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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 12 1980

MEMORANDUM FOR: Edgemont Remedial Action Program Files (FIN No. B-2217)

FROM: Greg G. Eadie
Uranium Recovery Licensing Branch

SUBJECT: REMEDIAL ACTION PROGRAM FOR EDGEMONT, SOUTH DAKOTA

Background

At the request of the U. S. Nuclear Regulatory Commission (NRC), the town of Edgemont, South Dakota and vicinity was surveyed in early November 1978 to determine if uranium mill tailings from the former Edgemont Uranium Mill had been used for off-site construction purposes. The U. S. Environmental Protection Agency (EPA) conducted the surveys using a specially shielded gamma radiation detection system mounted in a van type motor vehicle. A similar survey had been conducted by the EPA in 1971-72 and comparison of results between the two surveys (i.e., 1971-72 and 1978) indicated a total of 60 possible tailings use locations in the area. However, there is a possibility that additional tailings use locations exist since the mobile van system has inherent detection problems, such as shielding and response time factors, which essentially limit this system's use and require more detailed gamma radiation surveys at each suspect location.

In December 1979, the EPA provided Radon Progeny Integrating Sampling Units (RPISU) to the State to conduct measurements of working levels (WL) inside those structures identified as gamma anomalies (i.e., above background radiation levels). As of June 10, 1980, the following distribution of WL's has been reported for 31 structures surveyed (note that not all of these structures are gamma anomalies).

>0.10WL -- 4 structures
>0.05WL -- 5 structures
>0.03WL -- 6 structures
>0.015WL -- 4 structures
less than 0.015WL -- 12 structures

Also, the Department of Housing and Urban Development (HUD) has become involved in requiring a grab-WL sampling at any structure in Edgemont prior to guarantying federal mortgage monies. Therefore, in order to fully assess all possible locations having elevated radiological conditions, the following programs, as shown in Figure 1, shall be conducted in the vicinity of Edgemont, South Dakota:

I. Grab Working Level Measurements (HUD/EPA Protocol)

A grab (i.e., brief sampling time of about 5 minutes or a 10 to 20 liter volume) sample to determine the radon progeny concentrations (in WL) should be completed using the Thomas method for analysis. This grab WL sampling shall be conducted based on the HUD/EPA protocol (see Enclosure 2) in the following manner:

1. The structure must be in the "closed-up" condition (i.e., all doors and windows shut, and no air conditioning or heating systems in operation) for at least 3 hours prior to sample collection.

2. The grab WL sample shall be collected in the area of longest occupancy, e.g., the bedroom or finished basement area of a residence, or the main working area of a commercial building.

3. If the inside grab WL exceeds 0.033 WL, such a structure shall then be resampled. If upon confirmation of a value in excess of 0.033WL, that structure shall be considered for the engineering assessment.

4. If the grab WL is between 0.01 and 0.033WL, a definitive gamma radiation survey and/or soil sampling programs shall be completed as discussed below.

5. If the grab WL is less than 0.010WL, the structure shall be cleared and will not require further radiological assessments.

II. Gamma Radiation Measurements

A portable gamma survey meter (e.g., micro R meter) shall be used to complete the gamma radiation measurements both inside and outside of the structure. This survey meter shall be cross-calibrated with a Pressurized Ionization Chamber (PIC) in order to provide realistic exposure measurements. This survey shall be designed to detect the presence of any possible residual radioactive material under, within or around the structure. A map shall be provided indicating all locations having above background radiation levels. This survey need only be performed once for each structure.

III. Long-term Radon Progeny Sampling

Long-term radon progeny sampling using either the Radon Progeny Integration Sampling Unit (RPISU) or the Measurement of Daughters (MOD) sampling unit may be required in any structure having a grab WL in the range 0.01 to 0.033WL and a radiation survey indicating the presence of residual radioactive material or an exposure rate less than 20 μR/hr above background. Such long-term radon progeny samples shall be collected for at least 100 hours, every other month, for at least six samples during a yearly cycle.

