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Date: April 29, 1999
Refer to: EM/ER:99-108

APR 1999 RECEIVED

Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: TECHNOLOGY FEASIBILITY DEMONSTRATION PROJECT AT TA-15, E-F SITE, POTENTIAL RELEASE SITE (PRS) 15-004(f)

Dear Mr. Garcia:

Enclosed is the Technology Feasibility Demonstration Project for Technical Area (TA)-15, E-F Site, Potential Release Site (PRS) 15-004(f). PRS 15-004(f) is listed on Table A of Module VIII of the Los Alamos National Laboratory's Hazardous Waste Facility Permit. As outlined in our planned work schedule, this work will begin May 3, 1999.

If you have any questions or concerns please feel free to call Dave McInroy at (505) 667-0819 or Joe Mose at (505) 667-5808.

Sincerely,

James M. Ray for

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

T. J. Taylor

Theodore J. Taylor, Program Manager
DOE/LAAO

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Enclosure: Technology Feasibility Demonstration Project for TA-15, E-F Site, Potential Release Site (PRS) 15-004(f)

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TECHNICAL FEASIBILITY DEMONSTRATION PROJECT AT TA-15: E-F FIRING SITE

PLAN

APRIL 28, 1999

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1.0 INTRODUCTION

This plan describes a technology feasibility demonstration to determine the applicability of using the Segmented Gate System (SGS) technology to remediate firing sites that are contaminated with uranium and high explosives (HE) at Los Alamos National Laboratory (LANL). This innovative technology involves assaying material and sorting it into uranium-contaminated and non-contaminated (below a screening level) components and has been successfully used to remediate uranium-contaminated material while reducing the volume of generated radioactive waste. Per the direction of the New Mexico Environment Department Hazardous and Radioactive Materials Bureau (NMED-HRMB) on April 8, 1999, the Environmental Restoration (ER) Project will proceed with the technology feasibility demonstration using approximately 10 cubic yards of material from Potential Release Site (PRS) 15-004(f). PRS 15-004(f), E-F Site, is listed on Table A of the Hazardous and Solid Waste Amendments (HSWA) Module of LANL's Hazardous Waste Facility Permit. This plan outlines the proposed procedures required to demonstrate the feasibility of this technology in a two part process.

TA-15 soil, as represented by E-F Firing site, is contaminated with a variety of materials, including: metals, uranium, HE, shrapnel, and debris (wood, wire, steel plates). The potential presence of HE constitutes a personnel safety hazard. The first part of the demonstration will consist of a preliminary sorting of oversized (greater than 6 in) material (shrapnel, debris, etc.). Following the oversized material sorting, a rubberized mechanical screen plant (Tornado Star) will be used to sort soil into two size fractions: less than or equal to 3/8 in. and greater than 3/8 in. Because of the possibility for HE contamination of soil at E-F Site, the mechanical soil sorting system will be used to produce a soil feedstock (less than or equal to 3/8 in.) that can be assayed for HE presence in accordance with the DX-Division Standard Operating Procedure (SOP) for the Spot Test. If the HE spot test is negative, or if the HE content is less than 5%, as detailed in the DX-Division SOP, the soil is operationally defined as non-explosive, and can serve as a feedstock for the second part of the demonstration. If the HE content is greater than 5%, the demonstration will be terminated.

The second part of the demonstration consists of the segregation of the prepared feedstock into above and below criteria uranium-containing soil using the SGS. The SGS system will already be performing a separate remediation at LANL's TA-33, and the TA-15 demonstration will take advantage of the local availability of the SGS for the second part of the demonstration. Figure 1 shows an outline of the project. The demonstration of the segregation of the TA-15 soil with the SGS will take place after all TA-33 soil has been processed.

To the northeast of the large E-F Site mounds, two small piles of soil and debris exist. Together, the piles are estimated to contain about 40 cubic yards of soil. Enough bulk soil from the 40 cubic yards will be size-segregated to yield about 10 cubic yds of feedstock for the SGS demonstration. Uranium and shrapnel can be seen on the surface of the existing piles. The composition of the piles suggests that the material originated from re-distribution of firing site debris. The actual composition of the piles is unknown. Because of the defined area, ease of removal, and obvious visual uranium contamination of the soil piles, they are proposed for the demonstration.

2.0 TECHNICAL FEASIBILITY DEMONSTRATION OBJECTIVES

The general objectives of this technical feasibility demonstration are two-fold:

- Assess the capabilities of the Tornado Star for safely preparing a 3/8 in. soil feedstock;
- Assess the capabilities of the SGS for segregating the feedstock of uranium-contaminated soil to produce the lowest concentration of uranium possible in the soil.

