DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

13 January 2005

MEMORANDUM FOR U.S. NUCLEAR REGULATORY COMMISSION
Region IV
611 Ryan Plaza Drive, Suite 400
ATTN: Mr. Bob Evans
Arlington, TX 76011-4005

FROM: AFMOA/SGZR
110 Luke Avenue, Room 405
Bolling AFB DC 20332-7050

JAN 14 2005

SUBJECT: Response to NRC Query of Decommissioning Test Area C-74L, Eglin Air Force Base, Florida

Attached, you will find the requested maps and survey plans generated between September 2002 and October 2004. The aim of this package is to clarify specific items and questions related to the attachments not included with the 6 Aug 04, USAF response to NRC requested additional information regaurding the Decommissioning Plan for Test Area C-74L, Eglin Air Force Base, Florida. Eglin AFB's letter of response, dated 10 Jan 05, is located at Attachment 1, while your email, dated 1 Dec 04, that initiated this request can be found at Attachment 2.

If you have further questions, please contact me at 202-767-4735 or e-mail, clint.abell@pentagon.af.mil.

CLINT E. ABELL, Capt, USAF, BSC
Health Physicist, Radiation Protection Division
USAF Radioisotope Committee Secretariat
Air Force Medical Operation Agency
Office of the Surgeon General

Attachments:
1. 96 AMDS/SGPB ltr, dated 10 Jan 05
2. Your email, dated 1 Dec 04

469166

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH AIR BASE WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

10 January 2005

TO: USAF Radioisotope Committee
USAF AFMS/SGPR (ATTN: Capt Abell)
110 Luke Ave
Bolling AFB, DC 20322-7050

SUBJECT: Response to NRC Query of Decommissioning Test Area C74L Eglin AFB FL

Attached is our response to the NRCs questions about the decommissioning plan.

The soil removal will be completed the first week of February and we plan to start the final status survey on February 8. The NRC requested notice of this date to schedule their inspection.

For additional information please contact me at DSN 875-8294 or (850) 883-8294.

Stephen K Curry
STEPHEN K CURRY
96th AMDS/SGPB
Eglin AFB, FL 32542

ATCH 1

Received 1 DEC 04
Case

I have reviewed the Oct. 27th submittal, and I have the following questions/comments:

1. Response to question # 1 states that a survey plan was attached. I could not locate the attachment. I did not receive the attachment or it was separated from the original submittal and is lost on my desk. Or, did you mean as an attachment to the DP and not the Oct. 27 Memo?

The same paragraph discusses the Item B survey plan. Is this survey plan applicable to Item A of the site or only to Item B?

2. Question #2 asks that Class 2 areas be justified as Class 2 (in lieu of the default position of Class 1 areas). What are the justifications for designating drum storage area and remainder of site land as Class 2 areas (and any other area that is Class 2 or 3)?

3. The paragraph just prior to Question #3 mentions a USACE report recommendation of a catch box and asphalt pad investigation. Was this investigation completed and documented in the site release survey report that was supposed to have been finalized in June 2004?

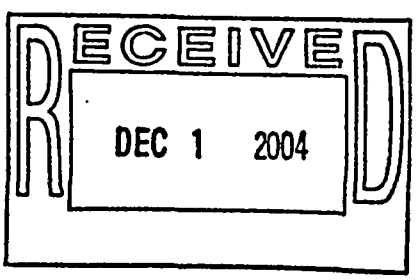
4. Response to Question #3 mentions an attachment. I can't seem to locate that attachment.

5. Responses to Questions #4 and beyond mention changes to the DP. Could you submit revised pages to the DP for inclusion into our original copy?

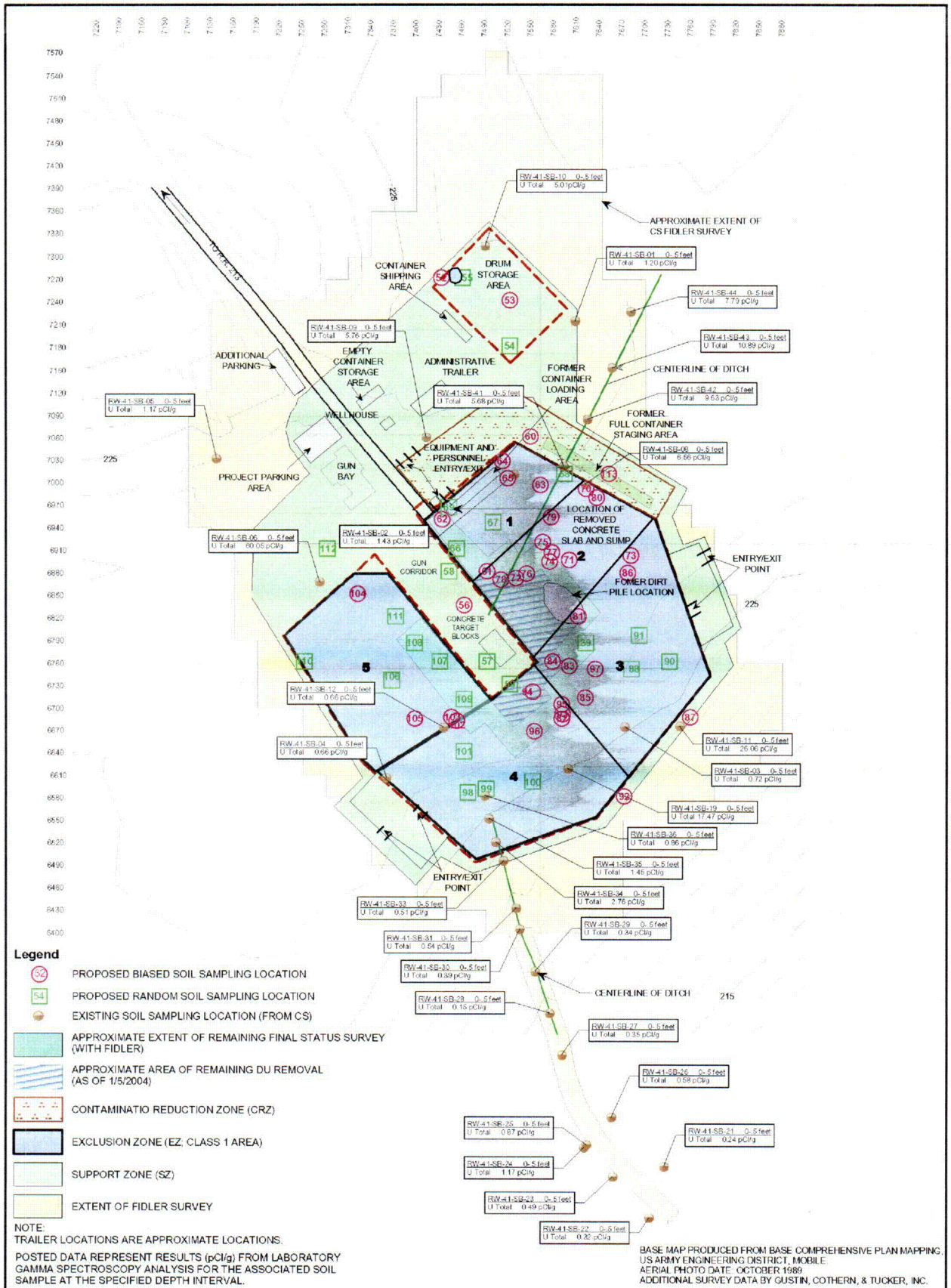
6. The response to question #5 mentions an attachment that I cannot locate.

If you have any questions or do not understand my questions, please feel free to contact me. Thank you for your support!!

Bob Evans



ATCH 2



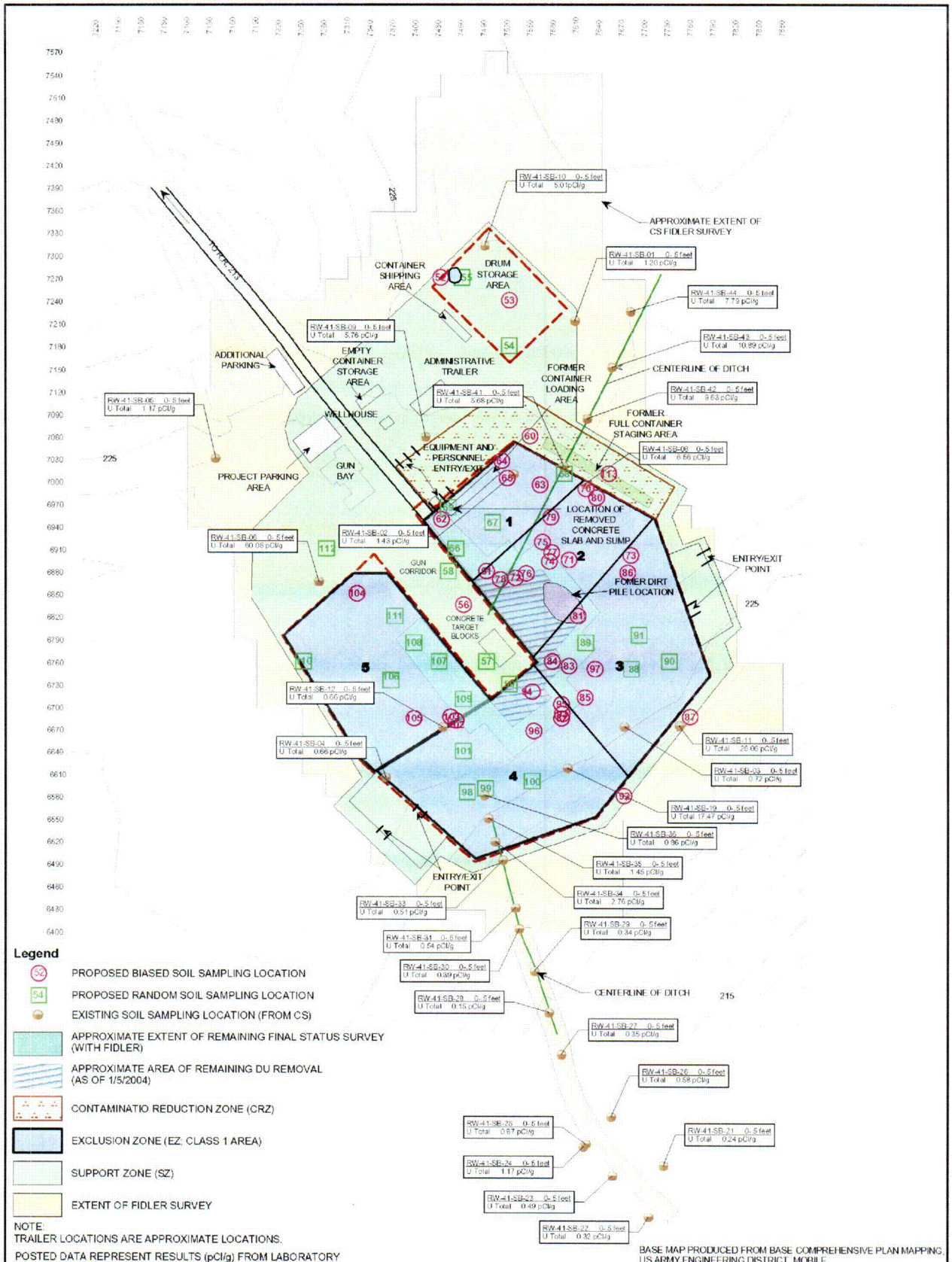
E A R T H T E C H

A Tyco Infrastructure Services Company

FIGURE 1
IRP SITE NO. RW-41 TEST AREA C-74L
GUNNERY BALLISTIC FACILITY
PROPOSED SITE FINAL STATUS SURVEY
SOIL SAMPLING PROGRAM

EGLIN AIR FORCE BASE, FLORIDA
PROJECTS NO. 69396

C01



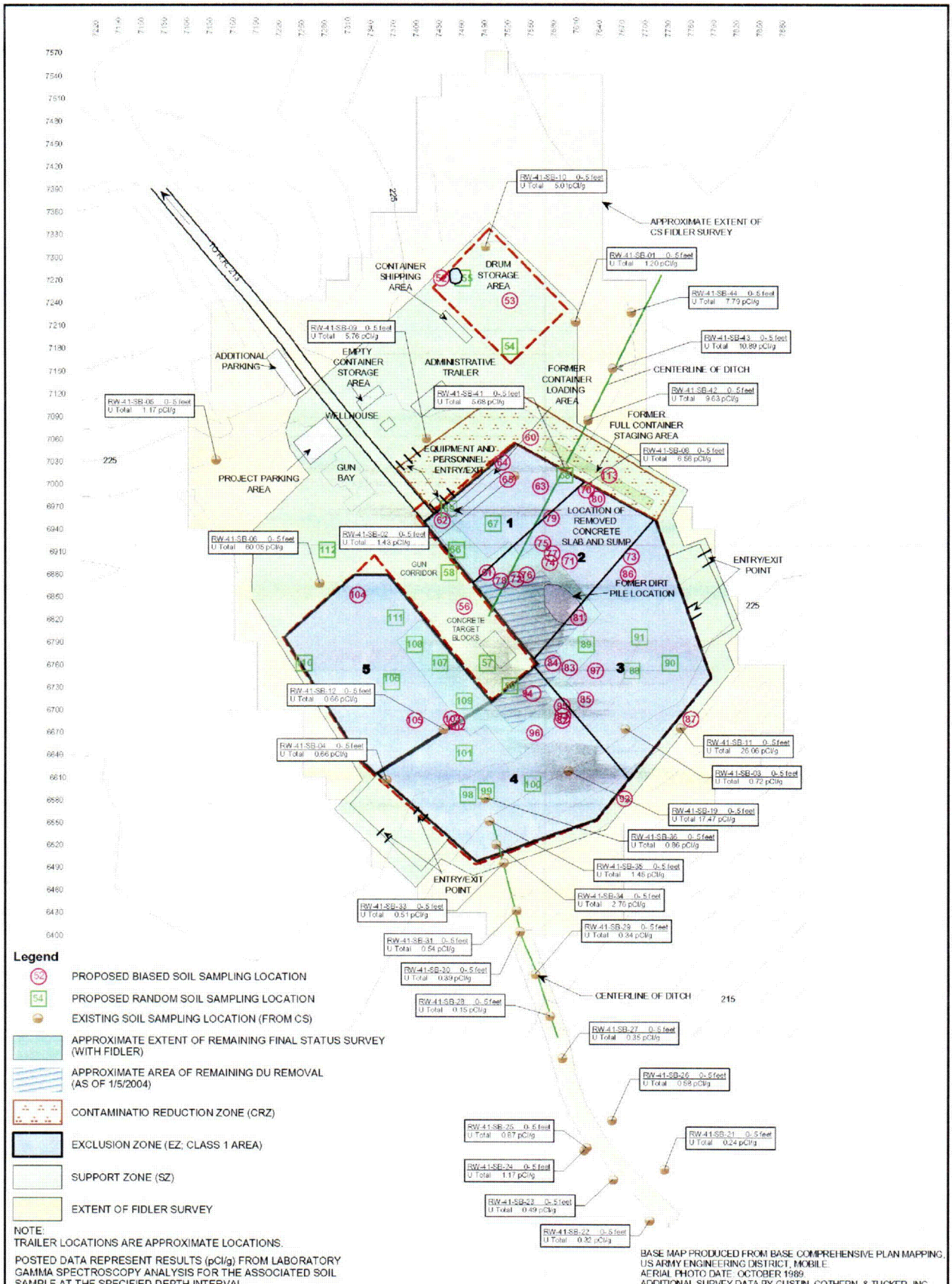
E A R T H T E C H

A Tyco Infrastructure Services Company

FIGURE 1
IRP SITE NO. RW-41 TEST AREA C-74L
GUNNERY BALLISTIC FACILITY
PROPOSED SITE FINAL STATUS SURVEY
SOIL SAMPLING PROGRAM

EGLIN AIR FORCE BASE, FLORIDA
PROJECTS NO. 69396

C02



E A R T H T E C H

A Tyco Infrastructure Services Company

FIGURE 1
IRP SITE NO. RW-41 TEST AREA C-74L
GUNNERY BALLISTIC FACILITY
PROPOSED SITE FINAL STATUS SURVEY
SOIL SAMPLING PROGRAM

EGLIN AIR FORCE BASE, FLORIDA
PROJECTS NO. 69396

C03

File 15C
SGC

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH AIR BASE WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

6 August 2004

Thru: Department of the Air Force
USAF Radioisotope Committee
HQ AFMSA/SGPR (ATTN: Lt Col Mather)
110 Luke Ave
Bolling AFB, DC 20322-7050

To: U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
ATTN: Mr. Jack Whitten
Arlington, TX 76011-4005

SUBJECT: Decommissioning Plan for Test Area C-74L, Eglin Air Force Base, Florida

Re: U.S. Nuclear Regulatory Commission (NRC) Letter, SUBJ: Request for Additional Information Regarding Eglin Air Force Base Decommissioning Plan, dated Feb 19, 2004

USAF Radioisotope Committee (RIC) Letter, SUBJ: NRC Inspection Report (w/attachments regarding Decommissioning Inspection of Test Area C-74L EAFB, 9-11 Feb 2004)

Mr. Whitten
(Nuclear Materials Licensing Branch)

This letter provides additional information requested by the NRC for Eglin Air Force Base incident to execution of the Decommissioning Plan for Test Area C-74L Gunnery Ballistic Facility at Eglin Air Force Base (Eglin). Upon review and acceptance of these responses it is anticipated that Eglin's Draft Decommissioning Plan for C-74L will be approved. This letter with its attached responses will serve to supplement the Decommissioning Plan for continued field remediation and management of regulated low level radioactive wastes at the site. (Test Area C-74L is currently listed in Eglin's Installation Restoration Program as IRP Site No. RW-41.)

The responses are considered sufficiently detailed to describe the concept for the soil excavation and management of generated low level wastes. The Derived Concentration Guideline Limits are revised to follow NRC requirements and are consistent across the site for media survey units. The responses also clarify the execution of survey work performed through March 2004. As noted in the responses, the Decommissioning Plan consists of Part A and Part B (referred to in the Plan as Items A and B). Part A consists of the land areas at C-74L where radiologically impacted areas remain in restoration status. Part A radiological operations are conducted by an Eglin Subcontractor (Earth Tech, Inc.). Part B consists of buildings and target areas at C-74L where limited radiological decontamination and site release surveys were completed. Part B radiological operations were performed by the U.S. Army Corps of Engineers (USACE) Omaha District. Eglin's Base Bioenvironmental Engineering Office has directed and integrated radiological operations at the facility.

In April 2004 Eglin informed the NRC and RIC that three additional areas of subsurface DU impacted soils had been identified at C-74L. These areas were discovered during conduct of radiological surveys and while completing excavation of known surface and near-surface areas at the site. Eglin suspended removal operations at that time (March 2004) and resumed site investigation using FIDLER and down logging techniques to determine the vertical and lateral extent of subsurface impacted soils. Three areas were identified which exist at approximately 12 – 24 inches depth, the largest area through the gun corridor, a subsurface area immediately west on the corridor and a small subsurface area just to the south. Work plans call for removal of an additional 9,000 cubic feet of DU impacted soils. This work is expected to resume in the October-November 2004 timeframe.

The gun corridor is declared a Class 1 Area due to the subsurface impacted soils discovered (previously the corridor was listed as a Class 3 Area). The asphalt pad will be removed and the FIDLER survey extended to the Gun Bay. Upon completion of soil excavation at the site, a final status survey will be performed in accordance with the Decommissioning Plan and existing site work plans. A Final Status Survey Report will be prepared which will address the separate MARSSIM survey units listed under Parts A and B in the Decommissioning Plan. The Site Release Survey Report (Part B) will be included as an Appendix to the Final Report for the entire site. Eglin will apprise the RIC and NRC of its progress in order to schedule the appropriate time for site visit and collection of confirmation samples at the site.

Eglin is pursuing funding resources to complete disposal of regulated low level wastes. It is anticipated that excavated soils will remain stored at the facility just north of the range complex and shipped in staged increments as funds become available. Upon completion of disposal operations Eglin will complete its decommissioning requirements requesting termination of the C-74L portion of the installation's Radioactive Materials Permit.

Please contact Mr. Steve Curry at Eglin Base Bioenvironmental Engineering (850) 883-8294 regarding any questions concerning the attached responses or if any further information or clarification required.

FOR....

DOUGLAS DAVIS
46TW/TSRL
Eglin Air Force Base, FL

RALPH ARMSTRONG
96 ABW/EMR
Eglin Air Force Base, FL

Stephen K Curry

STEPHEN CURRY
96th Aerospace Medicine Squadron
Base Bioenvironmental Engineering RSO
Eglin Air Force Base, FL

Comments/Questions Related to Eglin Air Force Base Decommissioning Plan

1. **The draft Decommissioning Plan (DP) consists of two major potions. The two portions provide inconsistent details of the proposed final status survey. In particular, one portion is lacking a $DCGL_{emc}$, and the other portion is lacking final status survey plan information for outdoor soil/land areas. Please resubmit the proposed final status survey in a manner that is consistent across the site.**

The inconsistencies in the two portions of the Decommissioning Plan are addressed as follows. The $DCGL_{emc}$ for both portions of the Decommissioning Plan (Items/Parts listed as A or B) will be performed consistent with one another. The $DCGL_{emc}$ is changed to 22 kcpm, which is equivalent to a soil DU concentration of 300 pCi/g. The final status survey of all outdoor soil/land areas will be conducted in accordance with the final status survey plan for the major land areas (exclusion area, gun corridor, drum storage area, etc.) The $DCGL_w$ for the outdoor soil/land areas has also been changed to 469 pCi/g. A copy of the Radiological Survey Plan (Sept 2002) for Buildings and Target Areas is attached. This Plan was prepared by the U.S. Army Corps of Engineers (USACE) Omaha District in consultation with Eglin's Low Level Materials Partnering Team and addresses sections described in Items B of the Decommissioning Plan. The Final Status Survey Report prepared at the conclusion of all field work will include as an appendix the USACE Site Release Report for the Buildings and Target Areas.

2. **The MARSSIM survey unit classifications have a direct impact on the number of final status survey measurements collected in each survey unit. The DP has inconsistent, out of date, or unjustified survey unit classifications. Please update the site-wide survey unit classifications and provide a justification for each area classified as MARSSIM Class 2 or Class 3.**

The following is a revised listing of the survey units located on Test Area C-74L:

a. Gun Corridor – Class 1 (1645 square meters)
b. Drum Storage Area – Class 2 (1376 square meters)
c. Radiation Controlled Area/Exclusion Zone (EZ) – Class 1 (15,051 square meters)
d. Remainder of Site Land - Class 2 (45,147 square Meters)

MARSSIMs suggests an area size to be applied for land classification purposes. The MARSSIM classification also considers exposure pathway modeling, assumptions, and site-specific conditions. The MARSSIM suggested Class 1 site classification is a land area up to 2,000 square meters. For Class 2 site the land area ranges from 2,000 to 10,000 square meters. The drum storage area (Class 2) and the Gun Corridor (Class 1) meet the area requirements. The radiation controlled area (Class 1) and remainder of the site land (Class 2) area are in

excess of the MARSSIM suggested areas. The following discussion justifies why the increased area size and reduced number of soil samples do not negatively impact the design of the FSS or the ability to assure survey units meet site release criteria.

With the site characterization survey performed in 1999 and the subsequent remediation activities conducted from 1999 to present, the RW-41 site has been well characterized with several 100% FIDLER walkover surveys. All survey units were 100% FIDLER surveyed and static measurements collected at all grid nodes (independent of its MARSSIM classification). The design of the FSS for RW-41 considers the previous investigative and remedial work performed at the site. Prior to conducting the FSS, all hot spots found in surface and sub-surface soils will have been removed, additional FIDLER scanning surveys conducted, and static measurements taken. A comprehensive effort will be made to ensure all survey units do not contain areas of elevated activity exceeding 22 kcpm (equating to 300 pCi/g). Following this field methodology provides confidence that residual radioactive levels are well below the 469 pCi/g ($DCGL_w$ for total uranium) previously agreed to by the NRC.

Equating the $DCGL_{emc}$ (44 kcpm) to the initial $DCGL_w$ (600 pCi/g) allowed field measurements at the site to be evaluated directly to the $DCGL_w$, removing the need for statistical tests. Comparing field measurements directly to the $DCGL_w$ also provides greater confidence that site release criteria have been met. Therefore, the remediation of any areas of elevated activity above one half the original $DCGL_{emc}$ 22 kcpm (or 300 pCi/g for total uranium) ensures that survey unit contamination levels could be declared well below the NRC established release criteria of 469 pCi/g.

Based on the 1999 site characterization study and the FIDLER survey information collected during 2002/2003, the site does not contain any areas of homogenous DU contamination. DU was mainly found as fragments or small particles spread sparsely over the site in a very random pattern. As noted in MARSSIM (paragraph 5.5.2.4) the determination of soil sampling points for small areas of elevated activity relying on statistical selection of sampling points and methods would not likely provide adequate characterization and assure with confidence that release criteria can be met. Surface scanning and systematic measurements in conjunction with soil sampling are required.

Previous studies have also indicated that many areas of elevated activity can be remediated at the site with the removal of a single fragment or numerous particles in less than a one square foot area. This makes soil sampling as a means of evaluating whether a survey unit meets release criterion inadequate regardless of the number of soil samples collected.

Decommission Plan, Part A

With exceptions as noted, Part A of the Decommissioning Plan addresses the land areas at Test Area C-74L. The exceptions noted include the land immediately surrounding Building 9372, the asphalt apron adjacent to Building 9372 and extending south to the the gun corridor, and the range runoff outfall area.

It was recognized early in the investigative process that the site did not contain areas of homogeneous DU contamination. Rather, the site contamination was heterogeneous represented by discrete DU fragments ranging from complete intact DU penetrators down to various size DU fragments or particles. It was also concluded that over 90 percent of the surface soils at RW-41 contained no DU fragments or particles. Except in a few areas, DU hot spots consisted of small DU fragments residing in less than a cubic inch of soil. In most cases DU hot spots were not clumped together but existed individually within several feet to several yards of each other. In some areas, hot spots existed as much as 50 to 100 feet from each other. Sparse, random hotspot locations greatly influenced the design of the site characterization survey and field remediation techniques selected to ensure success. In a strict application of MARSSIM protocols, i.e. soil sampling alone, would not ensure detection of all areas of elevated activity at the site. Because of the random distribution of hot spots over the site, the probability of finding even 10 percent of existing hot spots would be questionable. To ensure the site was properly remediated with all survey unit's residual activity below the release criteria, scanning techniques and direct measurements were the primary means of validating remaining survey unit residual activity. The FIDLER was also selected as the survey instrument of choice to increase the sensitivity of the field measurements.

The first step was determining the $DCGL_{emc}$. The procedure used to establish the $DCGL_{emc}$ was modified from MARSSIM. The $DCGL_{emc}$ (44 kcpm) for the site was equated directly to the $DCGL_w$ (600 pCi/g) for the site, and one half the $DCGL_{emc}$ (22 kcpm) was set as the action level. Any direct measurement which exceeded 22 kcpm, required the radiological technician/surveyor to flag the location, record the count rate on the flag and in the field notebook, then return to the location and manually remove the radioactive material. After the radioactive material was removed another direct measurement was taken at the location. If the measurement again exceeded one half the $DCGL_{emc}$, additional soil was removed until a direct measurement below 22 kcpm was measured. If the measurement was below 22 kcpm but higher than background it was left up to the radiological surveyor if he/she considered it practical to continue with removal of the remaining DU. In many cases, if the DU remaining was easily accessible it was removed as well.

Direct measurements and scan percentages within all Class 1 and Class 2 survey units followed the same remedial/release criteria. In other words, all Class 2

survey units received 100% FIDLER scans in two directions with static measurements taken at each survey node. The only difference was the Class 2 areas where survey nodes were 30 feet apart, instead of 10 feet. Direct measurements were taken at all grid nodes and at each location where FIDLER measurements exceeded 22 kcpm ($DCGL_{emc}$). A small percentage of the grids within the radiation controlled area/exclusion zone (EZ) contained too many hot spots to perform direct measurements. In this case the upper 3 to 6 inches of soil was removed from the grid and a 100 percent scan survey of the grid performed again. If there were still too many hot spots the grid would again have a 3-6 inch layer of soil removed and another 100 percent survey performed until only several or no hot spots were detectable in the grid. Direct measurements were again taken noting with flags any hot spot locations remaining. Static measurements taken involved recording the count rate on the flag at each direct measurement location.

To reduce the possibility of missing an area of elevated activity greater than the $DCGL_w$, the grid size within the Class I survey units was reduced to ten feet. Class 2 areas used a 30 foot grid. As was stated before, each grid, in both the Class 1 and Class 2 areas were 100 percent surveyed in two directions. Any areas exceeding 22 kcpm were marked with a pin flag and the DU later removed. All cleared grids were marked with a different colored pin flag, which was placed in the middle of the grid. Direct measurements verified that DU contamination had been successfully removed from the grid before it was marked as cleared.

Any areas of elevated activity which continued to increase with depth were investigated in both the horizontal and vertical direction until all DU contamination above 22 kcpm was removed and the removal verified by direct measurement with a FIDLER.

The above procedure was used during the 1999 characterization survey of Test Area C-74L, and subsequent removal operations conducted in 2002 and 2003. Once the FSS is completed, all survey units will have received a FIDLER 100 percent survey a minimum of six times. Many grids within the radiation controlled area will have had two additional FIDLER 100 percent surveys and numerous static surveys.

Based on MARSSIM protocols, the six FIDLER 100 percent surveys, grid node static readings, and static readings made at each location where areas of elevated activity were found offer substantial evidence that each survey unit meets the site release criteria. This evaluation also considers application of the soil sampling criteria found in the discussion of soil samples in Question 3 of this document.

Decommissioning Plan, Part B

The survey unit classification for Part B of the Decommissioning Plan are not addressed here since the Part B release survey areas have been completed. All

areas of Building 9372, the Building 9372 sump and drain, Building 9373, the range runoff and outfall areas, catch box, and asphalt pad areas were considered Class 3 areas. During the USACE conducted site release survey the gun mount slots on the south asphalt apron area were changed to a Class 1 area due to the presence of DU fragments discovered in the slots. These fragments were removed incident to the conduct of the survey. The results of the draft USACE survey report recommends that all of Building 9372, the Building 9372 sump and drain, Building 9373 and the range runoff and outfall areas be released without radiological restrictions. The draft USACE report recommends that the catch box and asphalt pad be investigated further, decontaminated or disposed of with consideration of contaminant levels identified. The USACE Site Release Survey Report is expected to be finalized by 23 June 2004 and will be provided for your review. The Final Status Survey Report for C-74L decommissioning will include the USACE Site Release Report as an appendix.

3. **The number of soil samples to be collected as part of the final status survey is inconsistent across the site. Please clarify the number of soil samples that will be collected site-wide and justify the proposed number if less than the number recommended in MARSSIM for each survey unit classification.**

Applying 469 pCi/g as the $DCGL_w$ and relying on a remedial action level of 300 pCi/g as the lower bound of the Class 1 area (EZ), the DU residual present, relative to the background, exists at a very small percentage of the $DCGL_w$. The average concentration of total uranium within the controlled area is 110 pCi/g. The average concentration of total uranium within the Class 2 areas is much less than 110 pCi/g. The average concentration of total uranium found within the controlled area will be used to determine the number of soil samples necessary for each survey unit. Considering the relative values of alpha and beta radiation, the decision errors will be 0.01 in all cases. This will produce the greatest number of soil samples for conservative evaluation. The value of sign p is 1 since (469-300)/110 = 1.53. The number of soil samples = $(2.326 + 2.326)^2/4(1.0-0.5)^2$ = 21.64 or 22 samples. Adding 20 percent more allows a total of 27 soil samples required for evaluation under MARSSIM.

MARSSIM paragraph 5.5.24 (Determining Data Points for Small Areas of Elevated Activity) provides a statistical test to use when it is necessary to determine the number of soil sampling locations required when residual radioactivity in an area exceeds the $DCGL_w$. This method/test is good for contamination conditions that are approximately uniform across the survey unit. The number of soil samples indicated above may not successfully detect small areas of elevated contamination. Instead, systematic measurements and sampling in conjunction with surface scanning surveys are used to obtain adequate assurance that small areas of elevated radioactivity will still satisfy the release criterion or the $DCGL_{emc}$.

The FSS soil samples will consist of three types: existing soil samples collected during the Characterization Study (CS) in 1999; new biased soil samples; and new random soil samples. The attached Figure 1 shows the locations of these samples. A total of 31 CS soil samples, 30 biased soil samples, and 30 random (unbiased) soil samples will be collected at locations within the gun corridor, former drum storage area, and Areas 1 through 5 of the radiation controlled area. This represents a total of 91 soil samples throughout the site.

In addition to the collection and analysis of these soil samples, the FSS will include a 100 percent survey of all Class 1 and Class 2 areas. The 100 percent FIDLER survey will be performed in two directions perpendicular to each other resulting in each grid being completely surveyed twice. Also at each survey node a static measurement will be taken. In addition, a static measurement was taken at each location where FIDLER readings indicated DU was present at levels greater than 22 kcpm (300 pCi/g, which is less than the $DCGL_w$ 469 pCi/g).

At the conclusion of the FSS each survey unit will have been completely surveyed with the FIDLER a total of 6 times. A 100 percent survey in two directions was conducted in 1999, another 100 percent- FIDLER survey in two directions was completed in 2002/2003 and again in the 100 percent walkover in 2004. DU contamination was removed in accordance with approved procedures used in the first two surveys. The notable exception was where removal at surface could not access deeper DU contamination and heavy equipment and other manual DU removal methods were used.

The 100 percent FIDLER scanning surveys, static measurements of both Class 1 and Class 2 areas, and with 91 soil samples collected for analysis from both biased and random locations far exceed the requirements of MARSSIM for ensuring areas of elevated radioactivity have been removed and satisfy the release criterion of 469 pCi/g.

4. **The wording of the DP suggests that a second final status survey will be conducted after backfilling of excavated areas. Please clarify whether additional survey measurements will be taken after backfilling of excavated areas.**

The Decommissioning Plan has been revised. The wording indicating that a second FSS will be conducted after backfilling of excavated areas has been removed. The FSS will be conducted prior to any backfill operations.

5. **Please add site area and/or survey unit sizes (in units of square meters) to the DP. As examples, the gun corridor, drum storage area, and target area sizes were not clearly stated in the DP.**

The survey unit sizes for the gun corridor, and drum storage area have been added to the Decommissioning Plan in units of square meters. The target area is not a

SG FUNCTIONAL DIRECTORY

MADARIS, Sandra	Lt Col	Chief, Procurement Services	301-619-4083	301-619-3613	Sandra Madaris
REESE, Patrick	Maj	Chief, Financial Resources	301-619-4030 (DSN 343)	301-619-2557 (DSN 343)	Patrick Reese
RUBIO, Ben	Maj	AF Senior Service Rep, DMLSS	301-619-3941 (DSN 343)	301-619-7831 (DSN 343)	Ben Rubio
HILL, William	Civ	Chief, Information Management and Technology	301-619-7289 (DSN 343)	301-619-2557 (DSN 343)	William Hill
VIA, David	Civ	Chief, Combat Support	301-619-4028 (DSN 343)	301-619-2557 (DSN 343)	David Via
BAKER, David	Civ	Chief, Clinical Engineering	301-619-7047 (DSN 343)	301-619-2557 (DSN 343)	David Baker
LYONS, Dale	Civ	Chief, Business Analysis	301-619-4017 (DSN 343)	301-619-2557 (DSN 343)	Dale Lyons
MOORE, Thomas	Capt	Chief, Industrial Operations	210-925-6260	210-925-6166	Thomas Moore
WEST, Gwena	Civ	Personnel and Administrative Services	301-619-4155 (DSN 343)	301-619-4036 (DSN 343)	Gwena West
MANNING, Allen	CMSgt	4A1 Career Field Manager	301-619-4154 (DSN 343)	301-619-4037 (DSN 343)	Allen Manning
KOLESZAR, Richard	CMSgt	4A2 Career Field Manager	301-619-4040 (DSN 343)	301-619-4037 (DSN 343)	Richard Koleszar
CONNER, Rhonda	Civ	Office Support Assistant	301-619-2005 (DSN 343)	301-619-4037 (DSN 343)	Rhonda Conner
Resource Management (SGSR)					
HANSON, Linda	Col	Director, Resource Management	703-681-6644	703-681-6011	Linda Hanson
TENNEY, Tracy	Lt Col	Chief, Budget Execution	703-681-6664	703-681-6011	Tracy Tenney
GRAVES, John	Maj	Chief, Resource Management Operations	703-681-6625	703-681-6011	John Graves
ROBINSON, Sheila	Maj	Senior Program Analyst	703-681-6667 (DSN 761)	703-681-6011 (DSN 761)	Sheila Robinson
COLE, Andrew	Maj	Senior Program Analyst	703-681-6680 (DSN 761)	703-681-6011 (DSN 761)	Andrew Cole
SUCKOW, Scott	Maj	Chief, TRICARE Finance	703-681-6357 (DSN 761)	703-681-6011 (DSN 761)	Scott Suckow
BAILEY-MARSHALL, Linda	Maj	Chief, Manpower Resources	202-767-4377	202-767-1455	Linda Bailey-Marshall
CAIN, David	Capt	Senior Program Analyst	703-681-6619 (DSN 761)	703-681-6011 (DSN 761)	David Cain
PRATER, Delisa	MSgt	AF UBO Program Manager	703-681-6627 (DSN 761)	703-681-6011 (DSN 761)	Delisa Prater
MILSTER, JoAnn	MSgt	AF Data Quality Manager	703-681-6504 (DSN 761)	703-681-6011 (DSN 761)	Joann Milster
DORRIAN, Darrell	MSgt	AF MEPRS Program Manager	703-681-6356 (DSN 761)	703-681-6011 (DSN 761)	Darrell Dorrian
CALLENDER, Jody	TSgt	AF MEPRS Program Manager	703-681-6356 (DSN 761)	703-681-6011 (DSN 761)	
HOLDEN, Tameka	TSgt	NCOIC, Resource Mgt Operations	703-681-6303 (DSN 761)	703-681-6011 (DSN 761)	Tameka Holden
QUADE, Margaret	Civ	Senior Program Analyst	301-645-4418	703-681-6011 (DSN 761)	Margaret Quade
WHITTLER, Cheryl	Civ	Senior Program Analyst	703-681-6669 (DSN 761)	703-681-6011 (DSN 761)	Cheryl Whittler
VACANT	Civ	Senior Program Analyst	703-681-6677 (DSN 761)	703-681-6011 (DSN 761)	
CARMIENCKE, Janice	Civ	Senior Program Analyst	703-681-6058 (DSN 761)	703-681-6011 (DSN 761)	Janice Carmiencke
VACANT	Civ	HQ Program Analyst	703-681-6486 (DSN 761)	703-681-6011 (DSN 761)	
TALCOVITZ, Rob	Ctr	SG Senior Financial Analyst	703-681-6665 (DSN 761)	703-681-6011 (DSN 761)	Rob Talcovitz
GARAY, Lisa	Ctr	SG Financial Analyst	703-681-6690 (DSN 761)	703-681-6011 (DSN 761)	Lisa Garay
GORDON, Audrey	Ctr	SG Budget Analyst	404-4366 (DSN 754)	202-767-1455	Audrey Gordon
AIR FORCE MEDICAL OPERATIONS AGENCY (AFMOA/SGZ)					
WERESZYNSKI, Virginia	Col	Commander	703-697-2004	703-693-7143	Virginia Wereszynski
GUSTIN, Maureen	Civ	Secretary	703-697-9075	703-693-7143	Maureen Gustin
Performance Optimization Center (SGZI)					
REICHARD, Rick	Lt Col	Director, Peacetime Medicine	703-681-7044	703-681-4518	Rick Reichard
CRAMER, Carol	Maj	Chief, Population Health Information Support	703-681-4133	703-681-4518	Carol Cramer
MOILANEN, Dale	Maj	Chief, Managed Care and Financial Information Support	703-681-7032	703-681-4518	Dale Moilanen
HYZY, Jerome	Maj	Chief, Group Practice Management Health Care Integration Information Support	703-681-4126	703-681-4518	Jerome Hyzy
VACANT		Chief, Specialty Care Optimization Information Support		703-681-4518	
VACANT	MSgt	NCOIC, Peacetime Medicine		703-681-4518	
TEDROW, Aaron	SSgt	NCOIC, Information Operations	703-681-7084	703-681-4518	Aaron Tedrow
SINGLETON, Lewis	SMSgt		703-681-7083	703-681-4518	Lewis Singleton
Medical Operations Center (SGZO)					
KNIGHT, Kenneth	Lt Col	Chief, Medical Operations Center	703-697-8611	703-693-7143	Kenneth Knight
RASMUSSEN, Karen	Maj	Deputy Chief, Medical Operations Center	703-697-9075	703-693-7143	Karen Rassmussen
PASKEVICIUS, Joey	Maj	Chief, Aeromedical Evacuation Plans & Ops	703-697-9075	703-693-7143	Joey Paskevicius
VACANT	Maj	Chief, Medical Operations Planning Team	703-697-9075 (DSN 227)	703-693-7143 (DSN 223)	
HOLLOWAY, Sean	Maj	Chief, Medical Operations Planning Team	703-692-7683 (DSN 227)	703-693-7143 (DSN 223)	Sean Holloway
PLAUDIS, David	MSgt	NCOIC, Medical Operations Center	703-697-9075	703-693-7143	David Plaudis
COLLINS, Robert	TSgt	NCOIC, Medical Crisis Action Team	703-697-9075	703-693-7143	Rob Collins
JONES, Lei (Skyline3 Office)	Lt Col	Emergency Planning Coordinator	703-681-8171 (DSN 761)	703-681-8050 (DSN 761)	Lei Jones
LENT-TUCKER, Diane (Bolling SGO)	Lt Col	Chief, AF Medical Service Lessons Learned	767-1287	767-4841	Diane Lent-Tucker

separate area from the gun corridor. The land around the targets has been included in the FSS. The $DCGL_{emc}$ and $DCGL_w$ remain at 22 kcpm and 469 pCi/g respectively. The decontamination DCGL for the targets and catch box (gun butt) are listed in the scoping survey conducted by USACE and attached to this document.

6. **Clarify whether the soil samples will be analyzed for total uranium or uranium-238.**

All final status survey soil samples will be analyzed for total uranium.

7. **Provide background values for building surfaces.** The building surface background values as recorded in the USACE Final Status Survey of Building 9373 and 9372 are as follows:

Material	Alpha (static) Mean cpm	Beta (static) Mean cpm	Scanner Mean alpha cpm	Scanner Mean Beta cpm	Gamma Mean uR/hr	FIDLER cpm	Areas
Concrete	3	161	3	181	12	9251	Floors, gun bay walls
Cinder Block 1	1	126	3	280	12	6412	Walls
Plaster (Stucco)	3	285	7	251	10	4000	Building exterior
Asphalt	13	493	NA	NA	9	11000	Range areas
Tile	2	129	3	179	12	3827	9372 floors
Cinder Block 2	3	365	7	558	12	17660	Some wall portions and 9373
Steel	40	300	NA	NA	12	4000	Range pieces

Table taken from Draft Site Release Survey Report No. CESWT-SO-R1-11-2002, Eglin AFB, Niceville, Florida, September 2002

8. **The proposed background value for uranium in groundwater was negative number (-24.4 pCi/l) with an unusually high minimum detectable activity (105 pCi/l). Please justify the proposed value or submit an alternate background value for groundwater.**

To clarify the background values of groundwater at the site, the Decommissioning Plan is revised to require collection of additional water samples to include a split sample submission to two approved laboratories. Samples will be analyzed for total uranium. A revised background value for groundwater will be generated.

9. **The DP indicates that containerized wastes will be transferred to another area at Eglin Air Force Base (C-64) after loading, but the licensee was actually storing containers onsite at Area C-74L. The DP requires updating with regards to onsite storage of containerized radioactive wastes.**

The Decommissioning Plan has been updated. The Plan now states that waste storage will be on site and not transferred to Test Area C-64 as previously indicated.

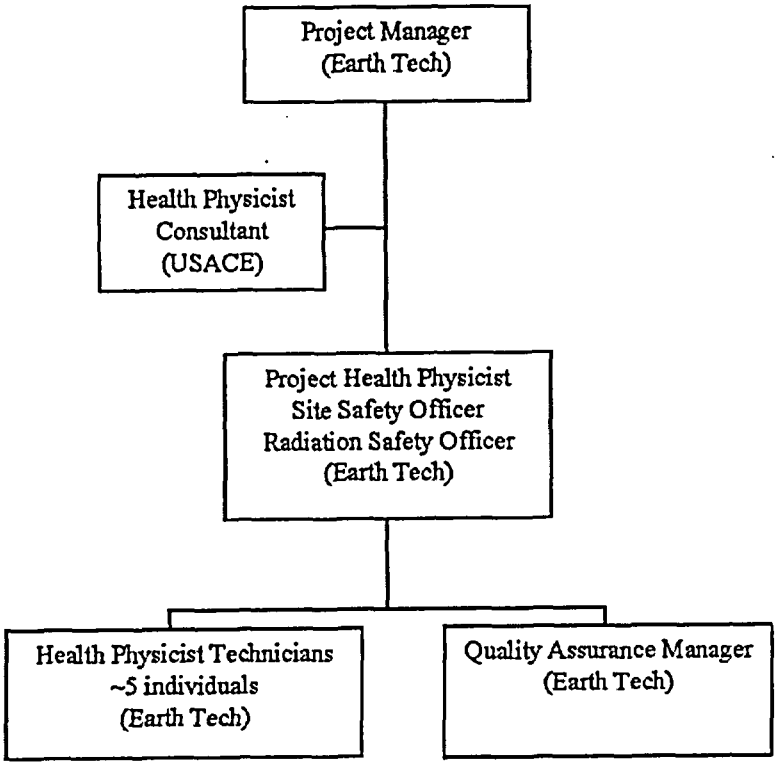
10. **The DP wording and actual field practices were inconsistent in use of dosimeters, bioassays, silt fencing, and plastic sheeting. Please update the DP to specify whether these areas are optional (at the discretion of the onsite project manager or radiation safety officer) or mandatory.**

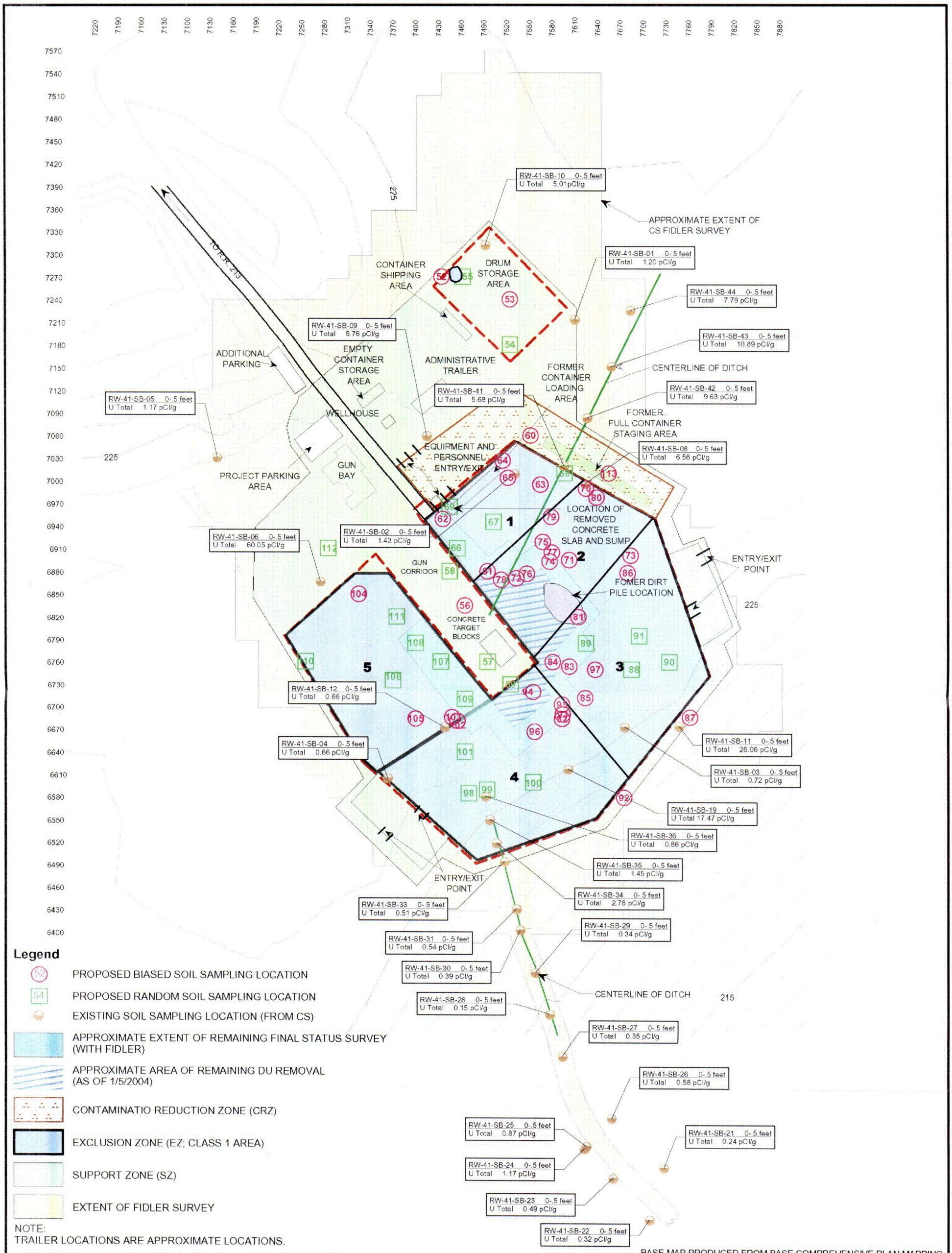
The requirement to use dosimeters and bioassays has been removed from the Decommissioning Plan. The requirement to use silt fencing and plastic sheeting has been removed from the Plan as well.

11. **The organizational charts provided in the DP were out-of-date. Please update accordingly.**

The organizational chart in the Decommissioning Plan has been updated to reflect positional responsibilities and management relationships. Primary positions will include a Project Manager with budgetary and scheduling authority, a Site Project Manager, Site Radiation Safety Officer, and Site Safety Officer.

C-74L Ground Decommissioning
Soil Remediation
Flow Diagram





NOTE:
TRAILER LOCATIONS ARE APPROXIMATE LOCATIONS.

POSTED DATA REPRESENT RESULTS (pCi/g) FROM LABORATORY GAMMA SPECTROSCOPY ANALYSIS FOR THE ASSOCIATED SOIL SAMPLE AT THE SPECIFIED DEPTH INTERVAL.

BASE MAP PRODUCED FROM BASE COMPREHENSIVE PLAN MAPPING, US ARMY ENGINEERING DISTRICT, MOBILE.
AERIAL PHOTO DATE: OCTOBER 1989.
ADDITIONAL SURVEY DATA BY GUSTIN, COTHERN, & TUCKER, INC.

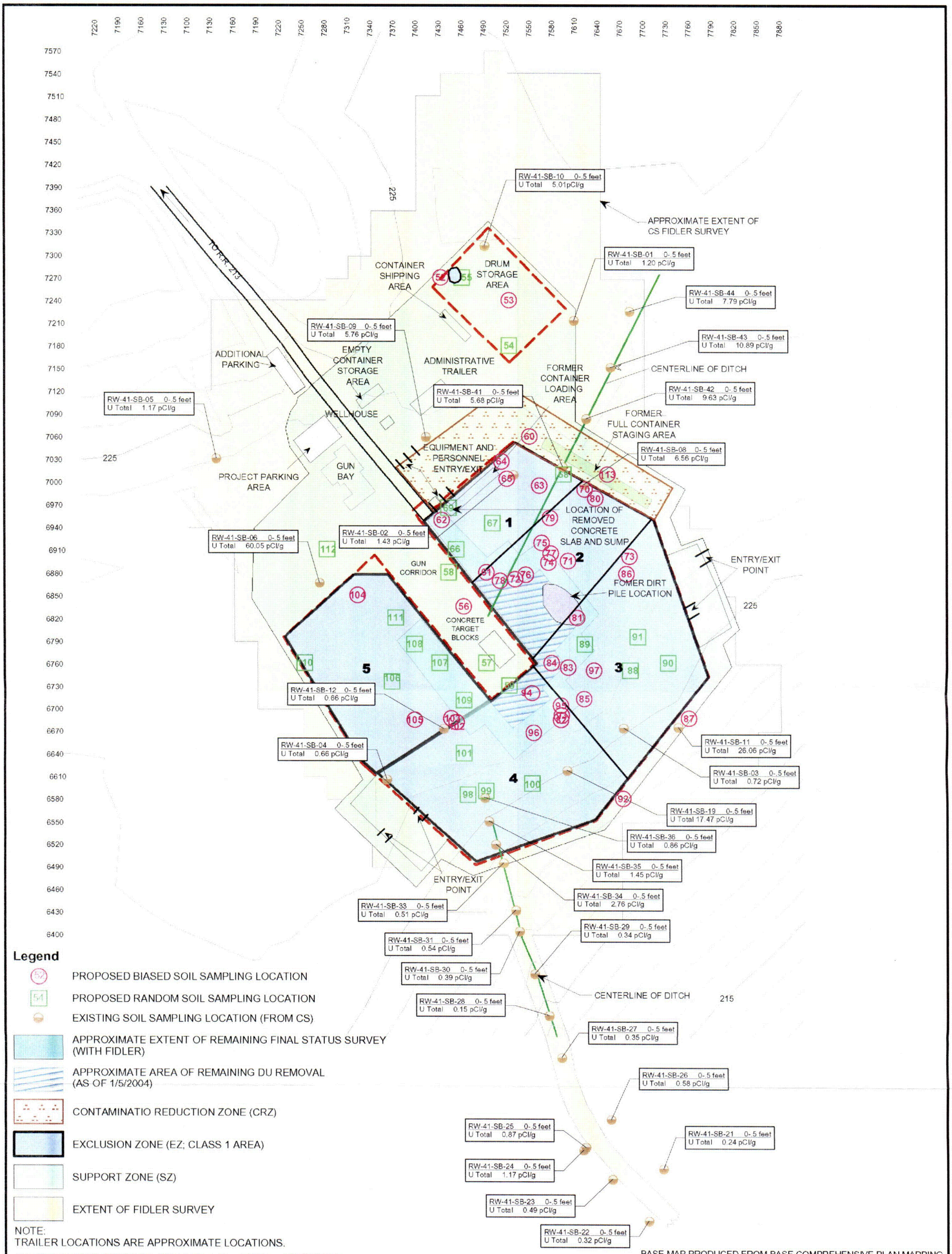
E A R T H T E C H

A Tyco Infrastructure Services Company

FIGURE 1
IRP SITE NO. RW-41 TEST AREA C-74L
GUNNERY BALLISTIC FACILITY
PROPOSED SITE FINAL STATUS SURVEY
SOIL SAMPLING PROGRAM

EGLIN AIR FORCE BASE, FLORIDA
PROJECTS NO. 69396

C05



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EARTH TECH

A Tyco Infrastructure Services Company

FIGURE 1
IRP SITE NO. RW-41 TEST AREA C-74L
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EGLIN AIR FORCE BASE, FLORIDA
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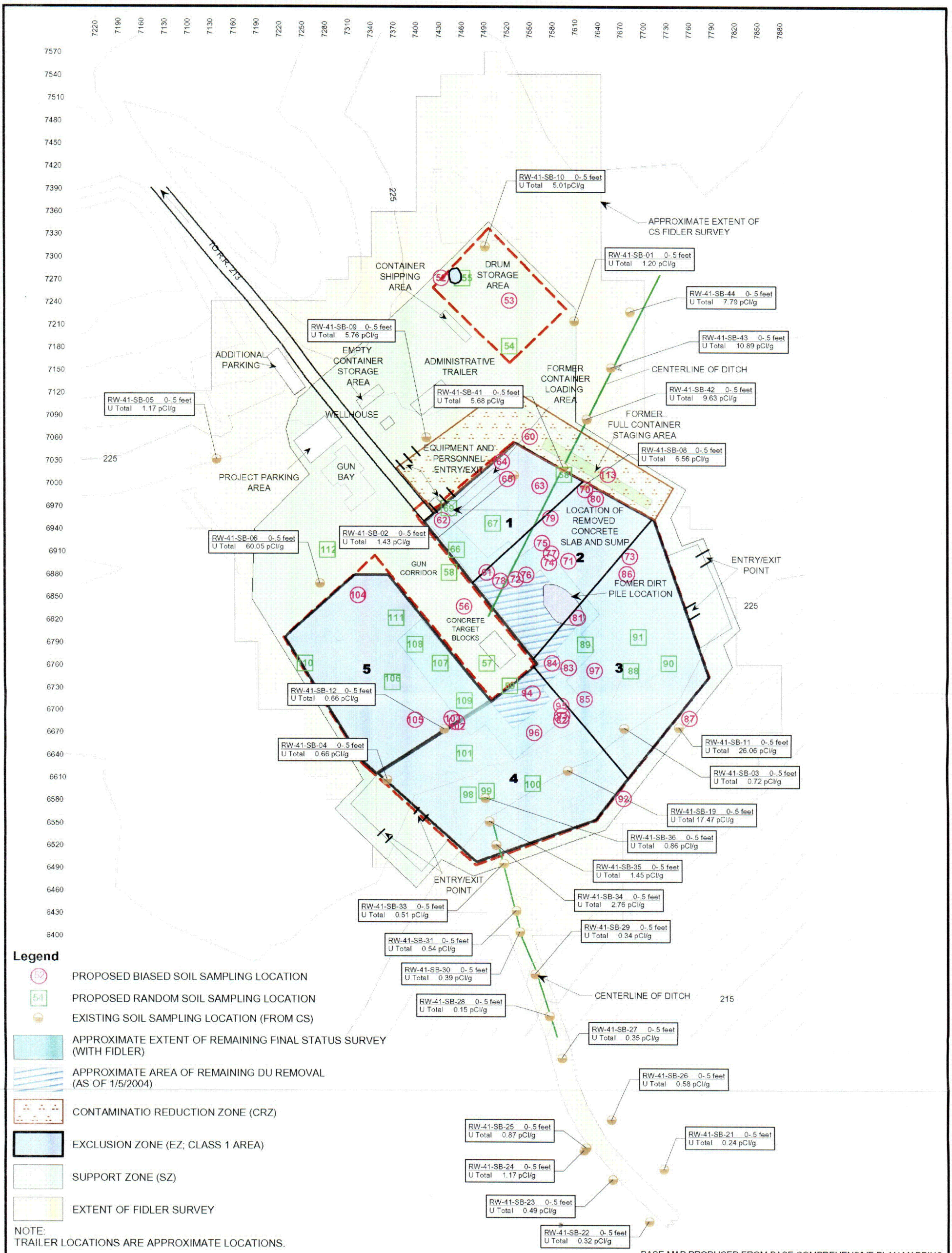
C05



EARTH TECH

A Tyco Infrastructure Services Company

FIGURE 1
IRP SITE NO. RW-41 TEST AREA C-74L
GUNNERY BALLISTIC FACILITY
PROPOSED SITE FINAL STATUS SURVEY
SOIL SAMPLING PROGRAM

EGLIN AIR FORCE BASE, FLORIDA
PROJECTS NO. 69396

C06

FINAL

RADIOLOGICAL SURVEY PLAN FOR THE TERMINATION OF NRC LICENSED RADIOACTIVE MATERIAL USE AT EGLIN AIR FORCE BASE TEST RANGE C-74L

Buildings and Target Areas

NICEVILLE, FLORIDA

September 2002

U.S. Army Corps of Engineers
Omaha District
Hazardous Toxic and Radioactive Waste Program
Radiation Safety Support Team

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

Page

LIST OF TABLES

Page

ABBREVIATIONS AND ACRONYMS

AEC	U.S. Atomic Energy Commission
cpm	counts per minute
$DCGL_w$	derived concentration guideline limit
DQA	data quality assurance
DU	depleted uranium
dpm	disintegrations per minute
DQO	data quality objectives
EAFB	Eglin Air Force Base
EPA	Environmental Protection Agency
ESOP	Eglin standard operating procedure
H_0	null hypothesis
HAS	historical site assessment
IAEA	International Atomic Energy Agency
ICM	interim corrective measure
K-40	potassium-40
Kg	kilogram
LBGR	lower bound of gray region
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
NaI	sodium iodide
NFA	no further action
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
pCi/g	picoCuries per gram
Pm-147	Promethium-147
RPD	relative percent difference
SI	site investigation
TEDE	total effective dose equivalent
Th-232	thorium-232
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
UCL	upper confidence level
USAF	US Air Force
µrem/h	microrem per hour
USACE	U.S. Army Corps of Engineers
WRS	Wilcoxon Rank Sum

EXECUTIVE SUMMARY

Eglin Air Force Base (EAFB) ceased licensed operations involving depleted uranium (DU) at test range C-74L in the fall of 1978 and intends to terminate its Air Force permit for the Nuclear Regulatory Commission (NRC) licensed material use.

