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1	1	Cog. Mgr. G.C. Henckel	C Henckel	6/11/92	H6-04	EDMC (2)			H6-08	3	
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Author/Requestor (Printed/Signature): P. J. Valcich — Date: 6-2-93

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SCOPE

This report summarizes and documents the results of the radiological surveys conducted April 10 and 17, 1993, in the 100-IU-1 Operable Unit in the Riverland Expedited Response Action (ERA) Area, Hanford Site, Washington (Figure 1). In addition, this report explains the survey methodology using the Ultrasonic Ranging and Data System (USRADS).

The radiological survey field task consisted of two activities: characterization of the specific background conditions and the radiological survey of the area.

The USRADS radiological survey of these sites and the background study were conducted by Site Investigative Surveys Environmental Restoration Health Physics Organization of the Westinghouse Hanford Company. The survey methodology was based on use of the USRADS for automated recording of the gross gamma radiation levels at or near 6 in. and at 3 ft from the surface soil.

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PURPOSE

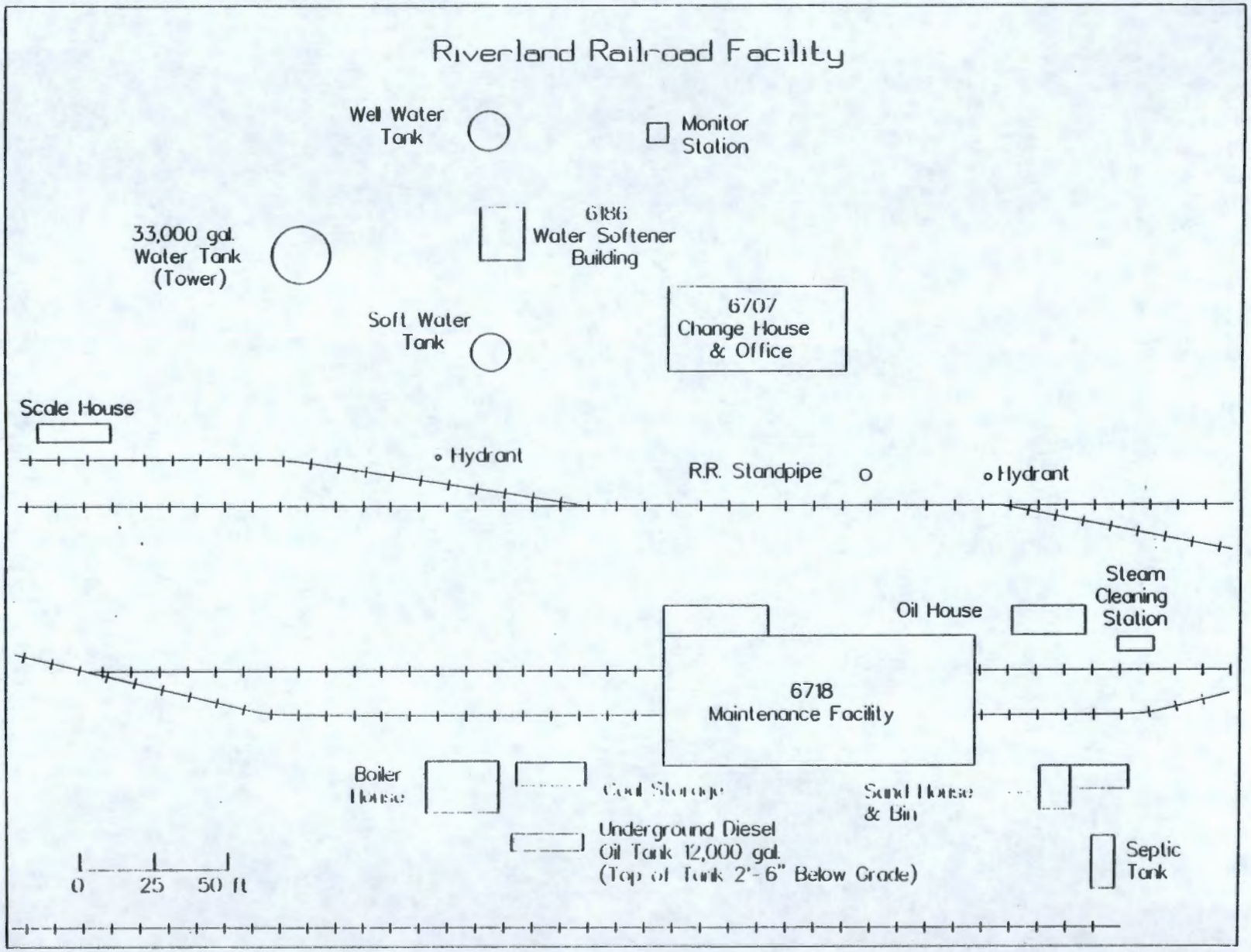
This survey was performed to provide radiological data to be used to either support or refute the customer's request for an exemption from radiological release requirements specific to the Riverland ERA Project (100-IU-1 Operable Unit). The site consists of eight different project areas including the Rail Yard Site, which is the only area known to have a history of working with radioactive material. The Rail Yard Site was decommissioned in 1954 and remediated in the 1960's.