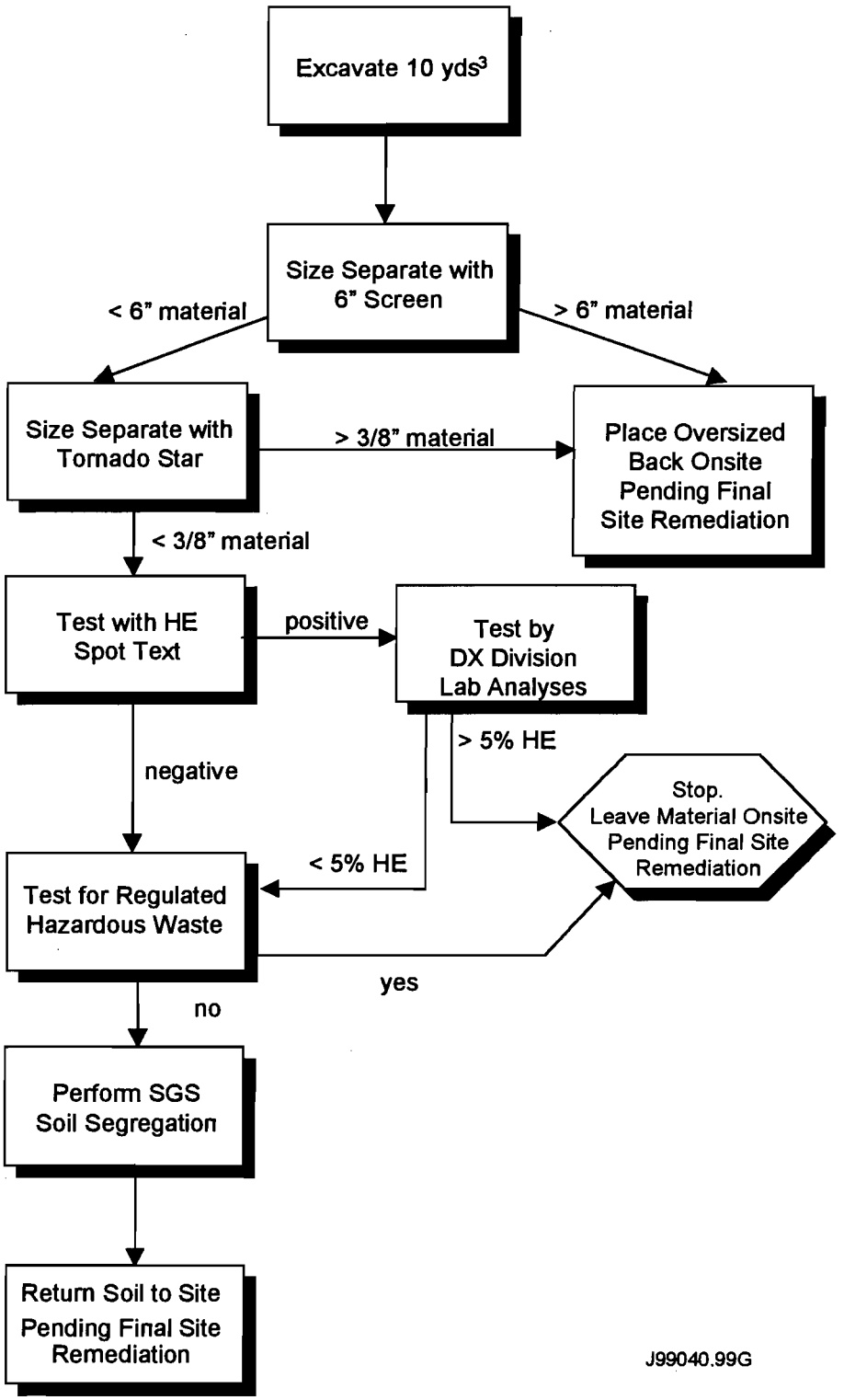


Figure 1. Project Outline

The overall effectiveness of the procedures have site-specific elements. This demonstration will assess the effectiveness of the two procedures to support selection of a remediation alternative for E-F Site and similar sites at LANL.

2.1 Phase I

The objective of the Tornado Star portion of the project is to demonstrate the capability of the equipment to safely process potentially HE-contaminated soil. The sorting will produce soil with a particle size of 3/8-in. diameter or less. The production of a uniform particle size is important to meet DX-Division concerns for demonstrating HE safety. According to DX-Division SOP, firing sites such as E-F Site are defined as a heterogeneous area, meaning that soil may contain HE in large chunks or small pieces, which may be on the surface or buried. Unless each parcel of soil is tested individually with the DX-Division HE Spot Test, there is no way of knowing in advance whether all the soil from a heterogeneous location is non-explosive. The Tornado Star can remotely process soil into a size that will be much more homogeneous than the bulk soil. Following processing, a representative number of HE spot tests can be used to determine whether the soil is non-explosive, without having to test the entire amount of soil, which is impractical. The mechanical sorting capabilities of the Tornado Star may be influenced by soil characteristics such as density, percent moisture, and particle size. Visual inspection and particle size measurements of the final soil pile will be used to determine the effectiveness of the sorting operation and will be used to optimize machine operating parameters, such as belt speed, star screen speed, etc.

