CSMRI
9.1

Environmental Health and Safety
Colorado School of Mines
Golden, CO 80401-1887
303/273-3316

COLORADO SCHOOL OF MINES
GOLDEN, COLORADO 80401-1887

Jeffrey Deckler
Remedial Programs Manager
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
HMWMD-B2
4300 Cherry Creek Drive South
Denver, CO 80246-1530

April 6, 2006

Subject: Response to the Comments Pertaining to the CSMRI Site Draft Site Characterization Work Plan Dated January 24, 2006

Dear Mr. Deckler:

The Colorado School of Mines (School) is in receipt of the above referenced comments. We understand your concerns that the document does not include disposal of the contaminated materials and we greatly appreciate your understanding of the School's concerns. The School intends to determine and implement the disposition plan of the material addressed in the work plan promptly following the completion of the site characterization.

This letter responds to CDPHE's comments on the work plan. For simplicity, the CDPHE comment is provided in regular type and the School's response is in italics.

CDPHE Comment:

- The ARARs analysis must indicate that the Rules and Regulations for Radiation Control have a strong preference for off-site disposal, and that there are several criteria described in Section 4.61.3 that must be met for on-site disposal to be allowed. As the agency responsible for implementing these rules, your ARARs analysis should indicate that it is unlikely these criteria can be met.

School Response:
An ARARs analysis was performed in the Remedial Investigation and Feasibility Study, January 2004 (RIFS) after Site characterization had been believed to have been completed by New Horizons. When the School completes the proposed site investigation and analyzes the results, the School may have to re-evaluate the ARARs issues and, if so, will take into account CDPHE's comment at that point in time.

CDPHE Comment:

- In evaluating alternatives for on-site disposal, state Solid Waste regulations must also be included in the analysis. Siting and design criteria for solid waste landfills would be applicable. In addition, a Certificate of Designation would be needed, and should be considered under the public acceptance criteria.

School Response:
Similarly solid waste regulations were considered in the ARARs analysis in the RIFS after Site characterization had been believed to have been completed by New Horizons. When the School completes the proposed site investigation and analyzes the results, the School may have to re-evaluate the ARARs issues and, if so, will take into account CDPHE's comment at that point in time.

CDPHE Comment:

- The stockpiling of these materials will result in inadvertent mixing. As we have said in the past, mixing will not be allowed as a means to justify on-site disposal. Therefore, as on-site disposal is evaluated, CSM must consider the design of an engineered disposal facility that utilizes previous in-situ measurements in its design criteria.

School Response:
The NRC mixing rule does not permit the use of mixing to increase the footprint of the impacted material. The School is not proposing to increase the footprint of the impacted material. The mixing rule allows mixing of greater contaminated soil with less contaminated soil to meet disposal site Waste Acceptance Criteria. The NRC acknowledges that this is common industry and regulatory practice. The School understands CDPHE's position on this issue, but the School prefers to follow, and believes CDPHE should follow, the NRC's position and determine the disposal option consistent with NRC documents. Nonetheless, the School will collect during the site investigation in-situ data sufficient to assess on-site remedies. How the data is used is an issue that may be resolved at a future date, if resolution is even necessary. If off-site disposal is the selected remedy, resolution of the differences between the School and CDPHE is unnecessary.

CDPHE Comment:
Due to the fact that the stockpiles may remain on site for an extended period of time while the final cleanup decision is re-made, additional engineering controls and monitoring will be required to insure the protectiveness of this storage and compliance with all applicable state rules and regulations. These controls must be added to the plan.

School Response:
Additional stockpile management and monitoring will be added to the work plan document. Please see the attached, CSMRI Site Characterization: Management of Soil Stockpiles

CDPHE Comment:
The document describes a method for determining background in the field. We are unsure of the purpose of this exercise. Background has already been determined and approved for the site. This, in combination with the (cleanup criteria), means that everything above 4.1 pCi/gm radium must be excavated. It would seem more appropriate to calibrate your field instruments to this level. All references to new background measurements or calculations should be removed from the document.