A Historical Site Assessment (HSA) was conducted by the US Army Corps of Engineers (USACE), St. Louis District entitled *Low-Level Radioactive Material Eglin AFB Archives Search Report* (USACE, 1999). According to the HSA , the primary use of DU was for test firing of the GAU-8A weapon system only. DU fragments were removed from range C-74L in previous removal actions during 1980. These actions concentrated on the outdoor portions of the range.

This survey is to determine the extent, if any, of residual DU on building, range, and target material surfaces. Specifically the objectives of this survey effort are to:

- Identify the presence or absence of DU contamination on structure surfaces and on site soils that are within close proximity of the structures.
- Perform a data quality assessment (DQA) using *Multi Agency Radiation Survey and Site Investigation Manual* (MARSSIM) as a framework. If DU is absent, at concentrations below the DCGL, or passes the DQA process, provide enough supporting data for No Further Action (NFA) recommendation and acceptance.
- If DU is present at a concentration that fails the DQA process, delineate the extent of DU contamination to allow for the design of appropriate interim corrective measure (ICM) activities (Eglin, December 1998).

This survey plan follows the guidance of NUREG-1575, *Multi Agency Radiation Survey and Site Investigation Manual* (MARSSIM), and is also designed to meet the requirements of Eglin Standard Operating Procedure 15 (ESOP 15, *Low Level Radioactive Material Site Investigations*) and 10 CFR 40.36.

SECTION 1
INTRODUCTION

1.1 SITE HISTORY AND PROJECT BACKGROUND INFORMATION

This survey plan follows the guidance of NUREG-1575, *Multi Agency Radiation Survey and Site Investigation Manual* (MARSSIM), and is also designed to meet the requirements of Eglin Standard Operating Procedure 15 (ESOP 15, *Low Level Radioactive Material Site Investigations*) and 10 CFR 40.36.

The following background information has been compiled from previous investigations performed at Test Area C-74L Gunnery Ballistic Facility and a literature survey report generated by USACE, St. Louis District entitled *Low-Level Radioactive Material Eglin AFB Archives Search Report* (USACE, 1999). Test Area C-74L Gunnery Ballistics Facility is an active facility comprised of two gun bays used to test the damage potential and terminal ballistics of various ammunitions (Becker and others, 1994). The test area has been in operation since at least 1963 as a gunnery ballistics facility. From late 1974 to 1978, Test Area C-74L was used for pre-production testing of the GAU-8 gun system, which uses DU in the ammunition. An estimated 16,315 pounds (7,400 kilograms [Kg]) of depleted uranium (DU) was expended at Test Area C-74L. In late 1978, all testing involving DU was transferred to Test Area C-64, and the mission at C-74L was changed to include only the firing of high incendiary explosives.

Eglin has performed environmental work from 1976 through 1991 at the site to evaluate the impact of DU on site soils and groundwater, as well as nearby sediment and surface water. In 1980, limited DU fragment excavation was performed within the approach gun corridor leading from the gun bay building to and including the target butt (Becker and others, 1990; Becker and others, 1994).

1.1.1 NRC License/USAF Permit. Licensed radioactive material use at Eglin AFB is authorized by the U.S. Nuclear Regulatory Commission (NRC) through the U.S. Air Force (USAF) Master NRC license. For Test Area C-74L, the USAF Radioactive Material Permit number is FL-08883-01/02AFP, 040-08883.

1.1.2 Material Lifecycle. The Ballistics Building (Building No. 9372) was not used to store any DU munitions. Munitions were brought to the site at the start of the weapon system test and any remaining rounds were taken back to the normal storage area at the end of the test.

During a visit in October 2001, interviews with site personnel indicated that current typical test procedures include heating and cooling of ammunition. Ovens are onsite for this purpose. It could not be determined if this practice was used on the DU munitions also or if so, if the ovens present were the same ones used.

DU munitions were fired exclusively (not as part of a combat load).

The GAU-8, 30mm DU rounds all use an aluminum wind screen which, when combined with other components, effectively encapsulates the DU until the round strikes a target (see

figure 1). Under normal handling and storage of these munitions DU contamination is unlikely. Since firing was conducted and contamination exists in soils, it is possible that site workers may have spread this contamination into the gun bays. Accidents or malfunctions of the munitions may be another source of potential contamination, however, this was not documented in the site history.

Once fired the resultant DU fragments were left where they fell until range installation restoration activities occurred during 1980. Targets and concrete blocks used during the DU test timeframe were removed from the site during this restoration (Earth Tech 2001). Pock marks on building exteriors indicate that occasionally fragments of rounds would ricochet back to the building. It is not known if conventional or DU fragments caused the marks but the potential exists that both could have.

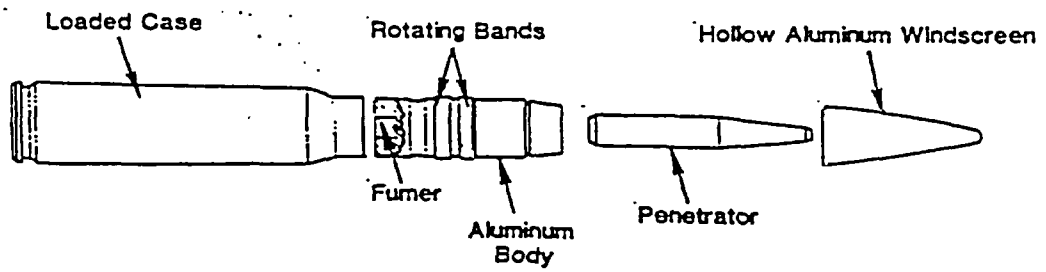


FIGURE 1. 30 mm DU MUNITION

1.2 RADIOLOGICAL SCOPING SURVEY DATA

1.2.1 SCOPING SURVEY. A scoping survey was conducted on October 4, 2001 by members of the survey team. Information to complete this plan as well as information to augment site historical data was gathered. Table 1 is a summary of field instrumentation results from the scoping survey.

1.2.2 REFERENCE AREA. Reference areas will be selected as part of this site investigation survey and data may be adjusted accordingly based on the reference area survey results.

TABLE 1. Summary of Scoping Survey Results

Area	Mean Alpha (cpm)	(dpm)	Mean Beta (cpm)	(dpm)	uR/hr range
Background	1	10	NR	NA	3-5
Interior Concrete	2	20	NR	NA	3-5
Exterior Concrete Pads	11	120	NR	NA	5-7
Target Steel	19	197	NR	NA	4-6
Asphalt and block walls	1	10	NR	NA	3-5

NR Not Recorded; NA Not Applicable

1.3 KEY ORGANIZATIONS AND RESPONSIBILITIES

- **Eglin AFB:** Will provide project funding, guidance, and site security. Primary point of contact for EAFB is Steve Curry the installation Radiation Safety Officer.

- **Omaha District USACE:** Will serve as the USACE project management district. Primary point of contact is Mr. Gene Liu (402)-221-7711.

  Will provide health physics support directly to the project team and oversight. Ms. Julie Peterson CHP (402)-697-2592 and Mr. Brian Hearty CHP (402)-697-2478.

- **Tulsa District, USACE:** Will serve as the project health physics support and coordinator of field work to include preparation of plans and preparation of final reports. Primary point of contact is Mr. David Hays (918)-669-4966.

- **Baltimore District, USACE:** Will provide health physics support. Primary point of contact is Mr. Hans Honerlah (410)-962-9184.

1.4 TENTATIVE SCHEDULE

- The Draft Workplan completed by Tulsa District, USACE in February 2002.

- Draft Workplan presented to the Eglin Low-Level Radioactive Material (LLRM) Partnering Team for review and discussion May, 2002.
- Draft Final Workplan provided to the Eglin LLRM Partnering Team for final approval August 19, 2002. Comments requested by September 2, 2002.

- Final Workplan issued September 16, 2002.

- Survey teams arrive EAFB September 16, 2002 for site orientation, safety briefings, and instrumentation setup.

- Surveys are conducted during a one week period from September 16-20, 2002.

- A draft Final Status Survey Report will be prepared within 30 days of completion of surveys. The draft will be presented to all parties receiving the draft plan for comment. Comments requested 30 days after receipt of report.

- After addressing comments the Final Status Survey Report will be issued.

1.5 SITE DESCRIPTION

1.5.1 LOCATION. (See Figure 2) The C-74L site is located in Walton County, Florida, within the north-central part of the Eglin Reservation, approximately 14 miles northeast of the city of Niceville. The site occupies an area east-northeast of Auxiliary Field No. 1. To reach the site from the East Gate of Eglin Main Base, travel east on State Route (S.R.) 20 for 3.6 miles. Turn left (north) onto S.R. 285, and travel approximately 11.6 miles. Turn right (east) on Range Road (R.R.) 213. Proceed on R.R. 213 4.8 miles, past R.R. 214, and turn right (south) at the next road. Travel approximately 0.75 miles. The control building for C-74L Test Area (Building No. 9372) is on the right side of the road.

1.5.2 WEATHER. Surveys are scheduled during the month of September. September temperatures range from an average low of 66 to an average high of 88 degrees Fahrenheit. Annual precipitation is approximately 65 inches.

1.5.3 AREAS TO BE SURVEYED

1.5.3.1 BUILDING No. 9372, BALLISTICS RESEARCH. The historical use of the Ballistics Building at C-74L, and design of the depleted uranium munitions, indicate it is unlikely that contamination exists within the building at greater than background levels. The possibility of residual radioactivity cannot be ruled out conclusively on this alone, thus, portions of the building are considered impacted.

Two areas of the building which were used as firing points are considered impacted by licensed activities. These two areas are known as Gun Bays 1 and 2. The building's other work areas will be considered impacted as well, due to the potential of DU contamination being tracked into the structure by employees on the range. Other portions of the building that will be considered are the external surfaces facing down range and the roof. These areas are being considered due to the potential of fragments ricocheting back onto or on the building roof. If present, the contamination would likely be found on floors and lower walls of the building. See Appendices A and B for building diagrams and photographs.

1.5.3.2 BUILDING No. 9373, WELL HOUSE. The external surfaces of the well house building (Building No. 9373), which is a non-occupied structure believed to be built after DU munitions work had ceased, are considered impacted due to potential windblown contamination. The inside of the well house is considered non-impacted.

1.5.3.3 TARGETS, BLOCKS, AND CATCHES. Contaminated target and concrete blocks were removed from the site during site restoration activities in 1980. During the October

2001 scoping survey elevated (above expected background) alpha activity was detected on the catch basin and associated steel. A characterization survey will be performed on the accessible surfaces of the catch basin. Given the previous restoration activities and the mass of the various items, only the accessible areas will be surveyed.

1.5.3.4 DRAIN AND SUMP LINE. A small surface runoff drain sump (4 square feet) and line is located off the south west corner of Building No. 9372. This sump apparently caught surface run off from the gun bays and asphalt pads near the building. The sump is drained to a surface intermittent stream by a PVC pipe. The sump, drain line, and outfall area will be surveyed.

1.5.3.5 SOILS AND ASPHALT. The soils around the structures will be surveyed due to the potential of material ricocheting off impacting buildings and then falling to the base of the structure. These surveys will be limited to a distance of one meter from the building footprint. The asphalt pads between the gun bay and catch basins will be surveyed. Historical documentation indicates that these asphalt pads were in place during the DU munitions work.

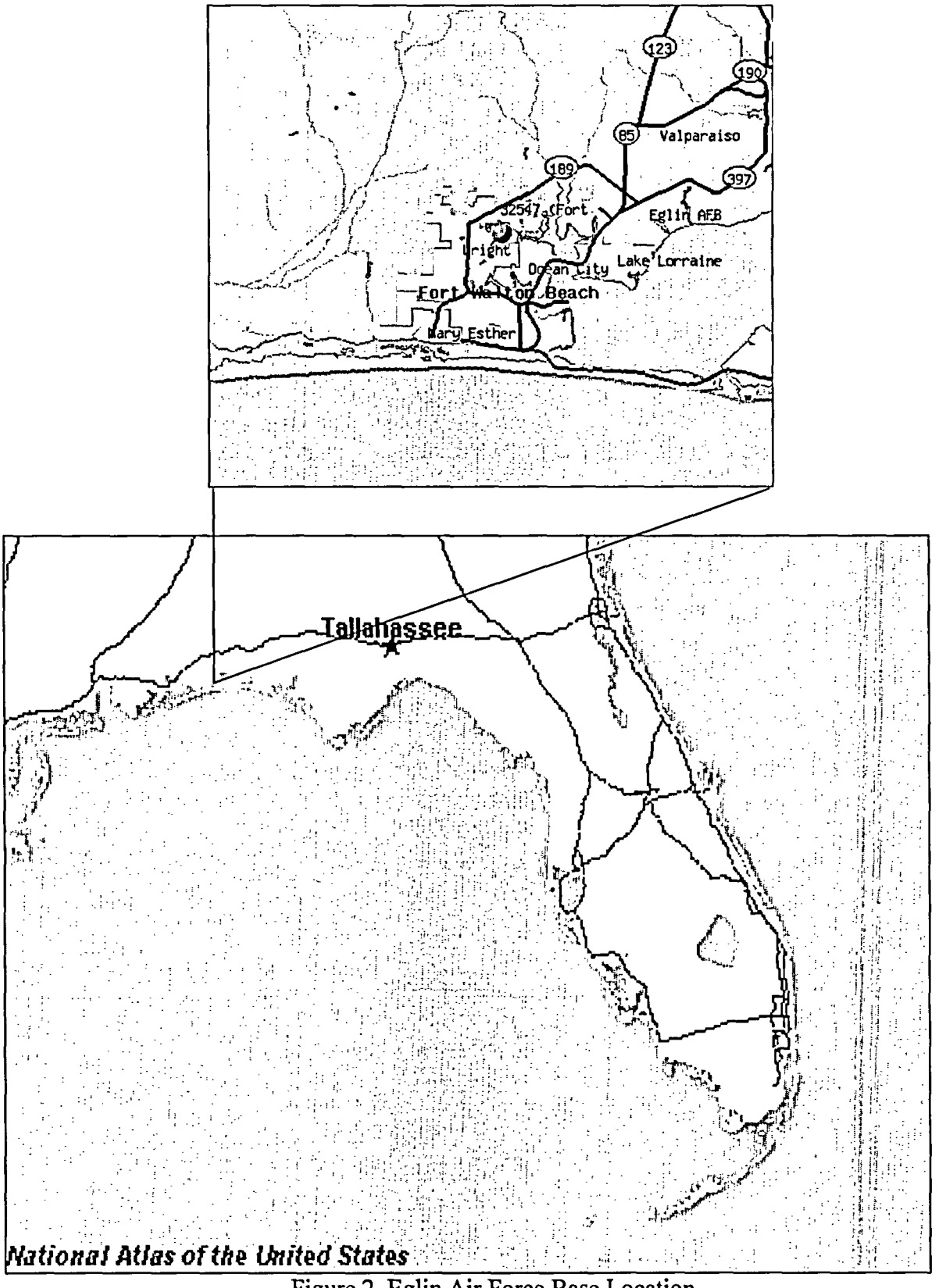


Figure 2, Eglin Air Force Base Location

SECTION 2
SAMPLING PLAN

2. SURVEY SAMPLING PLAN

2.1. SURVEY OBJECTIVES. As stated in the Eglin SI ESOP #15 the objectives of this survey effort are to:

- Identify the presence or absence of DU contamination on structure surfaces and on site soils that are within close proximity of the structures (one meter).
- Perform a data quality assessment (DQA) using MARSSIM as a framework. If DU is absent, at concentrations below the DCGL, or passes the DQA process, provide enough supporting data for NFA recommendation and acceptance.
- If DU is present at a concentration that fails the DQA process, delineate the extent of DU contamination to allow for the design of appropriate ICM activities (Eglin, December 1998).

2.2 GENERAL

2.2.1 GUIDANCE. The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC 2000) and Eglin SOPs will be followed in the design, implementation, and data interpretation for this survey effort. This survey effort is designed to provide data for purposes of investigation/characterization that may also meet MARSSIM final status survey requirements for some areas.

2.2.2 USE OF THE MARSSIM PROCESS. The MARSSIM process was developed collaboratively by the NRC, EPA, DOE, and U.S. Department of Defense, for use in designing, implementing, and evaluating radiological surveys. This process emphasizes the use of EPA's data quality objectives (DQOs) and data quality assessment processes, along with a sound quality assurance/quality control program. The "graded approach" concept is also used to ensure that survey efforts are maximized in those areas where there is the highest probability for residual contamination or greatest potential for adverse impacts of residual contamination. implementation of this graded approach is incorporated throughout the MARSSIM process. examples include the following:

- classification of survey units by contamination potential,
- limitation of survey unit size on the basis of contamination potential,
- fractional area coverage by scanning, and
- data point selection method (systematic vs. judgmental),

The MARSSIM process also embodies flexibility to allow adaptation of guidance to be responsive to specific site situations and agency objectives and requirements.

The primary focus of MARSSIM is to demonstrate compliance of a site or facility with regulatory agency criteria for future use without radiological restrictions. This type of survey is known as a Final Status Survey, and MARSSIM provides prescriptive guidance for designing and conducting such a survey.

Aspects of MARSSIM are intended for application with dose-based guideline levels of residual contamination, implemented by averaging over an entire "survey unit." This dose-based guideline approach also incorporates provisions for establishing additional limitations for small isolated areas of elevated concentrations of the contaminant. These aspects are not considered for this survey based on the unlikely potential for contamination. However, any areas identified as elevated when compared to action levels will be investigated and marked.

On the basis of operational knowledge, previous restoration activities, and previous surveys, residual contamination in excess of a small fraction of the release criteria is not anticipated at C-74L. Structures that have elevated areas greater than DCGLs will require characterization, possible remediation, and resurvey.

2.3 CONTAMINANTS OF POTENTIAL CONCERN AND ASSOCIATED GUIDELINES

2.3.1 CONTAMINANTS OF POTENTIAL CONCERN. The contaminant of potential concern is DU. Uranium is a naturally occurring radioactive isotope. DU is uranium that has been separated from the other naturally occurring members of the uranium and actinium decay series and depleted of U-234 and U-235. In natural uranium, the U-234, U-235, and U-238 isotopes are present in their naturally occurring ratios, while this ratio has been altered in DU. The naturally occurring activity ratios of U-234/U-235/U-238 to U-238 are 1.0/0.047/1.0, respectively (AEPI 1995). The DU activity ratios of U-234/U-235/U-238 to U-238 are 0.13/0.013/1.0, respectively (AEPI 1995). The activity of a gram (g) of DU is 0.4 micro-curies (uCi) (AEPI 1995). Thus the activity in 1g of DU is comprised of 0.052 uCi of U-234; 0.005 uCi of U-235 and 0.348 uCi of U-238.

DU emits alpha, beta, and gamma radiation (short lived daughter contribution included). Each of these radiation types can be used to estimate quantities of residual uranium activity; however, because of relative low abundance of gamma radiation and adverse conditions of many surfaces, beta radiation is often used as an indicator of the surface activity.

DU is used in military ordnance, medical, space, aviation, heavy equipment, and the petroleum industry. The military uses DU in kinetic energy rounds due to its density (AEPI 1995). The DU munitions used for the GAU-8 gun system were the aluminum encased 30 mm penetrators (see figure 1). The aluminum jacket would prevent the DU from contaminating surfaces during storage, transportation, and handling.

2.3.2 DERIVED CONCENTRATION GUIDELINE LEVEL. A derived concentration guideline level (DCGL) can come from numerous sources such as regulators, dose/risk assessments, or applicable standards. The Eglin LLRM Partnering Team accepted and set a DCGL to be used for DU in soil at Eglin AFB test ranges. The DCGL corresponds to an

activity of DU in soil in picoCuries per gram (pCi/g) that would result in a lifetime excess cancer risk (LECR) of 3E-04 for the following future land use scenarios:

- Industrial Scenario - 600 pCi/g
- Construction Worker - 7,500 pCi/g
- Residential - 500 pCi/g

The DCGL for the industrial scenario is selected since it is considered to be the most likely future land use designation for C-74L.

The DCGL for habitable building internal surfaces is selected from the NRC's NUREG/CR-5512, Vol. 3 (90^{th} percentile) as a conservative approach (see Appendix D).

The DCGL for equipment, building exteriors, and other surfaces (catch boxes, asphalt, etc.) is selected from Table 12-1 of the Base Wide Site Safety and Health Plan (BSSHP) for LLRM Site Investigations and the USACE EM-385-1-80.

TABLE 2. SITE DCGL (SEE APPENDIX D FOR CALCULATIONS)

Media	DU DCGL ($dpm/100cm^2$)	DCGL (pCi/g)	DCGL by Measurement Method (in excess of background)
Building interior surfaces	[1]100	NA	100 $dpm/100cm^2$ gross Alpha[2] 400 $dpm/100cm^2$ gross Beta[3]
Soil[5]	NA	600	510 pCi/g U-238
Equipment surfaces and external building surfaces	[4]5,000	NA	5,000 $dpm/100cm^2$ gross Alpha 5,000 $dpm/100cm^2$ gross Beta
Equipment	NA	NA	β,γ Dose Rate 0.2 mrad/hr @ 1 cm

[1] Since DU is comprised of approximately 99.8% U-238, 0.001% U-234, and 0.2% U-235 and the NUREG/CR-5512 values are isotope specific, the DU value is derived from the activity ratios of U-238, U-234, and U-235 in DU of 85%, 13%, and 2% respectively. When corrected for this activity abundance the 100 $dpm/100cm^2$ DCGL insures that the sum of the ratios for all three isotopes would not exceed unity (i.e. the criteria is met). Appendix E lists the NRC DCGLs for typical isotopes of concern.
[2] Since 1 disintegration per minute (dpm) of DU results in the emission of 1 alpha particle per minute the DU to gross alpha conversion factor is 1.
[3] Since 1 dpm of DU results in the emission of 4 beta particles per minute the DU to gross beta conversion factor is 4.
[4] Applies to alpha and beta emitters independently.
[5] Applies to material samples such as concrete blocks also.
NA = Not Applicable.

2.4. SURVEY METHODS AND TECHNIQUES

2.4.1 CLASSIFICATION OF AREAS BY CONTAMINATION POTENTIAL. For the purposes of guiding the degree and nature of final status survey coverage, MARSSIM identifies three classifications of areas, according to contamination potential. Class 1 areas have a potential for contamination that exceeds guidelines; class 2 areas have a potential for contamination, but it is unlikely that the contamination level exceeds the average guideline; and

class 3 areas are not expected to contain residual activity in excess of a small fraction of the average guideline.

It is unlikely that contamination exists in excess of DCGLs in survey areas due to the design, handling procedures, previous remediation, and use of the items at C-74L.

The site history does not reveal any accidents or incidents involving DU munitions that may have lead to contamination where not expected.

Based on operational knowledge, previous restoration efforts, and scoping surveys, areas of the facility were classified using MARSSIM final status survey guidance. Table 3 lists the areas by initial classification.

Table 3. Investigation Areas and Initial Classification

Area	Survey Type	Survey Unit #	Initial Class
Gun Bays	Final Status	1	3
Building 9372 Work Areas	Final Status	2	3
Building 9372 Exteriors	Final Status	3	3
Building 9373 Exteriors	Final Status	4	3
Asphalt and Range Equipment	Scoping	5	NA[1]
Range Catch Box	Characterization	6	3
Drain Sump, Drain Line, and Soils	Scoping	7	NA[1]

[1]Expected to be non-impacted.

2.4.2 DETERMINATION OF DATA REQUIREMENTS. For final status surveys where the contaminant is present in background, such as uranium, or when the measurement method is not isotope specific, such as gross alpha, the Wilcoxon Rank Sum (WRS) test is used. The WRS test assumes the reference area and survey unit data distributions are similar except for a possible shift in the median values. When the data are severely skewed, the value for the mean difference may be above the $DCGL_w$, while the median difference is below the $DCGL_w$. In such cases, the survey unit does *not* meet the release criterion regardless of the result of the statistical test. On the other hand, if the difference between the largest survey unit measurement and the smallest reference area measurement is less than the $DCGL_w$, the WRS test will always show that the survey unit meets the release criterion.

As part of the DQO process, the null hypothesis (H_0) for demonstrating compliance of data with guidelines must be stated. The H_0 is that residual contamination exceeds the acceptance criterion (guideline). If the H_0 is accepted, the conditions of the area surveyed do not satisfy the guideline, and further evaluation and/or remediation is necessary. If the H_0 is rejected, the alternative hypothesis must be accepted and the finding of the evaluation is that the site satisfies the guideline.

The quantity and quality of data collected is intended to be adequate for use in demonstrating that the areas of the site that were not expected to contain residual radioactivity satisfy the guidelines for unrestricted release. To enable testing of data relative to guidelines, the

USACE established acceptable decision errors for this project. The Type I (alpha) decision error used in data testing was 0.05. This provides a confidence level of 95% that the statistical tests will not incorrectly determine that a surveyed area satisfies criteria when, in fact, it does not. The Type II (beta) decision error was 0.05. This provides a confidence level of 95% that the statistical tests will not incorrectly determine that a surveyed area does not satisfy criteria when, in fact, it does. Data quality objectives for Final Status Surveys are discussed in Appendix F.

2.4.3 MEASUREMENTS TO DEMONSTRATE COMPLIANCE WITH GUIDELINES. Data needs for Wilcoxon Rank Sum (WRS) statistical tests applicable to Final Status Survey Class 3 areas were determined as follows:

1) Calculate the Relative Shift (Δ/σ)

   Δ = $DCGL_W$ – Lower Bound of the Gray Region (LBGR)

   a. Determine the $DCGL_W$

   b. Determine the LBGR

      The LBGR was selected to be 50% of the DCGL.

Sigma should be produced empirically for both the reference area (σ_r) and the survey area (σ_s).

   c. The relative shift is calculated to be Δ/σ.

      MARSSIM recommends a range of 1 to 3 for Δ/σ. For planning purposes the standard deviation obtained during the scoping survey was arbitrarily increased by 50%.

      A worst case relative shift value of 2.5 was then calculated for the survey units planning purposes based on data acquired during scoping. This data will be compared to data collected from reference area surveys as part of this survey. If the actual value is above 3, the LBGR would be adjusted to provide a relative shift in MARSSIM recommended range.

2) Determine P_r

   This was taken directly from MARSSIM (page 5-28, Table 5.1).

3) Determine the Decision Error Percentiles

   The null hypothesis (H_0) for each survey unit is that the residual radioactivity exceeds the $DCGL_W$. Acceptance decision errors for testing the hypothesis were set at 0.05 for Type I errors and 0.05 for Type II errors.

4) Calculate the Number of Data Points by:

$$N = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2}$$

where

N is the number of samples required for a given level of confidence;

$Z_{1-\alpha}$ and $Z_{1-\beta}$ are standard statistical values that vary with the level of confidence required and are obtained from tables; and

P_r was obtained directly from MARSSIM.

An additional 20% was added to allow for potential sample loss and quality control.

For planning purposes the number of data points required for all survey units is 28, to be split evenly between the reference area and the survey area.

5) Data Point Needs for Areas of Elevated Activity

With exception of the gamma and beta scans for uranium and alpha scans of rough or covered surfaces, sensitivities of proposed instruments and techniques are such that $DCGL_w$ concentrations can be identified by scans. Because no Class I survey units are anticipated, there was not a requirement for determining data needs to satisfy elevated area provisions. The scanning MDC will be calculated and will be set as the investigation level for all scans (see MARSSIM Table 5), however, any reading outside that expected of background will be investigated further.

2.4.3.1 SURVEY UNIT DETERMINATION. The analysis of previous survey data indicates that 10 to 15 sample locations are required in each survey unit. Locations will be randomly selected and marked on the survey unit drawings (see Appendix C) for an example.

2.4.3.2 BACKGROUND (REFERENCE AREA) DETERMINATIONS. In accordance with the calculated data requirements, 15 reference level measurements of gross alpha activity, gross beta activity and dose rate will be performed in areas without a history of radioactive materials use. Currently the machine room of building no. 9372 is identified as a reference area. Additional reference areas/materials may be identified during the surveys.

2.4.4 SURVEY METHODS AND TECHNIQUES

2.4.4.1 WIPE SAMPLING. Wipe samples will be taken utilizing a pre-labeled wipe. Samples are collected from an area of at least 100 cm^2 (4" by 4" area) by using sufficient pressure on the wipe to pick up loose contamination without tearing or separating the swipe.

Wipe samples will be numbered on the outside of the wipe holder see paragraph 2.4.4.6

Wipe samples will be grouped according to survey units and kept separate from other survey unit groups.

2.4.4.2 **SOIL SURVEY/SAMPLING.** Surface scans will be conducted along the building perimeter and drip line. Surface soil samples (0-6 inch depth interval) will be collected in accordance with ESOP #15 and labeled in accordance with ESOP #3 (see Appendix H). Sample collection locations will be judgemental (i.e., representative of areas with the greatest potential for contamination). Reference areas will be determined onsite.

2.4.4.3 **DRAIN AND SUMP LINE SURVEY.** A scan of the drain line will be conducted. A downhole NaI detector or pipe probe will be pushed through the pipe.

2.4.4.4 **FIELD MEASUREMENTS.** Alpha, Beta, and Gamma instrument readings will be taken at each sampling location. Additionally 100% of floors and 100% of gun bay lower walls (10% of walls in other rooms) will be scanned. Typical field instruments that may be used are listed in Table 4. Example calculations for MDC and scan MDC are in Appendix D. MDC's and critical levels are dependent on background and, thus, actual MDC's and critical levels must be determined in the field.

Table 4 Typical Survey Instrumentation

Instrument	Probe Model	Probe Type	Display (units)
Ludlum 2224 (Scanner)	Ludlum 37-1-1	Gas Flow Proportional	CPM
Ludlum 2360	Ludlum 43-89	Alpha/Beta Scintilator	CPM
Ludlum 2221	FIDLER Ludlum 44-9	Low Energy Gamma Pancake GM	CPM CPM
Ludlum 2350	Ludlum 44-2 Ludlum 44-9	NaI 1x1" crystal Pancake GM	uR/hr CPM

*** Equivalent instruments may be substituted.**

Sample locations will be selected randomly. Use of a random number generator or computer program such as the Visual Sampling Plan will be used to select sample point locations. The integrated count and gamma readings will be taken at sample locations and will correspond by sample number see paragraph 2.4.4.6.

Readings reported in uR/hr will be taken in ratemeter mode, and readings reported in cpm will likely be a 2 min integrated count. Actual count times may vary based on background and MDC calculations.

The Ludlum 43-89 responds to Alpha and Beta particles. When coupled to a model 2360 scaler, beta and alpha measurements can be obtained separately from the same count. This eliminates the need for separate instruments. All alpha and beta radiation measurements will be taken at approximately 0.5 cm or less from the surface.

In accordance with NRC regulation for termination surveys (10 CFR 40.36) gamma exposure rate will be recorded at each sample location. Additionally scanning and integrated counts in select areas (such as painted surfaces) will be conducted with a Field Instrument for Detection of Low Energy Radiation (FIDLER) detector. With the exception of the scan and FIDLER measurements, any gamma radiation measurements will be taken at approximately 1 meter from the surface. FIDLER Scan MDCs will be determined for building surfaces and soil.

Instrument MDC will be determined and should be no more than 50% of the DCGL. All MDCs will be presented in the final status survey report.

An action level for integrated measurements will be set at each instrument's critical level. This level is the counts at which there is a 95% probability that the measurement is above background, although it may not be able to be quantified reliably. The scan MDC for scanning instruments will be set as the investigation level for scanning. Elevated activity areas identified during scanning will be assigned as additional sample locations.

Considerations for painted surfaces: Interior building walls have been painted since DU testing ceased. Although contamination of walls is considered remote, if present it may have been covered by paint. Beta and gamma emissions are expected to be attenuated somewhat, however, we expect to be able to detect some of these emissions through the paint. To aid in identifying this situation the instrument critical level will be used as an investigational level. If a sample result exceeds the measurement method critical level on painted surfaces a static count of sufficient duration to quantify DU activity below paint will be conducted. This count time will be determined in the field (since impacted by background) but is estimated based on NUREG 1507 guidance and 1 coat of paint every three years to be 60 minutes.

2.4.4.5 LABORATORY ANALYSIS. The Commercial Laboratory (Outreach Labs) will utilize its Internal Quality Assurance (QA) Plan for the sample analysis. Sample LLD/MDA will be determined and should be no more than 50% of the DCGL. Copies of the QA plan are available upon request. Sample Chain of Custody (COC) procedures will be established per the QA section (3) of this plan.

To facilitate comparison to guideline levels and for standardization, wipes and instrument results will be reported in dpm/100 cm^2 (disintegrations per minute/ 100 square centimeters).

Samples will be analyzed as presented in Table 5.

Table 5 Sample Analysis

Isotope of Interest	Test Methodology	Matrix	MDC
Gross Alpha	Gas Flow Proportional Counter	Wipe	10 dpm
Gross Beta	Gas Flow Proportional Counter	Wipe	20 dpm
U-238	Gamma Spectrometry	Soil	5 pCi/g

2.4.4.6 SAMPLE NUMBERING. Wipe samples will be numbered as follows (soil

samples will be number in accordance with ESOP #3):

- EAFB = E
- Building # = #
- Survey Unit # = #
- Location #= #
- Sink = S
- Drain = D
- Vent = V
- Random = R
- Above 2 meters = C

Example: Sample number E9372-1-08 is from building number 9372, Gun bays location #8. Sample locations will be marked on building diagram and marked with paint or chalk in the area for ease of reproduction. Additional reference areas may be selected and surveyed.

Judgmental samples, such as, drains will be numbered as above plus the additional designation (i.e. D). Locations on the ceiling will be labeled as the location on the floor they are above but will be designated with a "C". The "R" designation will be used on samples taken from moveable items such as boxes or shelves.

Points of elevated activity identified during scanning will be made additional sampling points and will be numbered as above.

2.5 SITE SAFETY AND HEALTH PLAN. Appendix G contains the Site Specific Safety and Health Plan (SSHP). The installation has prepared a *BASEWIDE HEALTH AND SAFETY PLAN, ADDENDUM No. 1, LOW-LEVEL RADIOACTIVE MATERIALS, SITE INVESTIGATIONS.* Both plans will be discussed in pre-work briefings and will be onsite during surveys. Since contamination is not suspected it is unlikely that persons or equipment shall become contaminated, however, personnel will frisk themselves and equipment periodically to check for contamination. If contamination is detected during surveys personnel will frisk prior to departing the area and perform decontamination in accordance with the SSHP. Sampling material and PPE contaminated above the levels in Table G-1, Appendix G, will be sealed in plastic bags. Following coordination with EAFB, such material will be transferred to C-64. Items that are not contaminated above the Table G-1 limits will be treated as non-contaminated.

2.6 DOCUMENTATION. The following discussion outlines standard practices and procedures to be used when documenting a sampling episode. Proper completion of the logbook and supporting paperwork with indelible ink is necessary to support potential enforcement actions that may result from the sample analysis. Therefore, maintaining sample integrity through proper documentation is essential.

Project field logbooks must be bound and should have numbered, water-resistant pages. All pertinent information regarding the site and sampling procedures must be documented in indelible ink. Notations should be made in logbook fashion, noting the time and date of all

entries. Information recorded in this logbook should include, but not be limited to, the following:

- Name and exact location of site of investigation or interest
- Date and time of arrival and departure
- Names of all persons on site
- Field instrument equipment used and purpose of use (i.e., health & safety screening, sample selection for laboratory analysis), calibration methods used, field results, and quality control (QC) information
- Date and time of sample and data collection and any factors that may affect their quality
- Weather conditions on the day of sampling, and any additional pertinent field observations.

SECTION 3
QUALITY ASSURANCE/QUALITY CONTROL

3. QUALITY ASSURANCE/QUALITY CONTROL PLAN

3.1. OBJECTIVES. The objective of this Quality Assurance (QA) Plan is to provide guidance during the radiological survey process and to ensure procedures and techniques provide usable and reliable data.

3.1.1 DATA QUALITY INDICATORS. The data quality indicators for precision, accuracy, representativeness, completeness, and comparability are established. For this investigation these were established for the field analytes (gross alpha/beta or gamma spectrometry) and the lab methods (gross alpha/beta or gamma spectrometry).

- Precision is determined by comparison of replicate values from sample analysis. The objective is a relative percent difference of 30% or less at 50% of the criterion value. The control charts insure adequate precision is maintained for the field instruments.

- Accuracy is the degree of agreement with the true or known. The objective for this parameter is +/- 30% at 50% of the criterion value.

- Representativeness and comparability do not have numeric values. Performance for these indicators was ensured through the selection and proper implementation of systematic sampling and measurement techniques.

- Completeness refers to the portion of the data that meet acceptance criteria and are, therefore, useable for statistical testing. The objective is 90% for this project.

3.2. WIPE SAMPLES

3.2.1 LABORATORY QUALITY ASSURANCE. The QA\QC for lab instruments will be accomplished by Outreach Laboratory following their current written procedures. A copy of the plans are available upon request.

3.2.2 WIPE SAMPLE LABELING. Wipe samples will be pre-labeled (as noted in section 2.4.4.1), grouped by survey unit, and placed into plastic bags after collection. Blank samples will be submitted to the lab at least at the rate of 1 per every 10 samples. Blanks are used to check for cross contamination throughout the survey process.

3.2.3 CHAIN OF CUSTODY. Samples will be recorded on a chain of custody (COC) form as soon as collected. The samples will remain in possession of the collector until sealed in a container and shipped to the lab. The container will be sealed using COC seals and tape if not in control of the sampler or the lab. The COC form will be sealed inside the container and will be stored and tracked with the samples until sample disposal. A COC form is included in Appendix C.

3.2.4 CROSS CONTAMINATION CONTROL. Disposable gloves and other protective apparel as appropriate will be worn. Gloves will be changed after each blank sample is collected. Personnel will be monitored for contamination using field instruments. Table E-1 in Appendix E list contamination limits. To minimize cross contamination potential, surveys will be conducted in the following order:

1. Reference Area
2. Class 3 Areas

3.3. FIELD MEASURENMENTS. Prior to beginning any survey, the operator will perform a pre-operational check that will include background and QA chart checks (see below).

3.3.1 INSTRUMENT CHECKS.

Perform battery check.

Check cables if broken or frayed.

Take background reading and ensure it's within chart parameters.

Perform quality control check on meters utilizing a source that emits the same radiation and approximate energy as that of the primary isotope of interest, ensure values are within the parameters in the quality control chart.

3.3.2 QUALITY CONTROL CHART. Prior to the survey, all survey meters will be calibrated and have valid calibration certificates, and if possible, operability checks noted in the instrumentation section. A Quality Control (QC) chart will be started.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$s_x = \sqrt{\frac{\sum_{i=1}^{n} (\bar{x} - x_i)^2}{n-1}}$$

The QC chart is created by obtaining 20 to 30 data readings with an appropriate check source. Calculate the mean and the standard deviation using the above equations.

Create a graph with the date on the horizontal axis and source readings on the vertical axis. The mean is assumed to be the "true" value. The values for the warning limits (2 sigma) and control limits (3 sigma) are then calculated. Draw horizontal lines at the values that represents the mean, warning limits, and control limits. The graph will be used to plot the daily operability checks for survey meters operated in the integrate mode. The same procedure will be employed for analog meters. However, warning limits may be set at 15% and control limits at 20% of the mean value.

If daily operability checks fall outside the warning limits (but inside the control limits), the operability check should be repeated.

If the daily operability check falls outside the control limit, the operability check will be repeated. If the check falls outside the control limits again, the instrument will be removed from service until it is either repaired, recalibrated or the cause for the out of control reading is identified. The instrument will also be removed from service and recalibrated whenever a malfunction is suspected. A new QC chart will be started when the meter is recalibrated or repaired.

All daily operability checks (including any outside the warning or control limits) will be recorded in the instrument QA/QC files.

Appendix C contains example of an instrument QC chart.

3.3.3 INSTRUMENT CONTAMINATION. While performing surveys, the probe may be contaminated, causing the background count rate to increase. If this is suspected, repeatedly clean the detector and repeat the background until the counts fall back within the predetermined rate.

3.4 SOIL SAMPLING. Soil samples will be collected in accordance with ESOP #15 and numbered in accordance with ESOP #3. Soil samples will be collected using one time use instruments. A duplicate sample will be collected and submitted blind to the laboratory at a rate 10%. At least 2 duplicates will be collected if total number of samples is less than 10.

3.5 QUALITY ASSURANCE.

3.5.1 ONSITE QUALITY ASSURANCE. An independent office of the USACE (Hazardous, Toxic, and Radioactive Waste Center of Expertise) will conduct a site visit during the survey and will perform the following:

- Review of work plans and reports.
- Review survey data.
- Oversight of survey procedures, survey techniques, and accepted health physics practices. Violations of acceptable health physics practices, survey techniques, and survey procedures as outlined in this plan will be recorded in the QA log book and discussed with the EAFB Radiation Safety Officer.

3.5.2 VERIFICATION SURVEY. A verification survey may be requested by the NRC or the USAF.

- If requested, the requesting agency will be allowed to perform the survey and will be escorted by the onsite health physicist.
- A verification survey will not be conducted if not requested by the USAF or NRC.
- The verification survey is a QA/QC tool. It is used to verify or confirm the adequacy and accuracy of an NRC licensee's final termination survey. A verification survey is only an independent sampling of the licensee's or installation's more elaborate survey (termination survey or final status survey}, and not a complete duplication. The survey will ensure compliance with all applicable federal, state and local radiological regulations.

SECTION 4
REFERENCES

4.0 REFERENCES

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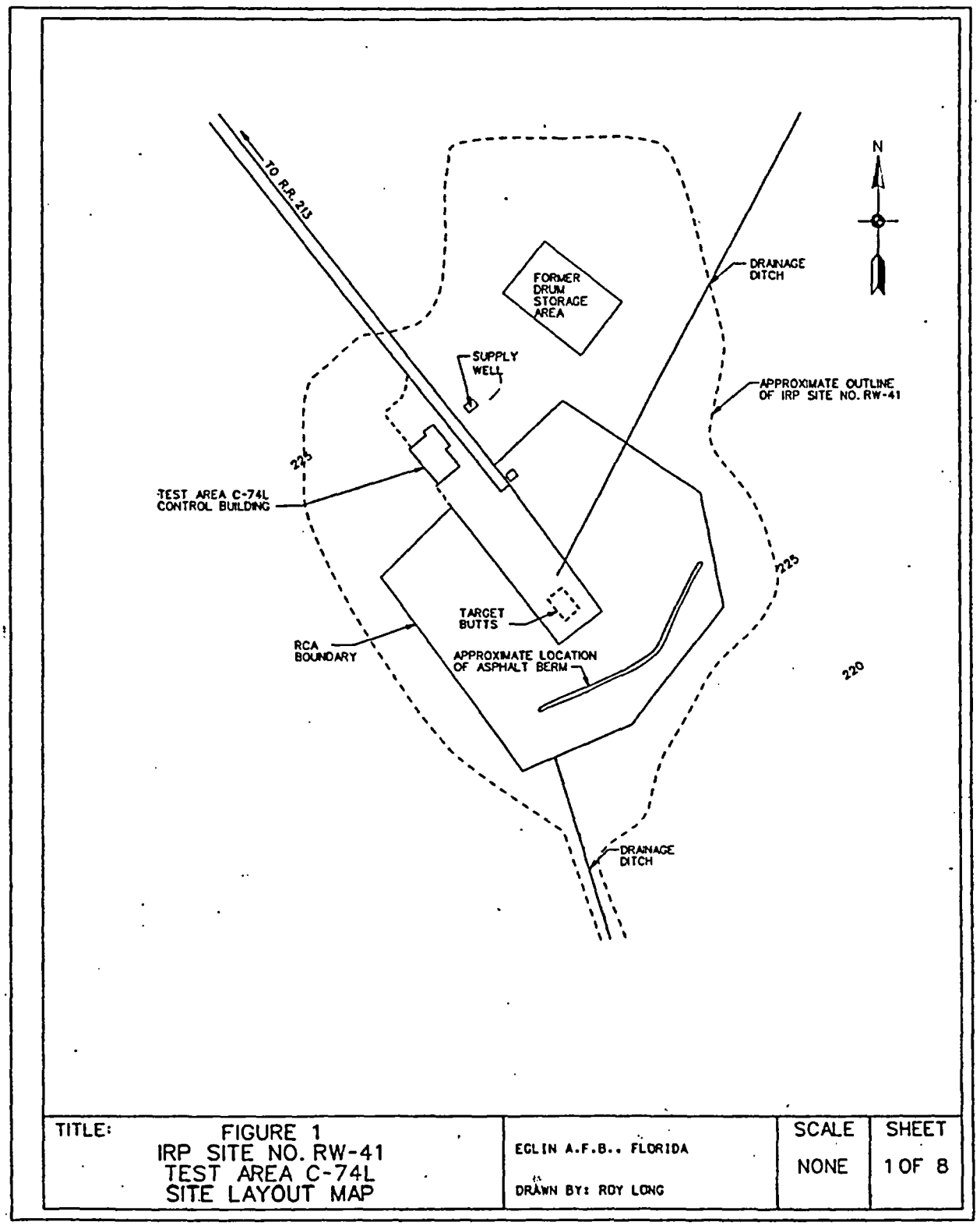
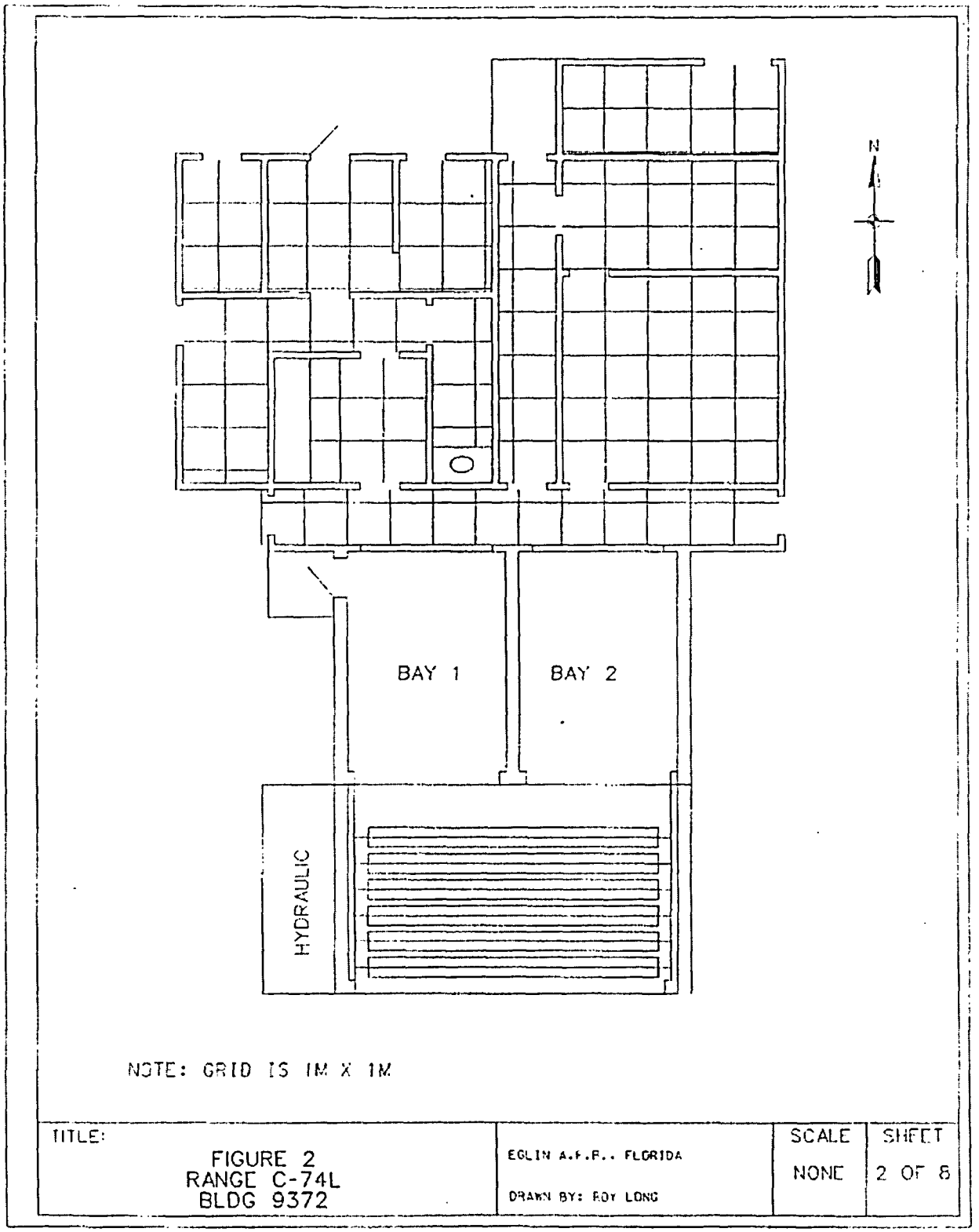
APPENDIX A

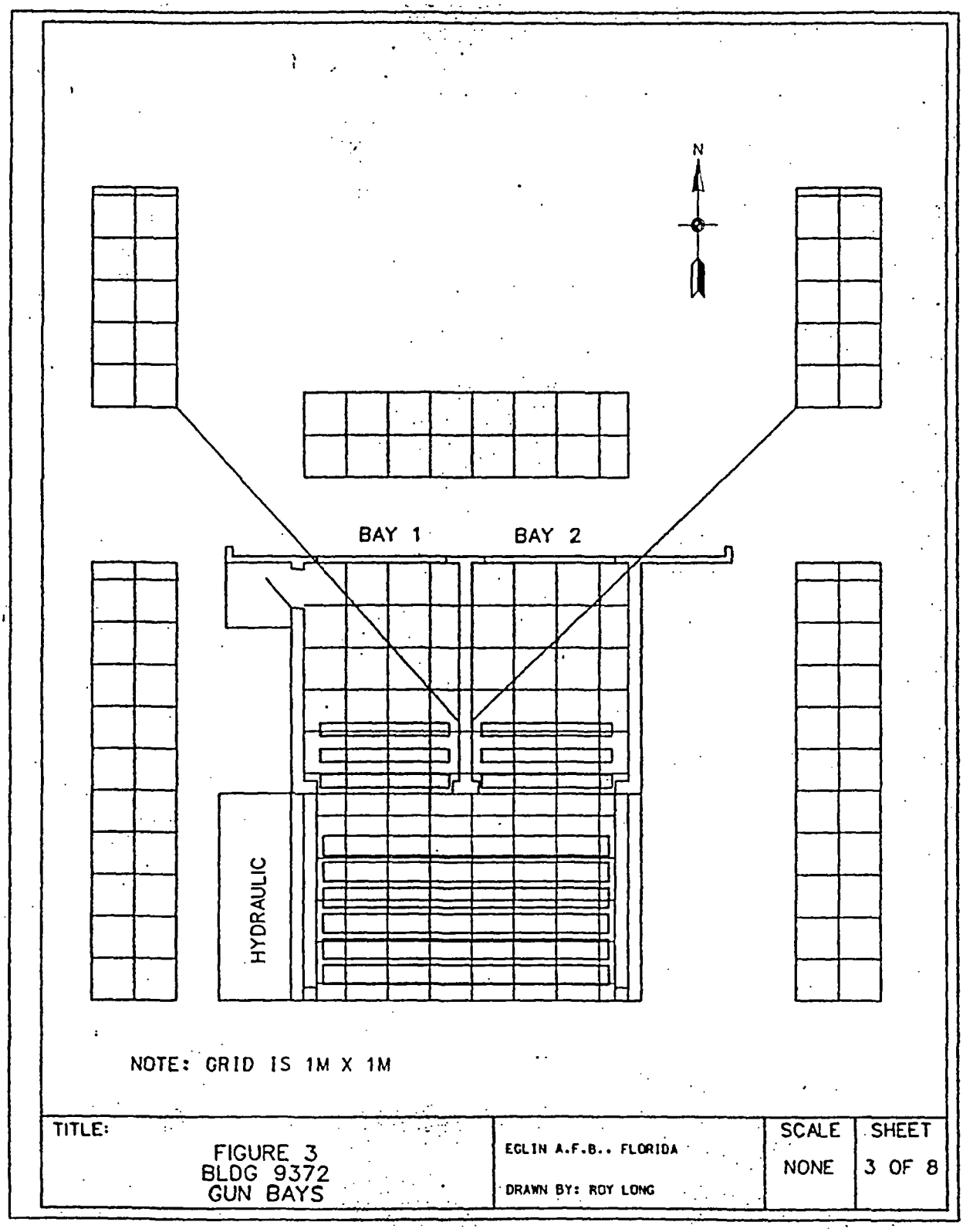
SURVEY UNIT LIST
AND
FIGURES

SURVEY UNIT LIST

Survey Unit Number	Survey Unit	Class	Survey Type	Remarks
1	Gun Bays	3	Final Status	Both bays are Survey Unit 1
2	Building No. 9372 Work Areas	3	Final Status	Remainder of Building No. 9372 (except mechanical room)
3/4	Building No.s 9372 and 9373 Exteriors	3	Final Status	Exteriors only, measurements may be done inside Building No. 9373 if accessible
5	Range Equipment/Asphalt	NA	Scoping	Expected to be non-impacted
6	Range Catch Box	3	Characterize	Scoping survey identified elevated alpha readings
7	Drain Sump and Line	NA	Scoping	Expected to be non-impacted