2.2 Phase II

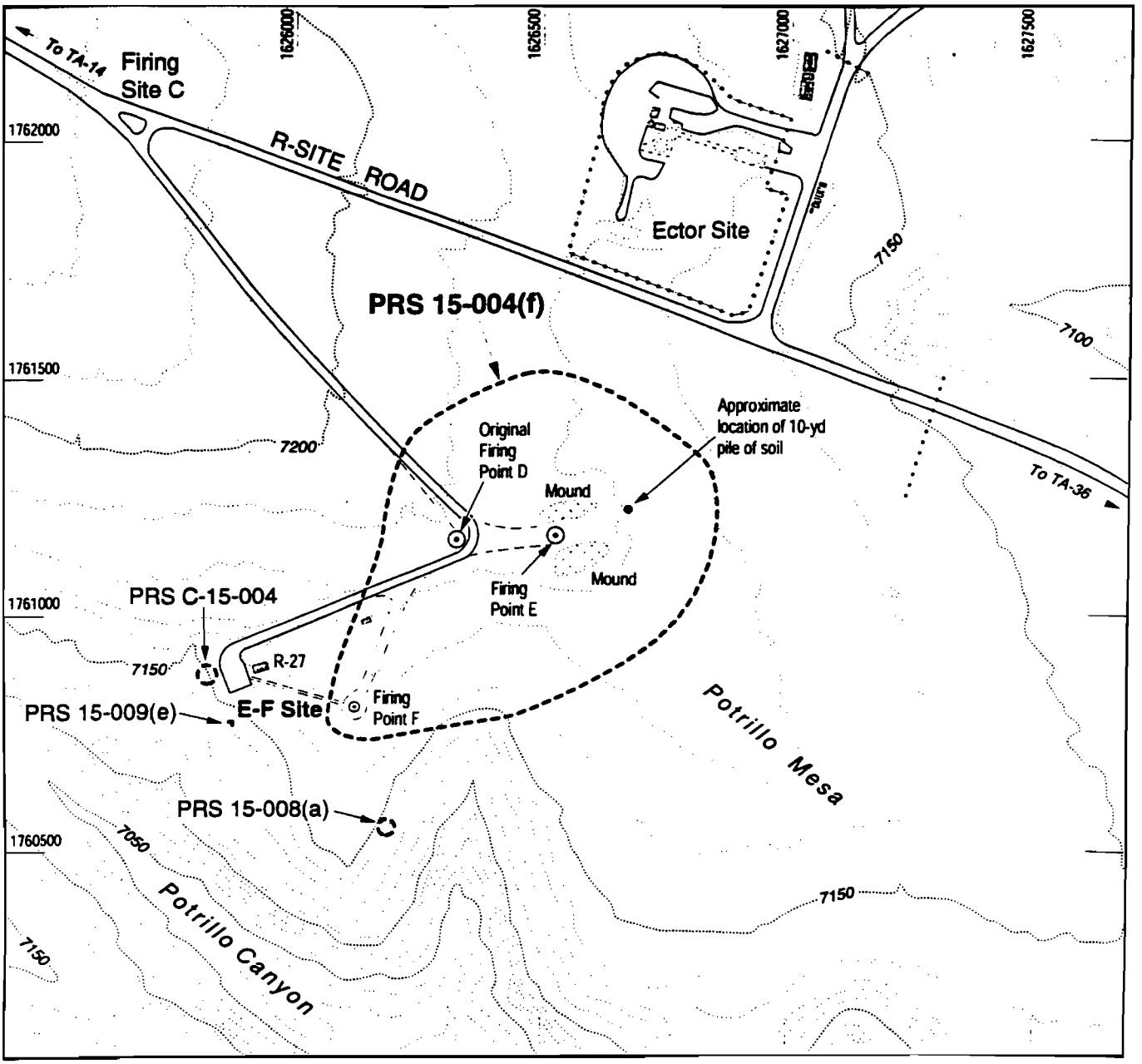
The objective of the SGS part of the demonstration is to determine the effectiveness of the system to assay and separate uranium-contaminated soil from TA-15's E-F Site into two fractions: one fraction will be below cleanup goals and/or other criteria that are considered protective of human health and the environment. The other fraction is above cleanup goals. The object is to maximize the fraction of soil which can safely be returned to the site, and minimize the waste fraction. During the first phase of the project, it is possible that preparation of the 3/8 in soil feedstock will unavoidably homogenize the uranium to such an extent that the SGS separation is not effective. Determining if this is occurring is an important part of the demonstration. From the demonstration, the percentage of soil that must eventually be disposed of can be estimated, and potential cost savings (compared to conventional disposal) due to volume reduction will be projected.

3.0 SITE HISTORY OF PRS 15-004(F): E-F FIRING SITE

Firing Site E-F (Figure 2) was the most extensively used firing site at LANL in terms of continued use and quantities of uranium expended. E-F Site was established in 1947 for tests using up to 2,500 pounds of explosives. It was used frequently from 1943 through 1973 and was last used in 1981. Initially, natural uranium metal was used in the devices that were tested. Between 1945 and 1957, an estimated 48 tons were expended on E-F Site. After 1957, approximately 22 tons of depleted uranium (DU) was expended.

Firing Sites E and F were originally depressions in the soil. As tests were conducted, either the soil was re-graded to level the disturbed earth, or new gravel was brought in to fill the depressions. Eventually, nearby soil was mounded about 20 ft high to the north and south of Firing Site E to protect nearby buildings. Explosions were carried out between the mounds, which reduced the potential for shrapnel being propelled into the buildings.

Several surveys were conducted at E-F Firing Site to determine the extent of radioactive contamination; however, none were conducted on the small pile that will be the focus of this work. The RCRA Facility Investigation (RFI) Work Plan (LANL 1995, ER ID 20946) contains historical information regarding E-F



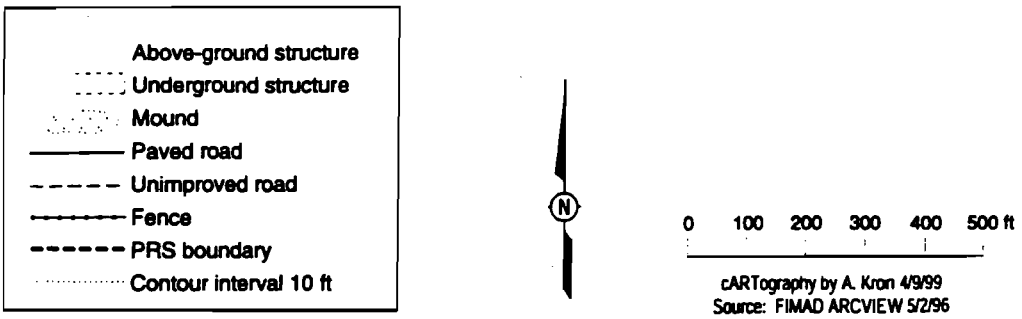


Figure 2. Site diagram for Firing Site E-F; shaded area shows SWMU 15-004(f).

