NRC Staff Comments and ATL Responses on Draft MOX Technical Report Titled:

"Comparison of HEPA and Deep-Bed Sand Filters for
Final Air Filtration at MOX Fuel Fabrication Facility"

J. Davis - Comments on ATL Draft

HEPA vs Sand Filters

1. Would NRC prefer the first paragraph of the introduction to describe the review as a "safety" and environmental review (rather than a technical and environmental review)?

ATL Response - The use of the phrase "technical and environmental review" is a direct quote from the scope of work used to describe ATL's duties under Task 1 of contract NRC-02-01-002. This review cannot be considered a true "safety" evaluation. Rather it is more in the nature of a compare/contrast report. Thus, the use of the phrase "Technical Review."

2. Document needs technical editing to correct misspellings and grammatical errors.

ATL Response - The final document has been reviewed by ATL's technical editor before submission to the NRC.

3. The last paragraph on page 1 should make it clear that this report applies only to the two final stages of HEPA filters.

ATL Response - The document has been revised to clarify this potential misunderstanding.

4. Figure 1 looks like air-flow is parallel to the filter media. Is this correct; it seems counter-intuitive?

ATL Response - The figure was meant to show air flowing into the filter. ATL revised the figure to improve its understandability.

Other comments from 8/9 meeting have been captured in Dave Brown's comments.

D. Brown's comments on ATL's draft report, "Comparison of HEPA and Deep-Bed Sand Filters for Final Air Filtration at MOX Fuel Fabrication Facility"

The report does not address the sensitivity of the cost comparisons to several key assumptions.

For example, the assumed replacement interval of 20 months for every single final exhaust HEPA filter appears conservative. Absent any chemical or physical conditions that will challenge these filters, they will likely remain in place as long as they meet the limiting conditions for

operation on differential pressure and efficiency at each surveillance interval. A more realistic 36 month replacement interval reduces the overall HEPA life-cycle cost from $39 million to $22 million. A 5 year replacement interval reduces costs to $13 million.

ATL Response - It is agreed that the HEPA filters should remain in place as long as they meet the limiting conditions for operation on differential pressure, efficiency, or level of radiological contamination. However, the only documentation ATL has for HEPA filter life within the DOE is the December 1992 report by LLNL titled "Survey of Life-Cycle Costs of Glass-Paper HEPA Filters" which gives an average life of 18 to 24 months for HEPA filters in radiochemical service. Lacking alternative guidance, ATL has selected the 20-month life as an average of the 18 to 24 month filter life reported by LANL.

The assumption that all spent HEPA filters can be disposed of as LLW is non-conservative. Given the relatively low mass of HEPA filters and the assumption that 8 HEPA filters will fit in a B-25 box, the derived TRU concentration for spent filters may well be above 100 nCi/gram (Table 1, 10 CFR 61.55), especially for pre-filters. If one conservatively one assumes that the life-cycle cost for TRU waste applies to all HEPA filters ($6.35 M per facility-wide change-out), the life-cycle cost for HEPA filters jumps to $152.5 M. A more likely scenario might be the disposal of 188 pre-filters as TRU and the 376 HEPA's as LLW.

ATL Response - Agreed. The document has been revised to reflect an alternative disposal option. The revised document assumes that 126 pre-filters and HEPA filters will be disposed of as TRU waste, 972 as LLW, and 1080 as free release waste.

The facility life of 40 years is not consistent with the proposed action, and should be justified. The life-cycle cost, as it would be derived by ATL, is very sensitive to this assumption. I calculated costs for different facility lifetimes from startup to deactivation below:

Years	HEPA	Sand Filters
20	**$19,401,600**	**$33,618,467**
25	$24,252,000	$34,368,467
30	$29,102,400	$35,118,467
35	$33,952,800	$35,868,467
40	**$38,803,200**	**$36,618,467**
50	$48,504,000	$38,118,467

ATL Response - ATL agrees that the 40 life cycle is not in agreement with the proposed action. At the time of the initial report development ATL was not aware that the DOE

planned to operate the facility for only 10 years. The final report has been revised to reflect this information.

