NIAGARA MOHAWK

NMP-4321

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

March 30, 1982

Mr. Ronald C. Haynes
Regional Administrator
United States Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, PA 19406

RE: Docket No. 50-220
DPR-63

Dear Mr. Haynes

Your letter of January 25, 1982, requested Niagara Mohawk to repeat our previously submitted evaluation for the field detection and measurement of airborne radioiodines. Our letter of February 18, 1982, requested a delay in the submittal of this data until March 31, 1982. This letter transmitts the re-evaluation requested by your staff in the aforementioned correspondence.

Enclosure I provides a re-evaluation of our ability to rapidly and accurately detect and measure airborne radioiodine concentrations under field conditions.

Niagara Mohawk believes that this transmittal satisfies the commitment made to your staff on January 6, 1982. Please contact me at your earliest convenience if the information does not meet with your approval. You may be assured of our continued cooperation.

Very truly yours

Thomas E. Lempges

Thomas E. Lempges
Vice President
Nuclear Generation

TEL/jm

8204260/73

ENCLOSURE I

Re-evaluation of the Detection and Measurement of Airborne Radioiodine Under Field Conditions

I. INTRODUCTION

A rapid means of detecting airborne radioiodine activity during an emergency is necessary to expedite the identification of the plume centerline and the recommendation of protective actions to the general public.

As a result of the NRC Emergency Preparedness Appraisal (Inspection No. 81-18), the NMPNS re-evaluated it's ability to detect radioiodine in the field. This evaluation was completed and transmitted to the Commission on October 20, 1981. Subsequently, Region I staff members (Messrs. Crocker, Kottan and Ms. Mojta) during a telephone conversation on January 6, 1982, with P. Volza of our staff, requested that this evaluation be repeated. Areas to be addressed during the re-evaluation should include:

a. Use of I-131 as the predominate source of iodine when determining detection efficiency

b. Homogenous mixing of source in first third of sampling cartridge

c. Use of survey meter resolving time when calculating MDC/MDA

The radioiodine detection efficiency determined as a result of this re-evaluation will be incorporated into appropriate emergency implementing procedures to provide an expeditious evaluation of airborne radioiodines released during an emergency condition.

II. METHODOLOGY

Six (6) SAI CP-100 charcoal sampling cartridges were face loaded with I-131 by Analytics, Inc. of Atlanta, Georgia. This loading involved the homogenous mixing of the I-131 source onto the first 5 mm. of the sampling cartridge. A complete description of the loading technique and its supporting documentation is provided in Attachment 1 to this report.

Upon receipt from Analytics, the cartridges were analyzed on the Station GeLi to verify their deposited activity. Each cartridge was subsequently counted using an Eberline RM-14 countrate meter and an HP-210 Geiger Muller probe. The probe was held approximately 1/2 to 3/4 inch from the cartridge and counted for a total time of 1 minute in a low background area (< 100 cpm). The maximum value obtained during the 1 minute count time was recorded and subsequently used to determine the detection efficiency. Each cartridge was counted three (3) times to ensure reproducibility and proved an adequate sample data base.

II. METHODOLOGY (Continued)

Background determinations were performed using a clean CP-100 cartridge and counted in the same manner as the loaded cartridges. Additionally, background was also determined by holding the probe free in air. Since there was no difference observed between the two readings, either method could be used in determining background values.

The data obtained during the GeLi and RM-14/HP-210 analyses were used to determine total deposited activity and observed count rate respectively. The recorded data was subsequently used to determine radioiodine detection efficiency and analyzed for significance at the 90% confidence level.

$$\% \text{ efficiency} = \frac{\text{Total count rate (cpm)} - \text{background count rate (cpm)}}{\text{Total Activity (dpm)}} \times 100$$

III. RESULTS

The data collected is presented and summarized in Table 1. This data was evaluated for acceptance using Chavenet's Criterion for Rejection. (where n=3, and $\frac{x_i - \bar{x}}{Sn-1} < 1.37$)

Since the ratio of the deviation over the standard deviation did not exceed 1.37, the data was considered acceptable. The results of this acceptance evaluation can be found in Table 2. Furthermore, the results were also analyzed via the T distribution to determine the confidence interval for the mean. It was found that the results indicated a 90% confidence interval for the mean assuming a normal distribution. The results of this evaluation can also be found in Table 2.