IV. Soil Sampling

Soil sampling, both surface and at depth, shall be completed at specified locations to determine the concentrations of uranium decay chain series radionuclides (e.g., uranium, radium-226, thorium-230 and lead-210). The lower limit of detection shall be at least 0.50 pCi/gram of soil for radium-226 analysis which shall be used to determine compliance to the regulatory standards. Bore-hole logging to determine the presence of radium-226 at depths of up to 8 feet may also be required.

V. Engineering Assessment

An engineering assessment shall be completed at each stucture which exceeds the EPA's standards for uranium mill tailings cleanup (i.e., as proposed in 40 CFR 192 of an annual average WL greater than 0.015, or having radium in soil greater than 5 pCi/g, or a gamma radiation exposure rate in excess of background of 0.02 mR/hr). The assessment shall provide a detailed map of all residual radioactive material deposits and volume estimates. Such information may be obtained by gamma radiation survey techniques, bore-hole logging techniques, or soil sampling and analysis.

Gregory G. Eadie

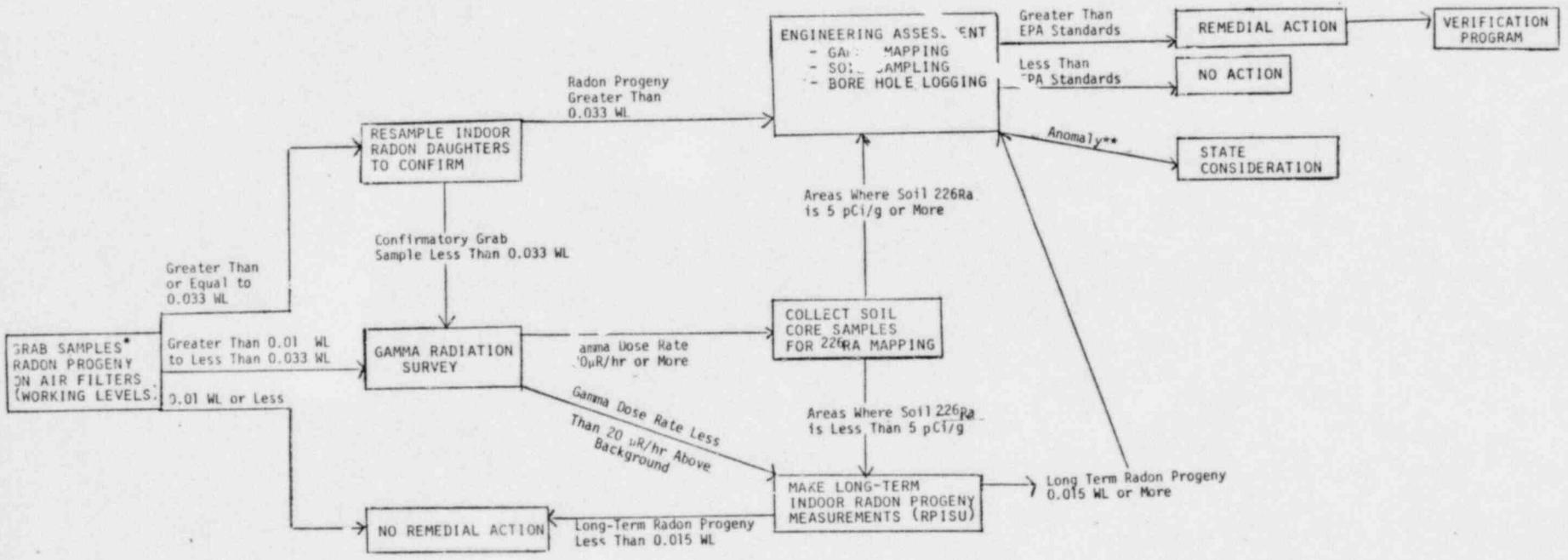
Greg G. Eadie
Uranium Recovery Licensing Branch
Division of Waste Managment

Approved by: Ross A. Scarano, Chief

Enclosures:
1. Figure 1
2. Interim HUD/South Dakota Radiation Survey Protocol

ENCLOSURE 1

FIGURE 1 REMEDIAL ACTION PROGRAM FOR EDGEMONT, SOUTH DAKOTA



*HUD/EPA Protocol

**Anomaly may be natural terrestrial radioactivity resulting in radiological exposure in excess of EPA Standards.

Enclosure 2

INTERIM
HUD/SOUTH DAKOTA RADIATION
SURVEY PROTOCOL

FEBRUARY 1980

EXHIBIT "A"

CRITERIA

Basic criteria adopted for the South Dakota/HUD radiation level certification program will be drawn from two established sources.

