LSNReviews

From: Oleg Povetko [opovetko@cnwra.swri.edu]
Sent: Wednesday, April 16, 2008 9:10 PM
To: natalex
Subject: RE: Report - Radon
Attachments: 04-16-08_2002.jpg; 04-16-08_1957.jpg; 04-16-08_1958.jpg; 04-16-08_1959.jpg; 04-16-08_2000.jpg; 04-16-08_2001.jpg

Posmotrel na WL (working level) definition:

"Any combination of the short-lived radon (Rn-222) daughters, Po-218, Pb-214, Bi-214, and Po-214, in 1 liter of air that has a potential alpha energy emission of 1.3E5 Mev when Rn-222 is in equilibrium with its daughters.

At equilibrium: 1 WL=100 pCi Rn-222/L of air."

Navernoe, mozhno otsyuda plyasat', tol'ko nado dobavit' Bi-210 (2 alphy) i Po-210 (esche odna alpha), kotorye budut v non-equilibrium.

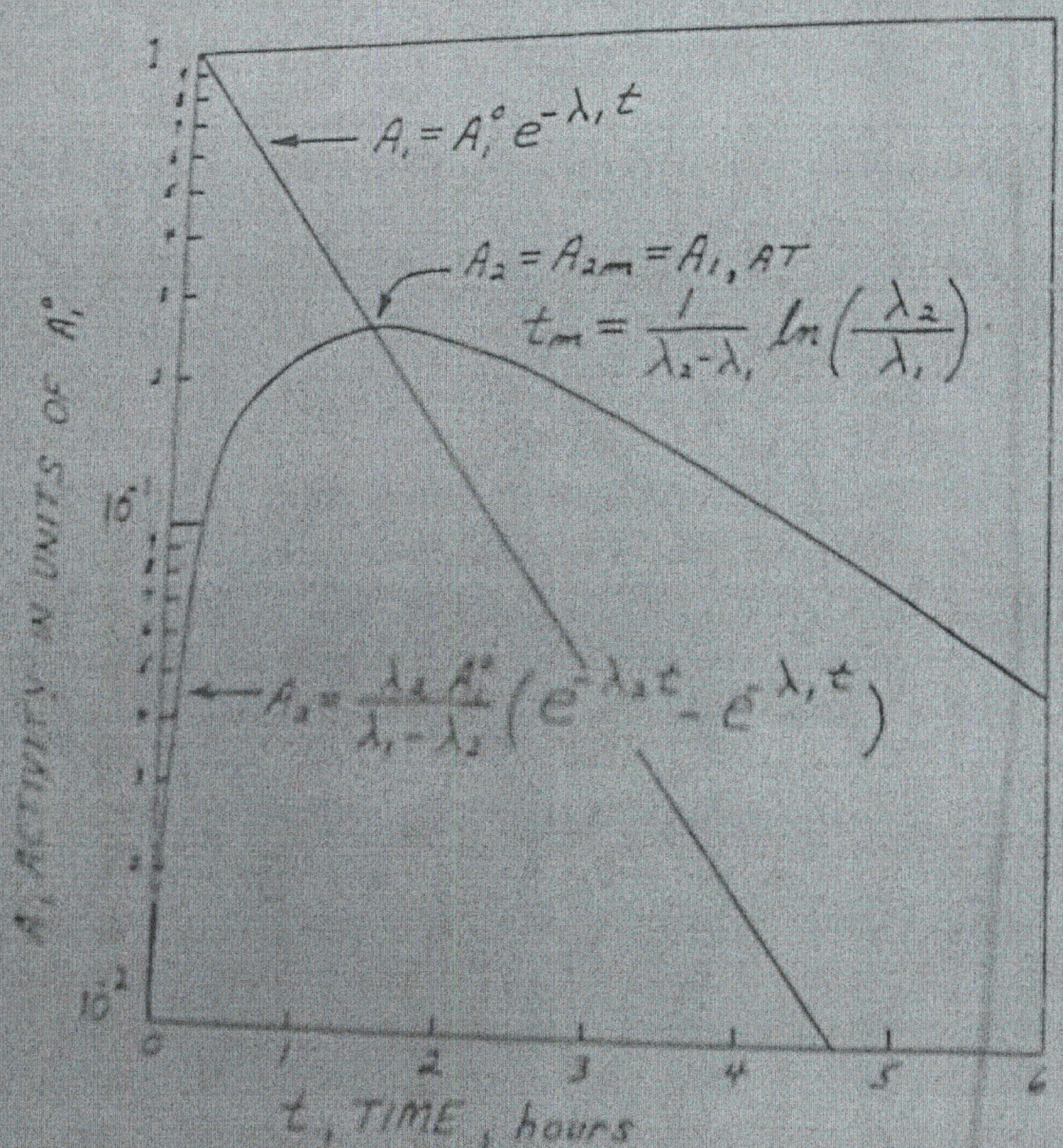
A potom nado posmotret', chto, esli vse eti raspadchiki osyadut na poverxnosti, to kakaya alpha energiya vydelyaetsya ot etix raspadchikov v edinicu vremeni, to est' Mev/sec. Ya pricepil formuly iz konspektov, mozhet pomogut poschitat' etu dobavku Bi i Po.

