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Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

SEP 14 1995

Mr. Steve M. Alexander
Perimeter Areas Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336-6018

Mr. Douglas R. Sherwood
Hanford Project Manager
U.S. Environmental Protection Agency
712 Swift Boulevard, Suite 5
Richland, Washington 99352-0539

Mr. Doug Wells
State of Washington
Department of Health
P.O. Box 47827
Olympia, Washington 98504-7827

Dear Messrs. Alexander, Sherwood, and Wells:

RESPONSES TO COMMENTS ON THE SOIL WASHING PILOT SCALE TREATABILITY TEST FOR THE 100-DR-1 OPERABLE UNIT DOE/RL-95-46, DRAFT A 41565

Enclosed for your use are comment packages as listed below:

- State of Washington, Department of Ecology, and U.S. Environmental Protection Agency comment response package on the Soil Washing Pilot Scale Treatability Test for the 100-DR-1 Operable Unit, DOE/RL-95-46, Draft A (Enclosure 1)

- State of Washington, Department of Health, comment response package on the Soil Washing Pilot Scale Treatability Test for the 100-DR-1 Operable Unit, DOE/RL-95-46, Draft A (Enclosure 2)

If you have any questions, please contact Ms. N. S. Kimball on 376-4670.

Sincerely,

Julie K. Erickson, Senior Project Manager
Remedial Actions Project

RAP:NSK

Enclosures: As stated

cc w/o attach:
G. R. Eidam, ERC
M. H. Sturges, ERC

SOIL WASHING PILOT SCALE TREATABILITY TEST FOR THE 100-DR-1 OPERABLE UNIT

RESPONSE TO REGULATOR COMMENTS

General

1. **COMMENT:** The text states that the data obtained is not adequate to perform a quantitative comparison between field screening and analytical data. This should have been one of the goals for this test. The DOE should provide information pertaining to how this will be accomplished.

   RESPONSE: The Objective for radiation monitors was to install and collect data to assess the viability of real time monitors for process control and to make field changes required to improve system performance. All of these objectives were met. The report makes several recommendations to improve system performance and also recommends out sourcing further activities in this area.

2. **COMMENT:** The cost of this treatability test according to appendix B is $2,291,000. This cost is extremely high and EPA and Ecology expect to see efforts by DOE and its' contractors to lower this cost for the purposes of cost benefit analysis.

   RESPONSE: Noted.

3. **COMMENT:** The text recommends modifications be made to the pilot scale system or procurement of a larger system. DOE should, if appropriate or required, use the soil washing plant used in this treatability test for any additional tests or remediation.

   RESPONSE: A cost analysis is currently underway to evaluate the use of the pilot plant for additional testing and/or remediation.

4. **COMMENT:** Besides radionuclides, to what degree did this test concentrate naturally occurring inorganics in the resulting contaminated filter cake? If so, did any of these concentrations exceed ERDF waste acceptance criteria?

   RESPONSE: Chromium was the only inorganic analyzed for other than radionuclides. There were no ERDF waste acceptance criteria exceeded during the test.

5. **COMMENT:** There is a need for better distinction between wet sieving and wet sieving with attrition scrubbing results throughout this document.

   RESPONSE: Need clarification of comment. The report clearly shows the added removal efficiency due to attrition scrubbing. All available data has been presented.

Specific Comments

1. **COMMENT:** Page ES-11. The text should provide more detailed information concerning capital and operating costs. One primary goal of a treatability test is to obtain detailed cost information.

   RESPONSE: The approved objectives of this test (Section 2.1, page 2-1) do not include cost information. Appendix C does, however, provide estimated costs for a 100 + ph plant based on information gathered during the test. Appendix B provides costs for this project obtained from Project Controls. Additional cost information is currently being developed in a detailed comparison of remove/dispose and remove/treat/dispose.

2. **COMMENT:** Page 1-2, Section 1.2, second paragraph. Change "internal" to "interim".

   RESPONSE: Agree - will be changed

3. **COMMENT:** Page 1-4, Table 1-1. The text needs to explain why the ^{137}Cs values vary up and down.

   RESPONSE: Need clarification of comment. There may not be any explanation other than analytical variations. The point is that no appreciable build up was observed.

4. **COMMENT:** Page 1-5, first paragraph, change ^{157}Eu to ^{152}Eu.

   RESPONSE: Agree - will be changed.

5. **COMMENT:** Page 1-5, second paragraph, last sentence, change "all parties" to "the Tri-Parties".

   RESPONSE: Agree - will be changed.

6. **COMMENT:** Page 2-1, Section 2.1, #3. Explain why EPA Level V analyses was used for feed water.

