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COMMUNITY SAFETY / RADIATION SAFETY
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10833 LE CONTE AVENUE
LOS ANGELES, CALIFORNIA 90024-1765

January 11, 1990

Mr. Emilio M. Garcia
U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Dear Mr. Garcia:

Attached is information on our recent radioactive contamination measurements made to verify the status of the 22 large concrete shielding blocks that the University donated to the Wildlife Waystation in San Fernando in September, 1987.

On November 22, 1989 preliminary measurements made at the Waystation indicated that the blocks conformed to the material release limits given in the November, 1985 ASLB Settlement Agreement. On December 13, considerably more detailed measurements were made at the Waystation. A large fork-lift was employed to move the blocks and gain access to their surfaces and to verify their identifications.

The measurements at the Waystation were made of direct radiation and fixed contamination near the block surfaces. Swipe samples were collected for laboratory counting of any removable contamination.

Particular attention was devoted to block C-5, because its original location, relative to the reactor, was directly above blocks C-6 and C-7, i.e., in the direction away from the reactor. Blocks C-6 and C-7 had been transferred to a low-level radioactive waste burial site.

The C-5 surface contamination measurements of 4 of the 6 faces of the block were indistinguishable from background. Measurements on the 10x84-in. "west" face with an area of 0.55 m^2 showed an average contamination level of 856 beta-gamma dis/min per 100 cm^2 and a maximum of 5384 beta-gamma dis/min per 100 cm^2.

The results for the 40x84-in. "bottom" face, with an area of 2.65 m^2 divided into 3 parts, each with an area of 0.88 m^2:

1. All measurements were indistinguishable from background.

2. Average contamination level was 755 beta-gamma dis/min. per 100 cm^2 and maximum was 5918 dis/min. per 100 cm^2.

3. All measurements were indistinguishable from background.

B-2

Swipe samples collected at the Waystation (and counted in the Division's laboratory with a liquid scintillation counter) and direct radiation measurements confirmed that the 1987 measurements complied with the release standards given in the Settlement Agreement for removable contamination and the penetrating radiation level at one meter from the blocks.

In short, the recent measurements have confirmed that 20 of the 22 blocks donated to the Waystation are within the standards for the release of material as not radioactive. Two of the blocks (ST-W1 or W2 and ST-5) had already been put to use by the Waystation probably buried for erosion control. While they could not be directly re-evaluated, their radioactivity status is borne out by the negative results of measurements made of blocks originally installed adjacent to the two blocks but closer to the reactor core, as well as the measurements made prior to their release in September, 1987.

We have concluded that the 22 shielding blocks need not be considered as radioactive according to the release standard given in the Settlement Agreement. All of the recent measurements support the basis for the donation of the blocks in 1987. While the C-5 block also conforms to the release standard, it may cause concern among Wildlife Waystation people, and therefore, this block was returned to the former reactor facility by the School of Engineering and Applied Science, in order to eliminate any concern by Waystation people, no matter how unfounded the concern may be.

Sincerely yours,

James E. McLaughlin
Director, Radiation Safety

Enclosure

cc: Alexander Adams, U.S. NRC, Washington
Richard Sessions, Executive Officer, SEAS
John C. Barber, Assistant vice Chancellor, Community Safety
Amos Norman, Chair, Radiation Safety Committee

STATE OF CALIFORNIA
COUNTY OF LOS ANGELES

On January 11, 1990 before me, the undersigned, a Notary Public in and for said county and State, personally appeared James E. McLaughlin, known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that the executed the same.

OFFICIAL SEAL
VIRGINIA SAVOIE
NOTARY PUBLIC-CALIFORNIA
LOS ANGELES COUNTY
My Commission Expires Feb. 8, 1991

Notary Public in and for said County and State

SUBSCRIBED AND SWORN TO BEFORE ME THIS 11 DAY OF January 1990

NOTARY PUBLIC-CALIFORNIA

University of California
Los Angeles

Docket No. 50-142

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Rev. Feb. 23, 1989

PART A: VERIFICATION OF RADIOLOGICAL STATUS OF 22 CONCRETE SHIELD BLOCKS AT WILDLIFE WAYSTATION

INSTRUMENTS AND RADIOACTIVITY LIMITS INTRODUCTION

In September of 1987, twenty-two large concrete blocks were donated to the Wildlife Waystation in San Fernando, California. The weights of the blocks ranged from about 1.3 to 3.3 tons and are being permanently emplaced at the Waystation for the control of soil erosion, which is especially troublesome in this location.