PROCEDURE

The radiological surveys were conducted following the procedures contained in the *Health Physics Procedures Manual* (WHC-IP-0692.A) (WHC 1992), in particular, Section 11.20.02, "Ultrasonic Ranging and Data System (USRADS): Connecting the Equipment," Rev. 0; Section 11.20.01, "Ultrasonic Ranging and Data System (USRADS): Equipment Setup," Rev. 0; Section 1.25.13, "Ultrasonic Ranging and Data System (USRADS): System Calibration," Rev. 0; Section 11.20.03, "Ultrasonic Ranging and Data System (USRADS): Performing the Survey," Rev. 0; and Section 11.01.01, "Background Determination for Environmental Surveys," Rev. 0.

The radiological surveys were conducted using both a digital count rate meter with a sodium iodide detector reporting in counts per minute (cpm) and a dose rate meter reporting micro Roentgen per hour (uR/h). The count rate meter was set for gross counting, i.e., window "out". The window setting allows detection of low, intermediate, and high energy photons.

Figure 1. Riverland ERA USRADS Radiological Survey.



These instruments were connected to a CHEMRAD Tennessee Corp. Series 2000 USRADS. The USRADS equipment is used to record the detector readings versus the location of the readings, generate a map of the survey area, and save the data on computer storage media.

USRADS SURVEY SITES

INTRODUCTION

An approximately 3.4-acre site was surveyed and within this area, 14,759 data points were collected. Each data point represents two gross gamma radiation readings, counts per minute with a NaI detector at 6 in. and a dose rate with a micro-R meter at 3 ft, along with the physical coordinates of the readings. A total of 12 individual surveys were conducted in order to complete this entire area.

LOCATION

The USRADS survey was performed over the areas of the rail yard that could most logically be assumed to contain residual radioactive contamination. The survey was concentrated around the decon pit area and the former rail line in the direction of Highway 240.

Before initiating the USRADS radiological surveys, a grid system was established so that the individual surveys could be controlled and tied together. Site Investigative Surveys technicians placed stakes in a 150- by 75-ft (with the exception of grid #1) grid within the area to be surveyed (Figure 2). Each grid block was given a numeric designator.