   RESPONSE: Specified in approved SAP as level needed for data validation.

7. **COMMENT:** Page 2-2, Table 2-1, #2, replace "7.5.1" with "7.4.1".

   RESPONSE: Agree - will change.

8. **COMMENT:** Page 2-5, #5. This section indicates there were no exposure to radiation detected during the test, however other emissions and/or environmental impacts (e.g., particulates, noise, chemicals) were established as objectives. What were the results?

RESPONSE: Agree - will add the following text: Air samples collected during the test showed no measurable levels of airborne contaminants. Noise levels measured during operations were high enough to require personal protection in the form of ear muffs or ear plugs. Safety glasses were required due to mechanical and potential chemical exposures.

9. **COMMENT:** Page 2-5, #6, second paragraph. Explain why real-time monitors could be a valuable tool. The previous paragraph states that the monitors operated reliably, but were unable to establish a quantitative relationship.

   RESPONSE: More factors are considered in assessing the future potential for radiation monitors than the quality of data produced by the system during this test. The quality of the system must be considered. It was well known that this was excessed equipment going into this test, but the cost for a newer system for a test of this magnitude is prohibitive. One must also examine the conditions encountered during the test, such as positioning of the monitors, arrangement of the detectors, the geometry of the material under the detectors, the counting time that actually occurred, and fluctuations in temperature. If these things can be improved upon the system would be more effective. One must also look at other applications of the same technology by others in the industry where several successful applications by other companies exist. Other factors might be potential cost savings in analytical costs or potential process improvements by using real time monitors. Once all the factors have been examined, an assessment can be made as to the future potential for radiation monitors. The observation that monitors could be a valuable tool is based on this assessment.

10. **COMMENT:** Page 2-5, #8. There aren't eight objectives identified in section 2.1.

    RESPONSE: Agree - will be fixed.

11. **COMMENT:** Page 2-7, first paragraph, third sentence. The parameters to select or identify when soils from a site could be successfully processed aren't identified.

    RESPONSE: These are identified in following text (2.4) and Figure 2-5.

12. **COMMENT:** Page 2-9, Section 2.4.1, second paragraph. Text needs to elaborate on how contaminants can pose a removal problem.

    RESPONSE: Following paragraph provides explanation.

13. **COMMENT:** Page 2-10, figure 2-5. The figure needs to identify regulatory requirements (e.g., meeting ARAR), and the portions of the process applicable (e.g., wet sieving only or wet sieving with stage-1 attrition scrubbing).

RESPONSE: Need clarification - (1) regulatory requirement are addressed in the form of cleanup criteria. (2) Not appropriate to split out portions of the process at this level. This would fall out in the decision process under "Evaluation Model."

14. **COMMENT:** Page 2-11, Section 2.4.2.2, second and third paragraph. Explain how is it conservative to say haulage and treatment are equal when haulage is less expensive.

    RESPONSE: Statement is that haulage is essentially equal for each alternative and not a significant factor for comparison purposes. Changed wording to be more descriptive.

15. **COMMENT:** Page 2-11, third paragraph, third sentence. The cost of backfill material needs to be considered. Currently, the BC-1 Demonstration Project is ongoing. Apparently, backfill material is an issue. This assumption must be reevaluated and discussed with the Natural Resource Trustee Council. In addition, a cost benefit of soil washing should be the need for less backfill material reducing the size of the borrow site and ERDF, and the cost to enlarge and mitigate those sites.

    RESPONSE: This is beyond the scope of this report and is currently being addressed in a detailed cost comparison of remove/dispose versus remove/treat/dispose.

16. **COMMENT:** Page 4-4, second paragraph. State the design feed rate.

    RESPONSE: Feed rate is referenced in 1.1 No. 3 @ 10 tons/hour - Added sentence to end of paragraph stating design capacity.

17. **COMMENT:** Page 5-6, Section 5.2.2, bottom of page. The test involved 22 people per day. The text needs to justify each person. In addition, the text should provide a recommendation of the minimum number of people necessary to conduct this work.

    RESPONSE: Needs clarification - "Justification" Following text added:

    This is the minimum number of personnel required to perform a test of this scope. Future operations could be performed with fewer plant operators (4) if upgrades and automation is done. Samplers could also be reduced to reflect the level of effort. The remainder of the staff would remain the same.

    Appendix C (page C-2) details the personnel required for a full scale operation.

18. **COMMENT:** Pages 5-10 through 5-13, Figures 5-3 through 5-5. Text needs to identify sampling points prior to discussing the results obtained at those points.

    RESPONSE: Sampling points are identified in Figure 3-1 and on charts.