No consideration was given to the operating costs of the two options. The substantially higher differential pressure demand of the sand filter, for example, implies a significantly different power demand (and life-cycle electricity cost) for the blowers.

ATL Response - An increased operating cost of $150,000 per year was included for the operation of the sand filter (page 6, paragraph 6 of the draft report). These monies are an estimate of the difference in operating costs between the HEPA filters and deep-bed sand filter. ATL revised the final document to better explain this cost issue.

The costs of decommissioning appear to have been limited to just disposal costs. The costs of performing decommissioning activities, including administrative and engineered protective measures for workers and the environment, should be a consideration. For example, if the sand filter were ever challenged by a severe accident, one might envision a remote-handled decommissioning effort at substantial cost, similar to DOE's 1-acre Pit-9 site at INEEL, for which estimates exceed $300 M. (There's no bag-in/bag-out device on a sand-filter.)

ATL Response - The administrative and engineering costs for decommissioning either the sand filter or the HEPA filters would be equivalent and thus, would have little or no impact on the overall life-cycle cost comparison of the two systems.

ATL agrees that decommissioning the sand filters with robotic or remote handling equipment would substantially increase decommissioning costs, just as it would if a severe accident challenged the HEPA filters. In the event of a severe accident the only advantage a sand filter offers would be its robust design. The sand filter is large enough that it would, most likely, absorb a pressure surge that would normally breach the HEPA filters.

ALEX Murray Comments on "Comparison of HEPA and Deep-Bed Sand Filters for Final Air Filtration at MOX Fuel Fabrication Facility," 8/9/01 draft.

Overall, the report raises the question if HEPA filters can do the job reliably. As written, the public would get the impression that HEPAs at a DOE site do not work reliably. This is more than an economic argument. The report needs to reconcile the conclusions (either HEPA or sand filters can do the job) with the generally negative findings on the DOE experience with HEPA filters.

ATL Response: ATL agrees that – with proper surveillance and maintenance – the HEPA filter is a more cost effective and slightly more efficient solution. The report has been

revised to emphasize this. The key issue for using HEPA filters in the DOE is the documented history of poor maintenance and surveillance from the Defense Nuclear Facilities Safety Board (DNFSB). Since the MFFF will be operated by DSC with oversight by an NRC on-site inspector, it can be assumed that the facility will more closely follow the inspection and maintenance practices of commercial nuclear facilities.

On page 1, paragraph 2, please check the statement in the last sentence. Is there a clear basis for DOE using sand filters historically? Perhaps for major radiochemical facilities?

ATL Response: The report has been revised to include a listing of sand filters installed at DOE and commercial facilities.

On page 1, paragraph 5, please identify which HEPAs are IROFS and credited in the safety analyses. Also, please check the SCFM value of 201,880 and include a reference point for comparison, such as a DOE facility (Purex?) or Melox.

ATL Response: The document has been revised to identify which HEPA filters are considered important to safety. The SCFM value of 201,880 is comparable to the 231,000 CFM proposed for the DOE's planned Pit Disassembly and Conversion Facility (PDCF) ventilation system.

On page 2, paragraph 2: recommend including portions of the DNFSB quote.

ATL Response: The document has been revised to include additional reference information and specific material from the DNFSB.

On page 2, paragraph 3: please rephrase the last sentence to address the "excellent" generalization; perhaps something like, "The performance history for HEPA filters has shown that design basis performance characteristics can be achieved by proper design and installation, routine testing and monitoring, regular and proactive preventative maintenance, and periodic filter replacement. Without these appropriate management measures, HEPA filter performance may decline and not meet design basis values."

ATL Response: The document has been revised to incorporate the recommended sentence.

On page 2, Section 4: recommend listing some facilities (both DOE and commercial) with HEPAs for plutonium/fuels use, and some performance information, both good and bad. If possible, DCS experience with HEPAs should be included - the Melox experience? Perhaps the experience can be correlated to the maintenance programs. Fundamentally, can HEPAs work reliably for Pu applications?