TO R.R. 213
N
DRAINAGE DITCH
FORMER DRUM STORAGE AREA
SUPPLY WELL
APPROXIMATE OUTLINE OF IRP SITE NO. RW-41
225
TEST AREA C-74L CONTROL BUILDING
225
TARGET BUTTS
RCA BOUNDARY
APPROXIMATE LOCATION OF ASPHALT BERM
220
DRAINAGE DITCH
TITLE: FIGURE 1
IRP SITE NO. RW-41
TEST AREA C-74L
SITE LAYOUT MAP
EGLIN A.F.B., FLORIDA
DRAWN BY: ROY LONG
SCALE
NONE
SHEET
1 OF 8


N
BAY 1
BAY 2
HYDRAULIC
NOTE: GRID IS 1M X 1M
TITLE:
FIGURE 2
RANGE C-74L
BLDG 9372
EGLIN A.F.B., FLORIDA
DRAWN BY: ROY LONG
SCALE
NONE
SHEET
2 OF 8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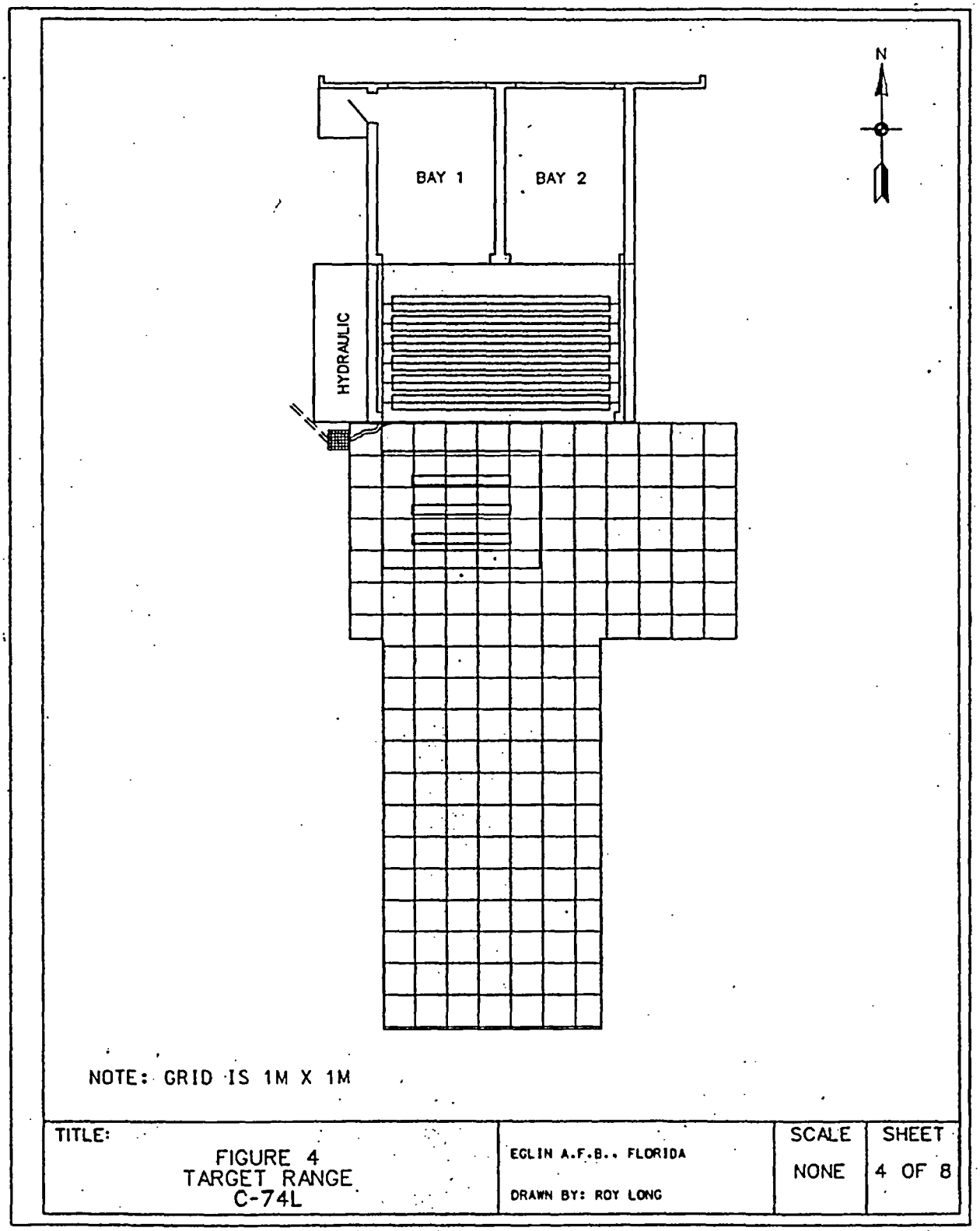
BAY 1
BAY 2
HYDRAULIC
NOTE: GRID IS 1M X 1M
TITLE:
FIGURE 3
BLDG 9372
GUN BAYS
EGLIN A.F.B., FLORIDA
DRAWN BY: ROY LONG
SCALE
NONE
SHEET
3 OF 8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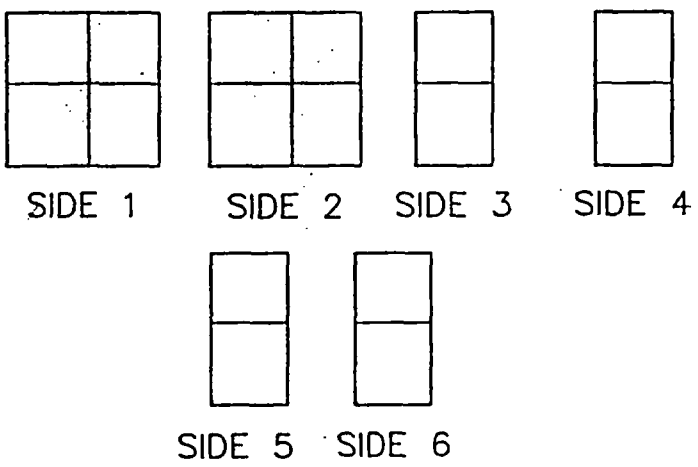
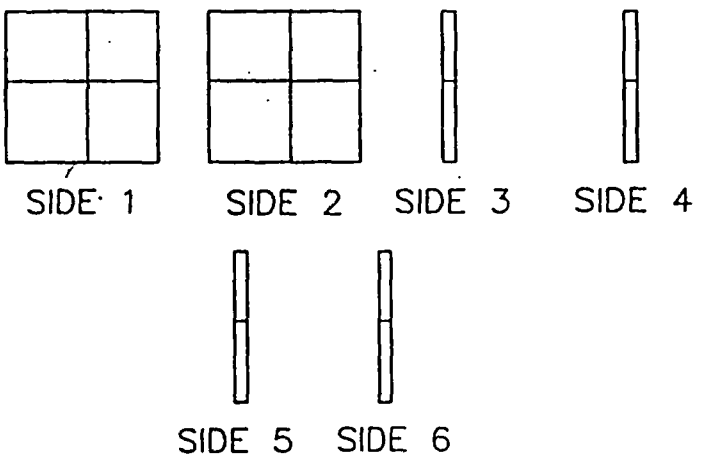
BAY 1
BAY 2
HYDRAULIC
NOTE: GRID IS 1M X 1M
TITLE:
FIGURE 4
TARGET RANGE
C-74L
EGLIN A.F.B., FLORIDA
DRAWN BY: ROY LONG
SCALE
NONE
SHEET
4 OF 8



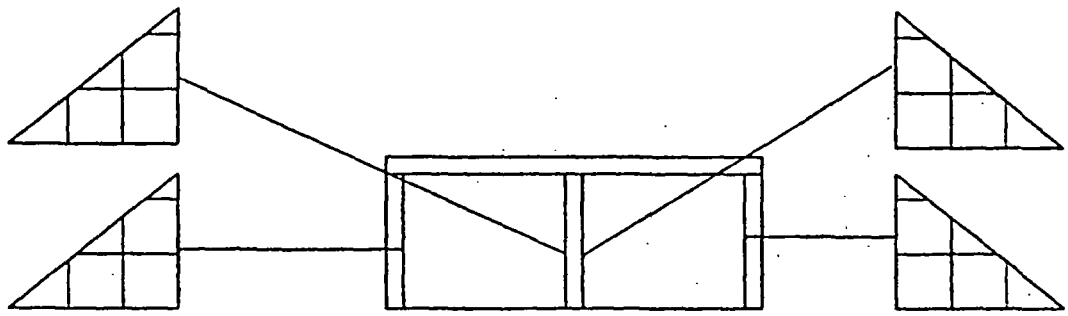
NOTE: GRID IS 1M X 1M

TITLE:		SCALE	SHEET
FIGURE 5 TARGET BLOCK	EGLIN A.F.B., FLORIDA DRAWN BY: ROY LONG	NONE	5 OF 8

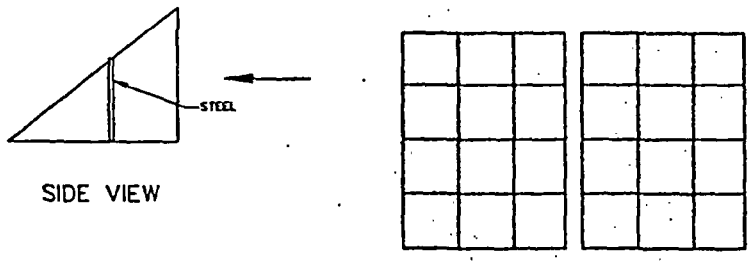


NOTE: GRID IS 1M X 1M

TITLE: FIGURE 6 TARGET BLOCK	EGLIN A.F.B., FLORIDA DRAWN BY: ROY LONG	SCALE NONE	SHEET 6 OF 8



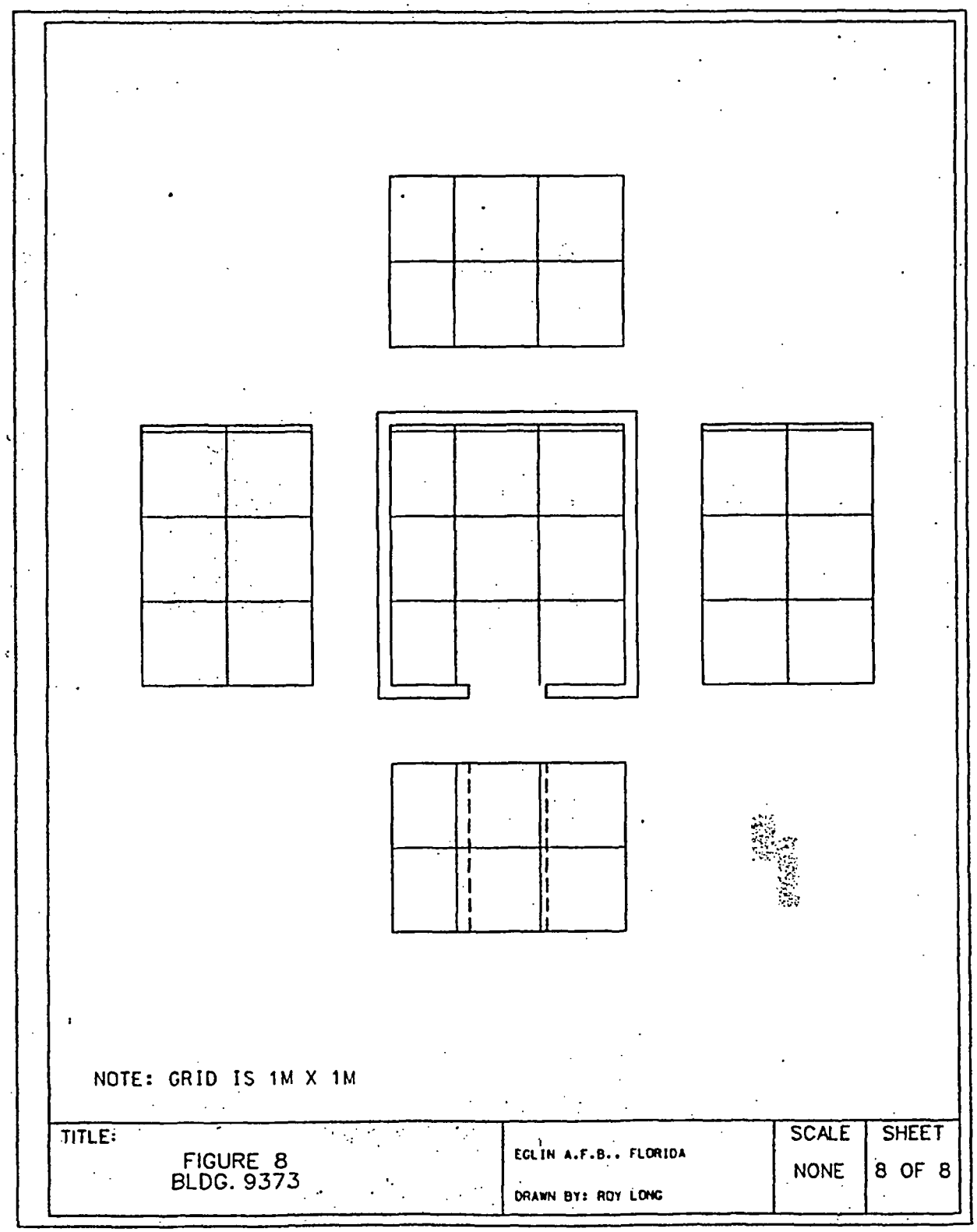
FRONT VIEW



SIDE VIEW

NOTE: GRID IS 1M X 1M

TITLE:		SCALE	SHEET
FIGURE 7 CATCH BOX	EGLIN A.F.B., FLORIDA DRAWN BY: ROY LONG	NONE	7 OF 8

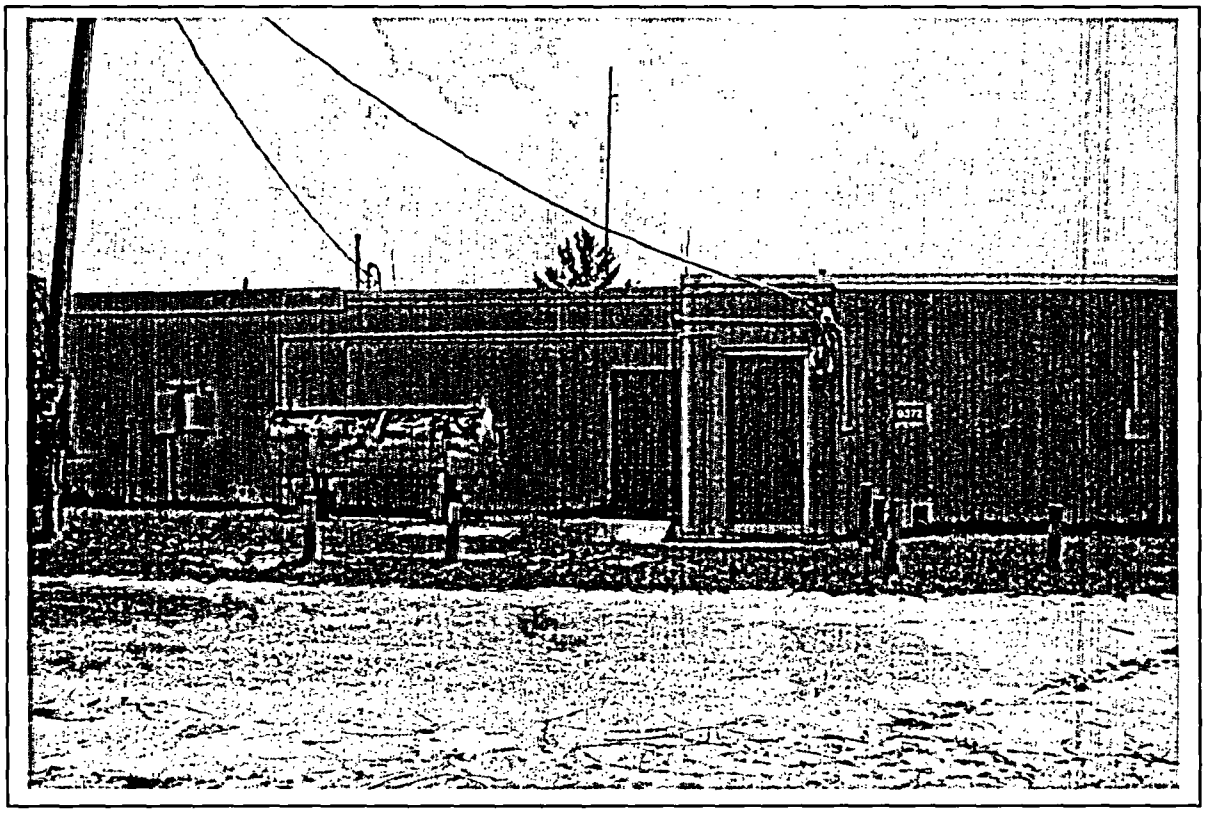


NOTE: GRID IS 1M X 1M

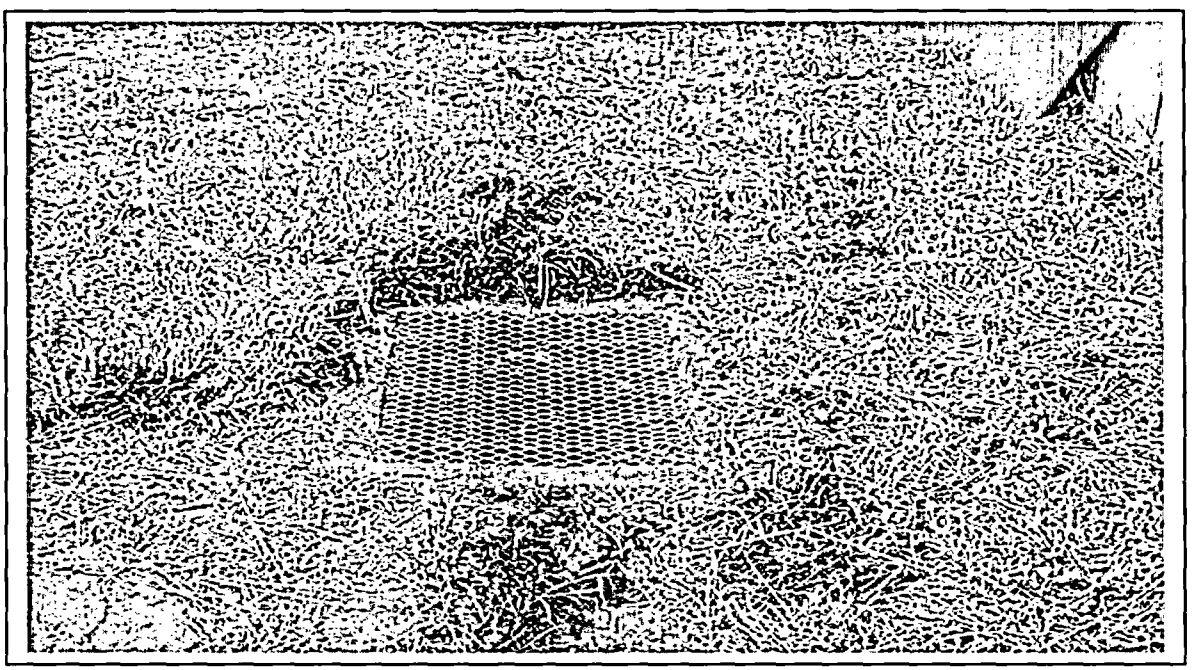
TITLE:		SCALE	SHEET
FIGURE 8 BLDG. 9373	EGLIN A.F.B., FLORIDA DRAWN BY: ROY LONG	NONE	8 OF 8

APPENDIX B

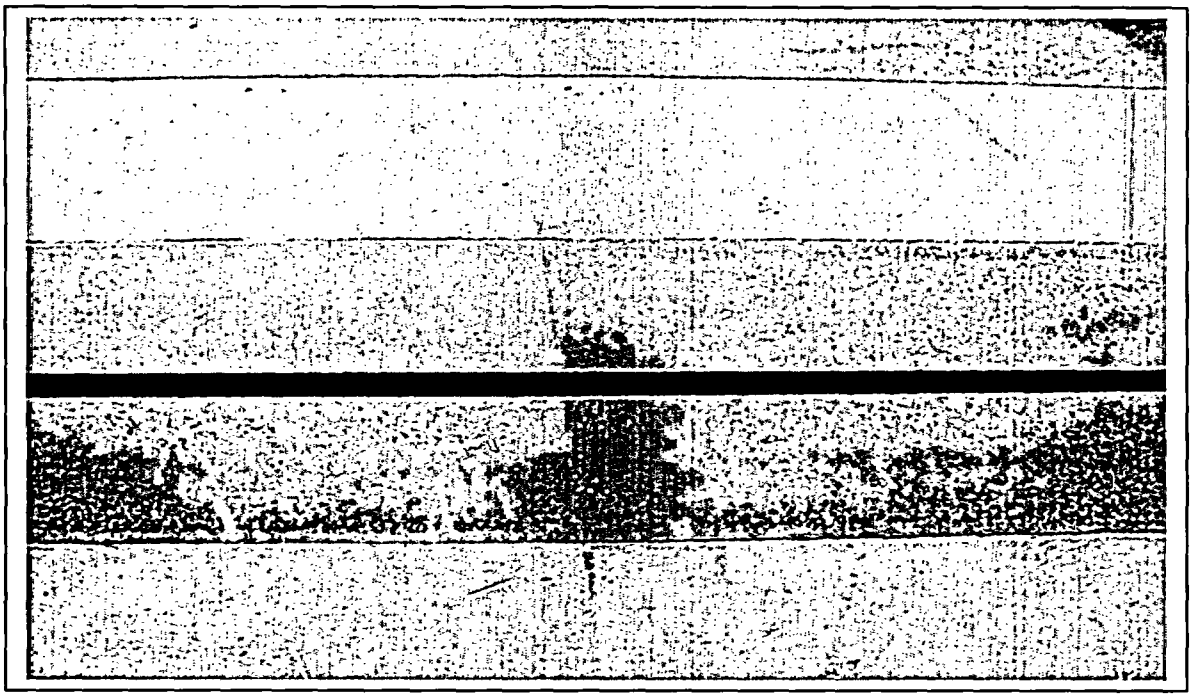
PHOTOGRAPHS



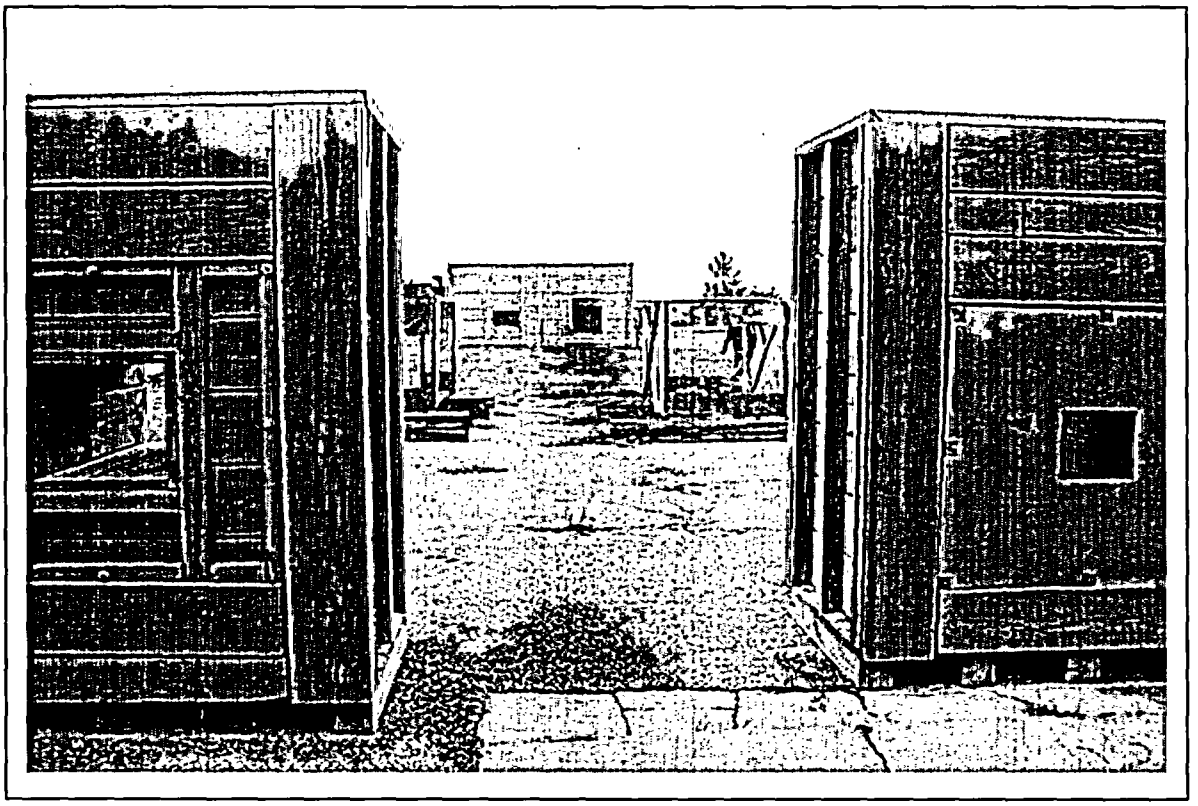
Building 9372



Drain outside of 9372

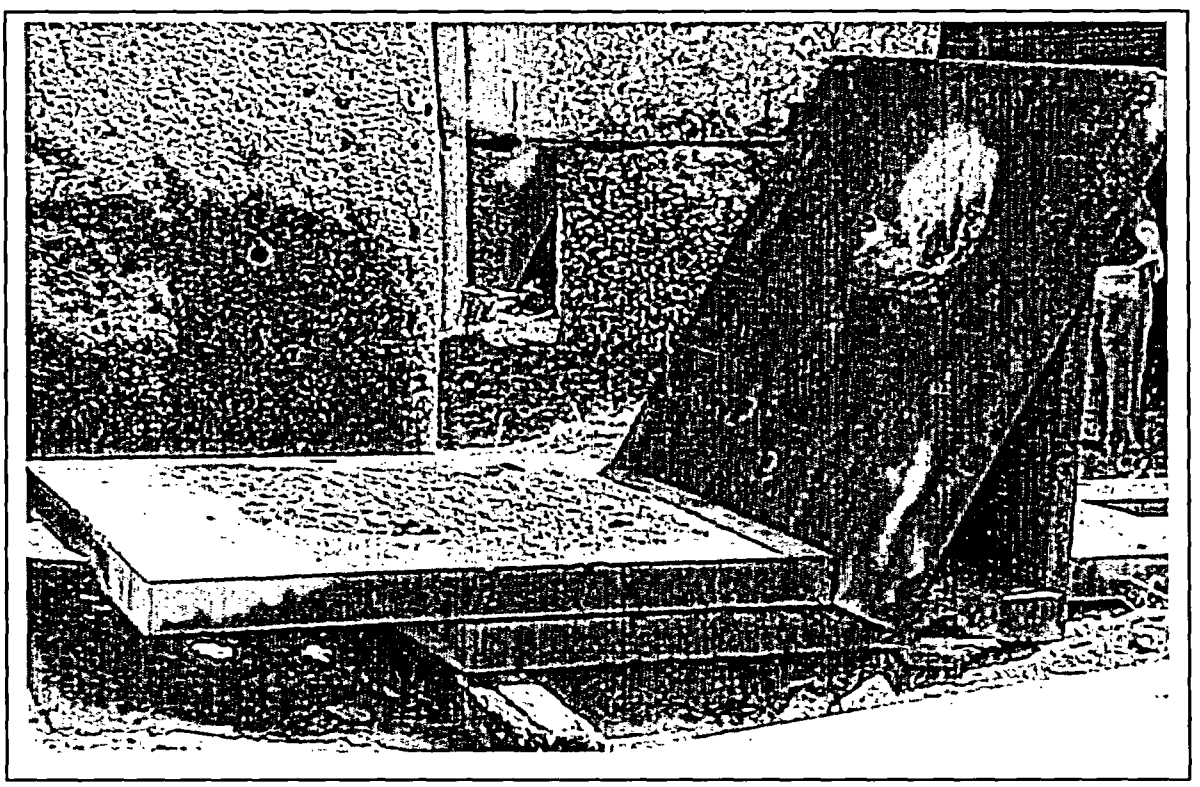


Gun Mount Slots 9372

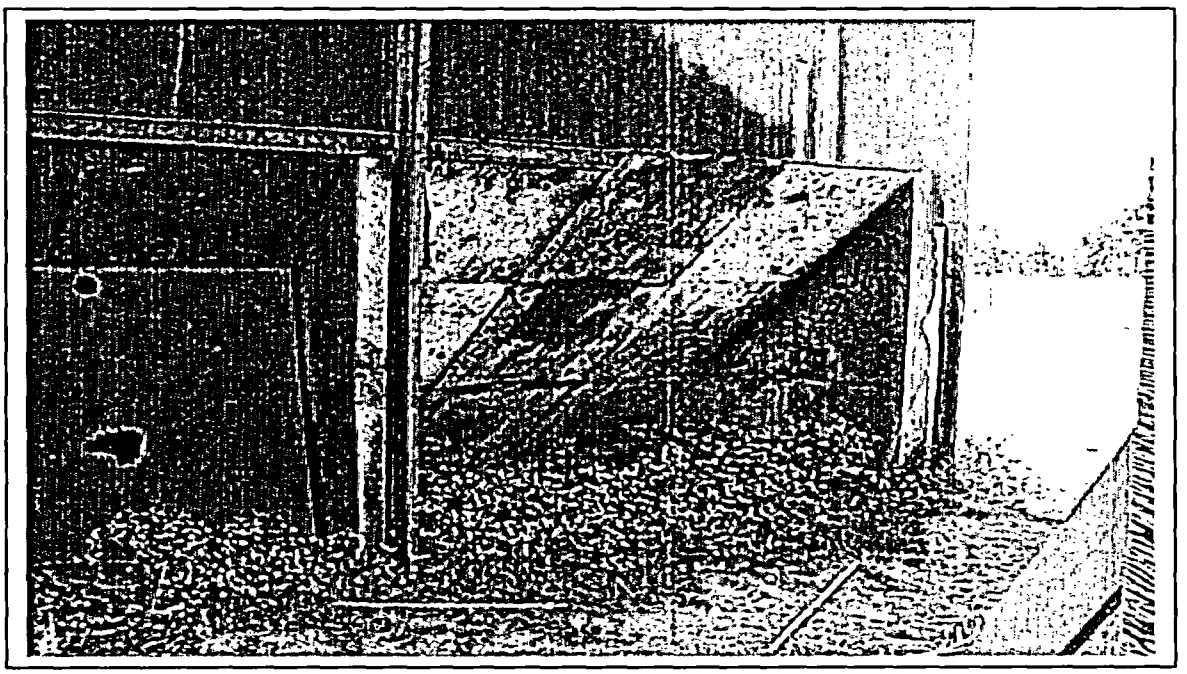


View Looking Down Range

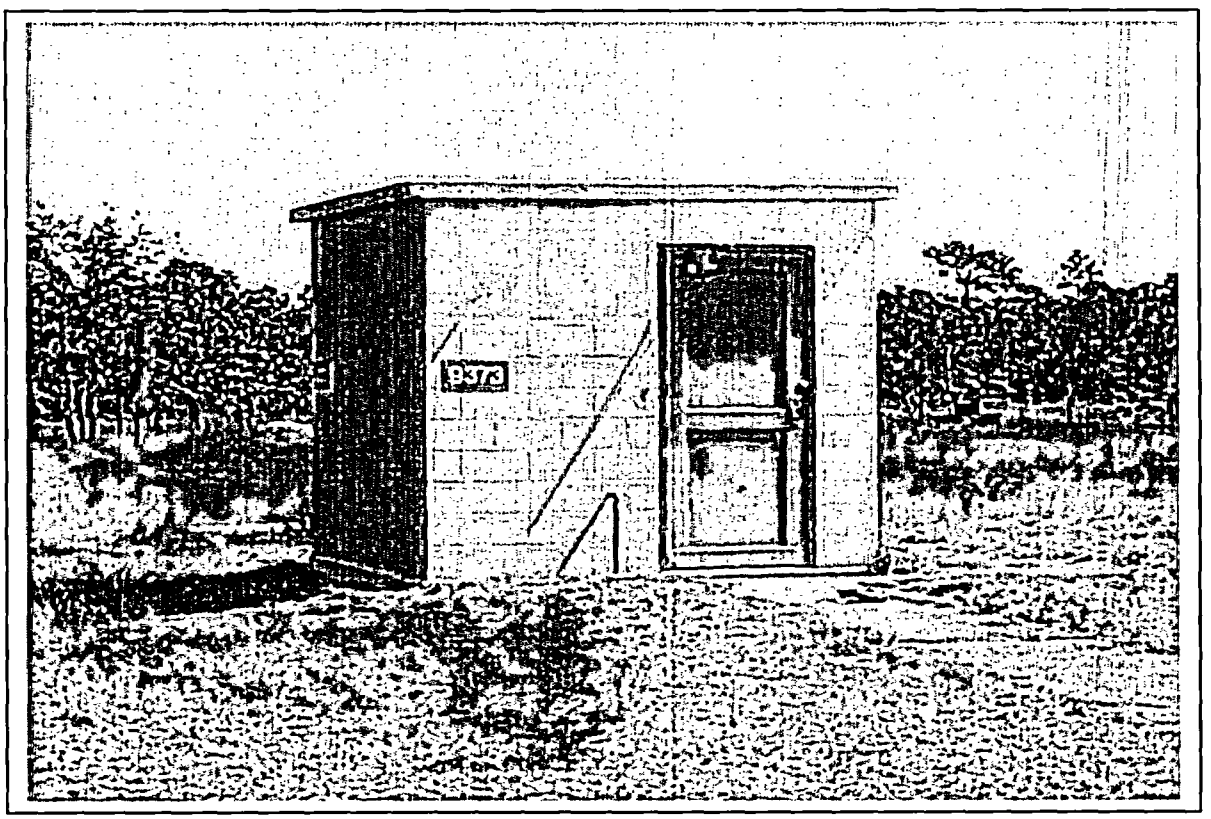
Drain Outfall



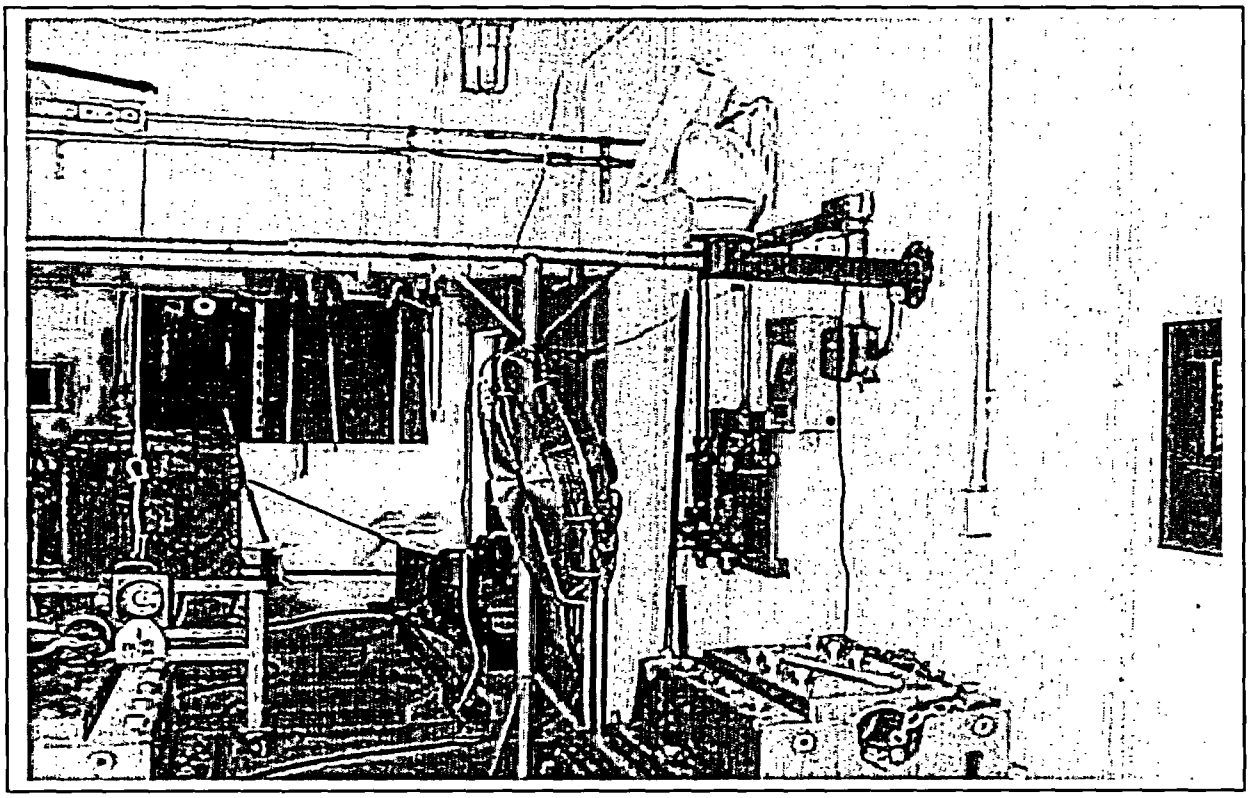
Targets and Blocks



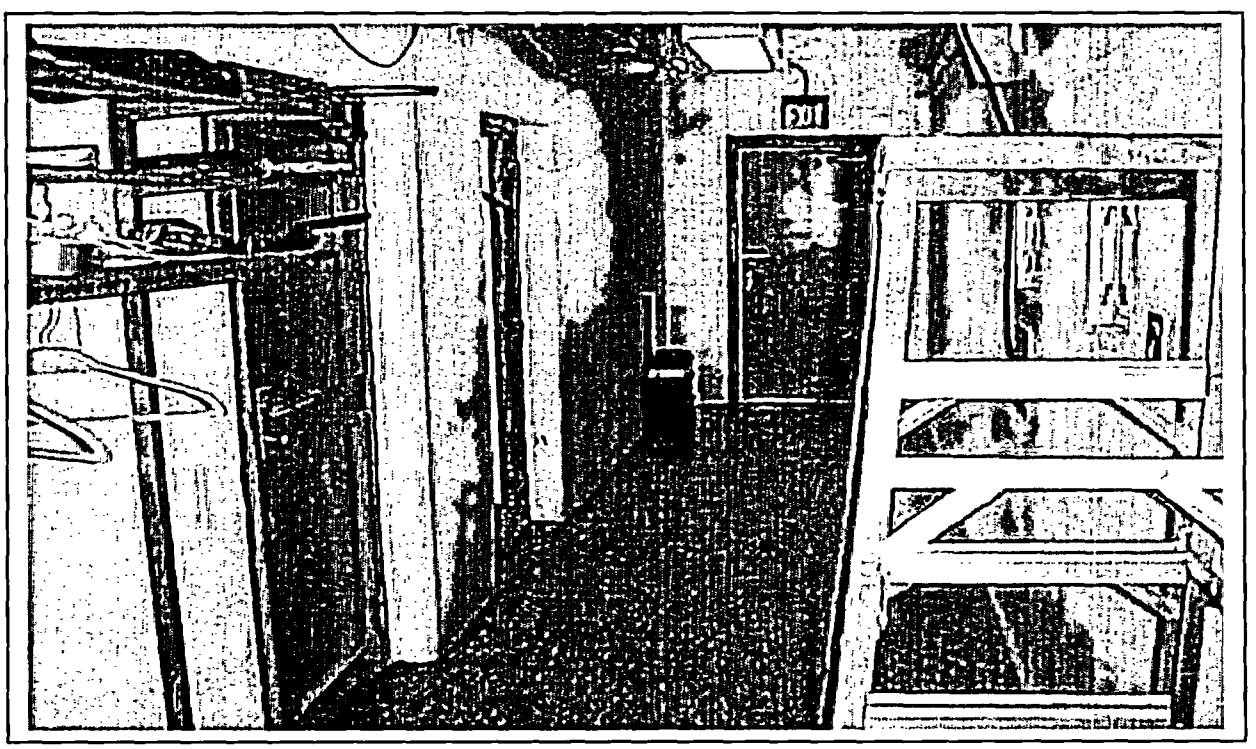
Catch Box



Building 9373



Inside of Gun Bays



Inside of 9372

APPENDIX C

EXAMPLES OF FORMS, QC, AND DATA PRESENTATION

CONTAMINATION/RADIATION SURVEY REPORT	PROJECT NUMBER	DATE:	TIME START	TIME COMPLETE	PAGE ____ OF ____
LOCATION:	SURVEYOR				
	SURVEY NUMBER:				
	MAP ID:				

PERMISSIBLE LEVELS	
Loose _____ dpm/100cm² Alpha	_____ dpm/100cm² Beta-Gamma
Total _____ dpm/100cm² Alpha	_____ dpm/100cm² Beta-Gamma

Γ OTHER (SEE COMMENTS)

Γ NO ACTION REQUIRED

Source Check Data	Contamination Surveys				Radiation Surveys
	α (LOOSE)	α (TOTAL)	β-γ (LOOSE)	β-γ (TOTAL)	Beta-Gamma
Instrument					
Source Type and I.D.					
Source Strength in dpm					µCi
Efficiency					
MDA in dpm/100 cm²					
Background in cpm					mrem/hr or µrem/hr

REASON FOR SURVEY

Γ PROCEDURE-NO. _____

Γ SPECIAL _____

Γ ROUTINE _____

Contamination Γ By Shift Γ Daily Γ Weekly Γ Monthly Γ

Radiation Γ By Shift Γ Daily Γ Weekly Γ Monthly Γ

COMMENTS:

Contamination Survey INSTRUMENT SERIAL #	ALPHA (LOOSE) /	BETA-GAMMA (LOOSE) /
	ALPHA (TOTAL) /	BETA-GAMMA (TOTAL) /
Radiation Survey INSTRUMENT SERIAL #	NEUTRON /	BETA-GAMMA /

Item or Location	Alpha Loose dpm/100cm²	Alpha Total dpm/100cm²	Beta-Gamma Loose dpm/100cm²	Beta-Gamma Total dpm/100cm²	Beta-Gamma mrem/hr Γ micro rem/hr Γ Neutron Γ
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

THE KNOWING & WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.

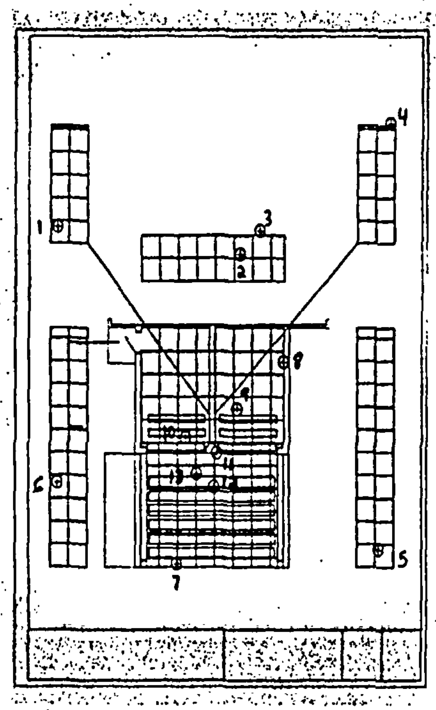
RADCON REVIEW _____ DATE _____

CONTAMINATION / RADIATION SURVEY REPORT (CONTINUATION SHEET)							PROJECT NUMBER			DATE		PAGE OF
LOCATION				SURVEYOR			COMMENTS					
				SURVEY NUMBER								
				MAP ID								
RADCON REVIEW _____ DATE _____												
	Alpha		Beta-Gamma		Beta-Gamma mrem/hr Γ microrem/hr Γ Neutron Γ	Item or Location		Alpha		Beta-Gamma		Beta-Gamma mrem/hr Γ micro rem/hr Γ Neutron Γ	Item or Location
	LOOSE	TOTAL	LOOSE	TOTAL				LOOSE	TOTAL	LOOSE	TOTAL		
Item #	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²			Item #	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²	dpm/ 100cm²		

THE KNOWING & WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.

Example of Survey Form

Eglin C-74L Survey
Gun Bays



Date ______________

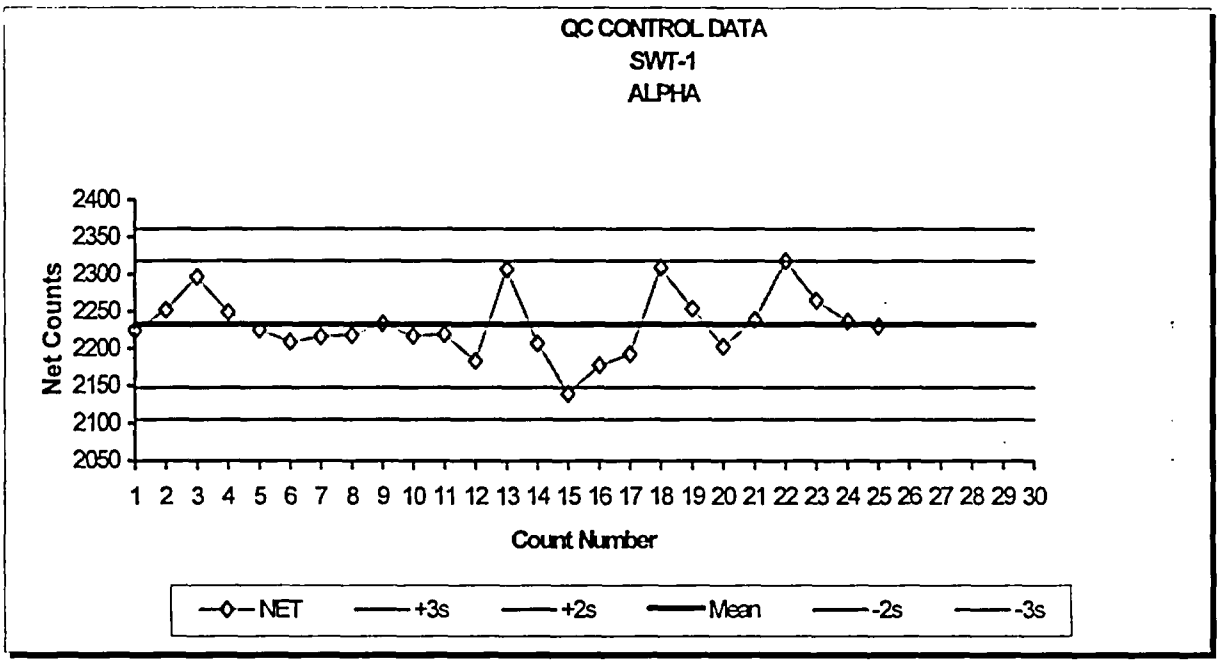
Survey Team Lead ______________________

Beta Instrument ______________ BK ________

Gamma Instrument ______________________

Alpha Instrument ______________ BK ________

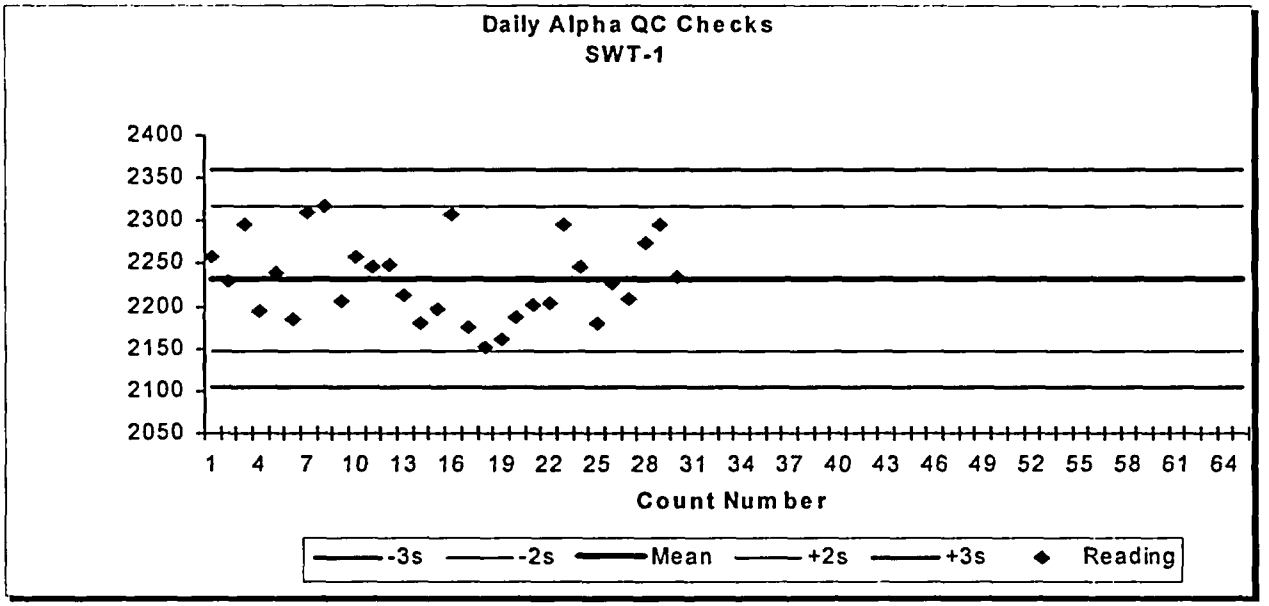
Sample	Alpha Lc ______ Eff. ______ Flag ______		Gamma Bk. ______ Flag ______		Beta Lc ______ Eff. ______ Flag ______		Sample Number and Remarks
L_d/MDA x/100cm²	cpm	dpm	uR/hr	Net	cpm	dpm	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							



Model:	2360	SN#	145468	PROBE	43-89	SN#	169229	Cal Due:	4May01
Source:	Th-230	SN#	220-0545	Activity:	12,200 dpm			Cal Date:	1Feb96
Mean	+2s		-2s		+3s:		-3s	Date:	30May00
2233	2318	to	2148	to	2361	to	2105	Efficiency:	0.183036

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	2226	2224	11	2221	2219	21	2241	2239	
2	2254	2252	12	2186	2184	22	2320	2318	
3	2299	2297	13	2309	2307	23	2267	2265	
4	2251	2249	14	2209	2207	24	2239	2237	
5	2228	2226	15	2142	2140	25	2233	2231	
6	2211	2209	16	2180	2178	26			
7	2218	2216	17	2195	2193	27			
8	2220	2218	18	2311	2309	28			
9	2236	2234	19	2256	2254	29			
10	2219	2217	20	2205	2203	30			
Bkgd:	2	cpm	Mean:	2233	cpm	2sigma:	85 cpm	3sigma:	127 cpm

Example of Instrument QC chart set up sheet.



Daily Alpha Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	30May00	2260	1	2259	2231	2	2229	NU		#####
2	31May00	2299	4	2295	2196	1	2195	NU		#####
3	1Jun00	2240	0	2240	2187	3	2184	NU		#####
4	2Jun00	2313	2	2311	2318	0	2318			0
5	3Jun00	2208	1	2207	2257	0	2257	2249	2	2247
6	5Jun00	2251	2	2249	2214	2	2212			0
7	6Jun00	2180	1	2179	2197	1	2196	2309	2	2307
8	6Jun00	2177	1	2176			0			0
9	7Jun00	2152	0	2152	2164	3	2161	2188	1	2187
10	8Jun00	2203	1	2202	2204	1	2203	2300	3	2297
11	9Jun00	2248	2	2246	2179	0	2179			0
12	12Jun00	2229	2	2227			0			0
13	13Jun00	2209	0	2209	2276	2	2274	2297	0	2297
14	14Jun00	2235	0	2235			0			0
15	15Jun00			0			0			0
16	16Jun00			0			0			0
17	17Jun00			0			0			0
18	18Jun00			0			0			0
19	19Jun00			0			0			0
20	20Jun00			0			0			0
21	21Jun00			0			0			0

NU = Not Used
NA = Not Applicable

Example of Field Instrument QC Checks

US ArmyCorps of Engineers
Tulsa District

Chain of Custody Record

Page of Date:

NAME: David Hays
ADDRESS: 1645 South 101st East Avenue
Tulsa, Oklahoma 74128
PHONE NUMBER: Off: (918) 669-4966 Fax: (918) 669-7569
PROJECT MANAGER: David Hays
PROJECT NAME: Eglin AFB Radiological Survey
CONTRACT/JOB #: N/A
SAMPLER (SIGNATURE): (PRINTED NAME) Hans Honerlah

LABORATORY NAME: Outreach Radioanalytical Laboratory
ADDRESS: Broken Arrow, OK 74012
PHONE NUMBER: (918) 251-2515
CONTACT NAME: Donna

Field Sample ID #	SDG #	Date	Time	Site ID	Station	Depth	Matrix	Requested Parameters: Gross Alpha	Gross Beta											OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
Gunbay-1	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-2	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-3	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-4	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-5	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-6	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-7	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-8	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-9	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-10	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-11	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-12	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-13	N/A	4/8/02		Eglin		N/A	wipe	X	X											
Gunbay-14	N/A	4/8/02		Eglin		N/A	wipe	X	X											

Relinquished by:	Date	Received by:	Date
Signature		Signature	
Printed Name	Time	Printed Name	Time
Company USACE		Company	
Relinquished by:	Date	Received by:	Date
Signature		Signature	
Printed Name	Time	Printed Name	Time
Company		Company	

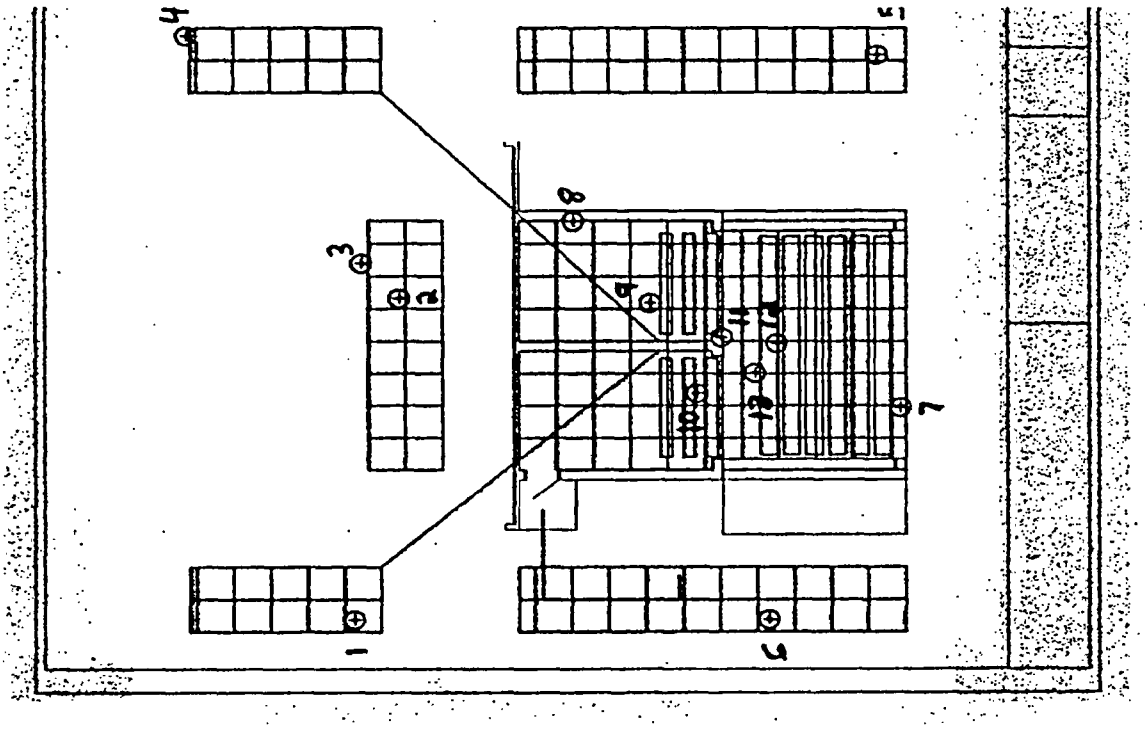
Total Number of Containers:

# of containers this pg.: 1
Shipment Method: Federal Express
Airbill No.: 814774189912

NOTES:
District POC: Dave Hays REQUEST
GROSS ALPHA MDA < 10dpm; REQUEST
GROSS Beta MDA < 20dpm

SAMPLING EVENT NAME:
Eglin AFB Radiological Survey

Example COC



Building 9372, Gun Bays

Example of data report

Date: 01-Jun-00

LOCATION CODE	MONITORING Alpha					Beta			NO.
(Units =>)	dpm/100 cm^2								
(Bkgd =>)	94.4	9110	19.0	0.1		1.2			
(MDC =>)	58	1054	-	9.6		16			
1	20	544	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-1
2	9	320	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-2
3	7	420	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-3
4	4	384	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-4
5	2	48	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-5
6	2	264	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-6
7	13	76	-1	A	+/- 0.0	B	+/- 0.0	Pass	Gun-7
8	-2	-120	-1	A	+/- 0.0	B	+/- 0.0	Pass	Gun-8
9	31	-104	-1	A	+/- 0.0	B	+/- 0.0	Pass	Gun-9
10	40	-4	0	A	+/- 0.0	B	+/- 0.0	Pass	Gun-10
11	47	128	-2	A	+/- 0.0	B	+/- 0.0	Pass	Gun-11
12	29	-156	-3	A	+/- 0.0	B	+/- 0.0	Pass	Gun-12
13	18	336	-1	A	+/- 0.0	B	+/- 0.0	Pass	Gun-13
14-Blank	NA	NA	NA	A	+/- 0.0	B	+/- 0.0	Pass	Gun-14

A = Alpha analysis result is less than the minimum detectable conentration. MDC less than 10 dpm.