A. U.S. Surgeon General's Guidelines for Grand Junction, Colorado, dated July 27, 1970.

B. U.S. Environmental Protection Agency's Recommendations to the State of Florida, dated June 8, 1979.

Criteria #1

Any weighted indoor Working Level (WWL) determined to be above 0.02 WL (including background) shall be classified as exceeding that level the Administrator of the EPA has found acceptable in terms of the increased long term risk of lung cancer in the exposed population. See Note below.

Criteria #2

If a weighted indoor working level measurement exceeds 0.015 WL, an additional set of measurements shall be made on another day to verify such a reading to determine acceptability of existing residences. All measurements taken will be averaged to determine the WWL.

Note: When annual average air concentrations of radon decay products are less than 0.02 WL, remedial action required to reduce such concentrations to as low as reasonably achievable levels should be taken.

METHODOLOGY I

(For existing residences)

In determining acceptability of a residence for federally supported financing in Edgemont, South Dakota and vicinity, the State will perform indoor radon daughter measurements in the following manner:

1. For each measurement an air sample having a minimum volume of 20 liters will be drawn through a 25 millimeter Millipore Type AA filter having a pore size of 0.80 microns. After an appropriate period of decay, the filter will be counted for alpha activity with a scintillation counter. The radon daughter concentration in Working Levels (WL) will be calculated and recorded.

2. A House Closed Reading (HCR) shall be made in a ground floor or basement room after the residence has been sealed for a minimum period of three (3) hours. Sealed means that all windows, doors, and outside vents are closed. To make the measurement, The State Officer will enter the residence, opening the entry door only to the extent that equipment and staff may enter. If the HCR exceeds 0.02 WL, then a House Open Reading (HOR) will be taken.

3. The House Open Reading will be made in the same location where the HCR was taken. The HOR will be made while the room is being ventilated at a normal level using available doors, windows, fans, etc., that supply fresh outside air. Such ventilation shall be in use for a minimum of 15 minutes before the HOR is taken.

   Weighting Procedure:

   Each reading (HCR and HOR) will receive the following weighting:

   7/12 HCR + 5/12 HOR = WWL

   The WWL shall then be used to certify a given resident's acceptability for further federal financing consideration. In the Edgemont area seven months are chosen as precluding the use of outside ventilation due to inclement weather.

4. The weighted indoor working level procedure may be bypassed by making a "house closed reading" to maximize conditions (worst case) to determine acceptability directly if the working level determination falls below 0.02 WL.

5. An alternate method of determining acceptability of a residence is the use of data acquired by measurement with a Radon Indoor Progeny Integrating Sampling Unit (RIPISU). RIPISU data will be derived from a minimum sampling time of 60 hours. RIPISU data acquired in the period between November 15 and April 1 can be substituted for the HCR. RIPISU data acquired between June 1 and September 30 can be substituted for the HOR.

METHODOLOGY II

(For Undeveloped Vacant Land)

Future radiation exposures in structures built on a given tract of land can be influenced by certain conditions. These can be largely characterized by answering the following questions.

1. Is the land mineralized with geological formations that contain uranium decay chain elements in varying amounts?

2. Is the underlying geology sufficiently disturbed by fracturing, tunneling or other perturbations which can enhance radon seepage and diffusion to the ground's surface?

3. Has the involved tract of land been reclaimed, graded or previously impacted with deposits of phosphate and/or copper slag that contains uranium decay chain elements in varying amounts?

4. Will the building materials used in subsequent construction of a structure on a given tract of vacant land contain a sufficiently low enough level of uranium decay chain elements? (Normally, this is the case if non-waste materials are used in fabrication of building materials.)

In determining acceptability of a given tract of land for its utilization as a federally financed project site in Edgemont, South Dakota and vicinity, the State will handle each evaluation and certification on a case by case basis. This is due to the complexity of parameters that need to be considered in the process.