19. **COMMENT:** Page 7-2, Table 7-1. Was the TCLP run for other inorganics (e.g., arsenic, mercury or lead)?

    RESPONSE: Chromium was only inorganic contaminant of concern based on previous analysis of samples collected for bench scale work and process knowledge.

20. **COMMENT:** Page B-5 Construction/Operation Costs. the detail of these costs should be comparable to the analysis done in Table C-2.

    RESPONSE: Treatability costs are not comparable to full scale costs. The information gathered during the pilot test was used as a basis for the estimate in Appendix C.

21. **COMMENT:** Page C-3, Utilities Estimates. Reference costs used for electricity, water, dielse, and gasoline.

    RESPONSE: Added sentence: Unit costs are based on best engineering judgement of utility and market rates.

22. **COMMENT:** Page C-3, Utilities Estimates. Is the cost of equipment included in the capital costs or materials?

    RESPONSE: There are no equipment costs under "Utilities". All equipment costs are under capital (other than additional process analytical) which is included as a separate line item on page C-6 annualized over ten years.

23. **COMMENT:** Page C-4, Analytical Costs. Explain the basis for selecting 10 years to annualize costs.

    RESPONSE: Equipment costs are typically annualized over 10 years. This is consistent with the other equipment in this estimate.

24. **COMMENT:** Page C-6, Incremental Cost Analysis. Is this stage-1 or stage-2 attrition scrubbing?

    RESPONSE: This represents the entire operation of two stage scrubbing.

25. **COMMENT:** Page C-7, Cost to Scrub versus Cost to Dispose. Both calculations lack the cost of backfill material.

    RESPONSE: Correct - See Response to Comment No. 15.

26. **COMMENT:** Page C-7, Cost to Scrub versus Cost to Dispose. In the scrub calculation $6.14/ton is not correct. The capital cost should be removed from this figure for a true

comparison, since it is not represented in ERDF's disposal cost.

RESPONSE: The $6.14 is correct (sum of the column). This is level of detail is beyond the scope of this report and is currently being addressed in a detailed cost comparison of remove/dispose versus remove/treat/dispose.

27. **COMMENT:** Page C-7, Table C-2. Analytical costs for attrition scrubbing are zero. How?

RESPONSE: There are no additional analytical requirements for the attrition scrubbing process.

SOIL WASHING PILOT SCALE TREATABILITY TEST FOR THE 100-DR-1 OPERABLE UNIT

RESPONSE TO DEPARTMENT OF HEALTH COMMENTS
September 7, 1995

Ms. Julie Erickson
U.S. Department of Energy
P.O. Box 550, MSIN H4-83
Richland, WA 99352

Dear Ms. Erickson:

The Washington Department of Health (the Department) has reviewed the Department of Energy's document "Soil Washing Pilot Scale Treatability Test for the 100-DR-1 Operable Unit, DOE/RL-95-46, Draft A" (the document). The Department recognizes that the document addresses an important issue for cleanup of the 100 areas, namely the reduction of soil volumes that must be transported to the Environmental Restoration Disposal Facility. The Department has serious reservations, however, regarding the document's discussion of radiological issues and, more importantly, the viability of soil-washing technology.

One of the first steps in establishing the utility of soil-washing technology is to set performance levels for radioactivity concentrations. The document refers to these as test performance goals (TPGs). It is interesting to the Department that the TPGs listed on page 1-3 would yield an annual dose to the public of 100 mrem per year per radionuclide in a residential scenario. Thus if there were more than one radionuclide present the total dose to the public from artificial radioactivity would be a few hundred mrem per year. How can these TPGs be viewed as adequate when the Tri-Party agencies have apparently committed to a 15 mrem per year cleanup standard for the 100 areas?

1. RESPONSE: Established "Clean Up Levels" would have been preferred by all parties, however, they were not available. The TPGs addressed in the report on page 1-1, number 4, were approved in NPL Agreement Form #76 dated 11/21/94 (attached). In addition, NPL #76 states that test results "will also be evaluated over a range of residuals....down to those listed in the Test Plan (DOE/RL-92-15, Rev. 0 [eg. 3 pCi/g for ^{137}Cs]." This is addressed in the report on page 1-2, Number 5.

