MASTER

THE ARGONNE RADIUM STUDIES

Evaluation of Clinical Effect Versus Dose in Radium Dial Painters

Charles E. Miller,* Asher J. Finkel,**
and Robert J. Hasterlik[†]

*Loyola University Medical School, Maywood, Illinois. Work supported
in part by USAEC Contract (AT)11-(1)-2088

**Argonne National Laboratory

[†]Argonne Cancer Research Hospital

LEGAL NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

EVALUATION OF CLINICAL EFFECT VERSUS DOSE IN RADIUM DIAL PAINTERS

I. Introduction

The ultimate goal of the study of the long-term effects of radium in humans is to delineate the dose-response curve. The shape of this curve is of great importance in setting the maximum permissible amount of any radioactive material to which humans may be exposed. Various theories of clinical effects versus dose have been postulated.

One view maintains that the dose-response curve is a linear or semi-logarithmic function that goes through zero. That is, the incidence rate of tumors among a group of patients who have each accumulated x dose is y_x where x is the total dose accumulated and y is the mathematical function relating dose to incidence rate. According to a strict linear function, if 50 per cent of a group of patients who each had received a total dose of z units developed tumors, then 25 per cent of a group of patients who each had received a total dose of $1/2 z$, and 12.5 per cent of a group who had received a total dose of $1/4 z$ units would develop tumors. Regardless whether a direct linear relationship, as in the example above, or a logarithmic relationship of incidence to dose is employed, even a very small dose given to a large enough group of persons will induce a tumor in one person in the group.

Another view maintains that the dose-response curve has a threshold. According to this theory, no individual who has absorbed less than the threshold dose will develop deleterious clinical effects. Various groups have suggested that the shape of the dose-response curve above the threshold is: (1) a steeply rising function, (2) a sigmoid curve or, (3) a step function.

It has also been suggested that clinical effects are not related to the total accumulated dose but to the maximum dose rate that the individual received. In the case of continuous uniform ingestion, the maximum dose rate will occur on the last day of exposure.

Widely different maximum permissible levels would be set for the various isotopes if any one of the three above proposed dose-effect relationships were demonstrated to be valid. The linear dose-effect relationship requires that the maximum permissible level be kept as low as possible since any amount will effect some individual if a large enough group is exposed. The threshold response would permit everyone to ingest any amount, i.e., a large single quantity or a small amount daily for a long period, so long as the total accumulated dose during his lifetime did not exceed the threshold value. The maximum dose rate hypothesis would permit an individual to ingest a standard amount indefinitely regardless of the total dose accumulated over the years just so long as the dose rate that he received did not exceed some critical value.

The data obtained on the radium-bearing dial painters has been analyzed extensively in an attempt to determine if the data could be interpreted to support any one of the three above hypotheses. In view of the extensive disagreement among scientists concerning the dose response curve, the results of all of these analyses are included even though they yielded negative results. In addition, one section is included to demonstrate that the results can be biased greatly by the inclusion of the data from the same patient obtained at various times.

The dose rate and the total accumulated dose at various times for the ANL-ACRH population of radium patients have been correlated with an x-ray score given by the radiologist after examination of skeletal survey films. The x-ray score is a quantitative expression of the radiographic changes in the skeleton attributable to radium deposition and it reflects, to some extent at least, the degree of damage to the skeleton.

II. Calculation of ^{226}Ra and RaB and RaC
and the dose delivered therefrom

The ^{226}Ra and radon (^{222}Rn) body contents of each dial painter were calculated for every day from the first day of employment until 48 years after termination of employment. For these calculations the simplified assumption was made that the dial painters worked every day, i.e., a 7-day week, and that the same amount of radium entered the patient's bloodstream from the gut each day of employment. The ^{226}Ra and radon contents were calculated by straightforward day-by-day summation rather than by integration of a retention function. This procedure, which was feasible because of present-day high-speed electronic computers, avoided the integration of complicated functions and the many simplifying assumptions usually associated with integration of these functions. This approach also circumvented the fact that the mathematical expression that describes the retention pattern of radon produced within the bone by the decay of ^{226}Ra is not fully known.

Radium retention in the body was assumed to follow a mathematical function such as $R = a t^{-b}$, or $R =$ the sum of 3 exponentials. The measured

^{226}Ra in the patient on a particular day, the length of time in days between the last day of employment and the date of the radium measurement, the length of employment, and the patient's identification number constituted the computer input. The amount of radium, Q , that would have entered the patient's bloodstream each day for the patient to have had the measured content of radium at the time of measurement was calculated by use of equation (1A) or (1B), depending upon whether the power function or exponential retention of radium was assumed.

$$Q = \frac{^{226}\text{Ra}}{\frac{a}{b+1}[(T+F)^{b+1} - T^{b+1}]} \quad 1A$$

$$Q = \frac{^{226}\text{Ra}}{\frac{0.023}{\lambda}[e^{-\lambda(T+F)} - e^{-\lambda T}]} \quad 1B$$

where F = length of employment,

T = elapsed time in days from cessation of ingestion to time of measurement,

a = coefficient of power function,

b = exponent of power function, $R = a t^b$, (where b is negative)

$\lambda = (0.693146/5472.0)$

^{226}Ra = measured radium body content at time T .

In the case of exponential retention, only the last long half-time enters the calculation since the short half-time terms have already decayed.

A sample set of calculations for a hypothetical patient who contained 1.0 μCi of radium on the 14,000th day after cessation of employment and

who worked for a total of 30 days is given in Table 1. These calculations are given in explanation of the technique used to derive the various dose parameters. The time in days (T) during the patient's employment and after cessation of employment are given in column 1. The amount of radium (RA) that would have been present in the body on each of these days if the patient had received a single injection of Q μ Ci of radium on the first day of employment is given in column 2. For these calculations the time used after cessation of employment is the actual length of time that the patient was employed, plus the number of days after employment. The running sum of the figures given in column 2 during the patient's period of employment is given in column 3. The value (SRA) given in column 3 for any particular day represents the amount of radium in the patient's body at that particular time, i.e., the radium body content on the sixth day represents that component remaining from 6 days ago, plus that from 5 days ago, etc., plus that from the present day. The value given in this third column for any day after cessation of employment is simply the sum, in this case, of the 30 values given in column 2 beginning with that particular day and going backward in time for 30 days. For example, the radium content present on the 32nd day after cessation of employment can be found by adding the values in column 2 between day 2 and 32 days after cessation of employment. The values given in column 4 are simply the continuous running sum of the values given in column 3. These values (SSRA) are the cumulative microcurie days to which the body has been exposed.

The amount of radon (RN) present in the body, again from a single injection of Q μ Ci of radium on the first day of employment is given in column 5. Previous experimentation with animals has demonstrated that the RaB and RaC content of an animal is equal to the ^{226}Ra content on that day

multiplied by the power function, $C T^{+d}$. It should be emphasized that the RaB and RaC content of the animal on any particular day from a single injection represents the buildup, i.e., integration of the radon retained from numerous days before. This expression for radon retention does not represent dynamic but rather an empirical day-by-day relationship. Consequently, this expression for radon retention $C T^{+d}$ cannot be integrated in the case of multiple injections or continuous ingestion since it already represents the integration of radon by the animal's metabolism.

In order to obtain the amount of radon present, the ^{226}Ra content (RA) given in column 2 based on a single injection of Q μCi of radium has been entered in the equation

$$R_n = RA(1 - e^{-\lambda T})^D CT^D$$

where $\lambda = (0.693146/3.825)$,

C = coefficient of power function,

D = exponent of power function,

T = time in days.

The term in this equation, $(1 - e^{-\lambda T})$, represents the initial buildup of radon. The radon daughters, RaB and RaC, in equilibrium with Rn, for any day as given by this equation is in column 5. The RaB and RaC value for any day during the lifetime of the patient from, in this case a 30-day exposure, is given in column 6. This value (SRN) represents the cumulative sum of the values given in column 5 for the first 30 days and then the total of the preceding 30 days for any day thereafter. The running sum of the actual RaB and RaC content is given in column 7 and represents the cumulative micro-curie days of RaB and RaC (SSRN). The percentage retention of radon (RET) defined as RaB and RaC present in the body divided by ^{226}Ra present in the body is given in column 8. The day-by-day ^{226}Ra present in the body and

RaB and RaC in the body (columns 4 and 7, respectively) were each multiplied by the appropriate factor⁽¹⁾ to compute the dose per day in rads. These values (DSRA and DSRN) are given in columns 9 and 10 and the sum of the two values (DTOT) is given in column 11. The running sum of the daily dose is given in column 12 and represents the total cumulative rads to the body for any day during their employment or any day thereafter for 17,532 days (48 years).

III. Correlation of dose parameters to x-ray observations

In view of the discussions which have been conducted for years concerning the relationship between absorbed dose and clinical changes in the body and the complete lack of agreement regarding these responses, our data were analyzed very extensively to determine if any significant correlation could be found between various dose parameters and the clinical x-ray findings.

The data cards were sorted in many different ways in an attempt to detect any obvious trends. This preliminary clarification revealed that some of the patient data should be deleted for various reasons, and as a result, seven measurements on six patients were eliminated from the complete data analysis. For example, when the data cards were arranged according to descending x-ray score and categorized by general clinical impression, the total accumulated dose values for three patients, 03-499, 03-558, and 03-594, were obviously out of line with the data for other patients in that group. These three patients had high x-ray scores and thus appeared near the top of the tabulation but they had actually received relatively small total doses to the body. The presence of a slight amount of ²⁰⁸Tl had been observed in patients 03-499 and 03-558

at the time of their measurement in 1960. The calculated total accumulated dose at various times (Table 2) was based only on ^{226}Ra , which was obviously somewhat less than the total dose that these patients had actually absorbed since the ^{208}Tl dose was not included. The total dose accumulated from the mesothorium content could have been calculated and added to the radium dose. However, this was not done since a large uncertainty would have to be assigned to the total dose delivered to the body because of the inexactness of the ^{208}Tl measurement. The data for these two patients were therefore removed from the analysis.

Consideration has been given to the possibility, however slight, that other patients in our study may also have ingested a slight amount of mesothorium from some source other than their occupational exposure. Sufficient information was obtained to establish that patients 03-499 and 03-558 had probably received their mesothorium content iatrogenically. It is highly improbable that the presence of ^{208}Tl in any other dial painters could have escaped unnoticed since each patient's gamma-ray spectra were compared carefully to that from individuals who were known to have received pure ^{226}Ra . Also, since each patient's radium body content was calculated from the count rate observed in five different energy bands, the presence of even a slight amount of ^{208}Tl would lead to discrepant radium values in these five energy bands.

Re-examination of the medical history obtained on patient 03-594 disclosed that she had been taking steroids at the time of her x-rays and her x-ray score probably reflected the effect of this drug; conse-

quently her data cards were also removed. The data on three other patients, 03-619, 03-657, and 03-671 had to be eliminated because no x-ray scores were available. These cases serve to point out the difficulties inherent in this analysis.

The total accumulated dose and dose rate values given in Table 2 comprise essentially the total body of data available for analysis on occupationally exposed patients. Although many other patients were studied, their data could not be included for various reasons. In addition, patients who had received radium iatrogenically were not included in this analysis since it was difficult in most cases to ascertain the number of injections given and the amount of radium per injection.

Analysis of Complete Data

Correlation coefficients were computed for both total absorbed dose and dose rate versus x-ray score at selected times after cessation of ingestion for the entire group of patients listed in Table 2. Correlation coefficients were employed for these analyses since the first goal was to determine whether the x-ray score was more dependent upon: (1) dose rate at one day or dose rate at a later time, (2) total accumulated dose at 1 day or various selected times later, (3) actual measured radium content at the time of the study, or (4) the total amount of radium ingested. The correlation coefficient provided a convenient method to intercompare the various data.

An extremely high degree of correlation was found between both the total dose, as well as the dose rate, and x-ray score (Table 3). Practi-

cally the identical correlation coefficient was found between total dose at 1, 5, 10, 20, 30, and 40 years and x-ray score, while a slightly lower correlation coefficient was found between the total dose at 1 day and x-ray score. This slightly lower value at 1 day probably has no statistical significance.

The correlation coefficients between dose rate and x-ray score for 5, 20, and 40 years are practically identical to those found between total dose and x-ray score for the corresponding years. The correlation coefficients found between dose rate and x-ray score at 100 days, 10 days, and 1 day are progressively smaller, and are smaller than the corresponding coefficient found for the total dose to x-ray score at 1 day. This slight decrease in correlation coefficients at earlier times may not be statistically significant, but it does serve to demonstrate the lack of a much higher correlation at 1 day when compared to later times.

The data were subdivided into five groups according to general x-ray impression: negative, minimal, mild, moderate, and advanced changes, and correlation coefficients were obtained for each of these groups between both the total absorbed dose and x-ray score and between the dose rate and x-ray score at 1 day and 5 years (Table 4). The total dose and the dose rate at 1 day were analyzed since it has been suggested that maximum dose rate may be a more important parameter than total absorbed dose⁽²⁾. Dose parameters at 5 years were employed since correlation coefficients found for 5 years were highest when the whole series of patients was analyzed (Table 3). Correlation coefficients were obtained for these combinations of data when retention was assumed to follow both the power

function and the sum of exponentials and are given in Table 4. The correlation coefficients found for the patients who exhibited minimal, mild and moderate x-ray changes suggest that there is little, if any, correlation between total dose or dose rate and x-ray score within each group of patients. The statistically significant ($P=.01$) correlation coefficients found for those patients in the negative x-ray category suggest that when based on the exponential function the total dose at 1 day and 5 years, as well as the dose rate at 5 years, is correlated with x-ray changes. For all 4 groups (negative through moderate) a larger correlation coefficient was found if retention was assumed to follow an exponential function. For the patients in the advanced category an extremely high degree of correlation, $P<0.001$, exists between the total dose at 1 day and 5 years and the dose rate at 5 years and x-ray score, while no correlation exists between dose rate at 1 day and the x-ray score.

The correlation coefficients for both the actual amount of radium measured in the patient and the calculated total amount entering the bloodstream versus x-ray score, each calculated both by power function and exponential retention, are given in Table 5. The value used for the former was the actual amount of radium measured at some date between approximately the 33rd and 45th year after radium deposition. The total amount of radium that entered the bloodstream was calculated by multiplying Q (the amount of radium that entered the bloodstream per day) by F (the feeding period) (see Eq. 1A and 1B).

The correlation coefficients for the complete series of 304 measurements, as well as for the sub-groups based on x-ray impression, are given in Table 5. When the complete series of measurements was employed practically the same correlation coefficients were found between total radium entering the bloodstream and x-ray score as that found between total dose and x-ray score at any time from 1 to 40 years (See Table 3). This finding would be expected for this group of patients in that they all worked somewhat comparable lengths of time and thus the total accumulated dose at any time beyond 1 year after cessation of employment really reflected the total amount of radium that had entered the bloodstream. The correlation coefficient found between the measured radium and x-ray score was highly significant, $P < 0.001$, and just slightly smaller than that found between total radium entering the bloodstream and x-ray score. The slight difference may or may not be significant.

When the results were sorted into groups according to x-ray impression there seemed to be slight correlation at $P = 0.05$ level between the radium entering the bloodstream and x-ray score for the 171 measurements in the negative group. There was no significance between the measured radium for this group nor the total radium entering the bloodstream and the x-ray score for the minimal, mild, or moderate groups. Interestingly, the correlation coefficients, although not significant at the $P = 0.05$ level, were higher when these calculations were made on the basis of exponential retention than when calculated according to power function retention. An extremely high degree of correlation, $P = 0.001$,

was found to exist between measured whole-body radium or the radium entering the bloodstream and x-ray score for those 37 measurements included in the advanced x-ray category. Examination of the data disclosed that this high degree of correlation found to exist between the 37 dose parameters and x-ray scores for the patients included in the advanced group reflected the fact that these 37 pair of numbers included 5 sets for each of 3 patients, 4 sets for each of 2 patients, 2 sets for each of 4 patients, and 6 pair for individual patients. It is not clear why no correlation exists between dose rate at 1 day and x-ray score when such a high degree of correlation exists between dose rate at 5 years, total dose at 1 day, and total dose at 5 years and x-ray score.

Any attempted analysis of x-ray score in terms of cumulative dose immediately encounters the difficulty that the x-ray score is very dependent upon the elapsed time between the ingestion of radium and the time that the x-rays were obtained. The x-ray score for many patients had been found to increase substantially between 1957 and 1968, while the total integrated dose to the skeleton increased but slightly. In some cases the patient's total dose did not agree with that found for other patients within the same x-ray category, and the high x-ray score associated with very low total dose was the consequence of the patient having been studied perhaps as long as nine years later than other patients in the same category (e.g., patient 03-429, see "mild" category in Table 2). If this patient had been studied earlier she would undoubtedly have had a low x-ray score and thus would have been in a lesser x-ray category.

To obtain a more accurate appraisal of the data the decision was made to use only one entry per patient in an adjusted data analysis and that only those patients be included for whom approximately the same elapsed time existed between cessation of radium ingestion and the ^{226}Ra measurement (Table 6). For each patient the measurement and x-ray score made nearest January 1, 1960 were used. Since measurements made in 1959, 1963, etc., all yielded about the same value for total accumulated dose, the average value based on all the measurements for each patient was employed. Note, for example, the accumulated dose values for patient 03-551 in Table 7. Quite good agreement is found to exist among the five cumulative dose quantities listed in any column even though the values were based on five separate ^{226}Ra determinations made between the 11,212th day and the 15,184th day after cessation of work. This agreement attests to the accuracy of the whole-body counter determinations, and demonstrates that the radium retention for this patient was in good agreement with the average retention function used for all patients. Interestingly, the x-ray score for this particular patient did not progress with time as it did for most patients.

Analysis of Adjusted Data

The adjusted data, one line per patient, are given in Table 6. Data have been sorted according to x-ray impression recorded about 1960. If the 1960 reading was not available, the nearest x-ray score, within one or two years, was used. Data for five patients that were omitted from the final analyses are included in the table. These five sets of data designated by

an asterisk in the right hand margin were originally included since the x-ray scores were obtained about 1960. After completing the analyses, the inclusion of certain patients in the smaller groups were observed to unduly influence the correlation coefficients obtained. The x-ray score of 27.5 obtained for patient 09-004 included in the moderate group is the highest value in this group while the total accumulated dose received by this patient is practically the lowest value in the group. Examination of the work history disclosed that this patient had received the radium between 1912 and 1920 while most of the patients had ingested the radium during 1924. Here the higher x-ray score reflects the fact that the x-rays were taken between 40 and 48 years instead of 36 years after exposure. Consequently, the work histories of the other patients were reexamined and the data for 4 other patients were omitted from the repeat analyses.

Correlation coefficients were obtained between the various dose parameters and x-ray score for the advanced, moderate, mild, minimal, and negative groups. Since these groups were somewhat artificially created on the basis of the radiologist's interpretation of the radiographs, plus the fact that the clinical classification of the patient might change to a more severe one at a later date, successively larger groups of patients were also included in the analysis in an attempt to determine whether or not a correlation was being lost because of the particular delineation of groups. Correlation coefficients were obtained in this way between the various dose parameters and x-ray scores for the advanced-moderate-mild, and advanced-moderate-mild-minimal groups as well as for

the combined group of all of the patients.

Correlation coefficients between total dose and x-ray score

The correlation coefficients obtained between the total dose at various times and the x-ray scores for the patients within the five groups when sorted according to radiographic category are given in Table 8. No significant correlation is found ($P > 0.1$ level) between total dose and x-ray score for any except the minimal group. Here the correlation at the $P = .05$ level is found at 1 day with both the power function and the exponential function.

Since the patients were rather artificially grouped in the previous table according to the clinical impression recorded in 1960 and may have fallen into a different clinical group because of progressive severity of radiographic changes, the correlation coefficients obtained between x-ray score and total dose at various times for selected combined groups of patients are given in Table 9. No correlation ($P > 0.10$) is observed for the 17 patients in the advanced-moderate group. Correlation coefficients significant at the $P = 0.05$ level are found for the 27 patients in the advanced-moderate-mild group and significant at the $P = 0.01$ for both the 44 patients in the advanced-moderate-mild-minimal group and the total group of 192 patients.

Although the increase in correlation coefficients found between x-ray score and total dose calculated for increasing time from cessation of ingestion are not statistically significant, the same trend is found for each group. For each group of patients, the lowest correlation coefficient is found when the total dose was calculated for the first day after employ-

ment, a higher value is found for the correlation coefficient for the dose received by 1 year, and the same value appears for all doses accumulated for selected later times. These correlation coefficients are only of value in that they demonstrate that a higher degree of correlation does not exist between the total dose received by the first day after cessation of ingestion and x-ray score. In addition, they demonstrate about the same degree of correlation whether the dose was based on the retention of radium by the power function or the sum of exponentials.

Correlation Coefficients between Dose Rate and X-ray Score

The correlation coefficients found between dose rate and x-ray score for the various groups are given in Table 10. No significant correlation ($P > 0.1$) exists for any of the groups when either the power function or exponential retention is used.

As was done with the total dose analyses, the groups were combined into larger groups and the correlation coefficients between dose rate and x-ray scores obtained (Table 11). While there is no significant correlation ($P = 0.1$) for the data on the 17 patients in the advanced-moderate group, there is a significant correlation for the advanced-moderate-mild ($P < .05$) and the advanced-moderate-mild groups ($P < .001$). For the former combination the correlation at 1 day is significant at the $P = 0.05$ level but increased to a level of significance of $P = 0.02$ for the dose rate at 100 days or longer. For the 44 patients in the advanced-moderate-mild-minimal group, the correlation coefficient is significant at the $P = 0.001$ level for all elapsed times.

While the increase in correlation coefficients found between x-ray score and total dose calculated for increasing time from cessation of ingestion is not statistically significant, the same trend is found within each group as was found for the total dose analyses. The lowest correlation coefficient was found for the first day at which time the dose rate to the patient's skeleton was highest. Higher correlation coefficients were found at longer times until 1 year after which the same values were obtained for all selected times.

These correlation coefficients suggest that the maximum dose rate may not be the most significant dose parameter. It is important that practically the same correlation coefficients were found between total dose and x-ray score as was found between dose rate and x-ray score for each particular group of patients.

The observation that the dose rate at 1 day is not as highly correlated with x-ray change at later times does not necessarily refute the notion that the maximum dose rate delivered to the body is not the important factor; rather this lack of correlation may result from the fact that the dose rate calculated in this section was based on the assumption that the dial painters ingested an equal amount of radium every day during the significant exposure period. If, as would be expected, some of the patients actually ingested most of the radium that was fixed in the body during a short period of time, either during the early training period or at some later period, the dose rate calculated at 1 day would be significantly affected. However, this higher-than-expected ingestion during a short period of time would not greatly affect the dose rate at later times.

Parameters of Linear Regression Equations

In view of the significant degree of correlation found for the selected groups of patients included in the advanced-moderate-mild and the advanced-moderate-mild-minimal groups, these data were analyzed in an attempt to see if they would support a dose-response curve. First, the data were plotted on both linear and semilog graphs (see Fig.1,2). When plotted on a linear graph, the data points did seem to scatter somewhat about a line. When plotted on a semilog grid, the x-ray scores found for the patients up to about 1000 rad seem to fall somewhat about a straight line but then the data points scatter to the right of the curve and do not follow it. This preliminary graphical analysis suggested that the response curve, or at least the relationship between total accumulated dose and x-ray score, was linearly related. Consequently, the data that had been sorted into groups according to x-ray impression were analyzed with linear regression program (Table 12). The equation of $x\text{-ray score} = a + b \text{ times dose}$, found with the advanced-moderate-mild-minimal group is very interesting. The value of a in this equation represents the intercept on the x-ray axis for the zero dose (Fig.3). A value of 2.93 ± 1.77 is found when this total series of patients was employed. One scientific group has contended that the minimal changes observed and read into the x-rays represented the effect of aging rather than the presence of radioactivity in the skeleton. This intercept of 2.93 would suggest that scores up to approximately 3 could be construed to represent normal changes in the skeleton and should not be correlated with dose.

The eight measurements for the advanced group were removed and the 36 data points for the moderate-mild-minimal patients were employed. The

parameters found for these 36 data points are given in the table and demonstrate a zero dose intercept of 3.70 ± 1.16 for x-ray score. The slope of this line is somewhat flatter than that found when the series of 44 data points was employed. A third combination of 27 data points based on the advanced-moderate-mild group was also employed. In this case, the same slope was found as that for the moderate-mild-minimal group but a zero intercept of 7.87 ± 4.44 was found on the x-ray score. The three intercepts found with these three groups of patients are not statistically different from each other. The advanced-moderate group was employed and no significant regression line was obtained. This simply substantiates the lack of correlation coefficients found previously for the advanced-moderate groups.

Linear regressions were also obtained with the x-ray score as the independent variable and dose as the dependent variable. The parameters of the linear regression found under this condition are given in the lower section of Table 11. In this case, the advanced-moderate-mild-minimal group intercepted the zero x-ray score at 408.9 ± 185 rads (Fig.4). This analysis would suggest that there were no x-ray changes attributable to radioactive dose until 409 rads had been accumulated. The slope of this line is highly significant. Again, the advanced group was eliminated and the moderate-mild-minimal group was employed. In this case the zero intercept x-ray score of 134 ± 200 rads was obtained. The slope of this regression line was quite close to that found for the total group of patients. The advanced-moderate group did not substantiate a particularly significant linear regression. Although the absolute magnitude of the zero intercept

parameters are considerably larger than those found for the other two groups of patients, they are not statistically different. The standard deviation assigned to each zero intercept reflects the large amount of scatter present among the data.

The linear regression parameters for x-ray score and total accumulated dose based on the exponential retention of radium are given in Table 13. These parameters agree very closely with those found when the retention of radium was assumed to follow a power function.

The parameters of the linear regression equation obtained between dose rate on the first day after cessation of employment and x-ray score are given in Table 14 and 15. The magnitude of the zero intercepts for x-ray score (top section of the tables) are not significantly different than those based on the total accumulated dose at 40 years.

The linear regressions obtained between the total dose accumulated during the first 40 years and the x-ray score obtained 36 years after cessation of ingestion can be used to support either of two very different arguments. When dose was used as the independent variable, an x-ray score of about 3 was obtained as the intercept for zero dose. This finding would support the contention that the first few units of x-ray score represents radiographic "noise" due to the effects of aging or other factors and not the presence of radium. However, the logical conclusion then follows that any dose above zero increases the x-ray score and thus there is no dose threshold for accumulated dose if the x-ray score is used as the clinical criterion.

On the other hand, when x-ray score was used as the independent variable, a total dose of about 400 rads was obtained for the intercept of zero x-ray score. This observation could be used to support the contention that there is a threshold of 400 rads below which dose no x-ray changes would be observed. Since Maximum Permissible Levels are based on a continuous level in the body, a total of 400 rads would be delivered to the skeleton if a constant value of 0.36 μc of ^{226}Ra in equilibrium with 30% of its daughters were present in the body for 40 years. This quantity is 3.6 times the accepted MPL of 0.1 μc for ^{226}Ra . Actually, a patient who contained 0.22 μc in her body at 40 years after cessation of ingestion would have accumulated 400 rads. However, this patient (1) would have had a maximum burden in the body of from 6.7 to 1.5 μc depending upon whether the radium was ingested during a 14 day or a 2 year period and (2) would have ingested a total of 49 μc in either instance. These values are significantly above the MPL for continuous levels.

IV. Discussion

Variability in Dose-Response Curves. It is surprising to find that when the x-ray scores are plotted against total accumulated dose, they fall as close to the regression line as they do and that these data do not exhibit a much greater scatter. That the points do not exhibit more scatter may in part be due to the compensating integration inherent in the x-ray scoring system.

It is well known that approximately half the radium deposition in the body is uniformly distributed throughout the skeleton, i.e., diffuse component, while the remainder is concentrated in a number of haversian

systems, i.e., hot rods. The concentration of radium in these haversian systems may run from 10 to 100 times the concentration of radium in the remainder of the skeleton. The magnitude of this ratio between the diffuse component and the hot spot depends upon the length of time that the patient ingested radium; that is, a person who received the radium during a very short period of time will have a very high ratio between hot spots and diffuse, while the person who ingests it over an extended period of time will have a lower ratio such as a factor of ten between hot spots and diffuse.

It has been reported that in addition to the different concentrations of radium in the haversian systems and in the rest of the bone tissue, a very distinctly nonuniform distribution may appear around the circumference of a particular bone, and from one bone to another. In microradiographs of a femur cross-section from patient 03-216⁽³⁾, it was observed that very little radium was present in approximately two-thirds of the bone, while a fairly high concentration was present in the remaining section. The whole-body measurement yields the total amount of radium present in the body and therefore dose calculations yield the average dose to the entire skeleton. Obviously, one segment of this femur was receiving many times the average dose calculated, while the rest of the femur was receiving much less than the average dose. Incidentally, the autoradiograph of this same cross-section demonstrated changes typical of radium throughout the entire cross-section of femur. The fact that essentially the same amount of destruction occurs around the entire bone suggests that approximately the same concentration existed in all portions of the bone during early times in order to damage the cells and to lead to the

destruction observed in the microradiograph.

The total dose calculated for this patient to produce the changes noted could be adjusted either upward or downward depending whether one assumes: (1) that the radium content of the large segment had been "washed out" quite rapidly in recent years while the radium content of the small segment had followed the expected retention pattern, or (2) that the radium content of the total bone had followed the usual retention pattern up to some point in time after which most of the radium in the "hot" section was retained for some unexplained reason. The first assumption would lead to a total dose several times higher while the latter assumption would lead to a total dose that was several times lower than the average dose based on the actual measurement.

In view of the fact that about the same amount of change had occurred in all sections of the bone, this non-uniform distribution of radium would not have shown up on the x-rays. Consequently, the identical situation could exist in the skeletons of the dial painter included in this study. In fact, data obtained on these patients could be interpreted to support this contention.

Scans along the longitudinal axis of several dial painters revealed that some patients contain 35% of their total-body radium in the head, while others contain 35% in the pelvis or the feet⁽⁴⁾. One individual contained over 50% of his total-body radium in the lower limbs. In those individuals in which it was observed that 35% of the total-body radium was in the head, it is extremely unlikely that all of the bones in the head contained twice the concentration of the remaining skeleton,

a condition which would lead to a dose rate twice as large in the head than that in the rest of the body. It is more likely that one or more small regions in the head contained many times as much radium as the average skeleton in the body. Consequently, the scan demonstrates that in some patients the dose to the head, pelvis, or feet, as the case may be, is at least twice the dose calculated from the total-body measurement, and the true dose to these volumes is probably many times the average.

The true total dose received by the body may differ greatly from that based on the measured body radium if the observed non-uniform distribution along the skeleton does not reflect the original deposition of radium in the skeleton but rather either rapid wash out of radium from the bulk of the skeleton or avid retention by a small segment of the skeleton.

In view of the non-uniformity of the distribution of radium on the micro-level--haversian system, macro level--around the circumference of a single bone, or gross level--along the longitudinal axis of the body, a significant uncertainty must be assigned to every dose calculation even though the whole body measurement of radium was extremely accurate. This problem of non-uniform distribution cannot readily be resolved by micro-radiography of bone from those individuals who contain an appreciable amount of radium. Such studies of individuals who actually develop tumors would be of interest were it not for the fact that the rapidly growing tumor replaces the very bone that contained the deposit of radium that originally induced the tumor. Studies made after the advent of the tumor do not serve to reveal the amount of radium that induced

the tumor.

