THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN 48640

June 16, 1970

Mr. William H. Schultz
U. S. Atomic Energy Commission
Division of Compliance, Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Dear Mr. Schultz:

This letter acknowledges your letter, dated June 8, 1970, and the items of noncompliance under License Numbers 21-265-2 and 21-265-6, listed in paragraph 5, AEC Form 592.

By-product material has been used by, or under the supervision of, individuals who have been informally designated to do so by the Radiation Hazards Committee. Prior to the use of by-product material, personnel must have had training as to the safe and proper use of by-product material. This has been accomplished by formal safety courses, or informal safety meetings by, or with, the Health Physics Section of The Dow Chemical Company. The Health Physics Section then discussed those individuals qualified to use by-product material with the Radiation Hazards Committee Chairman.

As mentioned earlier, this has been informal in nature in the past. Due to the citation for noncompliance with the letter, although we feel we have met the intention of license condition #12, a formal approval procedure has been set up. All current and future users of by-product material under AEC License Numbers 21-265-2 and 21-265-6, will be those individuals, or under the supervision of those individuals, who have been given formal written approval to do so by the Radiation Hazards Committee. Approval for all current users of by-product material will be completed by July 15, 1970. Approval for all future users of by-product material will be completed as necessary.

Very truly,

H. R. Hoyle

H. R. Hoyle
Biochemical Research Laboratory
1701 Building
MElrose 6-2377 (Area Code 517)

HRH:sjl

MEMO ROUTE SLIP
Form AEC-93 (Rev. May 14, 1947)

See me about this.	For concurrence.	For action.	
Note and return.	For signature.	For information.	

TO (Name and unit)	INITIALS / DATE	REMARKS
J. R. Roeder Division of Compliance Headquarters	INITIALS DATE	SUBJECT: DOW CHEMICAL COMPANY MIDLAND, MICHIGAN LICENSE NO. 21-265-2, -4, -6 & STB-527 & SMB-111
TO (Name and unit)	INITIALS DATE	REMARKS
TO (Name and unit)	INITIALS DATE	REMARKS

FROM (Name and unit)	REMARKS
James M. Allan CO:III	Attached are two copies of licensee's adequate reply to our letter of 6-8-70
PHONE NO. / DATE	

USE OTHER SIDE FOR ADDITIONAL REMARKS

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THE DOW CHEMICAL COMPANY

June 16, 1972

E. O. Coad
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G. W. Mann
R. M. Stevens

ANALYSIS OF ASH RESIDUE FOR RADIOACTIVE CONTAMINATION

Summary

A method of analysis utilizing liquid scintillation has been developed to determine the presence of ^{14}C and ^{3}H contamination in ashes after incineration of waste laboratory solids and animal carcasses from various tracer studies. No significant contamination was found in ashes currently assayed.

Discussion

Radiation monitoring of ashes from incinerated laboratory refuse such as Kleenex tissue, absorbent paper and animal carcasses which contain trace amounts of ^{14}C or ^{3}H is essential to assure that no hazards are present for Dow personnel and that proper safety procedures are maintained.

For simplicity the liquid scintillation procedure is essentially the same as the dual pulse height analysis method which was developed for analysis of water effluent (see report dated 9/28/71, Analysis of Water Effluent from the Research Center for Radioactive Contamination). This method may be adapted for use to any of the radioisotopes for which the research center is currently licensed. The method can detect either carbon-14 or tritium at levels of approximately 2000 dpm/gm ash. Due to the extreme quenching effect caused by the ash suspension this method can be considered only semi-quantitative with little accuracy if the sample is below the above mentioned limits.

Method of Analysis

A composite sample of ash should be collected when the fire box of the incinerator is cleaned out. A portion of the ash should be ground to a fine powder in a mortar and pestle and 100 mg portions taken for analysis.

Equipment

1. Packard Tri-Carb liquid scintillation detector, Model 2211.

2. Insta-Gel emulsifier (Packard Instrument Company).

3. Tritiated water standard solution.

4. Carbon-14 toluene standard solution.

5. Glass scintillation vials.

Instrument Settings (Dual Pulse Height Analysis)

Red Channel (^{14}C)
Gain - 7.3%
Differential Window - A-B 150-1000
Counting Efficiency of ^{14}C standard - 70%

Green Channel (^{3}H)
Gain - 7.3%
Differential Window - C-D 50-1000
Counting Efficiency of ^{3}H standard - 42%

Procedure

1. Place 10 ml Insta-Gel into scintillation vials.

2. Add 100 mg of ash residue sample.

3. Add 5.0 ml of water to sample and shake well.

4. Place samples in scintillation counter for 24 hours previous to counting (in dark).

5. Count samples for 100 minutes each for minimum standard error.

6. Compare control ash sample to that of the ash residue for analysis. If a significant cpm over background is present add internal standards of ^{3}H or ^{14}C to determine the counting efficiency of the instrument (quenching effect). The standard or standards added will depend upon radionuclide contaminant present.

7. Knowing the efficiency of each isotope allows the solution of two simultaneous algebraic equations to quantitate the contaminant present. This technique can be used to count double-labeled samples if the energy of the isotopes are not close to one another. The ratio of the energy of the two isotopes should not be less than 4.

Calculations

The red scaler counts from A to B and the green scaler counts from C to D. Then, the count rate on the red scaler is

$$R_R = A_1 E_{1R} + A_{11} E_{11R}$$

where R_R is the count rate on the red scaler, A_1 is the activity of ^{14}C, E_{1R} is the counting efficiency of ^{14}C in the A-B range (i.e., the counting efficiency of ^{14}C on the red scaler), A_{11} is the activity of ^{3}H, and E_{11R} is the counting efficiency of ^{3}H in the A-B range. Similarly,

$$R_G = A_1 E_{1G} + A_{11} E_{11G}$$

where R_G is the count rate on the green scaler, E_{1G} is the counting efficiency of ^{14}C in the C to D range, and E_{11G} is the counting efficiency of ^{3}H. Combining these two equations and solving for A_1 and A_{11} yields.

$$(^{14}C)\ A_1 = \frac{R_R - R_G \dfrac{E_{11R}}{E_{11G}}}{E_{1R} - E_{1G} \dfrac{E_{11R}}{E_{11G}}}$$

$$(^{3}H)\ A_{11} = \frac{R_R - R_G \dfrac{E_{1R}}{E_{1G}}}{E_{11R} - E_{11B} \dfrac{E_{1R}}{E_{1G}}}$$

Joel F. Heeg
Radiation Protection Officer

Reference B733-40