School Response:
The reference section is not meant to describe changes to the background concentration selected as part of the tentative cleanup goal. Rather, our field procedures require us to calibrate our field instruments daily. We believe that calibrating them to background is most appropriate for this site. Therefore, we will be essentially determining the reading our instrument gives for background daily, however, this will have no affect on our cleanup goal.

The CSMRI Site Draft Site Characterization Work Plan submitted does not include procedures or plans for prospective study, redevelopment or re-evaluation of Site contaminant background levels.

In December of 2005 the School and CDPHE agreed to use the radionuclide background concentrations previously published in the RIFS and all background values for metals that had been published in the RIFS with the exception of arsenic and mercury. This was documented in the joint School/CDPHE report dated December 2, 2005 (below). The School and CDPHE also "agreed to evaluate any new data developed during further investigation and excavation work for consideration of background radionuclide concentrations in different formations" (see below). Such new data will be used in regard to background only in the event that sample collection and analysis performed during Site investigation indicate higher than expected background levels of a contaminant of concern in identifiable geologic formations on the Site. The Work Plan will be revised to incorporate this procedure.

> *"4. At the November 22, 2005 regular progress meeting the School agreed that the background levels for radionuclides previously published in the Remedial Investigation/Feasibility Study (RI/FS) would be used in further investigation and excavation work. However, future work will recognize that different background radionuclide concentrations may be present in different soil formations. The parties agreed to evaluate any new data developed during further investigation and excavation work for consideration of background radionuclide concentrations in different formations.*
>
> *5. CDPHE and the School further agreed to use existing background levels for barium, cadmium, chromium, lead, mercury, molybdenum, selenium, silver, vanadium, and zinc. The RI/FS data for mercury were developed in reference to total mercury but included elemental mercury. Because no data are available for elemental mercury, the School will use total mercury goals. The RI/FS arsenic cleanup goal of 11 mg/kg conflicts with actual Site background levels, and a revised cleanup goal of 39 mg/kg will be used. CDPHE will evaluate the School's proposal for a revised cleanup goal for arsenic when it is submitted in the cleanup plan for the remaining soils."*

Specific:

CDPHE Comment:
Page 1-5, 1.5 Current Site Conditions-All of the wells should be sampled. If wells were abandoned, why were they and when were they? Were they sampled prior to abandonment and if so, what were the results? Please submit the well abandonment logs for our files.

School Response:
At the start of excavation work in 2004, New Horizons identified well numbers six and seven as having the potential to provide contaminant pathways to groundwater as they were located in areas slated for excavation. In order to prevent the migration of contaminants along those pathways during excavation, New Horizons closed those wells by filling them with concrete. No sampling or abandonment logs for the wells were subsequently provided to the School by New Horizons. Groundwater monitoring performed since the halt of excavation has not included the abandoned wells.

CDPHE Comment:
Page 4-4, 4.2 Site Preparation- Where will the metal debris, piping, drums, etc. that are placed in roll-off containers be removed to?

School Response:
Debris that was readily available for removal from site was done so during the Bagged Soil Removal activity as outlined in the Bagged Soil Disposal Work plan. Any additional debris encountered during soil characterization will also be stockpiled on-site. Activity levels will be checked by swipe analysis, and final disposition will be determined prior to the implementation of the selected remedial alternative.

CDPHE Comment:
Page 4-4, 4.2 Site Preparation - It is indicated that the previous excavated test pits be backfilled with the excavated material to render the site more suitable for performing the gamma characterization. This could result in mixing and dilution of sample and survey results or shielding of deposits within the excavation. These areas were excavated for a reason and should be evaluated in place as well as the adjacent stockpiles. It is not recommended to backfill these excavations until they have been tested.

School Response:
These test pits will be left open as requested by the CDPHE.

CDPHE Comment:
Figure 4-2 only shows 20 BFI test pit locations while the text under section 4.2 Site Preparation mentions 21 test pits. Where is the other pit?

School Response:
Stoller will change text to reflect the number 20

CDPHE Comment:
Page 5-2, 5. Site Characterization - Third bullet regarding Figure 5-4 shows areas in excess of 100 pCi/gm. What is the basis for using 100 pCi/gm? Based on the approved risk assessment the BFI landfill cannot take materials greater than 40 pCi/gm. Should a separate pile be made for materials between 40 pCi/gm and 100 pCi/gm?