A larger uncertainty must be assigned to the calculations of the initial dose rate administered to the body. First, the total amount of radium that entered the body is not known with accuracy for the reasons listed above. Secondly, the maximum dose rate is very dependent upon the time span during which the radium was ingested. Tables and graphs have been published elsewhere to demonstrate this point⁽⁵⁾. For example, assume that two dial painters each had a body burden of 1 μCi on the 14,000 day after termination of employment, that they had worked for 30 days and 2 years, respectively, and that each had ingested a constant amount each day during her employment. The patient who had worked for two years would have had a body burden that reached a maximum of only 8.4 μCi on the last day, while the patient who worked for 30 days would have had 50.7 μCi . The maximum dose rate to the body from ^{226}Ra plus RaB and RaC is 0.446 rads per day for the patient who worked 730 days, and 2.165 rads per day for the patient who worked 30 days.

The difficulty encountered when one attempts to calculate the maximum dose rate is that many of the dial painters do not know their exact times of employment and some patients have given dates that were found to be wrong on the basis of records located later. Even when the dates are known, there is still no way to determine if the employee ingested most of the radium during, for instance, the first month of employment while in training, during some short period of time at a later date, or if she ingested a uniform small amount every day during the entire period of employment. Consequently, if a dial painter worked for two years, the actual dose rate to the body could have been five times the value calculated on the basis of a uniform daily intake if

the radium had been ingested during the first month of employment. The maximum dose rate calculated from the complete work period thus yields a lower limit for maximum dose rate.

All of these analyses have served to demonstrate the difficulties in correlating x-ray score to either total dose or dose rate since the x-ray scores have been increasing from the 36th through the 45th years after cessation of radium ingestion, while the dose rate or total accumulated dose is changing very little at these late times. The population still alive that can be studied really is too limited in number to provide any meaningful correlation in the future. Consequently, a large uncertainty must be assigned to any dose parameter that might be used, and, in fact, the magnitudes of these uncertainties are such as to almost invalidate the possibility of ever arriving at a firm conclusion of dose versus effect. Statements should be limited to those relating the total average dose absorbed by the patients in each group and the range of doses in these groups.

V. Average Total Accumulated Dose for Patients in Each Clinical Category

The mean and its standard deviation were obtained for the total accumulated dose for the patients included in each radiographic category (Table 16). It can be seen from this table that the average dose absorbed by the patients in the different groups when sorted by radiographic category progresses upward as the severity of skeletal involvement increased. The eight patients in the advanced group absorbed from 1760 to 4031 rads, while the individual patients in the moderate group absorbed from 1086 to 3295 rads (Table 6). Four of these patients in the moderate

group received a higher integrated exposure than the four lowest patients in the advanced group. Interestingly five of the patients in the mild group received a greater dose than one patient in the advanced group. The total accumulated dose for the mild group ranged from 656 rads up to 2790 rads. The mean value for this group is 1563 rads but the standard deviation is 810 rads, or the mean is smaller than two standard deviations. Significantly, the standard deviations given for the mean dose for both the minimal and negative groups are considerably larger than the means.

VI. Malignancies and Pathological Fractures of the Skeleton
Attributed to the Presence of Radium

The data for those dial painters in this series who have developed malignancies of the skeleton and pathological fractures attributed to the presence of radium are designated by an appropriate symbol: M for malignancies and F for a fracture, in Figure 5. A dashed M is listed for one patient with an unconfirmed malignancy and a p for a patient who experienced a fracture that may have been a pathological fracture but was not verified as such.

The data are presented in this form since there are not a sufficient number of patients involved to permit any significant statistical analyses to support a dose response curve. The graph does not include all of the tumor patients reported in our other papers (5,6) since pertinent information such as length of employment, x-ray score, etc., were not, or never will be, available.

There are the same number of confirmed pathological fractures (six)

as confirmed malignancies (six) among the 23 patients who had absorbed over 1200 rads during the past 40 years. One patient who accumulated the largest total dose, developed a malignancy and also suffered a pathological fracture. This patient is included in both categories. One patient developed two types of malignancies some ten years apart although only one M is listed and one patient had pathological fractures in each femur several years apart. These two patients are each counted as a single case in each category.

Discussion

The data given in Figure 3 demonstrate that pathological fractures should be considered when evaluating the long term effects of radium in humans. While they are not as serious as the occurrence of a life-threatening malignancy, nevertheless they are deleterious effects. The limited amount of data available might be interpreted to suggest that the fractures occur at a higher total dose level than malignancies since four of the six fractures occurred in patients who had accumulated between 2700 and 4100 rads while only two of the six malignancies occurred in this range. Four of the six malignancies occurred among patients who had accumulated between 1380 and 2700 rads while only two fractures occurred in this range.

VII. Effects of Radiation on Reproduction

The data regarding the number of pregnancies, miscarriages, infant deaths, and number of living children have been extracted from the ANL 7531-ACRH 106 report⁽⁶⁾ on radium bearing patients in order to determine if any trends could be observed between these parameters and the radium content of these patients. Suitable data on 213 female patients who had

been married were selected for analyses. It was possible to include all married females in the radium study in these analyses. The method of discovery of the patient, i.e. by search or by referral because of a tumor, would not affect these parameters since no patients were referred for these reasons.

The data on the patients were first arranged by ascending body burden of radium (Table 17). The number of live births are given immediately after "para" and the number of children known to be living and well to the right of the number of live births. No number is given for living and well if the number of living and well was not explicitly stated in the medical history obtained when the patient was seen. The number of conceptions are also given as well as the information as to miscarriages, infant deaths, etc.

Visual inspection of the data given in Table 17 did not disclose any obvious trends of increased number of miscarriages, infant deaths, etc., with body burden of radium. There was a slight suggestion that a larger proportion of the women who contained between 0.01 and 0.02 μ c of radium had miscarriages than those women who contained less or more radium. Consequently, the data were combined into seven groups according to radium content. Arbitrary ranges of 0.001 to 0.003, 0.003 to 0.01, 0.01 to 0.03, etc. were used in order to distribute the patients among the seven groups (Table 18). The trends among the various indices of reproduction will be discussed in turn.

Live births

The number of patients included in each group, the number of live

births, and the number of live births per patient are given in columns 2, 3, and 4, respectively. The number of live births per woman in each group does not demonstrate any trend with body burden. While the value of 1.64 live births per woman observed for those women who contained over 1 μ c (the highest category) is less than the average value of 1.79 observed for the total group of 213, it is higher than the value of 1.52 found for those women who contained between 0.03 and 0.1 μ c.

Percent of women who never conceived

The actual number as well as the percentage in each group who had never become pregnant are given in columns 6 and 7. The term "infertile union" is used instead of barren since it was not established which spouse was responsible or if it was through choice. No trend exists between percent of the group that never conceived and radium body content. If the group that contained between 0.001 and 0.003 (the lowest group) is ignored, about 21.5 percent of the alternate groups who contained 0.003 to 0.01, 0.03 to 0.1, and 0.3 to 1.0 μ c of radium never conceived while about 12.5 percent of the in-between groups who contained 0.01 to 0.03, 0.1 to 0.3, and above 1.0 μ c or radium also never conceived. If the women in these six groups were combined into three groups with radium body contents of 0.003 to 0.03, 0.03 to 0.3, and 0.3 μ c and above, 15.9, 18.5, and 15.6 percent respectively of the women in each group failed to become pregnant. These values are very close to the value of 15% accepted as the percentage of involuntary sterile unions in the general population⁽⁷⁾. Consequently, the percentage of sterile unions does not seem to be any higher among these radium patients than among the general population.

Miscarriages

The number of reported miscarriages and the number of women who had miscarriages are given in column 8. The number of miscarriages is given above the slash and the number of women who had miscarriages is given below the slash. The data are presented in this form since the total number of miscarriages may be influenced by a few persons who had many. For example, the data for one patient in the 0.01 to 0.03 range was eliminated since she had ten miscarriages with no live births.

The percentage of miscarriages as well as the percentage of women who had miscarriages are given in the table. Again, the percentages vary at random and do not demonstrate any trend with increasing body burden of radium.

Infant deaths during first year

The number of infant deaths that occurred during the first year are given in the last column of Table 18. Again, no correlation or trend exists between radium body content and infant deaths during the first year. Among the group of 45 patients who contained between 0.001 and 0.003 μc of radium (the lowest radium content), three deaths between birth and two months of age were reported. In addition, one still birth and the death of one premature child were reported. If these last two cases are excluded, an infant mortality rate of 1 child per 15 women is obtained. This ratio is about the same as that observed for the 48 women who contained between 0.01 and 0.03 μc (1 death per 16 women), and for the 17 women who contained over 1 μc (1 death per 17 women). The 29 women who contained between 0.1 and 0.3 μc reported only one infant death while the three alternate groups who contained 0.003 to 0.01, 0.03 to 0.1, and 0.3 to 1.0 did not report any infant deaths during the first year.

If the stillborn and the death of the premature infant are included as deaths during the first year, the highest infant mortality rate is found for those patients whose body content ranged from undetectable up to 0.003 μ c of radium.

Discussion

The data do not demonstrate any trends between radium body content of adult female dial painters and (1) infant mortality rates, (2) percentage of women who did not conceive, (3) the incidence of miscarriages, or (4) live births per woman. These conclusions are based on inspection of the data rather than statistical analyses since the number of persons in each group is small. Furthermore, data on a sufficiently large group of women who contain radium will never be available to permit a statistical test. However, if the small dose delivered to the body by 90-Sr from fallout did produce the increased infant mortality that has been claimed by some individuals, the very large doses absorbed by these patients should have produced a high infant mortality rate at least among those women included in the upper three categories. The data fail to demonstrate any higher infant mortality for any group.

VIII Conclusions:

Careful, detailed evaluation of the data forces one to the conclusion that the information obtained from the study of the long term effects of radium in humans can probably never be used to accurately delineate the dose response curve but rather used only to support generalities such as: "As of this time, no one who has received a total accumulated dose of less than 1200 rads has developed a tumour" or "The larger the total dose, the higher the x-ray score." An accurate dose response curve cannot be

derived from an analyses of the data because of the variability and uncertainty inherent in both the dose parameters and in the clinical indices. Unfortunately, data will never be available on a large enough group of patients to support valid statistical analyses to overcome these uncertainties.

A significant uncertainty must be assigned to any dose parameter. The radium is not uniformly distributed throughout the skeleton but may be concentrated in the head, pelvis, or extremities. Because of this very gross non-uniform distribution that exists along the length of the body of some patients, the true total accumulated dose to part of the skeleton may be several times the average total dose based on a whole body measurement. Although the total accumulated dose calculated for late times is not particularly dependent upon the retention curve employed, the dose rate calculated for early times is very dependent upon the retention curve used. The possibility always exists that a particular patient excreted the radium either more or less rapidly than predicted by the average retention curve. The use of the incorrect retention equation yields an intake, and associated dose rate, at early times that may be either significantly high or low. Interestingly, calculation of an initial intake from a current whole body measurement and then integration back along the function to obtain the total dose yields a value that is rather independent of the power function parameters employed.

The uncertainty associated with the clinical indices that negates the derivation of a dose response curve results from the fact that: (1) the severity of the clinical response increase with time, and (2) the patients were studied at different times after the radium was deposited in the skeleton. For example, the severity of changes in the

skeleton as seen on x-ray films increased so drastically between the 36th and 48th year that it is possible to identify by visual inspection of x-ray score versus total dose those patients who have contained the radium for 44 to 48 years when tabulated with a group who only contained the radium for 36 years. Consequently, patients studied at widely different times after the radium was deposited cannot be grouped to obtain data on a statistical significant number of patients.

A number of the patients studied by us had obtained the radium between 1912 and 1920 while the majority of the patients received the radium between 1924 and 1926. Since the clinical studies on most of the patients were performed between 1958 and 1962, the patients who obtained the radium between 1912 and 1920 had to be excluded since their x-ray scores were obviously too high compared to the calculated accumulated dose. Those patients who obtained the radium during 1924 but declined to cooperate until 1963 or after had to be excluded for the same reason. A significant number of the patients died during the 1960's and thus could not be restudied. As a result, the only sizable group who were studied at the same elapsed time after the radium was deposited were those who worked in 1924 or 1925 and were studied about 1960. Patients from the other radium studies cannot be included with this series since they obtained the radium, in most cases, between 1912 and 1920 and were also studied about 1960.

In view of the changes in clinical indices with time and the limited number of patients available for study, only gross conclusions will or can be stated regarding the total average accumulated dose necessary to produce malignancies and pathological fractures. Again,

the elapsed time involved will distort the picture. In the case of malignancies, the latent period between the induction of the tumour and the diagnosis is unknown and thus the total accumulated dose up to the time of the induction of the tumour cannot be calculated. In the case of pathological fractures, based on the observation of increased x-ray score (greater changes to the skeleton) with time, fractures would be expected to be seen at lower total accumulated doses at later times if these fractures result only after rather complete destruction at a localized site.

The repetitive whole body radium measurements obtained on some of these patients have demonstrated that it is not necessary to remeasure those patients already measured. For example, calculations of the total accumulated doses at various elapsed times based on whole body measurements made 30.7, 33.6, 37.6, 38.5, and 41.6 years after the cessation of ingestion (patient 03-551, table 7) all yielded about the same total accumulated dose. Consequently, the patients still alive should be followed medically to determine the true cause of death in pathological fractures. The appropriate total average accumulated dose at the time of the fracture or malignancy can be calculated from the previous measurements.

The analyses of infant deaths during the first year, number of living and well children per women, number of pregnancies, etc. failed to disclose any correlation between these parameters and the radium body content.

REFERENCES

1. Evans, R.D. Radium and Mesothorium Poisoning. Annual Progress Report, Massachusetts Institute of Technology, M.I.T.-952-1 (1964), p. 55.
2. Finkel, M. P., P. B. Jenkins, and B. O. Biskis. Parameters of radiation dosage that influence production of osteogenic sarcomas in mice. Nat. Cancer Inst. Monogr. No. 14, 243-270 (1964).
3. Lucas, H. F., R. E. Rowland, C. E. Miller, R. B. Holtzman, R. J. Hasterlik, and A. J. Finkel. An unusual case of radium toxicity, Am. J. Roentg. 90, 1042-1051 (1963).
4. Miller, C. E., A new technique for determining the distribution of radium and thorium in living persons, in "Assessment of Radio-activity in Man," Vol. I, Heidelberg, Germany, May 11-16, 1964 (International Atomic Energy Agency, Vienna, Austria, 1964, pp. 67-77.
5. Finkel, A. J., C. E. Miller and R. J. Hasterlik, Radium-induced malignant tumors in man. "Delayed Effects of Bone-seeking Radio-nuclides," Ed., C. A. Mays (University of Utah Press, Salt Lake City, Utah, 1969), pp. 195-225.
6. Miller, C. E., R. J. Hasterlik, and A. J. Finkel. The Argonne Radium Studies. Summary of Fundamental Data. ANL-7531 and ACRH-106, (1969) pp. 1-596.
7. Behrman, S. J., R. W. Kistner, A rational approach to the evaluation of infertility, in "Progress in Infertility," Ed., S. J. Behrman (Little, Brown and Co., Boston, 1968), p.1

FIGURE LEGENDS

Figure 1

Total dose accumulated during the first 40 years after cessation of ingestion of radium plotted against the x-ray score. The x-rays were obtained about 36 years after cessation of ingestion (elapsed time) for all except the five patients designated by an arrow for whom the elapsed time was 40 to 48 years. The following symbols are used for the patients according to the various radiographic diagnoses: x - advanced changes, • - moderate changes, o - mild changes, and v - minimal changes.

Figure 2

Total dose accumulated during the first 40 years after cessation of ingestion of radium plotted on a semi-log grid against the x-ray score. The x-rays were obtained about 36 years after cessation of ingestion (elapsed time) for all except the three patients designated by an arrow for whom the elapsed time was 40 to 48 years. The following symbols are used for the patients according to the various radiographic diagnoses: x - advanced changes, • - moderate changes, o mild changes, and v - minimal changes.

Figure 3

The linear regression line found to fit the data of Figure 1 when total accumulated dose at 40 years was used as the independent variable and x-ray score as the dependent variable.

Figure 4

The linear regression line found to fit the data of Figure 1 when the x-ray score was used as the independent variable and total accumulated dose at 40 years as the dependent variable.

Figure 5

The data presented in Figure 1 are replotted with the patients who have developed malignancies or pathological fractures designated by the appropriate symbol. The letter m is given beside the data point for each patient who had a confirmed malignancy attributed to the presence of radium and an f beside each patient who experienced a pathological fracture. A dotted m is given for a patient who was reported to have had a malignancy but for whom pathological reports were not available. A b is given for a patient who had a fracture that may have been pathological.

FIGURE I

FIGURE 2

FIGURE 3:

FIGURE 4

TABLE 1

CALCULATIONS FOR HYPOTHETICAL PATIENT WHO WORKED 30 DAYS AND CONTAINED 1 MICROCURIE ON THE 14,000 DAY.

POWER FUNCTION PARAMETERS A = .30, B = -.44, C = .057, D = .18 AMOUNT ABSORBED DAILY FROM GUT = 7.417 MICROCURIES

DURING INGESTION PERIOD

DAYS	RA	SRA	SSRA	RN	SRN	SSRN	RET	DSRA	DSRN	DTOT	SDTOT
.5	4.821149	4.821149	4.82	.021012	.021012	.02	.0043	.167775	.002941	.170717	.17
1.5	1.861565	6.682714	11.50	.027167	.048179	.06	.0072	.232558	.006745	.239303	.41
2.5	1.486842	8.169556	19.67	.036411	.084590	.15	.0103	.284300	.011842	.296143	.70
3.5	1.282237	9.451794	29.12	.043009	.127600	.28	.0135	.328922	.017864	.346786	1.05
4.5	1.148006	10.599801	39.72	.047829	.175429	.45	.0165	.368873	.024560	.393433	1.44
5.5	1.050990	11.650792	51.37	.051368	.226798	.68	.0194	.405447	.031751	.437199	1.88
6.5	.976509	12.627302	64.00	.053954	.280753	.96	.0222	.439430	.039305	.478735	2.36
7.5	.916920	13.544222	77.54	.055817	.336570	1.30	.0248	.471338	.047119	.518458	2.88
8.5	.867788	14.412010	91.95	.057126	.393696	1.69	.0273	.501537	.055117	.556655	3.43
9.5	.826342	15.238353	107.19	.058006	.451703	2.14	.0296	.530294	.063238	.593533	4.03
10.5	.790742	16.029096	123.22	.058556	.510259	2.65	.0318	.557812	.071436	.629248	4.66
11.5	.759716	16.788812	140.81	.058849	.569108	3.22	.0338	.584250	.079675	.663925	5.32
12.5	.732348	17.521160	157.53	.058943	.628052	3.85	.0358	.609736	.087927	.697663	6.02
13.5	.707964	18.229125	175.76	.058885	.686937	4.54	.0376	.634373	.096171	.730544	6.75
14.5	.686051	18.915176	194.68	.058789	.745646	5.28	.0394	.658248	.104390	.762638	7.51
15.5	.666212	19.581388	214.26	.058445	.804091	6.09	.0410	.681432	.112572	.794005	8.30
16.5	.648134	20.229523	234.49	.058113	.862205	6.95	.0426	.703987	.120708	.824696	9.13
17.5	.631570	20.861092	255.35	.057733	.919939	7.87	.0440	.725966	.128791	.854757	9.98
18.5	.616315	21.477408	276.83	.057318	.977258	8.84	.0455	.747413	.136816	.884230	10.87
19.5	.602203	22.079611	298.91	.056879	1.034138	9.88	.0468	.768370	.144779	.913149	11.78
20.5	.589096	22.668708	321.57	.056424	1.090562	10.97	.0481	.788871	.152678	.941549	12.72
21.5	.576880	23.245588	344.82	.055960	1.146523	12.12	.0493	.808946	.160513	.969459	13.69
22.5	.565455	23.811043	368.63	.055493	1.202016	13.32	.0504	.828624	.168282	.996906	14.69
23.5	.554738	24.365781	393.00	.055026	1.257042	14.58	.0515	.847929	.175985	1.023915	15.71
24.5	.544659	24.910441	417.91	.054562	1.311685	15.89	.0526	.866883	.183624	1.050508	16.76
25.5	.535156	25.445598	443.35	.054104	1.365710	17.25	.0536	.885506	.191199	1.076706	17.84
26.5	.526175	25.971773	469.32	.053654	1.419365	18.67	.0546	.903817	.198711	1.102528	18.94
27.5	.517668	26.489441	495.81	.053213	1.472578	20.14	.0555	.921832	.206160	1.127993	20.07
28.5	.509596	26.999038	522.81	.052781	1.525360	21.67	.0564	.939566	.213550	1.153116	21.22
29.5	.501922	27.500950	550.31	.052360	1.577720	23.25	.0573	.957033	.220680	1.177914	22.40

TABLE 1, CONTINUED

AFTER INGESTION PERIOD STOPPED

DAYS	RA	SRA	SSRA	RN	SRN	SSRN		DAYS	RET	DSRA	DSRN
.5	.494614	23,174426	573.49	.051949	1,608658	24.86	.0694	.806470	.225212	1.031682	23.43
1.5	.487642	21,800504	595.29	.051550	1,633041	26.49	.0749	.758657	.228625	.987283	24.42
2.5	.480982	20,794645	616.08	.051161	1,647791	28.14	.0792	.723653	.230690	.954344	25.37
3.5	.474611	19,987019	636.07	.050782	1,655564	29.79	.0828	.695548	.231778	.927327	26.30
4.5	.468509	19,307521	655.38	.050415	1,658150	31.45	.0858	.671901	.232141	.904042	27.21
5.5	.462655	18,719186	674.10	.050058	1,656839	33.11	.0885	.651427	.231957	.883385	28.09
6.5	.457035	18,199711	692.30	.049711	1,652596	34.76	.0908	.633349	.231363	.864713	28.95
7.5	.451631	17,734423	710.03	.049374	1,646153	36.41	.0928	.617157	.230461	.847619	29.80
8.5	.446432	17,313067	727.34	.049046	1,638073	38.04	.0946	.602494	.229330	.831825	30.63
9.5	.441423	16,928149	744.27	.048728	1,628794	39.67	.0962	.589099	.228031	.817130	31.45
10.5	.436594	16,574001	760.85	.048418	1,618657	41.29	.0976	.576775	.226611	.803387	32.25
11.5	.431933	16,246218	777.09	.048117	1,607925	42.90	.0989	.565368	.225109	.790478	33.04
12.5	.427432	15,941302	793.03	.047825	1,596807	44.50	.1001	.554757	.223553	.778310	33.82
13.5	.423080	15,656418	808.69	.047540	1,585462	46.08	.1012	.544843	.221964	.766808	34.59
14.5	.418870	15,389237	824.08	.047263	1,574016	47.66	.1022	.535545	.220362	.755907	35.35
15.5	.414794	15,137820	839.22	.046993	1,562564	49.22	.1032	.526796	.218759	.745555	36.09
16.5	.410846	14,900531	854.12	.046730	1,551181	50.77	.1041	.518538	.217165	.735703	36.83
17.5	.407017	14,675979	868.79	.046474	1,539921	52.31	.1049	.510724	.215589	.726313	37.55
18.5	.403303	14,462968	883.26	.046224	1,528827	53.84	.1057	.503311	.214035	.717347	38.27
19.5	.399698	14,260462	897.52	.045981	1,517929	55.36	.1064	.496264	.212510	.708774	38.98
20.5	.396196	14,067562	911.58	.045743	1,507248	56.86	.1071	.489551	.211014	.700565	39.68
21.5	.392792	13,883474	925.47	.045511	1,496799	58.36	.1078	.483144	.209551	.692696	40.37
22.5	.389482	13,707502	939.18	.045285	1,486592	59.85	.1084	.477021	.208122	.685143	41.06
23.5	.386262	13,539026	952.71	.045064	1,476630	61.32	.1090	.471158	.206728	.677886	41.74
24.5	.383128	13,377494	966.09	.044848	1,466916	62.79	.1096	.465536	.205368	.670905	42.41
25.5	.380075	13,222413	979.31	.044637	1,457448	64.25	.1102	.460139	.204042	.664182	43.07
26.5	.377100	13,073339	992.39	.044430	1,448224	65.70	.1107	.454952	.202751	.657703	43.73
27.5	.374200	12,929871	1005.32	.044228	1,439240	67.14	.1113	.449959	.201493	.651453	44.38
28.5	.371372	12,791646	1018.11	.044031	1,430489	68.57	.1118	.445149	.200268	.645417	45.03
29.5	.368613	12,658337	1030.77	.043837	1,421967	69.99	.1123	.440510	.199075	.639585	45.66
30.5	.365919	12,529643	1043.30	.043648	1,413665	71.40	.1128	.436031	.197913	.633944	46.30
31.5	.363289	12,405290	1055.70	.043462	1,405598	72.81	.1133	.431704	.196781	.628485	46.93

Table 4

CORRELATION COEFFICIENTS FOR TOTAL DOSE AND DOSE RATE VERSUS X-RAY SCORE

Number of Measurements	X-ray Impression	Total Dose		Dose Rate	
		1 day	5 years	1 day	5 years
<u>Power Function Retention</u>					
37	Advanced	0.645	0.545	0.192	0.469
29	Moderate	0.107	0.002	-0.122	-0.043
32	Mild	-0.003	0.059	0.101	0.085
35	Minimal	0.252	0.171	0.065	0.136
171	Negative	0.155	0.172	0.124	0.170
<u>Exponential Retention</u>					
37	Advanced	0.633	0.555	0.186	0.482
29	Moderate	0.244	0.150	0.034	0.099
32	Mild	0.011	0.078	0.111	0.109
35	Minimal	0.318	0.240	0.143	0.199
171	Negative	0.203	0.225	0.148	0.223

Table 5

CORRELATION COEFFICIENTS OF X-RAY SCORE VERSUS MEASURED RADIUM
AND TOTAL RADIUM ENTERING BLOODSTREAM

<u>X-ray Impression</u>	<u>Number of Patients</u>	<u>Correlation Coefficients</u>		
		<u>Measured Radium</u>	<u>Total Ingested Radium</u>	
			<u>Power Function</u>	<u>Exponential</u>
	304	0.801	0.808	0.815
Advanced	37	0.489	0.498	0.499
Moderate	29	-0.084	-0.028	0.110
Mild	32	0.068	0.076	0.102
Minimal	35	0.129	0.148	0.208
Negative	171	0.144	0.172	0.224

47

TABLE 2A

TOTAL DOSE TO SKELETON IN RADS. COMPUTED BY POWER FUNCTION
 GROUPED BY RADIOLOGICAL OR CLINICAL DIAGNOSIS AT TIME OF X-RAY
 LISTED BY ASCENDING PATIENT NUMBER
 ONE SET OF DATA PER GAMMA RAY MEASUREMENT

PT. NO.	X-RAY SCORE	ELAPSED TIME SINCE CESSATION OF INGESTION						
		1 DAY	1 YR	5 YR	10 YR	20 YR	30 YR	40 YR
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-401	39.5	347.3	573 _{±6}	1178.9	1742.8	2646.0	3405.6	4084.3
03-401	43.5	338.2	558 _{±7}	1148.2	1697.3	2577.0	3316.8	3977.8
03-402	24.0	206.6	309 _{±8}	597.5	869.9	1389.0	1679.3	2010.6
03-402	26.0	207.3	311 _{±0}	599.7	873.2	1313.9	1685.6	2018.1
03-402	33.0	212.0	318 _{±0}	613.2	892.8	1343.4	1723.5	2063.6
03-402	33.0	258.9	388 _{±3}	748.8	1090.1	1640.3	2104.4	2519.6
03-402	33.0	200.7	301 _{±0}	580.5	845.1	1271.6	1631.4	1953.3
03-404	22.0	149.4	220 _{±1}	418.6	607.2	911.7	1168.7	1398.7
03-404	22.0	164.8	242 _{±7}	461.7	669.7	1005.5	1289.0	1542.7
03-431	16.0	284.1	405 _{±5}	751.9	1083.3	1619.8	2073.2	2479.2
03-431	16.0	269.7	385 _{±0}	713.9	1028.6	1538.0	1968.5	2354.0
03-449	30.0	255.5	355 _{±1}	643.1	920.4	1370.4	1751.4	2092.6
03-473	39.0	223.5	335 _{±0}	645.7	940.0	1414.3	1814.4	2172.3
03-473	43.0	217.4	325 _{±9}	628.3	914.6	1376.1	1765.4	2113.6
03-528	17.0	361.7	494 _{±0}	879.9	1253.3	1860.4	2374.8	2835.8
03-548	29.0	387.6	581 _{±3}	1121.0	1632.1	2455.8	3150.6	3772.2
03-548	34.0	346.8	520 _{±1}	1003.0	1460.4	2197.4	2819.1	3375.2
03-548	33.0	343.0	514 _{±5}	992.2	1444.6	2173.7	2788.7	3338.8
03-548	33.0	388.7	582 _{±9}	1124.2	1636.8	2462.8	3159.7	3783.0
03-551	39.5	253.4	348 _{±0}	623.2	889.0	1321.0	1686.8	2014.7
03-551	51.0	291.7	400 _{±5}	717.2	1023.0	1520.1	1941.2	2318.5
03-551	38.0	310.0	425 _{±8}	762.4	1087.5	1616.0	2063.5	2464.7
03-551	38.0	262.6	360 _{±5}	645.6	920.9	1368.4	1747.4	2087.1
03-551	41.0	279.7	384 _{±1}	687.8	981.1	1457.8	1861.6	2223.4
03-554	19.0	242.8	449 _{±2}	978.3	1464.3	2238.7	2888.6	3468.6
03-571	20.0	71.0	201 _{±3}	497.8	762.1	1179.5	1528.4	1839.2
03-571	16.0	64.0	181 _{±4}	448.7	686.9	1063.2	1377.6	1657.8
03-571	16.0	62.4	176 _{±9}	437.4	669.7	1036.4	1342.9	1616.1
03-571	18.0	64.5	182 _{±8}	452.0	692.0	1071.0	1387.8	1670.1
03-571	18.0	77.8	220 _{±6}	545.5	835.1	1292.5	1674.7	2015.4
03-619	-	122.6	304 _{±7}	731.1	1114.2	1720.2	2227.1	2678.9
03-657	-	2472.0	3396 _{±7}	6078.3	8670.7	12883.7	16452.2	19650.2
03-671	-	119.9	602 _{±2}	1594.0	2464.6	3834.2	4976.9	5994.4
03-726	25.0	141.0	192 _{±5}	342.9	488.4	724.9	925.3	1105.0

MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION

03-404	17.0	176.1	259.3	493.2	715.5	1074.3	1377.1	1648.1
03-404	24.0	158.5	233.5	444.1	644.3	967.3	1240.1	1484.1
03-404	24.0	145.0	213.5	406.1	589.1	884.5	1133.9	1357.0
03-405	22.0	94.1	155.4	319.3	472.1	716.7	922.4	1106.3
03-405	15.5	93.3	154.1	316.6	468.0	710.4	914.4	1096.6
03-405	15.5	84.2	139.0	285.7	422.3	641.1	825.2	989.6
03-405	22.0	98.7	162.9	334.7	494.7	751.1	966.7	1159.4
03-407	19.0	246.4	366.1	701.2	1019.1	1531.8	1964.5	2351.6
03-416	18.0	148.6	281.7	620.0	930.0	1423.5	1837.5	2207.0
03-416	18.0	179.9	341.1	750.9	1126.2	1723.9	2225.2	2672.7
03-423	12.5	132.0	197.9	381.7	555.7	836.2	1072.8	1284.4
03-423	22.0	104.6	156.8	302.4	440.3	662.5	850.0	1017.7
03-423	27.0	101.3	151.9	293.0	426.5	641.8	823.4	985.8
03-423	27.0	108.4	162.6	313.7	456.7	687.1	881.6	1055.5
03-429	18.0	310.5	470.4	913.9	1333.1	2008.1	2577.3	3086.4
03-429	18.0	330.9	501.2	973.7	1420.3	2139.5	2745.9	3288.3
03-429	18.0	322.8	488.9	949.9	1385.5	2087.1	2678.7	3207.8
03-429	28.0	318.9	483.1	938.6	1369.1	2062.3	2646.9	3169.8
03-429	28.0	375.2	568.4	1104.3	1610.7	2426.3	3114.0	3729.1
03-431	11.0	291.1	415.6	770.6	1110.2	1660.0	2124.7	2540.8
03-455	15.0	85.6	171.8	386.9	582.9	894.4	1155.5	1388.4
03-459	18.0	101.6	227.9	533.0	806.4	1245.0	1610.4	1936.3
03-459	19.0	87.6	196.5	459.4	696.9	1073.2	1388.3	1669.2
03-459	19.0	88.9	199.4	466.3	707.3	1089.3	1409.1	1694.2
03-459	19.0	77.5	173.9	406.7	616.8	950.0	1228.9	1477.5
03-484	18.0	317.9	453.9	841.6	1212.5	1812.9	2320.4	2774.8
03-484	22.0	309.0	441.1	817.9	1178.4	1761.9	2255.2	2696.8
03-484	22.0	348.1	496.8	921.3	1327.3	1984.6	2540.2	3037.6
03-499	19.0	27.0	54.2	122.0	183.9	282.1	364.5	438.0
03-499	18.0	24.8	49.8	112.3	169.1	259.5	335.3	402.9
03-558	15.0	5.0	20.2	52.6	81.2	126.1	163.6	197.1
03-586	20.0	127.4	221.5	468.3	696.5	1061.2	1367.6	1641.2
03-586	20.0	128.4	223.2	471.9	702.0	1069.5	1378.3	1654.1
09- 4	27.5	223.3	262.9	389.9	519.6	736.4	923.0	1091.3

