miller largely limits his declaration to quotes from an LLNL instructional  
4 manual that does not cover biological facilities and then from two presentations made at  
5 DOE air filtration conferences that he does not appear to understand properly.

6  
7 8. Miller introduces the LLNL Environment, Safety and Health Manual Document  
8 12.5 (September 1, 2000, now with minor editorial update June 25, 2003). While this  
9 document was not included in the Administrative Record, Miller invokes it as "support"  
10 for "discussion of the HEPA filter program management at LLNL described in the BSL-3  
11 EA for the proposed BSL-3 facility" (paragraph 3). I have reviewed the ES&H Document  
12 12.5 using the web citation given by Miller. The ES&H Document 12.5 contains  
13 generalized standards for HEPA filters in radiological facilities at LLNL. The document  
14 provides no specific guidance as to how HEPA filters will be used or managed in the  
15 BSL-3 at LLNL. In fact, it never discusses HEPA filters in relation to biological agents,  
16 biological agent research facilities or BSL-3s. Using the "find" function, the only mention  
17 of the terms "BSL," "bio," or "biological" I turned up was a single notation in the ES&H  
18 Document 12.5 introduction to state that biological safety cabinets would *not* be covered  
19 by the document.

20  
21 9. Miller further states in paragraph 3 that the Work Smart Standards are  
22 "incorporated" into ES&H Manual Document 12.5 and that "adherence to the Work Smart  
23 Standards outlined in the ES&H Manual is a commitment by LLNL to the DOE through  
24 its operating contract with DOE." The Work Smart Standards that Miller references apply  
25 to HEPA filter operations at LLNL's nuclear facilities. As explained, the ES&H Manual  
26 Document 12.5 does *not* include biological facilities. Moreover, in a memorandum  
27 produced by DOE concurrent with its preparation of the EA for the LLNL BSL-3, the  
28 DOE acknowledges that it has no Work Smart Standards for the proposed BSL-3. The

1 memorandum, titled "Authorization Basis Requirements for Proposed BSL-3 Facility" and  
2 dated March 7, 2002, states: "NNSA/OAK and LLNL are currently pursuing establishment  
3 of a Bio-Safety Level 3 (BSL-3) Facility at the Lawrence Livermore National Laboratory.

4 In order to fully understand the hazards and risks associated with the operations of a  
5 BSL-3 facility, safety analysis must be performed per the LLNL Work Smart Standards.

6 Currently, no specific requirements exist for classification/categorization of biological  
7 facilities and subsequent hazard identification and analysis. The Non-Nuclear

8 Authorization Basis Standards Identification Team is expected to provide a

9 recommendation, as well as details, on the treatment of biological hazards in their

10 Standard; however, the timing for the completion of the Standard does not support the

11 schedule for the preparation, planning and establishment of the BSL-3 facility at LLNL."

12 (The memorandum is provided as Attachment 1.) This DOE memorandum is referenced

13 in the Draft Site Wide Environmental Impact Statement for Continued Operation of the

14 Lawrence Livermore National Laboratory (February 2004).

15  
16 10. Miller replies to the facts laid out in my declarations regarding weaknesses in

17 HEPA filters by citing the LLNL ES&H Manual Document 12.5 at section 2.2, which

18 directs that "the purchased HEPA filters be tested and certified by an independent DOE

19 filter test facility and have a minimum efficiency of 99.97% at 0.3 micron particle size."

20 This document is not discussed in the BSL-3 EA. It does not address many of the issues I

21 raised. First, as stated, the ES&H Manual Document 12.5 and its directives apply only to

22 radiological operations at LLNL. Biological facilities are not discussed or covered in this

23 document.