School Response:
The 100 pCi/g cutoff was determined to be the total in-place activity concentration that, if added to the stockpile potentially destined for BFI, may cause waste characterization samples to exceed the acceptance criteria. Stoller is confident that material between 40 pCi/g and 100 pCi/g total in-place activity will likely, once excavated, be within the acceptable range for acceptance to BFI, thus not limiting our remedial alternatives.

Additionally, the School does not understand where the number 40 pCi/g in CDPHE's comment originates. The BFI Risk Assessment, submitted to the CDPHE and referenced in the above comment, did not speak to the maximum concentration of Ra226 that BFI could accept and maintain an exposure that is protective of human health (<25 mrem/yr). The risk assessment only demonstrated that the levels anticipated for this material were protective of human health if disposed of in the BFI landfill. If necessary, additional risk assessment may be performed for higher than anticipated concentrations.

CDPHE Comment:
Page 5-3, 5. Site Characterization- "The majority of the excavation will be limited to one foot below the ground surface." This is a rather firm statement to make when the school has adamantly stated that they don't know what is out there. It is not clear if this is in the area where the proposed BFI trenches that are two to three feet deep are to be backfilled. Again, do not backfill the existing trenches. In areas where only one foot of material is removed, trenches 2 to 3 feet deep should be excavated to verify that there is no material buried in the heterogeneous materials on the site.

School Response:
To avoid any misunderstanding, this sentence has been removed from the text. However, the one-foot excavation takes place during the initial soil excavation and is based on existing surface soil analytical data. Once this soil is excavated the entire area will be re-screened. Following the gamma survey, site characterization of soils at depth can begin. Soil removal will proceed to depth until soil is encountered below the tentative DCGLs. Once the removal of soil above the tentative DCGLs is complete, confirmatory samples will be collected for laboratory analysis. Trenching is unnecessary.

CDPHE Comment:
Page 5-7, 5.7 Materials Handling- Is the excess of 100pCi/gm total radioactive or radium-226 only? As stated above, there may need to be another stockpile for materials that are between 40 and 100 pCi/gm, in order to ensure compliance with waste acceptance criteria at the approved disposal facility.

School Response:
The 100 pCi/g is for total activity (the sum of Ra226, Ra228, U 234, 235, 238, and Th 228, 230, 232). As explained above, a fourth stockpile is not planned.

CDPHE Comment:
Page 5-7, 5.7 Materials Handling- If the materials that have been placed in the separate stockpiles have already been sampled, why do they need to be sampled again? It is a waste of time and money, especially if materials are stockpiled appropriately.

School Response:
The sampling of the stockpiles will be done to get a representative sample of the stockpile, characterize the stockpile, and meet the waste acceptance requirements of any disposal facility.

CDPHE Comment:
Page 5-10, 5.8.4 Personal Protective Equipment- Document should say what level of protection will be required, level C or D.

School Response:
Stoller will add level D for support persons and Level C for field workers.

CDPHE Comment:
Figure 5-3, What is the gamma number used for drawing the areas of known and inferred extent?

School Response:
The mapped extents are not based on a gamma level. Instead they are based on the tentative clean up goals for each gamma-emitting isotope as stated in the legend on the figure.

CDPHE Comment:
Figure 5-4 should show the areas where the areas containing 40-100 pCi/gm total activity are located.

School Response:
See previous responses concerning this.

CDPHE Comment:
Figure 5-6 may require removal of all of the material in the north area near Clear Creek as all 7 locations show a need for removal, but are not tied together.

School Response:
In an effort to preserve as much of the riparian area as possible, we will target known impacts and let the extent determine how much needs to be excavated, consistent with the extent determination protocols described in the work plan. The School remains concerned that the impact to the riparian ecosystem of excavation will be greater than the benefit from the excavation of these relatively low concentrations.

CDPHE Comment:
Page 6-1, 6. Sampling and Analysis Plan – mentions that the purpose of the SAP is to provide necessary guidance to control excavation by properly identifying soils that exceed the tentative clean-up goals. These goals, which are part of the approved cleanup decommissioning plan, should not be referred to as tentative. Reevaluation of the approved plan for cost-recovery purposes does not make these goals tentative.