The document also contains a major inconsistency regarding the europium contaminants. Chapter 6 insists that the europium contaminant of concern is ^{154}Eu while the remainder of the document claims that the appropriate europium isotope is ^{152}Eu. An examination of the laboratory analysis of soil samples (in Appendices D and F) reveals that ^{152}Eu is in fact the important europium isotope. If this were merely a typographical error the Department would not make an issue of it, but it is not. The author (or authors) of Chapter 6 were fully convinced that ^{154}Eu was the europium isotope of concern. All of the analysis in that chapter explicitly demonstrate that they are considering ^{154}Eu. Examples of this can be found in the gamma-ray energies listed in Table 6-1, the prepared calibration sources listed in Table 6-2 and the simulated spectrum in figure 6-2 (b). Was the real-time monitoring system aspect of this chapter written before the laboratory analysis was complete or did the author(s) simply not look at that data?

2. RESPONSE: The work scope for building and implementing the radiation monitors for this test was developed in early 1994 (see attached letter from R. Brodzinski, Battelle, 2/10/1994) and was based on bench scale test data reported in *100 Area Soil Washing Bench Scale Tests* (DOE/RL-93-107). This data detected ^{152}Eu, ^{154}Eu and ^{155}Eu. The decision was made to detect ^{154}Eu. The "Lessons Learned" in the Executive Summary and Observations section in Chapter 2 will be expanded to state that future projects should more thoroughly evaluate which isotopes to monitor.

There is an additional flaw in Chapter 6 that is also troubling. The simulated spectrum in Figure 6-2 (b) is conspicuously missing some ^{154}Eu peaks that <u>must</u> be present, but might have caused problems for the document's interpretation of the data spectrum in Figure 6-2 (a). The simulated spectrum excludes a peak at 591 keV that must be present at approximately the same intensity as the peak at 248 keV (5% branching ratio at 591 keV vs. 7% at 248 keV) and it excludes a peak that should appear in the valley between the two ^{60}Co peaks (at 1275 keV). The latter peak should be at least as intense as the (combined) peak at approximately 1000 keV (35% branching ratio at 1275 keV vs. 28% at approximately 1000 keV). If ^{154}Eu is present, all of the peaks must be present. Further, since Table 6-1 specifically lists these peak energies it cannot be that the author(s) were unaware of them. What then is the source of this error?

3. RESPONSE: Some peaks were intentionally left off Figure 6-2 to improve clarity. Figure 6-2 will be revised to show all peaks listed in Table 6-1.

The document also claims on page 6-2 that while quantitative correlations were not observed between real-time monitoring data and laboratory data, "qualitative relationships were observed." What does this mean? The laboratory data and real-time monitoring data in Table 6-6 reveal that the uncertainty in real-time monitoring data for ^{154}Eu and ^{60}Co is typically about two orders of magnitude larger than the "true" result, as measured by laboratory analysis. In the case of ^{137}Cs, the uncertainty is comparable to the true result. Thus, in all cases, there is essentially no chance of establishing statistically significant relationships between the two bodies of data. Further, examination of Table 6-4 reveals that the conversion factor from counts per minute to pCi/g varied widely from date to date. This suggests that the document significantly underestimates the data uncertainty in Table 6-6. How then did the Department of Energy establish a "qualitative" relationship?

4. RESPONSE: The term "qualitative" is meant to refer to the ability of the system to measure relatively gross changes in radiation above background and to be able to identify the source of the radiation using the gamma spectrum. Due to the lack of measurable levels of Europium or Cobalt, a comparison of analytical and monitor data is not appropriate. The comment is correct stating that no statistical relationship was established between monitor and analytical data resulting in the statement that no quantitative relationship could be established. The objective was to use surplus radiation monitoring equipment for proof of principle testing which was accomplished. The "Lessons Learned" in the Executive Summary and the Observations section in Chapter 2 will be expanded to address the appropriateness of using excessed equipment.

Another technical flaw can be found in the documents discussion of lower limits of detection (LLD) for the monitor arrays in Chapter 6. The document claims, on page 6-15, that the calculation of the LLD was taken from several references but does not cite these references. Further, the results of the document's LLD calculations, as listed in Table 6-5, are completely inconsistent with the data. One cannot reasonably claim an LLD of approximately 1-2 pCi/g for europium in columns 1 and 2 of that table, for example, when the data fluctuates between -100 pCi/g and +50 pCi/g. Table 6-6 further illustrates the absurdity of these LLD estimates by showing that the standard deviation of individual monitor results are typically 20-50 pCi/g.

5. RESPONSE: References have been added to the text. (Cember, ANSI, Std. Methods)

Cember, Herman, "Introduction to Health Physics". 2nd ed. Pergamamon Press, Great Britain, 1987.

American National Standards Institute. 1974 (reaffirmed 1980) "American National Standard Specifications and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents". ANSI N42.18-1974, Inst. Electrical Electronics Engineers, Inc. New York, N.Y.