The blocks were tested in 1987 against the direct, penetrating radiation and radioactive contamination standards laid down in the ASLB Settlement Agreement of November, 1985, Section 2.6. At that time, the test results for emergent dose rate and removable contamination were well below the established limits. The limits for allowing unrestricted release of property or material are 5 μR/h above normal background at a distance of 1 m. and 1000 dis/min per 100 cm^2 for removable contamination.

While we believe tests were made for compliance with the limits for fixed contamination because such monitoring is in accordance with established procedures in use for many years, results were not adequately recorded.

In addition, a visit by a representative of the ASLB Hearing intervenor, the Committee to Bridge the Gap, in September, 1989, apparently has raised concern about our monitoring methods. While there was no communication with the intervenor, there was some significant adverse publicity about the transfer of the blocks in both the paper and the electronic media.

In November, we began plans for verifying that the shield blocks conformed to the release standards. This effort included calibration of one pancake G.M. detector system (as well as re-calibration of a new "twin" instrument) and verification measurements made at the Waystation on November 22 and December 13, 1989.

Instrument Calibration

The instruments used were:

1. Two Ludlum Model 44-40 collimated G.M. counters with Model 2200 scaler-ratemeters. A plated Tc-99 source was used for the calibration, because a higher energy emitter would not match the emission energies expected from the shield blocks and could lead to underestimated surface emission rates.

The counting efficiencies determined from 5 minute counts of the TC-99 standard with a surface emission rate of 8160 ± 410 betas/min were:

Instrument No. 1 (old) = 0.335 ± 0.017

Instrument No. 2 (new) = 0.283 ± 0.014

During a NRC inspection in February, 1989 it was noted that the counting efficiency values over recent years were quite variable, so a small plastic calibration source holder was fabricated and could be re-positioned directly and reproducibly under the G.M. counter window.

2. Two low-level, gamma-ray dose rate instruments, namely, a Reuter-Stokes RSS-111, serial number V-5009 (HPIC) and a Ludlum Model 19 Micro-R-Meter (with a 1X1-in NaI (Tl) detector) were used. The former was calibrated by Reuter-Stokes in March, 1989, and the latter is calibrated-checked on a biannual period.

   The scintillation survey instrument was used for scanning the blocks and nearby terrain and gives an approximate, but adequate, screening estimate of penetrating radiation levels near background. The RSS-111, with its 10-in. diameter high pressure chamber, is designed to measure the radiation level due to terrestrial gamma-ray and other sources.

We noted that the undisturbed penetrating radiation background around the Campus is in the range of 11-12 μR/h and about the same at the Waystation. Exceptions at the Waystation are those locations close to exposed natural granitic rock.

In some cases, we noted that the radiation dose rate above the shield blocks were significantly reduced, because the blocks shielded the detector from emissions from the ground.

Contamination Limits and Calibrations

We have a problem in the use of the contamination limits as directed by the ASLB Settlement Agreement. Section 2.6 refers to the U.S. NRC Regulatory Guide 1.86 (dated June, 1974). This Guide contains "Acceptable Surface Contamination Levels" for items to be released for unrestricted use insofar as the radioactivity content. The Guide does not, however, define the term surface contamination.

A different NRC document, "Monitoring for Compliance with Decommissioning Termination Survey Criteria" (NUREG/CR-2082, June, 1981), describes surface contamination in terms of distinguishing removable and fixed contamination. It does state that the contamination limits (numerically equal to the R.G. 1.86 limits) "do not apply to premises, equipment, or scrap containing

induced radioactivity for which the radiological considerations pertinent to their use may be different." The report indicates that such radioactive material, that is made radioactive by neutron activation, should be considered on a case-by-case basis.

We note in passing that the ANSI "trial use and comment" standard, "Control of Radioactive Surface Contamination on Materials, Equipment, and Facilities To Be Released for Uncontrolled Use" (N13.12, August, 1978) also excludes neutron activation products from its scope. The follow-on standard of the same name by the Health Physics Society, dated May 3, 1982, rules out material that has dispersed radioactivity. This means, we think, radioactivity that is distributed in depth.