MILD CHANGES TYPICAL OF RADIUM DEPOSITION

03-416	10.5	159.2	301.8	664.4	996.6	1525.4	1969.1	2365.0
03-416	10.5	150.5	285.2	627.9	941.8	1441.5	1860.8	2234.9
03-416	16.0	154.5	292.8	644.5	966.7	1479.8	1910.1	2294.2
03-417	10.0	85.9	167.3	372.3	559.6	857.6	1107.4	1330.4
03-417	10.0	70.0	136.2	303.1	455.7	698.3	901.8	1083.3
03-417	10.0	68.9	134.2	298.6	448.9	687.9	888.4	1067.2
03-417	10.0	74.9	145.9	324.7	488.0	747.9	965.7	1160.2
03-428	7.0	53.4	132.0	317.0	483.0	745.6	965.3	1161.1
03-428	9.0	47.6	117.7	282.6	430.6	664.7	860.6	1035.2
03-428	9.0	47.8	118.3	284.0	432.8	668.1	864.9	1040.4
03-429	14.0	354.5	537.0	1043.3	1521.8	2292.4	2942.2	3523.4
03-433	15.0	185.5	311.2	646.2	955.7	1452.6	1870.4	2243.6
03-433	15.0	160.8	269.7	559.2	828.3	1259.0	1621.1	1944.6
03-433	15.0	157.3	263.9	547.2	810.6	1232.1	1586.4	1903.0

03-445	11.0	308.4	434.1	795.3	1142.0	1703.9	2179.2	2604.9
03-445	11.0	377.7	531.7	974.1	1398.8	2087.0	2669.2	3190.7
03-445	17.0	304.9	429.2	786.3	1129.0	1684.6	2154.5	2575.4
03-449	10.0	336.9	468.2	847.8	1213.4	1806.7	2308.9	2758.8
03-462	5.0	100.6	139.9	253.3	362.5	539.8	689.6	824.2
03-462	5.0	100.1	139.1	252.0	360.6	536.9	686.2	819.9
03-462	14.0	80.9	112.5	203.7	291.6	434.2	554.8	663.0
03-462	14.0	72.6	100.9	182.6	261.4	389.2	497.4	594.3
03-502	7.0	35.4	50.5	93.6	134.9	201.7	258.1	308.7
03-510	14.0	91.5	169.1	368.2	551.1	842.6	1087.1	1305.4
03-510	14.0	90.9	168.0	365.7	547.4	836.8	1079.7	1296.5
03-529	12.0	18.8	28.8	56.4	82.4	124.2	159.5	191.1
03-529	12.0	23.9	36.6	71.6	104.6	157.8	202.6	242.7
03-530	7.0	77.8	130.4	270.5	400.6	608.9	784.0	940.5
03-530	13.0	73.9	124.0	257.0	380.7	578.6	745.1	893.7
03-530	13.0	70.5	118.2	245.1	363.1	551.9	710.6	852.4
03-586	10.0	164.3	285.7	603.9	898.3	1368.6	1763.8	2116.6
03-586	10.0	134.6	234.1	494.8	736.0	1121.3	1445.1	1734.1
03-586	10.0	137.9	239.8	506.8	753.9	1148.6	1480.2	1776.4
03-588	6.0	93.3	130.5	237.6	340.6	507.7	649.0	775.6
03-588	15.0	74.6	104.3	190.0	272.3	405.9	518.9	620.1
03-588	15.0	68.7	96.1	175.0	250.9	373.9	478.0	571.3
03-594	13.0	4.2	8.7	19.8	29.9	46.0	59.4	71.4

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-412	1.0	58.6	87.1	166.9	242.7	364.8	467.8	560.0
03-412	8.0	46.4	69.0	132.2	192.2	288.9	370.6	443.6
03-412	8.0	39.5	58.8	112.7	163.9	246.3	315.9	378.1
03-412	8.0	41.1	61.1	117.2	170.3	256.1	328.4	393.1
03-417	2.5	95.1	185.0	411.9	619.1	948.7	1225.1	1471.8
03-419	2.0	75.1	150.6	339.1	510.8	783.8	1012.6	1216.8
03-419	2.0	79.0	158.6	357.1	538.0	825.5	1066.5	1281.5
03-419	5.0	70.6	141.6	318.8	480.3	736.9	952.0	1144.0
03-419	5.0	73.4	147.2	331.5	499.4	766.3	989.9	1189.5
03-424	6.0	64.1	95.3	182.5	265.2	398.6	511.2	611.9
03-445	5.5	326.3	459.4	841.5	1208.4	1803.0	2306.0	2756.4
03-445	5.5	327.7	461.3	845.1	1213.5	1810.7	2315.8	2768.2
03-483	2.0	0.2	0.3	0.5	0.8	1.1	1.5	1.8
03-488	2.0	11.2	31.9	79.0	120.9	187.2	242.6	291.9
03-490	3.0	6.1	8.4	15.0	21.4	31.7	40.5	48.4
03-500	5.0	0.0	0.2	0.5	0.7	1.1	1.4	1.7
03-505	4.0	16.1	33.4	76.1	114.9	176.6	228.2	274.3
03-505	4.0	18.2	37.6	85.8	129.5	198.9	257.1	309.0
03-510	3.5	106.7	197.3	429.5	642.8	982.7	1268.0	1522.6
03-520	5.0	7.4	21.1	52.2	79.9	123.6	160.2	192.7
03-520	5.0	8.6	24.5	60.5	92.7	143.4	185.8	223.6
03-524	2.5	4.3	12.2	30.1	46.2	71.4	92.6	111.4
03-526	3.0	0.1	0.2	0.5	0.7	1.1	1.4	1.7
03-568	4.5	26.3	36.2	64.8	92.4	137.3	175.3	209.3
03-572	3.0	6.1	16.1	39.1	59.8	92.4	119.7	144.0
03-577	4.0	12.8	20.5	41.5	61.1	92.6	119.1	142.7
03-591	1.0	14.8	15.5	18.0	20.7	25.6	30.0	34.1
03-604	1.0	3.9	4.6	6.8	9.1	12.8	16.1	19.0

03-614	4.0	14.5	29.1	65.7	98.9	151.8	196.1	235.6
03-615	1.0	3.7	5.8	11.7	17.2	26.0	33.5	40.1
03-727	6.0	36.9	56.0	108.7	158.6	238.9	306.6	367.1
03-727	6.0	45.9	69.5	135.1	197.0	296.7	380.8	456.1
09- 2	5.5	1.8	5.5	13.8	21.2	32.9	42.7	51.4
09- 7	3.0	5.5	8.8	17.8	26.2	39.8	51.1	61.3
09- 31	8.5	106.1	127.4	194.6	262.6	375.7	472.7	560.1

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-403	.0	2.3	2.7	3.9	5.2	7.3	9.1	10.8
03-406	.0	4.8	5.5	7.9	10.4	14.6	18.2	21.4
03-408	.0	19.2	34.7	74.8	111.8	170.7	220.1	264.3
03-410	.0	9.1	14.5	29.4	43.2	65.5	84.2	101.0
03-411	.0	0.4	0.4	0.6	0.7	1.0	1.2	1.4
03-415	.0	6.3	6.9	9.0	11.3	15.2	18.6	21.7
03-418	.0	2.8	3.1	4.3	5.5	7.6	9.4	11.1
03-420	.0	3.7	5.2	9.4	13.5	20.0	25.6	30.6
03-422	.0	2.3	5.5	13.0	19.8	30.5	39.5	47.5
03-426	.0	27.4	48.5	103.5	154.3	235.3	303.4	364.2
03-427	.0	3.2	8.0	19.2	29.3	45.2	58.5	70.3
03-427	.0	2.2	5.5	13.3	20.3	31.3	40.5	48.8
03-432	.0	6.7	10.8	21.8	32.1	48.7	62.6	75.1
03-434	.0	1.8	2.8	5.4	7.8	11.8	15.1	18.1
03-434	.0	1.9	2.9	5.7	8.3	12.6	16.1	19.3
03-435	.0	0.9	1.4	2.8	4.1	6.3	8.1	9.7
03-436	.0	10.0	11.4	15.6	20.0	27.4	33.9	39.8
03-437	.0	5.2	10.8	24.7	37.3	57.3	74.1	89.0
03-441	.0	4.2	10.4	25.0	38.1	58.9	76.2	91.7
03-442	.0	0.5	2.2	5.7	8.9	13.8	17.9	21.5
03-443	.0	0.2	0.3	0.5	0.6	0.9	1.1	1.4
03-444	.0	0.8	4.1	10.8	16.7	26.0	33.8	40.7
03-444	.0	0.5	2.8	7.4	11.4	17.7	23.0	27.7
03-446	.0	28.0	38.4	68.7	98.1	145.7	186.1	222.2
03-446	1.0	18.3	25.2	45.1	64.5	95.5	122.0	145.7
03-446	1.0	21.0	28.8	51.5	73.5	109.2	139.4	166.5
03-447	.0	0.0	0.3	0.9	1.4	2.1	2.8	3.3
03-450	.0	1.0	3.5	9.0	13.8	21.4	27.7	33.4
03-452	.0	2.7	7.6	18.7	28.6	44.3	57.4	69.1
03-452	.0	1.5	4.4	10.8	16.6	25.7	33.3	40.0
03-456	.0	7.2	8.5	12.6	16.8	23.7	29.8	35.2
03-457	.0	1.3	1.5	2.1	2.8	3.9	4.8	5.7
03-458	.0	3.0	3.3	4.5	5.7	7.8	9.6	11.3
03-460	1.0	0.7	2.2	5.5	8.4	13.0	16.9	20.3
03-461	.0	0.2	1.0	2.7	4.2	6.6	8.5	10.3
03-464	.0	0.1	0.2	0.5	0.7	1.1	1.4	1.7
03-465	.0	0.1	0.3	0.9	1.4	2.1	2.7	3.3
03-466	.0	0.2	0.7	1.8	2.8	4.3	5.5	6.7
03-467	.0	5.0	5.9	8.7	11.6	16.4	20.6	24.4
03-468	.0	4.7	7.2	14.0	20.5	30.9	39.7	47.5
03-469	.0	0.7	1.8	4.5	6.9	10.6	13.7	16.5
03-471	.0	1.7	2.9	6.1	9.0	13.7	17.7	21.2
03-474	.0	0.6	3.1	8.3	12.9	20.0	26.8	31.3
03-475	.0	0.1	0.2	0.5	0.7	1.1	1.4	1.7
03-476	.0	0.0	0.2	0.4	0.7	1.0	1.3	1.6

03-477	.0	0.4	1.8	4.8	7.4	11.5	14.9	17.9
03-478	.0	0.2	0.8	2.2	3.4	5.4	6.9	8.4
03-479	.0	4.6	13.2	32.7	50.0	77.5	100.4	120.8
03-480	.0	0.0	0.2	0.4	0.7	1.1	1.4	1.7
03-481	.0	5.0	5.8	8.3	10.9	15.3	19.1	22.5
03-482	.0	0.1	0.2	0.3	0.5	0.7	0.9	1.1
03-485	.0	0.3	0.4	0.5	0.7	1.0	1.3	1.6
03-486	.0	25.6	72.5	179.2	274.4	424.7	550.3	662.2
03-486	1.0	18.8	53.2	131.5	201.3	311.6	403.8	485.9
03-489	.0	14.2	25.7	55.4	82.7	126.3	162.9	195.6
03-491	.0	0.8	9.1	24.8	38.5	60.1	78.0	94.0
03-492	.0	0.9	1.1	1.7	2.3	3.3	4.2	5.0
03-493	.0	1.6	2.2	3.9	5.5	8.2	10.4	12.4
03-494	.0	0.3	0.8	1.8	2.8	4.3	5.5	6.7
03-495	.0	0.0	0.2	0.5	0.7	1.1	1.4	1.7
03-496	.0	0.1	0.3	0.9	1.4	2.2	2.8	3.4
03-501	.0	0.2	1.1	3.0	4.6	7.1	9.2	11.1
03-503	.0	20.4	32.0	63.5	93.2	140.9	181.0	216.9
03-504	.0	1.6	4.2	10.3	15.8	24.4	31.5	38.0
03-505	.0	18.0	37.4	85.2	128.7	197.6	255.4	307.0
03-506	.0	5.3	6.1	8.7	11.3	15.8	19.7	23.2
03-507	.0	0.3	2.0	5.4	8.4	13.1	17.0	20.4
03-508	.0	0.3	1.7	4.5	7.0	10.9	14.1	17.0
03-509	.0	36.5	38.9	47.5	56.9	73.4	88.1	101.5
03-512	.0	0.5	1.9	4.9	7.5	11.7	15.1	18.2
03-513	.0	8.7	24.5	60.7	92.9	143.8	186.4	224.3
03-513	.0	6.6	18.7	46.2	70.8	109.6	142.0	170.8
03-513	.0	6.9	19.5	48.2	73.8	114.2	148.0	178.1
03-515	.0	0.7	2.0	4.9	7.6	11.7	15.2	18.3
03-516	.0	1.0	3.2	8.0	12.4	19.1	24.8	29.9
03-518	.0	2.9	3.4	4.9	6.4	9.0	11.3	13.3
03-519	.0	3.3	16.6	43.8	67.8	105.5	136.9	164.9
03-520	.0	10.1	28.6	70.6	108.1	167.3	216.8	260.9
03-521	.0	0.6	1.8	4.5	6.9	10.7	13.8	16.6
03-522	.0	20.2	42.0	95.7	144.5	221.9	286.9	344.8
03-522	.0	13.2	27.4	62.5	94.3	144.9	187.3	225.1
03-522	.0	15.3	31.7	72.3	109.1	167.7	216.7	260.5
03-523	.0	1.7	4.4	10.6	16.2	25.1	32.5	39.1
03-525	.0	8.0	8.4	10.0	11.7	14.7	17.4	20.0
03-527	.0	0.8	1.3	2.5	3.6	5.4	6.9	8.3
03-529	.0	26.9	41.2	80.6	117.8	177.7	228.2	273.3
03-531	.0	12.1	14.8	23.2	31.6	45.6	57.6	68.3
03-532	.0	20.6	28.0	49.6	70.6	104.7	133.6	159.5
03-533	.0	1.0	2.9	7.2	11.0	17.1	22.1	26.6
03-534	.0	0.2	0.6	1.4	2.1	3.2	4.2	5.0
03-535	.0	18.5	57.5	144.6	221.9	343.9	445.8	536.6
03-535	.0	14.5	44.9	113.0	173.4	268.7	348.3	419.2
03-535	.0	14.4	44.8	112.5	172.6	267.5	346.7	417.4
03-536	.0	1.0	5.8	15.5	23.9	37.3	48.4	58.3
03-539	.0	1.0	2.8	7.0	10.7	16.6	21.5	25.8
03-542	.0	1.3	5.3	13.9	21.4	33.3	43.1	52.0
03-544	.0	0.3	1.0	2.4	3.6	5.6	7.2	8.7
03-546	.0	4.0	16.2	42.2	65.0	101.0	131.1	157.8
03-547	.0	3.0	4.7	9.5	14.0	21.2	27.2	32.6
03-548	.0	9.9	34.7	88.7	136.4	211.7	274.5	330.5
03-549	.0	4.3	11.4	27.7	42.3	65.4	84.7	101.9

03-550	1.0	2.1	3.4	7.0	10.3	15.5	20.0	23.9
03-552	.0	24.2	39.4	80.2	118.3	179.5	230.9	276.9
03-553	.0	1.1	4.5	11.7	18.1	28.1	36.5	43.9
03-555	.0	1.6	2.5	5.1	7.5	11.4	14.7	17.6
03-556	.0	1.0	1.6	3.2	4.8	7.3	9.4	11.2
03-559	.0	1.0	3.2	8.0	12.2	18.9	24.5	29.5
03-561	.0	2.3	11.4	30.1	46.6	72.5	94.1	113.3
03-562	.0	2.7	3.2	4.9	6.6	9.4	11.9	14.1
03-563	.0	0.6	2.6	6.8	10.4	16.2	21.1	25.4
03-564	.0	0.2	1.7	4.5	7.0	10.9	14.2	17.1
03-565	.0	8.2	9.1	12.2	15.5	21.1	26.0	30.5
03-566	.0	0.4	0.4	0.6	0.8	1.1	1.3	1.5
03-567	1.0	7.0	11.2	22.7	33.5	50.7	65.2	78.2
03-569	.0	31.6	43.4	77.7	110.8	164.7	210.3	251.2
03-570	.0	0.1	0.2	0.5	0.7	1.1	1.4	1.7
03-573	.0	2.3	5.4	12.9	19.6	30.2	39.1	47.0
03-574	.0	0.4	0.5	0.7	0.9	1.2	1.5	1.8
03-575	.0	0.1	0.2	0.4	0.6	1.0	1.3	1.5
03-576	.0	0.5	1.3	3.2	4.9	7.5	9.8	11.7
03-578	.0	1.2	3.2	7.7	11.8	18.3	23.7	28.5
03-579	.0	1.3	5.4	13.9	21.5	33.4	43.3	52.1
03-580	.0	0.0	0.3	0.9	1.4	2.2	2.8	3.4
03-581	.0	0.5	2.3	6.0	9.3	14.4	18.7	22.6
03-585	.0	32.3	41.1	67.8	94.2	137.6	174.6	207.8
03-585	2.0	22.8	29.0	47.8	66.4	97.0	123.0	146.4
03-585	2.0	28.0	35.6	58.8	81.7	119.3	151.3	180.1
03-587	.0	0.8	2.4	5.9	9.0	14.0	18.1	21.8
03-589	.0	4.5	14.1	35.4	54.3	84.1	109.1	131.3
03-590	.0	8.5	24.0	59.5	91.0	140.9	182.6	219.7
03-590	1.0	6.2	17.6	43.5	66.6	103.2	133.7	160.8
03-590	1.0	7.4	21.0	52.0	79.7	123.3	159.8	192.3
03-592	.0	10.2	36.1	92.4	142.2	220.8	286.3	344.7
03-592	.0	7.6	26.8	68.7	105.7	164.1	212.8	256.2
03-592	.0	6.9	24.3	62.1	95.6	148.4	192.5	231.7
03-593	.0	0.6	3.0	7.9	12.2	18.9	24.5	29.6
03-595	.0	0.1	0.2	0.4	0.7	1.0	1.3	1.6
03-596	.0	0.3	1.6	4.2	6.4	10.0	13.0	15.7
03-597	.0	11.9	29.5	70.7	107.7	166.3	215.3	259.0
03-598	.0	0.1	0.2	0.4	0.6	1.0	1.2	1.5
03-599	.0	0.6	1.7	4.3	6.5	10.1	13.1	15.7
03-600	.0	0.5	0.6	0.7	0.9	1.2	1.4	1.6
03-605	.5	0.5	0.7	1.5	2.2	3.4	4.3	5.2
03-607	1.0	14.4	38.0	92.6	141.5	218.7	283.2	340.7
03-612	.0	121.8	158.1	267.3	374.5	550.0	699.2	833.1
03-612	.0	135.6	176.2	297.8	417.2	612.7	778.9	928.2
03-613	.0	0.7	1.6	3.7	5.7	8.7	11.3	13.6
03-618	.0	0.9	2.1	4.9	7.5	11.6	14.9	18.0
03-620	.0	2.9	3.8	6.7	9.4	13.9	17.8	21.2
03-621	.0	2.2	2.9	5.1	7.2	10.6	13.6	16.2
03-628	.0	0.1	0.2	0.5	0.8	1.2	1.5	1.8
03-640	.0	0.6	1.1	2.4	3.6	5.5	7.1	8.5
03-645	.0	6.4	12.1	26.6	39.9	61.2	78.9	94.8
03-674	.0	0.7	1.7	4.2	6.4	9.8	12.7	15.3
03-679	.0	2.0	9.3	24.5	37.9	59.0	76.5	92.2

03=685	.0	20.5	38.8	85.4	128.1	196.1	253.1	304.0
03=685	.0	18.9	35.8	78.8	118.1	180.8	233.4	280.4
03=685	2.0	17.0	32.3	71.0	106.5	163.1	210.5	252.8
03=685	2.0	16.9	32.0	70.5	105.7	161.9	208.9	251.0
03=686	.0	6.2	8.6	15.7	22.5	33.6	42.9	51.3
03=687	.0	4.0	9.9	23.8	36.2	56.0	72.4	87.1
03=689	1.5	23.4	35.1	67.7	98.6	148.4	190.3	227.9
03=690	.0	12.1	20.4	42.2	62.6	95.1	122.5	146.9
03=697	.0	15.3	38.0	91.3	139.2	214.9	278.2	334.6
03=778	3.0	9.4	15.2	30.7	45.2	68.5	88.1	105.6
03=801	.0	0.0	0.2	0.5	0.7	1.2	1.5	1.8
03=836	.0	0.1	0.2	0.5	0.8	1.2	1.5	1.9
09= 1	.0	1.3	3.0	7.0	10.7	16.5	21.4	25.7
09= 29	.0	0.7	3.0	7.9	12.2	18.9	24.6	29.6
09= 46	.0	1.7	2.7	5.4	7.9	12.0	15.5	18.5
09= 72	.0	8.7	14.4	29.6	43.7	66.4	85.5	102.5
09= 74	.0	9.0	16.0	34.1	50.8	77.4	99.8	119.8

TABLE 2B

TOTAL DOSE TO SKELETON IN RADS. COMPUTED BY THREE EXPONENTIALS
 GROUPED BY RADIOLOGICAL OR CLINICAL DIAGNOSIS AT TIME OF X-RAY
 LISTED BY ASCENDING PATIENT NUMBER
 ONE SET OF DATA PER GAMMA RAY MEASUREMENT

PT. NO.	X-RAY SCORE	ELAPSED TIME SINCE CESSATION OF INGESTION						
		1 DAY	1 YR	5 YR	10 YR	20 YR	30 YR	40 YR
		ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION						
03-401	39.5	375.5	609.2	1463.0	2433.0	3863.5	4808.0	5421.5
03-401	43.5	408.8	663.3	1614.6	2649.0	4206.6	5234.9	5902.8
03-402	24.0	222.0	335.1	758.8	1217.9	1908.0	2363.1	2658.4
03-402	26.0	240.1	362.4	820.7	1317.2	2063.7	2555.9	2875.3
03-402	33.0	265.8	401.2	908.5	1458.2	2284.6	2829.5	3183.0
03-402	33.0	324.5	489.8	1109.3	1780.4	2789.4	3454.7	3886.4
03-402	33.0	283.8	428.4	970.2	1557.2	2439.6	3021.5	3399.1
03-404	22.0	220.6	328.1	731.1	1167.4	1823.0	2255.1	2535.5
03-404	22.0	243.3	361.9	806.4	1287.6	2010.6	2487.3	2796.5
03-431	16.0	378.9	549.1	1187.1	1876.7	2912.2	3594.5	4036.8
03-431	16.0	359.7	521.4	1127.1	1781.9	2765.1	3412.9	3832.8
03-449	30.0	357.3	506.0	1063.1	1664.5	2566.8	3160.9	3545.9
03-473	39.0	258.4	389.8	882.3	1415.9	2218.1	2747.1	3090.3
03-473	43.0	287.7	434.1	982.5	1576.7	2469.9	3058.9	3441.1
03-528	17.0	425.9	593.8	1222.5	1900.6	2917.4	3586.5	4020.0
03-540	29.0	441.7	666.6	1509.7	2423.2	3796.4	4701.8	5289.4
03-540	34.0	443.1	668.8	1514.7	2431.2	3808.9	4717.4	5306.8
03-540	33.0	504.7	761.8	1725.2	2769.1	4338.3	5373.0	6044.4
03-540	33.0	571.9	863.2	1954.7	3137.5	4915.4	6087.8	6848.6
03-551	39.5	272.5	381.9	791.3	1232.9	1895.4	2331.4	2613.9
03-551	51.0	345.2	483.7	1002.4	1561.9	2401.1	2953.4	3311.2
03-551	38.0	421.9	591.1	1224.8	1908.5	2933.9	3608.8	4046.0
03-551	38.0	370.0	518.4	1074.2	1673.8	2573.2	3165.1	3548.6
03-551	41.0	438.0	613.7	1271.6	1981.4	3045.9	3746.7	4200.6
03-554	19.0	302.0	528.3	1369.2	2286.1	3668.7	4582.3	5176.3
03-571	20.0	96.3	215.9	633.9	1092.5	1705.5	2244.2	2542.9
03-571	16.0	96.4	216.1	634.7	1093.8	1787.7	2247.0	2546.0
03-571	16.0	94.0	210.7	618.7	1066.3	1742.8	2190.5	2482.0
03-571	18.0	111.6	250.1	734.4	1265.7	2068.6	2600.0	2946.0
03-571	18.0	134.6	301.8	886.2	1527.3	2496.3	3137.6	3555.1
03-619	-	188.9	392.3	1121.6	1920.7	3127.7	3926.3	4446.1
03-657	-	1605.8	2249.9	4662.1	7264.4	11167.5	13736.6	15400.8
03-671	-	171.0	561.7	1751.4	3060.2	5040.2	6351.5	7205.7
03-726	25.0	228.3	318.3	655.1	1018.4	1563.2	1921.7	2153.9

MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION

03-404	17.0	190.6	283.5	631.6	1008.5	1574.8	1948.1	2190.3
03-404	24.0	203.5	302.8	674.6	1077.1	1682.0	2080.8	2339.4
03-404	24.0	186.1	276.8	616.8	984.9	1538.0	1902.6	2139.1
03-405	22.0	119.7	194.1	472.3	774.8	1230.3	1531.0	1726.4
03-405	15.5	100.1	162.3	395.0	648.0	1029.0	1280.5	1443.9
03-405	15.5	96.6	156.7	381.3	625.5	993.2	1236.0	1393.7
03-405	22.0	125.4	203.4	495.0	812.0	1289.4	1604.5	1809.2
03-407	19.0	266.1	398.7	895.6	1433.9	2242.8	2776.2	3122.2
03-416	18.0	224.2	398.2	1043.6	1747.7	2809.6	3511.4	3967.8
03-416	18.0	271.5	482.3	1263.8	2116.5	3402.4	4252.4	4805.0
03-423	12.5	142.5	215.1	487.2	782.0	1225.2	1517.4	1707.0
03-423	27.0	129.4	195.4	442.4	710.1	1112.6	1377.9	1550.1
03-423	22.0	121.1	182.7	413.8	664.2	1040.5	1288.7	1449.8
03-423	27.0	138.6	209.2	473.7	760.3	1191.2	1475.3	1659.6
03-429	18.0	396.3	602.9	1377.1	2216.2	3478.0	4310.1	4850.1
03-429	18.0	425.1	646.7	1477.1	2377.2	3730.5	4623.1	5202.3
03-429	18.0	414.7	630.9	1440.9	2319.0	3639.2	4509.9	5075.0
03-429	28.0	468.7	713.0	1628.5	2620.9	4113.0	5097.0	5735.6
03-429	28.0	551.4	838.8	1915.9	3083.4	4838.8	5996.5	6747.8
03-431	11.0	320.0	463.9	1002.7	1585.3	2460.0	3036.3	3409.9
03-455	15.0	106.5	195.7	524.9	884.6	1427.2	1785.9	2019.2
03-459	18.0	123.6	242.4	675.1	1148.5	1863.3	2336.1	2643.8
03-459	19.0	128.7	252.5	703.1	1196.1	1940.6	2433.0	2753.4
03-459	19.0	130.7	256.3	713.6	1214.0	1969.6	2469.4	2794.6
03-459	19.0	118.3	231.9	645.8	1098.8	1782.6	2234.9	2529.2
03-484	18.0	406.7	589.5	1274.3	2014.6	3126.2	3858.5	4333.3
03-484	22.0	456.4	661.5	1429.9	2260.7	3518.1	4329.9	4862.6
03-484	22.0	514.1	745.1	1610.6	2546.4	3951.4	4877.1	5477.2
03-499	19.0	32.1	58.9	158.1	266.4	429.9	537.9	608.2
03-499	18.0	35.1	64.5	173.1	291.7	470.6	588.8	665.8
03-558	15.0	8.2	23.3	71.6	124.7	205.0	258.2	292.8
03-586	20.0	185.2	311.2	781.4	1293.3	2064.6	2574.0	2905.1
03-586	20.0	186.7	313.7	787.5	1303.4	2080.7	2594.2	2927.9
09- 4	27.5	394.9	474.6	770.1	1085.0	1553.3	1859.4	2056.2

MILD CHANGES TYPICAL OF RADIUM DEPOSITION

03-416	10.5	176.5	313.4	821.4	1375.6	2211.4	2763.8	3123.0
03-416	10.5	172.5	306.4	803.0	1344.8	2161.9	2702.0	3053.1
03-416	16.0	202.5	359.7	942.7	1578.8	2538.1	3172.1	3584.3
03-417	10.0	112.0	202.1	535.6	899.8	1449.0	1812.1	2048.2
03-417	10.0	97.1	175.3	464.5	780.3	1256.6	1571.5	1776.3
03-417	10.0	95.6	172.7	457.6	768.7	1238.0	1548.2	1749.9
03-417	10.0	104.0	187.7	497.5	835.7	1345.8	1683.0	1902.3
03-428	7.0	64.5	133.7	382.0	654.0	1064.8	1336.7	1513.6
03-428	9.0	68.4	141.7	404.6	692.7	1127.9	1415.9	1603.3
03-428	9.0	68.7	142.4	406.7	696.2	1133.6	1423.0	1611.4
03-429	14.0	382.8	582.3	1330.0	2140.4	3358.9	4162.6	4684.1
03-433	15.0	199.9	327.8	805.8	1325.8	2118.8	2625.9	2961.8
03-433	15.0	219.5	359.9	884.6	1455.4	2315.1	2882.8	3251.6
03-433	15.0	214.8	352.2	865.7	1424.3	2265.6	2821.1	3182.0