"Standard Methods for the Examination of Water and Wastewater". APHA, AWWA, and WEF. Washington, D.C. (18th Ed., 1992). RADIOACTIVITY (7000).

Tables 6-6 and 6-7 are provided to show the affects of different ways to deal with background correction. The LLD calculation is independent of this topic and is shown only as an example of a mechanism for future applications.

The standard deviation of individual monitor results, namely 20-50 pCi/g, can be used to crudely estimate an LLD for Europium in this system. Since the LLD is (qualitatively) the activity at which the distribution of measurements will be readily resolvable from the distribution of measurements of zero activity (meaning only background is present) it should be a few times the above standard deviation. This yields a range of 100-300 pCi/g. One can arrive at a similar result by using the document's LLD equation on page 6-15, which directs one to multiply 4.66 by 20-50 pCi/g. The implication of this is that these monitor arrays are grossly inadequate to direct processes in a soil washing facility. This is in sharp contrast to the optimistic claims of the document, on page ES-8 for example, that "real time monitors could be a valuable tool for process control in a soil-washing system."

6. RESPONSE: The equation directs one to multiply 4.66 by the standard deviation of the instrument background counting rate, not pCi/g. The values analyzed in this scenario represent three seconds of count time (Standard Deviations). Again, this is done to illustrate the different background correction methods, not to give absolute statistical values. The data collected does not warrant a detailed statistical analysis. The intent of this section is to show the reader what type of data was collected, give a feel for the extent of the effort and the relative quality of data generated by the surplus system used. The implication was to say the current system is inadequate and needs serious thought to rebuilding, recalibration or replacement with emphasis on the replacement. These are stated in the summary. The optimistic claims were not for these monitors, but for the concept of using monitors to control the process. The "Lessons Learned" in the Executive Summary and the Observations section in Chapter 2 will be expanded to address the appropriateness of using excessed equipment.

The Department cannot tell why the document's LLD calculations are so grossly in error, but there are a number of possible explanations. The document's choice of 4.66 times S_b (and implicitly divided by live-time, though this is not mentioned in the document) may be simply inappropriate for the statistical domain of the problem. It appears more likely, however, that the authors of the document failed to consider sources of statistical error beyond counting error. One very good reference that discusses these issues in detail is "Lower Limit of Detection: Definition and Elaboration of a proposed Position for Radiological Effluent and Environmental Measurements", by L.A. Currie (NUREG/CR-4007).

7. RESPONSE: The report states (page 6-8, Section 6.3.3, first paragraph) "There is some question as to whether the quality of the data warrants detailed analysis." A significant amount of data were collected during the test and a great deal of time and money could be spent analyzing it. However, that level of effort would likely produce similar results because of the data. Consequently, a simple analysis was used.

The document also mentions on page 6-15, for example, that there are difficulties with the stability of monitoring data as temperature changes. The most probable cause of this is the temperature dependance of the gain of the NaI(Tl) detectors. That is, as the temperature increases, so does the gain of the detector. The end result is that the peak positions in one's spectrum will drift during the course of a work-shift. The solution to this problem is to simply stabilize the gain. Commercial gain-stabilization hardware and/or software is widely available. Glenn Knoll's "Radiation Detection and Measurement" is an excellent reference on this subject.

8. RESPONSE: Agree. The surplus equipment used did not have a simple system of gain adjustment. Each detector in the arrays has its own amplifier and gain adjustment, sealed in a case. Consequently it was physically impossible to do any fine tuning in the field. These were all balanced in the lab, transported as a single unit (14 detectors) and installed in the field. The sensitivity to temperature is due primarily to the temperamental nature of the electronics in the surplus equipment. The "Lessons Learned" in the Executive Summary and the Observations section in Chapter 2 will be expanded to address the appropriateness of using excessed equipment.

The gain stabilization problem has significant potential implications for the accuracy of the data. The consistently negative "background corrected" Europium concentrations in Table 6-5 or 6-6, for example, can only occur if there is a systematic error in background subtraction. One possible source of this error is to set the summing "windows" for the peak locations and background locations and then, as the day progresses, allow the gain to drift so that the peak is in the background window and background is in the peak window. Is this what happened?

9. RESPONSE: Agreed. The two methods of background correction are discussed at some length. This correction was done after the fact and is probably the weak link in the system. The level of sophistication used for the correction is proportional to the quality of the data. And, it was decided the data does not warrant the effort. The windows referred to in the comment were the same for peak and background and this very easily could have happened to some degree.

In light of the forementioned difficulties in background subtraction, LLD's, gain drifts and lack of correlation with laboratory data, how can the authors of the document seriously put forth the assertion that "it was observed that real-time monitors could be a valuable tool for process control in a soil-washing system"?