We maintain that neutron activated items with relatively thin surfaces may approximate similar surfaces that have been contaminated with uncontained radioactive material, especially when such radioactivity becomes chemically bound to the surface of the item. However, our 10-in. thick concrete shield blocks are exceptional, because the neutron activation varies with depth.

The type of detector commonly used in evaluating surface contamination and the nature of the concrete in terms of its effects on detector response effectively preclude us from inferring the total activity in the concrete with any degree of confidence.

The detectors were calibrated with a small quantity of a radionuclide taken from a NIST traceable solution deposited on a nickel disc. The vendor provides counting data from an internal gas flow proportional counter on the betas emitted from the surface of the disc, as well as the total disintegration rate (which is double the surface emission rate reduced by the backscatter contribution from the disc).

It is difficult to apply data from an array of radioactive atoms which decay isotropically and are distributed along the concrete surface to the development of an estimate of total activity in the median. Two important competing effects are neglected, one being depth distribution mentioned above and the other the back scatter effect from the concrete into the detector.

For this reason, we used the surface emission rate or "2π calibration," to convert our measurements taken on the concrete block faces. We did not use the "4π calibration," which is merely a fruitless attempt to quantify the total activity in the block, while neglecting the important concrete effects mentioned above.

In short, we assumed that the purpose was to assess the surface contamination on the concrete blocks. The surface emission rate is directly related to the detector response. This strategy does not seem to be a new one, because existing publications identify neutron activation "contamination" as a special problem. One draft publication, still in preparation (by the NCRP) and not yet available for use, states that the surface emission rate evaluation is adequate for radiation control purposes and an extreme analysis is not necessary or required.

In any case, one can blindly apply the "4π" calibration to the data on block C-5, given in Part B. In this case, the 4π counting efficiency for the detector system used for the C-5 evaluation is 20.9% (instrument no. 1). This means that the average and maximum C-5 data would be multiplied by 1.6 to get the (very roughly) estimated total activity, namely:

Location on C-5	2π		4π	
	avr. (dis./min per	max. 100 cm²)	avr. (dis./min per	max. 100 cm²)
C-5, West Face	856	5384	1370	8614
C-5, Part II	755	5918	1208	9469

Details of our analysis appear in Part B.

The R.G. 1.86 contamination limits used were 1000 dis/min of removable contamination per 100 cm², 5000 dis/min per 100 cm² for average value from measurements in an area less than 1 m² and 15000 dis/min per 100 cm² for the maximum value. However, it is our formal practice around the University to apply any limits in a conservative fashion, including contamination limits for determining "releasability" of material or property.

We note here that 21 of the blocks in question, when installed, will be unavailable to most of the general public, including the Waystation workers. Further, these blocks showed no measurable quantity for any of the 3 standards invoked by the Settlement Agreement. The 22nd block, C-5, is well below the fixed contamination standards of 5000 dis/min per 100 cm² average value over 1 m² or less and 15000 dis/min per 100 cm² maximum. The C-5 data on surface contamination are caused by neutron activation into an area of about 0.3 m². The major fraction of the total surface area of C-5 is at background levels for the 3 standards.

PART B: RADIATION SURVEY

SURFACE CONTAMINATION MEASUREMENTS:

Twenty of the twenty-two shield blocks were actually measured. It was observed that the concrete blocks shielded the soil, so the exposure rate and surface emission rate were lower than natural background. Each face of every block (except C-5) was scanned for a maximum point. A one-minute count was performed on this maximum point on each face of the block. Of all the faces, the highest net reading on the block is given in the following table. The detector used was Ludlum Model 44-40, serial no. PR062435 with Model 2200 Scaler Ratemeter, serial no. 69300. It had an efficiency of 28.3% and registered an average background of 56 cpm at the Waystation. The detector area is taken as 15.5 cm^2. The minimum detectable surface emission rate (MDSER) in this location was 862 dis/min per 100 cm^2.