B = Beta analysis result is less than the minimum detectable conentration. MDC less than 20 dpm.

* = Comparison of result to the criteria of 10% of the DCGL action level.

Location 13 is a duplicate of Location #5.

APPENDIX D

CALCULATIONS

1. **CE-Eglin-001, Derivation of Depleted Uranium DCGL from NRC Screening Values**
2. **CE-Eglin-002, Demonstration of MDC for Eglin Building Survey**

CALCULATION SHEET

CLIENT & PROJECT **USAF** **US Army Corps of Engineers – Omaha District** **Building Survey and Decommissioning, Eglin Air Force Base, FL.**	PAGE 1 OF 5
CALCULATION TITLE **CE-Eglin-001, Derivation of Depleted Uranium DCGL from NRC Screening Values**	QA CATEGORY (✓) I NUCLEAR SAFETY RELATED ☐ II ☐ III ☐ (other)

CALCULATION IDENTIFICATION NUMBER				
JOB ORDER NO.	DISCIPLINE	CURRENT CALC NO	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE NO.
NA	HP-FSS	CE-Eglin-001		N/A

APPROVALS – SIGNATURE & DATE			REV. NO. OR NEW CALC NO.	SUPERSEDES CALC NO. OR REV NO.	CONFIRMATION REQUIRED ☑	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATES(S)	INDEPENDENT REVIEWER(S)/DATE(S)			YES	NO
David C. Hays, USACE	Hans Honerlah, USACE Julie Peterson, USACE	Brian Hearty CHP, USACE	0 0	N/A N/A		

DISTRIBUTION

GROUP	NAME & LOCATION	COPY SENT (✓)	GROUP	NAME & LOCATION	COPY SENT (✓)
Project Manager Design Task Manager			Hans Honerlah Julie Peterson Brian Hearty	USACE, Baltimore USACE, HTRW CX USACE, HTRW CX	

CALCULATION IDENTIFICATION NUMBER				Page of 5
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-001		

RECORD OF REVISIONS

Revision 0 - Original Issue

1.0 INTRODUCTION

NUREG/CR-5512 (NRC 2001) provides screening values for Derived Concentration Guidelines (DCGL) based on calculations using the NRC D&D computer code. The DCGLs are provided for building surfaces in dpm/100 cm^2 by isotope. Since depleted uranium is comprised of U-235, U-238, and U-234 either a DCGL that accounts for the three is developed or each isotope must be measured independently.

2.0 OBJECTIVE

The objectives of this calculation are to:

- Compare the calculated DCGL from the approaches used to determine a DU DCGL, and
- Determine a DCGL for DU.

3.0 ASSUMPTIONS

This calculation is based on NUREG/CR-5512 screening values and the isotopic abundance of U-238, U-235, and U-234 in DOD DU as reported by the Army Environmental Policy Institute (AEPI 1995) or the assumptions incorporated in the ORISE computer code COMPASS.

4.0 METHODOLOGY

One method to determine a total DCGL would be to set the total DCGL as the lowest reported isotopic DCGL. Another method would be to establish a total DCGL based on the relative activity percentage of each isotope to the total. The latter method is chosen for this calculation. Two approaches to developing the total (DU) DCGL are presented here. First the Oak Ridge Institute for Science and Education (ORISE) computer code COMPASS was utilized to develop the DCGL, then the DCGL was hand calculated for a comparison.

The NUREG 5512, 90^{th} percentile screening DCGL used in this calculation are:

- U-238 = 101 dpm/100 cm^2
- U-235 = 98 dpm/100 cm^2
- U-234 = 91 dpm/100 cm^2

Lowest DCGL = 91 dpm/100 cm^2

CALCULATION IDENTIFICATION NUMBER				Page of 5
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-001		

COMPASS REPORT
DU DCGLw = 99 dpm/100 cm^2

Site Report

Depleted Uranium Summary

NOTE: Surface soil DCGLw units are pCi/g.
Building surface DCGLw units are dpm/100 cm².

Selected Method: Enter U-235 Weight Percent

U-235 Enrichment (weight %): 0.2

Radionuclide	Concentration (pCi/g)
U-234	21
U-235	1
U-238	77.6

	Surface Soil	Building Surface
U-234 DCGLw	N/A	91
U-235 DCGLw	N/A	98
U-238 DCGLw	N/A	101
Modified U-238 DCGLw	N/A	N/A
Total U DCGLw	N/A	99

Series Summary

Series	Radionuclide	Emission	Avg. Beta Energy (keV)	Yield
DU	U-234	Alpha	N/A	0.2108
	U-235	Alpha	N/A	0.01
	Th-231	Beta	76.4	0.01
	U-238	Alpha	N/A	0.7791
	Th-234	Beta	43.5	0.7791
	Pa-234m	Beta	819	0.7791

CALCULATION IDENTIFICATION NUMBER				Page of 5
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-001		

Uranium is a naturally occurring radioactive isotope. DU is uranium that has been separated from the other naturally occurring members of the uranium and actinium decay series and depleted of U-234 and U-235. In natural uranium, the U-234, U-235, and U-238 isotopes are present in their naturally occurring ratios, while this ratio has been altered in DU. The naturally occurring activity ratios of U-234/U-235/U-238 to U-238 are 1.0/0.047/1.0, respectively (AEPI 1995). The DU activity ratios of U-234/U-235/U-238 to U-238 are 0.18/0.013/1.0, respectively (AEPI 1995). The activity of a gram (g) of DU is approximately 0.4 micro-curies (uCi) (AEPI 1995). Thus the activity in 1g of DU is comprised of 0.052 uCi of U-234; 0.0052 uCi of U-235 and 0.348 uCi of U-238.

Since DU is comprised of approximately 99.8% U-238, 0.001% U-234, and 0.2% U-235 by weight and the NUREG/CR-5512 values are isotope specific, the DU value is derived from the activity ratios of U-238, U-235, and U-234 in DU of 83.2%, 15.7%, and 1.1% respectively.

$$DU\ DCGLw = (DCGL_{U\text{-}238})(\%\ U\text{-}238_{DU}) + (DCGL_{U\text{-}235})(\%\ U\text{-}235_{DU}) + (DCGL_{U\text{-}234})(\%\ U\text{-}234_{DU})$$

$$DU\ DCGLw = (101\ dpm/100\ cm^2)(.832) + (91\ dpm/100\ cm^2)(.157) + (98\ dpm/100\ cm^2)(.011)$$

$$DU\ DCGLw = 99.4\ dpm/100\ cm^2$$

Hand Calculation Method DU DCGLw = 100 dpm/100 cm^2 (rounding to 99 may be more appropriate)

Test of method using Sum of Ratios and a total DU result of 100 dpm/100 cm^2

$$SOR = \frac{(DU\ dpm/100\ cm^2)(\%\ U\text{-}238_{DU})}{(DCGL_{U\text{-}238})} + \frac{(DU\ dpm/100\ cm^2)(\%\ U\text{-}235_{DU})}{(DCGL_{U\text{-}235})} + \frac{(DU\ dpm/100\ cm^2)(\%\ U\text{-}234_{DU})}{(DCGL_{U\text{-}234})}$$

$$SOR = \frac{(100\ dpm/100\ cm^2)(0.83)}{(101\ dpm/100\ cm^2)} + \frac{(100\ dpm/100\ cm^2)(0.01)}{(98\ dpm/100\ cm^2)} + \frac{(100\ dpm/100\ cm^2)(0.15)}{(91\ dpm/100\ cm^2)}$$

SOR = 1

5.0 SUMMARY OF RESULTS

There is no significant difference in calculated DU DCGLw from either the COMPASS software or the hand calculated method. The conservative approach of choosing the lowest value results in a DCGLw for DU approximately 10% less than the other methods.

The DU DCGLw best utilized for the Eglin building surveys is 99 dpm/100 cm^2

CALCULATION IDENTIFICATION NUMBER				Page of 5
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-001		

6.0 REFERENCES

(AEPI 1995) *Health and Environmental Consequences of Depleted Uranium Use in the U.S. Army: Technical Report*, U.S. Army Environmental Policy Institute, June, 1995

(NRC 2000a) NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), U.S. Nuclear Regulatory Commission, dated August 2000

(NRC 2000b) NUREG-1727, *NMSS Decommissioning Standard Review Plan*, U.S. Nuclear Regulatory Commission, dated September 2000

(NRC 2001) NUREG/CR-5512 Vol. 3, SAND96-XXXX, *Residual Radioactive Contamination From Decommissioning*, Parameter Analysis, 2001

(ORISE 2001) *COMPASS version 1.0*, Computer Code, Oak Ridge Institute for Science and Education, 2001.

7.0 ATTACHMENTS

None

USACE – SWT- SO HEALTH PHYSICS

CALCULATION SHEET

CLIENT & PROJECT **USAF** **US Army Corps of Engineers – Omaha District** **Building Survey and Decommissioning, Eglin Air Force Base, FL.**	PAGE 1 OF 4
CALCULATION TITLE **CE-Eglin-002, Demonstration of MDC for Eglin Building Survey**	QA CATEGORY (✓) I NUCLEAR SAFETY RELATED ☐ II ☐ III ☐ (other)

CALCULATION IDENTIFICATION NUMBER				
JOB ORDER NO.	DISCIPLINE	CURRENT CALC NO	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE NO.
NA	**HP-FSS**	**CE-Eglin-002**		N/A

APPROVALS – SIGNATURE & DATE			REV. NO. OR NEW CALC NO.	SUPERSEDES CALC NO. OR REV NO.	CONFIRMATION REQUIRED ☑	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATES(S)	INDEPENDENT REVIEWER(S)/DATE(S)			YES	NO
David C. Hays, USACE	Hans Honerlah, USACE Julie Peterson, USACE	Brian Hearty CHP, USACE	0 0	N/A N/A		

DISTRIBUTION

GROUP	NAME & LOCATION	COPY SENT (✓)	GROUP	NAME & LOCATION	COPY SENT (✓)
Project Manager Design Task Manager			Hans Honerlah Julie Peterson Brian Hearty	USACE, Baltimore USACE, HTRW CX USACE, HTRW CX	

CALCULATION IDENTIFICATION NUMBER				Page 2 of 6
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-002		

RECORD OF REVISIONS

Revision 0 - Original Issue

1.0 INTRODUCTION

NUREG 1727, The Standard Review Plan for decommissioning plans requires that the NRC staff review the proposed survey methods to determine if the method is appropriate based on determination of the Minimal Detectable Concentration (MDC) being less than the DCGL. The licensee is expected to provide sufficient information in the plan to demonstrate this.

2.0 OBJECTIVE

The objective of this calculation is to estimate the priori MDC and demonstrate the adequacy of the expected survey method and instrumentation to be used during the Eglin AFB ballistics building surveys.

3.0 ASSUMPTIONS

This calculation is based on the following assumptions:

1) Of the building construction materials, concrete is the most prevalent and provides a typical gross alpha background of 0 to 4 cpm with an average of 2 cpm. These value fit well with the typical ZnS background on various materials (steel, drywall, wood) presented in NUREG 1507, except for ceramics.

2) The instrumentation to be used for gross alpha measurements is a Ludlum 2360 coupled to a Ludlum model 43-89 alpha/beta scintillation detector. The instruments alpha intrinsic efficiency is 0.4 (Ludlum 2001). Typical alpha background is less than 3 cpm and less than 1% beta to alpha cross talk (Ludlum 1998).

3) The ISO7503-1 alpha source efficiency of 0.25 (NRC 1998) will be used for calculations. NUREG 1507 lists typical source efficiency for distributed sources as 0.22 on steel, 0.54 on wood, and 0.43 on concrete, therefore 0.25 is assumed to be a conservative estimate.

4) The isotopic abundance of U-235, U-238, and U-234 result in a combined 1 alpha emission per dpm of depleted uranium (ORISE 2001).

4.0 METHODOLOGY

The approach used in this calculation is explained in MARSSIM chapter 6 (NRC 2000).

Critical Level Calculation

MARSSIM equation 6.6: Lc =

Where, Lc = critical level
B = Background counts expected in measurement

CALCULATION IDENTIFICATION NUMBER				Page 3 of 6
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-002		

1 min count time

$Lc = 2.33\sqrt{B}$

$Lc = 2.33\ \sqrt{2}$

Lc = 3.3 counts in 1 min

2 min count time

$Lc = 2.33\sqrt{B}$

$Lc = 2.33\ \sqrt{4}$

Lc = 4.66 counts in 2 min

Detection Limit Calculation

MARSSIM Equation 6-6. $Ld = 3 + 4.65\sqrt{B}$

Where, Ld = detection limit

1 min count time

$Ld = 3 + 4.65\sqrt{B}$

$Ld = 3 + 4.65\sqrt{2}$

Ld = 10 counts

2 min count time

$Ld = 3 + 4.65\sqrt{B}$

$Ld = 3 + 4.65\sqrt{4}$

Ld = 12 counts

MDC Calculation

MARSSIM Equation 6-7. MDC = C x Ld

Where C is used to convert from counts to concentration.

$$C = \frac{1}{(Ieff)(Seff)(A)(t)}$$

Given:

Ieff = Intrinsic efficiency = 0.4
Seff = Source efficiency = 0.25
A = Detector area /100 cm^2 = 1.25
t = count time in minutes

1 min count time

$$C = \frac{1}{(Ieff)(Seff)(A)(t)}$$

$$C = \frac{1}{(.4)(.25)(1.25)(1)}$$

C = 8 dpm/100 cm^2/count

2 min count time

$$C = \frac{1}{(Ieff)(Seff)(A)(t)}$$

$$C = \frac{1}{(.4)(.25)(1.25)(2)}$$

C = 4 dpm/100 cm^2/ count

1 min count time
MDC = C x Ld

MDC = (8 dpm/100 cm^2/count)(10counts)

MDC = 80 dpm/100 cm^2

2 min count time
MDC = C x Ld

MDC = (4 dpm/100 cm^2/count)(12counts)

MDC = 48 dpm/100 cm^2

Calculation Check

The ORISE computer code COMPASS was used to verify the hand calculations presented here. The output from COMPASS for DU and the same assumptions as in this calculation resulted in gross alpha MDCs of 79 and 51 dpm/100 cm^2 for count times of 1 and 2 minutes respectively.

5.0 SUMMARY OF RESULTS

The estimated MDC for gross alpha measurements and a 2 minute count time at Eglin AFB Ballistics building is 48 dpm/100 cm^2. This value is less than the expected DCGLw of 99 dpm/100 cm^2 and meets the suggested requirements of MARSSIM (50% of the DCGLw). Actual count time should be determined based on MDC calculations using actual field measurements of background materials.

6.0 SCAN MDC CALCULATIONS

MDC CALCULATIONS:

a) For Scan MDC calculations first scanning level of performance is:

- 95% true positive rate
- 60% false positive rate

b) Assume second stage pause length for scans is sufficient to insure that the first stage is more limiting.

EQUATION 1 (from equation 6-8 in MARSSIM)

$$S_i = d'\sqrt{b_i}$$

S_i= minimum detectable # of net counts in the observation interval.

d'= from Table 6.5 in MARSSIM based on a) above.

b_i = number of background counts in the interval.

EQUATION 2 (from equation 6-9 in MARSSIM)

$$MDCR = S_i \times (60/i)$$

MDCR = minimum detectable count rate.

S_i = from equation 1.

CALCULATION IDENTIFICATION NUMBER				Page 5 of 6
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-002		

EQUATION 3 (from "Scan MDCs for Land Areas" in MARSSIM)

$$MDCR_{surveyor} = \frac{MDRC}{\sqrt{p}}$$

$MDCR_{surveyor}$ = minimum detectable count rate of the surveyor

MDCR = from equation 2.

p = surveyor efficiency

EQUATION 3A (from "Scan MDCs for Land Areas" in MARSSIM)

$$MDER = \frac{MDCR_{surveyor}}{\text{exp}osure - rate - ratio}$$

MDER = minimum detectable exposure rate

$MDCR_{surveyor}$ = from equation 3.

Exposure-rate-ratio = cpm/μR/h = from Table 6.7 in MARSSIM.

EQUATION 4

$$MDC = \frac{3 + 4.65\sqrt{Br * t}}{t * E * \frac{A}{100}}$$

MDC = minimum detectable concentration.

Br = background counts.

t = count time.

E = efficiency of instrument.

A = area of probe.

EQUATION 5 (from "Scan MDCs for Buildings/Structure Surfaces" and equation 6-10 in MARSSIM)

$$_{Scan}MDC = \frac{MDRC}{\sqrt{p}E_i E_s \frac{probearea}{100cm^2}}$$

$_{scan}$MDC = minimum detectable concentration of scan.

MDCR surveyor = from equation 3.

E_i = instrument efficiency.

E_s = surveyor efficiency.

$\sqrt{p}$ = surveyor efficiency.

CALCULATION IDENTIFICATION NUMBER				Page 6 of 6
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
NA	HP-FSS	CE-Eglin-002		

EQUATION 6 (from formula 6-11 in MARSSIM)

$$_{Scan}MDC = \frac{(Conc)(MDER)}{X}$$

$_{scan}$MDC = from equation 5.

C_s = source concentration.

MDER = from equation 3A.

X = exposure rate from Michroshield™ computer code.

7.0 REFERENCES

(AEPI 1995) *Health and Environmental Consequences of Depleted Uranium Use in the U.S. Army: Technical Report*, U.S. Army Environmental Policy Institute, June, 1995

(Ludlum 1998) Instruction Manual, *Ludlum Model 43-89,43-90, and 44-116 Alpha/Beta Scintillators*, December 1998

(Ludlum 2001) Calibration Paperwork, *Bench Test Data for Detector Ludlum Model 43-89 SN 14546B*, dated 4 May 2000

(NRC 2000) NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), U.S. Nuclear Regulatory Commission, dated August 2000.

(NRC 2001) NUREG/CR-5512 Vol. 3, SAND96-XXXX, *Residual Radioactive Contamination From Decommissioning*, Parameter Analysis, U.S. Nuclear Regulatory Commission, dated 2001

(NRC 1998) NUREG 1507, *Minimal Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions,* U.S. Nuclear Regulatory Commission, dated June 1998.

(ORISE 2001) *COMPASS version 1.0*, Computer Code, Oak Ridge Institute for Science and Education, 2001.

8.0 ATTACHMENTS None

APPENDIX E

SUMMARY OF PLANNED SURVEYS AND TABLES OF CONTAMINATION LIMITS

USACE
SITE SURVEY UNIT PLAN

DATE: September 2002

SITE: Eglin AFB, Niceville, FL

PROJECT NUMBER: CESWT-SO-P1-01

POINT OF CONTACT: Dave Hays, Tulsa District

FACILITY: Building No. 9372, Gun Bays, Work Areas; Building No. 9373; Range Equipment

AREA CLASSIFICATION: 3

DCGL: Soil = 600 pCi/g
Interior Surface = 99 dpm/100 cm^2 alpha
Exterior Surface = 5000 dpm/100 cm^2 Alpha and Beta*
LBGR: 50% DCGL ESTIMATED sigma: 26 dpm/100 cm^2 alpha
ERRORS: Alpha = 0.05 Beta = 0.05

Remarks: Sample data from previously conducted scoping surveys are used to determine the number of samples for planning purposes. The actual number of samples will be changed if warranted based on reference area surveys (done during this survey).

* Exterior surveys will be professional judgment but for building exteriors we will take as many samples as required on the interior at a minimum.

DATA POINTS REQUIRED: 28 **N/2** = 14

AREA DIMENSIONS: multiple survey units

NUMBER OF GRIDS: NA random locations

RANDOM SAMPLES ABOVE 2 METERS: All samples selected randomly and will include above two meters in selection process.

HARD WIPES REQUIRED: 16 (one blank, one duplicate)

LS WIPES/VIALS REQUIRED: None

SURVEY UNIT GRAPHIC GENERATED: No

BACKGROUND LOCATION: Reference area selection September 2002

SAMPLING:

HARD WIPES: One per survey point
LS WIPES: Not applicable
GAMMA READING: One static reading per survey point
ALPHA AND BETA READINGS: One static reading/ survey point. Count time expected to be 1 to 2 minutes.
ALPHA AND BETA SCAN: Judgmental at least 10%
GAMMA SCAN: Judgmental, roofs, mount slots, pipe for drain, range

BIAS SAMPLING:
NUMBER OF SURVEY POINTS: 0
REMARKS: *Professional Judgment

RANDOM SAMPLING: Yes
NUMBER OF SURVEY POINTS: 14
REMARKS: Assign 14 total survey points

BUILDING MATERIAL SAMPLING REQUIRED: No

ENVIRONMENTAL SAMPLING REQUIRED: Yes, drain and outfall areas. 5 samples.

LABORATORY CONTACTED: Yes, wipe MDA alpha: 10 dpm; beta: 20 dpm

ISOTOPES OF CONCERN: DU (Uranium-238,235,234)

PROJECT TEAM LEADER **PROJECT OFFICER**

Table E-1. This table is excerpted from USACE EM 385-1-80 and is equivalent to USNRC Regulatory Guide 1.86.

Acceptable Surface Contamination Levels

NUCLIDE [a]	AVERAGE [b c] dpm/100 cm^2	MAXIMUM [b d] dpm/100 cm^2	REMOVABLE [b e] dpm/100 cm^2
U-nat, U-235, U-238 and associated decay products	5,000	15,000	1,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 [a]	15,000 [a]	1,000 [a]

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Table E-2. This table is excerpted from NUREG-5512, Vol.3 (Draft).

Table 4.6 - Concentration (dpm/100cm2) equivalent to 25 mrem/y for the specified value of Pcrit

Source	Pcrit=0.75	Pcrit=0.90	Pcrit=0.95
226Ra	1.43E+03	1.12E+03	1.01E+03
226Ra+C	4.05E+02	3.15E+02	2.85E+02
228Ra	2.71E+02	2.01E+02	1.79E+02
227Ac	2.46E+00	1.82E+00	1.61E+00
227Ac+C	2.46E+00	1.81E+00	1.61E+00
228Th	5.60E+01	4.14E+01	3.67E+01
228Th+C	5.60E+01	4.14E+01	3.67E+01
229Th	7.52E+00	5.55E+00	4.92E+00
229Th+C	7.52E+00	5.55E+00	4.92E+00
230Th	5.00E+01	3.69E+01	3.27E+01
230Th+C	4.44E+01	3.30E+01	2.93E+01
232Th	9.91E+00	7.31E+00	6.49E+00
232Th+C	8.17E+00	6.03E+00	5.35E+00
231Pa	1.17E+01	8.61E+00	7.64E+00
231Pa+C	2.03E+00	1.50E+00	1.33E+00
232U	2.29E+01	1.69E+01	1.50E+01
232U+C	1.61E+01	1.19E+01	1.06E+01
233U	1.20E+02	8.86E+01	7.86E+01
233U+C	6.76E+00	4.99E+00	4.43E+00
234U	1.23E+02	9.06E+01	8.04E+01
235U	1.32E+02	9.76E+01	8.66E+01
235U+C	2.00E+00	1.48E+00	1.31E+00
236U	1.30E+02	9.57E+01	8.49E+01
238U	1.37E+02	1.01E+02	8.99E+01
238U+C	2.64E+01	1.95E+01	1.74E+01
237Np	3.00E+01	2.21E+01	1.96E+01
237Np+C	5.36E+00	3.96E+00	3.51E+00
236Pu	1.23E+02	9.10E+01	8.07E+01
238Pu	4.15E+01	3.06E+01	2.72E+01

APPENDIX F

FINAL STATUS SURVEY DATA QUALITY OBJECTIVES

1. DATA QUALITY OBJECTIVES

Data quality objectives are developed following the process outlined in MARSSIM chapter 3 and Appendix D.

The DQOs for the building and target area surveys are summarized below. Specifically, the 7 step process to developing DQOs is followed.

1. **State the Problem**: The problem is the potential presence of residual radioactive material on Test Area C-74L building surfaces and target area structures, from former operations involving depleted uranium. The objective of the surveys is to obtain data of sufficient quality and quantity to support an unrestricted release of the building and target area materials.

    - Planning team consists of the Eglin LLRM Partnering team, USAF, and USACE.
    - The primary decision maker for the buildings and target area survey is the USAF.
    - USACE and the USAF have sufficient resources to complete the surveys.

2. **Identify the decision**:

    - The principal study question is: Do DU concentrations inside/outside buildings or on equipment exceed background by more than the appropriate derived concentration levels (DCGL)?
    - The following decision statements should be evaluated sequentially. If concentrations do not exceed the DCGLs, the release criterion is satisfied.
        1. Determine whether the survey unit DU surface concentrations (dpm/100cm^2) exceed background by more than the appropriate DCGL.
        2. If survey unit concentrations exceed background by more than the DCGL should remedial alternatives be considered.
        3. Recommend what survey units or areas should be remediated.

3. **Identify Inputs to the decision**: Several site characteristics must be determined to resolve the decision statements.

    - Concentrations of DU in the survey units or on equipment. This information will allow determination as to whether or not a survey unit is likely to be suitable for release. Obtaining this data will facilitate cost effective decision-making.

    - Concentrations of DU in non-impacted materials the survey units or on equipment. This information will be needed if there is an indication that background levels of alpha/beta emissions from a particular building material are a significant relative to the DCGL.

- External exposure and count rates. This information will be used to qualitatively determine if further investigations or remediation may be required.

4. **Define study boundaries:**

   - The population of interest is the areal concentration of depleted uranium on building and equipment surfaces. This will be subdivided geographically by the use of survey units.
   - The spatial boundaries of the surveys are limited to: the ballistics building floors, walls below 2 meters, and air handling system; the exterior surfaces of the ballistics (to include the asphalt/concrete pads) and well house buildings; and the target area catch box structure surfaces. Note: Accessible soils within one meter of potentially impacted structures will be scanned.
   - The decision applies to the time of the survey and for the future as long as the facility does not utilize radioactive materials. Data collection should be conducted based on project schedule and in coordination with the installation support of testing.
   - Decisions will be made for the building survey units and the target area equipment.
   - Constraints on data collection include site operations (testing), weather in target areas (outdoors, wet materials will impact readings), target material surfaces (extremely rough or jagged surfaces may limit data collection).

5. **Develop a Decision Rule:**

   - Parameters of interest are the mean, median, and standard deviation of data collected. Based on distribution characteristics from data collection, the parameters may be transformed to allow for statistical testing (log-normal, parametric, non-parametric).
   - Decisions are based on the DCGL presented for each area (99 dpm/100cm2 total uranium for interior building surfaces, 5,000 dpm/100cm2 total uranium for equipment, and 600 pCi/g for any soil samples obtained).
   - Decisions are made based on the piece of equipment, the surveys units, the building and the combination of the building and target area materials. In cases where contamination above the criteria are clearly indicated, decisions on remediation, reclassification, survey unit subdivision, etc., may be taken as appropriate.
   - Inputs to the decisions are:
     - Survey unit dimensions
     - Surface alpha, beta, and gamma scans (pipes, equipment, slots, survey units)
     - Integrated surface alpha measurements
     - Wipe samples
     - Soil samples where appropriate
   - Decision rules

- Survey unit dimensions: If the measured dimensions exceed the MARSSIM recommended size the boundaries will be adjusted accordingly.
- Scans: Areas that exhibit elevated scan readings will be marked for further investigation (integrated readings and wipe samples), consideration, or remediation (pipes). These data are evaluated qualitatively.
- Integrated surface alpha measurements;
  - If all measurements are less than the DCGL the survey unit is deemed to meet the release criteria.
  - If a measurement on a building surface exceeds the DCGL, it will be investigated and could require survey unit reclassification, subdivision, and/or remediation.
  - If any measurement on an equipment surface exceeds the DCGL, it will be investigated and could require survey unit reclassification, subdivision, and/or remediation.
- Wipe samples: If results of wipe samples indicate greater than 10% of the building DCGL or 20% of the equipment DCGL is removable an evaluation of the DCGL is required.

6. **Specify limits on decision errors:** Statistical acceptability decisions are always subject to error. Two error types are associated with the decisions.

   - Type 1: The null hypothesis is rejected when true. This error could result in potential doses to the critical receptors greater than prescribed by the DCGL. The maximum Type I error rate is set at 0.05.
   - Type 2: Null hypothesis is not rejected when it is false. This error results in increased costs due to re-surveying, remediation, etc., when it is not necessary. The maximum Type II error rate is set at 0.05.

7. **Optimize the Design:** The survey design will continually be optimized as the plans are reviewed and edited.

APPENDIX G
SITE SAFETY AND HEALTH PLAN
Eglin AFB, FL

Site Name: RW-41, Test Area C-74L

Version: [x] Original [ ] Revision/Date:

Prepared by: David Hays, Health Physicist

Affiliation: Tulsa District Corps of Engineers

Address/Phone: CESWT-SO, 1645 S. 101st E. Ave, Tulsa, OK, 74128

Signature/Date:

Reviewer Signature/Date: Hans Honerlah

Title/Affiliation: USACE, Health Physicist

Reviewer Signature/Date: Mike Kerr

Title/Affiliation: IH, USACE

SSHO:

Signature/Date:

1. Site Description and Contamination Characterization.

a. Site Description

SITE LOCATION	APPROXIMATE SIZE
Eglin AFB, FL	Inside buildings and within range
TOPOGRAPHY	**SITE USES**
( )Forested (x)Open Terrain ( )Lake, Pond ( )Wetland ( )Grassland ( ) Arid ( )Hilly ( )Tillage (X)Other_Building	( )Rural ( )Urban ( )Ag Business ( )Commercial ( )Farming ( )Industrial ( )Ranching ( )Mining (X)Military ( )Residential ( )Government ( )Recreational (X)Other _Munitions test____

b. Site History.

The following background information has been compiled from previous investigations performed at Test Area C-74L Gunnery Ballistic Facility and a literature survey report generated by USACE, St. Louis District entitled *Low-Level Radioactive Material Eglin AFB Archives Search Report* (USACE, 1999). Test Area C-74L Gunnery Ballistics Facility is an active facility comprised of two gun bays used to test the damage potential and terminal ballistics of various ammunitions (Becker and others, 1994). The test area has been in operation since at least 1963 as a gunnery ballistics facility. From late 1974 to 1978, Test Area C-74L was used for pre-production testing of the GAU-8 gun system, which uses DU in the ammunition. An estimated 16,315 pounds (7,400 kilograms [Kg]) of DU was expended at Test Area C-74L. In late 1978, all testing involving DU was transferred to Test Area C-64, and the mission at C-74L was changed to include the firing of incendiary and high explosive munitions.

Eglin has performed environmental work from 1976 through 1991 at the site to evaluate the impact of DU on site soils and groundwater, as well as nearby sediment and surface water. In 1980, limited DU fragment excavation was performed within the approach gun corridor leading from the gun bay building to and including the target butt (Becker and others, 1990; Becker and others, 1994).

NOTE: THE INSTALLATION HAS PREPARED A *BASEWIDE HEALTH AND SAFETY PLAN, ADDENDUM NO. 1, LOW-LEVEL RADIOACTIVE MATERIALS, SITE INVESTIGATIONS;* THIS PLAN WILL BE DISCUSSED IN PRE-WORK BRIEFINGS AND WILL BE ONSITE DURING SURVEYS AS IT IS CONSIDERED PART OF THIS SSHP.

c. Contamination Characterization

CONTAMINANT LISTING				
Name	Conc. Range	Media: Air Water, Soil	Location	Quantity Expected
Radiation	Background to microR/hr	Structure surfaces	Site buildings Target Area	Background
Depleted Uranium,	Background to microcurie	Structure surfaces	Site buildings Target Area	Background

ORDNANCE CONTAMINATION			
Type	Amount	Location	Surface/ Subsurface
30 mm, HE, DU, Incendiary	Fragments	Surface soils (0-6 inches) and subsurface soils (below 6 inches)	Surface off the approach corridor Suburface on the approach corridor

Strict adherence to the installation fire safety guidance is required.

2. **Hazard/Risk Analysis:**

a. Tasks to be performed:

1. Sampling of structures
2. Laboratory sample collection and preparation (wipes and soil)
3. Administrative type tasks

Task #	HAZARDS: Safety, Chemical, Physical, Radiological, Biological, UXO (See Below)	ACTION LEVELS: (See Below)
1-3	Walking, trips, falls	None
1	UXO	Visible
1-2	Radiation exposure, DU	5 mR/hr @ 30 cm

Depleted Uranium is believed to be present in fragments. DU emits ionizing radiation in the form of photons and particles. DU is primarily an internal hazard due to radiation and its chemical toxicity. Previous remediations at the site have reduced exposures pathways. Scoping surveys conducted in Oct 2001 failed to identify levels of DU greater than the action level of 5 mR/hr at 30 cm. Previous survey work has also led the USAF to conclude that respiratory

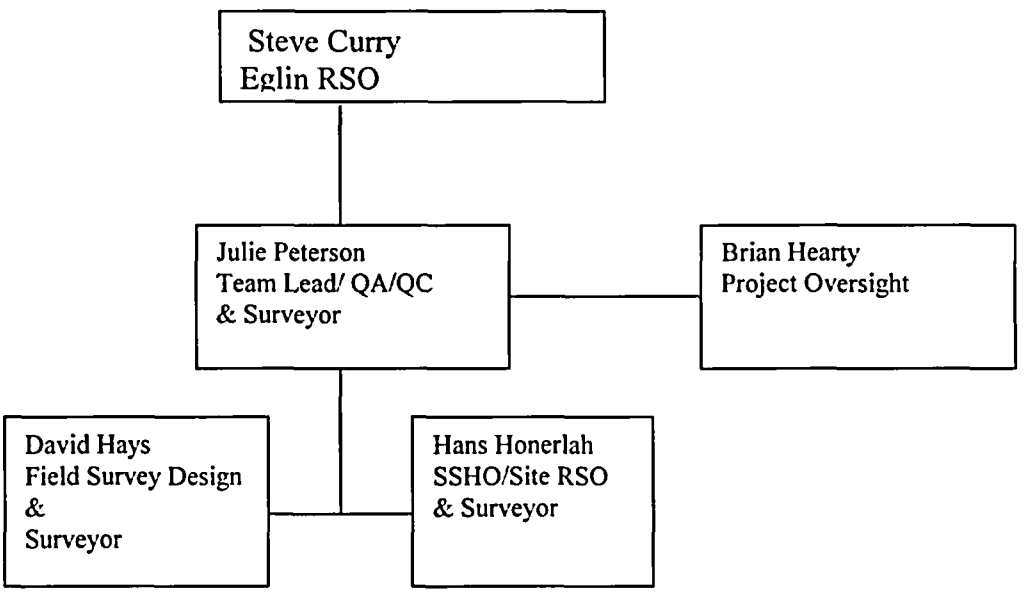
protection from DU is not necessary at this site for normal activities. Nuisance dusts will not be generated by the survey effort and wind blown dusts should be minimal due to the range asphalt and clay/sand base.

3. Staff Organization, Qualifications, and Responsibilities.

TITLE	NAME	RESPONSIBILITY	PHONE NO.
Qualified IH	Mike Kerr	Plan approval	918-669-4968
Team Lead	Julie Peterson	Site survey control	402-697-2592 402-203-6300 (cell)
SSHO/Site RSO	Hans Honerlah	On-site S&H authority	410-962-9184 402-207-4822 (cell)
CPR/First Aid	Dave Hays	Response	918-669-4966 918-605-8398 (cell)
CPR/First Aid	Hans Honerlah	Response	410-962-9184 402-207-4822 (cell)
Physician	Local hospital	Emergency response	See emergency plan **para 15**

Note: Three person team with a few site visitors expected. Safety team reports to the installation RSO, Steve Curry

Org. Chart for Field Effort



4. **Training.**

NAME	TYPE: 40-Hr/Rfshr/Suprv	PPE	SITE HAZARDS
David Hays	40 hr.// Rad Worker// 8-hr update, 8 hr supervisors	A,B,C,D	Registered Radiation Protection Technologist
Hans Honerlah	40 hr.// Rad Worker// 8-hr update, 8 hr supervisors	A,B,C,D	Certified HAZ MAT Manager
Julie Peterson	40 hr.// Rad Worker// 8-hr update, 8 hr supervisors, First aid/CPR	A,B,C,D	Certified Health Physicist
Brian Hearty	40 hr.// Rad Worker// 8-hr update, 8 hr supervisors, First aid/CPR	A,B,C,D	Certified Health Physicist

5. **Personal Protective Equipment.**

a. **Personal Protective Equipment (PPE) Program:** ***subject to SSHO site RSO Instructions--***

PPE Selection: **Level D**, radiological contaminants, hand work, should not create dust problems, ingestion from contaminated hands most likely route of entry.

PPE Use and Equipment Limitations: **No known atmospheric hazard;.**

Work Mission Duration: Less than 5 days.

PPE Maintenance and Storage:

1. Nitrile or Latex gloves will be free of holes/tears.

2. Eye protection will be clean and of appropriate shading for site conditions.

PPE Decontamination and Disposal: **SSHO/Site RSO Instructions**

PPE Training/Fitting: Gloves shall fit properly.

PPE Donning and Doffing: Gloves will be monitored with GM detector prior to removal and placing in plastic bag.

PPE Inspection: **Buddy System**

PPE Program Effectiveness: N/A; Level D only

PPE Temperature Limitations: Work is to be completed in early fall conditions and in level D, so temperature should not affect work.

b. Levels of Protection/Task:

Level D: A standard work uniform affording minimal protection, used for nuisance contamination only. The following constitute Level D equipment; it shall be used as specified below.

1. Coveralls\field work clothing
2. Gloves (optional)
3. Boots/shoes, Chemical-resistant steel toe and shank
4. Boots, outer, (Disposable)(optional)
5. Safety glasses or chemical splash goggles
6. Hard hat (optional)
7. Escape masks (optional)
8. Face shield (optional)
9. Disposable Work Clothing (optional)

TASK #	PPE
1	1,3,5
2	1,2,3,5
3	1

6. Medical Surveillance.

a. Medical surveillance program employee participation certification:
b. Note that some USACE Districts (Tulsa/Baltimore) are on 2 year cycles.

NAME	EXAM DATE
David Hays	2001
Hans Honerlah	2001
Julie Peterson	2001
Brian Hearty	2001

7. Dosimetry

a. Safety and health issues involving employees working within a **chemically restricted** area are beyond the scope of this SSHP.

b. Radiation Dosimetry: Exposures requiring dosimetry are not expected, however, personnel entering areas cordoned off with caution tape (i.e., survey areas) will wear Thermo Luminescent Dosimeters (TLD) and will utilize the US Army Ionizing Dosimetry Center (USAIRDC), Redstone Arsenal, AL for TLD analysis if instrumentation shows a potential for exposure.

c. Employee radiation exposure history: Maintained by USAIRDC.

d. Internal radioactive contamination exposure hazards are not expected due to the short duration and hand sampling methods of the project.

e. Reports of Exposure to Ionizing Radiation: Will be provided and maintained in accordance with 10 CFR 20, and Army regulations.

8. Exposure Monitoring/Air Sampling Program.

a. Air Monitoring/Air Sampling:NONE.

b. Real-time Screening for Ionizing Radiation: Will be performed.

c. Meteorological data: Early fall temperatures (66 to 88 degrees Fahrenheit), light winds, high humidity, and possible thundershowers. Work mainly indoors.

d. Noise monitoring: N/A. Equipment does not pose a noise hazard.

e. Monitoring/sampling results: Real time monitoring results will be recorded in the field logbook and will be performed onsite.

f. Exposure monitoring records: Real time monitoring results will be recorded in the field logbook. TLD results will be provided to site personnel by the USAIRDC.

9. Heat/Cold Stress Monitoring.

The buddy system shall be used to observe heat\cold stress symptoms. Arrangements shall be made to provide access to plain cool potable water.

10. Standard Operating Safety Procedures, Engineering Controls and Work Practices.

a. Site rules/prohibitions: **USE BUDDY SYSTEM; NO EATING, DRINKING, or SMOKING**

b. Work permit requirements: **NONE**

c. Material handling procedures: **DO NOT HANDLE CONTAMINATED SOILS, LIQUIDS, or RADIOACTIVE SOURCES with bare hands.** Utilize gloves, tweezers and tongs to the maximum extent while handling radioactive materials.

d. Drum/container handling procedures and precautions: Site currently does not contain drummed hazards.

e. Confined space entry procedures: **N/A Confined spaces will not be entered.**

f. Hot work, sources of ignition, fire protection/ prevention, and electrical safety: **AVOID ALL ELECTRICAL HAZARDS, NO SMOKING, AVOID SPARK PRODUCING OBJECTS...** Equipment does not pose a fire hazard.

g. Excavation and trench safety: **N/A-DO NOT ENTER**

h. Guarding of machinery and equipment: **N/A**

i. Lockout/Tagout: **N/A**

j. Fall protection: **NO STRUCTURAL CLIMBING, use of approved ladders to access roof. Will tie off if work near edge of roof.**

k. Hazard Communication: **MSDS's will be available for any hazardous materials brought onsite. All site personnel have completed HAZCOMM training.**

l. Illumination: **DAYLIGHT HOURS ONLY**

m. Sanitation: **USE ON-SITE/OFF-SITE FACILITIES**

n. Engineering controls: **N/A**

o. Process Systems Safety: **N/A**

p. Signs and labels: Areas cordoned off with caution tape will not require additional signage.

q. Ordnance Precautions. Ordnance is not expected, however, it can not be ruled out given the range use.

SPECIFIC ACTION TO BE TAKEN UPON LOCATING ORDNANCE

(1) DO NOT touch, move or jar any ordnance item, regardless of its apparent condition.

(2) **Approach the item cautiously,** take photographs and document a full description. Take notes of the markings or any other identifiers.

(3) DO NOT be misled by markings on the ordnance item stating "practice bomb", "dummy" or "inert". Even practice bombs have explosive charges that are used to mark/spot the point of impact; or the item could be mismarked.

(4) DO NOT roll the item over or scrape the item to identify the markings.

(5) The location of any ordnance items found during site investigation should be clearly marked so it can be easily located and avoided.

(6) NOTIFY Range Personnel immediately.

11. Site Control Measures.

a. Work areas and access points: All persons entering areas cordoned off with caution tape shall wear dosimetry and be scanned prior to leaving the area, see paragraph 12b.

b. Ionizing radiation restricted areas: The area cordoned off with caution tape will be a restricted area.

c. Site map delineating restricted areas will be generated prior beginning the project. Site maps are included at the end of this SSHP.

d. On-site and off-site communications

- On-site Communication: Oral with a contingency for hand signals as determined by the SSHO.

- Off-site Communication (Either on-site cellular phone or specified readily accessible on/off-site public or private phone): building phone system/cell phones/ radios subject to EAFB approval

e. Site security (physical and procedural):

- Physical Site Security: Doors will be locked when surveys are not being performed

- Procedural Site Security: Personnel will enter the range only from designated point and only with the permission of the SSHO.

f. General site access: The site is not public property and access is controlled by AF Security Police.

12. **Personal Hygiene and Decontamination.**

a. Necessary facilities and their locations:

- Personnel entering restricted areas should shower at their place of lodging at the end of the day. Contaminants onsite do not require emergency showers.

b. Decontamination SOPs: Personnel decontamination will be accomplished by removing the outer gloves and then monitoring personnel with appropriate radiation monitors; thin-end GM tubes will suffice for this requirement.

(1) If personnel clothing is found to be contaminated the clothing will be deconed by using tape to remove the contaminant and then remonitoring. If this fails to reduce the level of contamination then the article of clothing will be removed and sealed in a plastic bag for offsite decon or put in a radioactive waste container.

(2) If personnel are found to be contaminated baby wipes (damp cloth) will be used to wipe the contaminated areas. The areas will be monitored again and the process repeated. If on the 3rd attempt contamination still exists personnel will wash contaminated area with soap and water, and remonitor. It is important not to scrub the skin with abrasives as this could introduce the contaminant into the skin.

(3) Decon materials will be placed in a doubled garbage bag, labeled as radiologically contaminated materials, and transferred to C-64.

13. **Equipment Decontamination.**

a. Decontamination facilities/locations: Onsite, at restricted area boundary.

b. Decontamination procedures:

(1) After work is completed equipment will be monitored with field instruments. If found to be free of detectable contamination the equipment will be wipe tested and sealed in plastic bags until the laboratory analyzed wipe sample clears the equipment for reuse. During analysis time equipment will be held in the custody of the SSHO or other appropriate authority as determined by the SSHO.

(2) If field monitoring detects contamination on the equipment; tape will be utilized in an attempt to remove the contaminant. If this fails baby wipes will then be used. If this fails a determination will be made to either include the equipment as rad waste or to fix the contamination on the equipment (using tape), sealing the equipment in a double plastic bag, and shipping for decontamination.

(3) Decon materials will be placed in the rad waste container (double bag) and disposed of in accordance with the sampling plan.

14. Emergency Equipment and First Aid Requirements.

a. First aid equipment and supplies: Minor First Aid Kit

- Minimal,
- bandages for minor cuts and scratches
- tweezers
- Eye wash

b. Emergency eye washes/showers: **Squeeze bottles onsite.**

c. Emergency-use respirators: N/A

d. Spill control materials and equipment: N/A

e. Fire extinguishers: As specified according to size, type, and location:

- None, provided in site building

15. Emergency Response and Contingency Procedures (On-Site and Off-site).

a. Local fire/police/rescue pre-notification: Local authorities will be contacted prior to performing any intrusive work or entering restricted areas.

b. **Emergency Response Plan:**

(1) Pre-emergency planning and procedures for reporting incidents to appropriate government agencies: **(All incidents will be reported to Steve Curry by the SSHO).** SSHO will be notified of any injury or unsafe condition immediately.

(2) Personnel roles, lines of authority, communications:

- Personnel roles (See Paragraph 3): **Team Lead** -- Site control, real time monitoring, site access, emergency response, real time monitoring, decontamination
- Lines of Authority (See Paragraph 3):SSHO, Field team, Base RSO
- Communications (See Paragraph 11.d): oral and telephonic

(3) Posted instructions (route map attached) and list of emergency contacts:

Directions to Hospital: To reach Twin Cities Hospital from C-74L, travel on Range Road (RR) 213 to State Route (SR) 285 and turn right (south) on SR 285. Travel approximately 8 miles south on SR 285 to the intersection of SR 285 and College Blvd. Turn right (west) on College Blvd and travel approximately 2 miles to the intersection of College Blvd and Highway 85. Twin Cities Hospital is on the southwest corner of College Blvd and Highway 85, behind the Tom Thumb Gas Station.

Qualified Industrial Hygienist (See Par 3): Mike Kerr 918-669-4968

Nearest Medical: Eglin Hospital (life threatening emergencies only) **850-882-7227** or 7228
Twin Cities Hospital **850-678-4131**

Ambulance **911** or 850-882-7228

Emergency medivac: Life Flight Helicoptor
Babtist Hospital
1000 W. Moreno Street
Pensacola, FL
850-434-4811

Police **911** or 850-882--2502

Fire **911** or, emergency-850-882-5856

Poison Control Center 1-800-682-7625

National Response Center (by U.S. Coast Guard): 1-800-424-8802

(5) Emergency recognition and prevention: **The site shall be evacuated in the event significant unexpected hazards are encountered.**

(6) Site topography, layout, and prevailing weather conditions:

- Site Topography (See Paragraph 1.a):inside a building. b) flat open terrain
- Prevailing Weather Conditions: 45-85 F, south-easterly winds, possible severe thunderstorms

(7) **Criteria and procedures for site evacuation** (emergency alerting procedures/employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control):

- Emergency Alerting Procedures/Alarm System: **Oral Communication**
- Emergency PPE and Equipment: **(See Par 14.) None**
- Safe Distances: **As specified by the SSHO- real time monitoring**
- Places of Refuge: **Inside buildings**
- Evacuation Routes (See route map): **Meeting area is at State Route 285 and Range Road 213.**
- Site Security and Control (See Par 11): **As specified by the SSHO**

(8) Specific procedures for decontamination and medical treatment of injured personnel:

Treat injuries first. In cases of emergency—transport to Twin Cities Hospital without regard to radiation. In non-emergency situations, the SSHO will evaluate contamination, and determine decontamination procedures.

(9) Route maps to nearest pre-notified medical facility: **See attachment.**

(10) Criteria for initiating community alert program, contacts and responsibilities: **N/A**

(11) Critique of emergency responses and follow-up: To be completed on site, if warranted

(12) 29 CFR 1910.38(a) applicability: Not applicable, however, this plan includes many of the details discussed in the standard.

16. Accident Prevention.

a. Additional Accident Prevention Plan topics required by EM 385-1-1 which are not specifically covered in this appendix, shall be addressed as Specified by the SSHO and RSO.

b. The primary hazards may be snakes (rattlers, cotton mouth, copperhead, and coral), insects (black widow spiders, scorpions), mice (hanta virus), and poison ivy in areas of targets.

(1) Personnel will be cautioned and will avoid areas of obvious rodent, snake, or spider infestation. No attempt will be made to identify or capture animals. All shall be avoided.

(2) Poison Ivy and Oak may be encountered. Plants with tapered leaves in groups of three on woody vines with air roots and berries shall be avoided. A

walkover survey for poisonous plants will be conducted prior to beginning work.

17. **Logs, Reports, and Recordkeeping.** The records may include the following:

a. Daily safety inspection logs (may be part of the Daily QC Reports): **Safety briefings and attendance will be recorded daily.**

b. Equipment maintenance logs: **Calibration, response checks, all pertinent data to be recorded in a field log book.**

c. Environmental and personal exposure monitoring/ sampling results: **To be recorded in field log book.**

d. Records of radiation surveys, monitoring and disposal as per 10 CFR 20 subpart L: **To be recorded in field log book.**

SAFETY BRIEFING CHECKLIST/SSHP ACCEPTANCE FORM

SITE NAME: Eglin AFB DATE/TIME_____

GENERAL INFORMATION

_____ Purpose of Visit
_____ Key Site Personnel/Responsibilities
_____ Training & Medical Requirements

Site-Specific Information

_____ Site Description/Characterization/Past Uses
_____ Previous Studies/History
_____ Contaminant Characterization
_____ Potential Site Hazards/Health Effects
_____ OEW Safety Procedures
_____ Site Personal Protective Equipment(PPE) Program
_____ Site SOPs
_____ Site Control Measures, Decontamination and Communications
_____ Emergency Equipment
_____ Emergency Response/Phone Numbers/Nearest Medical Facility/Site Evacuation and Meeting Area
_____ Unanticipated hazardous conditions shall result in ceasing activities and evacuation of the site in accordance with instructions from the SSHO.

PLAN ACCEPTANCE
I, the undersigned, have read and have been verbally briefed on the topics noted above and in the SSHP; I understand the SSHP and agree to comply with all the indicated safety and health requirements:

PRINTED NAME	ORGANIZATION	SIGNATURE	DATE

Safety Briefing Presenter	Signature	Date

ATTACHMENT TO SSHP
ROUTE MAP TO HOSPITAL

(map to be provided onsite)

Directions: **Directions to Hospital: To reach Twin Cities Hospital from C-74L, travel on Range Road (RR) 213 to State Route (SR) 285 and turn right (south) on SR 285. Travel approximately 8 miles south on SR 285 to the intersection of SR 285 and College Blvd. Turn right (west) on College Blvd and travel approximately 2 miles to the intersection of College Blvd and Highway 85. Twin Cities Hospital is on the southwest corner of College Blvd and Highway 85, behind the Tom Thumb Gas Station.**

ATTACHMENT TO SSHP

Basewide Health and Safety Plan

APPENDIX H

EGLIN SOP'S

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469166

Final

FINAL STATUS SURVEY REPORT
Eglin Air Force Base, C-74L
16-20 September 2002

Buildings and Target Areas

Niceville, Florida

REPORT NO. CESWT-SO-R1-11-2002

October 2004

U.S. Army Corps of Engineers
Tulsa District Office
Hazardous Toxic and Radioactive Waste Program

469166

EXECUTIVE SUMMARY

FINAL STATUS SURVEY REPORT

REPORT NO. CESWT-SO-R1-11-2002

EGLIN AIR FORCE BASE, C-74L

NICEVILLE, FLORIDA

16-20 SEPTEMBER 2002

1.0 PURPOSE

The purpose of this survey is to provide an assessment of the radiological condition of certain US Air Force (USAF) permitted, US Nuclear Regulatory Commission (NRC) licensed radioactive material use areas at Eglin Air Force Base (EAFB). Specifically:

1.1 The objective of the final status survey was to demonstrate that the radiological parameters from any residual radioactive contamination are below the release criteria. For each survey unit, the null hypothesis to be tested is stated as "The survey unit contains radioactivity in excess of the release criteria."

1.2 The objective of this report is to provide sufficient data to disprove the null hypothesis for each survey unit resulting in the release of the affected areas from any potential restrictions due to the former use of radioactive materials.

2.0 CONCLUSIONS

2.1 Interpretation of survey and sample data reveals that there is no radiological contamination above the guidelines for release or distinguishable from background in or on site buildings. The null hypothesis is disproved for survey unit numbers one through five and eight through eleven.

2.2 Residual contamination remains above the criteria for release or distinguishable from background at one location on the asphalt pad and at one location on the catch box. The null hypothesis cannot be disproved for survey unit numbers six and seven. Currently, however, C-74L is an area of very limited occupancy and, therefore, the exposure hazard is minimal.

3.0 RECOMMENDATIONS

3.1 Recommend the surveyed areas listed below be released for future use without radiological restrictions. This constitutes the following areas of EAFB:

- All areas of Building 9372,
- Building 9372 sump and drain,
- Building 9373, and
- Range runoff outfall area.

3.2 Recommend the surveyed areas listed below be investigated further, decontaminated or disposed with consideration of contaminant levels. This constitutes the following C-74L range structures:

- Asphalt pad area, and
- Catch box structure.

TABLE OF CONTENTS

ABBREVIATIONS

bkg	background
cal	calibration
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
Cs-137	Cesium-137
DCGL	Derived Concentration Guideline Level
dpm	disintegrations per minute
$dpm/100cm^2$	disintegrations per minute per 100 square centimeters
eff	efficiency
HPO	Health Physics Office
HSA	Historical Site Assessment
IAW	In Accordance with
IOC	Industrial Operations Command (now Operations Support Command)
Kcpm	Kilo (1000) counts per minute
LLD	Lower Level of Detection
MARSSIM	Multi Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
mCi	millicurie
mm	millimeter
NA	Not Applicable
ND	Not Determined
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Guide
PCOC	potential Contaminants of Concern
QA	Quality Assurance

QC	Quality Control
RAM	Radioactive Material
RCC	Radiation Control Committee
RSO	Radiation Safety Officer
SN	serial number
SOP	standing operating procedure
USACE	United States Army Corps of Engineers
USACENAB	Baltimore District
USACESWT	Tulsa District
uR/hr	microRoentgen per hour
uCi	microCurie

FINAL STATUS SURVEY REPORT
SURVEY REPORT NO. CESWT-SO-R1-11-2002
EGLIN AIR FORCE BASE, RANGE C-74L
NICEVILLE, FLORIDA
16-20 SEPTEMBER 2002

1.0 PURPOSE

The purpose of this survey is to provide an assessment of the radiological condition of certain US Air Force (USAF) permitted, US Nuclear Regulatory Commission (NRC) licensed radioactive material use areas at Eglin Air Force Base (EAFB). Specifically:

1.1 The objective of the final status survey was to demonstrate that the radiological parameters from any residual radioactive contamination are below the release criteria. For each survey unit, the null hypothesis to be tested is stated as "The survey unit contains radioactivity in excess of the release criteria."

1.2 The objective of this report is to provide sufficient data to disprove the null hypothesis for each survey unit resulting in the release of the affected areas from any potential restrictions due to the former use of radioactive materials.