10. RESPONSE: More factors are considered in assessing the future potential for radiation monitors than the quality of data produced by the system during this test.

The quality of the system must be considered. It was well known that this was excessed equipment going into this test, but the cost for a newer system for a test of this magnitude is prohibitive. One must also examine the conditions encountered during the test, such as positioning of the monitors, arrangement of the detectors, the geometry of the material under the detectors, the counting time that actually occurred, and fluctuations in temperature. If these things can be improved upon the system would be more effective. One must also look at other applications of the same technology by others in the industry where several successful applications by other companies exist. Other factors might be potential cost savings in analytical costs or potential process improvements by using real time monitors. Once all the factors have been examined, an assessment can be made as to the future potential for radiation monitors. The observation that monitors could be a valuable tool is based on this assessment.

A minor error that appears throughout the text regarding the monitoring systems is the chemical symbol of the detector composition. These detectors are Sodium Iodide crystals that are doped with Thallium. Thus the correct notation is NaI(Tl), not NaI(TI).

11. RESPONSE: The report will be revised to NaI(Tl).

Another flaw in the document can be found on page ES-13, where it recommends that a "radioactive dose meter" should be used for cleanup verification. The Department does not fault the authors of the document for their lack of familiarity with radiological cleanup verification; however, they should probably avoid the subject unless they are willing to seriously think about it. A good reference to the subject is the Nuclear Regulatory Commission's NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination."

12. RESPONSE: The report does not recommend using a "radioactive dose meter" for cleanup verification. It does recommend using a low level radioactive dose meter to make field screening much simpler and more reliable. The role of field screening in the remediation process is beyond the scope of this report.

In summary, the document addresses an issue that is important for the cleanup of the 100 areas, however, the radiological discussions of the document are seriously flawed. To the extent that soil-washing requires real-time monitoring to direct the process, it remains unclear if soil-washing is a viable volume reduction technique. If you have any questions about our comments, please call me at 360-586-3585.

13. RESPONSE: The report addresses the viability of soil washing for volume reduction in relation to contaminant distribution, contaminant levels, cleanup levels, and cost considerations throughout the report and in some detail in appendix H. Radiation monitors are not required to control the soil washing process. Real time monitoring would, however, enhance the system and could significantly reduce analytical costs making it a valuable tool.

Sincerely,

Douglas P. Wells, Ph.D.

cc: John Erickson
Lynn Albin
Al Danielson
Keith Holliday - Ecology
Nichole Kimball - DOE
Glenn Goldberg - DOE
Paul Beaver - EPA

CH2M HILL Hanford, Inc.
Interoffice Memorandum

Job No.: 22192
Written Response Required? No
Who owes action?
Due Date: N/A
OU: 100-DR-1
TSD: N/A
ERA: N/A
Closes CCN:
Subject Code: 8540

To: Distribution

Date: December 1, 1994
From: Kelly Cook

Cindy Dixon for

100-DR-1 Revised Treatability Scope and Objectives

Please see attached 100-DR-1 Revised Treatability Scope and Objectives.

KEC:cad

Distribution:

J. G. April	H6-01
C. A. Dixon L/B	H6-02
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P. R. Staats	B5-18
N. A. Werdel	H4-83
BHI Document Control Project File	H4-79

Control Number 76	100 NPL Agreement/Change Control Form X Change __ Agreement __ Information Operable Unit: 100-DR-1	Date Submitted: 11/21/94 Date Approved:

Document Number and Title: 100-DR-1 Revised Treatability Scope and Objectives	Date Document Last Issued: NA
Originator: J. G. April	Phone: 373-6875

Summary Description:

Signatures are for concurrence with the revised scope and objectives for the 100-DR-1 pilot scale soil washing test (attached). The scope and objectives were discussed in a comment working meeting held 10/26/94.

The major change to the agreement is to delete testing with electrolyte and to add the sampling and analysis requirements.

Justification and Impact of Change:

This agreement does not impact previous schedules or established TPA milestones. Recent bench scale data indicates buildup of radionuclides in the electrolyte. Buildup of the radionuclides makes utilizing the electrolyte less attractive because further treatment steps are needed. Therefore the Tri-Parties agreed to delete the use of electrolyte from the test. Only one test will be run.

Sampling and analysis requirements have been cut back as a cost savings.