School Response:
The School understands the CDPHE concern over this issue, however, the School prefers to follow commonly accepted standards and ensure that the cost recovery option remains intact. To do this, this terminology is necessary. MARSSIM provides as follows:

> *"The development of DCGLs is often an iterative process, where the DCGLs selected or developed early in the Radiation Survey and Site Investigation (RSSI) Process are modified as additional site-specific information is obtained from subsequent surveys. One example of the iterative nature of DCGLs is the development of final cleanup levels in EPA's Superfund program. Soil Screening Levels[1] (SSLs; EPA 1996b, EPA 1996c) are selected or developed at a point early in the process, usually corresponding to the scoping survey in MARSSIM. An SSL can be further developed, based on site-specific information, to become a preliminary remediation goal (PRG; EPA 1991h), usually at a point corresponding to the characterization survey. If the PRG is found to be acceptable during the characterization survey, it is documented as the final cleanup level in the Record of Decision (ROD) for the site. The ROD is typically in place prior to any remedial action, because the remedy is also documented in the ROD. Additional information on the Superfund program can be found in Appendix F."*

MARSSIM, Revision 1, p. 4, (August 2000). The School is proposing to follow well-established protocols. Because the nature and extent of contamination has not been determined by New Horizons, the School must complete the site investigation and determine the nature and extent of contamination. When nature and extent is determined, the School will be able to determine if the tentative cleanup goals are final cleanup goals. This process is consistent with MARSSIM and EPA's Superfund program.

CDPHE Comment:
Page 6.2, 6. Sampling and Analysis Plan – Please add the following - Split samples will be provided to CDPHE for testing, and CDPHE will be given the opportunity to do a verification gamma survey upon completion of excavation activities.

School Response:
Up to ten percent of samples collected during confirmation sampling will be collected as split samples to be provided to CDPHE. Reasonable access to the site will be provided.

CDPHE Comment:
Page 6-3, 6.1 Field Radiation Detection Instrumentation- States "The FSL will be calculated as the average plus two standard deviations of the data set." Part 18 of the Colorado regulations says that

background will be the average, not two standard deviations. It is necessary to follow the Colorado radiation regulations during the reclamation and the sentence should be changed to the FSL will be calculated as the average- delete plus two standard deviations.

School Response:
Part 18 of 6CCR 1007-1 addresses uranium and thorium processing, and disposition of mill tailings on site. As such, the discussion of average background in this regulation does not apply to the CSMRI site characterization.

Background is different from the FSL. Yes -- background is the average without two standard deviations. But, the FSL is different. The FSL – Field Screening Level – is the level at which your instrument indicates either additional excavation or no additional excavation is necessary to achieve the clean up goal. Figure 5-8 in the Site Characterization Workplan depicts the instruments involved in the process of determining whether or not to excavate additional soil. The FSL applies to the gamma field scintillator, which in itself cannot justify the decision that soil excavation is complete. For the determination that soil excavation is complete, the gamma field scintillator, field XRF, and the gamma level 2 NaI counter all must agree excavation is complete. By implementing this process, we have effectively eliminated any possibility of our gamma field scintillator not identifying soil requiring excavation..

The final confirmatory sampling will be the ultimate decision point to decide whether all soil requiring excavation has been achieved.

CDPHE Comment:
Page 6-6, 6.5.2 Personnel and Equipment Survey Requirements – indicates that radon gas could potentially cause elevated removable alpha readings. Will radon be tested? There are also other alpha emitters on site that could contaminate personnel and equipment. Will these also be looked for?

School Response:
These other alpha emitters will be included in the surveys, only the Radon could give a "false" positive, and thus to eliminate the false positive the swipes will be allowed to decay before reading them. All other alpha will remain on the swipes and will be included in the count.

CDPHE Comment:
Section 6.7.2 - The procedure of mixing soils before filling individual sample containers for XRF measurements, would dilute these samples. Containers should be filled with material exhibiting the highest readings.