Current Arbitrary Designation of Block	Possible Past Designation of Block	Dimensions (in.)	Highest Net Reading (cpm) on the Block
1	ST-W-1/ST-W-2	66 x 40 x 10	0
2	W-10*	66 x 66 x 10	-4
3	W-8*	68 x 66 x 10	8
4	W-7*	68 x 66 x 10	-6
5	W-9*	68 x 66 x 10	7
6	ST-N*	74 x 40 x 10	8
7	T-1*	84 x 52 x 10	11
9	W-1*	66 x 40 x 10	9
10	C-3*	90 x 37 x 10	10
11	W2/W3/W4/W5/W6	66 x 40 x 10	22
12	W2/W3/W4/W5/W6	66 x 40 x 10	0
13	T-2*	84 x 48 x 10	-11
14	C-1*	90 x 37 x 10	14
15	C-2*	90 x 37 x 10	10
16	T-3*	84 x 48 x 10	21
17	W2/W3/W4/W5/W6	66 x 40 x 10	5
18	W2/W3/W4/W5/W6	66 x 40 x 10	10
19	W2/W3/W4/W5/W6	66 x 40 x 10	3
20	C-4*	84 x 44 x 10	-3

* These blocks were uniquely identified either due to their singular dimensions or the still visible past designation.

The two blocks that had been buried probably to serve as a foundation at the Waystation were identified as ST-S (74"x40"x10") and either ST-W-1 or ST-W-2

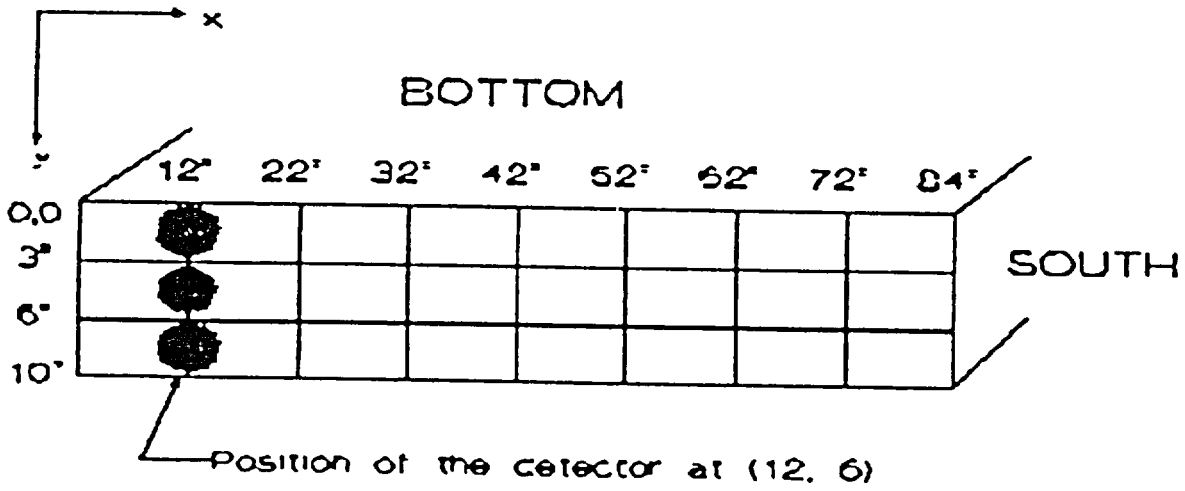
(66"x40"x10"). The location of these blocks relative to the reactor and the results in the above table clearly indicate that the blocks should read the same as, if not less than, background.

BLOCK C-5:

This block was of particular interest and a thorough survey was performed on it. All measurements on the block demonstrated its compliance with the limits in Regulatory Guide 1.86 as explained below. The block was given a designation of no. 8. Its dimensions are 84"x48"x10". The detector used was Ludlum Model 44-40, serial no.PR014910 with Model 2200, serial no. 58243. It had an efficiency of 33.5% and an average background of 115 counts /2 minutes (57.5 cpm). The detector area is 15.5 cm². With a two-minute count time, the minimum detectable surface emission rate (MDSER) was 510 dis/min per 100 cm².

a. West Face of C-5:

Twenty-seven (2-minute) readings were taken on this face of the block. The location of the readings and the actual gross and net counts per two minutes are described in the figure and table below:



Location of Reading (x,y)	Gross Counts in 2 minutes	Net Counts in 2 minutes*
(0,0)	79	-36
(0,3)	71	-44
(0,6)	71	-44
(12,0)	117	2
(12,3)	86	-29
(12,6)	77	-38
(22,0)	286	171
(22,3)	138	23
(22,6)	92	-23
(32,0)	507	392
(32,3)	238	123
(32,6)	117	2
(42,0)	670	555
(42,3)	320	205
(42,6)	133	18
(52,0)	512	397
(52,3)	249	134
(52,6)	139	24
(62,0)	350	235
(62,3)	163	48
(62,6)	110	-5
(72,0)	167	52
(72,3)	93	-22
(72,6)	79	-36
(84,0)	95	-20
(84,3)	85	-30
(84,6)	71	-44

* An average background of 115 counts /2 minutes at Waystation was subtracted from the gross counts.