IV. CONCLUSION

Based on the data presented in section III of this report, an average efficiency of 0.49% would be more than adequate in estimating field airborne radioiodine concentrations following an accident. Furthermore, using the average efficiency indicated above and the sampling/analysis requirements currently contained in appropriate emergency implementing procedures, the ability to detect and measure radioiodine concentrations of 1×10^{-7} µCi/cc as required per NUREG 0654, can be easily achieved (See Table 3).

It is, therefore, anticipated that appropriate emergency implementing procedures will be revised by July 1, 1982, to incorporate the detection efficiency determined as a result of this evaluation.

ATTACHMENT I

ANALYTICS, INC. • 1094 HEMPHILL AVE., N.W. • ATLANTA, GA. 30318 • (404) 876-0933

March 8, 1982

Mr. Tim Kurtz
NIAGARA MOHAWK POWER COMPANY
Nine Mile Point Nuclear Station
P. O. Box 32
Lycoming, NY 13093

Dear Tim:

We received your cartridges for fabrication today and would like to remind you of our change of address as indicated above. Our shipping schedule calls for the six (6) cartridges to be sent to you by Registered Mail on Monday, March 15.

As you requested, may I give you a brief description of our face loading procedure on charcoal cartridges. Noting the direction of flow on the cartridge, we open the exit face and remove the charcoal. For gamma counting, we place a layer of parafilm inside the entrance face of the cartridge. The desired radionuclide is evaporated onto a 5mm layer of charcoal in the cartridge. This active layer is then covered with a layer of parafilm, and the remaining charcoal is returned to the cartridge. The exit face is now replaced with silicone sealant. As you requested, no layer of parafilm will be placed between the active charcoal and the entrance face on your I-131 cartridges.

I have enclosed for your review a graph we charted after having dissected many charcoal cartridges from an I-131 dispensing facility. This data shows the distribution of I-131 by depth on the charcoal. It was from this data that we developed the 5mm face loading procedure.

Thank you for your continuing support. Please call us whenever we can be of service.