03-445	11.0	421.9	604.2	1287.3	2025.3	3132.9	3862.4	4335.3
03-445	11.0	516.8	740.1	1576.8	2480.7	3837.5	4731.0	5310.2
03-445	17.0	458.8	657.1	1400.0	2202.5	3407.0	4200.3	4714.5
03-449	10.0	381.1	539.7	1133.8	1775.1	2737.4	3371.0	3781.5
03-462	5.0	114.5	162.1	340.5	533.2	822.2	1012.5	1135.9
03-462	5.0	116.1	164.4	345.4	540.7	833.8	1026.8	1151.9
03-462	14.0	106.2	150.4	315.9	494.6	762.7	939.3	1053.7
03-462	14.0	95.2	134.8	283.2	443.4	683.8	842.0	944.6
03-502	7.0	47.2	68.4	148.0	233.9	363.0	448.0	503.1
03-510	14.0	122.5	214.1	554.7	926.2	1406.2	1856.3	2096.9
03-510	14.0	121.6	212.7	551.0	919.9	1476.1	1843.6	2082.6
03-529	12.0	30.2	46.3	106.8	172.3	270.9	335.9	378.1
03-529	12.0	38.4	58.8	135.6	218.8	344.0	426.6	480.2
03-530	7.0	104.2	170.9	420.0	691.0	1099.1	1368.6	1543.7
03-530	13.0	99.0	162.4	399.1	656.6	1044.5	1300.6	1467.0
03-530	13.0	94.4	154.9	380.6	626.2	996.2	1240.4	1399.1
03-586	10.0	180.1	302.7	759.9	1257.8	2007.9	2503.4	2825.4
03-586	10.0	170.6	286.6	719.6	1191.1	1901.4	2370.6	2675.5
03-586	10.0	174.7	293.6	737.1	1220.0	1947.7	2428.3	2740.6
03-588	6.0	110.4	157.3	332.6	522.0	806.3	993.5	1114.7
03-588	15.0	98.1	139.7	295.5	463.8	716.3	882.6	990.3
03-588	15.0	90.4	128.7	272.3	427.3	659.9	813.1	912.4
03-594	13.0	5.5	10.4	28.2	47.6	76.9	96.4	109.0

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-412	8.0	62.5	93.7	210.8	337.5	528.0	653.6	735.1
03-412	1.0	64.9	97.3	218.8	350.4	548.2	678.5	763.1
03-412	8.0	53.3	79.9	179.7	287.7	450.1	557.2	626.6
03-412	8.0	59.1	88.6	199.2	319.0	499.1	617.8	694.8
03-417	2.5	106.4	192.1	509.1	855.3	1377.3	1722.5	1946.9
03-419	2.0	83.9	154.2	413.6	696.9	1124.4	1407.0	1590.8
03-419	2.0	93.7	172.3	462.2	778.8	1256.5	1572.3	1777.7
03-419	5.0	93.3	171.5	460.0	775.1	1250.6	1564.9	1769.4
03-419	5.0	97.0	178.3	478.3	806.0	1300.4	1627.2	1839.8
03-424	6.0	69.4	104.0	233.5	373.9	584.8	723.8	814.0
03-445	5.5	362.6	519.3	1106.4	1740.7	2692.7	3319.7	3726.1
03-445	5.5	386.8	554.0	1180.2	1856.7	2872.2	3541.0	3974.5
03-483	2.0	0.3	0.4	0.8	1.2	1.8	2.3	2.5
03-488	2.0	16.3	36.7	108.0	186.2	304.4	382.6	433.5
03-490	3.0	6.5	9.1	18.8	29.2	44.9	55.3	62.0
03-500	5.0	0.1	0.2	0.6	1.1	1.8	2.3	2.6
03-505	4.0	24.7	46.3	125.6	212.3	343.2	429.8	486.0
03-505	4.0	27.8	52.1	141.5	239.2	386.7	484.2	547.6
03-510	3.5	126.3	220.8	571.9	954.9	1532.2	1913.8	2161.8
03-520	5.0	12.9	28.9	84.9	146.3	239.2	300.6	340.6
03-520	5.0	15.8	33.6	98.5	169.8	277.5	348.8	395.2
03-524	2.5	5.7	12.9	37.8	65.2	106.5	133.9	151.7
03-526	3.0	0.1	0.2	0.6	1.0	1.6	2.0	2.3
03-568	4.5	31.2	43.8	90.7	141.3	217.2	267.2	299.6
03-572	3.0	8.0	17.3	50.0	85.9	140.1	176.0	199.3
03-577	4.0	15.9	25.3	60.5	98.7	156.3	194.3	218.9
03-591	1.0	15.7	16.4	19.0	21.6	25.5	28.0	29.6
03-604	1.0	6.0	7.2	11.6	16.4	23.4	28.0	31.0

03-614	4.0	18.2	33.5	89.9	151.6	244.5	306.0	346.0
03-615	1.0	4.4	7.0	16.5	26.9	42.5	52.9	59.6
03-727	6.0	57.2	87.0	198.6	319.7	501.6	621.7	699.5
03-727	6.0	71.0	108.0	246.7	397.1	623.2	772.3	869.0
09- 2	5.5	3.3	7.8	23.2	40.1	65.7	82.7	93.7
09- 7	3.0	8.1	12.8	30.7	50.0	79.2	98.4	110.9
09- 31	8.5	180.2	221.1	373.6	536.3	778.8	937.5	1039.7

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-403	.0	1.8	2.2	3.5	4.9	6.9	8.3	9.1
03-406	.0	3.9	4.5	7.0	9.7	13.7	16.3	17.9
03-408	.0	20.9	36.0	92.2	153.5	245.9	306.9	346.6
03-410	.0	10.0	15.8	37.8	61.7	97.6	121.3	136.7
03-411	.0	0.3	0.4	0.5	0.7	1.0	1.2	1.3
03-415	.0	5.7	6.3	8.6	11.0	14.6	16.9	18.4
03-418	.0	2.8	3.2	4.6	6.2	8.5	10.0	10.9
03-420	.0	4.1	5.9	12.3	19.3	29.7	36.6	41.0
03-422	.0	2.8	5.6	15.7	26.8	43.5	54.6	61.8
03-426	.0	29.7	50.6	128.2	212.7	340.1	424.3	479.0
03-427	.0	3.9	8.1	23.1	39.6	64.5	81.0	91.7
03-427	.0	3.2	6.6	18.9	32.4	52.8	66.3	75.0
03-432	.0	7.2	11.5	27.5	44.8	70.9	88.2	99.4
03-434	.0	1.2	1.9	4.3	6.8	10.7	13.3	15.0
03-434	.0	1.4	2.1	4.8	7.7	12.0	14.9	16.8
03-435	.0	0.7	1.1	2.5	4.1	6.5	8.1	9.1
03-436	.0	10.3	11.7	17.0	22.5	30.8	36.1	39.5
03-437	.0	5.7	10.7	29.0	49.1	79.4	99.4	112.4
03-441	.0	5.1	10.6	30.2	51.7	84.2	105.7	119.7
03-442	.0	0.8	2.3	7.1	12.4	20.4	25.7	29.1
03-443	.0	0.2	0.2	0.4	0.6	0.9	1.1	1.2
03-444	.0	1.3	4.1	12.9	22.6	37.2	46.9	53.2
03-444	.0	1.0	3.3	10.3	18.0	29.6	37.3	42.3
03-446	.0	31.4	44.1	91.3	142.2	218.7	269.0	301.6
03-446	1.0	28.0	39.2	81.1	126.4	194.4	239.1	268.1
03-446	1.0	31.9	44.8	92.7	144.5	222.2	273.3	306.4
03-447	.0	0.1	0.3	1.1	1.9	3.2	4.0	4.5
03-450	.0	1.5	3.7	11.3	19.7	32.3	40.6	46.1
03-452	.0	3.5	7.8	22.9	39.4	64.4	80.9	91.7
03-452	.0	2.7	6.0	17.7	30.5	49.8	62.6	70.9
03-456	.0	5.2	6.2	10.1	14.2	20.3	24.3	26.9
03-457	.0	1.1	1.3	2.0	2.7	3.8	4.5	5.0
03-458	.0	3.0	3.4	4.8	6.4	8.7	10.1	11.1
03-460	1.0	1.0	2.4	7.2	12.4	20.4	25.6	29.0
03-461	.0	0.3	1.2	3.7	6.5	10.7	13.5	15.3
03-464	.0	0.1	0.2	0.6	1.0	1.7	2.1	2.4
03-465	.0	0.1	0.3	1.1	1.9	3.1	3.9	4.4
03-466	.0	0.2	0.7	2.3	4.0	6.5	8.2	9.3
03-467	.0	5.1	6.2	10.0	14.1	20.2	24.2	26.7
03-468	.0	4.8	7.3	16.9	27.3	43.0	53.3	60.0
03-469	.0	0.9	1.9	5.6	9.6	15.6	19.6	22.2
03-471	.0	1.8	2.9	7.3	11.9	19.0	23.6	26.7
03-474	.0	1.0	3.3	10.2	17.8	29.3	36.9	41.9
03-475	.0	0.1	0.2	0.7	1.1	1.8	2.2	2.5
03-476	.0	0.0	0.2	0.5	0.9	1.4	1.8	2.0

03-477	.0	0.6	1.8	5.7	10.0	16.5	20.7	23.5
03-478	.0	0.3	0.9	2.8	5.0	8.2	10.3	11.7
03-479	.0	6.4	14.3	42.0	72.4	118.3	148.7	168.4
03-480	.0	0.1	0.2	0.6	1.0	1.7	2.1	2.4
03-481	.0	3.7	4.4	6.8	9.4	13.2	15.7	17.3
03-482	.0	0.1	0.1	0.3	0.4	0.7	0.8	0.9
03-485	.0	0.3	0.3	0.6	0.8	1.2	1.5	1.6
03-486	.0	33.8	75.8	222.6	383.6	627.0	788.0	892.9
03-486	1.0	32.6	73.1	214.6	369.9	604.6	759.9	861.0
03-489	.0	15.0	25.8	66.1	110.1	176.4	220.2	248.7
03-491	.0	1.7	10.0	32.0	56.2	92.8	117.1	132.9
03-492	.0	0.6	0.8	1.3	1.9	2.8	3.4	3.8
03-493	.0	2.1	2.8	5.7	8.8	13.5	16.5	18.5
03-494	.0	0.4	0.8	2.3	3.9	6.4	8.0	9.0
03-495	.0	0.1	0.2	0.6	1.1	1.7	2.2	2.5
03-496	.0	0.1	0.4	1.2	2.1	3.5	4.4	5.0
03-501	.0	0.3	1.1	3.3	5.8	9.6	12.1	13.8
03-503	.0	24.2	37.8	88.6	143.8	226.8	281.6	317.1
03-504	.0	2.3	4.9	14.3	24.5	40.0	50.3	57.0
03-505	.0	22.4	42.0	114.1	192.9	311.7	390.3	441.5
03-506	.0	4.4	5.1	7.8	10.7	15.0	17.8	19.6
03-507	.0	0.6	2.3	7.3	12.7	21.0	26.5	30.0
03-508	.0	0.6	1.9	6.1	10.6	17.5	22.0	25.0
03-509	.0	37.2	39.8	49.5	59.6	74.4	83.9	89.9
03-512	.0	0.7	2.0	6.0	10.5	17.3	21.8	24.7
03-513	.0	11.6	25.9	76.1	131.1	214.3	269.3	305.2
03-513	.0	11.4	25.6	75.1	129.5	211.6	265.9	301.3
03-513	.0	11.9	26.7	78.3	135.0	220.6	277.3	314.2
03-515	.0	0.9	2.1	6.2	10.7	17.5	21.9	24.9
03-516	.0	1.4	3.4	10.1	17.4	28.5	35.8	40.6
03-518	.0	2.2	2.6	4.1	5.6	8.0	9.5	10.5
03-519	.0	5.5	18.2	56.8	99.3	163.5	206.0	233.7
03-520	.0	13.4	30.1	88.5	152.6	249.4	313.4	355.1
03-521	.0	0.9	1.9	5.6	9.7	15.9	20.0	22.6
03-522	.0	27.0	50.7	137.7	232.8	376.3	471.2	532.9
03-522	.0	21.5	40.3	109.4	184.9	298.9	374.3	423.3
03-522	.0	24.9	46.6	126.6	213.9	345.8	433.0	489.7
03-523	.0	2.3	4.9	14.2	24.4	39.7	49.9	56.5
03-525	.0	8.3	8.7	10.4	12.2	14.7	16.4	17.4
03-527	.0	0.9	1.3	3.0	4.9	7.7	9.5	10.7
03-529	.0	33.2	51.0	117.4	189.5	297.9	369.5	415.9
03-531	.0	13.0	16.3	28.5	41.5	60.9	73.7	81.9
03-532	.0	21.1	29.3	59.9	93.0	142.5	175.1	196.3
03-533	.0	1.4	3.1	9.1	15.7	25.6	32.2	36.5
03-534	.0	0.3	0.6	1.7	3.0	4.8	6.1	6.9
03-535	.0	28.7	67.9	202.3	349.9	573.0	720.7	816.9
03-535	.0	27.1	64.1	191.0	330.3	541.0	680.4	771.2
03-535	.0	26.9	63.8	190.2	328.9	538.6	677.4	767.8
03-536	.0	1.8	6.2	19.5	34.1	56.2	70.9	80.4
03-539	.0	1.5	3.3	9.7	16.6	27.2	34.2	38.7
03-542	.0	2.3	6.3	19.5	33.9	55.7	70.2	79.6
03-544	.0	0.5	1.1	3.3	5.7	9.4	11.8	13.4
03-546	.0	6.1	17.2	52.9	92.0	151.3	190.6	216.1
03-547	.0	3.5	5.4	12.9	20.9	33.1	41.1	46.3
03-548	.0	16.3	41.6	125.9	218.4	358.4	451.0	511.4
03-549	.0	5.7	12.1	35.2	60.4	98.6	123.9	140.3

03-550	1.0	3.1	4.9	11.6	19.0	30.1	37.4	42.1
03-552	.0	27.8	44.6	107.5	175.8	278.8	346.7	390.8
03-553	.0	1.0	5.0	15.4	26.8	44.0	55.5	62.9
03-555	.0	1.5	2.5	5.9	9.6	15.2	18.9	21.3
03-556	.0	1.0	1.5	3.7	6.1	9.7	12.0	13.6
03-559	.0	1.6	3.8	11.2	19.4	31.8	40.0	45.3
03-561	.0	3.9	12.7	39.5	69.1	113.8	143.4	162.7
03-562	.0	2.5	3.1	5.3	7.6	11.0	13.2	14.7
03-563	.0	0.9	2.9	8.9	15.5	25.5	32.1	36.4
03-564	.0	0.4	1.9	6.2	10.8	17.8	22.5	25.5
03-565	.0	7.8	8.8	12.4	16.2	21.9	25.6	27.9
03-566	.0	0.4	0.4	0.6	0.8	1.1	1.3	1.5
03-567	1.0	8.4	13.3	31.8	51.9	82.1	102.0	115.0
03-569	.0	37.5	52.5	108.8	169.6	260.7	320.6	359.5
03-570	.0	0.1	0.2	0.6	1.0	1.6	2.1	2.3
03-573	.0	2.9	5.9	16.5	28.2	45.9	57.6	65.2
03-574	.0	0.6	0.7	1.0	1.3	1.8	2.1	2.3
03-575	.0	0.1	0.1	0.4	0.7	1.2	1.5	1.7
03-576	.0	0.7	1.4	4.1	7.0	11.4	14.4	16.3
03-578	.0	1.6	3.4	9.9	17.1	27.8	35.0	39.6
03-579	.0	2.3	6.4	19.7	34.3	56.4	71.0	80.5
03-580	.0	0.1	0.4	1.2	2.2	3.6	4.5	5.1
03-581	.0	0.9	2.7	8.5	14.9	24.4	30.8	34.9
03-585	.0	44.7	58.3	108.9	163.3	244.6	298.0	332.4
03-585	2.0	40.5	52.9	98.8	148.1	221.8	270.2	301.5
03-585	2.0	49.9	65.0	121.5	182.1	272.8	332.3	370.8
03-587	.0	1.1	2.6	7.5	13.0	21.3	26.7	30.3
03-589	.0	6.7	15.9	47.4	82.0	134.3	168.9	191.5
03-590	.0	12.9	28.9	85.0	146.4	239.3	300.8	340.8
03-590	1.0	11.4	25.5	75.0	129.2	211.2	265.5	300.8
03-590	1.0	13.6	30.5	89.6	154.5	252.5	317.4	359.6
03-592	.0	17.2	44.1	133.5	231.8	380.5	478.9	543.0
03-592	.0	16.3	41.9	126.8	220.2	361.3	454.8	515.7
03-592	.0	14.7	37.9	114.7	199.1	326.8	411.3	466.4
03-593	.0	1.1	3.6	11.2	19.5	32.1	40.5	45.9
03-595	.0	0.1	0.2	0.5	0.9	1.5	1.8	2.1
03-596	.0	0.6	1.9	5.9	10.3	17.0	21.5	24.3
03-597	.0	15.4	32.0	91.3	156.4	254.6	319.6	361.9
03-598	.0	0.1	0.2	0.4	0.7	1.1	1.4	1.6
03-599	.0	0.9	2.1	6.1	10.6	17.3	21.7	24.6
03-600	.0	0.6	0.6	0.8	1.0	1.2	1.4	1.5
03-605	.5	0.6	0.9	2.1	3.5	5.5	6.8	7.7
03-607	1.0	21.7	46.7	135.1	232.1	378.7	475.6	538.8
03-612	.0	172.1	229.0	441.4	669.8	1011.6	1236.3	1381.5
03-612	.0	193.4	257.2	496.0	752.6	1136.7	1389.0	1552.2
03-613	.0	0.9	1.8	4.9	8.4	13.7	17.2	19.4
03-618	.0	1.4	2.8	7.7	13.1	21.3	26.7	30.2
03-620	.0	2.0	2.7	5.5	8.4	12.8	15.7	17.6
03-621	.0	1.5	2.1	4.2	6.4	9.8	12.0	13.4
03-628	.0	0.1	0.3	0.8	1.4	2.3	2.9	3.2
03-640	.0	0.7	1.2	3.2	5.4	8.7	10.9	12.3
03-645	.0	7.5	13.3	34.9	58.5	94.0	117.5	132.8
03-674	.0	0.9	2.0	5.6	9.6	15.6	19.5	22.1
03-679	.0	2.9	9.3	28.8	50.3	82.8	104.3	118.3

03-685	.0	29.8	52.9	138.6	232.1	373.2	466.4	527.0
03-685	.0	27.5	48.8	127.8	214.1	344.1	430.1	486.0
03-685	2.0	28.0	49.8	130.4	218.4	351.1	438.8	495.8
03-685	2.0	27.8	49.4	129.4	216.8	348.4	435.5	492.1
03-686	.0	8.5	12.0	25.5	40.0	61.7	76.0	85.3
03-687	.0	5.4	11.2	32.0	54.9	89.3	112.1	127.0
03-689	1.5	28.3	42.8	96.9	155.5	243.6	301.7	339.4
03-690	.0	11.4	18.7	45.9	75.5	120.0	149.5	168.6
03-697	.0	27.0	56.0	160.1	274.1	446.3	560.3	634.5
03-778	3.0	15.7	24.9	59.6	97.2	153.8	191.2	215.5
03-801	.0	0.1	0.2	0.8	1.3	2.2	2.7	3.1
03-836	.0	0.1	0.3	0.9	1.5	2.5	3.1	3.5
09- 1	.0	2.1	4.2	11.8	20.1	32.6	40.9	46.4
09- 29	.0	1.6	4.4	13.6	23.7	39.0	49.1	55.7
09- 46	.0	2.4	3.8	9.2	15.0	23.7	29.5	33.2
09- 72	.0	13.1	21.2	51.7	84.8	134.7	167.6	189.0
09- 74	.0	14.1	23.9	60.6	100.6	160.9	200.8	226.7

TABLE 2C

DAILY DOSE RATE TO SKELETON IN RADS. COMPUTED BY POWER FUNCTION

GROUPED BY RADIOLOGICAL OR CLINICAL DIAGNOSIS AT TIME OF X-RAY
 LISTED BY ASCENDING PATIENT NUMBER
 ONE SET OF DATA PER GAMMA RAY MEASUREMENT

PT. NO.	X-RAY SCORE	ELAPSED TIME IN DAYS			ELAPSED TIME IN YEARS			
		1	10	100	49	5	20	40
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-401	39.5	0.8242	0.7879	0.6614	0.5309	0.3476	0.2234	0.1776
03-401	43.5	0.8027	0.7674	0.6442	0.5171	0.3386	0.2175	0.1730
03-402	24.0	0.3608	0.3475	0.2997	0.2472	0.1672	0.1088	0.0867
03-402	26.0	0.3621	0.3488	0.3008	0.2482	0.1678	0.1092	0.0871
03-402	33.0	0.3703	0.3566	0.3076	0.2538	0.1716	0.1117	0.0890
03-402	33.0	0.4521	0.4355	0.3755	0.3098	0.2095	0.1363	0.1087
03-402	33.0	0.3505	0.3376	0.2911	0.2409	0.1624	0.1057	0.0843
03-404	22.0	0.2449	0.2362	0.2047	0.1699	0.1156	0.0755	0.0602
03-404	22.0	0.2701	0.2605	0.2258	0.1873	0.1275	0.0833	0.0664
03-431	16.0	0.4152	0.4015	0.3511	0.2941	0.2027	0.1331	0.1063
03-431	16.0	0.3943	0.3812	0.3334	0.2792	0.1925	0.1264	0.1010
03-449	30.0	0.3366	0.3261	0.2873	0.2427	0.1693	0.1118	0.0894
03-473	39.0	0.3895	0.3751	0.3236	0.2670	0.1806	0.1175	0.0937
03-473	43.0	0.3789	0.3650	0.3148	0.2598	0.1757	0.1144	0.0912
03-528	17.0	0.4434	0.4302	0.3810	0.3237	0.2276	0.1509	0.1208
03-540	29.0	0.6769	0.6519	0.5622	0.4639	0.3136	0.2041	0.1628
03-540	34.0	0.6056	0.5833	0.5031	0.4151	0.2806	0.1826	0.1456
03-540	33.0	0.5991	0.5770	0.4976	0.4106	0.2776	0.1807	0.1441
03-540	33.0	0.6788	0.6538	0.5638	0.4652	0.3145	0.2047	0.1632
03-551	39.5	0.3179	0.3082	0.2725	0.2311	0.1621	0.1073	0.0859
03-551	38.0	0.3293	0.3193	0.2823	0.2394	0.1679	0.1112	0.0890
03-551	41.0	0.3508	0.3402	0.3008	0.2551	0.1789	0.1184	0.0948
03-551	31.0	0.3658	0.3547	0.3136	0.2660	0.1866	0.1235	0.0989
03-551	38.0	0.3888	0.3771	0.3334	0.2828	0.1983	0.1313	0.1051
03-554	19.0	0.7882	0.7466	0.6072	0.4732	0.3007	0.1912	0.1518
03-571	20.0	0.5949	0.5415	0.3896	0.2774	0.1648	0.1028	0.0813
03-571	16.0	0.5362	0.4881	0.3512	0.2501	0.1485	0.0926	0.0733
03-571	16.0	0.5227	0.4758	0.3423	0.2438	0.1448	0.0903	0.0714
03-571	18.0	0.5402	0.4917	0.3537	0.2519	0.1496	0.0933	0.0738
03-571	18.0	0.6519	0.5934	0.4269	0.3040	0.1805	0.1126	0.0891
03-619	-	0.7844	0.7237	0.5413	0.3952	0.2384	0.1493	0.1182
03-657	-	3.1002	3.0063	2.6582	2.2544	1.5812	1.0468	0.8379
03-671	-	2.8201	2.3862	1.4454	0.9528	0.5446	0.3368	0.2661
03-726	25.0	0.1727	0.1676	0.1484	0.1261	0.0887	0.0588	0.0471

MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION

03-404	17.0	0.2886	0.2783	0.2413	0.2001	0.1363	0.0889	0.0710
03-404	24.0	0.2598	0.2506	0.2172	0.1802	0.1227	0.0801	0.0639
03-404	24.0	0.2376	0.2292	0.1986	0.1648	0.1122	0.0732	0.0584
03-405	22.0	0.2231	0.2133	0.1791	0.1438	0.0941	0.0605	0.0481
03-405	15.5	0.2212	0.2114	0.1775	0.1425	0.0933	0.0600	0.0477
03-405	15.5	0.1996	0.1908	0.1602	0.1286	0.0842	0.0541	0.0430
03-405	22.0	0.2338	0.2235	0.1877	0.1507	0.0987	0.0634	0.0504
03-407	19.0	0.4168	0.4017	0.3474	0.2874	0.1950	0.1271	0.1014
03-416	18.0	0.5134	0.4853	0.3920	0.3037	0.1919	0.1218	0.0967
03-416	18.0	0.6217	0.5877	0.4748	0.3678	0.2324	0.1475	0.1171
03-423	12.5	0.2305	0.2220	0.1914	0.1579	0.1068	0.0695	0.0554
03-423	22.0	0.1826	0.1759	0.1517	0.1251	0.0846	0.0551	0.0439
03-423	27.0	0.1769	0.1704	0.1469	0.1212	0.0820	0.0533	0.0425
03-423	27.0	0.1894	0.1824	0.1573	0.1298	0.0878	0.0571	0.0455
03-429	18.0	0.5611	0.5400	0.4644	0.3820	0.2573	0.1672	0.1333
03-429	18.0	0.5978	0.5753	0.4948	0.4070	0.2742	0.1782	0.1420
03-429	18.0	0.5832	0.5613	0.4827	0.3971	0.2675	0.1738	0.1385
03-429	28.0	0.5763	0.5546	0.4770	0.3924	0.2643	0.1717	0.1369
03-429	28.0	0.6779	0.6525	0.5611	0.4616	0.3189	0.2020	0.1611
03-431	11.0	0.4256	0.4114	0.3598	0.3014	0.2078	0.1364	0.1090
03-455	15.0	0.3405	0.3203	0.2546	0.1946	0.1215	0.0769	0.0609
03-459	18.0	0.5229	0.4871	0.3751	0.2796	0.1712	0.1076	0.0852
03-459	19.0	0.4508	0.4199	0.3234	0.2410	0.1476	0.0928	0.0735
03-459	19.0	0.4575	0.4262	0.3282	0.2446	0.1498	0.0942	0.0746
03-459	19.0	0.3990	0.3717	0.2862	0.2133	0.1306	0.0821	0.0650
03-484	22.0	0.5088	0.4919	0.4302	0.3603	0.2484	0.1631	0.1303
03-484	18.0	0.4648	0.4494	0.3930	0.3291	0.2269	0.1490	0.1190
03-484	22.0	0.4517	0.4367	0.3819	0.3199	0.2205	0.1448	0.1157
03-499	9.0	0.1074	0.1010	0.0803	0.0614	0.0383	0.0242	0.0192
03-499	18.0	0.0988	0.0929	0.0739	0.0564	0.0353	0.0223	0.0177
03-558	15.0	0.0812	0.0708	0.0458	0.0309	0.0178	0.0110	0.0087
03-586	20.0	0.3502	0.3334	0.2759	0.2184	0.1410	0.0901	0.0716
03-586	20.0	0.3529	0.3360	0.2781	0.2202	0.1421	0.0908	0.0722
09- 4	27.5	0.1237	0.1215	0.1125	0.1009	0.0776	0.0544	0.0442

MILD CHANGES TYPICAL OF RADIUM DEPOSITION

03-416	10.5	0.5502	0.5201	0.4201	0.3254	0.2057	0.1306	0.1036
03-416	10.5	0.5199	0.4915	0.3970	0.3075	0.1944	0.1234	0.0979
03-416	16.0	0.5337	0.5045	0.4075	0.3157	0.1995	0.1266	0.1005
03-417	10.0	0.3173	0.2993	0.2400	0.1847	0.1161	0.0735	0.0583
03-417	10.0	0.2584	0.2437	0.1954	0.1504	0.0945	0.0599	0.0475
03-417	10.0	0.2545	0.2401	0.1925	0.1482	0.0931	0.0590	0.0468
03-417	10.0	0.2767	0.2610	0.2093	0.1611	0.1012	0.0641	0.0509
03-428	7.0	0.3390	0.3129	0.2343	0.1712	0.1033	0.0647	0.0512
03-428	9.0	0.3022	0.2789	0.2089	0.1526	0.0921	0.0577	0.0457
03-428	9.0	0.3037	0.2804	0.2099	0.1534	0.0926	0.0580	0.0459
03-429	14.0	0.6405	0.6165	0.5302	0.4361	0.2938	0.1909	0.1522
03-433	15.0	0.4606	0.4398	0.3676	0.2938	0.1915	0.1229	0.0977
03-433	15.0	0.3992	0.3812	0.3186	0.2547	0.1660	0.1065	0.0847
03-433	15.0	0.3907	0.3730	0.3118	0.2492	0.1624	0.1042	0.0828

03-445	11.0	0.4273	0.4136	0.3631	0.3055	0.2119	0.1395	0.1115
03-445	11.0	0.5234	0.5066	0.4448	0.3742	0.2595	0.1709	0.1366
03-445	17.0	0.4225	0.4089	0.3590	0.3020	0.2095	0.1379	0.1102
03-449	10.0	0.4437	0.4299	0.3788	0.3200	0.2232	0.1474	0.1179
03-462	5.0	0.1326	0.1284	0.1132	0.0956	0.0667	0.0440	0.0352
03-462	5.0	0.1319	0.1278	0.1126	0.0951	0.0663	0.0438	0.0350
03-462	14.0	0.1066	0.1033	0.0910	0.0769	0.0536	0.0354	0.0283
03-462	14.0	0.0956	0.0926	0.0816	0.0689	0.0481	0.0317	0.0254
03-502	7.0	0.0517	0.0500	0.0437	0.0366	0.0252	0.0166	0.0132
03-510	14.0	0.2964	0.2808	0.2284	0.1780	0.1132	0.0720	0.0571
03-510	14.0	0.2944	0.2789	0.2269	0.1768	0.1124	0.0715	0.0567
03-529	12.0	0.0352	0.0339	0.0290	0.0238	0.0160	0.0104	0.0083
03-529	12.0	0.0447	0.0430	0.0369	0.0302	0.0203	0.0132	0.0105
03-530	7.0	0.1931	0.1843	0.1541	0.1232	0.0803	0.0515	0.0409
03-530	13.0	0.1835	0.1752	0.1464	0.1170	0.0763	0.0489	0.0389
03-530	13.0	0.1750	0.1671	0.1397	0.1116	0.0728	0.0467	0.0371
03-586	10.0	0.4516	0.4300	0.3556	0.2817	0.1818	0.1162	0.0923
03-586	10.0	0.3700	0.3523	0.2915	0.2308	0.1490	0.0952	0.0757
03-586	10.0	0.3790	0.3609	0.2986	0.2364	0.1526	0.0975	0.0775
03-588	6.0	0.1259	0.1220	0.1073	0.0905	0.0629	0.0415	0.0332
03-588	15.0	0.1007	0.0975	0.0856	0.0723	0.0503	0.0332	0.0265
03-588	15.0	0.0928	0.0898	0.0790	0.0666	0.0463	0.0306	0.0244
03-594	13.0	0.0180	0.0169	0.0133	0.0101	0.0063	0.0039	0.0031