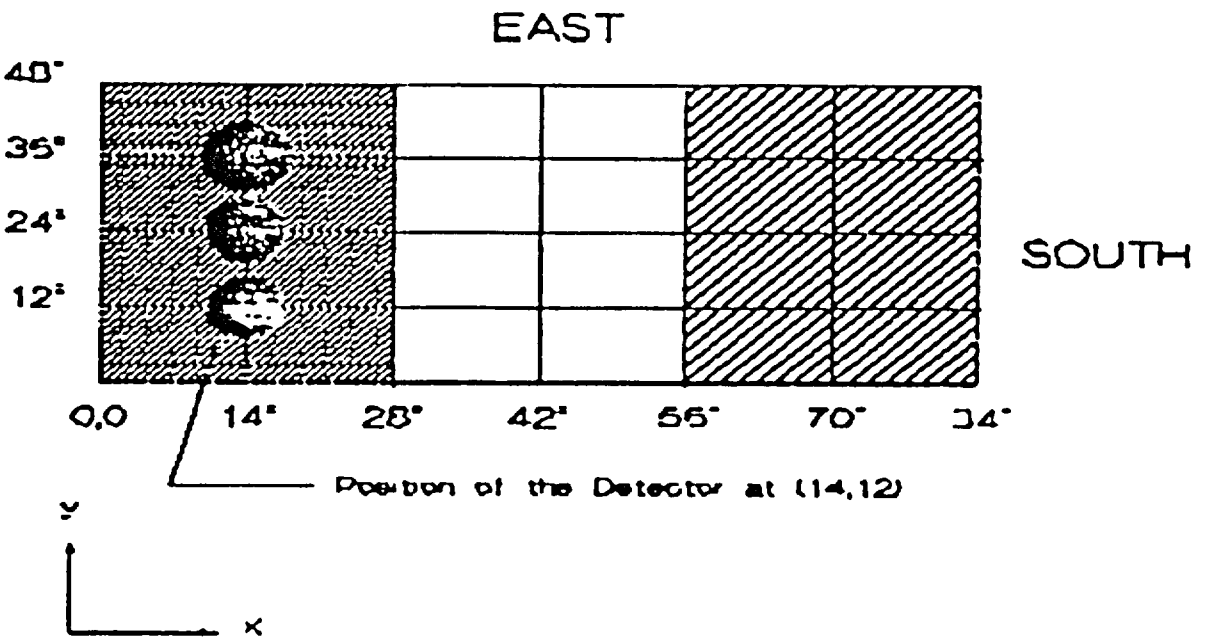
Average Surface Emission Rate = 856 β-γ dpm/100 cm²

Maximum Surface Emission Rate = 5384 β-γ dpm/100 cm²

Note that the negative net readings are taken as zero in calculating a conservative average surface emission rate.

b. Bottom Face of C-5:

The dimension of this face is 84"x 48" (2.65 m²). For averaging purposes, this face was divided into three parts, each 28"x 48" as shown in the figure below:



PART I: RECTANGLE (0,0) TO (28,48)

Location of Reading (x,y)	Gross Counts in 2 minutes	Net Counts in 2 minutes
(0,0)	107	-8
(14,12)	98	-17
(14,24)	72	-43
(14,36)	79	-36

PART II: RECTANGLE (28,0) TO (56,48)

Location of Reading (x,y)	Gross Counts in 2 minutes	Net Counts in 2 minutes
(28,0)	443	328
(28,12)	102	-13
(28,24)	73	-42
(28,36)	77	-38
(28,48)	62	-53
(42,0)	725	610
(42,12)	113	-2
(42,24)	104	-11
(42,36)	75	-40
(42,48)	50	-65
(56,0)	345	230
(56,12)	101	-14
(56,24)	83	-32
(56,36)	61	-54
(56,48)	55	-60

Average Surface Emission Rate = 755 β-γ dpm/100 cm²

Maximum Surface Emission Rate = 5918 β-γ dpm/100 cm²

Note that negative net readings are taken as zero in calculating the average surface emission rate.