Sincerely,

ANALYTICS, INCORPORATED

Patsy McFarland

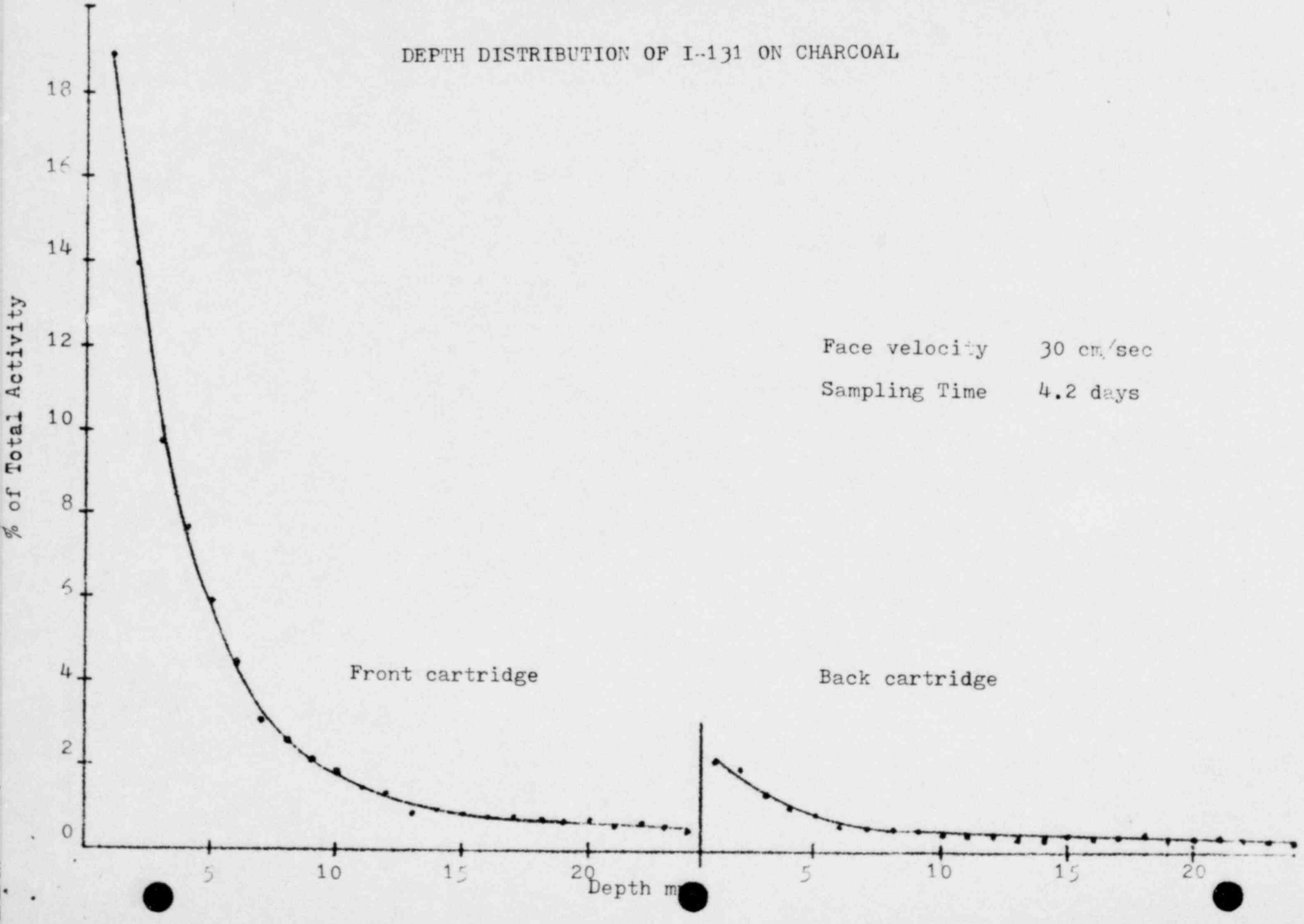
Patsy McFarland
QA Manager

PM:msa

Enclosures

ANALYTICS, INC. • 1094 HEMPHILL AVE., N.W. • ATLANTA, GA. 30318 • (404) 876-0933

DEPTH DISTRIBUTION OF I-131 ON CHARCOAL



ANALYTICS, INC. • 1094 HEMPHILL AVE., N.W. • ATLANTA, GA. 30318 • (404) 876-0933

DEPTH DISTRIBUTION OF I-131 ON CHARCOAL

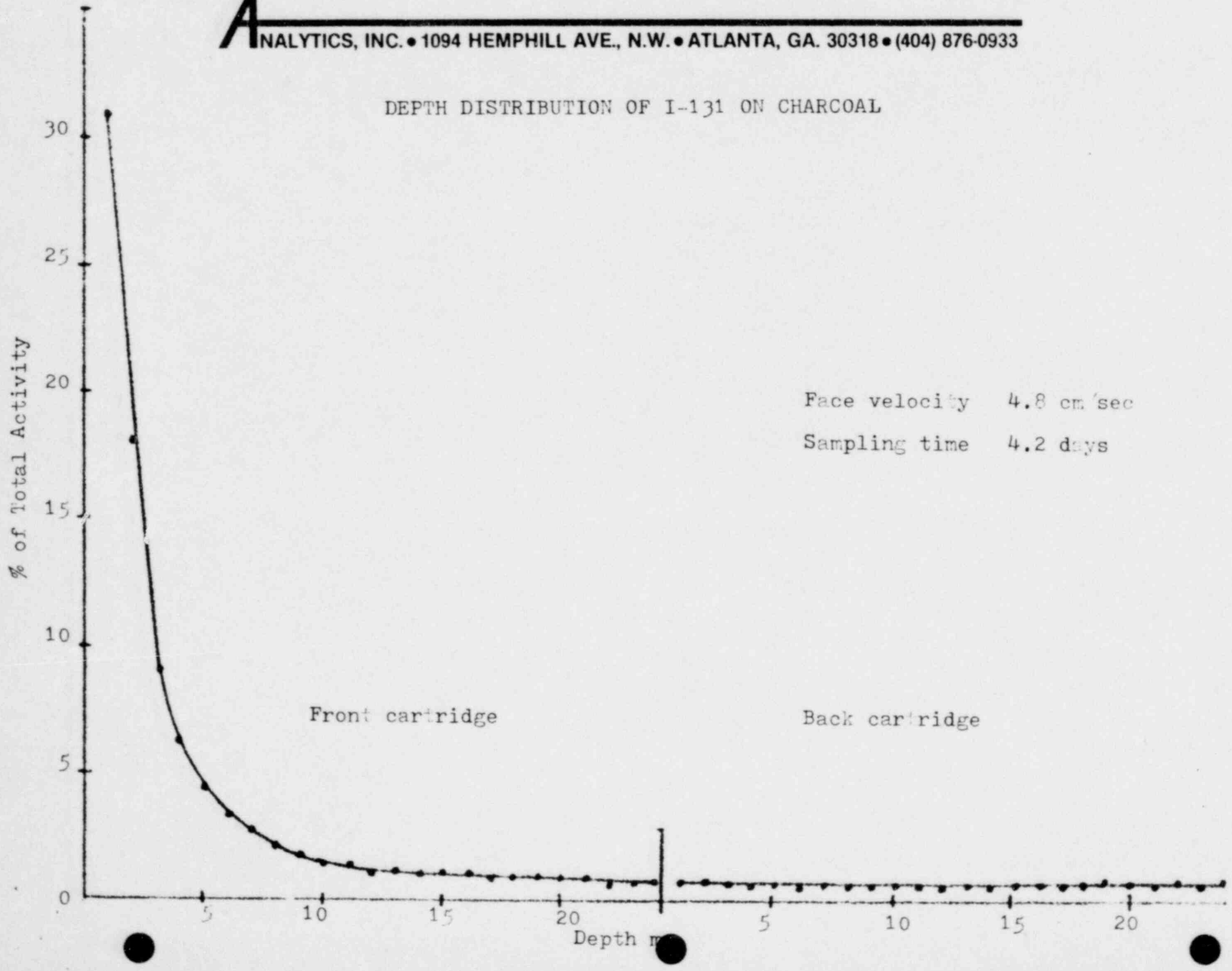


TABLE 1

RESULTS

A. Background/MDC Determinations[1]

Background	MDC
60	62.6 ∿ 63
80	72.2 ∿ 72
90	76.6 ∿ 77

B. Radioiodine Detection Efficiencies

Sample	Activity (dpm)	Nuclide	Total Counts (cpm)	Bkgd (cpm)	Net Counts	% Efficiency
1-a	3.57×10^5	I-131	1800	80	1720	0.48
b	3.57×10^5	I-131	1800	80	1720	0.48
c	3.57×10^5	I-131	1600	80	1520	0.43
2-a	7.18×10^5	I-131	2800	80	2720	0.38
b	7.18×10^5	I-131	3000	80	2920	0.41
c	7.18×10^5	I-131	3000	80	2920	0.41
3-a	3.36×10^5	I-131	1800	80	1720	0.51
b	3.36×10^5	I-131	1800	80	1720	0.51
c	3.36×10^5	I-131	1700	80	1620	0.48
4-a	6.76×10^5	I-131	3000	80	2920	0.40
b	6.76×10^5	I-131	3200	80	3120	0.46
c	6.76×10^5	I-131	2900	80	2820	0.42
5-a	6.68×10^4	I-131	420	80	340	0.51
b	6.68×10^4	I-131	480	80	400	0.60
c	6.68×10^4	I-131	500	60	440	0.66

TABLE 1 (Cont'd.)