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-412	1.0	0.0994	0.0958	0.0828	0.0685	0.0464	0.0303	0.0241
03-412	8.0	0.0787	0.0759	0.0656	0.0542	0.0368	0.0240	0.0191
03-412	8.0	0.0671	0.0647	0.0559	0.0462	0.0314	0.0204	0.0163
03-412	8.0	0.0698	0.0672	0.0581	0.0481	0.0326	0.0212	0.0169
03-417	2.5	0.3510	0.3311	0.2655	0.2043	0.1284	0.0814	0.0645
03-419	2.0	0.2984	0.2807	0.2231	0.1705	0.1065	0.0674	0.0534
03-419	2.0	0.3142	0.2956	0.2350	0.1796	0.1122	0.0709	0.0562
03-419	5.0	0.2805	0.2639	0.2098	0.1603	0.1001	0.0633	0.0502
03-419	5.0	0.2917	0.2744	0.2181	0.1667	0.1041	0.0658	0.0522
03-424	6.0	0.1085	0.1045	0.0904	0.0748	0.0507	0.0331	0.0264
03-445	5.5	0.4522	0.4376	0.3842	0.3233	0.2242	0.1476	0.1180
03-445	5.5	0.4541	0.4395	0.3859	0.3246	0.2251	0.1482	0.1185
03-483	2.0	0.0003	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001
03-488	2.0	0.0950	0.0864	0.0620	0.0441	0.0262	0.0163	0.0129
03-490	3.0	0.0076	0.0074	0.0066	0.0056	0.0039	0.0026	0.0021
03-500	5.0	0.0008	0.0007	0.0004	0.0003	0.0002	0.0001	0.0001
03-505	4.0	0.0692	0.0649	0.0512	0.0388	0.0241	0.0152	0.0120
03-505	4.0	0.0780	0.0732	0.0576	0.0437	0.0271	0.0171	0.0136
03-510	3.5	0.3457	0.3275	0.2664	0.2076	0.1320	0.0839	0.0666
03-520	5.0	0.0623	0.0568	0.0408	0.0291	0.0173	0.0108	0.0085
03-520	5.0	0.0723	0.0659	0.0474	0.0337	0.0200	0.0125	0.0099
03-524	2.5	0.0360	0.0328	0.0236	0.0168	0.0100	0.0062	0.0049
03-526	3.0	0.0005	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001
03-568	4.5	0.0330	0.0320	0.0283	0.0240	0.0168	0.0112	0.0089
03-572	3.0	0.0441	0.0405	0.0298	0.0215	0.0129	0.0080	0.0064
03-577	4.0	0.0279	0.0267	0.0226	0.0183	0.0121	0.0078	0.0062
03-591	3.0	0.0020	0.0020	0.0019	0.0018	0.0016	0.0013	0.0011
03-604	1.0	0.0022	0.0021	0.0020	0.0018	0.0014	0.0009	0.0008

03=614	4.0	0.0578	0.0544	0.0432	0.0330	0.0206	0.0130	0.0103
03=615	1.0	0.0078	0.0074	0.0043	0.0051	0.0034	0.0022	0.0017
03=727	6.0	0.0667	0.0642	0.0552	0.0454	0.0306	0.0199	0.0159
03=727	6.0	0.0829	0.0798	0.0646	0.0565	0.0380	0.0247	0.0197
09= 2	5.5	0.0177	0.0160	0.0112	0.0078	0.0046	0.0029	0.0023
09= 7	3.0	0.0120	0.0115	0.0067	0.0079	0.0052	0.0033	0.0027
09= 31	8.5	0.0671	0.0658	0.0605	0.0539	0.0408	0.0203	0.0229

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03=403	.0	0.0012	0.0012	0.0011	0.0010	0.0008	0.0005	0.0004
03=406	.0	0.0023	0.0022	0.0021	0.0019	0.0015	0.0011	0.0009
03=408	.0	0.0587	0.0557	0.0456	0.0357	0.0228	0.0146	0.0116
03=410	.0	0.0197	0.0189	0.0160	0.0129	0.0085	0.0055	0.0044
03=411	.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
03=415	.0	0.0019	0.0018	0.0018	0.0016	0.0013	0.0010	0.0008
03=418	.0	0.0011	0.0011	0.0010	0.0009	0.0007	0.0005	0.0004
03=420	.0	0.0049	0.0048	0.0042	0.0035	0.0025	0.0016	0.0013
03=422	.0	0.0133	0.0123	0.0104	0.0069	0.0042	0.0026	0.0021
03=426	.0	0.0792	0.0753	0.0620	0.0488	0.0314	0.0200	0.0159
03=427	.0	0.0205	0.0189	0.0142	0.0104	0.0063	0.0039	0.0031
03=427	.0	0.0142	0.0131	0.0098	0.0072	0.0043	0.0027	0.0022
03=432	.0	0.0147	0.0140	0.0119	0.0096	0.0064	0.0041	0.0033
03=434	.0	0.0033	0.0032	0.0027	0.0022	0.0015	0.0010	0.0008
03=434	.0	0.0035	0.0034	0.0029	0.0024	0.0016	0.0010	0.0008
03=435	.0	0.0019	0.0018	0.0015	0.0012	0.0008	0.0005	0.0004
03=436	.0	0.0038	0.0037	0.0035	0.0032	0.0026	0.0019	0.0015
03=437	.0	0.0225	0.0211	0.0166	0.0126	0.0078	0.0049	0.0039
03=441	.0	0.0268	0.0247	0.0185	0.0135	0.0082	0.0051	0.0040
03=442	.0	0.0089	0.0077	0.0050	0.0034	0.0019	0.0012	0.0010
03=443	.0	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
03=444	.0	0.0193	0.0163	0.0098	0.0065	0.0037	0.0023	0.0018
03=444	.0	0.0131	0.0111	0.0067	0.0044	0.0025	0.0016	0.0012
03=446	.0	0.0351	0.0340	0.0301	0.0255	0.0179	0.0118	0.0095
03=446	1.0	0.0230	0.0223	0.0197	0.0167	0.0117	0.0078	0.0062
03=446	1.0	0.0263	0.0255	0.0225	0.0191	0.0134	0.0089	0.0071
03=447	.0	0.0019	0.0015	0.0008	0.0005	0.0003	0.0002	0.0001
03=450	.0	0.0125	0.0111	0.0075	0.0052	0.0030	0.0019	0.0015
03=452	.0	0.0223	0.0203	0.0146	0.0104	0.0062	0.0039	0.0031
03=452	.0	0.0129	0.0118	0.0085	0.0060	0.0036	0.0022	0.0018
03=456	.0	0.0040	0.0039	0.0036	0.0033	0.0025	0.0018	0.0014
03=457	.0	0.0006	0.0006	0.0005	0.0005	0.0004	0.0003	0.0002
03=458	.0	0.0011	0.0010	0.0010	0.0009	0.0007	0.0005	0.0004
03=460	1.0	0.0073	0.0065	0.0045	0.0031	0.0018	0.0011	0.0009
03=461	.0	0.0054	0.0044	0.0025	0.0016	0.0009	0.0006	0.0005
03=464	.0	0.0004	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001
03=465	.0	0.0016	0.0013	0.0008	0.0005	0.0003	0.0002	0.0001
03=466	.0	0.0029	0.0025	0.0016	0.0011	0.0006	0.0004	0.0003
03=467	.0	0.0028	0.0027	0.0025	0.0023	0.0017	0.0012	0.0010
03=468	.0	0.0088	0.0084	0.0072	0.0059	0.0040	0.0026	0.0021
03=469	.0	0.0051	0.0047	0.0034	0.0025	0.0015	0.0009	0.0007
03=471	.0	0.0043	0.0042	0.0035	0.0028	0.0018	0.0012	0.0009
03=474	.0	0.0148	0.0125	0.0075	0.0050	0.0028	0.0018	0.0014
03=475	.0	0.0004	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001
03=476	.0	0.0008	0.0007	0.0004	0.0003	0.0001	0.0001	0.0001

03-477	.0	0.0085	0.0072	0.0043	0.0029	0.0016	0.0010	0.0008
03-478	.0	0.0040	0.0033	0.0020	0.0013	0.0008	0.0005	0.0004
03-479	.0	0.0391	0.0356	0.0256	0.0182	0.0108	0.0068	0.0053
03-480	.0	0.0007	0.0006	0.0004	0.0003	0.0002	0.0001	0.0001
03-481	.0	0.0024	0.0024	0.0022	0.0020	0.0016	0.0011	0.0009
03-482	.0	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0000
03-485	.0	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
03-486	.0	0.2142	0.1950	0.1403	0.0999	0.0593	0.0370	0.0293
03-486	1.0	0.1572	0.1431	0.1029	0.0733	0.0435	0.0272	0.0215
03-489	.0	0.0435	0.0413	0.0338	0.0265	0.0169	0.0108	0.0086
03-491	.0	0.0678	0.0493	0.0243	0.0153	0.0086	0.0053	0.0042
03-492	.0	0.0006	0.0006	0.0006	0.0005	0.0004	0.0003	0.0002
03-493	.0	0.0019	0.0018	0.0016	0.0014	0.0010	0.0007	0.0005
03-494	.0	0.0019	0.0018	0.0013	0.0010	0.0006	0.0004	0.0003
03-495	.0	0.0008	0.0007	0.0004	0.0003	0.0002	0.0001	0.0001
03-496	.0	0.0016	0.0014	0.0008	0.0005	0.0003	0.0002	0.0002
03-501	.0	0.0053	0.0044	0.0027	0.0018	0.0010	0.0006	0.0005
03-503	.0	0.0411	0.0395	0.0336	0.0274	0.0182	0.0118	0.0094
03-504	.0	0.0116	0.0107	0.0078	0.0057	0.0034	0.0021	0.0017
03-505	.0	0.0775	0.0727	0.0573	0.0434	0.0270	0.0170	0.0135
03-506	.0	0.0024	0.0024	0.0022	0.0020	0.0016	0.0011	0.0009
03-507	.0	0.0105	0.0087	0.0050	0.0033	0.0019	0.0011	0.0009
03-508	.0	0.0081	0.0068	0.0041	0.0027	0.0015	0.0010	0.0008
03-509	.0	0.0072	0.0071	0.0048	0.0034	0.0025	0.0016	0.0012
03-512	.0	0.0075	0.0065	0.0042	0.0029	0.0016	0.0010	0.0008
03-513	.0	0.0725	0.0660	0.0475	0.0338	0.0201	0.0125	0.0099
03-513	.0	0.0553	0.0503	0.0362	0.0258	0.0153	0.0095	0.0076
03-513	.0	0.0576	0.0524	0.0377	0.0269	0.0160	0.0100	0.0079
03-515	.0	0.0059	0.0054	0.0039	0.0028	0.0016	0.0010	0.0008
03-516	.0	0.0103	0.0093	0.0065	0.0046	0.0027	0.0017	0.0013
03-518	.0	0.0014	0.0014	0.0013	0.0012	0.0009	0.0007	0.0005
03-519	.0	0.0776	0.0656	0.0398	0.0262	0.0150	0.0093	0.0073
03-520	.0	0.0844	0.0768	0.0553	0.0394	0.0234	0.0146	0.0115
03-521	.0	0.0054	0.0049	0.0035	0.0025	0.0015	0.0009	0.0007
03-522	.0	0.0871	0.0817	0.0643	0.0488	0.0303	0.0191	0.0151
03-522	.0	0.0569	0.0533	0.0420	0.0319	0.0198	0.0125	0.0099
03-522	.0	0.0658	0.0617	0.0486	0.0369	0.0229	0.0144	0.0114
03-523	.0	0.0120	0.0110	0.0081	0.0058	0.0035	0.0022	0.0017
03-529	.0	0.0013	0.0013	0.0012	0.0011	0.0010	0.0008	0.0007
03-527	.0	0.0015	0.0014	0.0012	0.0010	0.0007	0.0004	0.0004
03-529	.0	0.0504	0.0484	0.0415	0.0341	0.0229	0.0148	0.0118
03-531	.0	0.0086	0.0084	0.0077	0.0068	0.0051	0.0035	0.0028
03-532	.0	0.0247	0.0240	0.0213	0.0181	0.0128	0.0085	0.0068
03-533	.0	0.0086	0.0078	0.0056	0.0040	0.0024	0.0015	0.0012
03-534	.0	0.0015	0.0013	0.0010	0.0007	0.0004	0.0003	0.0002
03-535	.0	0.1853	0.1670	0.1149	0.0820	0.0482	0.0300	0.0237
03-535	.0	0.1447	0.1304	0.0913	0.0640	0.0377	0.0235	0.0185
03-535	.0	0.1441	0.1299	0.0909	0.0637	0.0375	0.0234	0.0185
03-536	.0	0.0290	0.0242	0.0142	0.0093	0.0053	0.0033	0.0026
03-539	.0	0.0084	0.0076	0.0055	0.0039	0.0023	0.0014	0.0011
03-542	.0	0.0214	0.0187	0.0121	0.0081	0.0047	0.0029	0.0023
03-544	.0	0.0028	0.0024	0.0018	0.0013	0.0008	0.0005	0.0004
03-546	.0	0.0650	0.0567	0.0367	0.0247	0.0143	0.0089	0.0070
03-547	.0	0.0063	0.0060	0.0051	0.0041	0.0027	0.0018	0.0014
03-548	.0	0.1235	0.1098	0.0742	0.0511	0.0298	0.0185	0.0146
03-549	.0	0.0312	0.0286	0.0211	0.0152	0.0091	0.0057	0.0045

03-550	1.0	0.0047	0.0045	0.0038	0.0031	0.0020	0.0013	0.0010
03-552	.0	0.0550	0.0526	0.0443	0.0357	0.0235	0.0151	0.0120
03-553	.0	0.0181	0.0158	0.0102	0.0069	0.0040	0.0025	0.0019
03-555	.0	0.0034	0.0033	0.0028	0.0023	0.0015	0.0010	0.0008
03-556	.0	0.0022	0.0021	0.0018	0.0014	0.0010	0.0006	0.0005
03-559	.0	0.0102	0.0092	0.0064	0.0045	0.0027	0.0017	0.0013
03-561	.0	0.0533	0.0451	0.0273	0.0180	0.0103	0.0064	0.0050
03-562	.0	0.0017	0.0017	0.0015	0.0014	0.0010	0.0007	0.0006
03-563	.0	0.0112	0.0096	0.0060	0.0040	0.0023	0.0014	0.0011
03-564	.0	0.0111	0.0085	0.0044	0.0028	0.0016	0.0010	0.0008
03-565	.0	0.0028	0.0028	0.0026	0.0024	0.0019	0.0014	0.0012
03-566	.0	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
03-567	1.0	0.0153	0.0146	0.0124	0.0100	0.0066	0.0043	0.0034
03-569	.0	0.0396	0.0384	0.0340	0.0288	0.0202	0.0134	0.0107
03-570	.0	0.0005	0.0005	0.0003	0.0002	0.0001	0.0001	0.0001
03-573	.0	0.0132	0.0122	0.0093	0.0069	0.0042	0.0026	0.0021
03-574	.0	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
03-575	.0	0.0005	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001
03-576	.0	0.0034	0.0032	0.0024	0.0017	0.0010	0.0007	0.0005
03-578	.0	0.0087	0.0080	0.0059	0.0042	0.0025	0.0016	0.0013
03-579	.0	0.0215	0.0187	0.0121	0.0082	0.0047	0.0029	0.0023
03-580	.0	0.0020	0.0016	0.0009	0.0006	0.0003	0.0002	0.0002
03-581	.0	0.0100	0.0086	0.0054	0.0036	0.0020	0.0013	0.0010
03-585	.0	0.0285	0.0278	0.0252	0.0219	0.0160	0.0108	0.0087
03-585	2.0	0.0201	0.0196	0.0177	0.0154	0.0113	0.0076	0.0061
03-585	2.0	0.0247	0.0241	0.0218	0.0190	0.0139	0.0094	0.0075
03-587	.0	0.0070	0.0064	0.0046	0.0033	0.0020	0.0012	0.0010
03-589	.0	0.0453	0.0408	0.0286	0.0200	0.0118	0.0073	0.0058
03-590	.0	0.0711	0.0647	0.0465	0.0331	0.0197	0.0123	0.0097
03-590	1.0	0.0520	0.0474	0.0341	0.0243	0.0144	0.0090	0.0071
03-590	1.0	0.0622	0.0566	0.0407	0.0290	0.0172	0.0107	0.0085
03-592	.0	0.1300	0.1154	0.0777	0.0534	0.0311	0.0193	0.0153
03-592	.0	0.0966	0.0858	0.0577	0.0397	0.0231	0.0144	0.0113
03-592	.0	0.0874	0.0776	0.0522	0.0359	0.0209	0.0130	0.0103
03-593	.0	0.0139	0.0118	0.0071	0.0047	0.0027	0.0017	0.0013
03-595	.0	0.0004	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001
03-596	.0	0.0074	0.0062	0.0038	0.0025	0.0014	0.0009	0.0007
03-597	.0	0.0756	0.0698	0.0523	0.0382	0.0230	0.0144	0.0114
03-598	.0	0.0004	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001
03-599	.0	0.0051	0.0046	0.0033	0.0024	0.0014	0.0009	0.0007
03-600	.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
03-605	.5	0.0010	0.0010	0.0008	0.0007	0.0004	0.0003	0.0002
03-607	1.0	0.1044	0.0958	0.0704	0.0508	0.0304	0.0190	0.0150
03-612	.0	0.1192	0.1161	0.1043	0.0901	0.0650	0.0437	0.0351
03-612	.0	0.1328	0.1293	0.1162	0.1004	0.0724	0.0487	0.0391
03-613	.0	0.0038	0.0035	0.0027	0.0020	0.0012	0.0008	0.0006
03-618	.0	0.0049	0.0045	0.0035	0.0026	0.0016	0.0010	0.0008
03-620	.0	0.0032	0.0031	0.0028	0.0024	0.0017	0.0011	0.0009
03-621	.0	0.0024	0.0024	0.0021	0.0018	0.0013	0.0009	0.0007
03-628	.0	0.0005	0.0005	0.0004	0.0003	0.0002	0.0001	0.0001
03-640	.0	0.0020	0.0019	0.0015	0.0012	0.0007	0.0005	0.0004
03-645	.0	0.0221	0.0208	0.0168	0.0130	0.0082	0.0052	0.0042
03-674	.0	0.0045	0.0041	0.0031	0.0023	0.0014	0.0009	0.0007
03-679	.0	0.0418	0.0357	0.0220	0.0146	0.0084	0.0052	0.0041

03=685	.0	0.0707	0.0669	0.0540	0.0418	0.0264	0.0168	0.0133
03=685	.0	0.0652	0.0617	0.0498	0.0386	0.0244	0.0155	0.0123
03=685	2.0	0.0588	0.0556	0.0449	0.0348	0.0220	0.0140	0.0111
03=685	2.0	0.0584	0.0552	0.0446	0.0345	0.0218	0.0139	0.0110
03=686	.0	0.0083	0.0081	0.0071	0.0060	0.0042	0.0027	0.0022
03=687	.0	0.0254	0.0235	0.0176	0.0128	0.0078	0.0049	0.0038
03=689	1.5	0.0409	0.0394	0.0340	0.0280	0.0189	0.0123	0.0098
03=690	.0	0.0302	0.0288	0.0241	0.0192	0.0125	0.0080	0.0064
03=697	.0	0.0980	0.0904	0.0676	0.0494	0.0298	0.0186	0.0148
03=778	3.0	0.0206	0.0198	0.0167	0.0135	0.0089	0.0058	0.0046
03=801	.0	0.0007	0.0006	0.0004	0.0003	0.0002	0.0001	0.0001
03=836	.0	0.0006	0.0005	0.0004	0.0003	0.0002	0.0001	0.0001
09= 1	.0	0.0072	0.0067	0.0051	0.0037	0.0023	0.0014	0.0011
09= 29	.0	0.0122	0.0106	0.0069	0.0046	0.0027	0.0017	0.0013
09= 46	.0	0.0036	0.0035	0.0029	0.0024	0.0016	0.0010	0.0008
09= 72	.0	0.0207	0.0198	0.0166	0.0133	0.0087	0.0056	0.0045
09= 74	.0	0.0261	0.0248	0.0204	0.0161	0.0103	0.0066	0.0052

TABLE 2D

DAILY DOSE RATE TO SKELETON IN RADS, COMPUTED BY THREE EXPONENTIALS

GROUPED BY RADIOLOGICAL OR CLINICAL DIAGNOSIS AT TIME OF X-RAY

LISTED BY ASCENDING PATIENT NUMBER

ONE SET OF DATA PER GAMMA RAY MEASUREMENT

PT. NO.	X-RAY SCORE	ELAPSED TIME IN DAYS			ELAPSED TIME IN YEARS			
		1	10	100	49	5	20	40
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-401	39.5	0.8599	0.7734	0.6376	0.6205	0.5666	0.3174	0.1340
03-401	43.5	0.9363	0.8420	0.6942	0.6756	0.6169	0.3456	0.1458
03-402	24.0	0.3893	0.3583	0.3094	0.3022	0.2741	0.1530	0.0644
03-402	26.0	0.4210	0.3875	0.3346	0.3269	0.2965	0.1655	0.0697
03-402	33.0	0.4661	0.4290	0.3704	0.3619	0.3282	0.1832	0.0771
03-402	33.0	0.5691	0.5237	0.4523	0.4418	0.4007	0.2237	0.0942
03-402	33.0	0.4977	0.4581	0.3956	0.3864	0.3505	0.1956	0.0824
03-404	22.0	0.3659	0.3381	0.2944	0.2877	0.2606	0.1453	0.0612
03-404	22.0	0.4035	0.3729	0.3247	0.3173	0.2874	0.1613	0.0674
03-431	16.0	0.5680	0.5287	0.4665	0.4562	0.4121	0.2295	0.0965
03-431	16.0	0.5393	0.5020	0.4429	0.4332	0.3913	0.2179	0.0916
03-449	30.0	0.4882	0.4572	0.4078	0.3990	0.3595	0.1999	0.0839
03-473	39.0	0.4523	0.4163	0.3596	0.3513	0.3186	0.1778	0.0749
03-473	43.0	0.5036	0.4636	0.4004	0.3912	0.3548	0.1980	0.0834
03-528	17.0	0.5456	0.5128	0.4607	0.4509	0.4055	0.2252	0.0945
03-540	29.0	0.7746	0.7128	0.6155	0.6013	0.5454	0.3044	0.1282
03-540	34.0	0.7771	0.7152	0.6176	0.6033	0.5472	0.3054	0.1286
03-540	33.0	0.8851	0.8146	0.7034	0.6872	0.6233	0.3479	0.1465
03-540	33.0	1.1029	0.9229	0.7970	0.7786	0.7062	0.3942	0.1660
03-551	39.5	0.3564	0.3346	0.2909	0.2935	0.2641	0.1467	0.0616
03-551	51.0	0.4514	0.4238	0.3709	0.3718	0.3346	0.1859	0.0780
03-551	38.0	0.5516	0.5179	0.4642	0.4543	0.4088	0.2271	0.0953
03-551	38.0	0.4838	0.4542	0.4072	0.3984	0.3585	0.1992	0.0836
03-551	41.0	0.5727	0.5377	0.4820	0.4716	0.4244	0.2358	0.0989
03-554	19.0	0.9080	0.7941	0.6154	0.5947	0.5464	0.3069	0.1298
03-571	20.0	0.7021	0.5536	0.3209	0.2930	0.2728	0.1540	0.0653
03-571	16.0	0.7030	0.5543	0.3213	0.2933	0.2731	0.1542	0.0654
03-571	16.0	0.6853	0.5404	0.3132	0.2859	0.2663	0.1503	0.0637
03-571	18.0	0.8134	0.6414	0.3718	0.3394	0.3160	0.1784	0.0756
03-571	18.0	0.9816	0.7740	0.4487	0.4096	0.3814	0.2153	0.0913
03-619	-	1.0551	0.8581	0.5483	0.5122	0.4755	0.2681	0.1136
03-657	-	2.0997	1.9713	1.7670	1.7292	1.5560	0.8644	0.3627
03-671	-	3.6973	2.5556	1.0311	0.8296	0.7780	0.4401	0.1868
03-726	29.0	0.2923	0.2748	0.2468	0.2416	0.2172	0.1206	0.0506

MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION

03-404	17.0	0.3161	0.2921	0.2543	0.2485	0.2251	0.1255	0.0528
03-404	24.0	0.3376	0.3120	0.2716	0.2655	0.2404	0.1341	0.0564
03-404	24.0	0.3087	0.2853	0.2483	0.2427	0.2198	0.1226	0.0516
03-405	22.0	0.2737	0.2462	0.2030	0.1976	0.1804	0.1011	0.0427
03-405	15.5	0.2289	0.2059	0.1698	0.1653	0.1509	0.0845	0.0357
03-405	15.5	0.2210	0.1988	0.1639	0.1595	0.1457	0.0816	0.0344
03-405	22.0	0.2869	0.2580	0.2128	0.2071	0.1891	0.1059	0.0447
03-407	19.0	0.4538	0.4185	0.3629	0.3546	0.3214	0.1793	0.0755
03-416	18.0	0.7120	0.6189	0.4729	0.4561	0.4195	0.2357	0.0997
03-416	18.0	0.8623	0.7495	0.5727	0.5523	0.5080	0.2855	0.1207
03-423	12.5	0.2500	0.2300	0.1987	0.1941	0.1760	0.0982	0.0414
03-423	22.0	0.2123	0.1954	0.1687	0.1646	0.1495	0.0834	0.0351
03-423	27.0	0.2270	0.2089	0.1804	0.1762	0.1598	0.0892	0.0376
03-423	27.0	0.2430	0.2237	0.1931	0.1887	0.1711	0.0955	0.0402
03-429	18.0	0.7160	0.6574	0.5651	0.5519	0.5010	0.2797	0.1178
03-429	18.0	0.7680	0.7051	0.6061	0.5928	0.5373	0.3001	0.1264
03-429	18.0	0.7492	0.6879	0.5913	0.5775	0.5242	0.2927	0.1233
03-429	28.0	0.8467	0.7774	0.6683	0.6527	0.5924	0.3308	0.1393
03-429	28.0	0.9962	0.9146	0.7862	0.7679	0.6970	0.3892	0.1639
03-431	11.0	0.4798	0.4466	0.3940	0.3854	0.3481	0.1938	0.0815
03-455	15.0	0.3828	0.3280	0.2421	0.2323	0.2142	0.1205	0.0510
03-459	18.0	0.5619	0.4683	0.3213	0.3044	0.2818	0.1588	0.0672
03-459	19.0	0.5852	0.4877	0.3346	0.3171	0.2935	0.1653	0.0700
03-459	19.0	0.5939	0.4950	0.3396	0.3218	0.2979	0.1678	0.0711
03-459	19.0	0.5375	0.4480	0.3073	0.2913	0.2696	0.1519	0.0643
03-484	18.0	0.6097	0.5675	0.5007	0.4898	0.4423	0.2463	0.1035
03-484	22.0	0.6842	0.6369	0.5619	0.5496	0.4964	0.2764	0.1162
03-484	22.0	0.7707	0.7174	0.6329	0.6191	0.5591	0.3113	0.1309
03-499	19.0	0.1153	0.0988	0.0729	0.0700	0.0645	0.0363	0.0154
03-499	18.0	0.1262	0.1081	0.0798	0.0766	0.0706	0.0397	0.0168
03-558	15.0	0.1210	0.0881	0.0399	0.0337	0.0316	0.0178	0.0076
03-586	20.0	0.4818	0.4278	0.3433	0.3332	0.3052	0.1712	0.0723
03-586	20.0	0.4855	0.4312	0.3460	0.3358	0.3076	0.1725	0.0729
09- 4	27.5	0.2397	0.2322	0.2195	0.2145	0.1891	0.1033	0.0427

MILD CHANGES TYPICAL OF RADIUM DEPOSITION

03-416	10.5	0.5604	0.4871	0.3722	0.3590	0.3302	0.1855	0.0785
03-416	10.5	0.5479	0.4762	0.3639	0.3509	0.3228	0.1814	0.0767
03-416	16.0	0.6432	0.5591	0.4272	0.4120	0.3790	0.2130	0.0901
03-417	10.0	0.3770	0.3255	0.2448	0.2355	0.2169	0.1219	0.0516
03-417	10.0	0.3269	0.2823	0.2123	0.2043	0.1881	0.1058	0.0447
03-417	10.0	0.3221	0.2781	0.2091	0.2012	0.1853	0.1042	0.0441
03-417	10.0	0.3501	0.3023	0.2273	0.2188	0.2015	0.1133	0.0479
03-428	7.0	0.3577	0.2912	0.1865	0.1744	0.1619	0.0913	0.0387
03-428	9.0	0.3789	0.3084	0.1976	0.1847	0.1714	0.0967	0.0410
03-428	9.0	0.3808	0.3100	0.1986	0.1856	0.1723	0.0972	0.0412
03-429	14.0	0.6915	0.6349	0.5458	0.5330	0.4838	0.2702	0.1138
03-433	15.0	0.4760	0.4265	0.3488	0.3392	0.3101	0.1737	0.0734
03-433	15.0	0.5226	0.4682	0.3830	0.3724	0.3404	0.1907	0.0805
03-433	15.0	0.5114	0.4582	0.3748	0.3645	0.3331	0.1867	0.0788

03-443	11.0	0.6032	0.5632	0.4998	0.4889	0.4410	0.2454	0.1031
03-445	11.0	0.7388	0.6898	0.6122	0.5989	0.5402	0.3006	0.1263
03-448	17.0	0.6559	0.6125	0.5435	0.5317	0.4796	0.2669	0.1121
03-449	10.0	0.5207	0.4875	0.4349	0.4256	0.3834	0.2132	0.0895
03-462	5.0	0.1564	0.1464	0.1306	0.1278	0.1152	0.0640	0.0269
03-462	5.0	0.1586	0.1485	0.1325	0.1296	0.1168	0.0649	0.0273
03-462	14.0	0.1451	0.1358	0.1212	0.1186	0.1068	0.0594	0.0249
03-462	14.0	0.1301	0.1218	0.1086	0.1063	0.0958	0.0532	0.0224
03-502	7.0	0.0708	0.0659	0.0581	0.0569	0.0514	0.0286	0.0120
03-510	14.0	0.3676	0.3215	0.2493	0.2409	0.2213	0.1243	0.0526
03-510	14.0	0.3651	0.3193	0.2476	0.2393	0.2198	0.1235	0.0522
03-529	12.0	0.0563	0.0516	0.0441	0.0431	0.0391	0.0219	0.0092
03-529	12.0	0.0715	0.0655	0.0560	0.0547	0.0497	0.0278	0.0117
03-530	7.0	0.2481	0.2223	0.1818	0.1768	0.1616	0.0906	0.0382
03-530	13.0	0.2358	0.2112	0.1728	0.1680	0.1536	0.0861	0.0363
03-530	13.0	0.2249	0.2015	0.1648	0.1602	0.1465	0.0821	0.0347
03-586	10.0	0.4685	0.4161	0.3339	0.3241	0.2968	0.1665	0.0703
03-586	10.0	0.4437	0.3940	0.3162	0.3069	0.2810	0.1576	0.0666
03-586	10.0	0.4545	0.4036	0.3239	0.3143	0.2879	0.1615	0.0682
03-588	6.0	0.1543	0.1443	0.1284	0.1256	0.1132	0.0638	0.0264
03-588	15.0	0.1370	0.1282	0.1140	0.1116	0.1006	0.0559	0.0235
03-588	15.0	0.1263	0.1181	0.1051	0.1028	0.0927	0.0515	0.0216
03-594	13.0	0.0214	0.0182	0.0131	0.0125	0.0116	0.0065	0.0028