Methods that can be employed by the State to perform these evaluations will normally include:

1. gamma scintillometer grid surveys;

2. surface soil sampling and ground coring for radioanalytical determinations;

3. charcoal canister or scintillation cell monitoring of radon diffusion and seepage to ground surfaces;

4. use of aerial radiometric or other radioanalytical data to determine existing background gamma radiation.

See Figures 1 and 2 for clarifying data, definitions and depictions concerning this protocol.

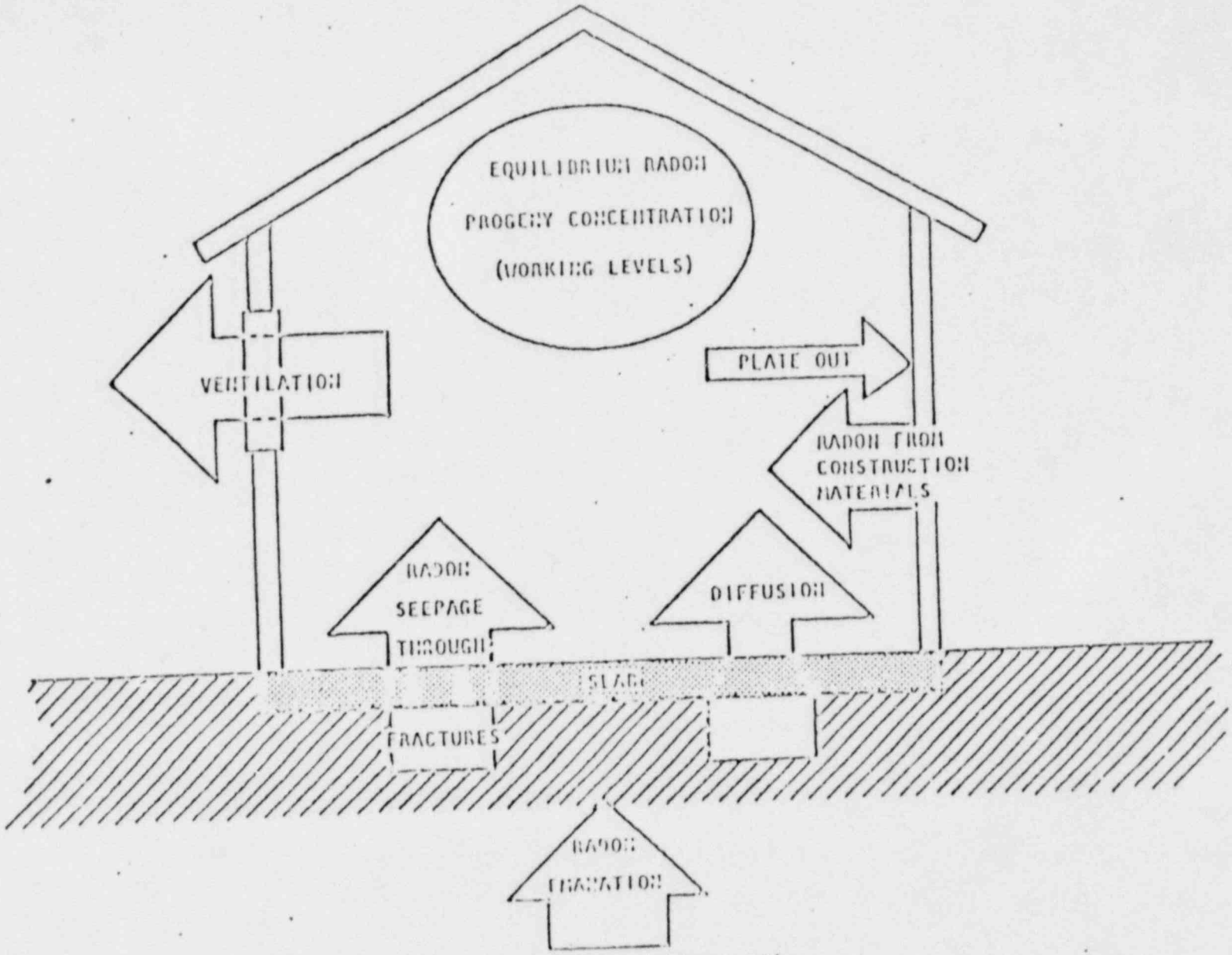


Figure 1 Factors Influencing Radon Decay Product Concentrations in Structures [Gulmond, February 1979]

