

MONITORING FOR LEAD CONTAMINATION

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Abstract—One of the first accomplishments of the Sub-committee on Low-Level Contamination of Materials and Reagents of the National Research Council, National Academy of Sciences, has been a study of the radioactive contamination of commercial lead. Twelve lead samples, ten from current commercial production and two “aged” specimens, showed a wide range of contamination levels. Yet, several of the commercial samples were comparable to the best aged leads available for low-level gamma shielding. The contaminant was identified as ^{210}Pb . Good correlation was observed in the measurements at three laboratories. The radioactive contamination in lead is caused by ^{210}Pb which occurs in lead derived from ores geologically associated with uranium. Since the decay products have a high ratio of alpha to gamma radiation and since alpha counting is considerably less complex than gamma counting, the alpha technique is definitely indicated. ^{210}Pb concentrations of 1 to 100 pCi/g could be measured by means of the ^{210}Po daughter. Therefore, lead samples may be monitored by alpha counting. A similar rationale is applicable to the beta radiation from ^{210}Pb and its daughters. Therefore, beta counting must be considered as an alternate possible monitoring technique. Commercially available alpha and beta counters and techniques have been investigated to determine which of these would be applicable to a monitoring system, what counting times are required and what methods are most suitable. Apparatus on hand has been tested, and some apparatus was borrowed and purchased for evaluation. The results indicate that standard commercial equipment will provide adequate monitoring for lead contamination and so make practical the supply and acquisition of very-low activity lead.

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DISCUSSION

F. DUHAMEL (*France*):

La Commission dont vous avez parlé et qui est chargée d'étudier la pollution du Rhin a-t-elle la possibilité de s'adjoindre un représentant d'un pays fortement intéressé à la pollution du Rhin et qui n'est pas membre de l'Euratom?

P. RECHT:

Rien ne s'oppose à ce qu'un représentant d'un autre pays que l'Euratom puisse participer aux travaux et à l'étude. D'ailleurs, dès le début des études, les autorités suisses ont été informées et certaines opérations de prélèvement et de mesures ont été accomplies en étroite collaboration avec la Suisse.

H. JACOBS (*Germany*):

Herr Dr. Maushart, Sie wiesen hin auf die Bedeutung der organischen Bestandteile im Schlamm in Bezug auf die Anlagerung der von Ihnen untersuchten Nuklide. Gibt es Korrelationen zwischen den Verteilungskoeffizienten und den Vegetationsperioden.

R. MAUSHART (*Germany*):

Wir haben einen Jahresgang des Verteilungskoeffizienten beobachtet. Ob er charakteristisch ist, lässt sich jedoch mit Sicherheit erst auf Grund von Messungen sagen, die sich über mehrere Jahre erstrecken.

G. BAGLIANO (*Italy*):

Pourriez-vous nous donner une idée sur la dispersion des résultats que vous avez obtenus?

P. KAYSER:

La dispersion des résultats de tous les points de prélèvement du bassin du Rhin était assez faible. En d'autres termes, les variations des résultats dans le temps, pour un même point de prélèvement, étaient du même ordre de grandeur que les variations dans l'espace.

Ch. TRITREMEL (*Austria*):

Im Reaktorzentrum Seibersdorf in Österreich wurden ebenfalls Schlammuntersuchungen im Vorfluter in Zusammenarbeit mit der IAEA-Wien

durchgeführt. Dabei wurde eine wesentlich unterschiedliche Ablagerung von Radionukliden im Schlamm vom normalen Flussboden und vom Boden im Bereich von Wehranlagen gefunden. Besonders war dies beim Radionuklid Cs¹³⁷ der Fall.

Frage: Wurden bei den Untersuchungen im Rhein auch Schlämme im Bereich von Wehranlagen untersucht und unterschiedliche Ablagerungsmengen von Radionukliden festgestellt?

P. KAYSER:

Les résultats des mesures ont montré que les activités étaient généralement plus élevées en amont des barrages, bien que du point de vue sanitaire ces différences fussent peu significatives.

P. M. BIRD (*Canada*):

Could Mr. Terrill give us any indication of the cost per quart if this process is applied to smaller volumes than indicated in his presentation?