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-412	1.0	0.1110	0.1024	0.0887	0.0867	0.0786	0.0438	0.0185
03-412	8.0	0.1069	0.0986	0.0855	0.0835	0.0757	0.0422	0.0178
03-412	8.0	0.0911	0.0840	0.0728	0.0712	0.0645	0.0360	0.0152
03-412	8.0	0.1011	0.0932	0.0808	0.0789	0.0715	0.0399	0.0168
03-417	2.5	0.3583	0.3094	0.2327	0.2239	0.2062	0.1159	0.0490
03-419	2.0	0.3015	0.2584	0.1907	0.1830	0.1687	0.0949	0.0402
03-419	2.0	0.3370	0.2888	0.2131	0.2045	0.1886	0.1061	0.0449
03-419	5.0	0.3354	0.2874	0.2121	0.2036	0.1877	0.1056	0.0447
03-419	5.0	0.3487	0.2989	0.2206	0.2117	0.1952	0.1098	0.0465
03-424	6.0	0.4183	0.1091	0.0946	0.0925	0.0838	0.0468	0.0197
03-445	5.5	0.5184	0.4841	0.4296	0.4202	0.3791	0.2109	0.0886
03-445	5.5	0.5530	0.5163	0.4582	0.4483	0.4043	0.2250	0.0945
03-483	2.0	0.0003	0.0003	0.0003	0.0003	0.0003	0.0001	0.0001
03-488	2.0	0.1208	0.0951	0.0548	0.0499	0.0465	0.0263	0.0111
03-490	3.0	0.0085	0.0079	0.0071	0.0070	0.0063	0.0035	0.0015
03-500	5.0	0.0014	0.0009	0.0004	0.0003	0.0003	0.0002	0.0001
03-505	4.0	0.0952	0.0809	0.0585	0.0559	0.0516	0.0291	0.0123
03-505	4.0	0.1072	0.0911	0.0659	0.0630	0.0582	0.0327	0.0139
03-510	3.5	0.3789	0.3315	0.2570	0.2484	0.2282	0.1282	0.0542
03-520	5.0	0.0940	0.0742	0.0430	0.0392	0.0365	0.0206	0.0087
03-520	5.0	0.1091	0.0861	0.0499	0.0455	0.0424	0.0239	0.0101
03-524	2.5	0.0419	0.0330	0.0191	0.0175	0.0163	0.0092	0.0039
03-526	3.0	0.0005	0.0004	0.0003	0.0003	0.0002	0.0001	0.0001
03-568	4.5	0.0408	0.0383	0.0344	0.0336	0.0303	0.0168	0.0071
03-572	3.0	0.0506	0.0406	0.0248	0.0230	0.0214	0.0120	0.0051
03-577	4.0	0.0339	0.0307	0.0257	0.0250	0.0228	0.0128	0.0054
03-591	1.0	0.0020	0.0020	0.0020	0.0019	0.0016	0.0008	0.0003
03-604	1.0	0.0036	0.0035	0.0033	0.0032	0.0029	0.0016	0.0006

03-614	4.0	0.0656	0.0562	0.0415	0.0398	0.0367	0.0206	0.0087
03-615	1.0	0.0092	0.0083	0.0070	0.0068	0.0062	0.0035	0.0015
03-727	6.0	0.1033	0.0948	0.0815	0.0796	0.0723	0.0403	0.0170
03-727	6.0	0.1283	0.1178	0.1013	0.0989	0.0898	0.0501	0.0211
09- 2	5.5	0.0288	0.0222	0.0120	0.0108	0.0101	0.0057	0.0024
09- 7	3.0	0.0172	0.0156	0.0130	0.0127	0.0116	0.0065	0.0027
09- 31	8.5	0.1245	0.1202	0.1129	0.1104	0.0977	0.0535	0.0222

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-403	.0	0.0010	0.0010	0.0010	0.0009	0.0008	0.0005	0.0002
03-406	.0	0.0020	0.0020	0.0019	0.0018	0.0016	0.0009	0.0004
03-408	.0	0.0595	0.0523	0.0411	0.0398	0.0365	0.0205	0.0087
03-410	.0	0.0212	0.0192	0.0160	0.0156	0.0142	0.0080	0.0034
03-411	.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
03-415	.0	0.0018	0.0018	0.0017	0.0017	0.0015	0.0008	0.0003
03-418	.0	0.0012	0.0011	0.0011	0.0011	0.0009	0.0005	0.0002
03-420	.0	0.0056	0.0053	0.0047	0.0046	0.0042	0.0023	0.0010
03-422	.0	0.0138	0.0114	0.0076	0.0071	0.0066	0.0037	0.0016
03-426	.0	0.0807	0.0714	0.0567	0.0550	0.0504	0.0283	0.0119
03-427	.0	0.0217	0.0176	0.0113	0.0106	0.0098	0.0055	0.0023
03-427	.0	0.0177	0.0144	0.0092	0.0086	0.0080	0.0045	0.0019
03-432	.0	0.0154	0.0139	0.0117	0.0114	0.0104	0.0058	0.0024
03-434	.0	0.0022	0.0020	0.0017	0.0017	0.0015	0.0009	0.0004
03-434	.0	0.0025	0.0023	0.0020	0.0019	0.0017	0.0010	0.0004
03-435	.0	0.0014	0.0013	0.0011	0.0010	0.0009	0.0005	0.0002
03-436	.0	0.0042	0.0041	0.0039	0.0038	0.0033	0.0018	0.0007
03-437	.0	0.0220	0.0187	0.0135	0.0129	0.0119	0.0067	0.0028
03-441	.0	0.0283	0.0230	0.0148	0.0138	0.0128	0.0072	0.0031
03-442	.0	0.0120	0.0088	0.0040	0.0034	0.0031	0.0018	0.0008
03-443	.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
03-444	.0	0.0275	0.0190	0.0076	0.0061	0.0057	0.0033	0.0014
03-444	.0	0.0219	0.0151	0.0061	0.0049	0.0046	0.0026	0.0011
03-446	.0	0.0411	0.0386	0.0346	0.0339	0.0305	0.0169	0.0071
03-446	1.0	0.0365	0.0343	0.0308	0.0301	0.0271	0.0150	0.0063
03-446	1.0	0.0418	0.0392	0.0352	0.0344	0.0310	0.0172	0.0072
03-447	.0	0.0033	0.0020	0.0007	0.0005	0.0005	0.0003	0.0001
03-450	.0	0.0162	0.0122	0.0061	0.0053	0.0050	0.0028	0.0012
03-452	.0	0.0253	0.0200	0.0116	0.0106	0.0098	0.0056	0.0024
03-452	.0	0.0196	0.0154	0.0090	0.0082	0.0076	0.0043	0.0018
03-456	.0	0.0031	0.0030	0.0029	0.0028	0.0025	0.0014	0.0006
03-457	.0	0.0005	0.0005	0.0005	0.0005	0.0004	0.0002	0.0001
03-458	.0	0.0012	0.0011	0.0011	0.0011	0.0009	0.0005	0.0002
03-460	1.0	0.0095	0.0073	0.0038	0.0033	0.0031	0.0018	0.0007
03-461	.0	0.0092	0.0061	0.0023	0.0018	0.0017	0.0009	0.0004
03-464	.0	0.0005	0.0004	0.0003	0.0003	0.0003	0.0001	0.0001
03-465	.0	0.0023	0.0016	0.0006	0.0005	0.0005	0.0003	0.0001
03-466	.0	0.0043	0.0030	0.0013	0.0011	0.0010	0.0006	0.0002
03-467	.0	0.0031	0.0030	0.0029	0.0028	0.0025	0.0013	0.0006
03-468	.0	0.0089	0.0082	0.0070	0.0068	0.0062	0.0035	0.0015
03-469	.0	0.0056	0.0045	0.0028	0.0026	0.0024	0.0013	0.0006
03-471	.0	0.0043	0.0038	0.0031	0.0031	0.0028	0.0016	0.0007
03-474	.0	0.0217	0.0149	0.0068	0.0048	0.0045	0.0026	0.0011
03-475	.0	0.0004	0.0004	0.0003	0.0003	0.0003	0.0001	0.0001
03-476	.0	0.0012	0.0008	0.0003	0.0002	0.0002	0.0001	0.0001

03-477	.0	0.0122	0.0084	0.0034	0.0027	0.0025	0.0014	0.0006
03-478	.0	0.0060	0.0042	0.0017	0.0013	0.0013	0.0007	0.0003
03-479	.0	0.0467	0.0368	0.0213	0.0194	0.0181	0.0102	0.0043
03-480	.0	0.0011	0.0008	0.0003	0.0003	0.0003	0.0001	0.0001
03-481	.0	0.0020	0.0019	0.0018	0.0018	0.0015	0.0008	0.0003
03-482	.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
03-485	.0	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0000
03-486	.0	0.2465	0.1944	0.1127	0.1029	0.0958	0.0541	0.0229
03-486	1.0	0.2377	0.1875	0.1087	0.0992	0.0924	0.0521	0.0221
03-489	.0	0.0427	0.0376	0.0295	0.0286	0.0262	0.0147	0.0062
03-491	.0	0.1401	0.0682	0.0214	0.0153	0.0144	0.0081	0.0035
03-492	.0	0.0005	0.0005	0.0004	0.0004	0.0004	0.0002	0.0001
03-493	.0	0.0025	0.0023	0.0021	0.0021	0.0019	0.0010	0.0004
03-494	.0	0.0021	0.0017	0.0011	0.0010	0.0010	0.0005	0.0002
03-495	.0	0.0013	0.0009	0.0004	0.0003	0.0003	0.0002	0.0001
03-496	.0	0.0026	0.0018	0.0007	0.0006	0.0005	0.0003	0.0001
03-501	.0	0.0071	0.0049	0.0020	0.0016	0.0015	0.0008	0.0004
03-503	.0	0.0481	0.0438	0.0371	0.0362	0.0329	0.0184	0.0078
03-504	.0	0.0144	0.0116	0.0071	0.0066	0.0061	0.0034	0.0015
03-505	.0	0.0864	0.0735	0.0531	0.0508	0.0469	0.0264	0.0112
03-506	.0	0.0022	0.0021	0.0020	0.0020	0.0017	0.0009	0.0004
03-507	.0	0.0178	0.0117	0.0044	0.0035	0.0032	0.0018	0.0008
03-508	.0	0.0129	0.0089	0.0036	0.0029	0.0027	0.0015	0.0006
03-509	.0	0.0076	0.0075	0.0073	0.0071	0.0061	0.0032	0.0013
03-512	.0	0.0102	0.0074	0.0034	0.0028	0.0027	0.0015	0.0006
03-513	.0	0.0843	0.0664	0.0385	0.0352	0.0327	0.0185	0.0078
03-513	.0	0.0832	0.0656	0.0380	0.0347	0.0323	0.0182	0.0077
03-513	.0	0.0867	0.0684	0.0396	0.0362	0.0337	0.0190	0.0081
03-515	.0	0.0069	0.0054	0.0031	0.0029	0.0027	0.0015	0.0006
03-516	.0	0.0125	0.0096	0.0052	0.0047	0.0044	0.0025	0.0010
03-518	.0	0.0012	0.0012	0.0011	0.0011	0.0009	0.0005	0.0002
03-519	.0	0.1199	0.0829	0.0334	0.0269	0.0252	0.0143	0.0061
03-520	.0	0.0980	0.0773	0.0448	0.0409	0.0381	0.0215	0.0091
03-521	.0	0.0062	0.0049	0.0029	0.0026	0.0024	0.0014	0.0006
03-522	.0	0.1045	0.0888	0.0641	0.0613	0.0566	0.0319	0.0135
03-522	.0	0.0830	0.0705	0.0509	0.0487	0.0450	0.0253	0.0107
03-522	.0	0.0960	0.0816	0.0589	0.0564	0.0520	0.0293	0.0124
03-523	.0	0.0144	0.0115	0.0070	0.0065	0.0061	0.0034	0.0014
03-525	.0	0.0013	0.0013	0.0013	0.0012	0.0011	0.0006	0.0002
03-527	.0	0.0016	0.0014	0.0012	0.0012	0.0011	0.0006	0.0003
03-529	.0	0.0619	0.0567	0.0485	0.0474	0.0430	0.0240	0.0101
03-531	.0	0.0100	0.0096	0.0080	0.0088	0.0078	0.0043	0.0018
03-532	.0	0.0265	0.0250	0.0225	0.0220	0.0198	0.0110	0.0046
03-533	.0	0.0101	0.0079	0.0046	0.0042	0.0039	0.0022	0.0009
03-534	.0	0.0016	0.0013	0.0008	0.0008	0.0007	0.0004	0.0002
03-535	.0	0.2509	0.1938	0.1050	0.0941	0.0878	0.0496	0.0210
03-535	.0	0.2368	0.1829	0.0991	0.0888	0.0829	0.0468	0.0198
03-535	.0	0.2358	0.1821	0.0987	0.0884	0.0825	0.0466	0.0198
03-536	.0	0.0452	0.0304	0.0117	0.0093	0.0087	0.0049	0.0021
03-539	.0	0.0107	0.0085	0.0049	0.0045	0.0042	0.0023	0.0010
03-542	.0	0.0329	0.0240	0.0109	0.0092	0.0086	0.0049	0.0021
03-544	.0	0.0037	0.0029	0.0017	0.0015	0.0014	0.0008	0.0003
03-546	.0	0.0893	0.0651	0.0295	0.0249	0.0233	0.0132	0.0056
03-547	.0	0.0071	0.0064	0.0054	0.0053	0.0048	0.0027	0.0011
03-548	.0	0.1794	0.1351	0.0674	0.0589	0.0550	0.0311	0.0132
03-549	.0	0.0356	0.0286	0.0175	0.0162	0.0150	0.0085	0.0036

03-550	1.0	0.0065	0.0059	0.0049	0.0048	0.0044	0.0025	0.0010
03-552	.0	0.0612	0.0553	0.0459	0.0447	0.0408	0.0228	0.0096
03-553	.0	0.0260	0.0189	0.0086	0.0072	0.0068	0.0038	0.0016
03-555	.0	0.0033	0.0030	0.0025	0.0024	0.0022	0.0012	0.0005
03-556	.0	0.0021	0.0019	0.0016	0.0016	0.0014	0.0008	0.0003
03-559	.0	0.0139	0.0108	0.0058	0.0052	0.0049	0.0028	0.0012
03-561	.0	0.0638	0.0577	0.0233	0.0187	0.0176	0.0099	0.0042
03-562	.0	0.0018	0.0017	0.0016	0.0016	0.0014	0.0008	0.0003
03-563	.0	0.0168	0.0119	0.0051	0.0042	0.0039	0.0022	0.0009
03-564	.0	0.0220	0.0122	0.0040	0.0029	0.0028	0.0016	0.0007
03-565	.0	0.0029	0.0028	0.0027	0.0027	0.0023	0.0012	0.0005
03-566	.0	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0000
03-567	1.0	0.0178	0.0161	0.0135	0.0131	0.0120	0.0067	0.0028
03-569	.0	0.0490	0.0460	0.0412	0.0404	0.0363	0.0202	0.0085
03-570	.0	0.0005	0.0004	0.0003	0.0003	0.0002	0.0001	0.0001
03-573	.0	0.0145	0.0120	0.0080	0.0075	0.0070	0.0039	0.0017
03-574	.0	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0000
03-575	.0	0.0005	0.0004	0.0002	0.0002	0.0002	0.0001	0.0000
03-576	.0	0.0038	0.0031	0.0020	0.0019	0.0017	0.0010	0.0004
03-578	.0	0.0101	0.0081	0.0049	0.0046	0.0042	0.0024	0.0010
03-579	.0	0.0333	0.0242	0.0110	0.0093	0.0087	0.0049	0.0021
03-580	.0	0.0037	0.0022	0.0008	0.0006	0.0006	0.0003	0.0001
03-581	.0	0.0162	0.0115	0.0049	0.0040	0.0038	0.0021	0.0009
03-585	.0	0.0424	0.0405	0.0373	0.0365	0.0326	0.0180	0.0075
03-585	2.0	0.0385	0.0367	0.0338	0.0331	0.0295	0.0163	0.0068
03-585	2.0	0.0473	0.0451	0.0416	0.0407	0.0363	0.0201	0.0084
03-587	.0	0.0084	0.0066	0.0038	0.0035	0.0032	0.0018	0.0008
03-589	.0	0.0588	0.0454	0.0246	0.0221	0.0206	0.0116	0.0049
03-590	.0	0.0941	0.0742	0.0430	0.0393	0.0366	0.0206	0.0088
03-590	1.0	0.0831	0.0655	0.0380	0.0347	0.0323	0.0182	0.0077
03-590	1.0	0.0993	0.0783	0.0454	0.0414	0.0386	0.0218	0.0092
03-592	.0	0.1933	0.1451	0.0718	0.0625	0.0584	0.0330	0.0140
03-592	.0	0.1836	0.1378	0.0682	0.0594	0.0555	0.0314	0.0133
03-592	.0	0.1660	0.1247	0.0617	0.0537	0.0502	0.0284	0.0120
03-593	.0	0.0236	0.0163	0.0066	0.0053	0.0050	0.0028	0.0012
03-595	.0	0.0004	0.0004	0.0003	0.0002	0.0002	0.0001	0.0001
03-596	.0	0.0125	0.0086	0.0035	0.0028	0.0026	0.0015	0.0006
03-597	.0	0.0855	0.0696	0.0446	0.0417	0.0387	0.0218	0.0092
03-598	.0	0.0003	0.0003	0.0002	0.0002	0.0002	0.0001	0.0000
03-599	.0	0.0068	0.0054	0.0031	0.0028	0.0026	0.0015	0.0006
03-600	.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
03-605	.5	0.0012	0.0011	0.0009	0.0009	0.0008	0.0004	0.0002
03-607	1.0	0.1368	0.1097	0.0671	0.0621	0.0577	0.0326	0.0138
03-612	.0	0.1796	0.1706	0.1562	0.1529	0.1367	0.0756	0.0316
03-612	.0	0.2018	0.1917	0.1755	0.1718	0.1536	0.0850	0.0355
03-613	.0	0.0043	0.0036	0.0024	0.0022	0.0021	0.0012	0.0005
03-618	.0	0.0064	0.0054	0.0037	0.0035	0.0032	0.0018	0.0008
03-620	.0	0.0023	0.0022	0.0020	0.0020	0.0018	0.0010	0.0004
03-621	.0	0.0018	0.0017	0.0015	0.0015	0.0013	0.0007	0.0003
03-628	.0	0.0008	0.0006	0.0004	0.0004	0.0003	0.0002	0.0001
03-640	.0	0.0023	0.0020	0.0015	0.0014	0.0013	0.0007	0.0003
03-645	.0	0.0238	0.0207	0.0158	0.0153	0.0140	0.0079	0.0033
03-674	.0	0.0052	0.0043	0.0027	0.0025	0.0024	0.0013	0.0006
03-679	.0	0.0574	0.0403	0.0167	0.0136	0.0128	0.0072	0.0031

03=685	.0	0.0946	0.0822	0.0628	0.0606	0.0557	0.0313	0.0132
03=685	.0	0.0872	0.0758	0.0579	0.0559	0.0514	0.0289	0.0122
03=685	2.0	0.0890	0.0773	0.0591	0.0570	0.0524	0.0295	0.0125
03=685	2.0	0.0883	0.0768	0.0586	0.0566	0.0520	0.0292	0.0124
03=686	.0	0.0118	0.0110	0.0098	0.0096	0.0087	0.0048	0.0020
03=687	.0	0.0300	0.0244	0.0157	0.0146	0.0136	0.0077	0.0032
03=689	1.5	0.0497	0.0457	0.0395	0.0386	0.0350	0.0195	0.0082
03=690	.0	0.0271	0.0243	0.0199	0.0193	0.0176	0.0099	0.0042
03=697	.0	0.1506	0.1225	0.0782	0.0731	0.0679	0.0383	0.0162
03=778	3.0	0.0334	0.0302	0.0253	0.0246	0.0224	0.0126	0.0053
03=801	.0	0.0013	0.0009	0.0004	0.0004	0.0003	0.0002	0.0001
03=836	.0	0.0010	0.0008	0.0004	0.0004	0.0004	0.0002	0.0001
09= 1	.0	0.0104	0.0085	0.0057	0.0053	0.0049	0.0028	0.0012
09= 29	.0	0.0230	0.0168	0.0076	0.0064	0.0060	0.0034	0.0014
09= 46	.0	0.0051	0.0047	0.0039	0.0038	0.0035	0.0019	0.0008
09= 72	.0	0.0300	0.0270	0.0222	0.0216	0.0198	0.0111	0.0047
09= 74	.0	0.0382	0.0338	0.0268	0.0260	0.0238	0.0134	0.0057

TABLE 3

CORRELATION COEFFICIENTS BETWEEN DOSE AND X-RAY SCORE AND DOSE RATE
AND X-RAY SCORE AT SELECTED TIMES AFTER CESSATION OF INGESTION

Time after Cessation of Ingestion	<u>Total Dose Based on</u>		Time after Cessation of Ingestion	<u>Dose Rate Based on</u>	
	<u>Power</u> Function	Exponential		<u>Power</u> Function	Exponential
1 day	.799	.805	1 day	.768	.780
			10 days	.773	.795
			100 days	.788	.813
1 year	.812	.817	1 year	.798	.814
5 years	.812	.819	5 years	.805	.814
10 years	.810	.818			
20 years	.809	.816	20 years	.807	.813
30 years	.809	.816			
40 years	.808	.816	40 years	.807	.813

Based on 304 whole body measurements of 208 patients.

TABLE 6A

MEAN TOTAL DOSE TO SKELETON IN RADS. COMPUTED BY POWER FUNCTION

GROUPED BY 1960 RADIOLOGICAL OR CLINICAL DIAGNOSIS AND SORTED
BY DECREASING TOTAL DOSE 40 YEARS AFTER CESSATION OF INGESTION.

PT. NO.	X-RAY SCORE	ELAPSED TIME SINCE CESSATION OF INGESTION						
		1 DAY	1 YR	5 YR	10 YR	20 YR	30 YR	40 YR
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-401	43.5	342.7	566.1	1163.5	1720.0	2611.5	3361.2	4031.0
03-540	31.0	366.5	549.7	1060.1	1543.4	2322.4	2979.5	3567.3
03-554	19.0	242.8	449.2	978.3	1464.3	2238.7	2888.6	3468.6
03-528	17.0	361.7	494.0	879.9	1253.3	1860.4	2374.8	2835.8
03-551	39.0	279.4	383.7	687.2	980.3	1456.6	1860.1	2221.6
03-473	41.0	220.4	330.4	636.9	927.3	1395.2	1789.9	2142.9
03-402	26.0	217.1	325.6	627.9	914.2	1375.6	1764.8	2113.0
03-571	18.0	67.9	192.6	476.2	729.1	1128.5	1462.2	1759.7
MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION								
03-429	16.0	331.6	502.4	976.0	1423.7	2144.6	2752.5	3296.2
03-484	20.0	324.9	463.9	860.2	1239.4	1853.1	2371.9	2836.4
03-431	13.0	291.1	415.6	770.6	1110.2	1660.0	2124.7	2540.8
03-407	10.0	246.4	366.1	701.2	1019.1	1531.8	1964.5	2351.6
03-459	18.0	88.9	199.6	466.3	707.3	1089.3	1409.1	1694.3
03-404	21.0	159.8	235.4	447.8	649.6	975.3	1250.3	1496.4
03-455	15.0	85.6	171.8	386.9	582.9	894.4	1155.5	1388.4
09- 4	27.5	223.3	262.9	389.9	519.6	736.4	923.0	1091.3
03-405	10.0	92.5	152.8	314.0	464.2	704.8	907.1	1087.9
03-423	21.0	111.5	167.3	322.7	469.8	706.9	906.9	1085.8
MILD CHANGES TYPICAL OF RADIUM DEPOSITION								
03-445	8.0	330.3	464.9	851.9	1223.2	1825.1	2334.3	2790.3
03-449	10.0	336.9	468.2	847.8	1213.4	1806.7	2308.9	2758.8
03-416	15.0	154.7	293.2	645.6	968.3	1482.2	1913.3	2298.0
03-433	15.0	167.8	281.6	583.8	864.8	1314.5	1692.6	2030.4
03-586	10.0	145.6	253.2	535.1	796.0	1212.8	1563.0	1875.7
03-510	14.0	106.7	197.3	429.5	642.8	982.7	1268.0	1522.6
03-428	8.0	49.6	122.6	294.5	448.8	692.8	896.9	1078.9
03-530	7.0	74.0	124.2	257.5	381.4	579.8	746.5	895.5
03-462	10.0	88.5	123.1	222.9	319.0	475.0	607.0	725.3
03-588	6.0	78.8	110.3	200.8	287.9	429.1	548.6	655.6
03-502	7.0	35.4	50.5	93.6	134.9	201.7	258.1	308.7

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-417	4.0	95.1	185.0	411.9	619.1	948.7	1225.1	1471.8
03-419	3.5	74.5	149.4	336.6	507.1	778.1	1005.2	1207.9
03-424	6.0	64.1	95.3	182.5	265.2	398.6	511.2	611.9
09- 31	8.5	106.1	127.4	194.6	262.6	375.7	472.7	560.1
03-412	4.0	46.4	68.9	132.2	192.2	289.0	370.6	443.7
03-488	2.0	11.2	31.9	79.0	120.9	187.2	242.6	291.9
03-614	4.0	14.5	29.1	65.7	98.9	151.0	196.1	235.6
03-568	4.5	26.3	36.2	64.8	92.4	137.3	175.3	209.3
03-572	3.0	6.1	16.1	39.1	59.8	92.4	119.7	144.0
03-577	4.0	12.8	20.5	41.5	61.1	92.6	119.1	142.7
03-524	2.5	4.3	12.2	30.1	46.2	71.4	92.6	111.4
09- 7	3.0	5.5	8.8	17.8	26.2	39.8	51.1	61.3
09- 2	5.5	1.8	5.5	13.8	21.2	32.9	42.7	51.4
03-490	3.0	6.1	8.4	15.0	21.4	31.7	40.5	48.4
03-615	1.0	3.7	5.8	11.7	17.2	26.0	33.5	40.1
03-591	1.0	14.8	15.5	18.0	20.7	25.6	30.0	34.1
03-604	1.0	3.9	4.6	6.8	9.1	12.8	16.1	19.0
03-483	2.0	.2	.3	.5	.8	1.1	1.5	1.8
03-526	3.0	.1	.2	.5	.7	1.1	1.4	1.7
03-500	5.0	.0	.2	.5	.7	1.1	1.4	1.7

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-612	0.0	128.7	167.1	282.5	395.8	581.3	739.0	880.6
03-486	0.0	22.2	62.8	155.3	237.8	368.1	477.0	574.0
03-535	0.0	15.8	49.0	123.3	189.3	293.3	380.2	457.7
03-426	0.0	27.4	48.5	103.5	154.3	235.3	303.4	364.2
03-607	1.0	14.4	38.0	92.6	141.5	218.7	283.2	340.7
03-697	0.0	15.3	38.0	91.3	139.2	214.9	278.2	334.6
03-548	0.0	9.9	34.7	88.7	136.4	211.7	274.5	330.5
03-505	0.0	18.0	37.4	85.2	128.7	197.6	255.4	307.0
03-592	0.0	8.2	29.0	74.4	114.4	177.7	230.5	277.5
03-552	0.0	24.2	39.4	80.2	118.3	179.5	230.9	276.9
03-522	0.0	16.2	33.7	76.8	115.9	178.1	230.3	276.8
03-529	0.0	26.9	41.2	80.6	117.8	177.7	228.2	273.3
03-685	0.0	18.3	34.7	76.4	114.6	175.4	226.4	272.0
03-408	0.0	19.2	34.7	74.8	111.8	170.7	220.1	264.3
03-520	0.0	10.1	28.6	70.6	108.1	167.3	216.8	260.9
03-597	0.0	11.9	29.5	70.7	107.7	166.3	215.3	259.0
03-569	0.0	31.6	43.4	77.7	110.8	164.7	210.3	251.2
03-689	1.5	23.4	35.1	67.7	98.6	148.4	190.3	227.9
03-503	0.0	20.4	32.0	63.5	93.2	140.9	181.0	216.9
03-489	0.0	14.2	25.7	55.4	82.7	126.3	162.9	195.6
03-513	0.0	7.4	20.9	51.7	79.1	122.5	158.8	191.0
03-590	0.0	7.3	20.8	51.6	79.1	122.4	158.7	190.9
03-446	0.0	22.4	30.8	55.1	78.6	116.8	149.1	178.1
03-585	0.0	27.7	35.2	58.1	80.7	117.9	149.6	178.1
03-519	0.0	3.3	16.6	43.8	67.8	105.5	136.9	164.9
03-532	0.0	20.6	28.0	49.6	70.6	104.7	133.6	159.5
03-546	0.0	4.0	16.2	42.2	65.0	101.0	131.1	157.8
03-690	0.0	12.1	20.4	42.2	62.6	95.1	122.5	146.9
03-589	0.0	4.5	14.1	35.4	54.3	84.1	109.1	131.3
03-479	0.0	4.6	13.2	32.7	50.0	77.5	100.4	120.8
09- 74	0.0	9.0	16.0	34.1	50.8	77.4	99.8	119.8

03-561	0.0	2.3	11.4	30.1	46.6	72.5	94.1	113.3
09- 72	0.0	8.7	14.4	29.6	43.7	66.4	85.5	102.5
03-549	0.0	4.3	11.4	27.7	42.3	65.4	84.7	101.9
03-509	0.0	36.5	38.9	47.5	56.9	73.4	88.1	101.5
03-410	0.0	9.1	14.5	29.4	43.2	65.5	84.2	101.0
03-645	0.0	6.4	12.1	26.6	39.9	61.2	78.9	94.8
03-491	0.0	.8	9.1	24.8	38.5	60.1	78.0	94.0
03-679	0.0	2.0	9.3	24.5	37.9	59.0	76.5	92.2
03-441	0.0	4.2	10.4	25.0	38.1	58.9	76.2	91.7
03-437	0.0	5.2	10.8	24.7	37.3	57.3	74.1	89.0
03-687	0.0	4.0	9.9	23.8	36.2	56.0	72.4	87.1
03-567	1.0	7.0	11.2	22.7	33.5	50.7	65.2	78.2
03-432	0.0	6.7	10.8	21.8	32.1	48.7	62.6	75.1
03-531	0.0	12.1	14.8	23.2	31.6	45.6	57.6	68.3
03-427	0.0	2.7	6.7	16.2	24.8	38.2	49.5	59.5
03-536	0.0	1.0	5.8	15.5	23.9	37.3	48.4	58.3
03-452	0.0	2.1	5.9	14.7	22.6	34.9	45.3	54.5
03-579	0.0	1.3	5.4	13.9	21.5	33.4	43.3	52.1
03-542	0.0	1.3	5.3	13.9	21.4	33.3	43.1	52.0
03-686	0.0	6.2	8.6	15.7	22.5	33.6	42.9	51.3
03-468	0.0	4.7	7.2	14.0	20.5	30.9	39.7	47.5
03-422	0.0	2.3	5.5	13.0	19.8	30.5	39.5	47.5
03-573	0.0	2.3	5.4	12.9	19.6	30.2	39.1	47.0
03-553	0.0	1.1	4.5	11.7	18.1	28.1	36.5	43.9
03-523	0.0	1.7	4.4	10.6	16.2	25.1	32.5	39.1
03-504	0.0	1.6	4.2	10.3	15.8	24.4	31.5	38.0
03-456	0.0	7.2	8.5	12.6	16.8	23.7	29.8	35.2
03-444	0.0	.6	3.4	9.1	14.8	21.8	28.4	34.2
03-450	0.0	1.0	3.5	9.0	13.8	21.4	27.7	33.4
03-547	0.0	3.0	4.7	9.5	14.0	21.2	27.2	32.6
03-474	0.0	.6	3.1	8.3	12.9	20.0	26.0	31.3
03-420	0.0	3.7	5.2	9.4	13.5	20.0	25.6	30.6
03-565	0.0	8.2	9.1	12.2	15.5	21.1	26.0	30.5
03-516	0.0	1.0	3.2	8.0	12.4	19.1	24.8	29.9
03-593	0.0	.6	3.0	7.9	12.2	18.9	24.5	29.6
09- 29	0.0	.7	3.0	7.9	12.2	18.9	24.6	29.6
03-559	0.0	1.0	3.2	8.0	12.2	18.9	24.5	29.5
03-578	0.0	1.2	3.2	7.7	11.8	18.3	23.7	28.5
03-533	0.0	1.0	2.9	7.2	11.0	17.1	22.1	26.6
09- 1	0.0	1.3	3.0	7.0	10.7	16.5	21.4	25.7
03-539	0.0	1.0	2.8	7.0	10.7	16.6	21.5	25.8
03-563	0.0	.6	2.6	6.8	10.4	16.2	21.1	25.4
03-467	0.0	5.0	5.9	8.7	11.6	16.4	20.6	24.4
03-558	1.0	2.1	3.4	7.0	10.3	15.5	20.0	23.9
03-506	0.0	5.3	6.1	8.7	11.3	15.8	19.7	23.2
03-581	0.0	.5	2.3	6.0	9.3	14.4	18.7	22.6
03-481	0.0	5.0	5.8	8.3	10.9	15.3	19.1	22.5
03-587	0.0	.8	2.4	5.9	9.0	14.0	18.1	21.8
03-415	0.0	6.3	6.9	9.0	11.3	15.2	18.6	21.7
03-442	0.0	.5	2.2	5.7	8.9	13.8	17.9	21.5
03-406	0.0	4.8	5.5	7.9	10.4	14.6	18.2	21.4
03-471	0.0	1.7	2.9	6.1	9.0	13.7	17.7	21.2
03-620	0.0	2.9	3.8	6.7	9.4	13.9	17.8	21.2
03-507	0.0	.3	2.0	5.4	8.4	13.1	17.0	20.4
03-460	1.0	.7	2.2	5.5	8.4	13.0	16.9	20.3
03-525	0.0	8.0	8.4	10.0	11.7	14.7	17.4	20.0
03-434	0.0	1.8	2.8	5.5	8.0	12.2	15.6	18.7
09- 46	0.0	1.7	2.7	5.4	7.9	12.0	15.5	18.5