Site, including results from previous investigations. An RFI investigation was conducted in the summer of 1994. The results of this work are described in the RFI Report (LANL 1995, ER ID 50294.4). Ninety-four sampling locations were selected for surface (0-6 in.) and subsurface (18-24 in.) sampling. Uranium was detected above LANL background in every sample. The range of uranium concentrations was from 5.46 mg/kg to 2763 mg/kg (total uranium). Other metals were detected in the soil (e.g., beryllium, lead, copper) but none were detected in concentrations that would exceed the TCLP and cause the soil from E-F Site to be classified as a hazardous waste. There were no positive readings on the HE spot test on any of the soil samples.

Figure 3 shows a map of E-F Site with uranium contours that were derived from site-wide laboratory and field X-Ray Fluorescence (XRF) data (LANL 1995, ER ID 50294.4). As shown on the map, there are several locations at E-F Site and the surrounding area that could be considered "hot spots" and thus potential candidates for full-scale excavation and remediation. The RFI results showed that the predominant isotopic form of uranium now present in the soil is natural. The estimated volume of potentially contaminated soil at E-F Site is about 2,000 yards over the 60-acre site.

4.0 TECHNICAL CAPABILITIES

4.1 Tornado Star Soil Sorter

The Tornado Star is a high-production, portable sorting plant that sorts soil into defined size fractions. After loading into a conventional hopper, the soil is directed onto a conveyor belt and then moved onto a series of rotating rubber fingers ("stars") that allow small particles to fall through, while oversized material travels to the end of the machine and falls into a separate pile. The use of the rubberized soil-sorting plant will reduce the chance for detonation of HE because rubber is non-sparking and will not generate shear points. Figure 4 shows a schematic and Figure 5 a photograph of the Tornado Star and the material that results from the sorting; oversized material drops off the end of the machine (nearest point in the photograph) while fine material falls through the "stars" and accumulates below the star bed in a long row extending toward the rear of the machine. The Tornado Star is capable of processing soil at a rate of up to 80 cubic yards per hour.

Although capable of being equipped with a mechanical "grizzly" for removal of oversized pieces of debris, uranium, and HE, the Tornado Star unit available for the demonstration does not have this equipment. The grizzly function will instead be carried out by using a section of galvanized fence (6-in. mesh) or other material (e.g., plywood with 6-in. holes) and a backhoe. Soil passing the 6-in. screen will be loaded into the Tornado Star hopper for processing. Oversized material will be left on site, in its approximate original position, pending final site remediation.

4.2 SGS

The SGS equipment assays and separates soil contaminated with radioactive material into distinct fractions. The procedure is capable of separating contamination from large volumes (as much as 100,000 cubic yards) of soil. Thermo NuTech (the owner of the SGS) has shown that reduction in the volume of contaminated soil can be as great as 98%.

The SGS plant includes a hopper, a conveyor system, radiation detectors, and computer controls that work by timed synchronization to segregate radioactively-contaminated soils moving on a conveyor belt based on a user-defined radioactivity threshold criteria. Fifteen NaI detectors are in each monitoring unit and are arranged in two overlapping rows of seven and eight detectors in each row. The two rows of detectors are offset to prevent hot particles from passing undetected between adjacent detectors. A master control board collects data from each detector and determines whether dispersed radioactivity has been detected, then selects and actuates one or more of the eight diversion chutes of the SGS. Soil with