B. Radioiodine Detection Efficiencies (Continued)

Sample	Activity (dpm)	Nuclide	Total Counts (cpm)	Bkgd (cpm)	Net Counts	% Efficiency
6-a	7.11×10^4	I-131	500	80	420	0.59
b	7.11×10^4	I-131	480	90	390	0.55
c	7.11×10^4	I-131	480	80	400	0.56
					Average	0.49%

NOTES

1. $MDC = 4.66 \sqrt{\frac{\text{Total Bkgd. Count Rate}}{\text{Bkgd. Count-time}}}$

Note that background count-time was 20 seconds.
This time corresponds to the time response characteristic
quoted by the manufacturer as necessary to reach 90% of
the equilibrium countrates.

TABLE 2

Summary of Statistical Evaluation of Data

Sample	Chavenet's Criterion for Rejection	$\bar{x}$ cpm	Sn-1	No. of Counts in one minute $\bar{x} + S/\sqrt{n}$	$\frac{t_{\alpha/2}\, s}{\sqrt{n}}$	$\bar{x} + \frac{t_{\alpha/2}\, s}{\sqrt{n}}$
1-		1653	115.5	1653 ± 67	195	1653 ± 195
a	0.58					
b	0.58					
c	1.15					
2-		2853	115.5	2853 ± 67	195	2853 ± 195
a	1.15					
b	0.58					
c	0.58					
3-		1687	57.7	1687 ± 33	97	1687 ± 97
a	0.57					
b	0.57					
c	0.44					
4-		2953	152.8	2953 ± 88	258	2953 ± 258
a	0.22					
b	1.09					
c	0.87					
5-		393	50.3	393 ± 29	85	393 ± 85
a	1.05					
b	0.14					
c	0.93					
6-		403	15.3	403 ± 9	26	403 ± 26
a	1.11					
b	0.85					
c	0.20					

NOTES

1. Where n = 3, then $|x_i - \bar{x}/Sn\text{-}1| < 1.37$ for acceptance

2. 90% confidence interval where $t\alpha/2 = 2.920$, υ (degree of freedom) = n-1 = 2

TABLE 3

Counting Statistics for Use of RM-14/HP-210 to Detect Radioiodines on Charcoal/Silver Zeolite Cartridge in the Field

A. Given:

1. Air Sample Volume - 15 $ft.^3$ and 20 $ft.^3$

2. Cartridge Retention Efficiency for Radioiodines -
   Silver Zeolite - 95%
   TEDA-Charcoal (cp-100) - 99%

3. Background - 100 cpm or less

4. Radioiodine Detection Efficiency - .49%

5. $$MDA = \frac{MDC}{\frac{(6.28 \times 10^{10}\ \text{dpm-cc})}{\text{U Ci-ft}^3}\ (ft^3)\ (\text{efficiency of Detection})\ (\text{efficiency of cartridge retention})}$$

B. Minimum Detectable Activities per Given Data

Count Time[1]	Air Vol. (ft^3)	Bkgd. (cpm)	MDC^2 $\left(4.66\sqrt{\frac{\text{bkgd (cpm)}}{.333\ \text{min.}}}\right)$	MDA (uCi/cc) Using Silver Zeolite	MDA (uCi/cc) Using CP-100
1 min.	15	100	81	1.85×10^{-8}	1.77×10^{-8}
1 min.	20	100	81	1.71×10^{-8}	1.64×10^{-8}

NOTES:

1. Count time to observe maximum value (3 counting intervals).

2. Based on instrument resolving time of 20 seconds (.333 min.).