03-515	0.0	.7	2.0	4.9	7.6	11.7	15.2	18.3
03-512	0.0	.5	1.9	4.9	7.5	11.7	15.1	18.2
03-618	0.0	.9	2.1	4.9	7.5	11.6	14.9	18.0
03-477	0.0	.4	1.8	4.8	7.4	11.5	14.9	17.9
03-555	0.0	1.6	2.5	5.1	7.5	11.4	14.7	17.6
03-564	0.0	.2	1.7	4.5	7.0	10.9	14.2	17.1
03-508	0.0	.3	1.7	4.5	7.0	10.9	14.1	17.0
03-521	0.0	.6	1.8	4.5	6.9	10.7	13.8	16.6
03-469	0.0	.7	1.8	4.5	6.9	10.6	13.7	16.5
03-621	0.0	2.2	2.9	5.1	7.2	10.6	13.6	16.2
03-596	0.0	.3	1.6	4.2	6.4	10.0	13.0	15.7
03-599	0.0	.6	1.7	4.3	6.5	10.1	13.1	15.7
03-674	0.0	.7	1.7	4.2	6.4	9.8	12.7	15.3
03-562	0.0	2.7	3.2	4.9	6.6	9.4	11.9	14.1
03-613	0.0	.7	1.6	3.7	5.7	8.7	11.3	13.6
03-518	0.0	2.9	3.4	4.9	6.4	9.0	11.3	13.3
03-493	0.0	1.6	2.2	3.9	5.5	8.2	10.4	12.4
03-576	0.0	.5	1.3	3.2	4.9	7.5	9.8	11.7
03-458	0.0	3.0	3.3	4.5	5.7	7.8	9.6	11.3
03-556	0.0	1.0	1.6	3.2	4.8	7.3	9.4	11.2
03-501	0.0	.2	1.1	3.0	4.6	7.1	9.2	11.1
03-418	0.0	2.8	3.1	4.3	5.5	7.6	9.4	11.1
03-403	0.0	2.3	2.7	3.9	5.2	7.3	9.1	10.8
03-461	0.0	.2	1.0	2.7	4.2	6.6	8.5	10.3
03-435	0.0	.9	1.4	2.8	4.1	6.3	8.1	9.7
03-544	0.0	.3	1.0	2.4	3.6	5.6	7.2	8.7
03-640	0.0	.6	1.1	2.4	3.6	5.5	7.1	8.5
03-478	0.0	.2	.8	2.2	3.4	5.4	6.9	8.4
03-527	0.0	.8	1.3	2.5	3.6	5.4	6.9	8.3
03-494	0.0	.3	.8	1.8	2.8	4.3	5.5	6.7
03-466	0.0	.2	.7	1.8	2.8	4.3	5.5	6.7
03-457	0.0	1.3	1.5	2.1	2.8	3.9	4.8	5.7
03-605	0.5	.5	.7	1.5	2.2	3.4	4.3	5.2
03-492	0.0	.9	1.1	1.7	2.3	3.3	4.2	5.0
03-534	0.0	.2	.6	1.4	2.1	3.2	4.2	5.0
03-496	0.0	.1	.3	.9	1.4	2.2	2.8	3.4
03-580	0.0	.0	.3	.9	1.4	2.2	2.8	3.4
03-465	0.0	.1	.3	.9	1.4	2.1	2.7	3.3
03-447	0.0	.0	.3	.9	1.4	2.1	2.8	3.3
03-836	0.0	.1	.2	.5	.8	1.2	1.6	1.9
03-574	0.0	.4	.5	.7	.9	1.2	1.5	1.8
03-628	0.0	.1	.2	.5	.8	1.2	1.5	1.8
03-801	0.0	.0	.2	.5	.7	1.2	1.5	1.8
03-464	0.0	.1	.2	.5	.7	1.1	1.4	1.7
03-475	0.0	.1	.2	.5	.7	1.1	1.4	1.7
03-480	0.0	.0	.2	.4	.7	1.1	1.4	1.7
03-495	0.0	.0	.2	.5	.7	1.1	1.4	1.7
03-570	0.0	.1	.2	.5	.7	1.1	1.4	1.7
03-436	0.0	.4	.5	.6	.8	1.1	1.4	1.6
03-476	0.0	.0	.2	.4	.7	1.0	1.3	1.6
03-485	0.0	.3	.4	.5	.7	1.0	1.3	1.6
03-595	0.0	.1	.2	.4	.7	1.0	1.3	1.6
03-600	0.0	.5	.6	.7	.9	1.2	1.4	1.6
03-566	0.0	.4	.4	.6	.8	1.1	1.3	1.5
03-575	0.0	.1	.2	.4	.6	1.0	1.3	1.5
03-598	0.0	.1	.2	.4	.6	1.0	1.2	1.5
03-411	0.0	.4	.4	.6	.7	1.0	1.2	1.4
03-443	0.0	.2	.3	.5	.6	.9	1.1	1.4
03-482	0.0	.1	.2	.3	.5	.7	.9	1.1

TABLE 6B

MEAN TOTAL DOSE TO SKELETON IN RADS, COMPUTED BY THREE EXPONENTIALS

GROUPED BY 1960 RADIOLOGICAL OR CLINICAL DIAGNOSIS AND SORTED
BY DECREASING TOTAL DOSE 40 YEARS AFTER CESSATION OF INGESTION.

PT. NO.	X-RAY SCORE	ELAPSED TIME SINCE CESSATION OF INGESTION						
		1 DAY	1 YR	5 YR	10 YR	20 YR	30 YR	40 YR
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-540	31.0	490.3	740.1	1676.0	2690.2	4214.7	5219.9	5872.3
03-401	43.5	392.1	636.2	1548.8	2541.0	4035.0	5021.4	5662.1
03-554	19.0	302.0	528.3	1369.2	2286.1	3668.7	4582.3	5176.3
03-528	17.0	425.9	593.8	1222.5	1900.6	2917.4	3586.5	4020.0
03-551	39.0	369.5	517.7	1072.8	1671.7	2569.9	3161.0	3544.0
03-473	41.0	273.0	411.9	932.4	1496.3	2343.9	2902.9	3265.7
03-402	26.0	267.2	403.3	913.4	1466.1	2297.0	2844.9	3200.4
03-571	18.0	106.5	238.9	701.5	1209.1	1976.1	2483.8	2814.4
MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION								
03-429	16.0	451.2	686.4	1567.9	2523.3	3959.9	4907.3	5522.1
03-484	20.0	459.0	665.3	1430.2	2273.9	3528.5	4355.1	4891.0
03-431	13.0	320.0	463.9	1002.7	1585.3	2460.0	3036.3	3409.9
03-407	19.0	266.1	398.7	895.6	1433.9	2242.8	2776.2	3122.2
03-459	18.0	125.3	245.7	684.4	1164.3	1889.0	2368.3	2680.2
03-404	21.0	193.4	287.7	640.9	1023.4	1598.2	1977.1	2222.9
09- 4	27.5	394.9	474.6	770.1	1085.0	1553.3	1859.4	2056.2
03-455	15.0	106.5	195.7	524.9	884.6	1427.2	1785.9	2019.2
03-405	10.0	110.4	179.1	435.9	715.0	1135.4	1413.0	1593.3
03-423	21.0	132.9	200.6	454.2	729.1	1142.3	1414.8	1591.6
MILD CHANGES TYPICAL OF RADIUM DEPOSITION								
03-445	8.0	465.8	667.1	1421.3	2236.1	3459.1	4264.5	4786.6
03-449	10.0	381.1	539.7	1133.8	1775.1	2737.4	3371.0	3781.5
03-416	15.0	183.8	326.4	855.7	1433.0	2313.8	2879.3	3253.4
03-433	15.0	211.4	346.6	852.0	1401.8	2229.8	2776.6	3131.8
03-586	10.0	175.1	294.3	738.8	1222.9	1952.3	2434.1	2747.1
03-510	14.0	122.0	213.4	552.8	923.0	1481.1	1849.9	2089.7
03-428	8.0	67.2	139.2	397.7	680.9	1108.7	1391.8	1576.1
03-530	7.0	99.2	162.7	399.9	657.9	1046.6	1303.2	1469.9
03-462	10.0	107.9	152.9	321.2	502.9	775.6	955.1	1071.5
03-588	6.0	99.6	141.9	300.1	471.0	727.4	896.4	1005.8
03-502	7.0	47.2	68.4	148.0	233.9	363.0	448.0	503.1

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-417	4.0	106.4	192.1	509.1	855.3	1377.3	1722.5	1946.9
03-419	3.5	91.9	169.0	453.5	764.2	1232.9	1542.8	1744.4
09- 31	8.5	180.2	221.1	373.6	536.3	778.8	937.5	1039.7
03-424	6.0	69.4	104.0	233.5	373.9	584.8	723.8	814.0
03-412	4.0	59.9	89.8	202.1	323.6	506.3	626.7	704.9
03-488	2.0	16.3	36.7	108.0	186.2	304.4	382.6	433.5
03-614	4.0	18.2	33.5	89.9	151.6	244.5	306.0	346.0
03-568	4.5	31.2	43.8	90.7	141.3	217.2	267.2	299.6
03-577	4.0	15.9	25.3	60.5	98.7	156.3	194.3	218.9
03-572	3.0	8.0	17.3	50.0	85.9	140.1	176.0	199.3
03-524	2.5	5.7	12.9	37.8	65.2	106.5	133.9	151.7
09- 7	3.0	8.1	12.8	30.7	50.0	79.2	98.4	110.9
09- 2	5.5	3.3	7.8	23.2	40.1	65.7	82.7	93.7
03-490	3.0	6.5	9.1	18.8	29.2	44.9	55.3	62.0
03-615	1.0	4.4	7.0	16.5	26.9	42.5	52.9	59.6
03-604	1.0	6.0	7.2	11.6	16.4	23.4	28.0	31.0
03-591	1.0	15.7	16.4	19.0	21.6	25.5	28.0	29.6
03-500	5.0	.1	.2	.6	1.1	1.8	2.3	2.6
03-483	2.0	.3	.4	.8	1.2	1.8	2.3	2.5
03-526	3.0	.1	.2	.6	1.0	1.6	2.0	2.3

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-612	0.0	182.7	243.1	468.7	711.2	1074.1	1312.6	1466.8
03-486	0.0	33.2	74.4	218.6	376.7	615.8	773.9	876.9
03-535	0.0	27.5	65.2	194.4	336.3	550.8	692.8	785.3
03-697	0.0	27.0	56.0	160.1	274.1	446.3	560.3	634.5
03-607	1.0	21.7	46.7	135.1	232.1	378.7	475.6	538.8
03-548	0.0	16.3	41.6	125.9	218.4	358.4	451.0	511.4
03-592	0.0	16.0	41.3	124.9	217.0	356.2	448.3	508.3
03-685	0.0	28.2	50.2	131.5	220.3	354.2	442.7	500.2
03-522	0.0	24.4	45.8	124.5	210.5	340.3	426.1	481.9
03-426	0.0	29.7	50.6	128.2	212.7	340.1	424.3	479.0
03-505	0.0	22.4	42.0	114.1	192.9	311.7	390.3	441.5
03-529	0.0	33.2	51.0	117.4	189.5	297.9	369.5	415.9
03-552	0.0	27.8	44.6	107.5	175.8	298.8	346.7	390.8
03-597	0.0	15.4	32.0	91.3	156.4	254.6	319.6	361.9
03-569	0.0	37.5	52.5	108.8	169.6	260.7	320.6	359.5
03-520	0.0	13.4	30.1	88.5	152.6	249.4	313.4	355.1
03-408	0.0	20.9	36.0	92.2	153.5	245.9	306.9	346.6
03-689	1.5	28.3	42.8	96.9	155.5	243.6	301.7	339.4
03-585	0.0	45.0	58.7	109.7	164.4	246.4	300.1	334.9
03-590	0.0	12.6	28.3	83.2	143.3	234.3	294.5	333.7
03-503	0.0	24.2	37.8	88.6	143.8	226.8	281.6	317.1
03-513	0.0	11.6	26.0	76.4	131.8	215.4	270.8	306.9
03-446	0.0	30.4	42.7	88.3	137.7	211.7	260.4	292.0
03-489	0.0	15.0	25.8	66.1	110.1	176.4	220.2	248.7
03-519	0.0	5.5	18.2	56.8	99.3	163.5	206.0	233.7
09- 74	0.0	14.1	23.9	60.6	100.6	160.9	200.8	226.7
03-546	0.0	6.1	17.2	52.9	92.0	151.3	190.6	216.1
03-532	0.0	21.1	29.3	59.9	93.0	142.5	175.1	196.3
03-589	0.0	6.7	15.9	47.4	82.0	134.3	168.9	191.5
09- 72	0.0	13.1	21.2	51.7	84.8	134.7	167.6	189.0
03-690	0.0	11.4	18.7	45.9	75.5	120.0	149.5	168.6

03-479	0.0	6.4	14.3	42.0	72.4	118.3	148.7	168.4
03-561	0.0	3.9	12.7	39.5	69.1	113.8	143.4	162.7
03-549	0.0	5.7	12.1	35.2	60.4	98.6	123.9	140.3
03-410	0.0	10.0	15.8	37.8	61.7	97.6	121.3	136.7
03-491	0.0	1.7	10.0	32.0	56.2	92.8	117.1	132.9
03-645	0.0	7.5	13.3	34.9	58.5	94.0	117.5	132.8
03-687	0.0	5.4	11.2	32.0	54.9	89.3	112.1	127.0
03-441	0.0	5.1	10.6	30.2	51.7	84.2	105.7	119.7
03-679	0.0	2.9	9.3	28.8	50.3	82.8	104.3	118.3
03-567	1.0	8.4	13.3	31.8	51.9	82.1	102.0	115.0
03-437	0.0	5.7	10.7	29.0	49.1	79.4	99.4	112.4
03-432	0.0	7.2	11.5	27.5	44.8	70.9	88.2	99.4
03-509	0.0	37.2	39.8	49.5	59.6	74.4	83.9	89.9
03-686	0.0	8.5	12.0	25.5	40.0	61.7	76.0	85.3
03-427	0.0	3.5	7.3	20.9	35.9	58.6	73.6	83.3
03-531	0.0	13.0	16.3	28.5	41.5	60.9	73.7	81.9
03-452	0.0	3.1	6.9	20.3	34.9	57.1	71.7	81.3
03-579	0.0	2.3	6.4	19.7	34.3	56.4	71.0	80.5
03-536	0.0	1.8	6.2	19.5	34.1	56.2	70.9	80.4
03-542	0.0	2.3	6.3	19.5	33.9	55.7	70.2	79.6
03-573	0.0	2.9	5.9	16.5	28.2	45.9	57.6	65.2
03-553	0.0	1.8	5.0	15.4	26.8	44.0	55.5	62.9
03-422	0.0	2.8	5.6	15.7	26.8	43.5	54.6	61.8
03-468	0.0	4.8	7.3	16.9	27.3	43.0	53.3	60.0
03-504	0.0	2.3	4.9	14.3	24.5	40.0	50.3	57.0
03-523	0.0	2.3	4.9	14.2	24.4	39.7	49.9	56.5
09- 29	0.0	1.6	4.4	13.6	23.7	39.0	49.1	55.7
03-444	0.0	1.1	3.7	11.6	20.3	33.4	42.1	47.7
09- 1	0.0	2.1	4.2	11.8	20.1	32.6	40.9	46.4
03-547	0.0	3.5	5.4	12.9	20.9	33.1	41.1	46.3
03-458	0.0	1.5	3.7	11.3	19.7	32.3	40.6	46.1
03-593	0.0	1.1	3.6	11.2	19.5	32.1	40.5	45.9
03-559	0.0	1.6	3.8	11.2	19.4	31.8	40.0	45.3
03-550	1.0	3.1	4.9	11.6	19.0	30.1	37.4	42.1
03-474	0.0	1.0	3.3	10.2	17.8	29.3	36.9	41.9
03-420	0.0	4.1	5.9	12.3	19.3	29.7	36.6	41.0
03-516	0.0	1.4	3.4	10.1	17.4	28.5	35.8	40.6
03-578	0.0	1.6	3.4	9.9	17.1	27.8	35.0	39.6
03-539	0.0	1.5	3.3	9.7	16.6	27.2	34.2	38.7
03-533	0.0	1.4	3.1	9.1	15.7	25.6	32.2	36.5
03-563	0.0	.9	2.9	8.9	15.5	25.5	32.1	36.4
03-581	0.0	.9	2.7	8.5	14.9	24.4	30.8	34.9
09- 46	0.0	2.4	3.8	9.2	15.0	23.7	29.5	33.2
03-587	0.0	1.1	2.6	7.5	13.0	21.3	26.7	30.3
03-618	0.0	1.4	2.8	7.7	13.1	21.3	26.7	30.2
03-507	0.0	.6	2.3	7.3	12.7	21.0	26.5	30.0
03-442	0.0	.8	2.3	7.1	12.4	20.4	25.7	29.1
03-460	1.0	1.0	2.4	7.2	12.4	20.4	25.6	29.0
03-565	0.0	7.8	8.8	12.4	16.2	21.9	25.6	27.9
03-456	0.0	5.2	6.2	10.1	14.2	20.3	24.3	26.9
03-467	0.0	5.1	6.2	10.0	14.1	20.2	24.2	26.7
03-471	0.0	1.8	2.9	7.3	11.9	19.0	23.6	26.7
03-564	0.0	.4	1.9	6.2	10.8	17.8	22.5	25.5
03-508	0.0	.6	1.9	6.1	10.6	17.5	22.0	25.0
03-515	0.0	.9	2.1	6.2	10.7	17.5	21.9	24.9
03-512	0.0	.7	2.0	6.0	10.5	17.3	21.8	24.7
03-599	0.0	.9	2.1	6.1	10.6	17.3	21.7	24.6
03-596	0.0	.6	1.9	5.9	10.3	17.0	21.5	24.3

03-477	0.0	.6	1.8	5.7	10.0	16.5	20.7	23.5
03-521	0.0	.9	1.9	5.6	9.7	15.9	20.0	22.6
03-469	0.0	.9	1.9	5.6	9.6	15.6	19.6	22.2
03-674	0.0	.9	2.0	5.6	9.6	15.6	19.5	22.1
03-555	0.0	1.5	2.5	5.9	9.6	15.2	18.9	21.3
03-506	0.0	4.4	5.1	7.8	10.7	15.0	17.8	19.6
03-613	0.0	.9	1.8	4.9	8.4	13.7	17.2	19.4
03-493	0.0	2.1	2.8	5.7	8.8	13.5	16.5	18.5
03-415	0.0	5.7	6.3	8.6	11.0	14.6	16.9	18.4
03-406	0.0	3.9	4.5	7.0	9.7	13.7	16.3	17.9
03-620	0.0	2.0	2.7	5.5	8.4	12.8	15.7	17.6
03-525	0.0	8.3	8.7	10.4	12.2	14.7	16.4	17.4
03-481	0.0	3.7	4.4	6.8	9.4	13.2	15.7	17.3
03-576	0.0	.7	1.4	4.1	7.0	11.4	14.4	16.3
03-434	0.0	1.3	1.9	4.5	7.2	11.3	14.1	15.9
03-461	0.0	.3	1.2	3.7	6.5	10.7	13.5	15.3
03-562	0.0	2.5	3.1	5.3	7.6	11.0	13.2	14.7
03-501	0.0	.3	1.1	3.3	5.8	9.6	12.1	13.8
03-556	0.0	1.0	1.5	3.7	6.1	9.7	12.0	13.6
03-544	0.0	.5	1.1	3.3	5.7	9.4	11.8	13.4
03-621	0.0	1.5	2.1	4.2	6.4	9.8	12.0	13.4
03-640	0.0	.7	1.2	3.2	5.4	8.7	10.9	12.3
03-478	0.0	.3	.9	2.8	5.0	8.2	10.3	11.7
03-458	0.0	3.0	3.4	4.8	6.4	8.7	10.1	11.1
03-418	0.0	2.8	3.2	4.6	6.2	8.5	10.0	10.9
03-527	0.0	.9	1.3	3.0	4.9	7.7	9.5	10.7
03-518	0.0	2.2	2.6	4.1	5.6	8.0	9.5	10.5
03-466	0.0	.2	.7	2.3	4.8	6.5	8.2	9.3
03-439	0.0	.7	1.1	2.5	4.1	6.5	8.1	9.1
03-403	0.0	1.8	2.2	3.5	4.9	6.9	8.3	9.1
03-494	0.0	.4	.8	2.3	3.9	6.4	8.0	9.0
03-605	0.5	.6	.9	2.1	3.5	5.5	6.8	7.7
03-534	0.0	.3	.6	1.7	3.0	4.8	6.1	6.9
03-580	0.0	.1	.4	1.2	2.2	3.6	4.5	5.1
03-496	0.0	.1	.4	1.2	2.1	3.5	4.4	5.0
03-457	0.0	1.1	1.3	2.0	2.7	3.8	4.5	5.0
03-447	0.0	.1	.3	1.1	1.9	3.2	4.0	4.5
03-465	0.0	.1	.3	1.1	1.9	3.1	3.9	4.4
03-492	0.0	.6	.8	1.3	1.9	2.8	3.4	3.8
03-836	0.0	.1	.3	.9	1.5	2.5	3.1	3.5
03-628	0.0	.1	.3	.8	1.4	2.3	2.9	3.2
03-801	0.0	.1	.2	.8	1.3	2.2	2.7	3.1
03-495	0.0	.1	.2	.6	1.1	1.7	2.2	2.5
03-475	0.0	.1	.2	.7	1.1	1.8	2.2	2.5
03-480	0.0	.1	.2	.6	1.0	1.7	2.1	2.4
03-464	0.0	.1	.2	.6	1.0	1.7	2.1	2.4
03-570	0.0	.1	.2	.6	1.0	1.6	2.1	2.3
03-574	0.0	.6	.7	1.0	1.3	1.8	2.1	2.3
03-595	0.0	.1	.2	.5	.9	1.5	1.8	2.1
03-476	0.0	.0	.2	.5	.9	1.4	1.8	2.0
03-575	0.0	.1	.1	.4	.7	1.2	1.5	1.7
03-485	0.0	.3	.3	.6	.8	1.2	1.5	1.6
03-436	0.0	.4	.5	.7	.9	1.2	1.4	1.6
03-598	0.0	.1	.2	.4	.7	1.1	1.4	1.6
03-566	0.0	.4	.4	.6	.8	1.1	1.3	1.5
03-600	0.0	.6	.6	.8	1.0	1.2	1.4	1.5
03-411	0.0	.3	.4	.5	.7	1.0	1.2	1.3
03-443	0.0	.2	.2	.4	.6	.9	1.1	1.2
03-482	0.0	.1	.1	.3	.4	.7	.8	.9

TABLE 6C

MEAN DAILY DOSE RATE TO SKELETON IN RADS. COMPUTED BY POWER FUNCTION

GROUPED BY 1960 RADIOLOGICAL OR CLINICAL DIAGNOSIS AND SORTED
BY DECREASING DOSE RATE 1 DAY AFTER CESSATION OF INGESTION.

PT. NO.	X-RAY SCORE	ELAPSED TIME IN DAYS			ELAPSED TIME IN YEARS			
		1	10	100	1	5	20	40
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-401	43.5	.8134	.7776	.6528	.5240	.3431	.2204	.1753
03-554	19.0	.7882	.7466	.6072	.4732	.3007	.1912	.1518
03-540	31.0	.6401	.6165	.5316	.4387	.2965	.1930	.1539
03-571	18.0	.5691	.5181	.3727	.2654	.1576	.0983	.0777
03-528	17.0	.4434	.4302	.3810	.3237	.2276	.1509	.1208
03-473	41.0	.3842	.3700	.3192	.2634	.1781	.1159	.0924
03-402	26.0	.3791	.3652	.3149	.2598	.1757	.1143	.0911
03-551	39.0	.3505	.3399	.3005	.2548	.1787	.1183	.0947
MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION								
03-429	16.0	.5992	.5767	.4960	.4080	.2748	.1785	.1423
03-484	20.0	.4751	.4593	.4017	.3364	.2319	.1523	.1216
03-459	18.0	.4575	.4262	.3282	.2446	.1498	.0941	.0745
03-431	13.0	.4256	.4114	.3508	.3014	.2078	.1364	.1090
03-407	19.0	.4168	.4017	.3474	.2874	.1950	.1271	.1014
03-455	15.0	.3405	.3203	.2546	.1946	.1215	.0769	.0609
03-404	21.0	.2620	.2527	.2100	.1817	.1237	.0807	.0644
03-405	10.0	.2194	.2097	.1761	.1414	.0925	.0595	.0473
03-423	21.0	.1948	.1876	.1618	.1335	.0903	.0587	.0468
09- 4	27.5	.1237	.1215	.1125	.1009	.0776	.0544	.0442
MILD CHANGES TYPICAL OF RADIUM DEPOSITION								
03-416	15.0	.5346	.5053	.4082	.3162	.1998	.1268	.1006
03-445	8.0	.4577	.4430	.3889	.3272	.2269	.1494	.1194
03-449	10.0	.4437	.4299	.3788	.3200	.2232	.1474	.1179
03-433	15.0	.4168	.3980	.3326	.2659	.1733	.1112	.0884
03-586	10.0	.4002	.3810	.3153	.2496	.1611	.1029	.0818
03-428	8.0	.3149	.2907	.2177	.1590	.0960	.0601	.0476
03-510	14.0	.2954	.2798	.2276	.1774	.1128	.0717	.0569
03-530	7.0	.1838	.1755	.1467	.1172	.0764	.0490	.0389
03-462	10.0	.1166	.1130	.0995	.0841	.0586	.0387	.0309
03-588	6.0	.1064	.1031	.0907	.0764	.0531	.0351	.0280
03-502	7.0	.0517	.0500	.0437	.0366	.0252	.0166	.0132

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-417	4.0	.3510	.3311	.2655	.2043	.1284	.0814	.0645
03-419	3.5	.2962	.2786	.2215	.1692	.1057	.0668	.0530
03-424	6.0	.1085	.1045	.0904	.0748	.0507	.0331	.0264
03-488	2.0	.0950	.0864	.0620	.0441	.0282	.0163	.0129
03-412	4.0	.0787	.0759	.0656	.0542	.0368	.0239	.0191
09- 31	8.5	.0671	.0658	.0605	.0539	.0408	.0283	.0229
03-614	4.0	.0578	.0544	.0432	.0330	.0206	.0130	.0103
03-572	3.0	.0441	.0405	.0208	.0215	.0129	.0080	.0064
03-524	2.5	.0360	.0328	.0236	.0168	.0100	.0062	.0049
03-568	4.5	.0330	.0320	.0283	.0240	.0168	.0112	.0089
03-577	4.0	.0279	.0267	.0226	.0183	.0121	.0078	.0062
09- 2	5.5	.0177	.0160	.0112	.0078	.0046	.0029	.0023
09- 7	3.0	.0120	.0115	.0097	.0079	.0052	.0033	.0027
03-615	1.0	.0078	.0074	.0063	.0051	.0034	.0022	.0017
03-490	3.0	.0076	.0074	.0066	.0056	.0039	.0026	.0021
03-604	1.0	.0022	.0021	.0020	.0018	.0014	.0009	.0008
03-591	1.0	.0020	.0020	.0019	.0018	.0016	.0013	.0011
03-500	5.0	.0008	.0007	.0004	.0003	.0002	.0001	.0001
03-526	3.0	.0005	.0004	.0003	.0002	.0001	.0001	.0001
03-483	2.0	.0003	.0003	.0002	.0002	.0001	.0001	.0001

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-486	0.0	.1857	.1690	.1216	.0866	.0514	.0321	.0254
03-535	0.0	.1580	.1424	.0997	.0699	.0411	.0256	.0202
03-612	0.0	.1260	.1227	.1102	.0952	.0687	.0462	.0371
03-548	0.0	.1235	.1098	.0742	.0511	.0298	.0185	.0146
03-592	0.0	.1046	.0929	.0625	.0430	.0250	.0155	.0123
03-607	1.0	.1044	.0958	.0704	.0508	.0304	.0190	.0150
03-697	0.0	.0980	.0904	.0676	.0494	.0298	.0186	.0148
03-520	0.0	.0844	.0768	.0553	.0394	.0234	.0146	.0115
03-426	0.0	.0792	.0753	.0620	.0488	.0314	.0200	.0159
03-519	0.0	.0776	.0626	.0398	.0262	.0150	.0093	.0073
03-505	0.0	.0775	.0727	.0573	.0434	.0270	.0170	.0135
03-597	0.0	.0756	.0698	.0523	.0382	.0230	.0144	.0114
03-522	0.0	.0699	.0655	.0516	.0392	.0243	.0153	.0121
03-491	0.0	.0678	.0493	.0243	.0153	.0086	.0053	.0042
03-546	0.0	.0650	.0567	.0367	.0247	.0143	.0089	.0070
03-685	0.0	.0632	.0598	.0483	.0374	.0236	.0150	.0119
03-513	0.0	.0618	.0562	.0404	.0288	.0171	.0106	.0084
03-590	0.0	.0617	.0562	.0404	.0288	.0171	.0106	.0084
03-408	0.0	.0587	.0557	.0456	.0357	.0228	.0146	.0116
03-552	0.0	.0550	.0526	.0443	.0357	.0235	.0151	.0120
03-561	0.0	.0533	.0451	.0273	.0180	.0103	.0064	.0050
03-529	0.0	.0504	.0484	.0415	.0341	.0229	.0148	.0118
03-589	0.0	.0453	.0408	.0286	.0200	.0118	.0073	.0058
03-489	0.0	.0435	.0413	.0338	.0265	.0169	.0108	.0086
03-679	0.0	.0418	.0357	.0220	.0146	.0084	.0052	.0041
03-503	0.0	.0411	.0395	.0336	.0274	.0182	.0118	.0094
03-689	1.5	.0409	.0394	.0340	.0280	.0189	.0123	.0098
03-569	0.0	.0396	.0384	.0340	.0288	.0202	.0134	.0107
03-479	0.0	.0391	.0356	.0296	.0182	.0108	.0068	.0053
03-549	0.0	.0312	.0286	.0211	.0152	.0091	.0057	.0045
03-690	0.0	.0302	.0288	.0241	.0192	.0125	.0080	.0064
03-536	0.0	.0290	.0242	.0142	.0093	.0053	.0033	.0026