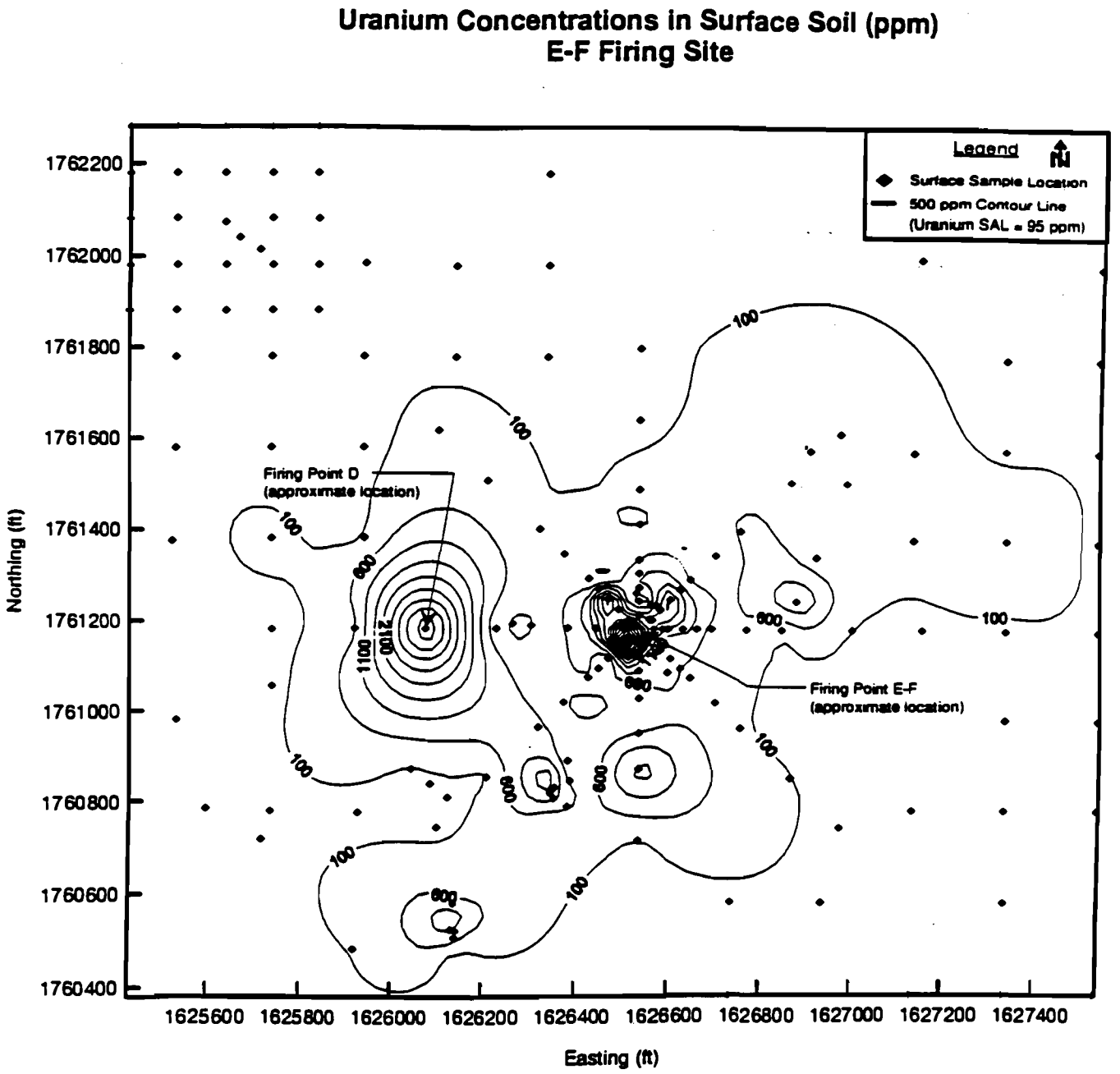


Figure 3. Uranium concentrations in surface soil (ppm), E-F Firing Site.