1.3 As detailed in the survey plan (USACE, 2002), the scope of this final status survey includes interior and exterior surfaces of Building 9372 (including the roof), exterior surfaces of Building 9373 (including the roof), the surface soil around Buildings 9372 and 9373 extending approximately 2 meters from each building footprint, the sump and drain for Building 9372, the asphalt pad located adjacent to Building 9372, the range runoff outfall area, and the catch box structure located at the end of the gun corridor (see Map 2, Appendix B and photographs, Appendix H).

1.3.1 It was determined during the scoping survey performed in October 2002 that the roofs of Buildings 9372 and 9373, the surface soils surrounding the buildings, the sump and drain for Building 9372 and the asphalt pad adjacent to the gun bays of Building 9372 should be investigated to confirm the absence of radiological material. Since measurements had not previously been taken in these locations, survey and sample work to be performed would be considered a scoping survey. The scoping survey for each of these areas, however, was designed to meet the requirements of a MARSSIM Class 3 Final Status Survey.

1.3.2 Elevated readings were obtained on the Catch Box during the October 2002 Scoping Survey. Survey work to be performed would be considered a characterization survey.

2.0 GENERAL

2.1 The final status survey was conducted in accordance with guidance in NUREG-1575, Rev.1 (NRC, 2001), Multi Agency Radiation Survey and Site Investigation Manual (MARSSIM), and is also designed to meet the requirements of applicable regulations at 10 CFR 40.42, "Expiration and Termination of Licenses and Decommissioning of Sites and Separate Building or Outdoor Areas."

2.1.1 The final status survey was performed as described in the plan entitled "Radiological Survey Plan for the Termination of NRC Licensed Radioactive Material Use at Eglin Air Force Base Test Range C-74L, Building and Target Areas", dated September 2002 and prepared by USACESWT (USACE, 2002). This plan was reviewed and approved by the Eglin LLRM Partnering Team in August-September 2002, prior to the commencement of field work.

2.2 Project management for the field survey was conducted by the US Army Corps of Engineers, Omaha District (USACENWO).

2.3 Ms. Julie Peterson, Certified Health Physicist, USACENWO managed the field survey. A team consisting of members of the USACE Radiation Safety Support Team conducted the survey. A list of team members is located in Appendix A.

2.4 The personnel mentioned above have varied expertise in radiological health issues and are qualified to perform the survey. Each individual was provided occupational health and safety training by USACESWT on 17 September 2002 to administer a safe working environment (Appendix A). This training was conducted in accordance with the Site Safety and Health Plan (Appendix G of "Radiological Survey Plan for the Termination of NRC Licensed Radioactive Material Use at Eglin Air Force Base Test Range C-74L, Building and Target Areas", dated September 2002 and prepared by USACESWT).

2.5 Outreach Laboratory (OL) performed the laboratory analyses. In addition, OL utilized its internal Quality Assurance (QA) Plan for the sample analysis and data validation.

2.6 The USACE Omaha District provided Mr. Brian Hearty, Certified Health Physicist, as a Quality Assurance Officer. Mr. Hearty reviewed the work plan and provided recommendations to ensure a comprehensive survey. He also observed surveys in progress to ensure the plans were followed, conducted independent measurements, and provided a written report included as Appendix G.

2.7 The final status survey was conducted for the Installation Restoration Program at EAFB. The EAFB Project Manager and base Radiation Safety Officer (RSO) was Mr. Steve Curry. Mr. Curry was on-site observing survey and sample efforts during the final status survey on several occasions.

3.0 BACKGROUND

3.1 **Site Background**. The following background information has been compiled from previous investigations performed at Test Area C-74L Gunnery Ballistic Facility and a literature survey report generated by USACE, St. Louis District entitled "Low-Level Radioactive Material Eglin AFB Archives Search Report" (USACE, 1999). Test Area C-74L Gunnery Ballistics Facility is an active facility comprised of two gun bays used to test the damage potential and terminal ballistics of various ammunitions (Becker and others, 1994). The test area has been in

operation since at least 1963 as a gunnery ballistics facility. From late 1974 to 1978, Test Area C-74L was used for pre-production testing of the GAU-8 gun system, which uses DU in the ammunition. An estimated 16,315 pounds (7,400 kilograms [Kg]) of depleted uranium (DU) was expended at Test Area C-74L. In late 1978, all testing involving DU was transferred to Test Area C-64, and the mission at C-74L was changed to include only the firing of high incendiary explosives.

Eglin has performed environmental work from 1976 through 2004 at the site to evaluate the impact of DU on site soils and groundwater, as well as nearby sediment and surface water. In 1980, limited DU fragment excavation was performed within the approach gun corridor leading from the gun bay building to and including the target butt (Becker and others, 1990; Becker and others, 1994).

3.1.1 The C-74L site is located in Walton County, Florida, within the north-central part of the Eglin Reservation, approximately 14 miles northeast of the city of Niceville (Map 1, Appendix B). The site occupies an area east-northeast of Auxiliary Field No. 1. To reach the site from the East Gate of Eglin Main Base, travel east on State Route (S.R.) 20 for 3.6 miles. Turn left (north) onto S.R. 285, and travel approximately 11.6 miles. Turn right (east) on Range Road (R.R.) 213. Proceed on R.R. 213 4.8 miles, past R.R. 214, and turn right (south) at the next road. Travel approximately 0.75 miles.

3.1.2 Interviews were conducted of the base RSO and various other individuals that work at EAFB, to obtain a balanced view of operations involving radioactive material.

3.2 **Project Related Information and Background.**

3.2.1 Licensed radioactive material use at EAFB is authorized by the US Nuclear Regulatory Commission (NRC) through the US Air Force Master NRC license. For Test Area C-74L, the USAF Radioactive Material Permit number is FL-08883-01/02AFP, 040-08883.

3.2.2 The use of permitted and licensed radioactive material (RAM) at C-74L was firing of DU munitions only. The Historical Site Assessment did not reveal any accidents or incidents involving DU munitions that may have led to contamination where not expected. It is unlikely that contamination exists in either building to be surveyed *other than DU fragments* that may have ricocheted back into the building. The GAU-8 30mm DU rounds all use an aluminum wind screen which, when combined with other components, effectively encapsulates the DU until the round strikes a target. During normal handling and storage of these munitions DU contamination is unlikely. Further, the Ballistics Building (Building No. 9372) was not used to store any DU munitions. Munitions were brought to the site at the start of each weapon system test and any remaining rounds were taken back to the normal storage area at the end of the test.

EAFB ceased operations involving Depleted Uranium (DU) at C-74L in 1978.

3.2.3 Information regarding previous decontamination and site restoration was obtained from an interview with Rick Crews, Air Force Research Laboratory on 18 October 2002. Mr. Crews was on-site during the former restoration activities. According to Mr. Crews, EAFB removed DU fragments to a depth of six inches during site decontamination and restoration activities in 1980. Contaminated target blocks and other items were removed and disposed off-site during the 1980 operation. Soil beneath the blocks was also cleaned. Contamination remained, however, below six inches in the target corridor, outside of the target corridor (from fragment ricochets), and potentially in the range catch box and buildings.

3.2.3.1 The concrete blocks at the end of the gun corridor are clean. DU has never been fired at these blocks.

3.3 **Chronology**.

3.3.1 A scoping survey was conducted on 4 October 2001 by members of the survey team. Information to complete this survey as well as information to augment site historical data was gathered.

3.3.2 The USACE began preparations for the survey in May of 2002.

3.3.3 On 17 September 2002, the USACE survey team conducted a preliminary walk through and gamma scan of typical surfaces to be surveyed to identify any potential safety or logistical problems and to assess the physical condition of the areas to be surveyed. The final status survey work then commenced. The survey work plan and site health and safety plan (USACE, 2002) were adhered to in all phases of the work. Required modifications to the plans are discussed in Section 4.

3.3.4 The USACESWT received final laboratory results on 30 October 2002.

3.4 **Site Conditions at Time of Survey.**

3.4.1 **Buildings.**

3.4.1.1 Building 9372 areas used for firing munitions were either empty or in limited use. The building had power and was clean (see photographs, Appendix H).

3.4.1.2 Depending on recent use or not, floors were free of excessive dust. In areas where dust was evident, floors were swept clean prior to surveys. The Site Specific Health and Safety Plan (SSHP) was followed in dealing with potential hazards.

3.4.1.3 All buildings to be surveyed were in a secured area of EAFB. Security personnel and fences limit access to these areas.

3.4.2 Weather during the survey was sunny and warm. Survey operations did not have to stop due to weather.

3.4.3 The central office of Building 3972 was surveyed by scanning prior to being used as the base of operations for the survey team. The USACE personnel utilized this office

throughout the survey. This area was surveyed by scanning after removal of sources of radiation (check sources).

3.5 Potential Contaminants and Release Guidelines. The potential contaminants at EAFB are discussed in Appendix F and summarized in Table 1. Guideline values for these isotopes were developed based on measurement techniques, and discussions with the base RSO, the state of Florida, and EPA Region IV. Guidelines are reported in Table 2.

Table 1. Potential Contaminants of Concern (PCOC)

Potential Contaminant	Date of Last Use	Fixed Measurement Technique	Removable Wipe Analysis
Depleted uranium	Late 1978	Gross alpha	Gross alpha
Depleted uranium	Late 1978	Gross beta	Gross beta

Table 2. Derived Concentration Guideline Levels (DCGL)

Media	DU DCGL ($dpm/100cm^2$)	DCGL (pCi/g)	DCGL by Measurement Method (in excess of background)
Building interior surfaces	[1]100	NA	100 $dpm/100cm^2$ gross alpha[2] 400 $dpm/100cm^2$ gross beta[3]
Soil[5]	NA	469	NA
Equipment surfaces and external building surfaces	[4]5,000	NA	5,000 $dpm/100cm^2$ gross alpha 5,000 $dpm/100cm^2$ gross beta
Equipment	NA	NA	β,γ Dose rate 0.2 mrad/hr @ 1 cm

[1] Since DU is comprised of approximately 99.8% U-238, 0.001% U-234, and 0.2% U-235 and the NUREG/CR-5512 values are isotope specific, the DU value is derived from the activity ratios of U-238, U-234, and U-235 in DU of 85%, 13%, and 2% respectively. When corrected for this activity abundance the 100 $dpm/100cm^2$ DCGL insures that the sum of the ratios for all three isotopes would not exceed unity (i.e. the criteria is met). Appendix E lists the NRC DCGLs for typical isotopes of concern.
[2] Since 1 disintegration per minute (dpm) of DU results in the emission of 1 alpha particle per minute the DU to gross alpha conversion factor is 1.
[3] Since 1 dpm of DU results in the emission of 4 beta particles per minute the DU to gross beta conversion factor is 4.
[4] Applies to alpha and beta emitters independently.
[5] Applies to material samples such as concrete blocks also.
NA = Not Applicable.

4.0 RADIATION SURVEYS and RESULTS

4.1 Instrumentation/Equipment.

4.1.1 A list of instruments used during this effort is provided in Appendix C. The Minimum Detectable Concentration (MDC) of each instrument is reported with the survey data. Efficiencies were determined with a radioisotope traceable to the National Institute of Standards and Technology (NIST), which had energies similar to the energies of the isotopes of concern.

4.1.2 After calibration, an efficiency factor was calculated for each instrument to correlate the meter reading to the actual radioactivity present.

4.1.3 The alpha/beta probes used for the survey were 100 and 125 square centimeter (cm^2) combination zinc sulfide/plastic scintillation detectors. To ensure adequate minimal detectable concentrations, a count time of 5 minutes was used for static alpha/beta readings indoors and a count time of 1 minute was used for static alpha/beta readings outdoors.

4.1.4 The efficiency value for each instrument was used to record the final reading into standardized regulatory criteria expressed in dpm/100cm^2 (corrected for probe area). The equation used to convert counts per minute (cpm) to disintegrations per minute (dpm) per 100cm^2 (dpm/100cm^2) can be found in NUREG-1575, Section 6. The monitoring values for gross alpha and beta in the data tables are presented in the converted values of dpm/100cm^2 (Appendix E).

4.1.5 The gamma microRoentgen per hour (uR/hr) probes used were 1-inch x 1-inch sodium iodide crystals internal to the instruments. The sensitivity of the gamma survey meter is less than 1 uR/hr and correlates with NUREG-1575, Table 6.7.

4.1.6 The gamma count rate instrument used for area scanning was the Field Identification and Detection of Low Energy Radiation (FIDLER) detector. The FIDLER has been used successfully in past survey operations at EAFB.

4.1.7 All portable survey meters were checked for operability prior to packaging and shipping to EAFB, upon arrival at the survey site, before each day of surveying, at the end of each day of surveying, and after any malfunctions or repairs. NUREG-1575, Section 6.5 was used as the reference to establish instrument response checks.

4.1.7.1 Alpha. Operational instrument checks were performed with a NIST traceable Thorium-230 source. All operational checks were made at approximately 2 mm from the alpha source. The same procedures were used for each check to assure reproducibility. See Appendix C.

4.1.7.2 Beta. Operational instrument checks were performed with a NIST traceable Technetium-99 source. All operational checks were made at approximately 2 mm from the beta source. The same procedures were used for each check to assure reproducibility. See Appendix C.

4.1.7.3 Gamma. Operational instrument checks were performed with a NIST traceable Cesium-137 source. Checks were made at approximately 1 mm from the source. The same procedures were used for each check to assure reproducibility. See Appendix C.

4.2 **Instrumentation Surveys**.

4.2.1 Instrumentation surveys were conducted within pre-established areas, at the frequency and following the methods described by the survey plan (USACE, 2002). Floor plan and sampling location diagrams can be found with the data for each surveyed area (See Appendix E).

4.2.2 Survey Units. A list of survey units, classifications, and survey types is included in Appendix B and summarized in Table 3. **The list of survey units presented in the survey plan (USACE, 2002) was altered to facilitate surveys and for ease of data management. Due to the discovery of DU fragments, certain areas required reclassification. Survey aspects presented in the plan, Eglin SOPs, and MARSSIM were adhered to.**

4.2.2.1 All but one survey unit is considered Class 3. For the purposes of guiding the degree and nature of final status survey coverage, MARSSIM identifies three classifications of areas, according to contamination potential. Class 1 areas have a potential for contamination that exceeds guidelines; Class 2 areas have a potential for contamination, but it is unlikely that the contamination level exceeds the average guideline; and, Class 3 areas are not expected to contain residual activity in excess of a small fraction of the average guideline.

Table 3. Survey Area/Unit Summary

No.	Survey Area	Survey Unit	Description	Radionuclide of interest	Potential Concern	Type of Survey
1	Bldg. 9372	Bldg. 9372 Work Areas Floors	Tile	Depleted Uranium (DU)	Area contamination	Final Status (Class 3)
2	Bldg. 9372	Bldg. 9372 Work Areas Walls	Block-1	DU	Area contamination	Final Status (Class 3)
3	Bldg. 9372	Gun Bays	Concrete	DU	Area contamination	Final Status (Class 3)
4	Bldg. 9373	Bldg. 9373 Exterior	Block-2	DU	Area contamination and fragments	Final Status (Class 3)
5	Bldg. 9372	Bldg. 9372 Exterior	Block-1	DU	Area contamination and fragments	Final Status (Class 3)
6	Range	Range Pads	Asphalt	DU	Area contamination and fragments	Scoping
7	Range	Catch Box	Concrete and steel	DU	Area contamination	Characteriza-tion

					and fragments	
8	Outfall	Drain Sump, Line and outfall soils	Concrete and PVC	DU	Fragments and soil contamination	Scoping
9	Bldg. 9372	Gun Slots	Concrete and steel	DU	Fragments	Final Status (Class 1)
10	Bldg. 9372 and 9373	Roofs	Tar Paper and pebble	DU	Fragments	Scoping
11	Bldg. 9372 and 9373	Bldg. Exterior Soils	Soil within 2 meters of building	DU	Fragments	Scoping (Removal)

4.2.3 Investigation values, or action levels, for each measurement were established for each type of survey instrument used. If any instrument reading exceeded the investigation values, a more thorough investigation was conducted. The scan MDC was conservatively selected as the investigation level for scanning and the instrument critical level was conservatively selected as the investigation level for static measurements. See Appendix C.

4.2.4 Gamma exposure rate measurements were taken at 1 meter above the surface in rate meter mode. An investigation level of 5 uR/hr above background was set for scans and static measurements.

4.3 **Sampling**.

4.3.1 All wipes and soil samples were collected in accordance with the sampling plan. Additionally, all samples met the laboratory and sampling plan quality assurance criteria. A copy of the sample Chain of Custody record is included in Appendix I.

4.3.2 Wipe tests were performed to determine the presence of removable contamination on surface areas and verify the assumptions of the DCGL determination. Hard smear wipe samples were collected using a Nucon® swipe to wipe an area of at least $100cm^2$. Eighty-nine wipe samples were collected and analyzed for gross alpha and gross beta activity.

4.3.3 Soil samples were collected in accordance with the survey plan. Three samples were collected from the drain sump and outfall area (2 samples and 1 quality assurance).

4.4 Survey Results.

4.4.1 **Instrument Background Results.** Background measurements were taken for each type of radiation to be monitored and with each monitoring instrument.

4.4.1.1 The average background values were established at a 95% confidence level. Background data are summarized in Appendix D and presented, in greater detail, with the survey unit results in Appendix E.

4.4.1.2 Suitable reference areas for the survey were located and instrument readings were collected using the same methods used in the survey units. These data are summarized in Appendix D.

4.4.1.3 Mr. Steve Curry, base RSO, mentioned that some concrete blocks were high in naturally occurring isotopes. He had experienced this in routine surveys. This was experienced during these surveys also. Obvious construction such as windows/openings that were bricked in demonstrated a wide range of background measurements. This contributed to the increase in survey units and difficulty in assessing reference area suitability.

4.4.2 **Survey Methods, Discussions and Results.**

4.4.2.1 Building 9372 - Ballistics Research.

Building 9372 comprised the bulk of the survey effort. Eight of the eleven survey units listed in Table 3 are for this building. Modifications to the work plan were made to facilitate data management and to account for variety of construction materials and site conditions (additional survey units were added).

Due to background differences in the other work areas (outside the gun bays) the walls were made a separate survey unit from the floors. This resulted in an extra survey unit not described in the plan.

Interior Results.

As specified in the survey plan (USACE, 2002), wipe sample locations were determined using the computer program, Visual Sample Plan (VSP). Sample locations were selected randomly at a rate of approximately 14 samples per survey unit (plus one duplicate and one blank). At each sample location, static alpha, beta, and gamma readings were taken as well as a wipe sample. Although, per MARSSIM, scan coverage is "judgmental" in Class 3 areas, scanning was performed on 100% of floors and 100% of gun bay lower walls. In other all other rooms, 10% of lower walls were scanned. Additional sample and scan details follow in subsequent sections.

The Building 9372 interior surveys were designed (DCGL, instrument, etc.) with area contamination as most probable given the previous remediation work at the site (for example, foot traffic bringing contamination into the building). During preliminary scanning of the gun bay survey unit (#3), however, fragments of DU were located in the gun slots (see Appendix H). These fragments were very easy to find and easily removed by slipping tape or a brush into the slot. Given the ease of finding a fragment, the lack of residual radioactive contamination under fragments, the fact that a 100% scan was being conducted of the gun bays, and that static measurements were not likely to find fragments, the gun slots were considered a separate Class one survey unit (#9). Three DU fragments were located and removed from the slots. Scans of the gun slots with a Ludlum44-9/3 long handled pancake GM were indistinguishable from background once the fragments were removed.

Interior Alpha Instrumentation Results. A fixed meter reading (5 minutes) was taken on contact with the surface at each sample location. The net alpha activity ranged from a low of -17 dpm/100 cm^2 to a high of 13 dpm/100 cm^2. All measurements were less than the appropriate

instrument's MDC (47 dpm/100 cm^2). All alpha survey results and locations (survey units specific) are presented in Appendix E.

Interior Beta Instrumentation Results. A fixed meter reading (5 minutes) was taken on contact with the surface at each sample location. The net beta-gamma activity ranged from a low of -643 dpm/100 cm^2 to a high of 237 dpm/100 cm^2. All measurements were less than the appropriate instrument's MDC (239 dpm/100 cm^2). All beta survey results and locations (survey units specific) are presented in Appendix E.

Interior Gamma Instrumentation Results. Each sample location was surveyed at approximately 1 meter from the surface and the location with the highest exposure reading was recorded. The exposure rate ranged from 2 uR/hr to 14 uR/hr at a meter height. The net exposure rate (result – background in reference area) ranged from -10 uR/hr to 2 uR/hr at 1 meter from sample locations in buildings. All gamma survey results and locations (survey unit specific) are presented in Appendix E.

Interior Scanning. One hundred percent of accessible floors and lower walls were scanned with the FIDLER and the Ludlum large area gas proportional probe. Scanning did not indicate the presence of contamination above the scan MDC in any area. The floor and wall scan MDC for alpha detection was calculated (IAW MARSSIM) as 177 dpm/100 cm^2 and the floor scan MDC for beta detection was calculated as 149 dpm/100 cm^2. The scan MDC being greater than the DCGL does not require increasing the sample number because the survey design is not driven by the elevated measurement comparison (MARSSIM, Roadmap-13). The investigation level was set at the MDC and scanning is judgmental in class 3 areas (See MARSSIM Roadmap Table 5).

Floor and wall scans with the FIDLER were all indistinguishable from background.

Laboratory Analysis - Wipe Tests. Wipe test samples were collected at each sample location and analyzed for removable contamination. Vents and air ducts were sampled also.

Blank wipe samples were used to screen for cross contamination and as a quality control (QC) measure. These QC wipe results can be found with the sample results.

Alpha Results. The gross alpha activity ranged from a low of less than 0 dpm/100 cm^2 to a high of less than 2 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 1 dpm/100 cm^2. Alpha results and locations where wipe tests were taken are included in Appendix E. Analysis shows that sample data does not exceed the MDC and thus, the release criteria or DCGL model parameter of 10% of the total criteria are not exceeded.

Beta Results. The gross beta activity ranged from a low of less than 1 dpm/100 cm^2 to a high of less than 3 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 3 dpm/100 cm^2. Beta results and locations where wipe tests were taken are included in Appendix E. Gross beta analysis shows no sample data exceeds the release criteria or DCGL model parameter of 10% of the total criteria.

Exterior Results.

The Building 9372 exterior surveys were designed (DCGL, instrument, etc.) with fragments or gross area contamination as the most probable given the ricocheting of fragments. Random sample locations were generated with VSP. At each sample location, static alpha, beta, and gamma readings were taken as well as wipes. Lower exterior walls were scanned, as was the roof, soils surrounding the building, and the drain/outfall area. Additional details and results follow.

Exterior Alpha Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net alpha activity ranged from a low of -20 dpm/100 cm^2 to a high of 20 dpm/100 cm^2. All measurements were less than the instrument's MDC (93 dpm/100 cm^2). All alpha survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Beta Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net beta-gamma activity ranged from a low of -216 dpm/100 cm^2 to a high of 224 dpm/100 cm^2. All measurements were less than the instrument's MDC (503 dpm/100 cm^2). All beta survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Gamma Instrumentation Results. Each sample location was surveyed at approximately 1 meter from the surface. The exposure rate ranged from 3 uR/hr to 6 uR/hr at a meter height. The net exposure rate (result – background in reference area) ranged from -1 uR/hr to 2 uR/hr at 1 meter from sample locations. All gamma survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Scanning. Twenty percent of lower walls were scanned with the FIDLER and the Ludlum large area gas proportional probe, biasing measurements to those locations most likely to contain residual radioactive material. Scanning did not indicate the presence of contamination above the scan MDC on any external surface. The scan MDC for alpha detection was calculated (IAW MARSSIM) as 177 dpm/100 cm^2 and the scan MDC for beta detection was calculated as 149 dpm/100 cm^2. The investigation level was set at the MDC and scanning is judgmental in class 3 areas (See MARSSIM Roadmap Table 5).

Scans with the FIDLER were all indistinguishable from background.

Laboratory Analysis - Wipe Tests. Wipe test samples were collected and analyzed for removable contamination. Blank wipe samples were used to screen for cross contamination and as a quality control (QC) measure. These QC wipe results can be found with the sample results.

Alpha Results. The gross alpha activity ranged from a low of less than 0 dpm/100 cm^2 to a high of less than 2 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 1 dpm/100 cm^2. Alpha results and locations where wipe tests were taken are included in Appendix E. Analysis shows that sample data does not exceed the MDC and thus, the release criteria or DCGL model parameter of 10% of the total criteria are not exceeded.

Beta Results. The gross beta activity ranged from a low of less than 1 dpm/100 cm^2 to a high of less than 3 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 3 dpm/100 cm^2. Beta results and locations where wipe tests were taken are included in Appendix E. Gross beta analysis shows no sample data exceeds the release criteria or DCGL model parameter of 10% of the total criteria.

Roof Survey. One hundred percent of accessible roof space was scanned with the FIDLER (see Appendix H). Background was obtained on two separate roofs of nearby buildings that had similar roofing materials. Scans with the FIDLER were all indistinguishable from background (3 – 4.5 kcpm). Counts ranged from 3.2 Kcpm to 4.5 Kcpm with results being very uniform and the higher results over the newest addition.

Grounds Survey. The ground around Building 9372 was scanned with the FIDLER. A narrow track (out to 2 meters from wall) was 100% scanned. This scan resulted in identifying 4 DU fragments near the ground surface (2 to 6 inches depth). These fragments were excavated by hand (see Appendix H) and given to Mr. Doug Davis, EAFB for disposal. Using previously approved Eglin protocol the area around the fragment was scanned and soil or fragments removed until indistinguishable from background. Top soil/sod was then replaced. The area was then walked over with the FIDLER again. This approach has been demonstrated in the past at Eglin as being sufficient to demonstrate compliance with soil DCGL (469 pCi/g).

Drain and Outfall Survey. A 4 square foot sump with a 4 inch PVC drain pipe is located just outside the gun bay (see Appendix H). The pipe extends approximately 100 yards to an outfall (washed out area). The areas around the outfall and sump were scanned with the FIDLER and uR/hr meters. Results of this scanning were indistinguishable from background (3 – 5 kcpm, 4-8 uR/hr). Three soil samples were collected: one from the sump, one from the outfall area, and 1 QA split. The sample results are in Appendix J and Table 4 below.

To assess the conditions in the pipe, a low energy gamma probe was advanced until the point of refusal from both ends of the drain pipe. The probe hit refusal at 17 feet from the sump

and 19 feet from the outfall. Rate meter counts were recorded at every foot. As a background the probe was buried 6-12 inches in the ground just off the pipeline. The count rate within the pipe was then compared to the background count rate + 3 standard deviations and then compared to the pipe count rate + 3 standard deviations. No single measurement exceeded either the background or pipe mean + 3 standard deviations. Given the biased nature of this limited scoping effort, it is not likely that the pipeline is carrying significant contamination away from the site. The sump U-238 level (6 pCi/g) is slightly more than the expected background of approximately 1 pCi/g. It is still, however, significantly less than the DCGL for soils (469 pCi/g).

Table 4. Soil Sample Results

Sample #	U-238 pCi/g	Uncertainty pCi/g	MDC pCi/g
E9372-D-R1	6.61	0.460	1.27
E9372-D-R2	6.25	0.426	1.09
E9372-D-SB-01	1.76	0.149	0.578

4.4.2.2 Building 9373 - Pump House

In accordance with the survey plan, the interior of Building 9373 was not surveyed. Static alpha, beta, and gamma readings were recorded at locations determined using VSP. Wipes were also taken in these locations. In addition, exterior building surface and roof scans were performed as described below.

Exterior Results

The Building 9373 exterior surveys were designed (DCGL, instrument, etc.) with gross area contamination as the most probable given the ricocheting of fragments and potential for contaminated dusts.

Exterior Alpha Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net alpha activity ranged from a low of

-30 dpm/100 cm^2 to a high of 30 dpm/100 cm^2. All measurements were less than the instrument's MDC (93 dpm/100 cm^2). All alpha survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Beta Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net beta-gamma activity ranged from a low of -152 dpm/100 cm^2 to a high of 496 dpm/100 cm^2. All measurements were less than the instrument's MDC (745 dpm/100 cm^2). The building is constructed with the high background block discussed in section 4.4.1.3. All beta survey results and locations (survey units specific) are presented in Appendix E.

Exterior Gamma Instrumentation Results. Each sample location was surveyed at approximately 1 meter from the surface. The exposure rate ranged from 6 uR/hr to 10 uR/hr at a meter height. The net exposure rate (result – background in reference area) ranged from 2 uR/hr to 6 uR/hr at 1 meter from sample locations. All gamma survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Scanning. Fifty percent of accessible walls were scanned with the FIDLER and the Ludlum large area gas proportional probe. Scanning did not indicate the presence of contamination above the scan MDC in any area. The scan MDC for alpha detection was calculated (IAW MARSSIM) as 177 dpm/100 cm^2 and the scan MDC for beta detection was calculated as 149 dpm/100 cm^2. The investigation level was set at the MDC and scanning is judgmental in Class 3 areas (See MARSSIM Roadmap Table 5).

Scans with the FIDLER were all indistinguishable from background.

Laboratory Analysis - Wipe Tests. Wipe test samples were collected and analyzed for removable contamination at each sample location. Blank wipe samples were used to screen for cross contamination and as a quality control (QC) measure. These QC wipe results can be found with the sample results.

Alpha Results. The gross alpha activity ranged from a low of less than 0 dpm/100 cm^2 to a high of less than 2 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 1 dpm/100 cm^2. Alpha results and locations where wipe tests were taken are included in Appendix E. Analysis shows that sample data does not exceed the MDC and thus, the release criteria or DCGL model parameter of 10% of the total criteria are not exceeded.

Beta Results. The gross beta activity ranged from a low of less than 1 dpm/100 cm^2 to a high of less than 3 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 3 dpm/100 cm^2. Beta results and locations where wipe tests were taken are included in Appendix E. Gross beta analysis shows no sample data exceeds the release criteria or DCGL model parameter of 10% of the total criteria.

Roof Survey. One hundred percent of accessible roof space was scanned with the FIDLER (see Appendix H). Background was obtained on two separate roofs of nearby buildings with roofing materials of similar composition. Scans with the FIDLER were all indistinguishable from background (3 – 4.5 Kcpm). Counts ranged from 4 Kcpm to 4.5 Kcpm with results being very uniform.

Grounds Survey. The ground around Building 9373 was scanned with the FIDLER. A narrow track (out to 2 meters from wall) was 100% scanned. Results of scanning did not identify any areas with readings distinguishable from background.

4.4.2.3 Asphalt Surveys

Surveys of the asphalt pad (extending from the Building 9372 gun bays to approximately 19 meters down range) were designed (DCGL, instrument, etc.) with gross area contamination as the most probable given the ricocheting of fragments and potential for contaminated dusts.

Exterior Alpha Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net alpha activity ranged from a low of -120 dpm/100 cm^2 to a high of 10 dpm/100 cm^2. All measurements were less than the

instrument's MDC (191 dpm/100 cm^2). All alpha survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Beta Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net beta-gamma activity ranged from a low of -2288 dpm/100 cm^2 to a high of 408 dpm/100 cm^2. All measurements were less than the instrument's MDC (862 dpm/100 cm^2). All beta survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Gamma Instrumentation Results. Each sample location was surveyed at approximately 1 meter from the surface. The exposure rate ranged from 4 uR/hr to 9 uR/hr at a meter height. The net exposure rate (result – background in reference area) ranged from 0 uR/hr to 5 uR/hr at 1 meter from sample locations. All gamma survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Scanning. One hundred percent of accessible asphalt was scanned with the FIDLER. Scans identified several elevated areas of potential concern. Once elevated areas were identified, an attempt was made to determine if the elevated counts were due to surface contamination, fragments, or subsurface fragments. All visible sand/dirt was swept from the area of concern and the area was resurveyed. Indications are that the elevated material is either embedded within or under the asphalt. Driving nails into the asphalt marked locations of potential concern.

Due to roughness of the asphalt limited scanning was conducted with the Ludlum large area probe. No areas of concern outside those identified by the FDLER were located.

Wipe samples were not taken on the asphalt.

4.4.2.4 Catch Box Characterization Survey Results

The catch box characterization surveys were designed (DCGL, instrument, etc.) with gross area contamination as the most probable given the box's purpose to stop rounds. Contamination was identified on the catch box during a scoping survey conducted in October 2001. Scanning followed by fixed instrument readings were conducted. Scans were to attempt to bound the area of contamination and identify areas for further investigation.

Exterior Alpha Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net alpha activity ranged from a low of -10 dpm/100 cm^2 to a high of 1370 dpm/100 cm^2. Measurements did exceed the instrument's MDC (106 dpm/100 cm^2). All alpha survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Beta Instrumentation Results. A fixed meter reading (1 minute) was taken on contact with the surface at each sample location. The net beta-gamma activity ranged from a low of –368 dpm/100 cm^2 to a high of 70,144 dpm/100 cm^2. Measurements did exceed the appropriate instrument's MDC (503 dpm/100 cm^2) and the DCGL for this survey (5,000 dpm/100 cm^2). All beta survey results and locations (survey unit specific) are presented in Appendix E.

Exterior Gamma Instrumentation Results. Each sample location was surveyed at approximately 1 meter from the surface. The exposure rate ranged from 5 uR/hr to 30 uR/hr at a meter height. The net exposure rate (result – background in reference area) ranged from 1 uR/hr to 26 uR/hr at 1 meter from sample locations. All gamma survey results and locations (survey units specific) are presented in Appendix E.

Exterior Scanning. The catch box was scanned with the Ludlum 43-89 and the FIDLER. Scans identified several elevated areas of potential concern. Once elevated areas were identified, static measurements were done to attempt to quantify the contamination. Locations of potential concern were marked with paint.

The Ludlum large area probe was not used.

Laboratory Analysis - Wipe Tests. Wipe test samples were collected and analyzed for removable contamination.

Alpha Results. The gross alpha activity ranged from a low of less than 0 dpm/100 cm^2 to a high of less than 19 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 1 dpm/100 cm^2. Alpha results and locations where wipe tests were taken are included in Appendix E. Analysis shows that sample data does exceed the MDC and the release criteria or DCGL model parameter of 10% of the total criteria are not exceeded.

Beta Results. The gross beta activity ranged from a low of less than 1 dpm/100 cm^2 to a high of less than 68 dpm/100 cm^2. The MDC at 95% confidence level was determined to be less than 3 dpm/100 cm^2. Beta results and locations where wipe tests were taken are included in Appendix E. Gross beta analysis shows that data does not exceed the release criteria or DCGL model parameter of 10% of the total criteria.

The primary area of concern on the catch box is the center that has been patched with a steel plate. Both the inside and outside of the box is contaminated above release guidelines.

4.4.2.5 **Targets.** Targets and blocks were randomly scanned with the FIDLER and Ludlum 43-89. Results were indistinguishable from background.

4.5 **Combined Survey Data Review.**

4.5.1 The survey data were evaluated in the following ways:

- by comparing each measurement to the guideline value (DCGL) for that measurement;
- by comparing the mean of the reference area measurements to the mean value of the survey unit measurements; and

- by subtracting the minimum measurement value of the reference area from the maximum value obtained for that measurement in the survey unit. If the difference is less than the guideline value for that measurement then the survey unit passes the release criterion.

4.5.2 A radiological dose/risk assessment is not necessary at this time due to the contamination characteristics and site occupancy being very low. Without decontamination or special disposal requirements, an assessment should be performed prior to disposing/recycling of the catch box materials.

4.5.3 The USACE Omaha District performed a quality assurance audit during the survey. The auditor collected independent measurements and observed the survey work in progress. The QA audit report is included as Appendix G.

5.0 CONCLUSIONS

5.1 Interpretation of survey and sample data reveals that there is no radiological contamination above the guidelines for release or distinguishable from background in or on site buildings. The null hypothesis is disproved for survey unit numbers one through five and eight through eleven.

5.2 Residual contamination remains above the criteria for release or distinguishable from background at one location on the asphalt pad and at one location on the catch box. The null hypothesis cannot be disproved for survey unit numbers six and seven. Currently, however, C-74L is an area of very limited occupancy and, therefore, the exposure hazard is minimal.

6.0 RECOMMENDATIONS

6.1 Recommend the surveyed areas listed below be released for future use without radiological restrictions. This constitutes the following areas of EAFB:

- All areas of Building 9372,
- Building 9372 sump and drain,
- Building 9373, and
- Range runoff outfall area.

6.2 Recommend the surveyed areas listed below be investigated further, decontaminated or disposed of with consideration of contaminant levels. This constitutes the following EAFB C-74L range structures:

- Asphalt pad area, and
- Catch box structure.

JULIE PETERSON, Certified Health Physicist
Omaha District, US Army Corps of Engineers

HANS B. HONERLAH, Health Physicist
Baltimore District, US Army Corps of Engineers

DAVID C. HAYS Jr., Health Physicist
Tulsa District, US Army Corps of Engineers

7.0 REFERENCES

7.1 AR 40-5, 15 October 1990, Preventive Medicine.

7.2. DA Pam 40-18, 30 June 1995, Personnel Dosimetry Guidance and Dose Recording Procedures for Personnel Occupationally Exposed to Ionizing Radiation.

7.3 AR 11-9, 30 May 1999, Army Radiation Safety.

7.4 ER and EM 385-1-80, 30 May 1997, Ionizing Radiation Protection, and Radiation Protection, USACE.

7.5 EM-385-1-1, 3 Sep 1996, Safety and Health Requirements Manual, USACE.

7.7 DoD Instruction No. 6055.8, 3 January 1983, Occupational Radiation Protection Program.

7.8 NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Rev. 1, August 2000.

7.9 TG 155, February 1993, Environmental Sampling Guide, US Army Environmental Hygiene Agency (USACHPPM).

7.10 Title 10, CFR, 1996 rev, Chapter I, Nuclear Regulatory Commission (USNRC).

7.11 Title 29, CFR, 1995 rev, Chapter I, Department of Labor.

7.12 Title 49, CFR, 1989 rev, Parts 100-177, Transportation.

7.13 NUREG/CR-5849, ORAU-92/C57, 1 June 1992, Manual for Conducting Radiological Surveys in Support of License Termination (DRAFT), USNRC.

7.14 DG-4006, February 17, 1998, Demonstrating Compliance With The Radiological Criteria For License Termination, (DRAFT),USNRC.

7.15 Historical Site Assessment, USACE, St. Louis District entitled *Low-Level Radioactive Material Eglin AFB Archives Search Report* (USACE, 1999).

7.16 Earth Tech 2001, E-mail from John Albright (Earth Tech) to Julie Peterson (USACE) November 2001.

7.17 US Army Environmental Policy Institute (AEPI) report entitled *Health and Environmental* Consequences *of Depleted Uranium Use in the US Army: Technical Report,* dated June 1995.

7.18 Eglin Basewide Quality Assurance Program Plan, Addendum No. 1, Low Level Radioactive Materials Site Investigations, April 1999.

7.19 Eglin Standard Operating Procedure No. 03, Sample Nomenclature and Control, Rev. 3, July 2001.

7.20 Eglin Standard Operating Procedure No. 15, Low-Level Radioactive Materials Site Investigations, Rev. 2, April 1999.

7.21 NUREG 1507, ORAU, June 1998, Minimal Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, USNRC.

7.22 Site Investigation Work Plan, Point of Interest No. 402, Test Area C-80B, June 1999, RUST.

7.23 NUREG 5512, Vol. 2, April 2001, Residual Radioactive Contamination From Decommissioning, USNRC.

7.24 *Radiological Survey Plan for the Termination of NRC Licensed Radioactive Material Use at Eglin Air Force Base Test Range C-74L, Building and Target Areas*, dated September 2002 and prepared by USACESWT (USACE, 2002).

Appendix A

LIST OF SURVEY TEAM MEMBERS

Field Survey Team Members

Name	Organization	Position
Julie Peterson, CHP	USACE (Omaha)	Health Physicist (HP), Lead
Hans Honerlah	USACE (Baltimore)	Health Physicist (HP)
David Hays	USACE (Tulsa)	Health Physicist (HP)
Brian Hearty, CHP	USACE (Omaha)	Health Physicist (Independent Quality Assurance)

USACE is the US Army Corps of Engineers

The members of the field team have varied experience in radiological surveys. Each have over 7 years experience in radiological survey work for a combination of the NRC and the US Army.

Site safety and health training as well as project specific training was provided to all members of the field team prior to beginning work.. A topic checklist and safety plan acceptance signature page is included in this appendix.

SAFETY BRIEFING CHECKLIST/SSHP ACCEPTANCE FORM

SITE NAME: Eglin AFB DATE/TIME 17 Sept 02 / 1000 hrs

GENERAL INFORMATION

✓ Purpose of Visit
✓ Key Site Personnel/Responsibilities
✓ Training & Medical Requirements

Site-Specific Information

✓ Site Description/Characterization/Past Uses
✓ Previous Studies/History
✓ Contaminant Characterization
✓ Potential Site Hazards/Health Effects
✓ OEW Safety Procedures
✓ Site Personal Protective Equipment(PPE) Program
✓ Site SOPs
✓ Site Control Measures, Decontamination and Communications
✓ Emergency Equipment
✓ Emergency Response/Phone Numbers/Nearest Medical Facility/Site Evacuation and Meeting Area
✓ Unanticipated hazardous conditions shall result in ceasing activities and evacuation of the site in accordance with instructions from the SSHO.

PLAN ACCEPTANCE

I, the undersigned, have read and have been verbally briefed on the topics noted above and in the SSHP; I understand the SSHP and agree to comply with all the indicated safety and health requirements:

PRINTED NAME	ORGANIZATION	SIGNATURE	DATE
Brian P. Hearty	USACE	Brian P. Hearty	9/17/02
Julie Peterson	USACE		9/17/02
Hans Hoverman	USACE		9/17/02
Safety Briefing Presenter		Signature	Date
David Hays			17 Sept 02

Appendix B

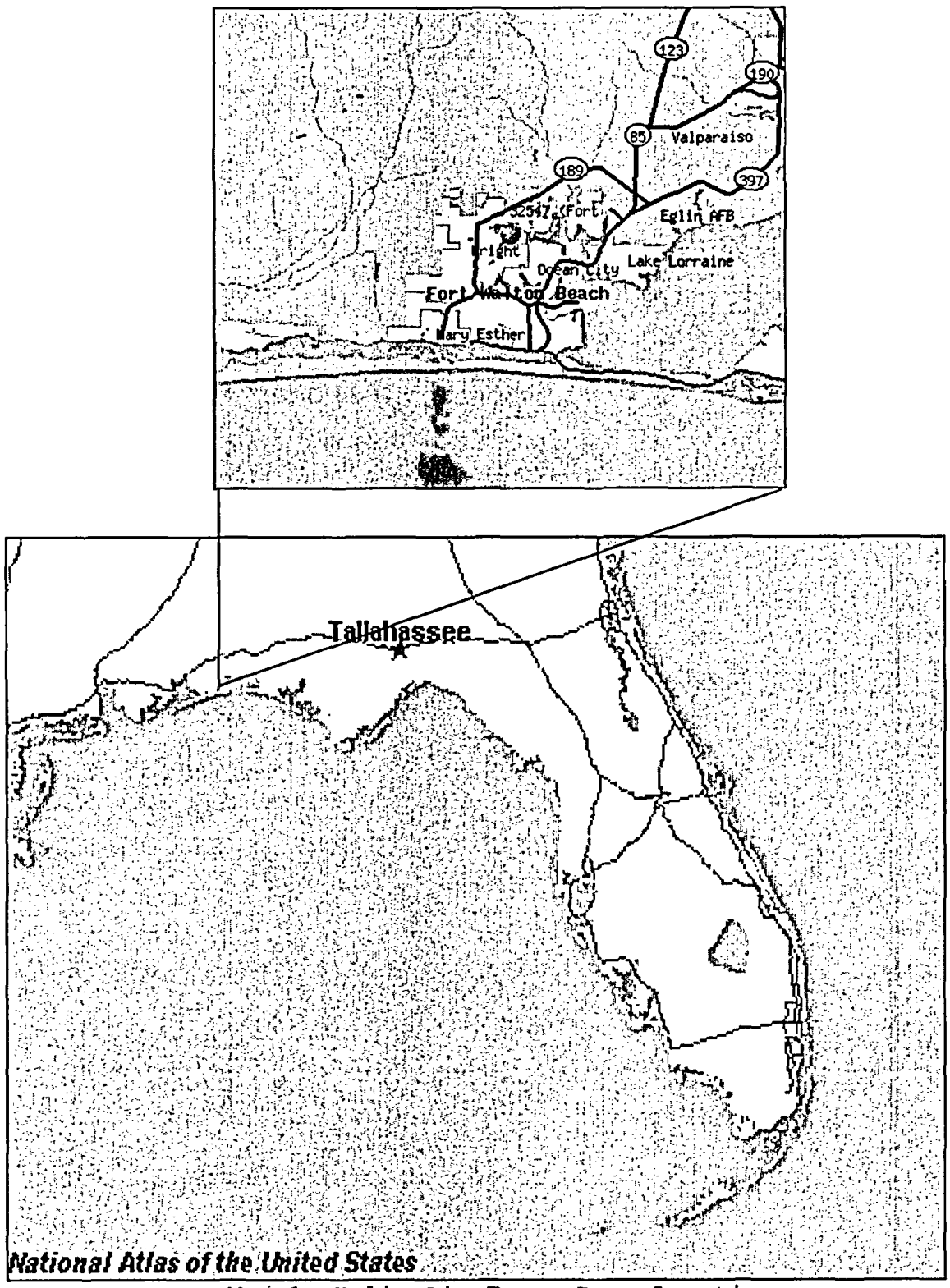
LIST OF SURVEY UNITS AND MAPS

Note:

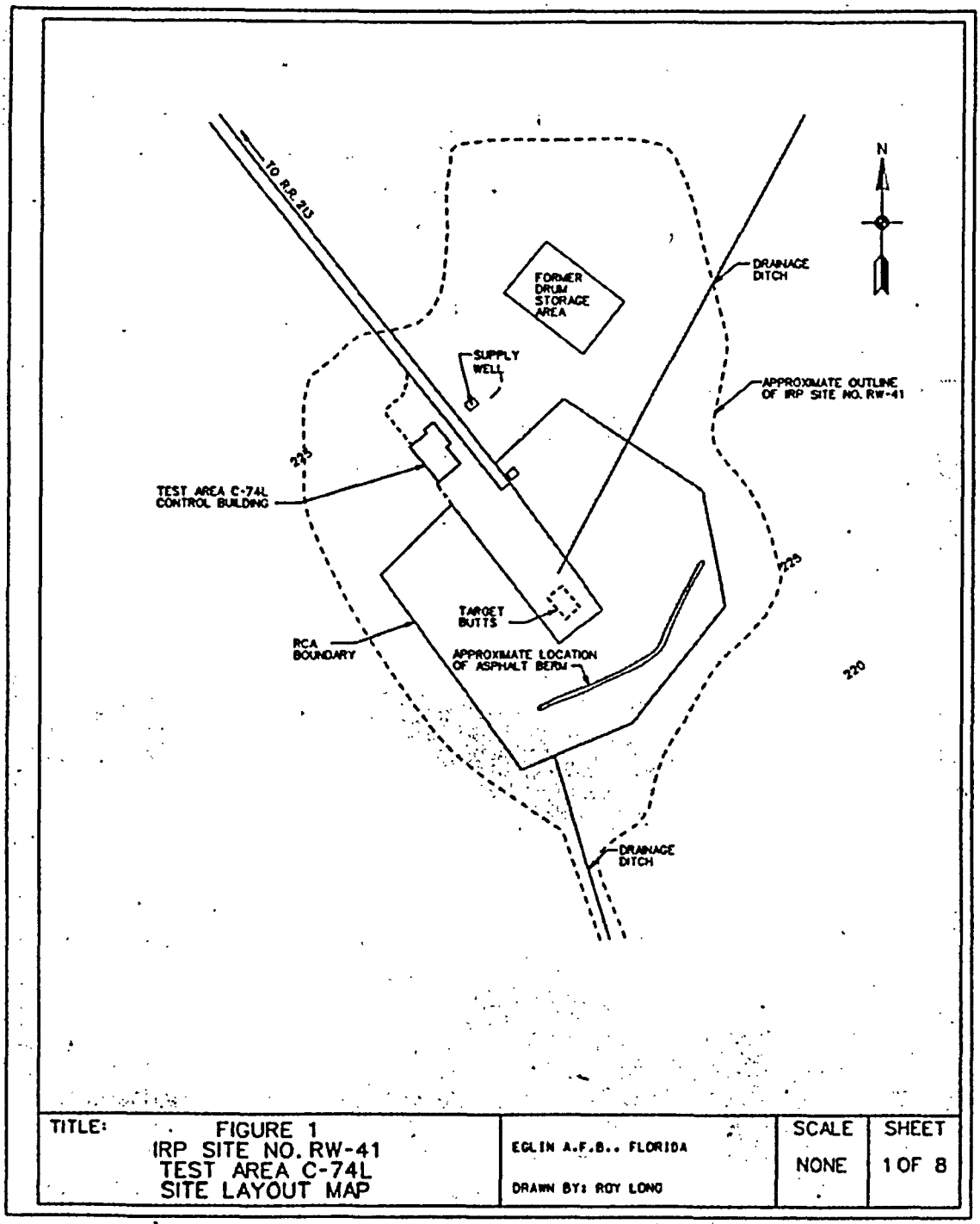
The list of survey units presented in the work plan was altered to facilitate surveys and for ease of data management. Survey aspects presented in the plan, Eglin SOPs, and MARSSIM were adhered to.

TABLE B-1. List of Survey Units

No.	Survey Area	Survey Unit	Description	Radionuclide of Interest	Potential Concern	Type of Survey
1	Bldg. 9372	Bldg. 9372 Work Areas Floors	Tile	Depleted Uranium (DU)	Area contamination	Final Status (Class 3)
2	Bldg. 9372	Bldg. 9372 Work Areas Walls	Block-1	DU	Area contamination	Final Status (Class 3)
3	Bldg. 9372	Gun Bays	Concrete	DU	Area contamination	Final Status (Class 3)
4	Bldg. 9373	Bldg. 9373 Exterior	Block-2	DU	Area contamination and fragments	Final Status (Class 3)
5	Bldg. 9372	Bldg. 9372 Exterior	Block-1	DU	Area contamination and fragments	Final Status (Class 3)
6	Range	Range Pads	Asphalt	DU	Area contamination and fragments	Scoping
7	Range	Catch Box	Concrete and steel	DU	Area contamination and fragments	Characterization
8	Outfall	Drain Sump, Line and outfall soils	Concrete and PVC	DU	Fragments and soil contamination	Scoping
9	Bldg. 9372	Gun Slots	Concrete and steel	DU	Fragments	Final Status (Class 1)
10	Bldg. 9372 and 9373	Roofs	Tar Paper and pebble	DU	Fragments	Scoping
11	Bldg. 9372 and 9373	Bldg. Exterior Soils	Soil within 2 meters of building	DU	Fragments	Scoping (Removal)



Map 1, Eglin Air Force Base Location
Range is located off of State Route 285 and Range Road 213.



Map 2, Eglin Range C-74L Layout. "Control Bldg" is Bldg 9372, "Supply Well" is Bldg 9373, and "Target Butts" includes the catchbox.

Appendix C

INSTRUMENTS & QUALITY ASSURANCE

Instrumentation

Set 1	[1]Beta	[1]Floor/wall Scanner	[1]Gamma	[1]Alpha
Manufacturer	Ludlum	Ludlum	Ludlum	Ludlum
Model	2360	2360	12S	2360
Serial Number	138255	138251	124213	138255
Calibration Due	10 Oct 02	10 Oct 02	10 Sep 03	10 Oct 02
Efficiency/ Sensitivity	19% for Tc-99	23% for Tc-99 & 21% for Pu-239	< 1 uR/hr	23% for Pu-239
Detector Manufacturer	Ludlum	Ludlum	Ludlum	Ludlum
Detector Model	43-93	43-37-1	Internal	43-93

[1] From calibration paperwork.

Set 2	[1]Beta	[1] Pipe Scanner	[1] Gamma	[1]Alpha
Manufacturer	Ludlum	Ludlum	Ludlum	Ludlum
Model	2360	2350-1	19	2360
Serial Number	145468	129436	148189	145468
Calibration Due	26 Mar 03	26 Mar 03	26 Mar 03	26 Mar 03
Efficiency/ Sensitivity	12% for Tc-99	2% for low energy photons	< 1 uR/hr	17% for Th-230
Detector Manufacturer	Ludlum	Ludlum	Ludlum	Ludlum
Detector Model	43-89	44-3	Internal	43-89

[1] From calibration paperwork.

Set 3 Miscellaneous	[1] Alpha/Beta/ Gamma (GM)	[1] Gamma (FIDLER)		
Manufacturer	Ludlum	Ludlum		
Model	2350-1	2221		
Serial Number	129436	125440		
Calibration Due	26 Mar 03	14 Aug 03		
Efficiency/ Sensitivity	5% Alpha	[2]ND		
Detector Manufacturer	Ludlum	Bicron		
Detector Model	44-9/3	FIDLER		

[1] From calibration paperwork.
[2] ND Not Determined.

All instruments met the QA/QC criteria.
Twice daily a check source reading was recorded and compared to the range listed on the instrument QC chart.

Summary of Investigation Levels

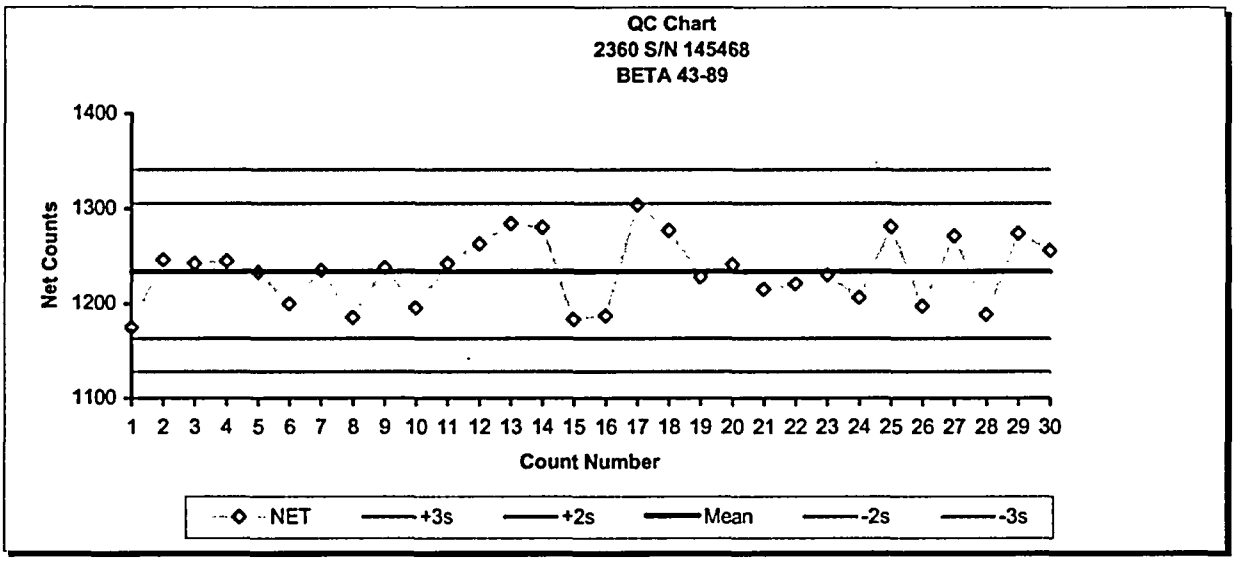
Instrument Use	[A]MDC dpm/100 cm^2	[B]Critical Level (cpm)	Investigation Level
Beta 43-93	359	410	410 cpm
Alpha 43-93	57	7	7 cpm
Floor Scanner Beta	149 (scan)	333 (static count)	333 cpm
Floor Scanner Alpha	177 (scan)	7 (static count)	10 cpm
Beta 43-89	662	324	324 cpm
Alpha 43-89	106	7	10 cpm
Gamma (both)	ND	NA	5 uR/hr above background (18 uR/hr)
FIDLER	ND	ND	300 Counts/min above background

ND = Not Determined, response above investigation level would prompt use of beta and/or gamma instruments.
A Determined from reference areas
B Background is included
Note: summary values are worst case (i.e. conservative based on worst instrument of sets or highest background.)