From: natalex [mailto:natalex@telus.net]
Sent: Tuesday, April 15, 2008 2:48 PM
To: 'Oleg Povetko'
Cc: 'Oleg Povetko'
Subject: Report - Radon

Олег, мне нужна цифра (MeV / Bq Radon), чтобы послать тебе отчет – я его не совсем закончил, правда, но … посмотришь сам.

Алексей

VISUAL 13.30



PARENT-DAUGHTER NON-EQUILIBRIUM SYSTEM: $\lambda_1 = 1 h^{-1}$ AND $\lambda_2 = 0.5 h^{-1}$

QUANTITY OF THE mth MEMBER OF A RADIOACTIVE SERIES

$$\frac{dN_{(m)}}{dt} = \lambda_{(m-1)} N_{(m-1)} - \lambda_{(m)} N_{(m)}, \text{ AND}$$

$$N_{(m)} = \sum_{i=1}^{i=m} N_i^{\circ} \prod_{j=i}^{j=m-1} \lambda_j \sum_{j=i}^{j=m} \frac{e^{-\lambda_j t}}{\prod_{\substack{p=i \\ p \neq j}}^{p=m} (\lambda_p - \lambda_j)}, \text{ FOR}$$

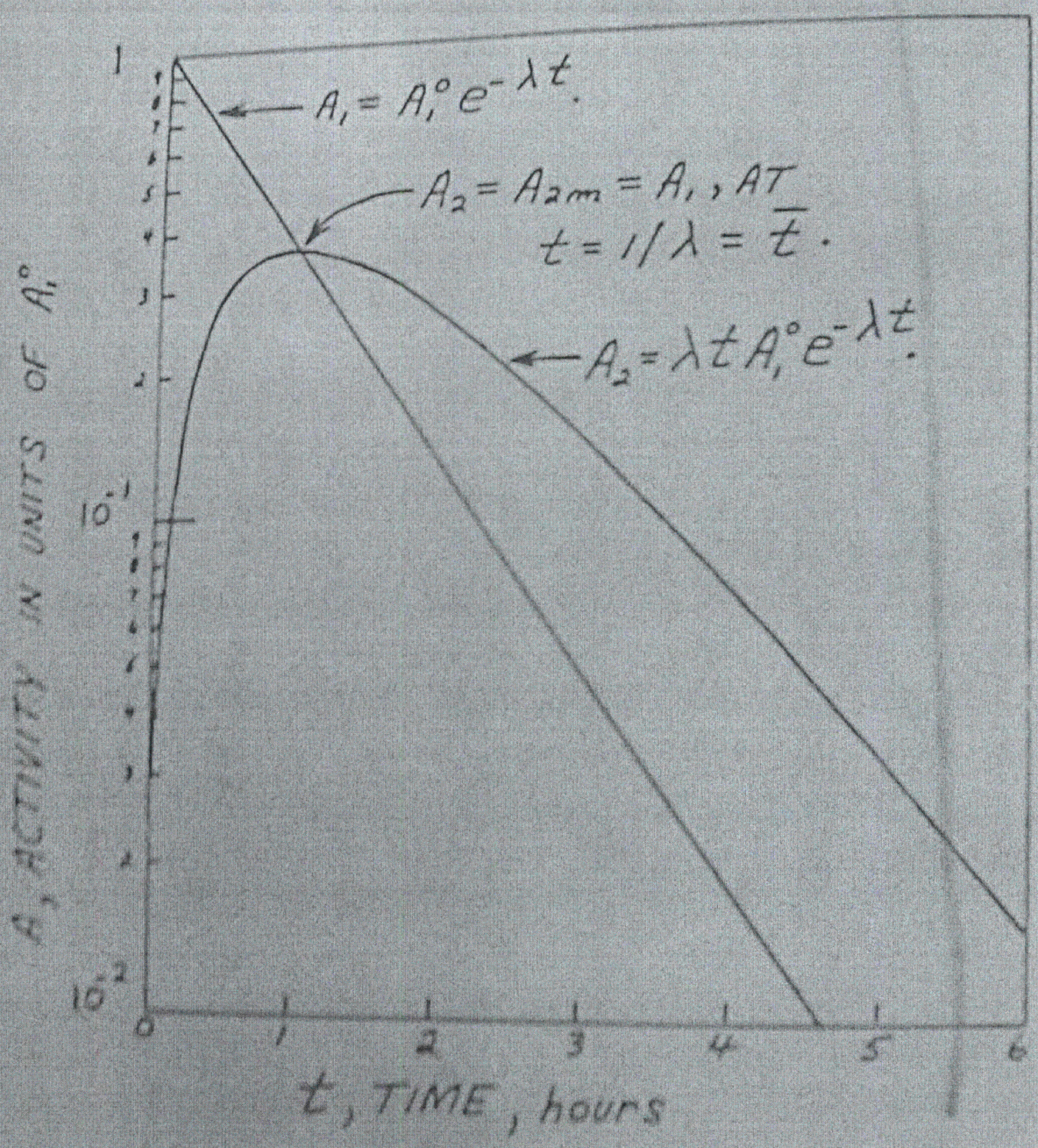
CASE OF NO DECAY BRANCHING.