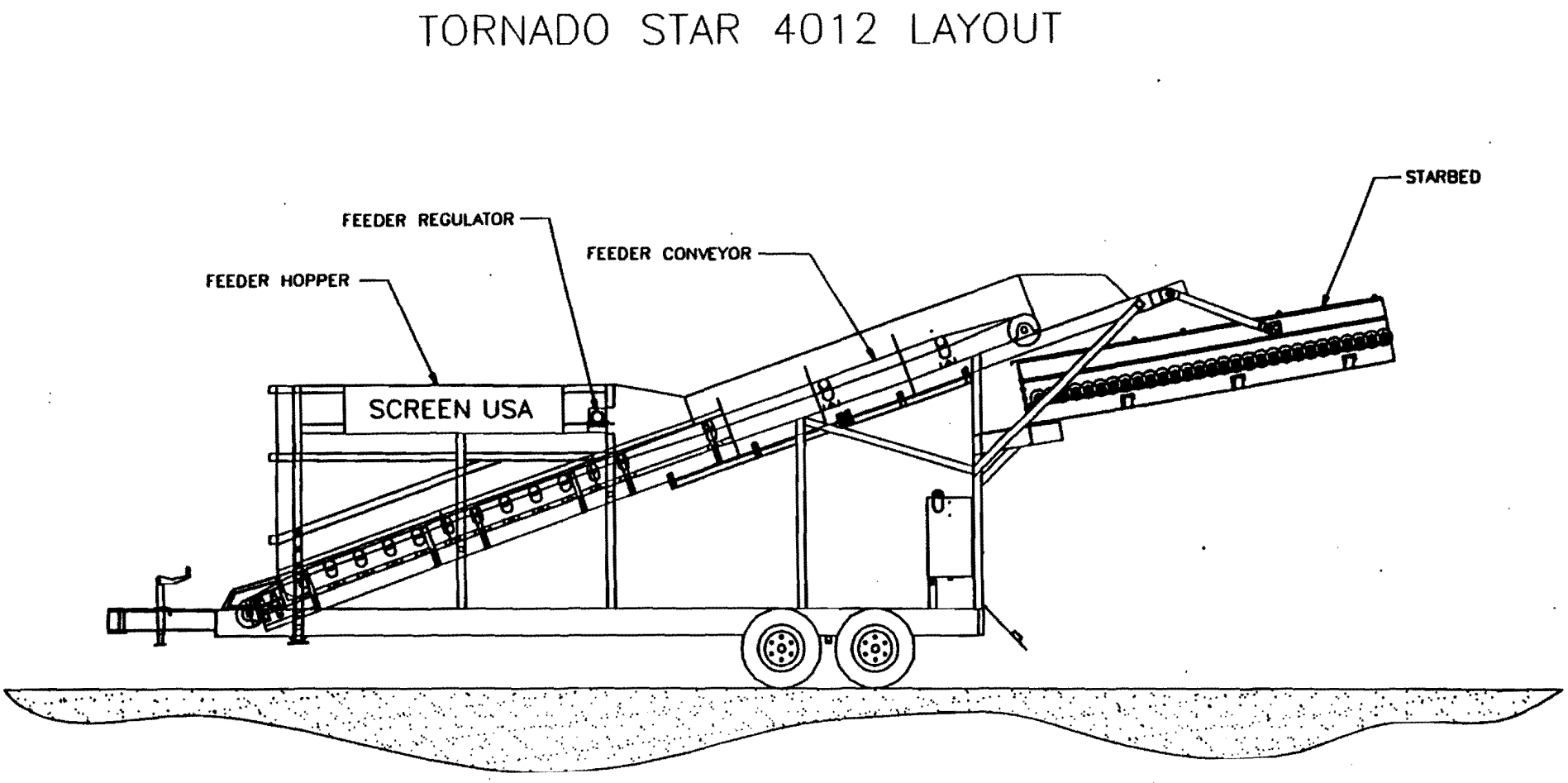


Figure 4. Schematic of the Tornado Star

Figure 5. Photograph of the Tornado Star

radioactivity above the demonstration goal will be diverted into "King Bags" for sampling and returned to TA-15 E-F Site; the soil that is not diverted (i.e., is below the demonstration goal) will be collected in a separate container, and samples also returned to TA-15. One of the goals of the SGS portion will be to determine the practical SGS detection limit for TA-15 soil.

The SGS technology was successfully demonstrated in 1996 at LANL at PRS 33-007(c). In this 1996 demonstration, the amount of soil requiring disposal was reduced by 97%. Thus, the SGS is a proven technology at LANL. At TA-33 however, there were no HE issues, therefore, the purpose of this demonstration is to establish the feasibility of the SGS for eventual use at E-F Site where HE-contaminated soil is possible.

5.0 DEMONSTRATION GOALS

Preliminary modeling calculations were performed using the computer program RESRAD to determine what concentration of uranium would be required in order to eventually return soil to E-F Site considering an industrial worker scenario. Results from the initial calculations show that an industrial worker has an exposure of 60 mrem/yr using the most conservative site values (345,000 m^2, 3 m depth, and natural uranium) and the highest concentration of uranium found in soil (2763 mg/kg x 0.7 = 1934 pCi/g). (See Appendix A for a summary of the calculations). For the worker not to exceed the proposed EPA dose limit of 15 mrem/yr, the uranium concentration of the soil must be reduced by a factor of 4 to 483 pCi/g.

These initial results show that the SGS has the capability of detecting uranium well below the concentrations of concern for an industrial worker, as the SGS detects concentrations as low as 50 pCi/g. As part of the demonstration, however, the soil will be sorted to determine the lowest possible detection of uranium. Concentrations below that calculated for an industrial worker may be required to be fully protective of human health and the environment, and the determination of the full capabilities of the SGS with TA-15 soil will provide a valuable input to support the selection of a remediation alternative for E-F Site and similar sites at LANL. Accordingly, soil may be processed through the SGS a number of times.

6.0 PROCEDURES

General procedures for setting up and using the Tornado Star are presented below. Because the SGS will be running at LANL under another program, the TA-33 Voluntary Corrective Action (VCA) Plan contains specifics regarding the processing of soil by the SGS. Standard operating procedures developed by Thermo Nuclean, Barela Timber Management Company (the owner of the Tornado Star), and LANL will be followed for all operations and are not discussed in this plan. Procedures for carrying out the sorting, sampling, and laboratory analyses are discussed below. Prior to initiation of work, all ER policies and procedures, such as conducting a readiness review will be completed. All plans (Work Plan, RWP, H&S Plan) and permits (excavation, ESH ID, air quality, etc.) will be finalized prior to the Readiness Review. A trained equipment operator will operate the backhoe and dump truck according to OSHA requirements. The dump truck driver will have a commercial driver's license. All subcontractors will adhere to the Site-Specific Health and Safety Plan.

6.1 TA-15 Oversized Soil Separation

Prior to delivery of the Tornado Star, the existing piles will be screened by manual methods to remove oversized material. Enough soil will be processed to yield about 10 cubic yards of 3/8 in. soil. A 6-ft-square piece of aluminum plate with 6-in. holes will be placed next to the soil piles. A backhoe with a Lexan blast shield will be used to place a small amount of soil and debris on the plate. The backhoe will very carefully agitate the material on the screen until all the material that can pass through the 6-in. openings has done so. Oversized material left on the plate will be returned to the area of the soil piles by tipping the plate. This oversized material will await the final remediation of E-F Site. The procedure will

prevent shrapnel, wire, wood, and large pieces of uranium from entering and potentially fouling the Tornado Star. Once the pile has been screened, the sorted material (less than 6 in.) will be further processed by the Tornado Star.

6.2 Tornado Star Procedures

Upon delivery, the Tornado Star will be placed close to the soil pile, off the E-F Site access road. A trained equipment operator will operate the Tornado Star. IT personnel will supervise the on-site activities and collect samples for all analyses. Delivery and set up of the Tornado Star will take approximately one day.

To prevent potential operator injury (e.g., if a detonation occurred while a person was near the Tornado Star controls), the Tornado Star will be operating prior to any loading of soil and will be kept operating during the entire operation. The closest approach to the Tornado Star by any personnel when potentially HE-contaminated soil is in the unit will be when the operator of the backhoe, equipped with a Lexan shield, loads the hopper. The Tornado Star will be equipped with a remotely operated "kill" switch that could turn off the equipment should an emergency arise.

Material from the 6-in. screening will be conveyed to the Tornado Star by a backhoe equipped with a Lexan blast shield. Material will be placed into the hopper of the Tornado Star and processed by the machine. After the last batch of soil is processed, the Tornado Star will be turned off. To minimize dust, a frame with plastic drop curtains will be placed around the Tornado Star where the soil drops off of the sorting mechanism. The plastic will extend in a vertical direction from the sides of the starbed to the ground. The plastic frame will eliminate the need for water-based dust suppression, which can cause clogging of the Tornado Star.