Instrument QC Charts

Chart Notes:

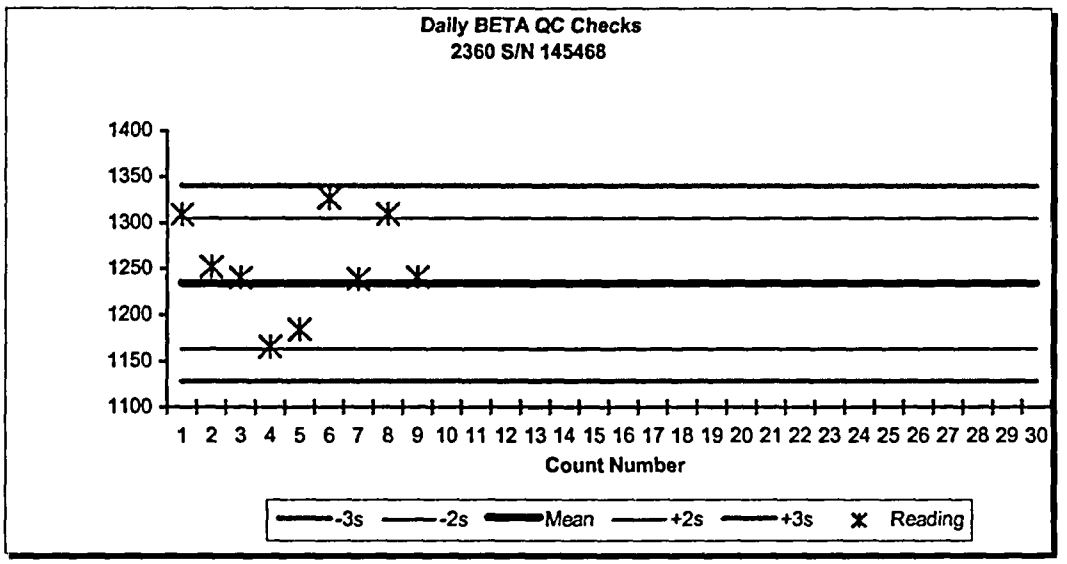
NA = Not Applicable
ND = Not required by plan and not done
NU = Not Used



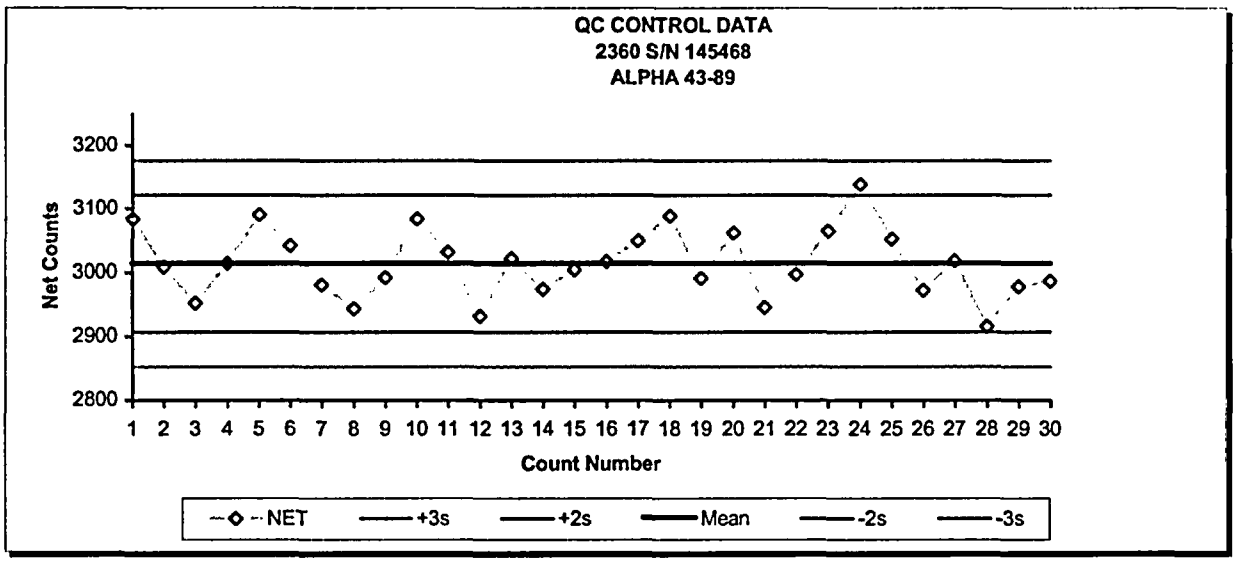
Model:	2360	SN#	145468	PROBE	43-89	SN#	169229	Cal Due:	26Mar03
Source:	Tc-99	SN#		Activity:	14,100	dpm		Cal Date:	1Feb95
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
1234	1305	to	1163	to	1341	to	1128	Efficiency:	0.088

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	1336	1175	11	1403	1242	21	1376	1215	
2	1407	1246	12	1424	1263	22	1382	1221	
3	1403	1242	13	1445	1284	23	1391	1230	
4	1406	1245	14	1441	1280	24	1367	1206	
5	1394	1233	15	1344	1183	25	1442	1281	
6	1361	1200	16	1348	1187	26	1358	1197	
7	1396	1235	17	1465	1304	27	1432	1271	
8	1346	1185	18	1438	1277	28	1349	1188	
9	1399	1238	19	1389	1228	29	1435	1274	
10	1356	1195	20	1402	1241	30	1417	1256	

Bkgd:	161	cpm	Mean:	1234	cpm	2sigma:	71 cpm	3sigma:	106 cpm



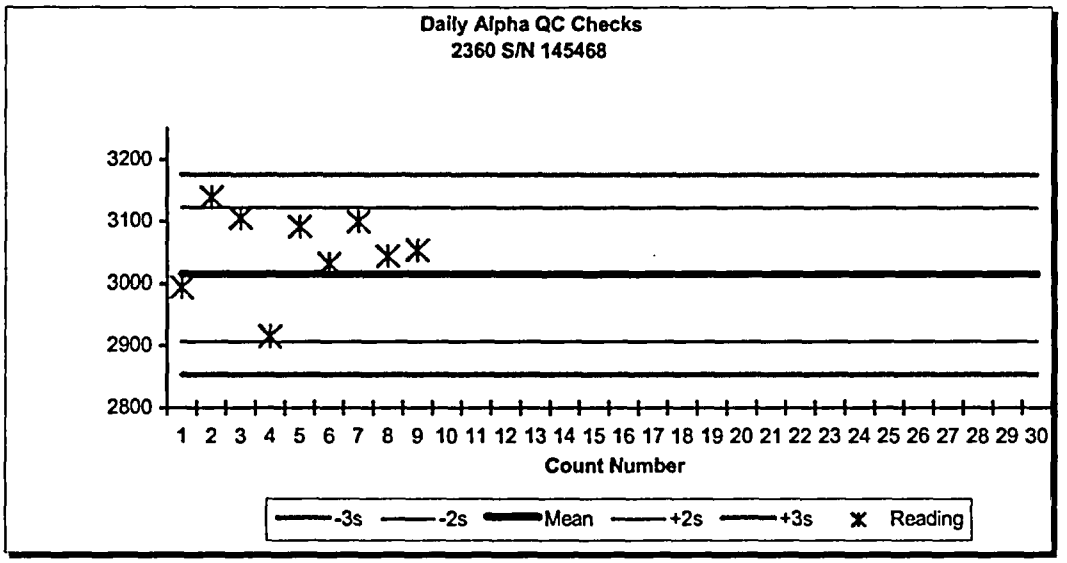
Daily BETA Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	1549	240	1309	ND			1579	327	1252
2	18Sep02	1495	255	1240	ND			1427	261	1166
3	19Sep02	1450	266	1184	1612	285	1327	1547	308	1239
4	20Sep02	1612	302	1310	1523	282	1241	NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0



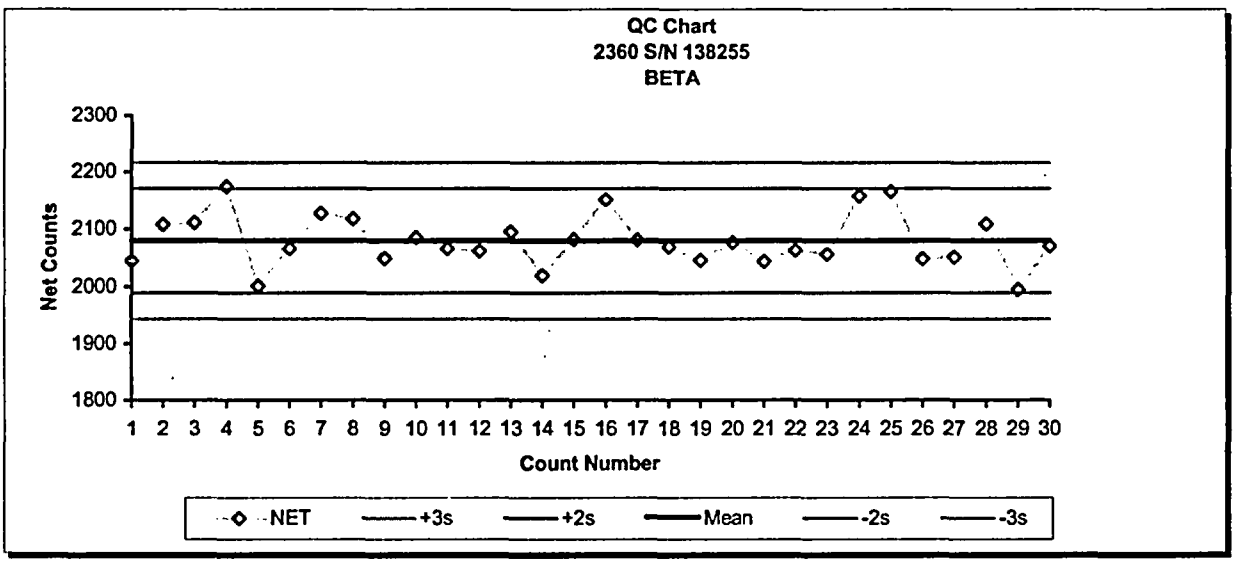
Model:	2360	SN#	145468	PROBE	43-89	SN#	169229	Cal Due:	26Mar03
Source:	Th230	SN#		Activity:	17,600	dpm		Cal Date:	1Feb95
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
3014	3122	to	2907	to	3176	to	2853	Efficiency:	0.171

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	3085	3084	11	3032	3031	21	2946	2945	
2	3009	3008	12	2933	2932	22	2998	2997	
3	2953	2952	13	3023	3022	23	3066	3065	
4	3015	3014	14	2975	2974	24	3140	3139	
5	3092	3091	15	3006	3005	25	3054	3053	
6	3043	3042	16	3018	3017	26	2973	2972	
7	2982	2981	17	3051	3050	27	3019	3018	
8	2944	2943	18	3090	3089	28	2916	2915	
9	2993	2992	19	2992	2991	29	2979	2978	
10	3085	3084	20	3063	3062	30	2987	2986	

Bkgd:	1	cpm	Mean:	3014	cpm	2sigma:	107 cpm	3sigma:	161 cpm



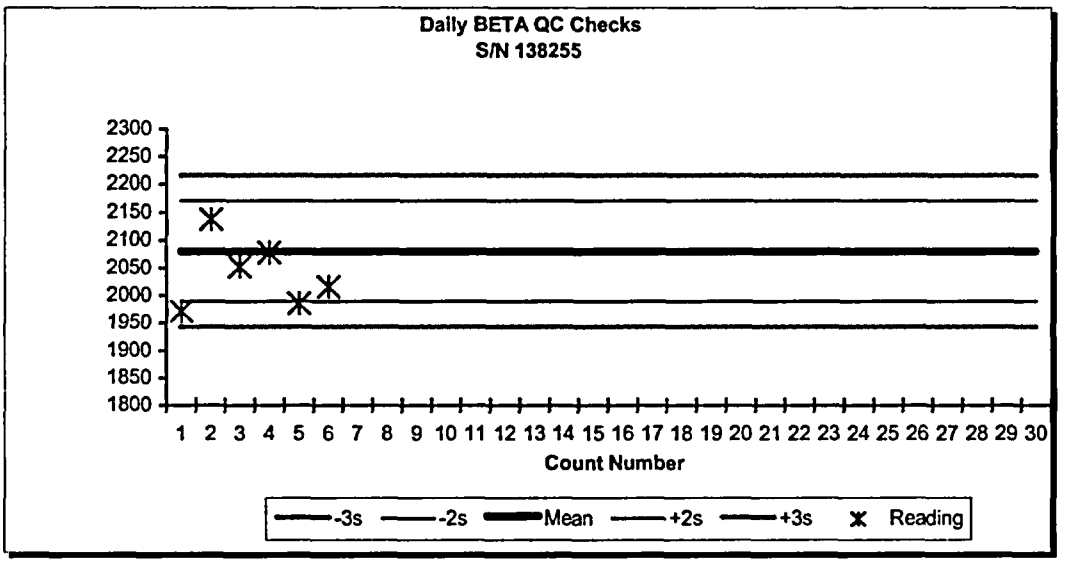
Daily Alpha Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	2994	0	2994	ND			3140	1	3139
2	18Sep02	3107	2	3105	ND			2916	1	2915
3	19Sep02	3091	0	3091	3032	1	3031	3100	1	3099
4	20Sep02	3044	1	3043	3054	1	3053	NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0



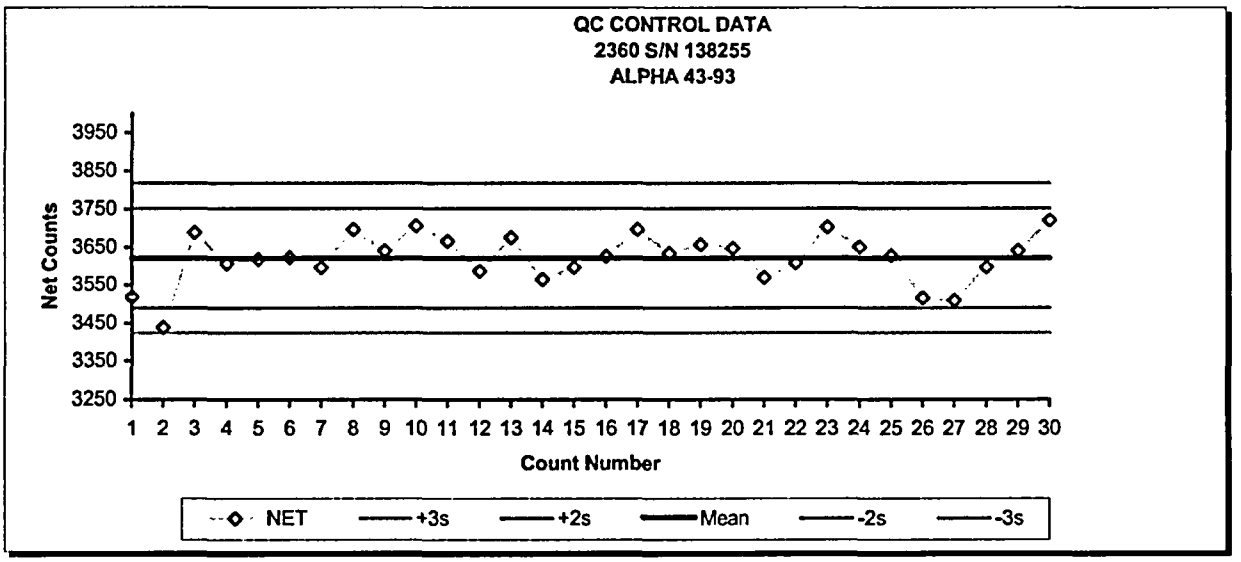
Model:	2360	SN#	138255	PROBE	43-93	SN#	PR182409	Cal Due:	10Oct02
Source:	Tc-99	SN#		Activity:	14,100	dpm		Cal Date:	1Feb95
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
2080	2171	to	1989	to	2216	to	1943	Efficiency:	0.147506

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	2167	2044	11	2189	2066	21	2166	2043	
2	2231	2108	12	2184	2061	22	2186	2063	
3	2234	2111	13	2218	2095	23	2179	2056	
4	2297	2174	14	2142	2019	24	2281	2158	
5	2123	2000	15	2205	2082	25	2289	2166	
6	2189	2066	16	2275	2152	26	2170	2047	
7	2250	2127	17	2204	2081	27	2174	2051	
8	2240	2117	18	2192	2069	28	2232	2109	
9	2171	2048	19	2168	2045	29	2117	1994	
10	2208	2085	20	2199	2076	30	2193	2070	

Bkgd:	123	cpm	Mean:	2080	cpm	2sigma:	91 cpm	3sigma:	136 cpm



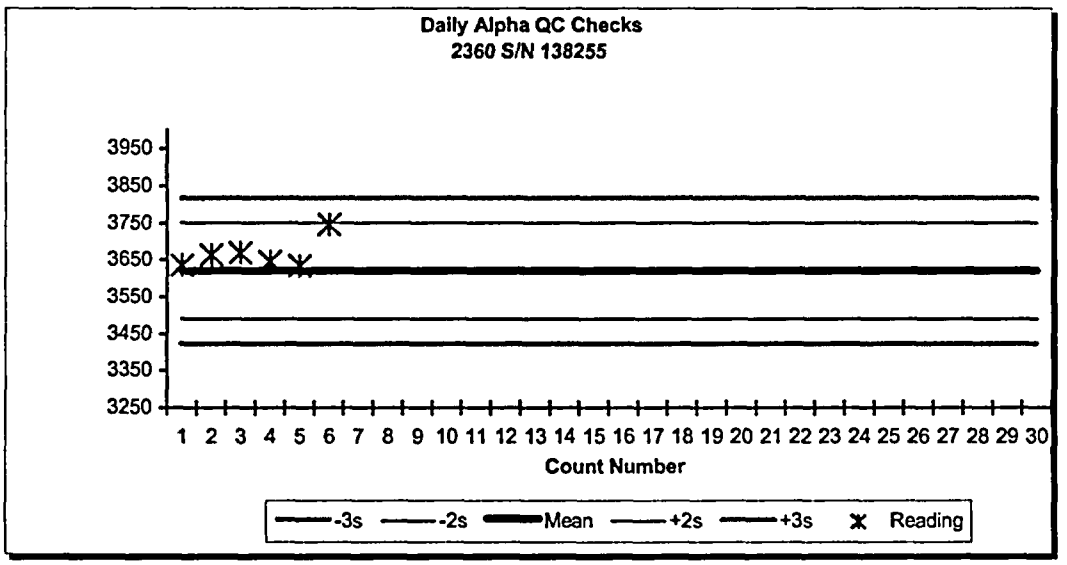
Daily BETA Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	2155	184	1971	ND			2371	234	2137
2	18Sep02	2303	251	2052	ND			2324	246	2078
3	19Sep02	2295	309	1986	ND			2298	282	2016
4	20Sep02	NU			NU			NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0



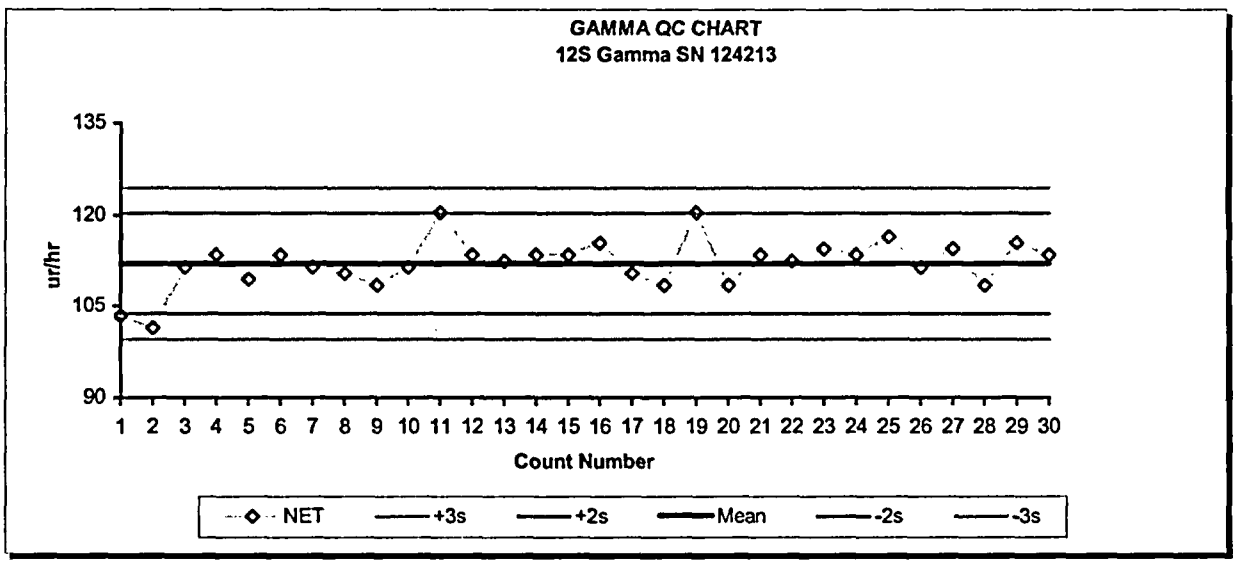
Model:	2360	SN#	138255	PROBE	43-93	SN#	PR182409	Cal Due:	10Oct02
Source:	Th230	SN#		Activity:	17,600	dpm		Cal Date:	1Feb95
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
3621	3752	to	3489	to	3817	to	3424	Efficiency:	0.205712

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	3520	3518	11	3667	3665	21	3572	3570	
2	3440	3438	12	3589	3587	22	3610	3608	
3	3690	3688	13	3677	3675	23	3704	3702	
4	3608	3606	14	3566	3564	24	3652	3650	
5	3620	3618	15	3598	3596	25	3629	3627	
6	3624	3622	16	3627	3625	26	3517	3515	
7	3598	3596	17	3698	3696	27	3510	3508	
8	3697	3695	18	3635	3633	28	3599	3597	
9	3642	3640	19	3657	3655	29	3641	3639	
10	3708	3706	20	3648	3646	30	3721	3719	

Bkgd:	2	cpm	Mean:	3621	cpm	2sigma:	131 cpm	3sigma:	196 cpm



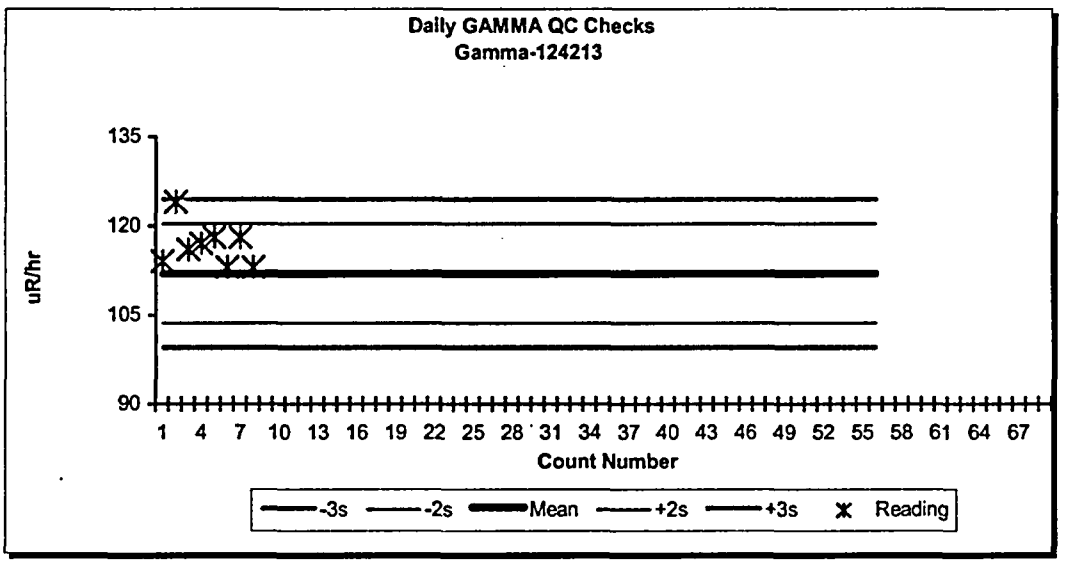
Daily Alpha Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	3637	1	3636	ND			3665	1	3664
2	18Sep02	3669	1	3668	ND			3645	0	3645
3	19Sep02	3637	3	3634	ND			3746	0	3746
4	20Sep02	NU	0		NU			NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0



Model:	12S	SN#	124213	PROBE	12S	SN#	NA	Cal Due:	10Sep03
Source:	Cs-137	SN#	547	Activity:	1	uCi		Cal Date:	24ARR00
Mean	+2s	SN#	-2s		+3s:		-3s	Date:	17Sep02
112	120	to	104	to	124	to	100	Efficiency:	NA

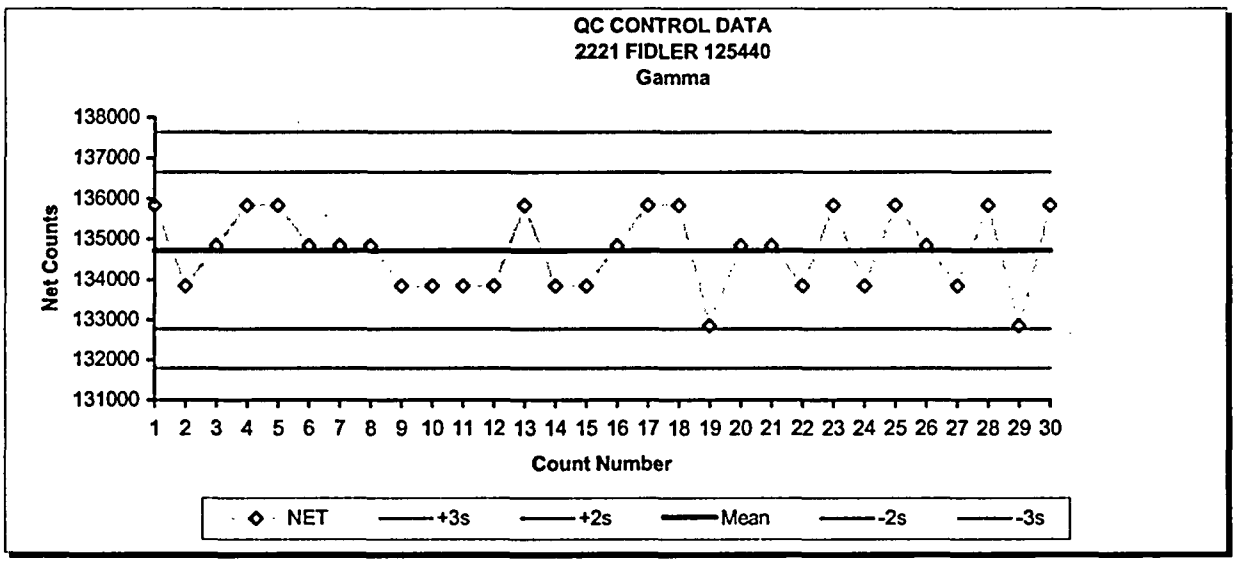
Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	110	103	11	127	120	21	120	113	
2	108	101	12	120	113	22	119	112	
3	118	111	13	119	112	23	121	114	
4	120	113	14	120	113	24	120	113	
5	116	109	15	120	113	25	123	116	
6	120	113	16	122	115	26	118	111	
7	118	111	17	117	110	27	121	114	
8	117	110	18	115	108	28	115	108	
9	115	108	19	127	120	29	122	115	
10	118	111	20	115	108	30	120	113	

Bkgd:	7	Mean:	112	2sigma:	8 cnts	3sigma:	12 cnts



Daily Checks										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	120	6	114	ND			133	9	124
2	18Sep02	128	12	116	ND			129	12	117
3	19Sep02	130	12	118	ND			125	12	113
4	20Sep02	130	12	118	ND			125	12	113
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0

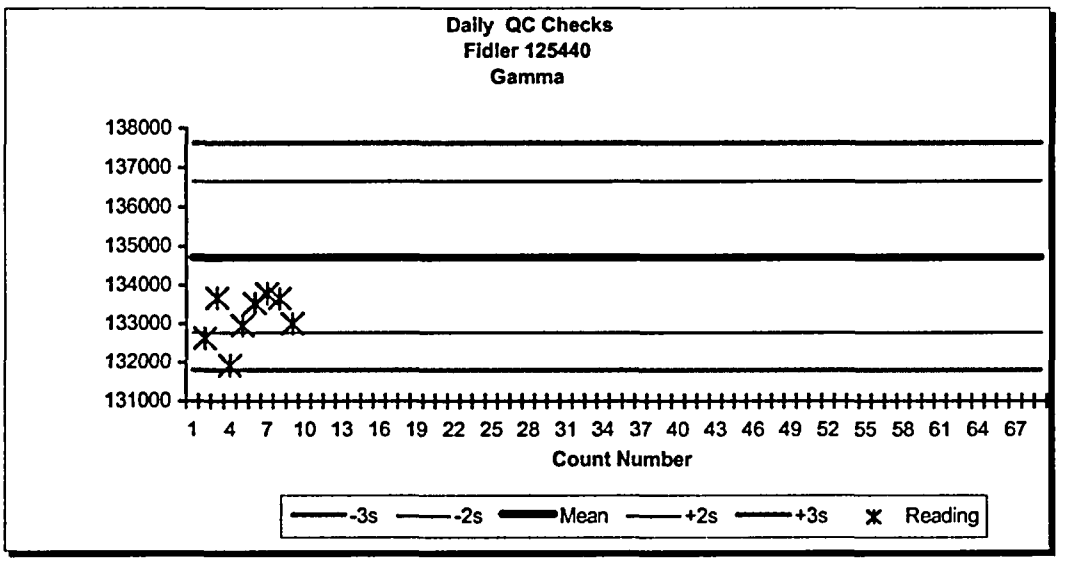
All values rounded to nearest whole number.
ND = Test not required by plan and not done.
NU = Not Used
NA = Not Applicable



Model:	2221	SN#	125440	PROBE	FIDLER	SN#	94113028	Cal Due:	14Aug03
Source:	Cs-137	SN#	547	Activity:	1	uCi		Cal Date:	
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
134712	136658	to	132765	to	137631	to	131792	Efficiency:	NA

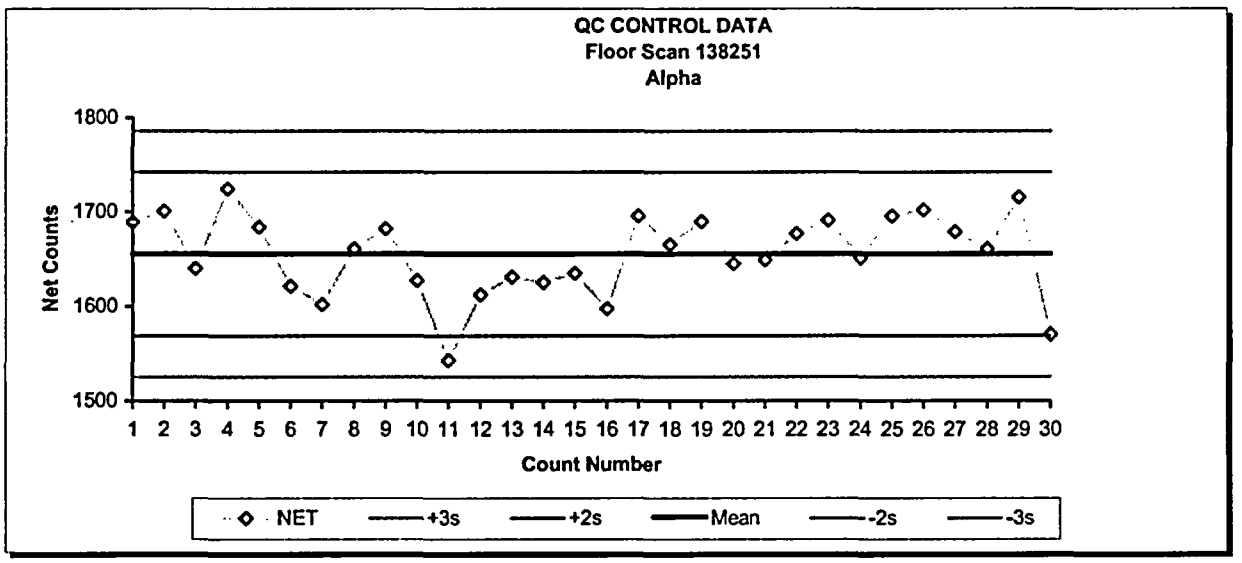
Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	139000	135845	11	137000	133845	21	138000	134845	
2	137000	133845	12	137000	133845	22	137000	133845	
3	138000	134845	13	139000	135845	23	139000	135845	
4	139000	135845	14	137000	133845	24	137000	133845	
5	139000	135845	15	137000	133845	25	139000	135845	
6	138000	134845	16	138000	134845	26	138000	134845	
7	138000	134845	17	139000	135845	27	137000	133845	
8	138000	134845	18	139000	135845	28	139000	135845	
9	137000	133845	19	136000	132845	29	136000	132845	
10	137000	133845	20	138000	134845	30	139000	135845	

Bkgd:	3155	cpm	Mean:	134712	cpm	2sigma:	1946 cpm	3sigma:	2919 cpm



Daily Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	139000	6369	132631	ND			140000	6325	133675
2	18Sep02	146000	14082	131918	ND			147000	14048	132952
3	19Sep02	148000	14474	133526	ND			148000	14213	133787
4	20Sep02	148000	14336	133664	ND			147000	13999	133001
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0

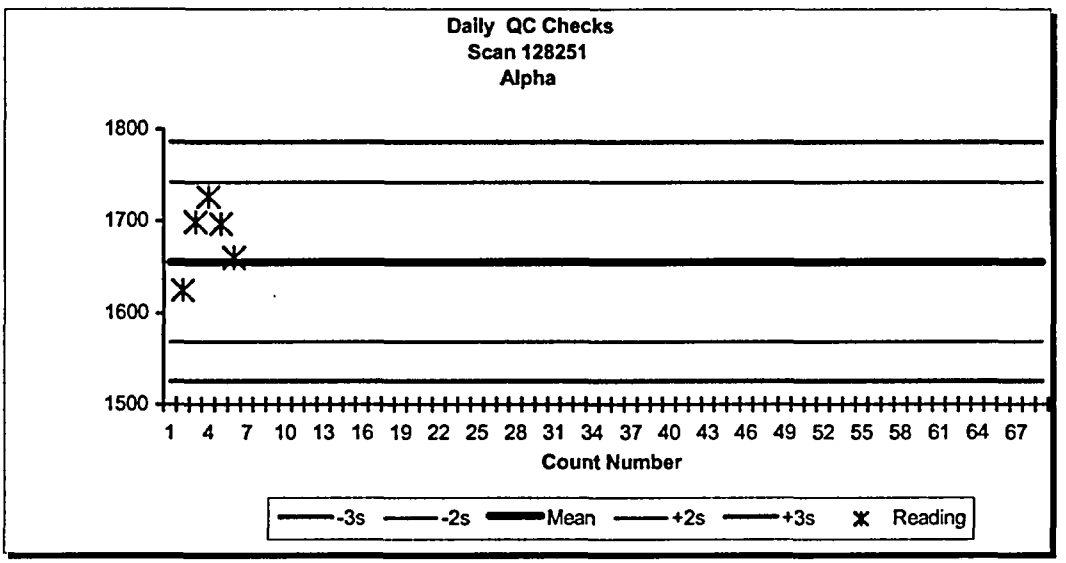
ND = Test not required by plan and not done.
NU = Not Used
17 Sep Background in van.



Model:	2360	SN#	138251	PROBE	43-37-1	SN#	PR136361	Cal Due:	10Oct02
Source:	Th-230	SN#	2 Source	Activity:	34,100	dpm		Cal Date:	
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
1655	1742	to	1569	to	1786	to	1525	Efficiency:	0.049

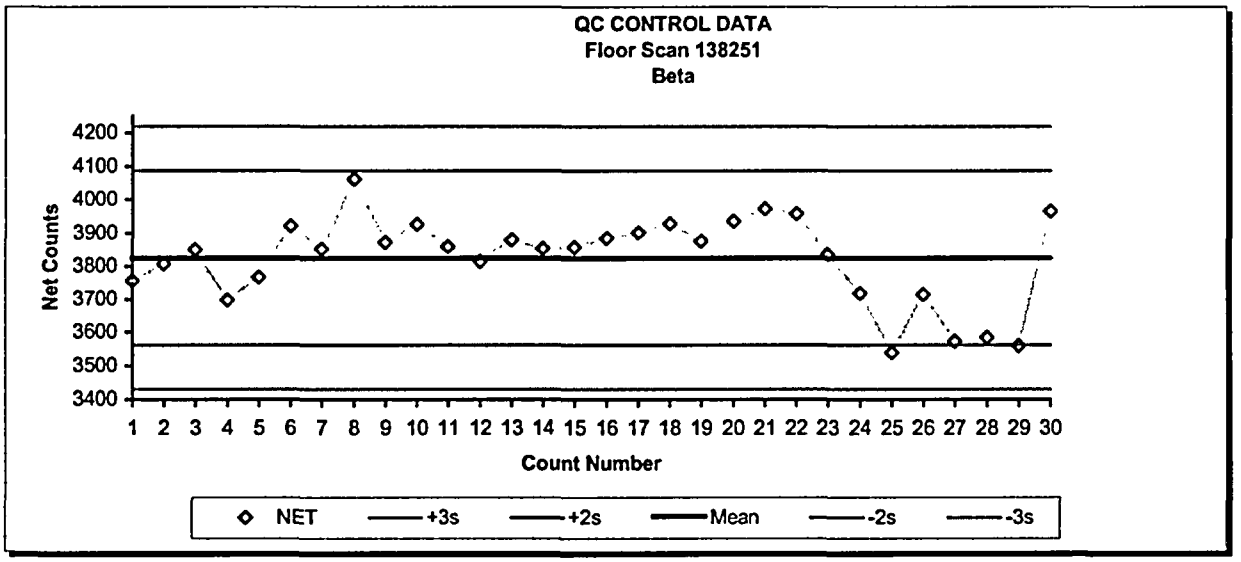
Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	1691	1689	11	1545	1543	21	1651	1649	
2	1703	1701	12	1614	1612	22	1679	1677	
3	1642	1640	13	1633	1631	23	1693	1691	
4	1727	1725	14	1627	1625	24	1653	1651	
5	1686	1684	15	1637	1635	25	1698	1696	
6	1623	1621	16	1599	1597	26	1704	1702	
7	1604	1602	17	1698	1696	27	1681	1679	
8	1663	1661	18	1667	1665	28	1663	1661	
9	1684	1682	19	1692	1690	29	1718	1716	
10	1629	1627	20	1647	1645	30	1572	1570	

Bkgd:	2	cpm	Mean:	1655	cpm	2sigma:	86 cpm	3sigma:	130 cpm



Daily Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	NU			ND			NU		
2	18Sep02	1626	1	1625	1702	3	1699	1727	1	1726
3	19Sep02	1699	2	1697	ND			1663	3	1660
4	20Sep02	NU			NU			NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0

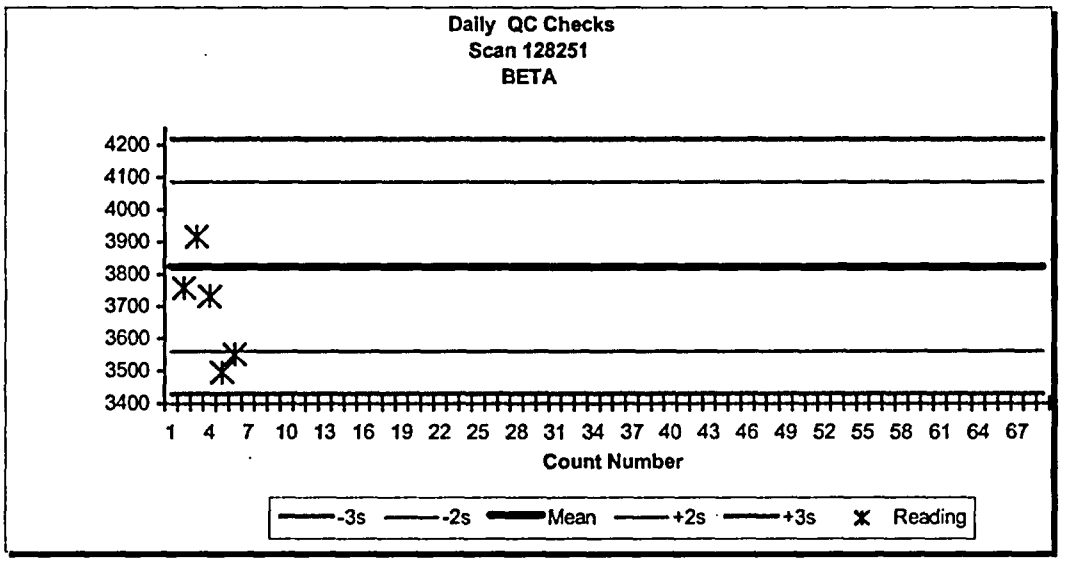
ND = Test not required by plan and not done.
NU = Not Used



Model:	2360	SN#	138251	PROBE	43-37-1	SN#	PR136361	Cal Due:	10Oct02
Source:	Tc-99	SN#	96TC220	Activity:	14,100	dpm		Cal Date:	1Feb95
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
3824	4087	to	3561	to	4218	to	3429	Efficiency:	0.271203

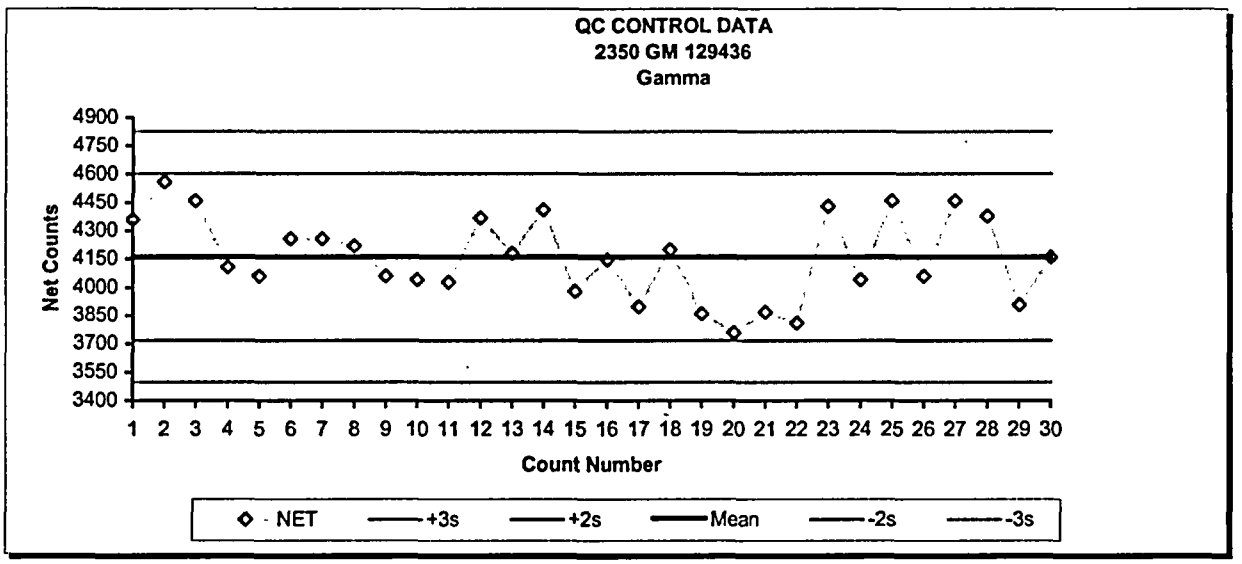
Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	4006	3757	11	4108	3859	21	4221	3972	
2	4057	3808	12	4063	3814	22	4207	3958	
3	4099	3850	13	4128	3879	23	4084	3835	
4	3947	3698	14	4102	3853	24	3967	3718	
5	4017	3768	15	4106	3857	25	3789	3540	
6	4170	3921	16	4133	3884	26	3963	3714	
7	4101	3852	17	4150	3901	27	3822	3573	
8	4311	4062	18	4177	3928	28	3832	3583	
9	4121	3872	19	4124	3875	29	3808	3559	
10	4176	3927	20	4185	3936	30	4215	3966	

Bkgd:	249	cpm	Mean:	3824	cpm	2sigma:	262 cpm	3sigma:	394 cpm



Daily Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	NU			ND			NU		
2	18Sep02	3989	230	3759	4156	240	3916	3969	238	3731
3	19Sep02	3731	235	3496	ND			3777	227	3550
4	20Sep02	NU			NU			NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0

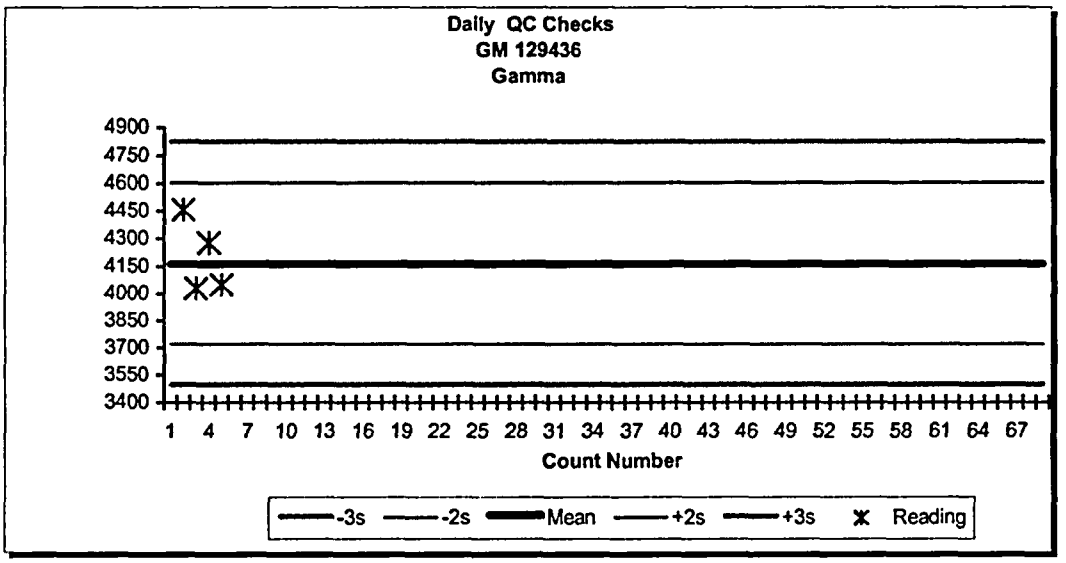
ND = Test not required by plan and not done.
NU = Not Used



Model:	2350	SN#	129436	PROBE	44-9/3	SN#	PR042567	Cal Due:	26Mar03
Source:	Cs-137	SN#	547	Activity:	1	uCi		Cal Date:	
Mean	+2s		-2s		+3s:		-3s	Date:	17Sep02
4160	4603	to	3718	to	4824	to	3496	Efficiency:	NA

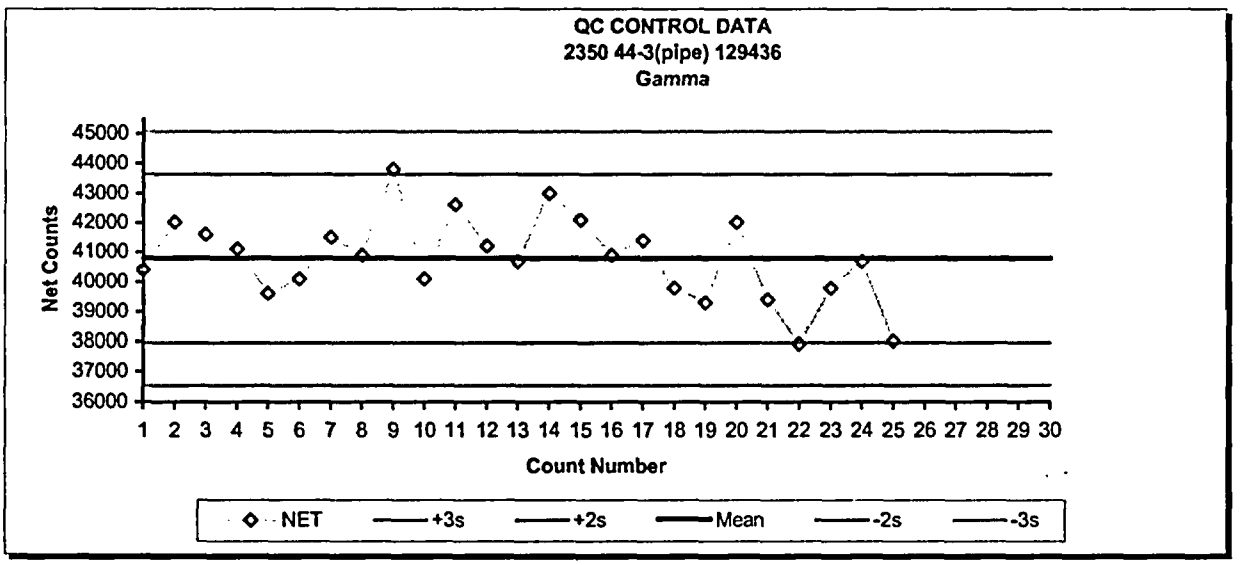
Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	4400	4360	11	4070	4030	21	3910	3870	
2	4600	4560	12	4410	4370	22	3850	3810	
3	4500	4460	13	4220	4180	23	4470	4430	
4	4150	4110	14	4450	4410	24	4080	4040	
5	4100	4060	15	4020	3980	25	4500	4460	
6	4300	4260	16	4190	4150	26	4100	4060	
7	4300	4260	17	3940	3900	27	4500	4460	
8	4260	4220	18	4240	4200	28	4420	4380	
9	4100	4060	19	3900	3860	29	3950	3910	
10	4080	4040	20	3800	3760	30	4200	4160	

Bkgd:	40	cpm	Mean:	4160	cpm	2sigma:	442 cpm	3sigma:	664 cpm



Daily Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	NU			ND			NU		
2	18Sep02	4500	43	4457	ND			4070	42	4028
3	19Sep02	4320	43	4277	ND			4090	41	4049
4	20Sep02	NU			ND			NU		
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0

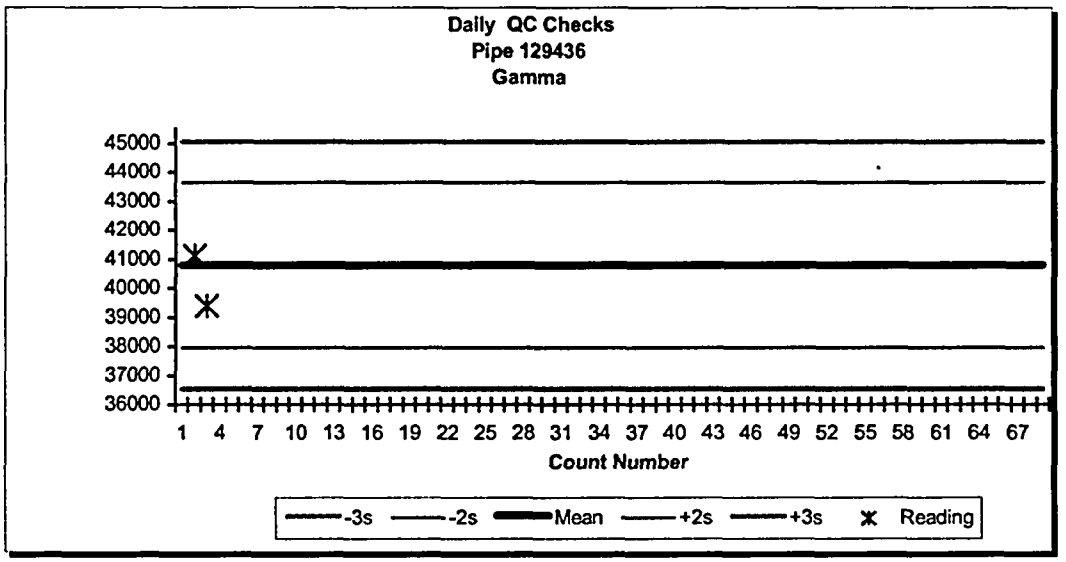
ND = Test not required by plan and not done.
NU = Not Used



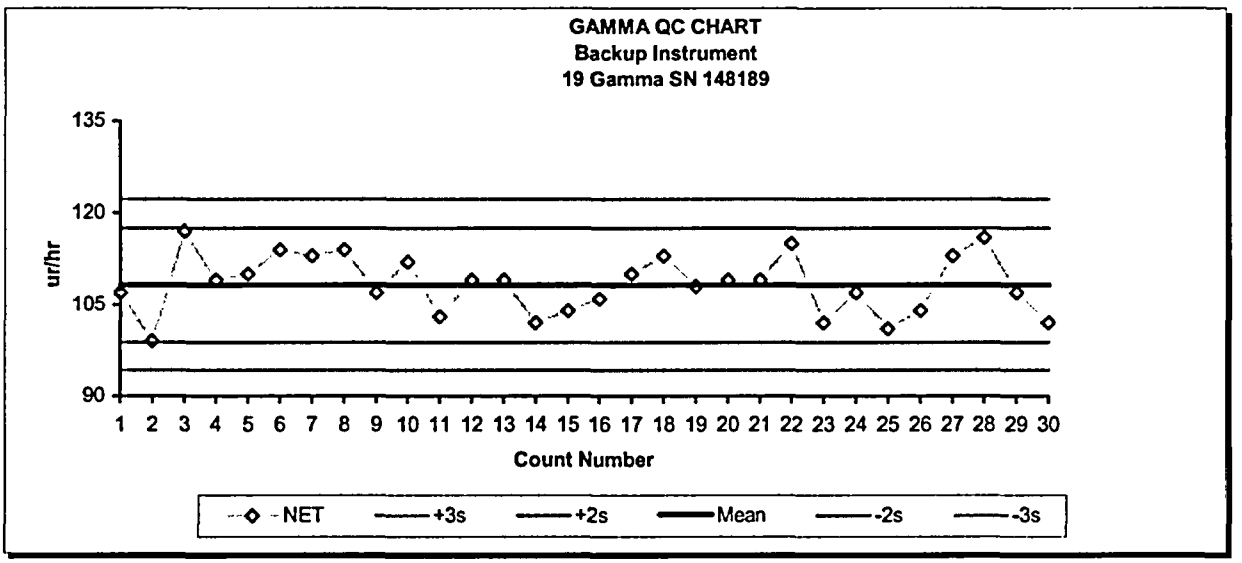
Model:	2350	SN#	129436	PROBE	44-3	SN#	PR143692	Cal Due:	26Mar03
Source:	Cs-137	SN#	547	Activity:	1	uCi		Cal Date:	
Mean	+2s		-2s		+3s:		-3s	Date:	20Sep02
40800	43642	to	37958	to	45063	to	36537	Efficiency:	NA

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	40700	40404	11	42900	42604	21	39700	39404	
2	42300	42004	12	41500	41204	22	38200	37904	
3	41900	41604	13	41000	40704	23	40100	39804	
4	41400	41104	14	43300	43004	24	41000	40704	
5	39900	39604	15	42400	42104	25	38300	38004	
6	40400	40104	16	41200	40904	26			
7	41800	41504	17	41700	41404	27			
8	41200	40904	18	40100	39804	28			
9	44100	43804	19	39600	39304	29			
10	40400	40104	20	42300	42004	30			

Bkgd:	296	cpm	Mean:	40800	cpm	2sigma:	2842 cpm	3sigma:	4263 cpm



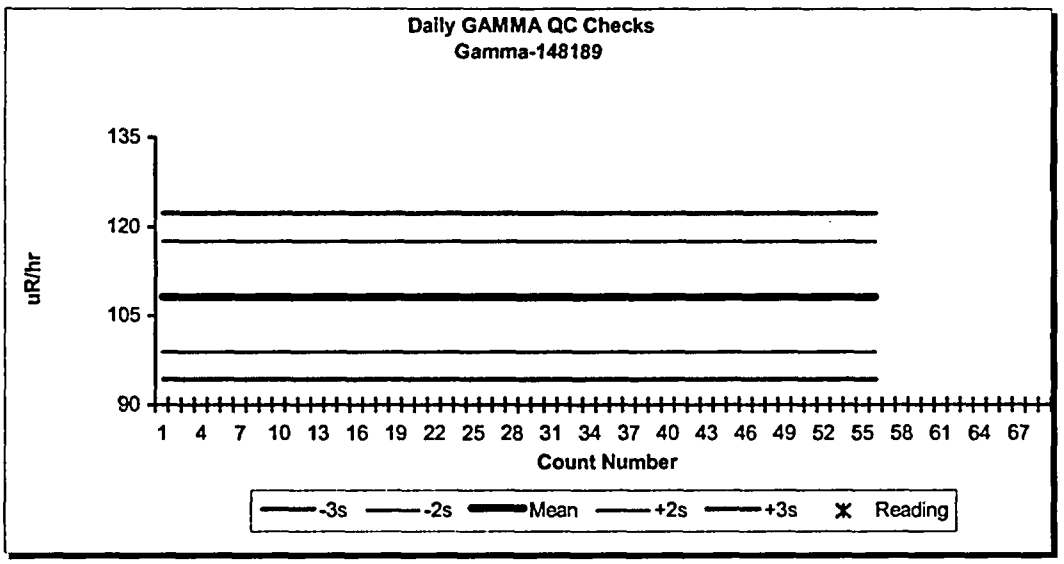
Daily Checks in cpm										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	NU			ND			NU		
2	18Sep02	NU			ND			NU		
3	19Sep02	NU			ND			NU		
4	20Sep02	41400	290	41110	ND			39700	303	39397
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0



Model:	19	SN#	148189	PROBE	19	SN#	NA	Cal Due:	26Mar03
Source:	Cs-137	SN#	547	Activity:	1	uCi		Cal Date:	24ARR00
Mean	+2s	SN#	-2s		+3s:		-3s	Date:	17Sep02
108	118	to	99	to	122	to	94	Efficiency:	NA

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	110	107	11	106	103	21	112	109	
2	102	99	12	112	109	22	118	115	
3	120	117	13	112	109	23	105	102	
4	112	109	14	105	102	24	110	107	
5	113	110	15	107	104	25	104	101	
6	117	114	16	109	106	26	107	104	
7	116	113	17	113	110	27	116	113	
8	117	114	18	116	113	28	119	116	
9	110	107	19	111	108	29	110	107	
10	115	112	20	112	109	30	105	102	

Bkgd:	3	Mean:	108	2sigma:	9 cnts	3sigma:	14 cnts



Daily Checks										
	Date	Gross	BKG	NET	GROSS	BKG	NET	GROSS	BKG	NET
1	17Sep02	NU								0
2	18Sep02	NU								0
3	19Sep02	NU								0
4	20Sep02	NU								0
5				0			0			0
6				0			0			0
7				0			0			0
8				0			0			0
9				0			0			0
10				0			0			0

NU = Not Used

Instrument was a backup only, not used.