ATL Response: The answer to the fundamental question "Can HEPAs work reliably for Pu applications?" is yes. The French MELOX operation demonstrates this. Since very little information is publicly available on the performance of HEPA filters for plutonium/fuels use in the commercial sector, it is not possible to provide a list of facilities that use HEPA filters in Plutonium applications.

On page 3, the paragraph after Figure 1: please explain/clarify how the calculation of 376 HEPA filters was obtained - Figure 11.4 (11.4-11?) of the CAR does not give a total number.

ATL Response: The figure is a summation of the total filters identified on each filter house shown on Figure 11.4-11 (e.g., the VHD HVAC system on the upper right side of figure 11.4-11 shows 2 filter houses. Each filter house is identified as containing "1 cell wide X 1 cell high." Likewise, the MDE HVAC system shown in the lower left of the same figure shows 11 filter houses and each house contains "2 cells wide X 3 cells high."

The number 376 is determined by adding all of the cells in each filter house. A summary of these numbers is shown in the following table:

HVAC System	# of Filter Houses	HEPA Filters/House	# of Filters/HVAC
VHD	2	2	4
PDE	2	12	24
HDE	18	12	216
MDE	11	12	132
Total	33		376

Additionally, Table 1 of the revised report identifies the number of filters actually required by the operating systems.

On page 4, after paragraph 3: there needs to be some specific assessment about the potential benefits of HEPAs versus the hazards of their not working, poor upkeep etc. - it's more than an economic argument.

ATL Response: ATL respectively disagrees, the major advantage of HEPA filters is a cost issue. They are slightly more effective (99.97% at 0.3 microns vs 99.95% at 0.7 microns for sand filters) but they are not as robust, they do require more maintenance, and they generate radioactive waste every time the pre-filters and HEPA filters are changed. The only area where a HEPA filter system is superior to a deep-bed sand filter is its construction cost.

On page 4, please clarify if any final HEPAs would be TRU waste (i.e., due to the HEPAs not credited for safety) or what percentage was assumed as TRU.

ATL Response: As shown in Table 3 on page 8 of the revised report, 126 pre- and EPA filters would be classified as TRU waste. This is 5.8 percent of the total 2,178 pre- and HEPA filters that would be used during the projected 10-year life of the facility.

On page 5, paragraph 1: please include at least one reference for "... similar D&D activities by the DOE ..."

ATL Response: The report has been revised to address this issue.

On page 5, Section 5: recommend listing some sand filters and specific info (flow rates, year etc.). F and H canyon sand filters should be included. The DWPF sand filter should also be included. Any commercial examples should be mentioned (GE Morris?). If possible, DOE and commercial experience should be cited. Fundamentally, have sand filters achieved adequate performance? (I think the answer is yes, but "we" have to be clear.)

ATL Response: The report has been revised to include a listing of several sand filters in radiochemical service throughout the United States. This list is in Table 4 on page 10 of the revised report.

On page 6, 3rd paragraph from the bottom: a reference is needed for the $150,000 per year value.

ATL Response: The number is an estimate. It is based on ATL's past experience with electric utility costs and fan horsepower designs. No specific reference is available for this figure.

On page 6, 2nd paragraph from the bottom: need specifics and a reference for closed DOE sand filters (B semiworks at Hanford?). Also, we need to note what is DOE's current plan/approach for the F/H/DWPF sand filters - if they intend to dispose of in place, then that should be noted as an option for the MOX facility (the facility would be returned to DOE for D&D) with a potential cost savings.

ATL Response: ATL has included a reference to closed sand filters (they have been abandoned in place) but cannot comment on the DOE's plans for decommissioning operating sand filters.

Page 7 is good but a non-sequitur - it should follow after the 2nd to last paragraph on page 5.

ATL Response: Agreed – The report has been revised to provide a better flow.

On page 8, the conclusions should add more qualifiers - under 1, "if HEPA filters are properly inspected and maintained, then they provide a slightly higher efficiency. The change in the estimated impact on potential releases from postulated accidents is very small, however, and well within expected uncertainties."

a. under 3, it is not clear how a HEPA system will work as well as a sand filter during fire and smoke events.
b. The impacts from in-place disposal of sand filters should be noted in Table 2.