School Response:
The section referenced in this comment describes procedures to make instrument correlations. For this effort to be successful samples covering a range of concentrations must be evaluated. The intent of this section was to describe the method used to split samples, allowing one sample to be analyzed by one instrument and the other by a different instrument. It is not reasonable in the context of this section to collect the hottest material, nor should concern arise with any potential mixing or diluting of the sample.

CDPHE Comment:
Page 6-10, 6.8 Sample Acquisition – Initial Gamma Characterization Survey Sampling - As the laboratory data will be reported on a dry-weight basis and moisture content will be requested, will moisture content be done on all samples? How will this moisture content data be used?

School Response:
As stated in the work plan, it will be used to assist in the correlation. If one result is based on dry weight and one is based on wet weight, to relate the two you must use a correction factor for the moisture. That is how it will be used.

CDPHE Comment:
Appendix A In the licensing activity summary table, it indicates that CSMRI had an AEC license for plutonium. Plutonium should be added to the sampling criteria unless a case can be made that plutonium analysis is not necessary. The public may read this document and may wonder why plutonium is not being looked for. The same may apply for americium. It would be good to know how much americium was on site.

School Response:
A very close review of the site operational history indicates that it was unlikely that plutonium or americium would be found in the soils at the CSMRI Site. This review may be found in both the Removal Action Options Analysis (RAOA), CSMRI Site, June 12, 1995, pages 2-55 and 2-58 and the RIFS at pages 4-7 thru 4-8. To simplify this response, we direct your attention to these documents. The School nevertheless went ahead and sampled and analyzed for plutonium and americium when it characterized the stockpile of the former settling pond sediment and the subsurface soils during the investigation portion of the RIFS performed by New Horizons. No americium or plutonium was found during either investigation. Nonetheless, the School will add plutonium and americium as analytes for a few of the samples to the site investigation work plan when Stoller samples the stockpiles of excavated materials.

CDPHE Comment:
Appendix B –Project Schedule – What will be the next step after project characterization and what is the schedule? Several piles of contaminated material will be on site and could blow into the surrounding neighborhoods and the college campus. This material should be removed as soon as possible. The plan should describe how the stockpiles and the open pits will be controlled.

School Response:
See new project schedule for remedial alternative selection and implementation schedule. The schedule will be impacted by the results of the Site investigation, so a schedule cannot be provided with certainty. The attached schedule is one likely scenario. Stockpiles and open excavations will be managed to limit material dispersal and maintain site safety. Management of the stockpiles will be as addressed previously. Open excavations will not only be with the fenced and locked site, but will be fenced with orange fencing to prevent entry.

CDPHE Comment:
Appendix G – ALARA Assessment – Staff disagrees with this section and the interpretation of ALARA. Regulation 4.61.2 requires that for unrestricted use, the site should be cleaned up to 25 mrem/year and the residual radioactivity has been reduced to levels that are ALARA. 4.52 of the regulations says that the license shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as reasonably achievable (ALARA). 3.16.2.5.2 of the regulations says that in order to terminate a radioactive material license, it is necessary to reduce residual radioactive contamination to levels which are as low as reasonably achievable. In the November 17, 2005 letter mentioned above several sites are discussed that have been cleaned up to ALARA levels less than what were approved for the Creekside site. Hopefully, CSM is not proposing to use higher cleanup standards then have been met elsewhere, especially at a site that is on a college campus close to the center of the town of Golden, Colorado. As we have previously stated, CSM has approved cleanup standards that we expect to be achieved. In addition, CSM has indicated that they had $3,800,000 in their budget to cleanup and restore the CSMRI site which should be more than enough to meet the ALARA objective. It would be helpful if CSM would submit what their projected costs are to complete the characterization and cleanup. This estimate could be based on the 10,000 cubic yards on page 1-3 of the Characterization Report and taking it to different repositories.