24  
25 11. Second, the filter test facility DOE uses, located at the Oak Ridge National

26 Laboratory in Tennessee, has no mandate to test HEPA filters for bioagents, according to

27 the *DOE Protocols and Procedures*. The Oak Ridge facility is the only filter test facility

28 DOE operates. It is charged with conducting tests of new filters for Category 1 and

1 Category 2 nuclear facilities and control rooms. The protocols and procedures for the  
2 filter test facility do not include biological facilities. The LLNL BSL-3 is not a covered  
3 facility.

4 12. Third, DOE's ability to conduct further needed filter tests for its mandated nuclear  
5 facilities is now in jeopardy. According to the Defense Nuclear Facilities Safety Board  
6 (DNFSB) and management personnel at the Oak Ridge filter test facility, the filter test  
7 facility equipment is more than a quarter century old. The facility is slated to close down  
8 operations sometime after September 2004, after which its filter testing functions may – or  
9 may not – be reopened at another location.

10  
11 13. In paragraph 6, Miller acknowledges the problem of HEPA filters becoming torn  
12 during installation and cites section 2.5 of ES&H Manual Document 12.5, which provides  
13 that installed HEPA filters "shall be tested in place." Miller states that "Unless otherwise  
14 specified, action, such as replacement of a filter, is required if more than 0.03% leakage is  
15 found." The ES&H Manual Document 12.5 provides no analysis to suggest that up to  
16 0.03% leakage is acceptable for HEPA filters in a BSL-3. In light of the fact that a BSL-3  
17 uses biological agents that are potentially lethal and, in some cases, infectious, it is  
18 inappropriate to rely on safeguards that might be acceptable in a less hazardous context.  
19 The fact that the LLNL BSL-3 will conduct experiments in which bio-warfare agents are  
20 genetically modified and/or are aerosolized in small animal challenges of up to 100 at a  
21 time heightens the risk posed and underscores the need to assess whether it is appropriate  
22 to use a 0.03% leakage rate.

23  
24 14. Moreover, DOE's in-place, or *in situ*, leak testing is designed to check the fit of the  
25 filter against its housing and is a poor indicator of other HEPA filter problems, including  
26 the potential for filter failure under accident conditions. Dr. John Mansfield of the  
27 Defense Nuclear Facilities Safety Board addressed this in his Keynote Address at the 25th  
28 Annual Air Cleaning Conference: "Another common misconception is that *in situ* field

1 testing demonstrates filter performance under upset conditions. In fact, incipient failure or  
2 severe structural degradation of the filter is unlikely to be detected by such tests; field tests  
3 merely test the leak tightness of a filter's fit against the frame. Filters can be severely  
4 weakened by age, wetting, loading or prolonged exposure to chemical vapors or extremes  
5 in temperature, without necessarily failing *in situ* tests. While some of these effects are  
6 understood, most are not, and the effects can act synergistically." (Operational Formality  
7 for Confinement Ventilation Systems: Some Lessons, Keynote Address for the 25th  
8 Harvard Air Cleaning Conference, August 1998, by Dr. John Mansfield, DNFSB,  
9 available at [www.eh.doe.gov/hepa](http://www.eh.doe.gov/hepa).)

10  
11 15. Miller acknowledges the problem I raised that HEPA filters become brittle with  
12 age, but offers only the LLNL ES&H Manual Document 12.5 to suggest that this problem  
13 has been addressed. The manual's section 2.6.5, he says, "addresses this problem by  
14 specifying that HEPA filters be replaced long before any potential degradation can occur"  
15 (paragraph 8). Miller goes on to say that Document 12 5 requires HEPA filters to be  
16 replaced, among other things, "if the filter age is greater than 10 years." Again, I have  
17 personal knowledge that operational conditions at LLNL have not conformed to what is  
18 written in the ES&H Manual Document 12.5. I know from my personal experience that  
19 HEPA filters have historically been left in place in the LLNL plutonium facility for more  
20 than *25 years*. Furthermore, there is no discussion in the ES&H Manual Document 12.5  
21 whether 10 years is an appropriate time frame to leave HEPAs in place in a BSL-3 facility  
22 that will aerosolize bio-warfare agents. Ten years is not a uniform standard at all DOE  
23 nuclear facilities. DOE's Savannah River Site, for example, limits HEPA filter use to no  
24 more than 5 years from the date of manufacture. (*Id.*, Mansfield, 25th Harvard Air  
25 Cleaning Conference, [www.eh.doe.gov/hepa](http://www.eh.doe.gov/hepa).)