PART III: RECTANGLE (56,0) TO (84,48)

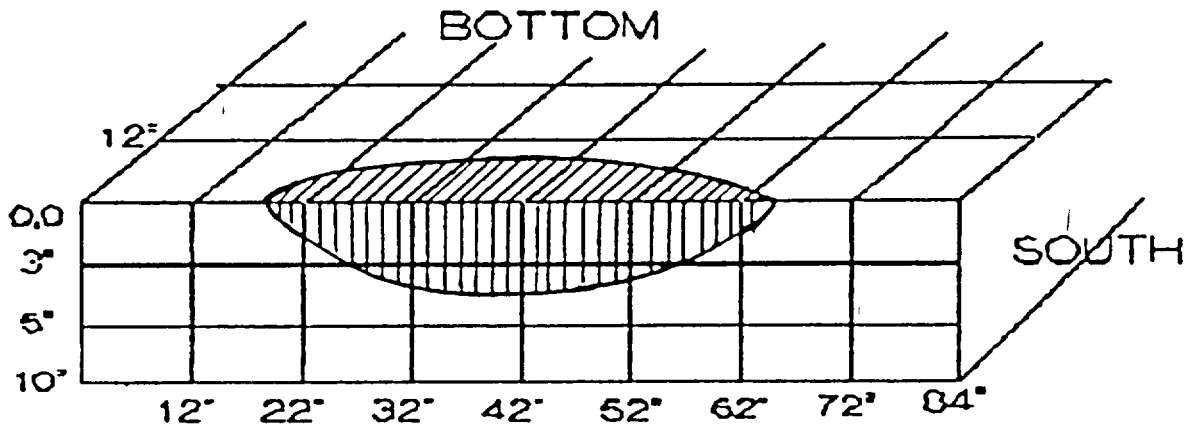
Location of Reading (x,y)	Gross Counts in 2 minutes	Net Counts in 2 minutes
(70,12)	102	-13
(70,24)	78	-37
(70,36)	57	-58
(84,0)	126	11

c. North, South, East, and Top Faces of C-5:

Average readings on all these faces are either less than or same as background.

d. NOTE:

From the data in the above tables, we estimated the approximate areas on the bottom and west face of block C-5 which read measurably over background as 0.3 m². The figure below illustrates this approximate area as the shaded region.



RADIATION SURVEY, SWIPE SAMPLES:

Prior to transfer from the SEAS, each face of the 22 shield blocks was measured for both the penetrating radiation dose rate and for removable contamination. All 22 blocks exhibited gamma-ray dose rates at one meter that were indistinguishable from normal background radiation in the SEAS. Further, all swipe samples showed no removable radioactive contamination.

The survey measurements reported here verified the earlier findings. Swipe samples collected from the 20 blocks surveyed during the present survey showed no removable contamination. The swipe samples were counted on our liquid scintillation counter (Beckman LS-5000 TD). All samples, as was the case in 1987, were below the LSC detection limit. During these counts, the gross detection limit was 23.5 dis/min.

Gamma-ray measurements were made with a Ludlum Model 19, Micro R Meter (Serial No. 43887). The dose rate at one meter from any block surface were found to be equal to or less than the background dose rate at the Waystation, namely 11-12 μR/h.

Gamma-ray measurements were also made with a 10-in. Diameter high pressure ionization chamber (HPIC Reuter-Stokes Model RS-111). This system was last calibrated by Reuter-Stokes in March 1989 and is soon due for a re-calibration. Two measurements made in the integrator mode for about two hours showed 11.3 μR/h as the average, undisturbed background value. Other measurements were made of the C-5 and W-8 blocks as follows:

Block ID and Location	HPIC Reading (μR/h)	Model 19 Reading (μR/h)
C-5, 30 inches above bottom face	12	11-12
C-5, center of detector 10 inches from West face and 30 inches from ground	15.3	15
C-5, 1 m from West face and 30 inches from ground	13	11-12
W-8, 30 inches above top face	11.6	11