ATL Response: Agreed – the report has been revised to incorporate additional references.

On page 9, first paragraph: it probably should note the effectiveness of the HEPA inspection/maintenance program as being a key consideration. However, it should also note that it is difficult to get around the DNFSB findings.

ATL Response: ATL has revised to report to strengthen the reference to preventive maintenance and inspection requirements for HEPA filters.

Tim Johnson's Comments on "Comparison of the HEPA and Deep-Bed Sand Filter for Final Air Filtration at MOX Fuel Fabrication Facility" 8/9/01 draft.

Mr. Johnson furnished a marked-up copy of the draft report with his comments in pencil. The following is a summation of the comments and ATL's response.

Add the phrase "at SRS" at the end of the last sentence of paragraph 2 of page 1.

ATL Response: The document has been revised to address this.

Discuss compaction as a method of reducing the volume of waste generated from HEPA filter replacement.

ATL Response: The use of compaction for volume reduction has been addressed in the document. As of 1992 Rocky Flats was the only DOE facility equipped to compact HEPA filters. Savannah River did not compact the filters and was able to fit 8 filters in a B-25 disposal box. Rocky Flats compacts their spent filters and is able to fit 24 crushed filters in one B-25 box. ATL has not been able to determine if Savannah River has, as yet, added a compaction facility to their HEPA filter disposal operation.

Discuss decommissioning and efficiencies for both HEPA and sand filters in section 3 of the report.

ATL Response: ATL has revised the report to address these issues.

Add the phrase "under severe conditions" to the discussion about the fragile nature of HEPA filters.

ATL Response: ATL has incorporated this revision into the final document.

Provide the basis for the 8 filters per B-25 box and 20 month life for HEPA filters.

ATL Response: Both figures are derived from a 1992 study titled "Survey of Life-Cycle Costs of Glass-Paper HEPA Filters" by Lawrence Livermore National Laboratory.

Suggest ATL include cost analysis for 10 and 20 year intervals

ATL Response: The report has been revised to address the planned facility life of 10 years. Additionally, a graph has been added to show the annual costs for HEPA versus Sand Filters for 25 years.

What would the cost be if some if the filters are disposed of a TRU waste?

ATL Response: The report has been revised to address this issue.

Add the high decommissioning costs to the disadvantages of a sand filter.

ATL Response: The document has been revised to address this issue.

Suggest using more recent DWPF costs of construction of a sand filter.

ATL Response: ATL does not have access to the specific construction costs for the DWPF sand filter. We have, however, reviewed the cost estimate used for the PDCF facility planned for Savannah River and found the contractor's cost estimate to be within 10% of the original ATL estimate.

Note that if the HEPA filters are operated to 5 - 6 inches water, the fans would be about the same.

ATL Response: Not quite. A sand filter will require fans capable of pulling a vacuum of 12 to 15 inches of water (-2.7 in WG in Glovebox plus -10 to -12 in WG through the sand filter) whereas the HEPA filters would require only 8 to 10 in WG (-2.7 in WG in Glovebox plus -5 to -6 in WG through a dirty filter). The fans designed for the sand filter would have to pull 50 percent more vacuum than the HEPA filter fans and would require a more rugged design and higher horsepower.

Change the phrase "D&D" to "decommissioning."

ATL Response: The document has been revised to incorporate this revision.

Re-evaluate disposal costs if part of the waste is classified as TRU waste.

ATL Response: The report has been revised to incorporate this revision.

Consider the life-cycle costs for 10, and 20 years

ATL Response: The report has been revised to incorporate this revision.

Identify the source for the photograph and information in Figure 2.

ATL Response: The report has been revised to incorporate this change.

Dual banks of HEPA filters do not necessarily provide higher efficiency that a single bank of filters.

ATL Response: ATL agrees and the report has been revised to incorporate this change.

Strike the first part of the first sentence of the last paragraph on page 8. It should read "Cost is one of the important factors ..."

ATL Response: ATL agrees – This revision has been incorporated into the final document.