Once the soil is sorted based on particle size, HE spot test results will be used to determine whether the soil must be assayed for HE using laboratory methods. If all HE spot test results are negative, the entire pile will be considered non-explosive as defined in DX-DO SOP-04, and the soil can be transported for the SGS phase, depending on the results of the waste determination described below. If any of the HE spot test results are positive, the soil will be considered heterogeneously contaminated with HE and additional samples will be sent to DX-2 for laboratory testing of the HE content. If the content is less than 5%, then the soil is also considered non-explosive. The volume of oversized material will be recorded, and the oversized material will be returned to its point of origin to await final site remediation

Once soil is determined to be non-explosive, samples will be collected to ensure that it is not a regulated hazardous waste. Section 7.1 details the number and kinds of analyses proposed. Should soil be determined to be hazardous waste, the project will be terminated because, due to contract limitations, the SGS equipment cannot currently process mixed waste. The preliminary data from E-F Site suggests that the concentrations of metals in the soil at E-F Site should not cause the soil to be classified as a hazardous waste.

Following the completion of the work with the Tornado Star, the equipment will be decontaminated, screened for release by the Radiation Control Technician (RCT), and removed from the site. All oversized material will be left on site in the approximate location from where it was obtained. Another remedial action will address the oversized material at a later date.

The 3/8 in. feedstock soil produced by the Tornado Star will be loaded into a lined roll-on/roll-off bin in preparation for transport to TA-33. When the TA-33 VCA is completed, the TA-15 soil will be transported in the bin by truck to TA-33.

6.3 SGS Procedures

At TA-33, the SGS will be readied for the TA-15 soil demonstration. Plastic drop-cloths will be placed under the SGS at locations where soil could fall from the apparatus. This non-processed soil will be removed and returned to TA-15 E-F Site after the demonstration. In this way, fugitive contamination of the ground at TA-33 will be minimized. During processing of the soil, the above-criteria soil will be caught in 3 cubic yard "King Bags" attached to the chute. The below-criteria soil will be caught with King Bags or a front end loader. Depending on the results, the SGS operation may be repeated several times to determine the optimal soil separation efficiency and uranium detection limits. After sorting, the soil will be sampled as described below. All soil will be brought back to TA-15 in a lined roll-on/roll-off bin and placed back on the ground near its point of origin. All equipment will be decontaminated.

7.0 SAMPLING PLAN

Samples will be collected and analyzed for a variety of purposes:

- to determine the presence or absence of HE as defined by using the HE spot test
- to determine HE composition using DX-2 (if necessary, based on the spot test results)
- for waste characterization purposes using SW-846 methods prior to transport to TA-33
- for pre- and post-SGS segregation to determine the SGS efficiency.

7.1 Sampling for the Tornado Star

HE spot test sampling and/or DX-2 analysis of HE will be conducted to determine if the sorted soil is non-explosive. These tests will be conducted on discrete grab samples. An initial 10 HE spot test samples will be collected from the surface of the sorted soil. If all results are negative, then an additional 10 samples will be collected from the interior for HE spot testing. If all samples are negative, waste characterization sampling will proceed as described below. If some or all HE spot test samples are positive, the soil will be sampled for laboratory analysis of HE. If the DX-Division laboratory analysis of soil reveals it is less than 5% HE, it is classified as non-explosive, and the soil will be further sampled to determine if it is a regulated hazardous waste. If the laboratory analysis reveals that the soil is explosive, the demonstration will be terminated.

Because there are no existing analyses of the soil proposed for this demonstration, an initial characterization will be conducted by collecting discrete grab samples and analyzing them for uranium by XRF spectroscopy. Initially, the soil will be configured into a 3-dimensional rectangle with nominal dimensions of 10 ft long, 5 ft wide and 5 ft deep. A grid that is 2.5 ft wide by 2 ft long and 2.5 ft deep will be placed on the soil, resulting in 20 sub-units. Discrete grab samples will be collected from the center of all 20 units for the XRF determination of uranium. The mean and standard deviation of the results from the XRF analyses will then be statistically analyzed according to Kratochvil and Taylor (1981) to determine the necessary number of laboratory samples to collect to characterize the soil. The formula to determine the number of lab samples is as follows:

$$N = \frac{t^2 s^2}{R^2 x^2}$$

where "N" is the number of samples necessary to characterize the soil, "t" is the student's t-table value for the level of confidence desired, "s" is the standard deviation of the measurements, "R" is the percent relative standard deviation acceptable in the average, and "x" is the average of the measurements. For this demonstration project, "t" will be 1.96 (the 95% confidence level of Student's "t") and "R" will be 20%.

The results of the formula will determine the number of samples to collect for laboratory measurements to determine the soil uranium concentration(for the SGS efficiency demonstration) and to determine whether the soil is a regulated hazardous waste. If N is less than 20, the grids will be numbered and a random number generator will determine the number of each grid to be sampled. If N is greater than 20, the grids will be re-drawn to have at least twice as many grids as sample points. The minimum number of samples to be collected is five, which will yield about one sample for every two yards of soil.

If soil is determined to be a regulated hazardous waste, the project will be terminated, and the soil will stay on-site awaiting eventual remediation.