26  
27 16. Miller's declaration introduces new information not in the EA or Administrative  
28 Record. For example, he states that the LLNL BSL-3 will use two HEPA filters in series

1 (paragraph 9). In my professional judgment, using two HEPA filters in series in the LLNL  
2 BSL-3 is inadequate to protect on-site LLNL workers and the community. As I testified  
3 earlier, HEPA filters are least effective against certain bioagents, particularly particles  
4 approximately 0.1 micrometers in size. (See my Declaration dated February 10, 2004 at  
5 paragraph 14.)

6 17. As I pointed out in greater detail in my earlier declaration at paragraph 14, many of  
7 the potentially lethal pathogens that may be used in the BSL-3 at LLNL are of the particle  
8 size most likely to escape capture by HEPA filters, even when the filters are operating  
9 properly. HEPA filters, as Miller acknowledges in paragraph 10, have a reduced  
10 efficiency (effectiveness) capturing particles between approximately 0.05 and 0.3  
11 micrometers in size, with the largest inefficiency in the 0.1 micrometer range. This  
12 deficiency is not discussed in detail in the EA, and the EA omits analysis of the health and  
13 safety implications of this HEPA filter inefficiency.

14 18. In paragraph 10, Miller also states that "accident analysis in the EA includes the  
15 potential of reduced efficiency by assuming that HEPA filters are only 95% efficient."  
16 This does not address the issue I raised, that HEPA filters experience reduced  
17 effectiveness in capturing particles that are around 0.1 micrometers in size during *routine*  
18 *filter operation*, not merely during accident conditions. Further, contrary to the overly  
19 optimistic and unanalyzed assumptions in the EA, there are many accident conditions that  
20 can reduce HEPA filter efficiency to well below 95%. In fact, HEPA filter effectiveness  
21 can be -- and has been -- reduced to zero in some accident conditions, such as fire. Far  
22 from being "fully addressed," the minimal information provided by DOE in the EA and  
23 Administrative Record regarding planned use of HEPA filters makes it extremely difficult  
24 for me, or for any expert, to fully assess the adequacy of DOE's strategy for employing  
25 HEPA filtration in the LLNL BSL-3. Known problems with HEPA filters are not fully  
26 discussed and no mitigation measures are outlined.

1 19. Under perfect operating conditions, on average, 1 out of every 1000 of the  
2 biological agents used in the LLNL BSL-3 in the 0.1 micrometer range will penetrate a  
3 single HEPA filter. With two HEPA filters in series, the average number of 0.1 micrometer size  
4 bio-agents that will escape is at least 1 out of every million (1,000,000), a number that  
5 represents a still unacceptable risk when a facility is handling large numbers of potentially  
6 lethal microorganisms. Moreover, this estimate is very conservative and may understate  
7 the number of organisms released to the environment because I have given the second  
8 HEPA filter the same mathematical efficiency as the first, when, in reality, it will be *less*  
9 efficient because particles that passed through one HEPA filter are more likely to pass  
10 through a second filter than those that didn't, as explained in my initial declaration at  
11 paragraph 20.

12  
13 20. The DOE EA for the LLNL BSL-3 states that the facility will handle up to a liter at  
14 a time of each pathogen at a concentration of  $10^8$  per milliliter. At this concentration, one  
15 liter equals about one hundred billion (100,000,000,000) cells or organisms. Therefore, if  
16 a liter containing a pathogen in the 0.1 micrometer size range were to become airborne,  
17 one hundred thousand (100,000) cells or organisms could escape two HEPA filters in  
18 series and be released into the environment. Note, this is the number that would be  
19 released to the environment if both HEPA filters were operating perfectly.