RADIOACTIVE SERIAL TRANSFORMATIONS

$$N_1 \xrightarrow{\lambda_1} N_2 \xrightarrow{\lambda_2} N_3 \xrightarrow{\lambda_3} \cdots N_i \xrightarrow{\lambda_i} \cdots N_m \xrightarrow{\lambda_m}$$

IF RADIONUCLIDES ARE LINKED THROUGH A RADIOACTIVE SERIES, THEN THE QUANTITY OF A DAUGHTER SPECIES DEPENDS NOT ONLY ON ITS INITIAL AMOUNT BUT ALSO THE INITIAL AMOUNTS OF ALL PARENTS.

$$N_m = \text{FUNCTION OF } N_1, N_2, N_3 \cdots N_i \cdots N_m.$$



PARENT - DAUGHTER NON-EQUILIBRIUM SYSTEM: $\lambda_1 = \lambda_2 = \lambda = 1 h^{-1}$.

ATOMS AND ACTIVITY FOR PARENT AND DAUGHTER

PARENT SPECIES

$$\frac{dN_1}{dt} = -\lambda_1 N_1 .$$

$$N_1 = N_1^\circ e^{-\lambda_1 t}$$

$$A_1 = A_1^\circ e^{-\lambda_1 t}$$

FIRST DAUGHTER SPECIES

$$\frac{dN_2}{dt} = \lambda_1 N_1 - \lambda_2 N_2 .$$

$$N_2 = N_2^\circ e^{-\lambda_2 t} + \frac{\lambda_1 N_1^\circ}{\lambda_2 - \lambda_1}\left(e^{-\lambda_1 t} - e^{-\lambda_2 t}\right)$$

$$A_2 = A_2^\circ e^{-\lambda_2 t} + \frac{\lambda_2 A_1^\circ}{\lambda_2 - \lambda_1}\left(e^{-\lambda_1 t} - e^{-\lambda_2 t}\right)$$

PARENT-DAUGHTER NON-EQUILIBRIUM SYSTEM (CONT)

CASE II: PARENT HALF-LIFE LESS THAN DAUGHTER'S:

$t_{1/2(1)} < t_{1/2(2)}$ AND $\lambda_1 > \lambda_2$.

ACTIVITY OF PARENT:

$$A_1 = A_1^\circ e^{-\lambda_1 t}$$

ACTIVITY OF DAUGHTER:

$$A_2 = \frac{\lambda_2 A_1^\circ}{\lambda_1 - \lambda_2}\left(e^{-\lambda_2 t} - e^{-\lambda_1 t}\right), \text{ AND}$$

$$A_2 = A_{2m} = A_1 \quad \text{WHEN} \quad t = \frac{1}{\lambda_2 - \lambda_1} \ln\left(\frac{\lambda_2}{\lambda_1}\right).$$