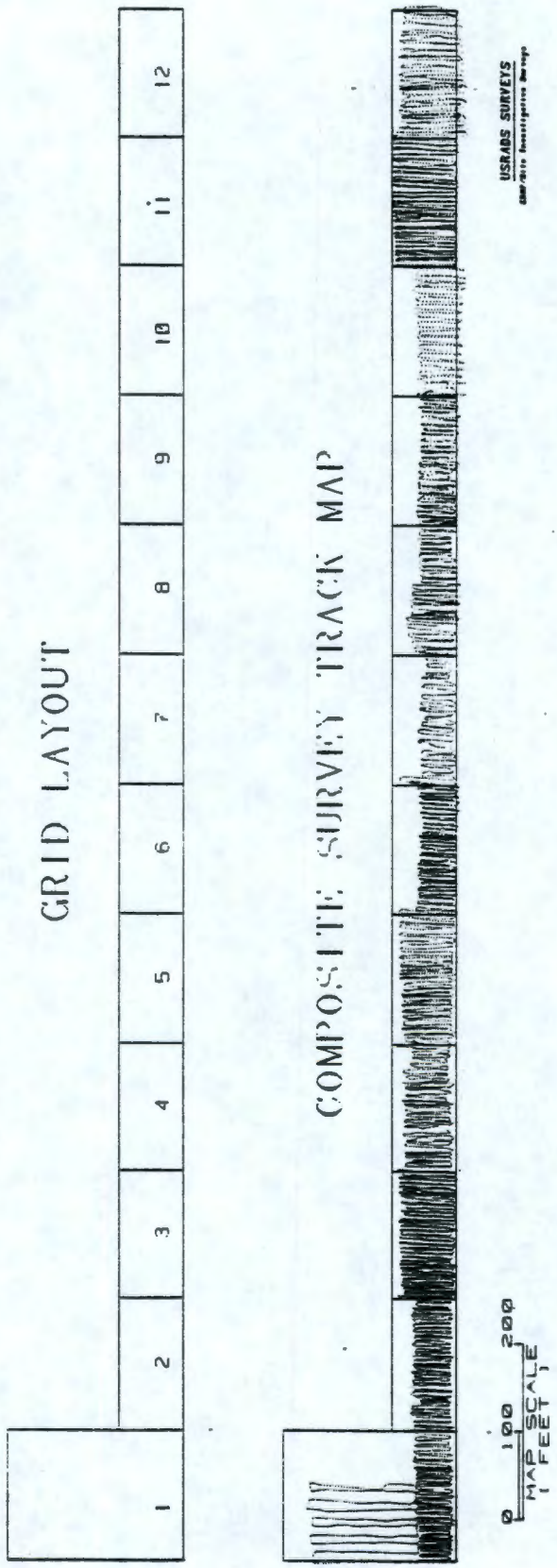
INSTRUMENTATION

Gamma detection instrumentation used is as follows:

- Ludlum Model 4 Count Rate Meter, Serial No. 81500 with Ludlum 44-10 2- by 2-in. NaI detector
- Ludlum Model 4 Count Rate Meter, Serial No. 81518 with Ludlum 44-10 2- by 2-in. NaI detector
- Ludlum Model 19 microR Meter, PNL No. 5024
- Ludlum Model 19 microR Meter, PNL No. 5029.

These instruments are maintained and calibrated by Pacific Northwest Laboratory.

Figure 2. Riverland ERA USRADS Radiological Survey Grid Layout and Composite Survey Track Map.



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Radiation survey instruments were checked for the proper instrument response at the beginning of each day. This was accomplished by placing a Cs-137 check source next to the detector and observing the instrument's response to the source. Local background radiation checks were also performed by taking three 1-minute counts.

DISCUSSION

USRADS METHODOLOGY

Each survey entailed setting up the USRADS equipment in a grid block, connecting the radiation survey meters to the USRADS Data Pack, calibrating the USRADS equipment, and performing the survey. Calibration of the USRADS is performed prior to starting a survey. The purpose of the calibration sequence is to reestablish the positioning instrumentation after the equipment is moved to a new location.

Every attempt was made to traverse each grid block on approximately 10-ft transects with additional coverage around areas with evidence of soil disturbance. Speed of survey was approximately 2 ft/sec. The gamma detector was maintained about 6 in. from the soil surface by suspending the detector from a boom attached to the surveyor's backpack. The dose rate meter was mounted to this boom 3 ft from the soil surface. In this manner detector geometry remained relatively constant throughout the entire survey.

USRADS SURVEY RESULTS

No statistically elevated radiation/contamination readings were observed in any location surveyed with the USRADS equipment. USRADS survey statistics are summarized in Table 1.

Figure 2 includes a composite survey track map of the entire area surveyed.

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Table 1. USRADS Survey Statistics.