20 21. The EA states that the LLNL BSL-3 will handle up to 10 liters of multiple  
21 bioagents at a time. At the concentration specified in the EA, this means that about one  
22 trillion (1,000,000,000,000) cells or organisms will be housed in the BSL-3. If a  
23 catastrophic circumstance were to make that inventory airborne, the number of cells or  
24 organisms escaping through two HEPA filters in series could approach one million  
25 (1,000,000) – even if the filters continued to operate perfectly. Moreover, DOE has  
26 recently released information that the LLNL BSL-3 will store up to 100 liters of various  
27 bio-warfare agents (see paragraph 26, below). This information was not in the EA.  
28

1 Without knowing the concentration figures, it is impossible to calculate the number of  
2 cells or microorganisms available in those 100 liters, but certainly the LLNL BSL-3  
3 inventory with 100 liters will exceed the one trillion cells or organisms present in the 10  
4 liters listed in the EA.

5 22. Under routine operating conditions, the aerosolizing unit in the LLNL BSL-3 will  
6 use one milliliter or more of pathogen at a time. A single milliliter will make airborne  
7 about one hundred million (100,000,000) cells or organisms. At the concentrations  
8 specified in the EA, and with two HEPA filters in series, each operating optimally,  
9 approximately one hundred (100) organisms measuring about 0.1 micrometers in size will  
10 get through to the environment. This estimate is for each routine experiment conducted in  
11 the BSL-3 aerosolization chamber.

12 23. One of the potentially lethal pathogens that will be handled in the LLNL BSL-3 is  
13 *Rickettsia burnetti* (also called *Coxiella burnetti* or Q fever). *Rickettsia* is easy to  
14 aerosolize, makes fomites for easy transmission once it's in the environment, and is very  
15 hardy, meaning it can survive and remain a dangerous health threat in the environment  
16 over time. *Rickettsia* is a bioobligate bacteria that is about 0.2 micrometers in size, one of  
17 the many pathogens to be used in the LLNL BSL-3 that fall between 0.05 and 0.3  
18 micrometers in size; the range where HEPA filters are least efficient even when operating  
19 perfectly. According to the EA (page 52), the CDC considers 10 *Rickettsia*  
20 microorganisms capable of causing illness, with other sources cited by CDC placing it as  
21 low as 1-5 *Rickettsia* microorganisms. In this case, one microorganism is one cell.

22 24. Therefore, in the above scenarios, under normal operating conditions wherein a  
23 minimum of one milliliter is aerosolized at a time, a minimum of 100 *Rickettsia*  
24 microorganisms on average will be released through the two HEPA filters in series to the  
25 environment -- capable of causing up to 10 illnesses for each such experiment. And, if one  
26 liter should ever get loose inside the BSL-3, about 100,000 *Rickettsia* microorganisms  
27  
28

1 would get through the two HEPAs in series and escape to the environment. One hundred  
2 thousand (100,000) Rickettsia microorganisms are capable of causing up to 10,000  
3 illnesses (using the most conservative CDC estimate of 10 Rickettsia microorganisms per  
4 illness). Further, new information has come to light that up to 100 liters of pathogens will  
5 be stored in the LLNL BSL-3.