Appendix D

REFERENCE AREA/BACKGROUND SURVEY RESULTS

1. Reference areas were selected based on operational history and construction. Non-impacted areas constructed of the same materials as found in the survey units were selected as reference areas. Reference area sampling included at least 14 measurements of each material typical of survey units for use in statistical tests if needed.

2. Although individual rooms/materials were surveyed randomly the results were organized by construction material to allow for comparisons to be made in the field (i.e. investigation levels, etc.).

Table D-1. Summary of reference area material means.

Material	Alpha (static) Mean cpm	Beta (static) Mean cpm	Scanner Mean alpha cpm	Scanner Mean Beta cpm	Gamma Mean uR/hr	FIDLER cpm	Areas
Concrete	3	161	3	181	12	9251	Floors, gun bay walls
Cinder Block 1	1	126	3	280	12	6412	Walls
Plaster (Stucco)	3	285	7	251	10	4000	Building exterior
Asphalt	13	493	NA	NA	9	11000	Range areas
Tile	2	129	3	179	12	3827	9372 floors
Cinder Block 2	3	365	7	558	12	17660	Some wall portions and 9373
Steel	40	300	NA	NA	12	4000	Range pieces

3. Reference areas were as follows: Mechanical and hydraulic rooms of Building 9372, asphalt roadway, tile in Building 9364, and roofs of Buildings 9352 and 9354.

4. Background results for each survey unit are reported with the survey data.

5. Eglin soil sampling protocols consider the normal presence of natural uranium as insignificant. As such, background for uanium in soils was not determined and not considered in evaluation of soil sample results. FIDLER background over soil ranged from 3 to 5 kcpm.

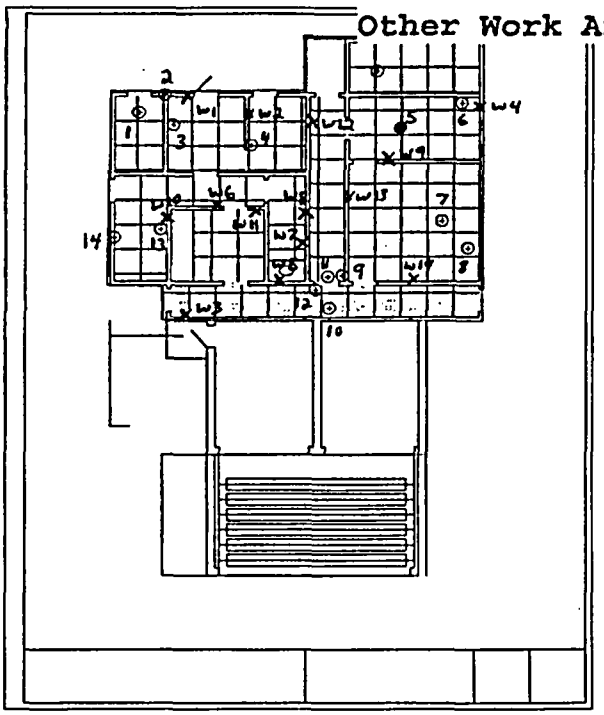
Appendix E

SURVEY AREA/UNIT RESULTS

Figure notes: For the interior of Building 9372, wipe sample locations on walls are marked with an "X" and are numbered with a "W" (for example, W1 through W14 for the walls of Building 9372).

Wipes sample locations on floors are marked with an encircled "X" or "+".

Other Work Areas Bldg 9372



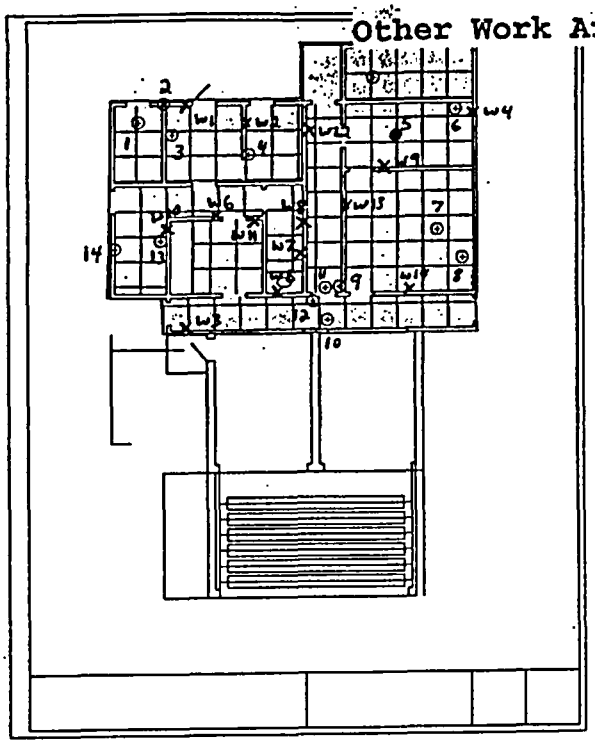
Date: 18-Sep-02 Floors									
LOCATION CODE	MONITORING			WIPE TEST					WIPE NO.
	Alpha	Beta	Gamma	Alpha		Beta		Pass*	
(Units =>)	dpm/100 cm²	dpm/100 cm²	uR/hr	dpm/100 cm² +/- 2 sigma					
(Bkgd =>)	17	679	12.0	0.4		2.1			
(MDC =>)	47	239	-	0.8		2.5			
1	3	29	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-01
2	-12	-29	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-02
3	-12	-38	-10	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-03
4	-12	-5	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-04
5	-3	96	2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-05
6	-3	154	4	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-06
7	-12	-159	0	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-07
8	-5	-145	2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-08
9	-8	-61	2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-09
10	-8	61	-6	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-10
11	-13	237	-5	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-11
12	-15	164	-6	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-12
13	-10	-65	-10	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-13
14	-12	-83	-10	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-14
15	Duplicate of #7	N/A	N/A	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-15
16	Blank	N/A	N/A	A	+/- 0.0	B	+/- 0.0	Pass	E9372-1-16

A = Alpha analysis result is less than the minimum detectable conentration. MDC less than 2 dpm.

B = Beta analysis result is less than the minimum detectable conentration. MDC less than 5 dpm.

* = Comparison of result to the criteria of 10% of the DCGL action level.

Other Work Areas Bldg 9372

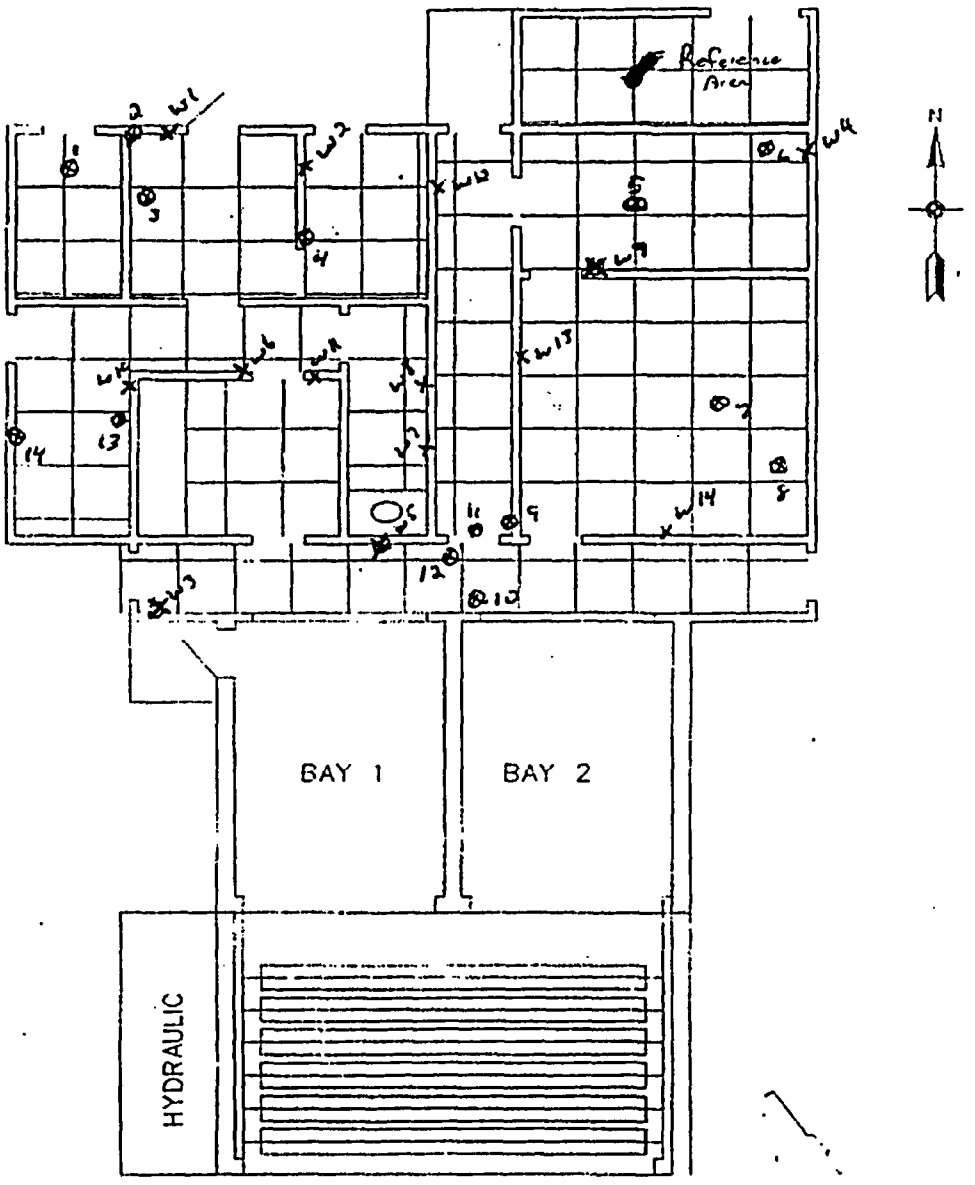


Date:	18-Sep-02			Walls				
LOCATION CODE	MONITORING			WIPE TEST				WIPE NO.
	Alpha	Beta	Gamma	Alpha		Beta	Pass*	
(Units =>)	dpm/100 cm²	dpm/100 cm²	uR/hr	dpm/100 cm² +/- 2 sigma				
(Bkgd =>)	17	663	12.0	0.4		2.1		
(MDC =>)	47	239	-	0.8		2.5		
1	-15	-185	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-01
2	-8	-123	-8	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-02
3	-10	-77	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-03
4	-13	8	2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-04
5	-15	-96	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-05
6	-10	-148	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-06
7	-10	-159	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-07
8	-12	-121	-10	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-08
9	-15	-262	2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-09
10	-8	-87	-9	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-10
11	-13	-151	-10	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-11
12	-12	141	-2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-12
13	-17	-174	0	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-13
14	-13	-643	2	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-14
15	Duplicate of #9	N/A	N/A	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-15
16	Blank -	N/A	N/A	A	+/- 0.0	B	+/- 0.0	Pass	E9372-2-16

A = Alpha analysis result is less than the minimum detectable conentration. MDC less than 2 dpm.

B = Beta analysis result is less than the minimum detectable conentration. MDC less than 5 dpm.

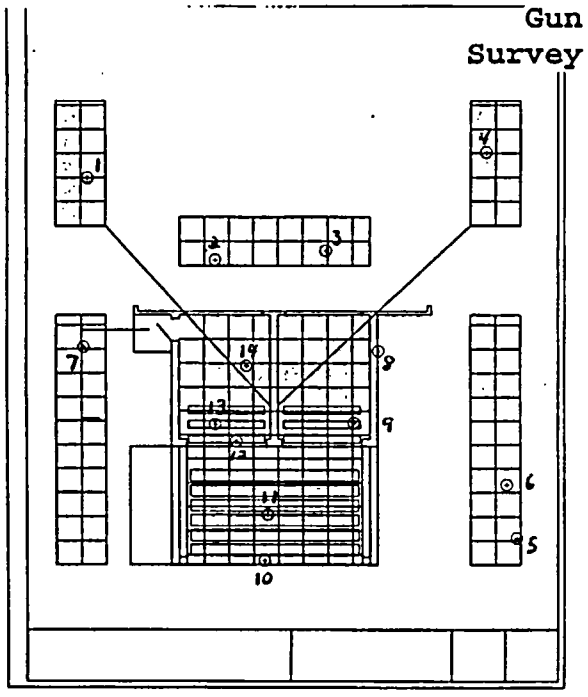
* = Comparison of result to the criteria of 10% of the DCGL action level.



NOTE: GRID IS 1M X 1M

TITLE:			
FIGURE 2 RANGE C-74L BLDG 9372	EGLIN A.F.B., FLORIDA DRAWN BY: ROY LONG	SCALE NONE	SHEET 2 OF 8

Gun Bay
Survey Unit 3



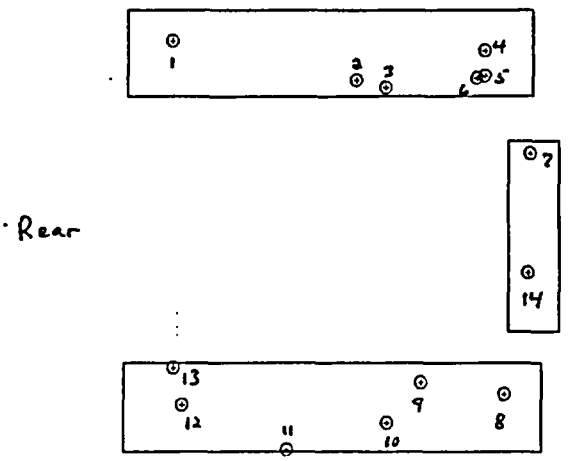
Date:	18-Sep-02							
LOCATION	MONITORING			WIPE TEST				WIPE NO.
CODE	Alpha	Beta	Gamma	Alpha	Beta	Pass*		
(Units =>)	dpm/100 cm²	dpm/100 cm²	uR/hr	dpm/100 cm² +/- 2 sigma				
(Bkgd =>)	17	847	12.0	0.4	2.1			
(MDC =>)	47	239	-	0.8	2.5			
1	-5	-145	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-01
2	-7	-117	-4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-02
3	3	-146	-4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-03
4	-3	-154	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-04
5	-2	-47	-4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-05
6	0	-58	-4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-06
7	-5	-77	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-07
8	13	-76	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-08
9	5	15	-4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-09
10	0	59	4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-10
11	-5	-6	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-11
12	0	135	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-12
13	0	-159	-4	A +/- 0.0	B +/- 0.0	Pass		E9372-3-13
14	-5	-43	0	A +/- 0.0	B +/- 0.0	Pass		E9372-3-14
15	Duplicate of #9	N/A	N/A	A +/- 0.0	B +/- 0.0	Pass		E9372-3-15
16	Blank	N/A	N/A	A +/- 0.0	B +/- 0.0	Pass		E9372-3-16

A = Alpha analysis result is less than the minimum detectable conentration. MDC less than 2 dpm.

B = Beta analysis result is less than the minimum detectable conentration. MDC less than 5 dpm.

* = Comparison of result to the criteria of 10% of the DCGL action level.

Building Exterior
9372



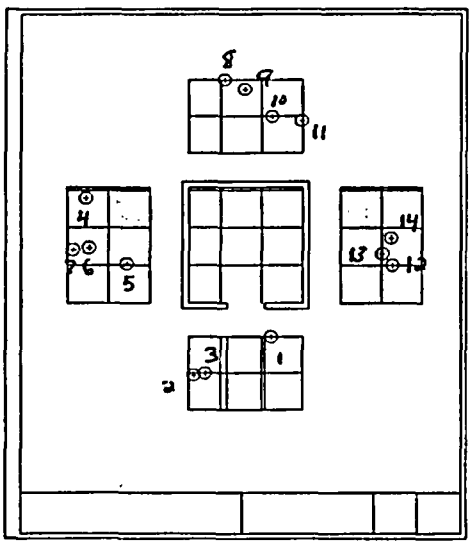
Date:	18-Sep-02									
LOCATION	MONITORING			WIPE TEST						WIPE
CODE	Alpha	Beta	Gamma	Alpha		Beta		Pass*		NO.
(Units =>)	dpm/100 cm^2	dpm/100 cm^2	uR/hr	dpm/100 cm^2 +/- 2 sigma						
(Bkgd =>)	25	1610	4.0	0.4		2.1				
(MDC =>)	93	503	-	0.8		2.5				
1	-10	-88	2	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-01
2	10	224	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-02
3	20	136	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-03
4	-20	208	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-04
5	-10	-16	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-05
6	-20	-64	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-06
7	0	-168	2	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-07
8	-20	120	1	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-08
9	-20	192	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-09
10	-10	160	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-10
11	-10	144	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-11
12	-10	120	0	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-12
13	-10	224	1	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-13
14	10	-216	-1	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-14
15	Duplicate of #9	N/A	N/A	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-15
16	Blank	N/A	N/A	A	+/- 0.0	B	+/- 0.0	Pass		E9372-4-16

A = Alpha analysis result is less than the minimum detectable conentration. MDC less than 2 dpm.

B = Beta analysis result is less than the minimum detectable conentration. MDC less than 5 dpm.

* = Comparison of result to the criteria of 10% of the DCGL action level.

Pump House
Exterior, Building 9373



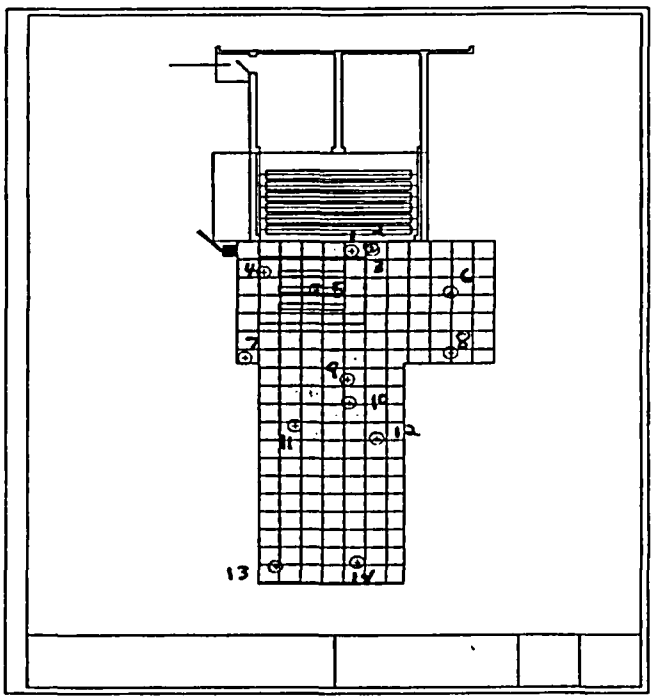
Date:	18-Sep-02							
LOCATION	MONITORING			WIPE TEST				WIPE NO.
CODE	Alpha	Beta	Gamma	Alpha	Beta	Pass*		
(Units =>)	dpm/100 cm²	dpm/100 cm²	uR/hr	dpm/100 cm² +/- 2 sigma				
(Bkgd =>)	38	3650	4.0	0.4	2.1			
(MDC =>)	93	745	-	0.8	2.5			
1	10	496	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-01
2	0	216	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-02
3	-10	-16	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-03
4	-20	168	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-04
5	30	64	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-05
6	-30	-152	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-06
7	-10	248	5	A +/- 0.0	B +/- 0.0	Pass		E9372-5-07
8	-10	-48	2	A +/- 0.0	B +/- 0.0	Pass		E9372-5-08
9	0	-64	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-09
10	-10	-16	6	A +/- 0.0	B +/- 0.0	Pass		E9372-5-10
11	-10	80	3	A +/- 0.0	B +/- 0.0	Pass		E9372-5-11
12	20	16	3	A +/- 0.0	B +/- 0.0	Pass		E9372-5-12
13	10	104	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-13
14	30	-128	4	A +/- 0.0	B +/- 0.0	Pass		E9372-5-14
15	Duplicate of #13	N/A	N/A	A +/- 0.0	B +/- 0.0	Pass		E9372-5-15
16	Blank	N/A	N/A	A +/- 0.0	B +/- 0.0	Pass		E9372-5-16

A = Alpha analysis result is less than the minimum detectable conentration. MDC less than 2 dpm.

B = Beta analysis result is less than the minimum detectable conentration. MDC less than 5 dpm.

* = Comparison of result to the criteria of 10% of the DCGL action level.

Range Corridor
Asphalt and Concrete



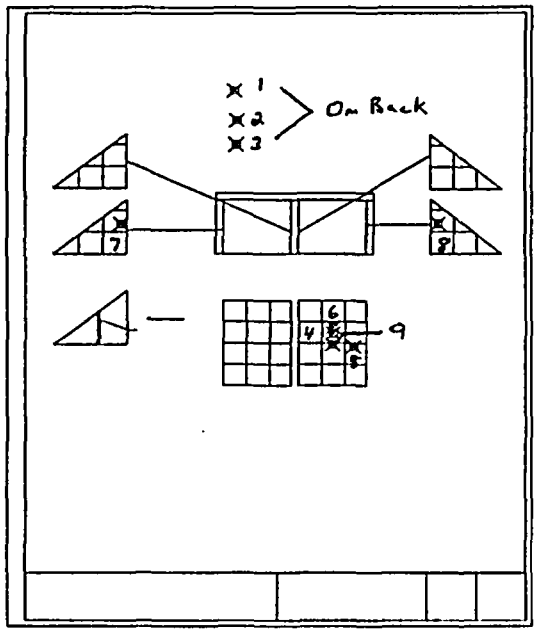
Date:	18-Sep-02				
LOCATION CODE	MONITORING			WIPE TEST	WIPE NO.
	Alpha	Beta	Gamma		
(Units =>)	dpm/100 cm²	dpm/100 cm²	uR/hr		
(Bkgd =>)	150	4930	4.0		
(MDC =>)	191	862	-		
1	-10	-2056	0		NA
2	-80	-2288	0		NA
3	0	-2184	1		NA
4	-120	-1456	3		NA
5	10	-2032	1		NA
6	-120	-1872	4		NA
7	-70	-856	3		NA
8	-10	-1512	4		NA
9	-60	-1064	4		NA
10	0	-352	4		NA
11	-60	-840	4		NA
12	-80	-1168	3		NA
13	-40	408	4		NA
14	-90	360	5		NA
					NA
					NA

Wipes were not taken on Asphalt

Several elevated locations identified in scanning. All appear to be subsurface.

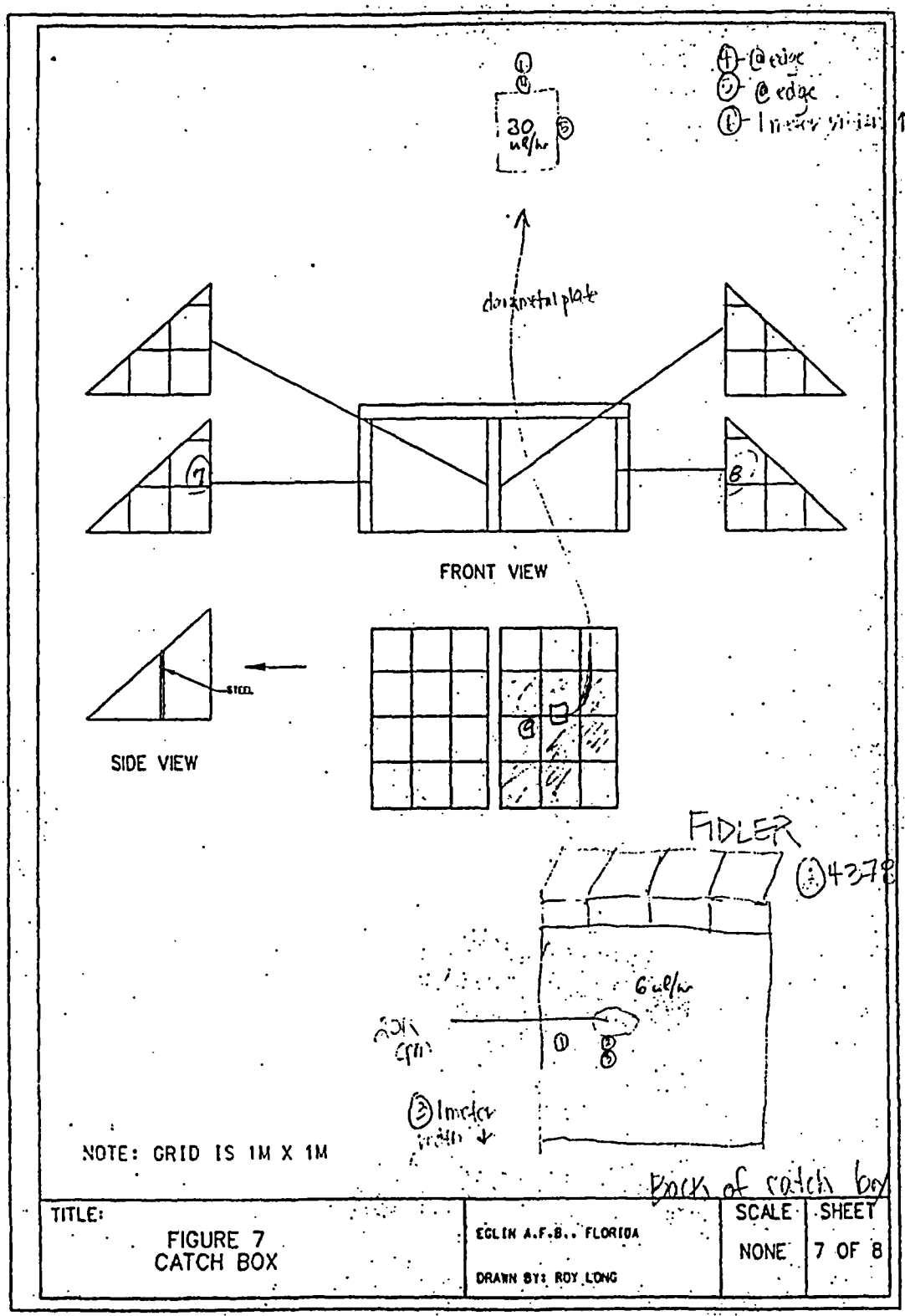
Catch Box

Charcterization Samlpe locations



Date:	19-Sep-02							
LOCATION CODE	MONITORING			WIPE TEST				WIPE NO.
	Alpha	Beta	Gamma	Alpha		Beta		Pass*
(Units =>)	dpm/100 cm²	dpm/100 cm²	uR/hr	dpm/100 cm² +/- 2 sigma				
(Bkgd =>)	38	1610	4.0	0.4		2.1		
(MDC =>)	106	503	-	0.8		2.5		
1	140	2240	1	0.2	+/- 0.5	1.0	+/- 1.6	Pass	ECB-6-01-1
2	360	15816	2	2.4	+/- 0.9	5.8	+/- 1.7	Pass	ECB-6-02-2
3	370	29952	2	NA	+/- 0.0	NA	+/- 0.0	NA	NA
4	930	31168	NA	NA	+/- 0.0	NA	+/- 0.0	NA	NA
5	1370	27560	NA	NA	+/- 0.0	NA	+/- 0.0	NA	NA
6	1290	70144	NA	18.3	+/- 2.2	67.9	+/- 4.4	Pass	ECB-6-06-3
7	-10	-368	1	0.0	+/- 0.4	0.0	+/- 1.4	Pass	ECB-6-07-4
8	30	896	1	NA	+/- 0.0	NA	+/- 0.0	NA	NA
9	640	17752	26	9.5	+/- 1.6	36.6	+/- 3.1	Pass	ECB-6-09-5

* = Comparison of result to the criteria of 10% of the DCGL action level.



TITLE:		SCALE	SHEET
FIGURE 7 CATCH BOX	EGLIN A.F.B., FLORIDA DRAWN BY: ROY LONG	NONE	7 OF 8

Appendix F

POTENTIAL CONTAMINANTS OF CONCERN

1. **Potential Contaminant:** The contaminant of potential concern is Depleted Uranium.

Depleted Uranium. Uranium is a naturally occurring radioactive isotope. DU is uranium that has been separated from the other naturally occurring members of the uranium and actinium decay series and depleted of U-234 and U-235. In natural uranium, the U-234, U-235, and U-238 isotopes are present in their naturally occurring ratios, while this ratio has been altered in DU. The naturally occurring activity ratios of U-234/U-235/U-238 to U-238 are 1.0/0.047/1.0, respectively (AEPI 1995). The DU activity ratios of U-234/U-235/U-238 are 0.13/0.013/1.0, respectively (AEPI 1995). The activity of a gram (g) of DU is 0.4 micro-curies (uCi) (AEPI 1995). Thus the activity in 1g of DU is comprised of 0.052 uCi of U-234; 0.005 uCi of U-235 and 0.348 uCi of U-238.

DU emits alpha, beta, and gamma radiation (short lived daughter contribution included). Each of these radiation types can be used to estimate quantities of residual uranium activity; however, because of relative low abundance of gamma radiation and adverse conditions of many surfaces, beta radiation is often used as an indicator of the surface activity.

DU is used in military ordnance, medical, space, aviation, heavy equipment, and the petroleum industry. The military uses DU in kinetic energy rounds due to its density (AEPI 1995). The primary DU munitions at Eglin were the aluminum encased 30 mm penetrators. Even outside of the storage and shipping containers the aluminum jacket would prevent the DU from contaminating surfaces.

2. Derived Concentration Guideline Levels

<u>Soil</u>

A derived concentration guideline level (DCGL) can come from numerous sources such as regulators, dose/risk assessments, or applicable standards. The Eglin LLRM Partnering Team accepted and set a DCGL to be used for DU in soil at Eglin AFB test ranges. The DCGL corresponds to an activity of DU in soil in picoCuries per gram (pCi/g) that would result in a lifetime excess cancer risk (LECR) of 3E-04 for the following future land use scenarios:

- Industrial Scenario - 600 pCi/g
- Construction Worker - 7,500 pCi/g
- Residential - 500 pCi/g

The DCGL for the industrial scenario was selected since it was considered to be the most likely future land use designation for C-74L.

Subsequent to the establishment of the 600 pCi/g DCGL, an agreement was made with the US NRC to use a recalculated DCGL of 469 pCi/g derived using a residential scenario and a 25 mrem/yr dose criteria. This commitment was made in a 4 June 2003 letter from Douglas Daveis, USAF Permit Certifying Official to Lt. Col. Kali Mather, HQ AFMOA/SGZR.

Building Surfaces

The DCGL for habitable building internal surfaces is selected from the NRC's NUREG/CR-5512, Vol. 3 (90^{th} percentile) as a conservative approach.

The DCGL for equipment, building exteriors, and other surfaces (catch boxes, asphalt, etc.) is selected from Table 12-1 of the Base Wide Site Safety and Health Plan (BSSHP) for LLRM Site Investigations and the USACE EM-385-1-80.

TABLE F-1. Site DCGL

Media	DU DCGL ($dpm/100cm^2$)	DCGL (pCi/g)	DCGL by Measurement Method (in excess of background)
Building interior surfaces	[1]100	NA	100 $dpm/100cm^2$ gross Alpha[2] 400 $dpm/100cm^2$ gross Beta[3]
Soil[5]	NA	469	NA
Equipment surfaces and external building surfaces	[4]5,000	NA	5,000 $dpm/100cm^2$ gross Alpha 5,000 $dpm/100cm^2$ gross Beta
Equipment	NA	NA	β,γ Dose Rate 0.2 mrad/hr @ 1 cm

[1] Since DU is comprised of approximately 99.8% U-238, 0.001% U-234, and 0.2% U-235 and the NUREG/CR-5512 values are isotope specific, the DU value is derived from the activity ratios of U-238, U-234, and U-235 in DU of 85%, 13%, and 2% respectively. When corrected for this activity abundance the 100 $dpm/100cm^2$ DCGL insures that the sum of the ratios for all three isotopes would not exceed unity (i.e. the criteria is met). Appendix E lists the NRC DCGLs for typical isotopes of concern.
[2] Since 1 disintegration per minute (dpm) of DU results in the emission of 1 alpha particle per minute the DU to gross alpha conversion factor is 1.
[3] Since 1 dpm of DU results in the emission of 4 beta particles per minute the DU to gross beta conversion factor is 4.
[4] Applies to alpha and beta emitters independently.
[5] Applies to material samples such as concrete blocks also.
NA = Not Applicable.

Enclosure to Appendix F

SUMMARY OF SAMPLING PLAN
AND
TABLE OF CONTAMINATION LIMITS

USACE
SITE SURVEY UNIT PLAN

DATE: September 2002

SITE: Eglin AFB, Niceville, FL

PROJECT NUMBER: CESWT-SO-P1-01

POINT OF CONTACT: Dave Hays, Tulsa District

FACILITY: Building No. 9372, Gun Bays, Work Areas; Building No. 9373; Range Equipment

AREA CLASSIFICATION: 3

DCGL: Soil = 469 pCi/g
Interior Surface = 99 dpm/100 cm^2 alpha
Exterior Surface = 5000 dpm/100 cm^2 Alpha and Beta*
LBGR: 50% DCGL ESTIMATED sigma: 26 dpm/100 cm^2 alpha
ERRORS: Alpha = 0.05 Beta = 0.05

Remarks: Sample data from previously conducted scoping surveys are used to determine the number of samples for planning purposes. The actual number of samples will be changed if warranted based on reference area surveys (done during this survey).

* Exterior surveys will be professional judgment but for building exteriors we will take as many samples as required on the interior at a minimum.

DATA POINTS REQUIRED: 28 N/2 = 14

AREA DIMENSIONS: multiple survey units

NUMBER OF GRIDS: NA random locations

RANDOM SAMPLES ABOVE 2 METERS: All samples selected randomly and will include above two meters in selection process.

HARD WIPES REQUIRED: 16 (one blank, one duplicate)

LS WIPES/VIALS REQUIRED: None

SURVEY UNIT GRAPHIC GENERATED: No

BACKGROUND LOCATION: Reference area selection September 2002

SAMPLING:

HARD WIPES: One per survey point
LS WIPES: Not applicable
GAMMA READING: One static reading per survey point
ALPHA AND BETA READINGS: One static reading/ survey point. Count time expected to be 1 to 2 minutes.
ALPHA AND BETA SCAN: Judgmental at least 10%
GAMMA SCAN: Judgmental, roofs, mount slots, pipe for drain, range

BIAS SAMPLING:
NUMBER OF SURVEY POINTS: 0
REMARKS: *Professional Judgment

RANDOM SAMPLING: Yes
NUMBER OF SURVEY POINTS: 14
REMARKS: Assign 14 total survey points

BUILDING MATERIAL SAMPLING REQUIRED: No

ENVIRONMENTAL SAMPLING REQUIRED: Yes, drain and outfall areas. 5 samples.

LABORATORY CONTACTED: Yes, wipe MDA alpha: 10 dpm; beta: 20 dpm

ISOTOPES OF CONCERN: DU (Uranium-238,235,234)

PROJECT TEAM LEADER **PROJECT OFFICER**

Table F-2. This table is excerpted from USACE EM 385-1-80 and is equivalent to USNRC Regulatory Guide 1.86 and the US Army Regulation 11-9.

Acceptable Surface Contamination Levels

NUCLIDE [a]	AVERAGE [b c] dpm/100 cm^2	MAXIMUM [b d] dpm/100 cm^2	REMOVABLE [b e] dpm/100 cm^2
U-nat, U-235, U-238 and associated decay products	5,000	15,000	1,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000	15,000	1,000

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Table F-3. This table is excerpted from NUREG-5512, Vol.3 (Draft).

Table 4.6 - Concentration (dpm/100cm2) equivalent to 25 mrem/y for the specified value of Pcrit

Source	Pcrit=0.75	Pcrit=0.90	Pcrit=0.95
226Ra	1.43E+03	1.12E+03	1.01E+03
226Ra+C	4.05E+02	3.15E+02	2.85E+02
228Ra	2.71E+02	2.01E+02	1.79E+02
227Ac	2.46E+00	1.82E+00	1.61E+00
227Ac+C	2.46E+00	1.81E+00	1.61E+00
228Th	5.60E+01	4.14E+01	3.67E+01
228Th+C	5.60E+01	4.14E+01	3.67E+01
229Th	7.52E+00	5.55E+00	4.92E+00
229Th+C	7.52E+00	5.55E+00	4.92E+00
230Th	5.00E+01	3.69E+01	3.27E+01
230Th+C	4.44E+01	3.30E+01	2.93E+01
232Th	9.91E+00	7.31E+00	6.49E+00
232Th+C	8.17E+00	6.03E+00	5.35E+00
231Pa	1.17E+01	8.61E+00	7.64E+00
231Pa+C	2.03E+00	1.50E+00	1.33E+00
232U	2.29E+01	1.69E+01	1.50E+01
232U+C	1.61E+01	1.19E+01	1.06E+01
233U	1.20E+02	8.86E+01	7.86E+01
233U+C	6.76E+00	4.99E+00	4.43E+00
234U	**1.23E+02**	**9.06E+01**	**8.04E+01**
235U	**1.32E+02**	**9.76E+01**	**8.66E+01**
235U+C	2.00E+00	1.48E+00	1.31E+00
236U	1.30E+02	9.57E+01	8.49E+01
238U	**1.37E+02**	**1.01E+02**	**8.99E+01**
238U+C	2.64E+01	1.95E+01	1.74E+01
237Np	3.00E+01	2.21E+01	1.96E+01
237Np+C	5.36E+00	3.96E+00	3.51E+00
236Pu	1.23E+02	9.10E+01	8.07E+01
238Pu	4.15E+01	3.06E+01	2.72E+01

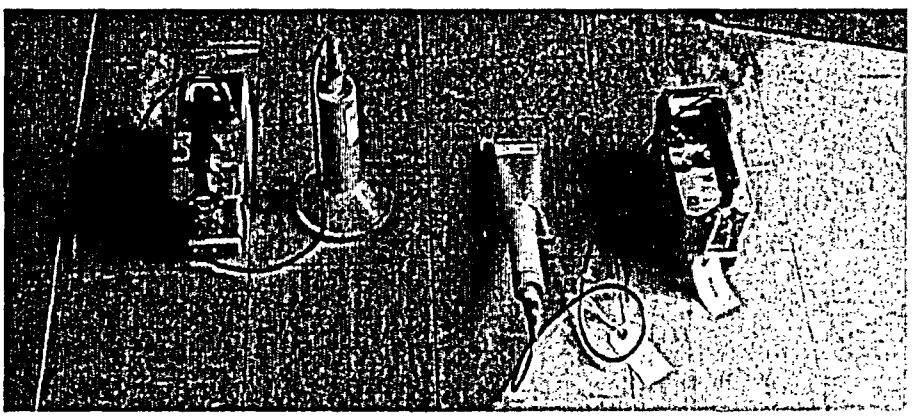
Appendix G

USACENWO QUALITY ASSURANCE REPORT

US Army Corps
of Engineers

FINAL

QUALITY ASSURANCE REPORT



EGLIN AIR FORCE BASE, C-74L
FINAL STATUS SURVEY
Buildings and Target Areas
16-20 September 2002

OCTOBER 2004

Prepared by:
Hazardous, Toxic, and Radioactive Waste Center of Expertise
Omaha District
U.S. Army Corps of Engineers

EXECUTIVE SUMMARY
QUALITY ASSURANCE REPORT

EGLIN AIR FORCE BASE, C-74L FINAL STATUS SURVEY
Buildings and Target Areas
16-20 September 2002

The U.S. Army Corps of Engineers (USACE) conducted a radiological survey to determine if residual radioactivity in certain buildings, soils and structures at Eglin Air Force Base Test Range C-74L was at a level that would allow release of those areas from regulatory control. Areas impacted by the former use of depleted uranium munitions were surveyed for final status in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (NRC 2000).

To ensure the technical quality of the survey, a health physicist from the USACE Hazardous, Toxic and Radioactive Waste Center of Expertise in Omaha, Nebraska was assigned as Quality Assurance Officer for the survey. The QA Officer reviewed the draft and final survey plans (USACE 2002), observed the survey team during the field effort, and collected independent measurements of residual radioactivity to confirm the findings of the survey team.

The QA Officer observed the proper implementation of the survey plan and the appropriate modification of the plan to address background reference area concerns and the identification of depleted uranium (DU) fragments in the gun bay slots. The suite of instruments chosen by the survey team readily identified areas of elevated activity when present. The FIDLER detector was impressive in its ability to locate buried DU fragments in surface soils.

The results of independent measurements in background reference areas and within several of the survey units compared favorably with those of the survey team. The QA Officer did not identify any areas of elevated residual radioactivity in the Building 9372 final status survey units.

This report will be included as Appendix G to the Final Status Survey Report (USACE 2004). Therefore, information available in that document and its other Appendices will be referenced when appropriate.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

1.0 Survey Plan Review.

1.1 Purpose of Survey.

The U.S. Army Corps of Engineers (USACE) conducted a radiological survey to determine if residual radioactivity in certain buildings, soils and structures at Eglin Air Force Base Test Range C-74L was at a level that would allow release of those areas from regulatory control. The survey included the interior and exterior surfaces of Building 9372 (including the roof), exterior surfaces of Building 9373 (including the roof), the surface soil adjacent to these buildings, the asphalt pad located adjacent to Building 9372, the sump and drain for Building 9372, the range runoff outfall area, and the catch box structure located at the end of the gun corridor.

1.2 Impacted Areas.

The QA Officer reviewed the site history and the results of the October 2001 scoping survey and determined that the initial classification of survey units identified in the survey plan (USACE 2002) was appropriate given the potential contaminant transport mechanisms at the site.

1.3 DCGL Development.

The use of the screening level DCGLs from Nuclear Regulatory Commission draft NUREG/CR-5512, Vol. 3, was discussed with the survey team to identify and resolve potential implementation concerns. The QA Officer reviewed and concurred with the $DCGL_W$ calculation for depleted uranium on building surfaces, 100 dpm/100 cm^2, that was documented in the plan.

1.4 Instrument Selection.

Given the conservative nature of the selected building surface $DCGL_W$, care was taken to ensure that the survey team chose the appropriate types of instrumentation needed to meet the demands of the survey and had available in sufficient quantity to allow adaptation to unforeseen conditions in the field. The suite of instrumentation selected offered a wide variety of strengths, many of which had been previously demonstrated at Eglin – an alpha/beta gas proportional floor monitor for comprehensive and cost-effective scanning of the building floors and exterior walls – a field instrument for the detection of low energy radiation (FIDLER) that has proven to be extremely capable of identifying DU fragments in soil – a long-handled GM detector that proved useful in scanning of hard to reach areas, a pipe probe for drain line survey –and various hand-held ZnS/plastic scintillation detectors that under most circumstances would meet the minimum detectable concentration (MDC) requirements of the plan. The QA officer discussed the survey team response to comments regarding the use of alpha measurements and reviewed and concurred with the MDC calculations documented in the plan.

2.0 Field Observations.

2.1 Instrument Set-up and Quality Control.

The survey team and QA Officer traveled to the Eglin Air Force Base (EAFB) area on September 16, 2002. The QA Officer observed the unpacking, inspection, set-up, and initial operational checks on the various survey instrumentation completed early on September 17. Survey team instruments were observed to be properly functioning. Quality control checks were performed on the QA instrument, a Ludlum 43-1-1, ZnS/plastic scintillation detector with fairly high efficiencies for both alpha and beta radiation. Attachment A provides information on the QA instrument and its QC charts.

2.2 Background Reference Areas.

After a tour of the C-74L range with EAFB personnel, a safety briefing was held, source checks were completed, and the survey team scanned an office area of Building 9372 to be used as a staging area for the survey. With the assistance of EAFB personnel, non-impacted areas were identified for use as background reference areas. The areas identified were the mechanical and hydraulic rooms of Building 9372, the roofs of nearby buildings that had similar construction to those on C-74L, a non-impacted asphalt road, and a building on a nearby range with similar floor tile.

Preliminary results from the Building 9372 mechanical room reference area were reviewed by the survey team and the potential for separating the "work areas" survey unit into a wall unit and a floor unit was discussed. See Table 2-1 below for the various survey units designated. An appropriate decision was made that background levels in the "old" cinder block walls and poured concrete floors were such that separate units would facilitate the comparison of survey unit and reference area data.

2.3 Visual Sample Plan.

The QA Officer observed the random selection of sample locations in the new "work areas" survey units using the Visual Sample Plan program created by Pacific Northwest National Laboratory, the latest version of which can be obtained at: http://dqo.pnl.gov/vsp/. The survey team was able to easily split the existing survey unit into walls and floors and then use VSP to generate random survey locations in each new unit.

2.4 Building Interior Surveys.

The survey team was observed using the VSP generated survey maps to locate survey locations which were subsequently marked for repeated measurement should that be necessary. Fixed measurements with the α/β scintillation and FIDLER probes, and scanning with these detectors and the floor monitor were observed to be in accordance with the survey plan. A small potential area of elevated activity was identified on the concrete floor in the corner of the interior bathroom with the floor monitor. Subsequent measurements with the hand-held survey meters confirmed only slightly elevated beta radiation within the range of background and no localized

source. The collection of wipe samples was performed as outlined in the survey plan. End-of-day source checks were performed as required.

2.5 Gun Bay Slot DU Fragment Removal.

During the 100% scan of the gun bay floors, the floor monitor provided an indication of residual radioactivity while over one of the several gun slots that are embedded in the floor of the gun bay. QA instrument and FIDLER readings confirmed elevated levels. A DU fragment was located within the slot, carefully swept out of the slot, bagged, and transferred to EAFB personnel.

The potential that other gun bay slots may contain fragments led the team to discuss the potential reclassification of the entire gun bay survey unit. Given that there was no indication of elevated measurements outside of the metal slots, and the slots unique potential for trapping errant fragments it was determined that only the slots would be reclassified to a Class 1 survey unit. The survey team was observed using the long-handled GM detector, along with a whisk broom and tape to remove potential fragments while surveying 100% of the slot area. Two other small fragments were identified and bagged for disposal.

2.6 Exterior Surveys.

The 100% walkover survey of the Building 9372 roof with a FIDLER detector was observed from the ground. No elevated readings were identified during the survey. The scan speed and distance from the roof to the detector were similar to that of the FIDLER survey that was observed to readily identify buried fragments in soil.

The use of the floor monitor gas proportional detector (removed from its cart) to survey the exterior walls of the buildings provided a more than adequate scan MDC and the surveyor was able to scan a large portion of the walls quickly due to the large probe area.

On 18 September, QA Officer observed FIDLER survey of outfall area. No elevated areas identified. QA instrument scans of drain pipes and surrounding rock in outfall are indistinguishable from background.

On 19 September, QA instrument scans on the catch box surfaces were compared to those collected by the survey team. Similar readings are obtained and no other areas are identified.

The QA Officer observed the layout of a grid in the asphalt area to facilitate the location of the randomly selected sample points. During the survey, several small elevated areas were identified with the FIDLER. The contamination/fragments appeared to be in, or under, the asphalt. These locations were marked for future investigation/removal and discussed with EAFB personnel.

2.7 Surface Soil DU Fragment Removal.

Four buried fragments were observed to be identified by the surveyor using the FIDLER detector to survey the soils immediately surrounding Building 9372. These fragments were dug up intact, bagged with a small amount of surrounding soil and provided to EAFB for disposal. Surveys of the soil following removal of the fragment were observed to be indistinguishable

from background. See Appendix H of the Final Status Survey Report (USACE 2004) for pictures.

Table 2-1
Survey Units

No.	Survey Area	Survey Unit	Description	Radionuclide of interest	Potential Concern	Type of Survey
1	Bldg. 9372	Bldg. 9372 Work Areas Floors	Tile/Concrete	Depleted Uranium (DU)	Area contamination	Final Status (Class 3)
2	Bldg. 9372	Bldg. 9372 Work Areas Walls	Cinder Block 1	DU	Area contamination	Final Status (Class 3)
3	Bldg. 9372	Gun Bays	Concrete	DU	Area contamination	Final Status (Class 3)
4	Bldg. 9373	Bldg. 9373 Exterior	Cinder Block 2	DU	Area contamination and fragments	Final Status (Class 3)
5	Bldg. 9372	Bldg. 9372 Exterior	Cinder Block 1	DU	Area contamination and fragments	Final Status (Class 3)
6	Range	Range Pads	Asphalt	DU	Area contamination and fragments	Scoping
7	Range	Catch Box	Concrete and Steel	DU	Area contamination and fragments	Characterization
8	Outfall	Drain Sump, Line and outfall soils	Concrete and PVC	DU	Fragments and soil contamination	Scoping
9	Bldg. 9372	Gun Slots	Concrete and Steel	DU	Fragments	Final Status (Class 1)
10	Bldg. 9372 and 9373	Roofs	Tar Paper and Pebble	DU	Fragments	Scoping
11	Bldg. 9372 and 9373	Bldg. Exterior Soils	Soil within 2 meters of building	DU	Fragments	Scoping (Removal)

3.0 Quality Assurance Measurements.

3.1 QA Instrument Selection and Quality Control.

The Ludlum 43-1-1 α/β scintillation detector was chosen because of its higher instrument efficiency than the larger 43-89 and 43-93 probes, and because of its ease of use during long count times. It was envisioned that the QA instrument count times would be longer, to obtain a lower MDC, than those count times used by the survey team. However, after reviewing the initial background reference results, the field team made an appropriate adjustment to the survey plan and also used five minute count times for survey unit measurements.

On the second day in the field, September 19, the QA instrument operability checks with the alpha source were slightly outside of the plus three sigma control line. Repeated measurements were able to bring the instrument back into control. As the readings were consistently greater than the control chart mean, a decision was made to continue use of the instrument for QA purposes.

3.2 Building Background Reference Areas.

Quality assurance measurements were taken in those background reference areas that will be used for comparison with the Building 9372 interior and gun bay survey unit results. Several readings were taken on each type of material so that a representative background could be obtained. For each background reference area, the average alpha and beta concentration, with its 95% confidence limit, was calculated using a spreadsheet program, see Attachment C – Sheets 1 through 4. The results are presented in Table 3-1 below. The minimum detectable concentration (MDC) for each type of radiation was also calculated using the appropriate equations from MARSSIM. Instrument efficiency for alpha (Th-230) and beta radiation (Tc-99) was provided by Ludlum and used in the calculation. Source efficiencies of 0.25 for alpha and 0.5 for higher energy beta were used as suggested in NUREG-1507 (NRC 1998). The MDC's achieved with a five-minute count time were below both the alpha (100 dpm/100 cm²) and beta (400 dpm/100 cm²) $DCGL_W$.

Table 3-1
Building 9372 Background Reference Area QA Results
Ludlum 43-1-1 α/β Scintillation Detector

REFERENCE AREA	USED FOR SURVEY UNIT(s)	ALPHA (dpm/100 cm²)		BETA (dpm/100 cm²)	
		AVERAGE	MDC	AVERAGE	MDC
Mechanical Room Floor	Work Areas Concrete Floors	43 ± 8	63	1344 ± 40	202
Mechanical Room Walls	Work Areas Block Walls	36 ± 7	58	2160 ± 105	256
Hydraulic Room Walls and Floor	Work Areas Poured Walls & Gun Bays	31 ± 11	55	980 ± 96	173
Bldg 9364 Green Tile	Work Areas Tile Floors	34 ± 8	57	806 ± 21	158

3.3 Building Interiors.

The focus of the independent QA measurements was in the Building 9372 final status survey units. The QA officer confirmed many of the survey locations in the work area floors, work area walls and gun bay units. Each result was converted into dpm/100 cm² using the appropriate efficiency factors; see Attachment C – Sheets 5 through 7. Unless clearly appropriate, such as the two painted concrete floor locations in Survey Unit 1, the source efficiency was not corrected for differences in coatings as both the reference area and survey unit were assumed to be similar.

Table 3-2 below provides the results of the QA measurements in Building 9372. The number of measurements of each material taken, the average result with its 95% confidence limit, and the maximum result is listed.

Table 3-2
Building 9372 Interior Survey Unit QA Results
Ludlum 43-1-1 α/β Scintillation Detector

No.	Survey Unit	Material	Number QA Meas.	ALPHA dpm/100 cm²		BETA dpm/100 cm²	
				Average	Maximum	Average	Maximum
1	Work Areas Floors	Tile	10	5 ± 3	12	911 ± 107	1147
1	Work Areas Floors	Concrete	4	19 ± 11	34	1519 ± 50	1568
2	Work Areas Walls	Block	3	23 ± 18	40	1679 ± 587	2041
2	Work Areas Walls	Concrete	3	12 ± 9	18	717 ± 133	845
3	Gun Bays	Concrete & Steel	9	28 ± 16	80	880 ± 93	1069

4.0 Conclusion.

4.1 Assessment of QA Survey Results.

The MARSSIM guidance for the initial interpretation of survey results when a background reference area is required includes a comparison of the survey unit and reference area means, and a comparison of the largest survey unit measurement with the smallest reference area measurement. If the difference in these comparisons is less than the appropriate $DCGL_W$ then a conclusion that the survey unit meets the release criterion can be made. Though the number of QA measurements in any specific survey unit was not meant to recreate the final status survey performed by the survey team, Table 4-1 shows the results of these comparisons for the QA data. The QA results, in conjunction with the fixed and scanning measurements performed by the survey team, supports the recommendations that the Building 9372 interior and gun bay survey units meet the conservative surface release criteria required by the plan.

4.2 Review of Final Status Survey Report.

The Final Status Survey Report (USACE 2004) was reviewed to ensure that the data assessment was adequately performed and that appropriate recommendations were made. The report documents the assumptions and field changes that were used by the field team to guide the selection of background reference areas and the delineation of new survey units. Because revisions to the survey plan were made in the field, the data obtained, and MDC's achieved, by the field team are appropriate to use in comparison to the $DCGL_W$.

An issue that has been discussed with the field team is the identification and removal of the three small fragments of DU from the gun bay slots. The determination to reclassify these slots as a new, Class 1 survey unit within the gun bay Class 3 survey unit was appropriate based on the physical nature of the contamination and its inaccessibility within the slot. The report should have indicated why fixed-measurements within the slots were not taken, and better described the limitations of the detector that was used during the final status survey of the slots. The long-handled GM probe was very effective at locating the DU fragments within the slots after they were initially discovered during the 100% scan with the floor monitor. However, the MDC's for alpha and beta contamination with this meter were not documented and probably exceed the conservative $DCGL_W$. As stated previously, the $DCGL_W$ used is based on a large area of contamination and frequent exposure. Neither of these assumptions is appropriate for the small area and inaccessibility of the gun slot surfaces and it is extremely likely that a specific $DCGL_W$ for this survey unit would be much greater based on area alone.

Table 4-1 Assessment of Building 9372 QA Results Ludlum 43-1-1 α/β Scintillation Detector					
All units are dpm/100 cm²	**Survey Unit/Material**				
	Work Areas Floors/ Tile	**Work Areas Floors/ Concrete**	**Work Areas Walls/ Block**	**Work Areas Walls/ Concrete**	**Gun Bays/ Concrete**
Survey Unit α Average	5	19	23	12	28
Ref. Area α Average	34	43	36	31	31
Difference	-29	-24	-12	-19	-3
	is less then	is less then	is less then	is less then	is less then
α $DCGL_W$	100	100	100	100	100
Survey Unit β Average	911	1519	1679	717	880
Ref. Area β Average	806	1344	2160	980	980
Difference	105	175	-481	-263	-100
	is less then	is less then	is less then	is less then	is less then
β $DCGL_W$	400	400	400	400	400
Survey Unit α Maximum	12	34	40	18	80
Ref. Area α Minimum	25	22	6	12	12
Difference	-12	12	34	6	68
	is less then	is less then	is less then	is less then	is less then
α $DCGL_W$	100	100	100	100	100
Survey Unit β Maximum	1147	1568	2041	845	1069
Ref. Area β Minimum	776	1244	1865	757	757
Difference	371	324	176	88	313
	is less then	is less then	is less then	is less then	is less then
β $DCGL_W$	400	400	400	400	400

5.0 References.

NRC 1998. *Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, Nuclear Regulatory Commission, June.