School Response:
In preparing this analysis Stoller followed Appendix N from NUREG-1757, Vol 2, which states that the ALARA analysis is to determine if the DCGLs are ALARA. Because this analysis shows that a cleanup level set by the ALARA process is higher then those being used at this site, then the site cleanup goals are ALARA. Appendix N also states that ALARA would rarely require surface soil contaminated with RA226 to be disposed of off site (N.1.4 Page N-13). The costs presented in Table 2 only represent a narrow and low set of costs and do not reflect the higher actual cost of this remedial effort. If all costs associated with this effort were summed up and included, the ALARA analysis would have had a similar result in that the tentative DCGLs would be found to be ALARA. Stoller prepared this analysis to ensure that the tentative cleanup goals met ALARA, not to raise the tentative cleanup goals for the site. The tentative cleanup goals remain the same. The sole purpose of this section is to see if the tentative DCGLs are ALARA. The analysis shows that they are.

CDPHE Comment:
Appendix G- Table 4 numbers need to be explained. The cost values used in Table 4 are approximately 4 to 12 times greater than the cost value for ALARA calculations in Table 2 and the volumes in Table 4 are 4 to 12 times higher than those used in Table 2. And if more money is being spent as shown in Table 4, the concentration /DCGL should be less, not higher as shown. The more money you spend the cleaner the site becomes.

School Response:
Table 4 summarizes several remedial scenarios. We felt this necessary because we do not know with the requisite degree of confidence the volume of impacted material at the site that exceeds the tentative DCGLs. The table does present some unrealistic soil volumes/costs, however, it is not demonstrating the more money you spend the cleaner the site. The table is demonstrating that if the volumes increase so will the money required to clean up the site. So as both volume and cost increase so does the concentration/DCGL equivalent to ALARA, just as shown in Table 4.

Thank you for your consideration of our responses to the comments you provided to the CSMRI Site Draft Characterization Work Plan. I look forward to hearing from you regarding the start of work on the Site.

Sincerely,

Linn D. Havelick
Colorado School of Mines
Environmental Health and Safety
1500 Illinois Street
Golden, CO 80401

Cc: Steve Brinkman
Maki Iatridis

CSMRI Site Characterization: Management of Soil Stockpiles

Three stockpiles will be made during the implementation of the CSMRI Site Characterization Work Plan. These three stockpiles will manage soils excavated during the investigation at the site with varying levels of contamination as describe below. The stockpiles will be managed with the goal being zero releases from the stockpiled material as described in the Management section below.

Stockpile Description

Stockpile A will be created from soil that has analytical results totaling more than 100 pCi/g total activity. Plastic sheeting will be placed beneath the stockpile to provide visual delineation of the boundary between stockpile soil and underlying soil. Stockpile A will contain approximately 150 cu yds of soil, and will be made during the first several days of field activities. Once made it will be sealed with a tackifier or suitable surfacting agent.

Stockpile B will contain all impacted material excavated during the investigation at the site, except the material managed in Stockpile A, with activities or metals concentrations above the Tentative DCGLs. Plastic sheeting well be placed beneath the stockpile to provide visual delineation of the boundary between stockpile soil and underlying soil. This stockpile will contain the 4,330 cu yds excavated during the initial soil excavation and all other soil characterized as being above the site tentative DCGLs and excavated from the site. This stockpile will be made during the first days of fieldwork and will continue to have soil added to it as characterization proceeds. Once made it will be sealed with a tackifier or suitable surfacting agent.

Stockpile C will contain soil below the tentative DCGLs including overburden and other "clean" soil needing temporary storage at the site. No plastic sheeting will be used as underlayment for this stockpile of clean soil.

Stockpile Management

Each stockpile will be managed with the goal being zero releases due to either wind or precipitation. Management protocols are described below.

Daily Management

The stockpiles will have water applied to them to provide dust suppression during each day soil is added to the pile and sufficient water at the end of each day to create a crust.

Break Management

If a break in the work is taken (weekends, holidays, etc) a heavy crust will be established on each stockpile. If the break is more than two days, a qualified technician will check the piles to ensure adequate crust and apply additional water as deemed necessary.

Remedial Alternatives Analysis Period Management

During the time period after soil excavation is completed, the stockpiles will be stabilized with a surfactant or other application that will effectively eliminate the potential for releases. Best management practices for storm water will be implemented. Erosion controls will be installed around the perimeter of the stockpiles and will consist of either silt fence or straw waddles. Drainage will be established that is protective of the waters of the State, and the site will be checked weekly to ensure proper controls remain effective and functional.