6 25. My professional alarm over a potential disaster occurring at the LLNL BSL-3 due  
7 to inadequate attention to HEPA filter problems is exacerbated by the recent disclosure by  
8 DOE that the LLNL BSL-3 will house not only the one liter of each organism up to a total  
9 of 10 liters of biological agents as outlined in the EA and Finding of No Significant  
10 Impact (FONSI), but actually will house up to 100 liters at a time of various bio-warfare  
11 agents. This ten times-greater storage limit became evident in May 2004 when DOE  
12 released 3 boxes of unclassified reference materials used by the Department to prepare its  
13 Draft Site Wide Environmental Impact Statement (SWEIS, February 2004). While the  
14 Draft SWEIS states that it does not analyze the LLNL BSL-3 beyond what was already in  
15 the EA and FONSI, one of the SWEIS reference documents contains important  
16 information not previously disclosed. The document is hand-numbered #193 and titled,  
17 LLNL SWEIS Data Collection, Biology and Biotechnology Research Program for  
18 Buildings 361, 362, 363, 364, 365, 366, 376 and BSL-3. It shows a dramatic ramp up for  
19 the entire LLNL Biology and Biotechnology Research Program, and under the  
20 "Administrative Limits" section, contains the following notation: "The BSL-3 laboratory  
21 will contain organisms of types, forms and quantities that require the precautions described  
22 in the BMBL for BSL-3 activities. This will include up to 1 liter of any one organism in  
23 growth media and a total of 25,000 samples of various pathogens (total of 100 liters in  
24 sealed 2-milliliter capsules)." (The document is provided as Attachment 2.)  
25  
26

27 26. Miller, in paragraph 11, states that "the minimum efficiency at 0.1 micron  
28 [micrometers] for two HEPA filters in series is 99.9999%." This number, Miller testifies,

1 was "demonstrated by M. Gonzales et al. in 'Performance of multiple HEPA filters against  
2 plutonium aerosols' in the 13th AEC Air Cleaning Conference . . . ." I have reviewed  
3 Gonzales' paper, available on the web at [www.eh.doe.gov/hepa](http://www.eh.doe.gov/hepa), and it does not conform to  
4 or support Miller's interpretation.

5 27. There are methodological problems with Gonzales' study. For example the drying  
6 temperature and time and the impactor used present obvious problems, and there are  
7 others. However, the question of whether or not this was a careful study is overshadowed  
8 in this instance by the bigger issue at hand: the study does not say what Miller claims.

9 28. First, the particle sizes used in the study on which the Gonzales paper reports are  
10 substantially different than 0.1 micrometers, which is the particle size for which HEPA  
11 filters are most inefficient – and also the size range of many of the bio-agents to be used in  
12 the LLNL BSL-3. Gonzales specifically notes his inability to purposely manufacture 0.1  
13 micrometer size particles for the study (page 505). In general, the plutonium particles  
14 manufactured for the study ranged in size from 0.7 micrometers to 1.6 micrometers, a size  
15 range 7 to 16 times larger than 0.1 micrometers. Additionally, Table 1 of the report lists  
16 the full range of "Mean Plutonium Aerosol Size Characteristics" obtained in the tests as  
17 ranging from 0.5 micrometers to 2.6 micrometers. It is scientifically unsound for Miller to  
18 claim that Gonzales' study "demonstrates" a 99.9999% minimum efficiency for 0.1  
19 micrometer size particles. It does nothing of the sort.  
20

21 29. Further, Table 5 of the study contains the findings for "HEPA Filter Efficiency as a  
22 Function of Aerosol Size" and, in addition to not containing results for 0.1 micrometer  
23 particles, Gonzales' table does not extend the number for any size particle out to four  
24 places beyond the decimal. Finally, Table 5 does show that for the smallest size particles  
25 found in the study (albeit still greater than 0.1 micrometers), the efficiency percentage for  
26 the second filter was slightly lower than for the first filter. In summary, nowhere in the  
27 paper did Gonzales demonstrate that the "minimum efficiency at 0.1 microns is 99.9999%"  
28

1 or any of the conclusions that Miller attempts to impute to Gonzales' 1974 study. Miller  
2 apparently misinterprets the paper.