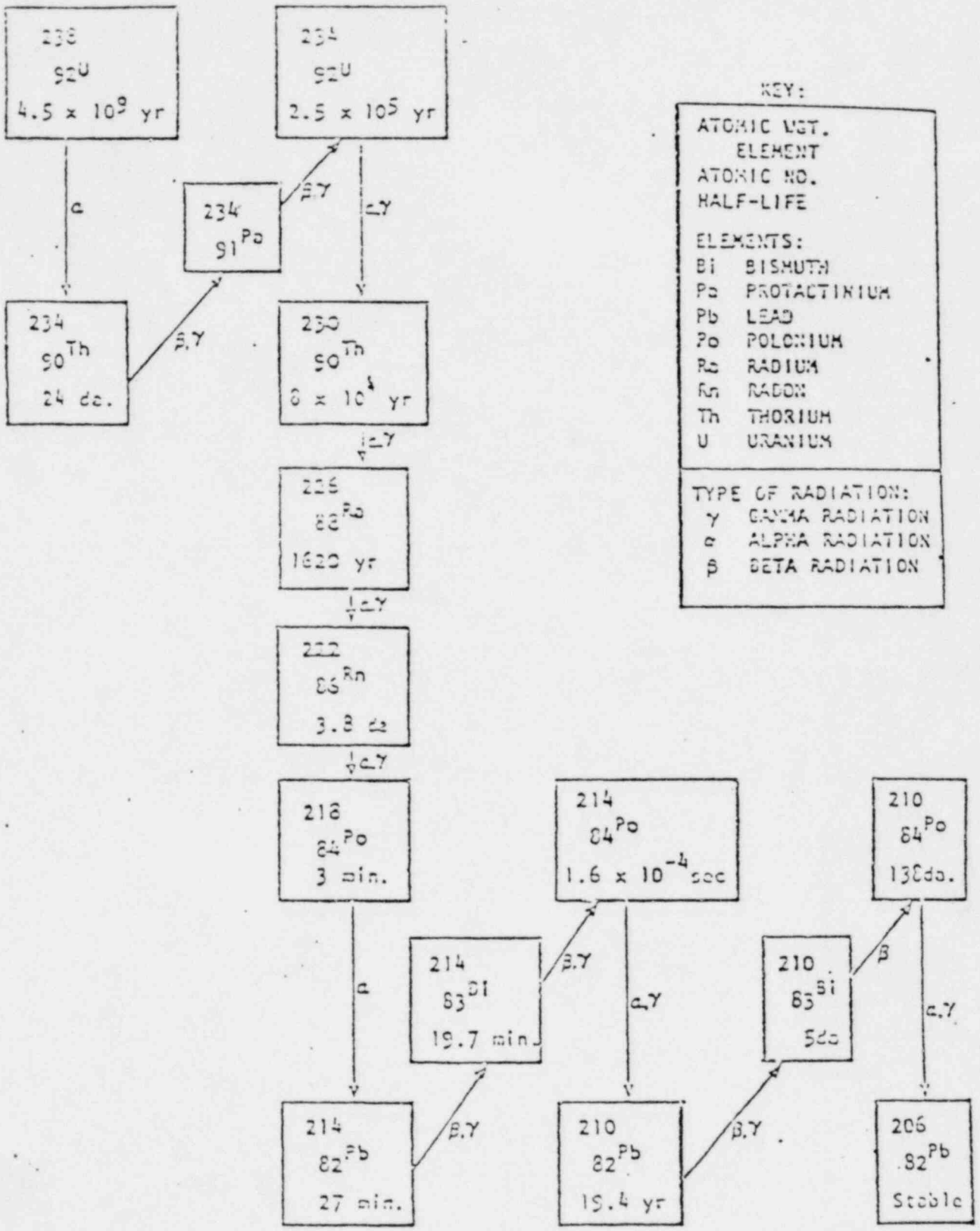


Figure 1. Uranium-238 Decay Series
From Guimond, February 1979