J. G. April [signature] — 11/21/94
ERC Treatability Studies Lead — Date

N. A. Werdel [signature] — 11/28/94
DOE Unit Manager — Date

P. R. Staats [signature] — 11/29/94
Ecology Unit Manager — Date

D. A. Faulk [signature] — 11-29-94
Env. Protection Agency Unit Manager — Date

Per Action Plan for Implementation of the Hanford Consent Order and Compliance Agreement Section 9.3

100-DR-1 PILOT-SCALE SOIL WASHING TREATABILITY TEST

1.0 REQUIREMENTS AND SCOPE

1.1 A shake down test will be performed in which equipment is set up, operating experience is obtained, and operating parameters for the test are selected.

1.2 The field tests will consist of 2 parts: a. wet sieving with water only; and b. by wet sieving and attrition scubbing with water only. Processes will include a trommel, screens, attrition scrubber, dewatering screens, a clarifier, and recycling of process water.

1.3 Field tests will process soil particles < 150 mm (6 in) dia. at 10 ton/hr. Time of processing and amount to be determined by field engineer. The system will operate during normal working hours. RL estimates 100 tons of processed soil may be an adequate amount if the system works well. An undetermined amount of soil will be processed in shake-down tests.

1.4 Target Performance Goals (TPG's) for the test will be accessible soil levels for radionuclides included in WHC-CM-7-5, Environmental Compliance Manual (1988) Table 6.2 for:

^{60}Co, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{90}Sr, ^{235}U, ^{238}U, $^{239/240}$Pu.

(eg. 30 pCi/g for ^{137}Cs)

Results of the pilot scale soil washing test at 116-D-1B will also be evaluated over a range of residuals down to levels, down to those listed in the Test Plan (DOE/RL-92-15, Rev. 0 [eg. 3 pCi/g for ^{137}Cs]).

1.5 Offsite TCLP analyses will be conducted for fine soils < 0.25 mm and for 2 mm to 0.25 mm soils. In addition, radiochemical analyses of TCLP extract will be performed off-site.

1.6 In addition to field tests, water treatment recycle tests will be conducted in the laboratory using available sediment from the bench scale testing. These include:

> Bench scale recycle batch processes prior to field testing. Contaminant buildup and other process factors will be assessed. Water treatment will include flocculation and filtration.

1.7 Contaminated soils < 0.25 mm will be placed in appropriate containers and handled in accordance with the waste control plan. Remaining soils are to be returned to the site after the test is completed. Process effluent will be evaporated or otherwise handled in accordance with the waste control plan.

2.0 OBJECTIVES AND MEASUREMENTS

2.1 Verify Chemical and radioactivity analyses of processed soils from the pilot scale treatability test are consistent with laboratory scale treatability test results.

Samples and composite samples will be collected and analyzed as specified in the Sample and Analysis Plan (SAP) (Attached).

2.2 Verify the percent reduction (by wt) that can be achieved for the soils processed is consistent with laboratory indications.

Sieve soils to determine the percent of soil particles in each size fraction before and after processing.

2.3 Assess water treatment requirements and recycling needs, including efficiency of treatment in removing contaminants from process effluent, and contaminant build up.

EPA Level II and V analyses will be conducted for feed water, effluent prior to treatment, and treated effluent samples.

2.4 Provide data on performance of the process equipment to allow scale-up to a full-scale system (eg. 100 ton/hr).

- o Determine operating utility requirements (chemical consumption, power, water etc.)
- o Record Settings of Equipment Controls
- o Determine Energy Input Requirements.
- o Determine Soil Water feed ratios, chemical ratios, pressure, flow rates, etc.

2.5 Assess emmissions and/or environmental impacts.

Record and report ALARA practices, air monitoring results, exposure levels, if any, detected by Health Physics Personnel.

2.6 Use real time radiation monitors

Install sodium iodide detectors to monitor processed soils. Data will be used as needed to make field changes required to improve system performance, and to assess the viability of real time monitors for process control.

2.7 Data Validation

Ten percent of all data will be validated using methodologies agreed to by all three parties.

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Date February 10, 1994

To Jim Field

From Ron Brodzinski *Ron*

Subject Soil Conveyor Monitor

Sorry about the extended delay in getting this information to you, but you know the syndrome: go out of town for two days and you're two weeks behind when you get back. The distribution list all contributed to this proposal, and I have copied them to make sure I have factually documented their input and to ensure they understand what will be required of each of them in executing the program.