For characterization purposes, samples will be analyzed for the following constituents prior to transport and SGS manipulation:

- Isotopic and total uranium
- Isotopic plutonium
- Total and TCLP metals
- VOCs
- SVOCs
- PCBs
- HE

7.2 Sampling for the SGS

Using the same number of samples calculated above, samples will be collected from each of the sorted soil piles after separation by the SGS. Samples will be analyzed for total and isotopic uranium and total metals. The volume of soil in each fraction will be estimated, and a mass balance of uranium will be calculated to determine the segregation efficiency of the SGS. Because soil will be present in King Bags or in the loader, gridded sampling will not be possible. In this case, discrete grab samples will be collected using professional judgement to best characterize the entire soil mass.

8.0 WASTE MANAGEMENT

Debris greater than 3/8-in. in diameter will be removed by a combination of methods and will be retained at the E-F Firing Site pending final remediation at a later date. Before the soil feedstock is taken to TA-33, it will be analyzed for VOCs, SVOCs, HE, PCBs, TAL metals, TCLP metals, and total and isotopic uranium and isotopic plutonium. All soil will be returned to TA-15 E-F Site and placed at its point of origin.

PPE and sampling equipment will be inspected for visual contamination and will be field screened for above-background radiation. The decontamination liquids will be disposed as waste based on the soil analyses and sent to TA-50 if they meet the waste acceptance criteria (WAC) or to another approved waste disposal facility if not. Equipment at TA-15 will be pressure washed, and the water will be discharged on the site in accordance with the Notice of Intent (NOI) of August 1997.

9.0 SCHEDULE

The estimated schedule of the demonstration activities is presented below.

TASK	START DATE	END DATE
Plan development	March 1, 1999	April 16, 1999
Readiness review prep	March 15, 1999	April 26, 1999
Readiness review	April 28, 1999	April 28, 1999
Oversized debris removal	May 3, 1999	May 3, 1999
Tornado Star operator training	April 21, 1999	April 21, 1999
Tornado Star mobilization	April 23, 1999	April 23, 1999
Size separation by Tornado Star	May 4, 1999	May 4, 1999
Sampling	May 5, 1999	May 5, 1999
Lab analysis – pre SGS	May 6, 1999	May 11, 1999
Tornado Star demobilization	May 24, 1999	May 26, 1999
Feedstock transport to TA-33	May 12, 1999	May 12, 1999
SGS separation	May 13, 1999	May 19, 1999
Laboratory analysis – post SGS	May 19, 1999	June 19, 1999
Draft report preparation	May 20, 1999	June 29, 1999
Final report	July 16, 1999	July 16, 1999

REFERENCES

Kratochvil, B. and J. Taylor (1981), Sampling for Chemical Analysis. Anal. Chem., 924A.

LANL (Los Alamos National Laboratory) 1995. "RFI Report for Potential Release Sites 15-004(a-d,f), 15-007(b), 15-008(a,b), 15-009(e,j), 15-012(b), C-15-004", Los Alamos National Laboratory Report LA-UR-95-3738, Los Alamos, New Mexico. (LANL 1995, ER ID 50294.4)

LANL (Los Alamos National Laboratory) June 1993. "RFI Work Plan for Operable Unit 1086", Los Alamos National Laboratory Report LA-UR-92-3968, Los Alamos, New Mexico. (LANL 1993, ER ID 20946)

APPENDIX A

PRS 15-004(F) E-F FIRING SITE RESRAD RESULTS FOR U-NAT & DU, COMMERCIAL SCENARIO

J. R. Mann, Inc. Memo

JOHN MANN, CERTIFIED HEALTH PHYSICIST
jrmanninc@worldnet.att.net

Date: 11 March 99

To: Tom Fogg

Subject: PRS 15-004(f) E-F Firing Site RESRAD Results for U-NAT & DU, Commercial Scenario

The RESRAD results for three site areas are tabulated below. The RESRAD result is presented in mrem/yr/pCi/g of soil. You will recall that the PRG in pCi/g is determined by dividing the desired radiation dose limit of 15 mrem/yr) by the RESRAD result (mrem/yr/pCi/g).

SITE Locale	SITE SIZE		RESRAD mrem/yr/pCi/g Commercial Scenario	
	Area(m^2)	Depth(m)	Natural U	Depleted U
Sect. 5.0 of 3-8-99 Draft Plan.	345,000	3	0.0312	Not run
Est. from Fig. 7.3-12 of RFI Work Plan.	145,000	0.1	0.0158	0.0228
	145,000	0.3	0.0203	0.0289
Est. from Fig 7.3-13 of RFI Work Plan.	277	0.1	0.0118	0.0178
	277	0.3	0.0150	0.0227
These four area sizes are based on their uranium concentration contours. Fig 4-7 of RFI report	26,300	1	0.0232	0.0285
	11,700	1	0.0228	0.0282
	4,550	1	0.0223	0.0276
	1670	1	0.0217	0.0268

There is very little difference in the results among the RESRAD runs made: the highest dose is 0. 0312 mrem/yr/pCi/g; the lowest is 0.0118 mrem/yr/pCi/g.

For Section 5.0, Clean up Requirements, of your draft plan:

"Results from the initial calculations show that an industrial worker has an exposure of 60 mrem/yr using the most conservative site values (345,000 m^2, 3m, and natural U) and the highest concentration of uranium found in soil (2763 mg/kg x 0.7 = 1934 pCi/g). For the worker not to exceed the proposed EPA dose limit of 15 mrem/yr, the uranium concentration in the soil must be reduced by a factor of 4 or 483 pCi/g".

I will retain the hard copy output of the RESRAD runs.