NRC 2000. *NUREG-1575, Rev. 1, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Nuclear Regulatory Commission, August.

USACE 2002. *Radiological Survey Plan for the Termination of NRC Licensed Radioactive Material Use at Eglin Air Force Base Test Range C-74L, Building and Target Areas*, U.S. Army Corps of Engineers, Tulsa District. September.

USACE 2004. *Final Status Survey Report, Eglin Air Force Base, C-74L, 16-20 September 2002, Buildings and Target Areas, Niceville, Florida, REPORT NO. CESWT-SO-R1-11-2002*, U.S. Army Corps of Engineers, Tulsa District. October.

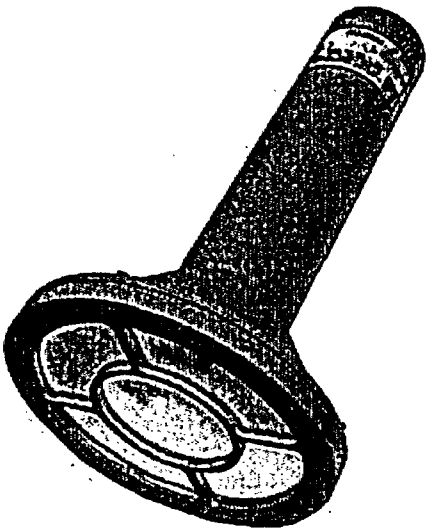
ATTACHMENT A

QA Instrument Information and Quality Control Charts

MODEL 43-1-1 Alpha/Beta Scintillator

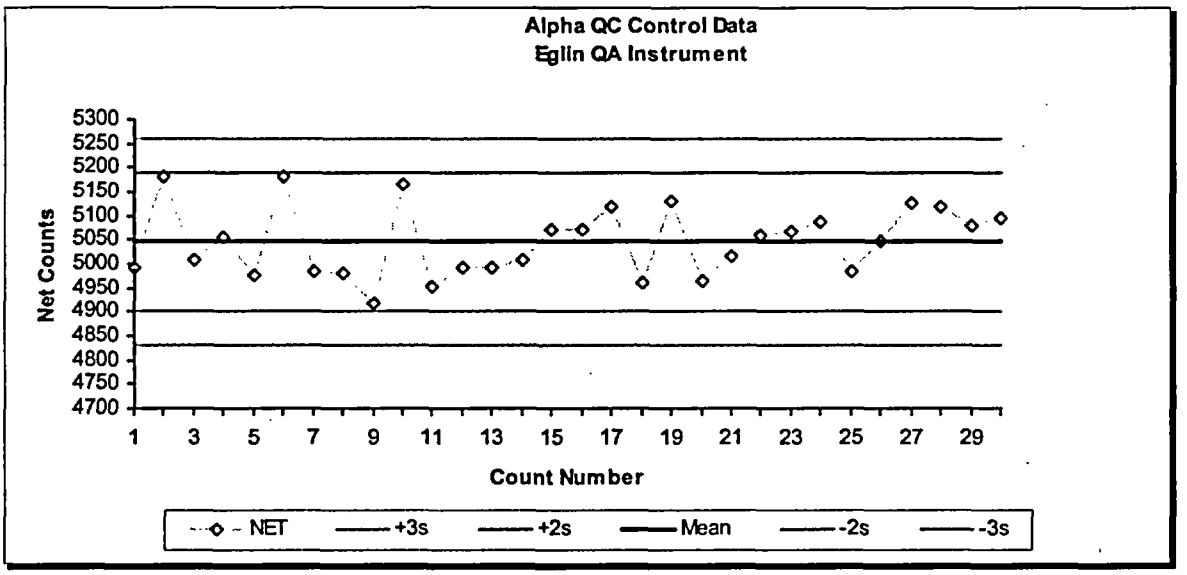
PART NUMBER:47-2336

The Model 43-1-1 is a large area dual phosphor alpha/beta scintillator that is designed to be used for simultaneously counting alpha and beta contamination



INDICATED USE: Alpha-beta survey
SCINTILLATOR: ZnS(Ag) adhered to 0.010" thick plastic scintillation material
WINDOW: Typically 0.8 mg/cm² aluminized mylar (*1.2 mg/cm² recommended for outdoor use*)
WINDOW AREA:
Active - 83 cm²
Open - 75 cm²
EFFICIENCY (4pi geometry): Typically 30% - Pu-239; 30% - Sr-90/Y-90; 5% - C-14
BACKGROUND:
Alpha - Less than 3 cpm
Beta - Typically 300 cpm or less (*10 microR/hr field*)
NON-UNIFORMITY: Less than 10%
CROSS TALK:
Alpha to Beta - Less than 10%
Beta to Alpha - Less than 1%
COMPATIBLE INSTRUMENTS: Model 2224, 2225, 2929
TUBE: 1.5"(3.8cm) diameter magnetically shielded photomultiplier
OPERATING VOLTAGE: Typically 500 - 1200 volts
DYNODE STRING RESISTANCE: 100 megohm
CONNECTOR: Series "C" (*others available*)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: -4° F(-20° C) to 122° F(50° C)
May be certified for operation from -40° F(-40° C) to 150° F(65° C)
SIZE: 4.8" (12.2cm) diameter X 9.8" (24.9cm)L
WEIGHT: 2 lb (0.9 kg)

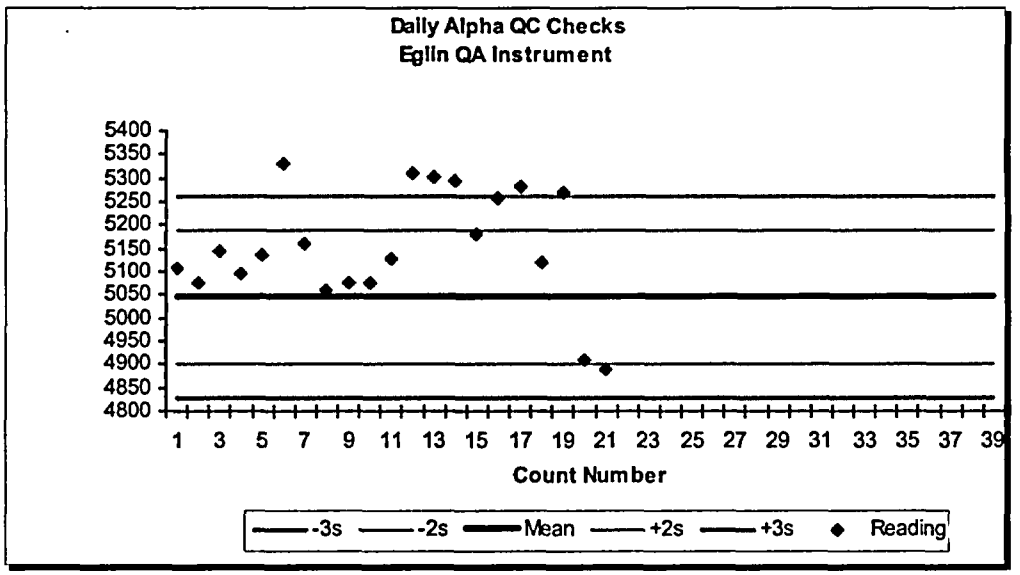
Ludlum probe information from http://www.ludlums.com/.



Model:	2360	SN#	141324	PROBE	43-1-1	SN#	PR143708	Cal Due:	26Mar03
Source:	Th-230	SN#	TH23005	Activity:	17,600	dpm		Cal Date:	26Mar02
Mean	+2s		-2s		+3s:		-3s	Date:	16Sep02
5046	5190	to	4902	to	5262	to	4830	Efficiency:	0.286699

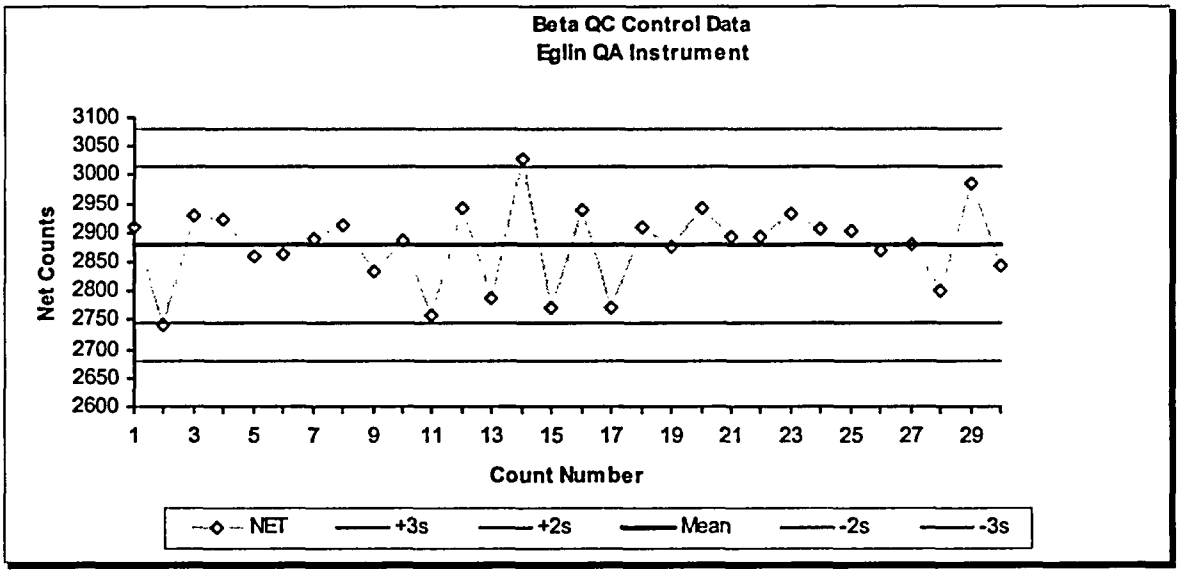
Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	4992	4992	11	4953	4953	21	5014	5014	
2	5182	5182	12	4994	4994	22	5059	5059	
3	5007	5007	13	4994	4994	23	5066	5066	
4	5056	5056	14	5006	5006	24	5086	5086	
5	4977	4977	15	5070	5070	25	4986	4986	
6	5182	5182	16	5070	5070	26	5046	5046	
7	4983	4983	17	5119	5119	27	5127	5127	
8	4980	4980	18	4962	4962	28	5118	5118	
9	4916	4916	19	5131	5131	29	5077	5077	
10	5166	5166	20	4965	4965	30	5093	5093	

Bkgd:	0	cpm	Mean:	5046	cpm	2sigma:	144 cpm	3sigma:	216 cpm



Daily Alpha Checks in cpm										
	Date	Gross	Bkgd	Net	Gross	Bkgd	Net	Gross	Bkgd	Net
1	17Sep02	5108	0	5108	5077	0	5077	NU	NU	NU
2	18Sep02	5144	0	5144	5095	0	5095	5137	1	5136
3	19Sep02	5332	1	5331	5163	1	5162	5059	1	5058
4	19Sep02	5078	1	5077	5076	1	5075	5130	1	5129
5	19Sep02	5309	0	5309	5302	0	5302	5293	0	5293
6	19Sep02	5180	0	5180	5258	0	5258	5281	0	5281
7	19Sep02	5120	0	5120	5271	0	5271	NU	NU	NU
8	20Sep02	4908	0	4908	4889	0	4889	NU	NU	NU

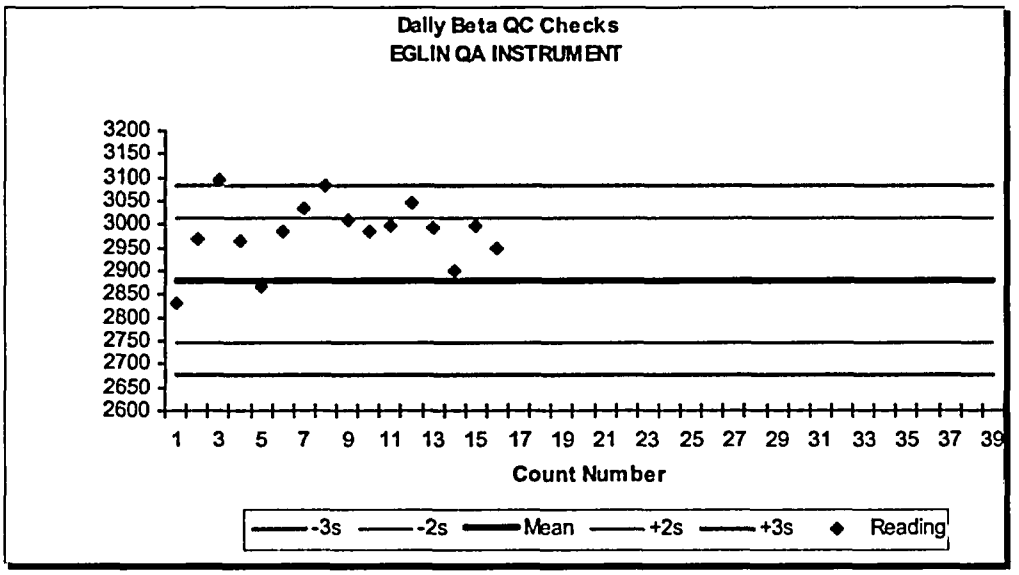
NU = Not Used
NA = Not Applicable



Model:	2360	SN#	141324	PROBE	43-1-1	SN#	PR143708	Cal Due:	26Mar03
Source:	Tc-99	SN#	TC22005	Activity:	14,100	dpm		Cal Date:	26Mar02
Mean	+2s		-2s		+3s:		-3s	Date:	16Sep02
2879	3013	to	2745	to	3081	to	2678	Efficiency:	0.204187

Chk.#	Gross	Net	Chk.#	Gross	Net	Chk.#	Gross	Net	COMMENTS
1	3034	2909	11	2884	2759	21	3017	2892	
2	2866	2741	12	3066	2941	22	3017	2892	
3	3053	2928	13	2913	2788	23	3058	2933	
4	3046	2921	14	3151	3026	24	3030	2905	
5	2985	2860	15	2896	2771	25	3028	2903	
6	2988	2863	16	3065	2940	26	2994	2869	
7	3016	2891	17	2897	2772	27	3004	2879	
8	3037	2912	18	3033	2908	28	2927	2802	
9	2960	2835	19	3002	2877	29	3110	2985	
10	3010	2885	20	3067	2942	30	2967	2842	

Bkgd:	125	cpm	Mean:	2879	cpm	2sigma:	134 cpm	3sigma:	201 cpm



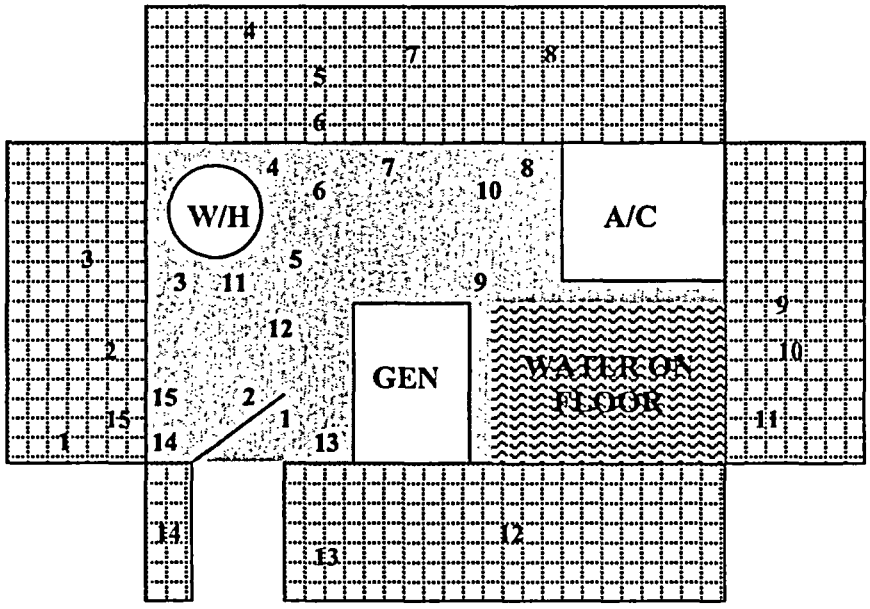
Daily Checks in cpm										
	Date	Gross	Bkgd	Net	Gross	Bkgd	Net	Gross	Bkgd	Net
1	17Sep02	3061	178	2883	3148	178	2970	NU	NU	NU
2	18Sep02	3266	172	3094	3138	172	2966	3073	207	2866
3	18Sep02	3146	162	2984	NU	NU	NU	NU	NU	NU
4	19Sep02	3209	177	3032	3260	177	3083	3187	177	3010
5	19Sep02	3162	177	2985	3176	177	2999	3224	177	3047
6	19Sep02	3171	177	2994	3056	155	2901	NU	NU	NU
7	20Sep02	3175	178	2997	3129	180	2949	NU	NU	NU

NU = Not Used
NA = Not Applicable

ATTACHMENT B

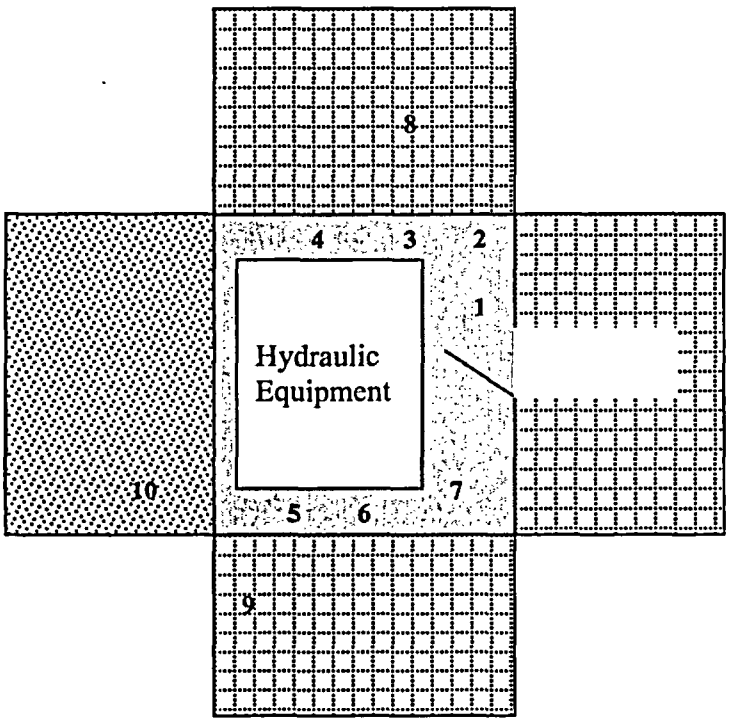
Background Reference Area Figures

Building 9372 Office Area Background Reference Area
(Building 9372 Mechanical Room)



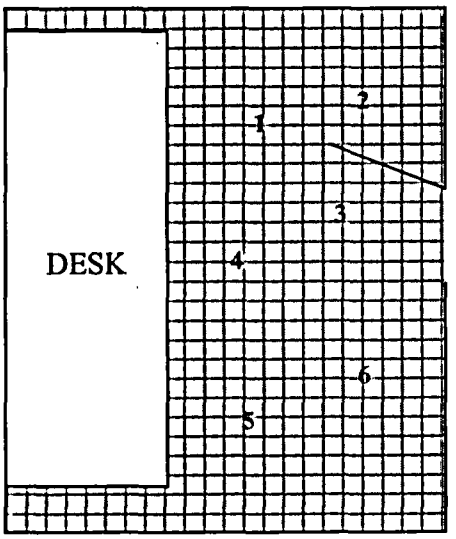
Concrete Floor/Cinder Block Walls
- Measurement Location

Building 9372 Gun Bay - Background Reference Area
(Building 9372 Hydraulic Room)



Concrete Floor/Three Cinder Block Walls/One Poured Wall
- Measurement Location

Building 9372 Green Tile - Background Reference Area
(Building 9364 Floor)



Green Tile Floor
- Measurement Location

ATTACHMENT C

QA Report Calculation Spreadsheets

Sheet 1 - Building 9372 Mechanical Room Floor Background Reference Area

5 minute count time	alpha	beta		alpha	beta
Location	counts	counts		dpm/100 cm²	dpm/100 cm²
1	14	1010		43	1367
2	11	943		34	1277
3	23	938		71	1270
4	22	962		68	1302
5	14	969		43	1312
6	16	1066		49	1443
7	18	1049		55	1420
8	7	1124		22	1522
9	13	947		40	1282
10	7	974		22	1319
11	10	919		31	1244
12	9	974		28	1319
13	20	944		62	1278
14	9	1041		28	1409
15	16	1036		49	1402
average	**13.9**	**993.1**		**42.9**	**1344.3**
std dev	5.2	58.5		16.0	79.1
95% confidence	**2.6**	**29.6**		**8.1**	**40.0**
critical level, Lc	8.7	73.4	MARSSIM Eq. 6-6		
detection level, Ld	20.4	149.5	MARSSIM Eq. 6-6		
inst efficiency	0.313	0.356	Ludlum		
source efficiency	0.25	0.5	ISO-7503-1		
probe area	83	83			
MDC dpm/100 cm²	**62.7**	**202.4**	MARSSIM Eq. 6-7		
smallest measurement dpm/100 cm²	**22**	**1244**			

Sheet 2 - Building 9372 Mechanical Room Wall Background Reference Area

5 minute count time	alpha	beta		alpha	beta
Location	counts	counts		dpm/100 cm²	dpm/100 cm²
1	18	1762		55	2385
2	12	1488		37	2014
3	18	1465		55	1983
4	14	1599		43	2165
5	17	1545		52	2092
6	12	1407		37	1905
7	11	1624		34	2198
8	10	1562		31	2115
9	9	1650		28	2234
10	13	1730		40	2342
11	2	1752		6	2372
12	11	1540		34	2085
13	12	1378		37	1865
14	5	1950		15	2640
15	13	1482		40	2006
average	**11.8**	**1595.6**		**36.3**	**2160.0**
std dev	4.4	153.7		13.4	208.1
95% confidence	**2.2**	**77.8**		**6.8**	**105.3**
critical level, Lc	8.0	93.1	MARSSIM Eq. 6-6		
detection level, Ld	19.0	188.7	MARSSIM Eq. 6-6		
inst efficiency	0.313	0.356	Ludlum		
source efficiency	0.25	0.5	ISO-7503-1		
probe area	83	83			
MDC dpm/100 cm²	**58.4**	**255.5**	MARSSIM Eq. 6-7		
smallest measurement dpm/100 cm²	**6**	**1865**			

Sheet 3 - Building 9372 Hydraulic Room Background Reference Area

5 minute count time	alpha	beta		alpha	beta
Location	counts	counts		dpm/100 cm²	dpm/100 cm²
1	21	762		65	1032
2	16	703		49	952
3	7	678		22	918
4	15	667		46	903
5	10	729		31	987
6	10	653		31	884
7	9	676		28	915
8	4	971		12	1314
9	5	841		15	1138
10	4	559		12	757
average	**10.1**	**723.9**		**31.1**	**980.0**
std dev	5.7	113.8		17.4	154.0
95% confidence	**3.5**	**70.5**		**10.8**	**95.5**
critical level, Lc	7.4	62.7	MARSSIM Eq. 6-6		
detection level, Ld	17.8	128.1	MARSSIM Eq. 6-6		
inst efficiency	0.313	0.356	Ludlum		
source efficiency	0.25	0.5	ISO-7503-1		
probe area	83	83			
MDC dpm/100 cm²	**54.7**	**173.4**	MARSSIM Eq. 6-7		
smallest measurement dpm/100 cm²	**12**	**757**			

Sheet 4 - Building 9364 Green Tile Background Reference Area

5 minute count time				alpha	beta
Location	alpha	beta		dpm/100 cm²	dpm/100 cm²
1	9	599		28	811
2	11	573		34	776
3	9	616		28	834
4	12	589		37	797
5	17	619		52	838
6	8	577		25	781
average	**11.0**	**595.5**		**33.9**	**806.1**
std dev	3.3	19.4		10.1	26.2
95% confidence	**2.6**	**15.5**		**8.1**	**21.0**
critical level, Lc	7.7	56.9	MARSSIM Eq. 6-6		
detection level, Ld	18.4	116.5	MARSSIM Eq. 6-6		
Inst efficiency	0.313	0.356	Ludlum		
source efficiency	0.25	0.5	ISO-7503-1		
probe area	83	83			
MDC dpm/100 cm²	**56.7**	**157.7**	MARSSIM Eq. 6-7		
smallest measurement					
dpm/100 cm²	**25**	**776**			

Sheet 5 - QA Results for Survey Unit 1: Building 9372 Floors
See Appendix F of USACE 2004 for location diagrams.

location	material	alpha counts	alpha source eff	alpha dpm/100 cm²	beta counts	beta source eff	beta dpm/100 cm²
2	tile	2	0.25	6	540	0.5	731
3	tile	3	0.25	9	601	0.5	814
7	tile	4	0.25	12	847	0.5	1147
8	tile	1	0.25	3	827	0.5	1120
9	tile	0	0.25	0	815	0.5	1103
10	tile	0	0.25	0	594	0.5	804
11	tile	3	0.25	9	751	0.5	1017
12	tile	1	0.25	3	682	0.5	923
13	tile	2	0.25	6	540	0.5	731
14	tile	1	0.25	3	534	0.5	723
			average	**5**		average	**911**
			std dev	**4**		std dev	**173**
			95% conf	**3**		95% conf	**107**
1	concrete painted**	3	0.125	18	559	0.25	1513
4	concrete painted**	0	0.125	0	579	0.25	1568
5	concrete	8	0.25	25	1053	0.5	1425
6	concrete	11	0.25	34	1130	0.5	1530
Bathroom*	concrete	6	0.25	18	1152	0.5	1559
			average	**19**		average	**1519**
			std dev	**12**		std dev	**57**
			95% conf	**11**		95% conf	**50**

count time (min)	5
alpha instrument efficiency	0.313
beta instrument efficiency	0.356
probe area (cm)	83
**source eff reduced per NUREG-1507	

	alpha		beta	
	tile	concrete	tile	concrete
Largest Surv Unit dpm/100 cm²	12	34	1147	1568
Smallest Ref Area dpm/100 cm²	25	22	776	1244
Difference	**-12**	**12**	**371**	**324**
	is less then	is less then	is less then	is less then
DCGL dpm/100 cm²	**100**	**100**	**400**	**400**

*This biased measurement was collected in an area identified as potentially elevated by the surveyor using the floor monitor.

Sheet 6 - QA Results for Survey Unit 2: Building 9372 Walls
See Appendix F of USACE 2004 for location diagrams.

location	material	alpha counts	alpha source eff	alpha dpm/100 cm²	beta counts	beta source eff	beta dpm/100 cm²
5	poured concrete	6	0.25	18	453	0.5	613
7	poured concrete	5	0.25	15	511	0.5	692
12	poured concrete	1	0.25	3	624	0.5	845
			average	**12**		average	**717**
			std dev	**8**		std dev	**118**
			95% conf	**9**		95% conf	**133**
9	cinder block	6	0.25	18	1,411	0.5	1910
13	cinder block	3	0.25	9	1,508	0.5	2041
Biased*	unpainted cinder bloc	13	0.25	40	801	0.5	1084
			average	**23**		average	**1679**
			std dev	**16**		std dev	**519**
			95% conf	**18**		95% conf	**587**

count time (min)	5
alpha instrument efficiency	0.313
beta instrument efficiency	0.356
probe area (cm)	83

	alpha		beta	
	poured	block	poured	block
Largest Surv Unit dpm/100 cm²	18	40	845	2041
Smallest Ref Area dpm/100 cm²	12	6	757	1865
Difference	**6**	**34**	**88**	**176**
	is less then	is less then	is less then	is less then
DCGL dpm/100 cm²	**100**	**100**	**400**	**400**

*Biased sample by wall location W3 consisting of an unpainted block, possibly new.

Sheet 7 - QA Results for Survey Unit 3: Building 9372 Gun Bay
See Appendix F of USACE 2004 for location diagrams.

location	material	alpha counts	alpha source eff	alpha dpm/100 cm²	beta counts	beta source eff	beta dpm/100 cm²
Wall 1	poured concrete	2	0.25	6	450	0.5	609
Wall 2	poured concrete	0	0.25	0	618	0.5	837
Wall 3	poured concrete	5	0.25	15	545	0.5	738
Floor 8	concrete	12	0.25	37	691	0.5	935
Floor 9	concrete	11	0.25	34	736	0.5	996
Floor 10	concrete	26	0.25	80	790	0.5	1069
Floor 11	concrete	4	0.25	12	713	0.5	965
Floor 12	concrete	15	0.25	46	698	0.5	945
Floor 14	concrete	8	0.25	25	610	0.5	826
			average	**28**		average	**880**
			std dev	**25**		std dev	**142**
			95% conf	**16**		95% conf	**93**
Floor 11*	metal	11	0.25	34	590	0.5	799
Floor 13*	metal	13	0.25	40	871	0.5	1179
Bay 1*	track 8	13	0.25	40	715	0.5	968
Bay 1*	track 9	13	0.25	40	1007	0.5	1363

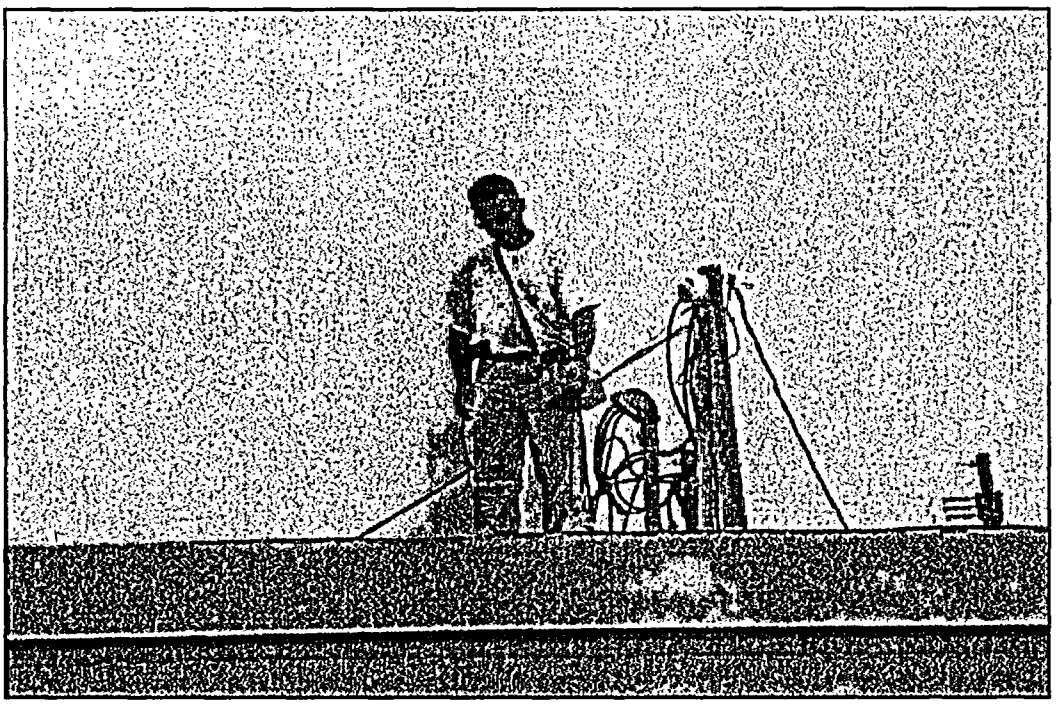
*These metal measurements were collected prior to reclassification of the tracks as a Class 1 survey unit and are not included in average calculation.

count time (min)	5
alpha instrument efficiency	0.313
beta instrument efficiency	0.356
probe area (cm)	83

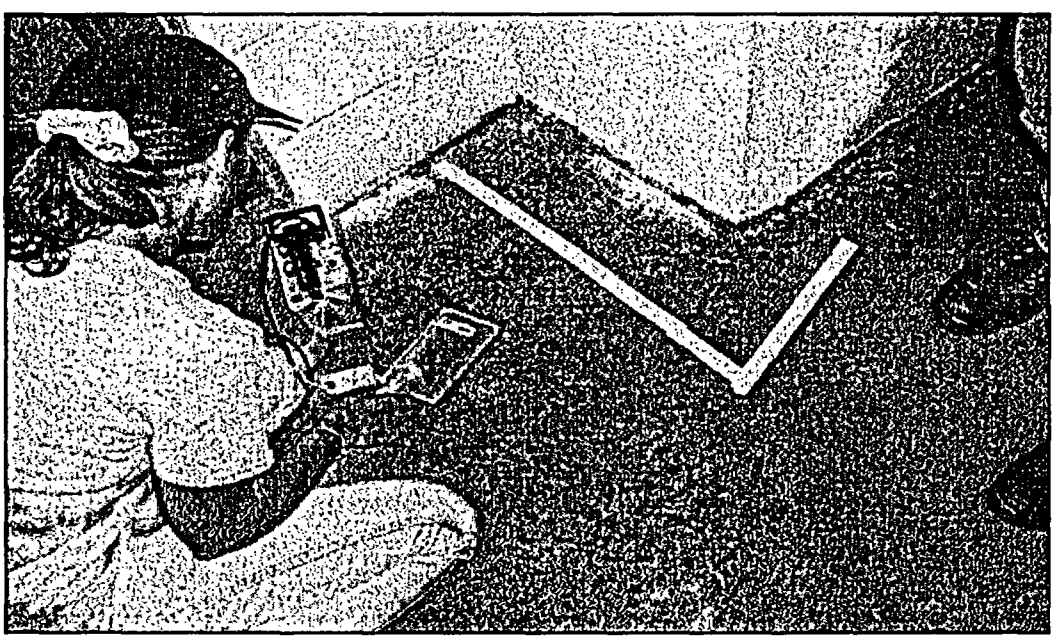
	alpha	beta
Largest Surv Unit dpm/100 cm²	80	1069
Smallest Ref Area dpm/100 cm²	12	757
Difference	**68**	**313**
	is less then	is less then
DCGL dpm/100 cm²	**100**	**400**

Appendix H

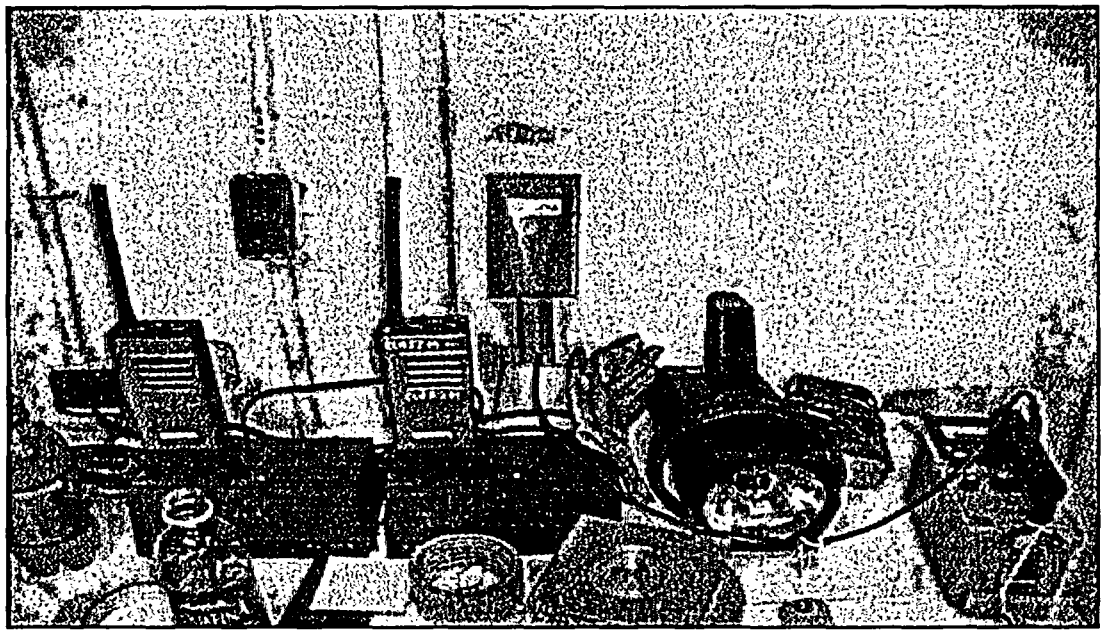
PHOTOGRAPHS



ROOF SURVEY of BLDG 9372 WITH FIDLER (NO ELEVATED READINGS)



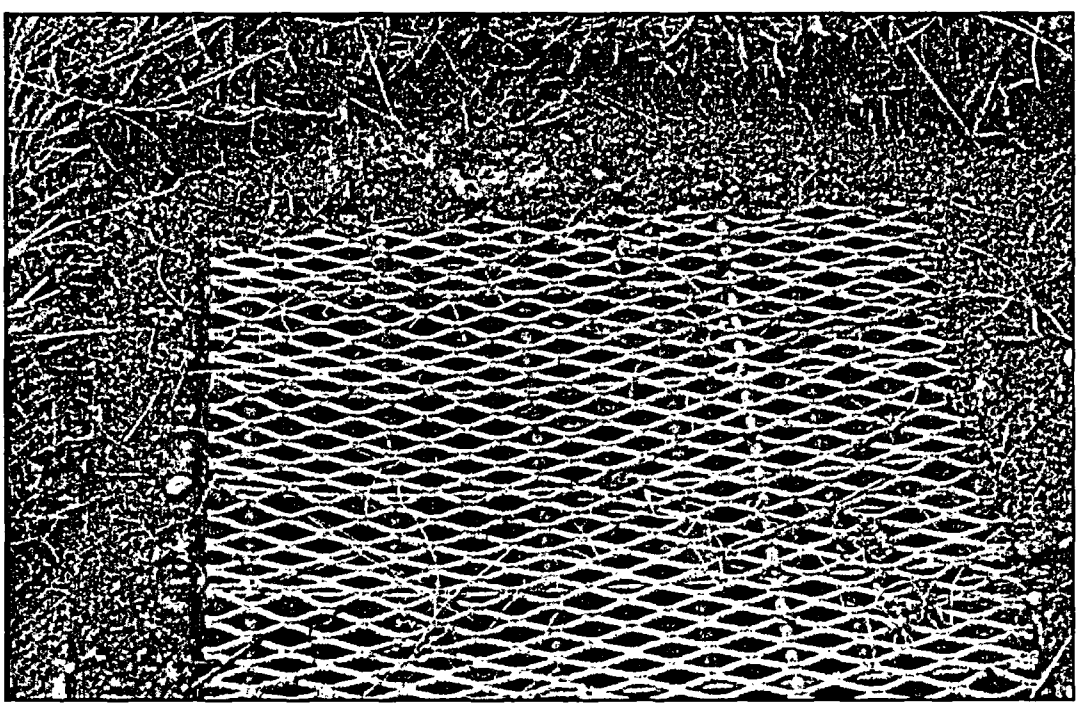
9372 Interior Surveys



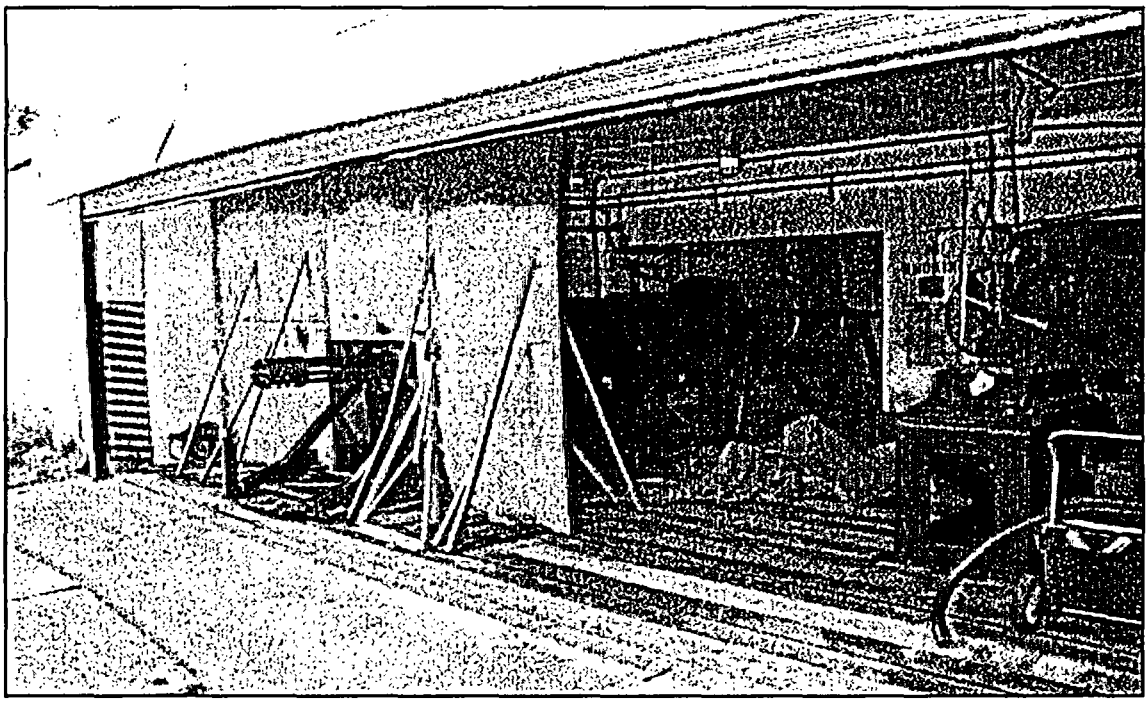
SURVEY OF WALLS IN BUILDING 9372.
JIG WAS USED FOR PHOTO PURPOSES

SURVEY OF PAVED (ASPHALT) AREA IN FRONT OF GUN BAYS
SEVERAL ELEVATED AREAS WERE IDENTIFIED

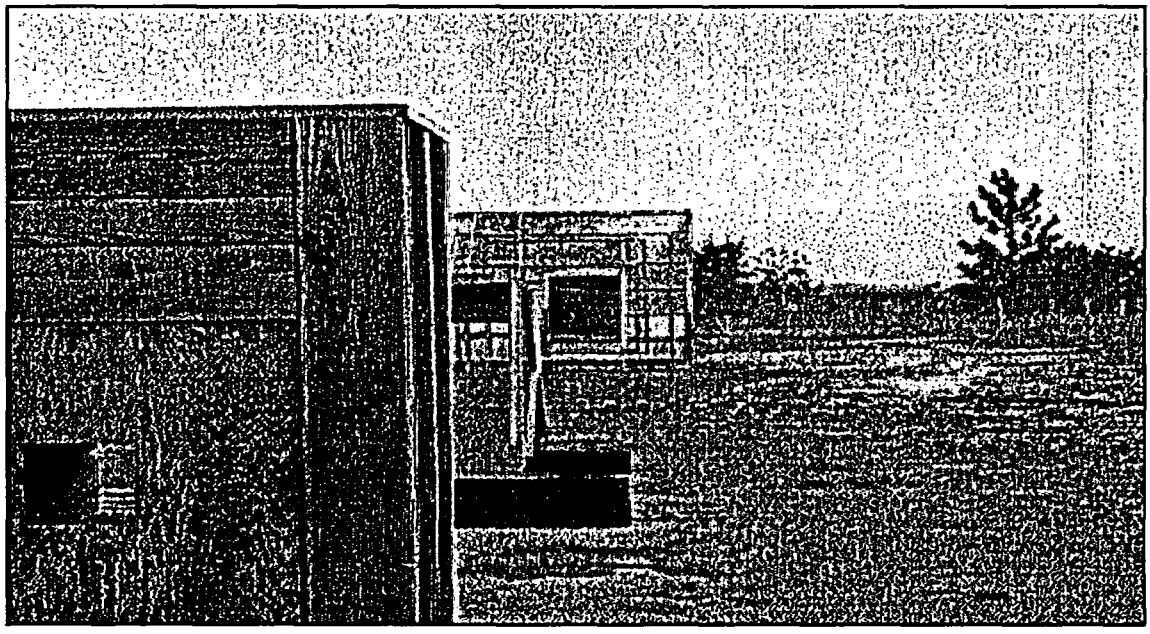
VIEW OF DRAIN OUTSIDE OF GUN BAYS



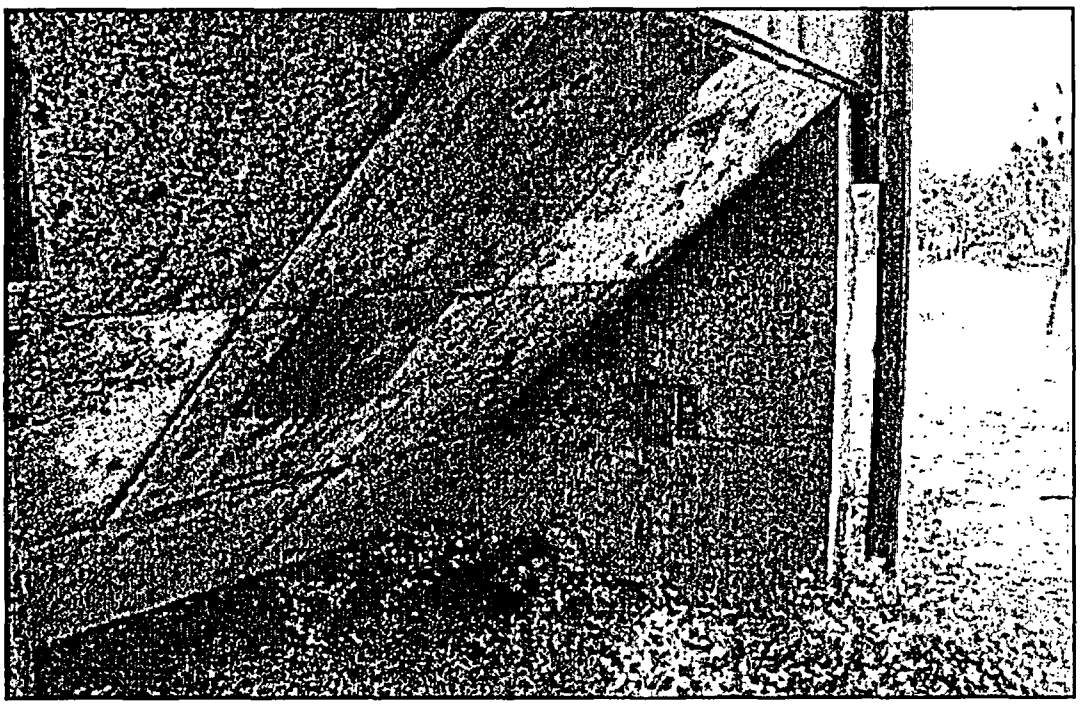
Drain Outfall Survey



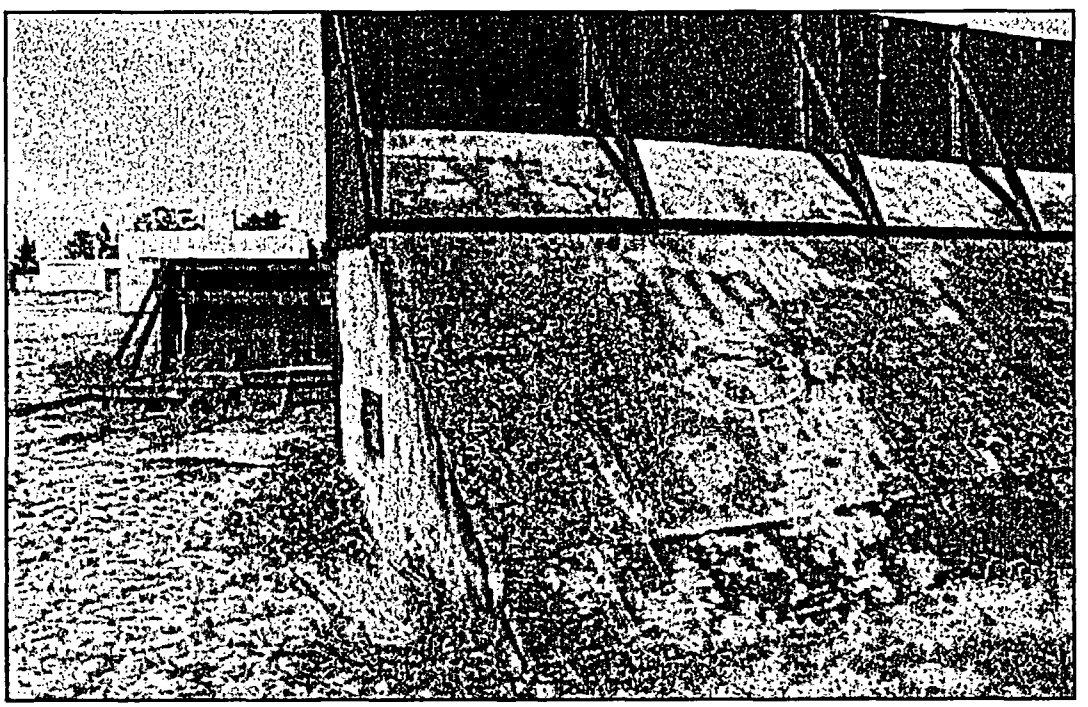
BUILDING 9372 GUN BAY WITH GAU-8/A IN PLACE.



VIEW DOWN THE RANGE FROM THE GUN BAYS

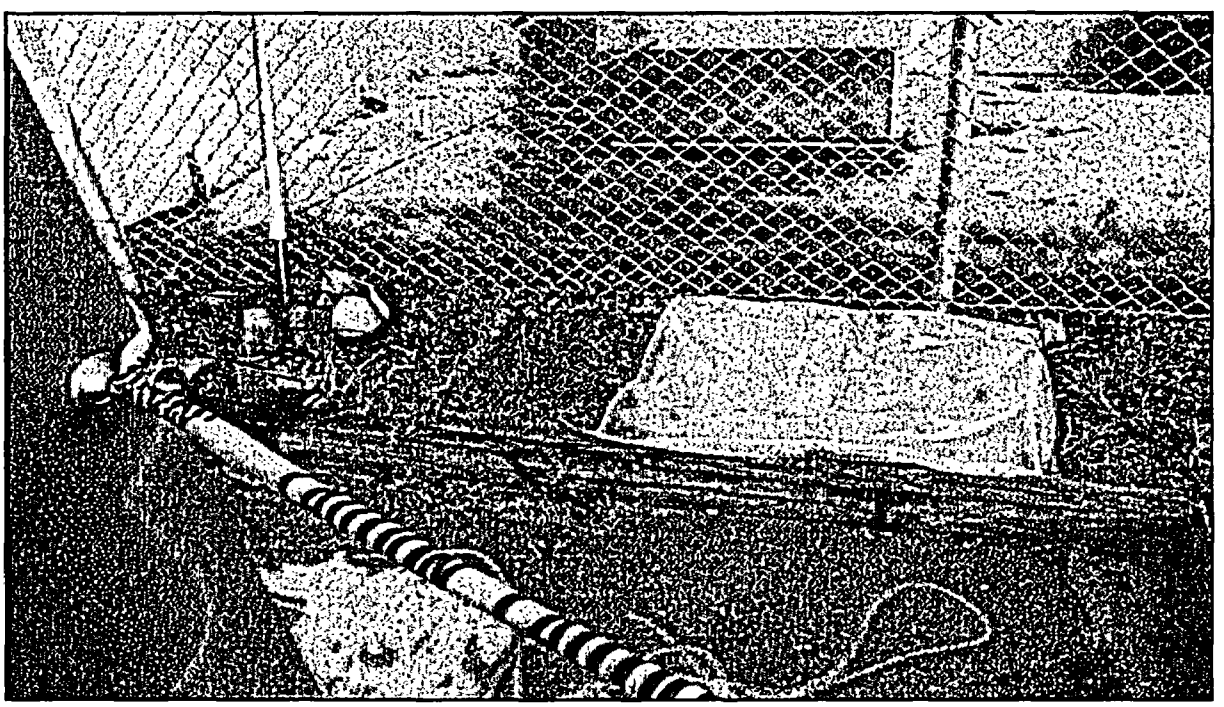


CLOSE VIEW OF TARGET CATCH BOX

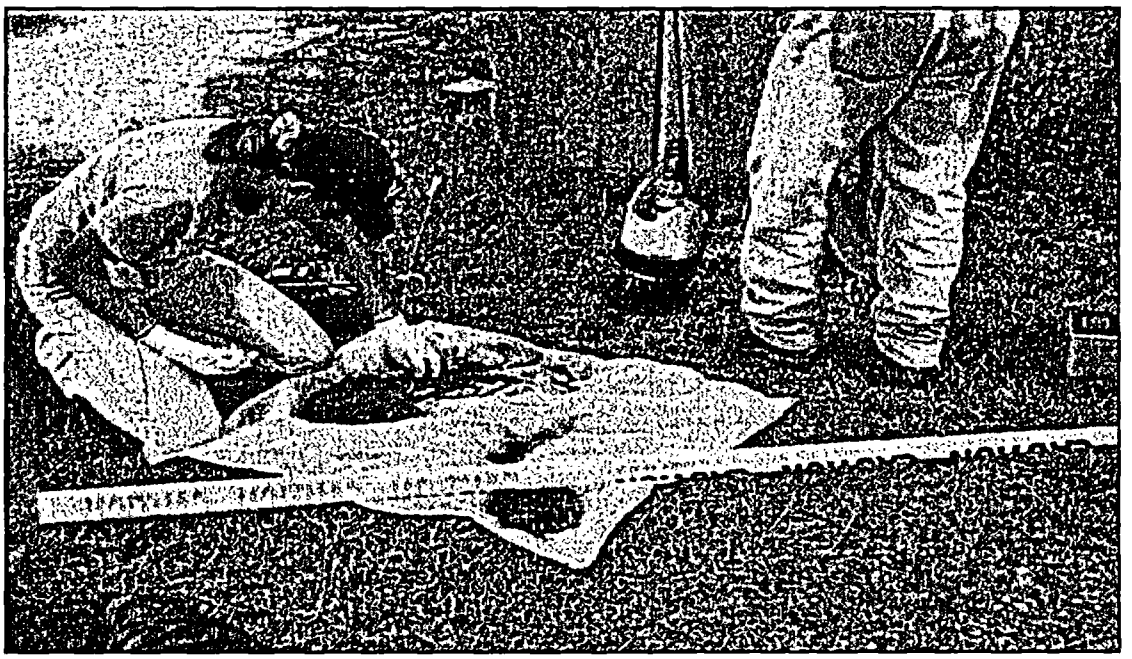


Back of Catch Box

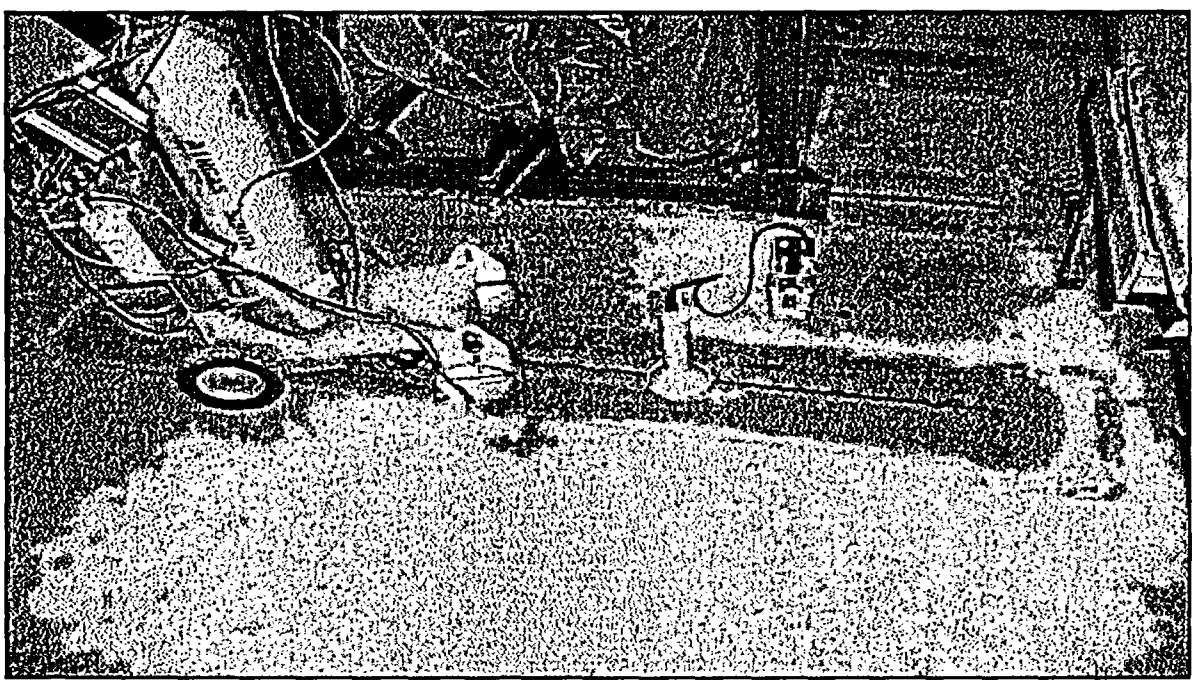
Removal of DU fragments from building area.



Location of Fragment near rear door to gun bay.



Removal of DU Fragment to left of Gun Bay.



Location of Fragment in Gun Mount Slot.