First, a brief description of my understanding of the problem. Soil to be "washed" will be transported by conveyor into the "washing machine." Clean soil will come out on two separate conveyors in two different size fractions. "Dirty" soil will come out on a fourth conveyor. Conveyors are two feet wide. Nominal conveyor speed is 100 feet per minute. Desired sensitivity for manmade radionuclides is 10 pCi/g. Major expected manmade radioactivities are ^{137}Cs, ^{60}Co, ^{154}Eu, and possibly ^{90}Sr. Delivery of an operational system is required by July 1, 1994. This is a demonstration project, and no higher level of Quality Assurance will be required than that of Battelle's Good Practices Standard. Similarly, no documentation or user's manual, other than a letter report describing the system and results, will be required in the scope of this effort. Finally, no formal operator training program will be required; we will, of course, assure that the system works properly and that any and all operators during this demonstration are sufficiently familiar with the equipment to reliably gather good data.

1) We propose to utilize existing arrays of 5-inch diameter NaI(Tl) scintillation crystals (each array is composed of fourteen detectors) to measure the characteristic gamma-rays emitted by ^{137}Cs, ^{60}Co, and ^{154}Eu and possibly the bremsstrahlung radiation emitted by $^{90}Sr(^{90}Y)$. A single array on each conveyor line should provide the required sensitivity at the planned speed. It will be necessary to gather these arrays from various storage locations, test each of the 56 detectors for operability, set the output gain on each photomultiplier tube, and replace any inoperable detectors. This effort is estimated to require one man-month ($20K).

2) It will be necessary to gather, assemble, and test electronic hardware components (HV, Amps, DAS, etc.) to acquire data from each of the 56 detectors. Some of these components are known to be available, some are known to be unavailable, and some we can't be sure about until we try to make things work. Please appreciate that these electronic components are not finished systems gathering dust on the shelf while waiting to be

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utilized. Part of the effort required in this task is to identify missing components; hence, we can't be totally sure what purchases may be required at this time. However, our best guess is that we will need to acquire no less than $15K worth of additional components. We do not anticipate needing significantly more than that. The labor effort for this task is again estimated to be one man-month ($20K).

3) It will be necessary to write and assemble appropriate software for data acquisition and reduction in order to provide live-time quantitative results. Another man-month of effort ($20K).

4) The systems will need to be calibrated in the laboratory to assure reliable quantitative data in the field. Factors anticipated to affect the calibration efficiency of the systems include the moisture content and the size fraction of the soils. Appropriate quantitative radioisotope sources, traceable to NIST, are available at PNL for this effort. Part of this task will include determining the sensitivity for ^{90}Sr by measuring the bremsstrahlung radiation from its equilibrium daughter, ^{90}Y. Should the NaI(Tl) detectors prove to be inadequate to determine ^{90}Sr, and should it be decided that sensitive and quantitative determinations of ^{90}Sr are required, an alternate technology, which is known to be adequately sensitive is proposed in a following task. Calibrations are estimated to require one man-month of effort ($20).

5) A physical engineering effort will be required to assemble detectors and electronics in proper configurations, mount systems on the conveyors, and arrange for the necessary infrastructure for operation in the field. This effort is estimated to require two man-months ($40K).

The above five tasks constitute a bare-bones effort to accomplish the planned demonstration. The total estimated cost for these five tasks is $135K. During our conversations, we entertained the possibility of WHC personnel providing technical manpower assistance. We welcome such a combined effort. I anticipate that approximately half of the labor effort in tasks 1, 2, 4, and 5 could be assumed by competent WHC personnel, reducing the PNL costs to $85K.

6) _If_ the NaI(Tl) detector arrays are not sufficiently sensitive to measure ^{90}Sr at the required detection level, and _if_ it is imperative to determine ^{90}Sr live time in the field, PNL can apply our optical fiber based beta counters for making that determination. This could be accomplished by utilizing one of our existing systems as a "loaner." The estimated costs for setting up the detector and electronics in the field configuration, calibration, and data reduction are $15K. If a dedicated detector were more desirable, one could be custom fabricated and installed for $50K total.

Finally, it is prudent to document that the demonstration is planned for July. Outdoor temperatures at Hanford in July are not compatible with the stable or reliable operation of electronic equipment and computers. The electronics and data acquisition systems will need to be housed in properly air-conditioned quarters, and even the detector arrays themselves should be contained within a thermally stable environment to minimize gain drift and assure quality data. From our discussions, it is my understanding that WHC will take the responsibility for environmental control. PNL will, of course, provide appropriate information and suggestions.

This proposed statement of work is flexible and negotiable. In fact, due to the prototypical nature of the effort, it is, at best, a good guesstimate of the work, time, and costs involved. Since much of the effort can be performed by more than one person at a time, and since some of the tasks can be accomplished simultaneously, a finished product should be easily deliverable by July 1, 1994, assuming a timely start. Please don't hesitate to contact me with regard to any of the details in this description of work, or on any other facet of the planned demonstration.