J. G. TERRILL:

It is our current belief that within the range of sizes that we are studying, namely, from 10,000 lb. to 100,000 per 8-hr day, that the cost would not vary greatly per unit weight of milk. However, if the plants would be much smaller, we believe it would be more expensive to maintain the equipment in working order with the type of technical help required for its proper operation. We would not expect the cost to decrease greatly per unit weight of milk for larger plants because much of the cost is related to the materials used in the regeneration processes.

P. SPAANDER (*Netherlands*):

I should like to ask two questions:

1. How did you succeed in keeping the calcium in the milk while removing the strontium from it?
2. How can it be explained that there were coliform organisms in the milk after pasteurization and after treating in such an excellent installation as you described?

J. G. TERRILL:

1. For the pH which removes a maximum amount of strontium-90 consistent with maintenance of milk in its normal form, it was necessary to develop a

regeneration solution which would assure an equilibrium with respect to the major milk cations. The factors affecting the optimum composition and a procedure for selecting the relative proportion of each salt are given in A. R. Landgrebe, L. F. Edmonson, and F. W. Douglas, Jr.: "Optimum Ration of Cations on Nuclear Sulfuric Acid Resin for Minimum Change in Composition of Resin-Treated Milk", *Journal of Dairy Science* (March 1963); and A. R. Landgrebe, L. F. Edmonson, and F. W. Douglas, Jr.: "The determination of the Apparent Equilibrium Constants of the Exchange Reactions of Sodium, Potassium, Calcium, and Magnesium with Amberlite IR-120", *Journal of Agricultural and Food Chemistry* 11 (March 1963).

2. Pasteurized milk with or without strontium removal treatment is milk from which the pathogens have been removed. Normal pasteurized milk in the United States still may contain *E. coli* and other non-pathogenic bacteria up to the levels indicated for the grades indicated as quoted from the Milk Ordinance and Code of the Public Health Service: "In all cases the milk shall show efficient pasteurization as evidenced by satisfactory phosphatase test, and at no time after pasteurization and before delivery shall the milk have a bacterial plate count exceeding 30,000 per milliliter, or a coliform count exceeding 10 per milliliter, as determined in accordance with section 6: Provided, that the raw milk at no time between dumping and pasteurization shall have bacterial plate count or direct microscopic clump count exceeding 400,000 per milliliter".

J. SHAPIRO (U.S.A.):

Do you have any hot particle problems from this cratering experiment; i.e. particles that could produce injury if inhaled or retained on the skin?

R. L. KATHREN:

There should be no internal hazard created by the release of "hot" particles. I would expect such particles to be relatively large and therefore well above the respirable range; moreover, if any, these would tend to settle rapidly and close to or within the crater. Normal health physics practice on re-entry is adequate.

Y. FEIGE (Israel):

Did you consider depth distribution of fall-out in the ground, or assume a surface plane source?

R. L. FRENCH:

If I understand your question, the answer would be that we assumed the ground surface to be perfectly smooth. We did not consider ground roughness effects.

D. BLANC (France):

Le sujet me semble extrêmement important, et je regrette vivement le manque de temps. Je voudrais poser deux questions:

1. Quels radio-éléments ont été utilisés dans ces mesures?
2. Quelle a été la durée des mesures, et quelle valeur statistique possèdent-elles?

NGUYEN BA CUONG:

Nous avons étudié la radio-activité de l'eau de pluie:

- en β totale en France
 - et en Sr^{90} aux États-Unis
- pendant les périodes suivantes:
- pour la France:
 - de Mars 1962 à Mai 1963
 - de Janvier 1964 à Juin 1965
 - pour les États-Unis:
 - de Septembre 1961 à Août 1963
 - de Septembre 1963 à Juin 1965

K. ŻARNOWIECKI (Poland):

Haben Sie Aktivitätsdifferenzen im Blei verschiedener Reinheitsgrade bemerkt?

W. KOLB (Germany):

Wir haben Hüttenweichblei, Feinblei und andere handelsübliche Qualitäten aus verschiedenen Hütten untersucht und keine Abhängigkeit der Aktivität vom Reinheitsgrad gefunden. Dies ist auch nicht anders zu erwarten, solange für die Aktivität überwiegend ein Bleisotop verantwortlich ist.