SURVEY	DATE	GRID	DATA PTS	MAX CPM	MEAN CPM	SIGMA	MAX uR	MEAN uR	SIGMA
RWA1	04/10/93	1	1652	9600	6769.79	681.29	11.12	6.68	1.47
RWA2	04/10/93	2	1247	8460	6787.07	654.39	11.72	6.65	1.57
RWA3	04/10/93	3	2162	9180	6871.28	728.22	13.52	6.78	1.57
RWA4A	04/10/93	4	1098	9180	6957.6	689.04	12.32	6.87	1.48
RWA5	04/10/93	5	1179	9840	7054.5	738.73	12.62	6.91	1.51
RWA6	04/10/93	6	1456	8940	6795.04	653.42	11.42	6.68	1.46
RWA7	04/10/93	7	636	8700	6788.49	617.95	11.42	6.89	1.5
RWA8A	04/10/93	8	966	8580	6882.11	636.55	11.42	6.89	1.48
RWA9A	04/17/93	9	1078	9420	7306.2	681.72	13.82	7.13	1.55
RWA10A	04/17/93	10	536	9360	7366.46	681.59	11.12	7.09	1.39
RWA11A	04/17/93	11	1701	9600	7486.24	720.46	11.72	7.06	1.52
RWA12A	04/17/93	12	1048	9060	7419.5	709.84	13.52	7.08	1.68

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AMBIENT RADIATION BACKGROUND AND MINIMUM DETECTABLE COUNT RATE DETERMINATION-- LOW BACKGROUND SITE

INTRODUCTION

The Low Background survey was conducted to establish baseline radiological background conditions in a designated test plot known to have no history of radiological operations. The radiological data collected during this survey are considered representative of the undisturbed soil surfaces on the Hanford Site. The survey was conducted on April 1, 1993.

LOCATION

The Low Background test plot is located in the 600 Area, between the 100-D/DR and 100-H Areas, approximately 2,000 ft from the Columbia River. The site had been previously staked on 100-ft intersects oriented along a north-south axis. The total size of the background plot is 500 by 500 ft. A 200- by 200-ft area was surveyed with USRADS for this background study.

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DISCUSSION

The survey was conducted using Ludlum Model 4 digital rate meters with a Ludlum Model 44-10, 2- by 2-in. sodium iodide detectors and a Ludlum Model 19 Ur meter. The meters were coupled to the USRADS for the purpose of recording the data from the output of the individual detectors versus the location of that data within the survey area.

Two surveys were performed to cover the 40,000-ft^2 site twice. A total of 5,940 data points were collected within this site. A summary of the survey results can be found in Table 2. The location of the Low Background Test Site, the survey grid layout, and a track map of the surveyed area is shown in Figure 1. The grid block was traversed on an approximately 10-ft cross-hatched pattern.

Table 2. Low Background Survey Results.

SURVEY	DATE	GRID	DATA PTS	MAX CPM	MEAN CPM	SIGMA	MAX uR	MEAN uR	SIGMA
LBS2A	04/01/93	1	2730	10860	8576.73	746.91	15.32	8.57	1.61
LBS2B	04/01/93	1	3210	10980	8804.15	757.5	13.52	8.51	1.66

As the surveyor traverses the survey area, the USRADS records the output data from the radiation detector versus the location of where in the survey area the data was detected - each second. Therefore, while the survey is in

progress, a real-time map of the survey area is generated. When the survey is completed, the survey data set is saved on a computer disk.

The average background count rate for the Low Background Site was determined to be 8,700 cpm and the average dose rate to be 8.57 uR/h.

MINUMUM DETECTABLE COUNT RATE

The minimum detectable count rate (MDC) was then calculated by employing the formula:

$$MDC=60\left(4.66\sqrt{\frac{Rb}{60}}\right)$$

where Rb is background count rate in counts per minute.

Based on the above formula, the minimum detectable count rate is

3366.83 cpm + 8700 cpm = 12,066.83 cpm.

One of the features of the USRADS is the ability to enter a "threshold" setting upon initiating a survey. The threshold setting is a value that when exceeded, the data point plotted on the CPU monitor is highlighted. This feature alerts the CPU operator that the CPM data have exceeded the threshold or preset value. For the purpose of conducting surface radiation surveys, it was desirable to establish a value for the threshold where readings above the setting could be considered for further investigations. The threshold value established for USRADS survey work is 12,050 cpm. This value is practical based on the premise that too low of a setting would highlight normal fluctuations above the calculated mean, and too high of a setting would cut off the low end of surface radiation that might be present.

REFERENCE

WHC, 1992, *Health Physics Procedures Manual*, WHC-IP-0692.A, Westinghouse Hanford Company, Richland, Washington.

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DISTRIBUTION SHEET

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Distribution	Station # 12	Date
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