3 30. The other study that Miller cites in his declaration is Werner Bergman et al.,  
4 "Criteria for Calculating the Efficiency of Deep-Pleated HEPA Filters with Aluminum  
5 Separators During and After Design Basis Accidents," from the 23rd DOE/NRC Air  
6 Cleaning Conference, July 1994, available on the web at [www.eh.doe.gov/hepa](http://www.eh.doe.gov/hepa). I have  
7 reviewed the Bergman et al. paper. Miller states in paragraph 9 that the Bergman paper  
8 "showed that HEPA filters will survive all known failure modes such as exposure to water,  
9 high temperature (752 degrees Fahrenheit) and high particle loading if the differential  
10 pressure across the filter does not exceed 10 inches of water gauge." (Note that inches of  
11 water gauge is a standard method of stating air pressure across the filter.)  
12

13 31. Bergman's report does not support Miller's assertion. For example, the report's  
14 Table 2, "Threshold Values of Differential Pressure Required to Structurally Damage the  
15 Standard HEPA Filter" offers the following information -- a loaded HEPA filter may  
16 become damaged at 99% humidity when as little pressure as 3.6 inches water gauge is  
17 applied to it. Miller misreads Bergman's report. The findings in the report support my  
18 initial declaration regarding operational problems with HEPA filters becoming wet,  
19 overloaded with particles, or blown out by pressure changes.

20 32. Further, Miller states in paragraph 9 that the LLNL BSL-3 will employ a sprinkler  
21 system to prevent high temperatures from reaching the filters. He repeats his  
22 misinterpretation of Bergman's study when he says in paragraph 12: "Mr. Fulk's concern  
23 that activating the sprinklers in the fire suppression system would saturate the filters is  
24 unwarranted. Although activating the fire suppression system would lead to elevated  
25 humidity in the room, it is unlikely that a filter would become wet because the water spray  
26 cannot penetrate the room to the HEPA filters. The elevated relative humidity might cause  
27 a slight increase in HEPA filter pressure drop, but not sufficient to plug the filter.  
28

1 Bergman et al. showed that wet HEPA filters will not be structurally damaged if the  
2 differential pressure drop across the HEPA filter is less than 10 inches water gauge."  
3 Miller's paragraph 12 goes on to say that because the pressure on the LLNL BSL-3 HEPA  
4 filters would be limited to 8-9 inches of water gauge before the fans turn themselves off  
5 there is no danger. Miller is wrong. As Bergman's report clearly shows, filter damage in  
6 deep-pleated HEPA filters can occur at 3.6 inches water gauge, less than half of the 8-9  
7 inches water gauge pressure that Miller asserts is perfectly safe for the LLNL BSL-3.  
8 Furthermore, the aforementioned Table 2 of Bergman's report carries the following  
9 important note: "This table applies to HEPA filters having deep-pleat design, organic  
10 sealant, and conventional glass fiber media. Other commercially available HEPA filters  
11 have lower threshold values for differential pressure." In plain English, this means that  
12 other types of commercially available HEPA filters are even more vulnerable to damage --  
13 and at even lower pressures.

15 33. As I noted in my initial declaration in paragraph 32, there are different kinds of  
16 HEPA filters and each type raises its own specific issues or problems. Since the EA  
17 doesn't discuss HEPA filters in any detail, and does not state what type of HEPA filter is  
18 planned for the BSL-3, there is no alternatives analysis in the EA and there are no  
19 mitigation measures discussed. Because the LLNL BSL-3 will be handling large numbers  
20 of potentially deadly pathogens, and because many of these pathogens can cause illness at  
21 low exposure levels and after only a short incubation time, the most stringent protection  
22 measures must be employed – and “worst case” rather than “best case” or simply  
23 “average” scenarios must be considered in advance. Thus, a much more comprehensive

24 ///  
25 ///  
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28 ///

1 analysis is called for. Failure to do so is scientific negligence and puts LLNL workers and  
2 the community at risk.

3 I DECLARE under penalty of perjury that the foregoing is true and correct of my  
4 personal knowledge, and if called as a witness, I could and would testify competently  
5 thereto.

6 Executed this 29th day of June, 2004 in Livermore, California  
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Marion M. Fulk

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