03-446	0.0	.0281	.0272	.0241	.0204	.0143	.0095	.0076
03-441	0.0	.0268	.0247	.0185	.0135	.0082	.0051	.0040
09- 74	0.0	.0261	.0248	.0204	.0161	.0103	.0066	.0052
03-687	0.0	.0254	.0235	.0176	.0128	.0078	.0049	.0038
03-532	0.0	.0247	.0240	.0213	.0181	.0128	.0085	.0068
03-585	0.0	.0244	.0238	.0215	.0187	.0137	.0092	.0074
03-437	0.0	.0225	.0211	.0166	.0126	.0078	.0049	.0039
03-645	0.0	.0221	.0208	.0168	.0130	.0082	.0052	.0042
03-579	0.0	.0215	.0187	.0121	.0082	.0047	.0029	.0023
03-542	0.0	.0214	.0187	.0121	.0081	.0047	.0029	.0023
09- 72	0.0	.0207	.0198	.0166	.0133	.0087	.0056	.0045
03-410	0.0	.0197	.0189	.0160	.0129	.0085	.0055	.0044
03-553	0.0	.0181	.0158	.0102	.0069	.0040	.0025	.0019
03-452	0.0	.0176	.0160	.0115	.0082	.0049	.0030	.0024
03-427	0.0	.0173	.0160	.0120	.0088	.0053	.0033	.0026
03-444	0.0	.0162	.0137	.0082	.0054	.0031	.0019	.0015
03-567	1.0	.0153	.0146	.0124	.0100	.0066	.0043	.0034
03-474	0.0	.0148	.0125	.0075	.0050	.0028	.0018	.0014
03-432	0.0	.0147	.0140	.0119	.0096	.0064	.0041	.0033
03-593	0.0	.0139	.0118	.0071	.0047	.0027	.0017	.0013
03-422	0.0	.0133	.0123	.0094	.0069	.0042	.0026	.0021
03-573	0.0	.0132	.0122	.0093	.0069	.0042	.0026	.0021
03-450	0.0	.0125	.0111	.0075	.0052	.0030	.0019	.0015
09- 29	0.0	.0122	.0106	.0069	.0046	.0027	.0007	.0013
03-523	0.0	.0120	.0110	.0081	.0058	.0035	.0022	.0017
03-504	0.0	.0116	.0107	.0078	.0057	.0034	.0021	.0017
03-563	0.0	.0112	.0096	.0060	.0040	.0023	.0014	.0011
03-564	0.0	.0111	.0085	.0044	.0028	.0016	.0010	.0008
03-507	0.0	.0105	.0087	.0050	.0033	.0019	.0011	.0009
03-516	0.0	.0103	.0093	.0065	.0046	.0027	.0017	.0013
03-559	0.0	.0102	.0092	.0064	.0045	.0027	.0017	.0013
03-581	0.0	.0100	.0086	.0054	.0036	.0020	.0013	.0010
03-442	0.0	.0089	.0077	.0050	.0034	.0019	.0012	.0010
03-468	0.0	.0088	.0084	.0072	.0059	.0040	.0026	.0021
03-578	0.0	.0087	.0080	.0059	.0042	.0025	.0016	.0013
03-531	0.0	.0086	.0084	.0077	.0068	.0051	.0035	.0028
03-533	0.0	.0086	.0078	.0056	.0040	.0024	.0015	.0012
03-477	0.0	.0085	.0072	.0043	.0029	.0016	.0010	.0008
03-539	0.0	.0084	.0076	.0055	.0039	.0023	.0014	.0011
03-686	0.0	.0083	.0081	.0071	.0060	.0042	.0027	.0022
03-508	0.0	.0081	.0068	.0041	.0027	.0015	.0010	.0008
03-512	0.0	.0075	.0065	.0042	.0029	.0016	.0010	.0008
03-596	0.0	.0074	.0062	.0038	.0025	.0014	.0009	.0007
03-460	1.0	.0073	.0065	.0045	.0031	.0018	.0011	.0009
03-509	0.0	.0072	.0071	.0068	.0064	.0055	.0042	.0035
09- 1	0.0	.0072	.0067	.0051	.0037	.0023	.0014	.0011
03-587	0.0	.0070	.0064	.0046	.0033	.0020	.0012	.0010
03-547	0.0	.0063	.0060	.0051	.0041	.0027	.0018	.0014
03-515	0.0	.0059	.0054	.0039	.0028	.0016	.0010	.0008
03-521	0.0	.0054	.0049	.0035	.0025	.0015	.0009	.0007
03-461	0.0	.0054	.0044	.0025	.0016	.0009	.0006	.0005
03-501	0.0	.0053	.0044	.0027	.0018	.0010	.0006	.0005
03-469	0.0	.0051	.0047	.0034	.0025	.0015	.0009	.0007
03-599	0.0	.0051	.0046	.0033	.0024	.0014	.0009	.0007
03-618	0.0	.0049	.0045	.0035	.0026	.0016	.0010	.0008
03-420	0.0	.0049	.0048	.0042	.0035	.0025	.0016	.0013
03-550	1.0	.0047	.0045	.0038	.0031	.0020	.0013	.0010
03-674	0.0	.0045	.0041	.0031	.0023	.0014	.0009	.0007

03-471	n.0	.0043	.0042	.0035	.0028	.0018	.0012	.0009
03-478	n.0	.0040	.0033	.0020	.0013	.0008	.0005	.0004
03-456	n.0	.0040	.0039	.0036	.0033	.0025	.0018	.0014
03-613	n.0	.0038	.0035	.0027	.0020	.0012	.0008	.0006
09- 46	n.0	.0036	.0035	.0029	.0024	.0016	.0010	.0008
03-434	n.0	.0034	.0033	.0028	.0023	.0015	.0010	.0008
03-576	n.0	.0034	.0032	.0024	.0017	.0010	.0007	.0005
03-555	n.0	.0034	.0033	.0028	.0023	.0015	.0010	.0008
03-620	n.0	.0032	.0031	.0028	.0024	.0017	.0011	.0009
03-466	n.0	.0029	.0025	.0016	.0011	.0006	.0004	.0003
03-565	n.0	.0028	.0028	.0026	.0024	.0019	.0014	.0012
03-544	n.0	.0028	.0026	.0018	.0013	.0008	.0005	.0004
03-467	n.0	.0028	.0027	.0025	.0023	.0017	.0012	.0010
03-621	n.0	.0024	.0024	.0021	.0018	.0013	.0009	.0007
03-481	n.0	.0024	.0024	.0022	.0020	.0016	.0011	.0009
03-506	n.0	.0024	.0024	.0022	.0020	.0016	.0011	.0009
03-406	n.0	.0023	.0022	.0021	.0019	.0015	.0011	.0009
03-556	n.0	.0022	.0021	.0018	.0014	.0010	.0006	.0005
03-640	n.0	.0020	.0019	.0015	.0012	.0007	.0005	.0004
03-580	n.0	.0020	.0016	.0009	.0006	.0003	.0002	.0002
03-494	n.0	.0019	.0018	.0013	.0010	.0006	.0004	.0003
03-493	n.0	.0019	.0018	.0016	.0014	.0010	.0007	.0005
03-447	n.0	.0019	.0015	.0008	.0005	.0003	.0002	.0001
03-415	n.0	.0019	.0018	.0018	.0016	.0013	.0010	.0008
03-435	n.0	.0019	.0018	.0015	.0012	.0008	.0005	.0004
03-562	n.0	.0017	.0017	.0015	.0014	.0010	.0007	.0006
03-496	n.0	.0016	.0014	.0008	.0005	.0003	.0002	.0002
03-465	n.0	.0016	.0013	.0008	.0005	.0003	.0002	.0001
03-534	n.0	.0015	.0013	.0010	.0007	.0004	.0003	.0002
03-527	n.0	.0015	.0014	.0012	.0010	.0007	.0004	.0004
03-518	n.0	.0014	.0014	.0013	.0012	.0009	.0007	.0005
03-525	n.0	.0013	.0013	.0012	.0011	.0010	.0008	.0007
03-403	n.0	.0012	.0012	.0011	.0010	.0008	.0005	.0004
03-458	n.0	.0011	.0010	.0010	.0009	.0007	.0005	.0004
03-418	n.0	.0011	.0011	.0010	.0009	.0007	.0005	.0004
03-605	n.5	.0010	.0010	.0008	.0007	.0004	.0003	.0002
03-495	n.0	.0008	.0007	.0004	.0003	.0002	.0001	.0001
03-476	n.0	.0008	.0007	.0004	.0003	.0001	.0001	.0001
03-801	n.0	.0007	.0006	.0004	.0003	.0002	.0001	.0001
03-480	n.0	.0007	.0006	.0004	.0003	.0002	.0001	.0001
03-836	n.0	.0006	.0005	.0004	.0003	.0002	.0001	.0001
03-492	n.0	.0006	.0006	.0006	.0005	.0004	.0003	.0002
03-457	n.0	.0006	.0006	.0005	.0005	.0004	.0003	.0002
03-628	n.0	.0005	.0005	.0004	.0003	.0002	.0001	.0001
03-575	n.0	.0005	.0004	.0003	.0002	.0001	.0001	.0001
03-570	n.0	.0005	.0005	.0003	.0002	.0001	.0001	.0001
03-598	n.0	.0004	.0004	.0003	.0002	.0001	.0001	.0001
03-595	n.0	.0004	.0004	.0003</

TABLE 60

MEAN DAILY DOSE RATE TO SKELETON IN RADS, COMPUTED BY THREE EXPONENTIALS

GROUPED BY 1960 RADIOLOGICAL OR CLINICAL DIAGNOSIS AND SORTED
BY DECREASING DOSE RATE 1 DAY AFTER CESSATION OF INGESTION.

PT. NO.	X-RAY SCORE	ELAPSED TIME IN DAYS			ELAPSED TIME IN YEARS			
		1	10	100	1	5	20	40
ADVANCED CHANGES TYPICAL OF RADIUM DEPOSITION								
03-554	10.0	.9080	.7941	.6154	.5947	.5464	.3069	.1298
03-401	43.5	.8981	.8077	.6659	.6480	.5917	.3315	.1399
03-540	31.0	.8599	.7913	.6833	.6676	.6055	.3379	.1423
03-571	18.0	.7770	.6127	.3551	.3242	.3019	.1704	.0722
03-528	17.0	.5456	.5128	.4607	.4509	.4055	.2252	.0945
03-551	30.0	.4831	.4536	.4066	.3979	.3580	.1989	.0834
03-473	41.0	.4779	.4390	.3800	.3712	.3367	.1879	.0791
03-402	26.0	.4686	.4313	.3724	.3638	.3300	.1842	.0775
MODERATE CHANGES TYPICAL OF RADIUM DEPOSITION								
03-429	16.0	.8152	.7484	.6434	.6284	.5703	.3185	.1341
03-484	20.0	.6882	.6406	.5651	.5528	.4992	.2780	.1168
03-459	18.0	.5696	.4747	.3287	.3086	.2857	.1609	.0681
03-431	13.0	.4798	.4466	.3940	.3854	.3481	.1938	.0815
03-407	10.0	.4538	.4185	.3659	.3546	.3214	.1793	.0755
03-455	15.0	.3828	.3280	.2421	.2323	.2142	.1205	.0510
03-404	21.0	.3208	.2964	.2580	.2522	.2284	.1274	.0536
03-405	19.0	.2526	.2272	.1873	.1823	.1665	.0932	.0393
09- 4	27.5	.2397	.2322	.2105	.2145	.1891	.1033	.0427
03-423	21.0	.2330	.2145	.1852	.1809	.1641	.0915	.0385
MILD CHANGES TYPICAL OF RADIUM DEPOSITION								
03-445	8.0	.6659	.6218	.5518	.5398	.4869	.2709	.1138
03-416	15.0	.5838	.5074	.3877	.3739	.3440	.1933	.0817
03-449	10.0	.5207	.4875	.4349	.4256	.3834	.2132	.0895
03-433	15.0	.5033	.4509	.3688	.3587	.3278	.1837	.0775
03-586	10.0	.4555	.4045	.3246	.3151	.2885	.1618	.0683
03-428	8.0	.3724	.3032	.1942	.1815	.1685	.0950	.0403
03-510	14.0	.3663	.3204	.2484	.2401	.2205	.1239	.0524
03-530	7.0	.2362	.2116	.1731	.1683	.1539	.0862	.0364
03-462	10.0	.1475	.1381	.1232	.1205	.1086	.0603	.0253
03-588	6.0	.1392	.1302	.1158	.1133	.1021	.0568	.0238
03-502	7.0	.0708	.0659	.0581	.0569	.0514	.0286	.0120

MINIMAL CHANGES TYPICAL OF RADIUM DEPOSITION

03-417	4.0	.3583	.3094	.2327	.2239	.2062	.1159	.0490
03-419	3.5	.3306	.2833	.2091	.2007	.1850	.1041	.0440
09- 31	8.5	.1245	.1202	.1129	.1104	.0977	.0535	.0222
03-488	2.0	.1208	.0951	.0548	.0499	.0465	.0263	.0111
03-424	6.0	.1183	.1091	.0946	.0925	.0838	.0468	.0197
03-412	4.0	.1025	.0945	.0819	.0800	.0725	.0404	.0170
03-614	4.0	.0656	.0562	.0415	.0398	.0367	.0206	.0087
03-572	3.0	.0506	.0406	.0248	.0230	.0214	.0120	.0051
03-524	2.5	.0419	.0330	.0191	.0175	.0163	.0092	.0039
03-568	4.5	.0408	.0383	.0344	.0336	.0303	.0168	.0071
03-577	4.0	.0339	.0307	.0257	.0250	.0228	.0128	.0054
09- 2	5.5	.0288	.0222	.0120	.0108	.0101	.0057	.0024
09- 7	3.0	.0172	.0156	.0130	.0127	.0116	.0065	.0027
03-615	1.0	.0092	.0083	.0070	.0068	.0062	.0035	.0015
03-490	3.0	.0085	.0079	.0071	.0070	.0063	.0035	.0015
03-604	1.0	.0036	.0035	.0033	.0032	.0029	.0016	.0006
03-591	1.0	.0020	.0020	.0020	.0019	.0016	.0008	.0003
03-500	5.0	.0014	.0009	.0004	.0003	.0003	.0002	.0001
03-526	3.0	.0005	.0004	.0003	.0003	.0002	.0001	.0001
03-483	2.0	.0003	.0003	.0003	.0003	.0003	.0001	.0001

NEGATIVE FOR CHANGES TYPICAL OF RADIUM DEPOSITION

03-486	0.0	.2421	.1909	.1107	.1010	.0941	.0531	.0225
03-535	0.0	.2411	.1862	.1009	.0904	.0844	.0476	.0202
03-612	0.0	.1907	.1811	.1658	.1623	.1451	.0803	.0335
03-592	0.0	.1809	.1358	.0672	.0585	.0547	.0309	.0131
03-548	0.0	.1794	.1381	.0674	.0589	.0550	.0311	.0132
03-697	0.0	.1506	.1225	.0782	.0731	.0679	.0383	.0162
03-491	0.0	.1401	.0682	.0214	.0153	.0144	.0081	.0035
03-607	1.0	.1368	.1097	.0671	.0621	.0577	.0326	.0138
03-519	0.0	.1199	.0829	.0334	.0269	.0252	.0143	.0061
03-520	0.0	.0980	.0773	.0448	.0409	.0381	.0215	.0091
03-522	0.0	.0948	.0803	.0579	.0554	.0512	.0288	.0122
03-590	0.0	.0921	.0726	.0421	.0384	.0358	.0202	.0085
03-685	0.0	.0897	.0780	.0506	.0575	.0528	.0297	.0125
03-546	0.0	.0893	.0651	.0295	.0249	.0233	.0132	.0056
03-505	0.0	.0864	.0735	.0531	.0508	.0469	.0264	.0112
03-597	0.0	.0855	.0696	.0446	.0417	.0387	.0218	.0092
03-513	0.0	.0847	.0668	.0387	.0353	.0329	.0185	.0078
03-561	0.0	.0835	.0577	.0233	.0187	.0176	.0099	.0042
03-426	0.0	.0807	.0714	.0367	.0350	.0304	.0203	.0119
03-529	0.0	.0619	.0567	.0485	.0474	.0430	.0240	.0101
03-552	0.0	.0612	.0553	.0459	.0447	.0408	.0228	.0096
03-408	0.0	.0595	.0523	.0411	.0398	.0365	.0205	.0087
03-589	0.0	.0588	.0454	.0246	.0221	.0206	.0116	.0049
03-679	0.0	.0574	.0403	.0167	.0136	.0128	.0072	.0031
03-689	1.5	.0497	.0457	.0395	.0386	.0350	.0195	.0082
03-569	0.0	.0490	.0460	.0412	.0404	.0363	.0202	.0085
03-503	0.0	.0481	.0438	.0371	.0362	.0329	.0184	.0078
03-479	0.0	.0467	.0368	.0213	.0194	.0181	.0102	.0043
03-536	0.0	.0452	.0304	.0117	.0093	.0087	.0049	.0021
03-585	0.0	.0427	.0407	.0375	.0367	.0328	.0181	.0075
03-489	0.0	.0427	.0376	.0295	.0286	.0262	.0147	.0062

03-446	0.0	.0398	.0373	.0335	.0328	.0295	.0163	.0068
09- 74	0.0	.0382	.0368	.0268	.0260	.0238	.0134	.0057
03-549	0.0	.0356	.0286	.0175	.0162	.0150	.0085	.0036
03-579	0.0	.0333	.0242	.0110	.0093	.0087	.0049	.0021
03-542	0.0	.0329	.0240	.0109	.0092	.0086	.0049	.0021
09- 72	0.0	.0300	.0270	.0222	.0216	.0198	.0111	.0047
03-687	0.0	.0300	.0244	.0157	.0146	.0136	.0077	.0032
03-441	0.0	.0283	.0230	.0148	.0138	.0128	.0072	.0031
03-690	0.0	.0271	.0243	.0199	.0193	.0176	.0099	.0042
03-532	0.0	.0265	.0250	.0225	.0220	.0198	.0110	.0046
03-553	0.0	.0260	.0189	.0086	.0072	.0068	.0038	.0016
03-444	0.0	.0247	.0170	.0068	.0055	.0051	.0029	.0012
03-645	0.0	.0238	.0207	.0158	.0153	.0140	.0079	.0033
03-593	0.0	.0236	.0163	.0066	.0053	.0050	.0028	.0012
09- 29	0.0	.0230	.0168	.0076	.0064	.0060	.0034	.0014
03-452	0.0	.0224	.0177	.0103	.0094	.0087	.0049	.0021
03-564	0.0	.0220	.0122	.0040	.0029	.0028	.0016	.0007
03-437	0.0	.0220	.0187	.0135	.0129	.0119	.0067	.0028
03-474	0.0	.0217	.0149	.0060	.0048	.0045	.0026	.0011
03-410	0.0	.0212	.0192	.0160	.0156	.0142	.0080	.0034
03-427	0.0	.0197	.0160	.0102	.0096	.0089	.0050	.0021
03-567	1.0	.0178	.0161	.0135	.0131	.0120	.0067	.0028
03-507	0.0	.0178	.0117	.0044	.0035	.0032	.0018	.0008
03-563	0.0	.0168	.0119	.0051	.0042	.0039	.0022	.0009
03-581	0.0	.0162	.0115	.0049	.0040	.0038	.0021	.0009
03-450	0.0	.0162	.0122	.0061	.0053	.0050	.0028	.0012
03-432	0.0	.0154	.0139	.0117	.0114	.0104	.0058	.0024
03-573	0.0	.0145	.0120	.0080	.0075	.0070	.0039	.0017
03-523	0.0	.0144	.0115	.0070	.0065	.0061	.0034	.0014
03-504	0.0	.0144	.0116	.0071	.0066	.0061	.0034	.0015
03-559	0.0	.0139	.0108	.0058	.0052	.0049	.0028	.0012
03-422	0.0	.0138	.0114	.0076	.0071	.0066	.0037	.0016
03-508	0.0	.0129	.0089	.0036	.0029	.0027	.0015	.0006
03-596	0.0	.0125	.0086	.0035	.0028	.0026	.0015	.0006
03-516	0.0	.0125	.0096	.0052	.0047	.0044	.0025	.0010
03-477	0.0	.0122	.0084	.0034	.0027	.0025	.0014	.0006
03-442	0.0	.0120	.0088	.0040	.0034	.0031	.0018	.0008
03-686	0.0	.0118	.0110	.0098	.0096	.0087	.0048	.0020
03-539	0.0	.0107	.0085	.0049	.0045	.0042	.0023	.0010
09- 1	0.0	.0104	.0085	.0057	.0053	.0049	.0028	.0012
03-512	0.0	.0102	.0074	.0034	.0028	.0027	.0015	.0006
03-578	0.0	.0101	.0081	.0049	.0046	.0042	.0024	.0010
03-533	0.0	.0101	.0079	.0046	.0042	.0039	.0022	.0009
03-531	0.0	.0100	.0096	.0090	.0088	.0078	.0043	.0018
03-460	1.0	.0095	.0073	.0038	.0033	.0031	.0018	.0007
03-461	0.0	.0092	.0061	.0023	.0018	.0017	.0009	.0004
03-468	0.0	.0089	.0082	.0070	.0068	.0062	.0035	.0015
03-587	0.0	.0084	.0066	.0038	.0035	.0032	.0018	.0008
03-509	0.0	.0076	.0075	.0073	.0071	.0061	.0032	.0013
03-547	0.0	.0071	.0064	.0054	.0053	.0048	.0027	.0011
03-501	0.0	.0071	.0049	.0020	.0016	.0015	.0008	.0004
03-515	0.0	.0069	.0054	.0031	.0029	.0027	.0015	.0006
03-599	0.0	.0068	.0054	.0031	.0028	.0026	.0015	.0006
03-550	1.0	.0065	.0059	.0049	.0048	.0044	.0025	.0010
03-618	0.0	.0064	.0054	.0037	.0035	.0032	.0018	.0008
03-521	0.0	.0062	.0049	.0029	.0026	.0024	.0014	.0006
03-478	0.0	.0060	.0042	.0017	.0013	.0013	.0007	.0003
03-469	0.0	.0056	.0045	.0028	.0026	.0024	.0013	.0006

03=420	n.0	.0056	.0053	.0047	.0046	.0042	.0023	.0010
03=674	n.0	.0052	.0043	.0027	.0025	.0024	.0013	.0006
03= 46	n.0	.0051	.0047	.0039	.0038	.0035	.0019	.0008
03=613	n.0	.0043	.0036	.0024	.0022	.0021	.0012	.0005
03=471	n.0	.0043	.0038	.0031	.0031	.0028	.0016	.0007
03=466	n.0	.0043	.0030	.0013	.0011	.0010	.0006	.0002
03=576	n.0	.0038	.0031	.0020	.0019	.0017	.0010	.0004
03=544	n.0	.0037	.0029	.0017	.0015	.0014	.0008	.0003
03=580	n.0	.0037	.0022	.0008	.0006	.0006	.0003	.0001
03=555	n.0	.0033	.0030	.0025	.0024	.0022	.0012	.0005
03=447	n.0	.0033	.0020	.0007	.0005	.0005	.0003	.0001
03=467	n.0	.0031	.0030	.0029	.0028	.0025	.0013	.0006
03=456	n.0	.0031	.0030	.0029	.0028	.0025	.0014	.0006
03=565	n.0	.0029	.0028	.0027	.0027	.0023	.0012	.0005
03=496	n.0	.0026	.0018	.0007	.0006	.0005	.0003	.0001
03=493	n.0	.0025	.0023	.0021	.0021	.0019	.0010	.0004
03=640	n.0	.0023	.0020	.0015	.0014	.0013	.0007	.0003
03=620	n.0	.0023	.0022	.0020	.0020	.0018	.0010	.0004
03=465	n.0	.0023	.0016	.0006	.0005	.0005	.0003	.0001
03=434	n.0	.0023	.0021	.0018	.0018	.0016	.0009	.0004
03=506	n.0	.0022	.0021	.0020	.0020	.0017	.0009	.0004
03=556	n.0	.0021	.0019	.0016	.0016	.0014	.0008	.0003
03=494	n.0	.0021	.0017	.0011	.0010	.0010	.0005	.0002
03=481	n.0	.0020	.0019	.0018	.0018	.0015	.0008	.0003
03=406	n.0	.0020	.0020	.0019	.0018	.0016	.0009	.0004
03=621	n.0	.0018	.0017	.0015	.0015	.0013	.0007	.0003
03=562	n.0	.0018	.0017	.0016	.0016	.0014	.0008	.0003
03=415	n.0	.0018	.0018	.0017	.0017	.0015	.0008	.0003
03=534	n.0	.0016	.0013	.0008	.0008	.0007	.0004	.0002
03=527	n.0	.0016	.0014	.0012	.0012	.0011	.0006	.0003
03=435	n.0	.0014	.0013	.0011	.0010	.0009	.0005	.0002
03=801	n.0	.0013	.0009	.0004	.0004	.0003	.0002	.0001
03=525	n.0	.0013	.0013	.0013	.0012	.0011	.0006	.0002
03=495	n.0	.0013	.0009	.0004	.0003	.0003	.0002	.0001
03=605	n.5	.0012	.0011	.0009	.0009	.0008	.0004	.0002
03=518	n.0	.0012	.0012	.0011	.0011	.0009	.0005	.0002
03=476	n.0	.0012	.0008	.0003	.0002	.0002	.0001	.0001
03=458	n.0	.0012	.0011	.0011	.0011	.0009	.0005	.0002
03=418	n.0	.0012	.0011	.0011	.0011	.0009	.0005	.0002
03=480	n.0	.0011	.0008	.0003	.0003	.0003	.0001	.0001
03=836	n.0	.0010	.0008	.0004	.0004	.0004	.0002	.0001
03=403	n.0	.0010	.0010	.0010	.0009	.0008	.0005	.0002
03=628	n.0	.0008	.0006	.0004	.0004	.0003	.0002	.0001
03=579	n.0	.0005	.0004	.0002	.0002	.0002	.0001	.0000
03=570	n.0	.0005	.0004	.0003	.0003	.0002	.0001	.0001
03=492	n.0	.0005	.0005	.0004	.0004	.0004	.0002	.0001
03=464	n.0	.0005	.0004	.0003	.0003	.0003	.0001	.0001
03=457	n.0	.0005	.0005	.0005</

TABLE 7

PATIENT NO. 03-551

TOTAL DOSE TO SKELETON IN RADS. COMPUTED BY POWER FUNCTION

DAY OF MEA.	X-RAY SCORE	ELAPSED TIME SINCE CESSATION OF INGESTION						
		1 DAY	1 YR	5 YR	10 YR	20 YR	30 YR	40 YR
11212	39.5	253.4	348.0	623.2	889.0	1321.0	1686.8	2014.7
12267	51.0	291.7	400.5	717.2	1023.0	1520.1	1941.2	2318.6
13743	38.0	310.0	425.8	762.4	1087.5	1616.0	2063.5	2464.7
14107	38.0	262.6	360.5	645.6	920.9	1368.4	1747.4	2087.1
15184	41.0	279.7	384.1	687.8	981.1	1457.8	1861.6	2223.4

DAILY DOSE RATE TO SKELETON IN RADS. COMPUTED BY POWER FUNCTION

DAY OF MEA.	X-RAY SCORE	ELAPSED TIME IN DAYS			ELAPSED TIME IN YEARS			
		1	10	100	49	5	20	40
11212	39.5	0.3179	0.3082	0.2725	0.2311	0.1621	0.1073	0.0859
12267	51.0	0.3658	0.3547	0.3136	0.2660	0.1866	0.1235	0.0989
13743	38.0	0.3888	0.3771	0.3334	0.2828	0.1983	0.1313	0.1051
14107	38.0	0.3293	0.3193	0.2823	0.2394	0.1679	0.1112	0.0890
15184	41.0	0.3508	0.3402	0.3008	0.2551	0.1789	0.1184	0.0948

TABLE 8

CORRELATION COEFFICIENTS FOR TOTAL DOSE AT VARIOUS TIMES VERSUS X-RAY
SCORE FOR GROUPS SORTED BY RADIOGRAPHIC CATEGORY

X-Ray Impression	Number of Patients	Elapsed Time						
		1 day	1 year	5 years	10 years	20 years	30 years	40 years
<u>Power Function Retention</u>								
Advanced	8	0.305	0.263	0.216	0.203	0.195	0.195	0.191
Moderate	9	-0.243	-0.303	-0.347	-0.358	-0.367	-0.365	-0.368
Mild	10	0.092	0.233	0.346	0.376	0.399	0.393	0.403
Minimal	17	0.477	0.419	0.390	0.384	0.380	0.381	0.380
Negative	148	0.065	0.079	0.087	0.089	0.090	0.090	0.090
<u>Exponential Retention</u>								
Advanced	8	0.300	0.277	0.232	0.211	0.192	0.197	0.189
Moderate	9	-0.173	-0.205	-0.240	-0.251	-0.261	-0.258	-0.262
Mild	10	0.032	0.121	0.235	0.273	0.307	0.298	0.311
Minimal	17	0.465	0.429	0.397	0.388	0.381	0.383	0.380
Negative	148	0.061	0.072	0.084	0.086	0.088	0.088	0.089

TABLE 9

CORRELATION COEFFICIENTS BETWEEN X-RAY SCORE AND
TOTAL DOSE AT VARIOUS TIMES FOR COMBINED GROUPS

X-ray Impression	Number of Patients	Elapsed Time						
		1 day	1 year	5 years	10 years	20 years	30 years	40 years
<u>Power Function Retention</u>								
Advanced-Moderate	17	0.317	0.328	0.326	0.324	0.323	0.322	0.322
Advanced-Moderate-Mild	27	0.399	0.439	0.457	0.460	0.461	0.461	0.461
Advanced-Moderate-Mild-Min	44	0.695	0.725	0.735	0.736	0.736	0.736	0.736
All patients	192	0.832	0.854	0.861	0.861	0.862	0.862	0.862
<u>Exponential Retention</u>								
Advanced-Moderate	17	0.311	0.318	0.317	0.313	0.311	0.309	0.309
Advanced-Moderate-Mild	27	0.386	0.414	0.437	0.442	0.444	0.444	0.445
Advanced-Moderate-Mild-Min	44	0.687	0.710	0.726	0.728	0.729	0.729	0.729
All patients	192	0.824	0.842	0.853	0.855	0.855	0.856	0.856

Table 10

CORRELATION COEFFICIENTS OF DOSE RATE VERSUS X-RAY SCORE
FOR ADJUSTED GROUPS OF PATIENTS

Number of Patients	X-ray Impression	Elapsed Time						
		1 day	10 days	100 days	1 year	5 years	20 years	40 years
<u>Power Function Retention</u>								
8	Advanced	-0.054	-0.028	0.054	0.117	0.167	0.181	0.184
9	Moderate	-0.468	-0.463	-0.439	-0.413	-0.385	-0.376	-0.374
10	Mild	0.547	0.539	0.506	0.464	0.409	0.385	0.380
17	Minimal	0.309	0.315	0.334	0.351	0.370	0.376	0.377
148	Negative	0.069	0.074	0.085	0.090	0.091	0.091	0.091
<u>Exponential Retention</u>								
8	Advanced	-0.127	-0.041	0.160	0.185	0.175	0.170	0.167
9	Moderate	-0.326	-0.310	-0.270	-0.265	-0.270	-0.272	-0.274
10	Mild	0.440	0.406	0.330	0.324	0.336	0.343	0.347
17	Minimal	0.310	0.329	0.373	0.379	0.375	0.373	0.373
148	Negative	0.054	0.066	0.086	0.090	0.090	0.090	0.090

Table 11

CORRELATION FACTORS BETWEEN DOSE RATE AT VARIOUS TIMES AND X-RAY SCORE
FOR COMBINED RADIOGRAPHIC GROUPS

X-ray Impression	Number of Patients	Elapsed Time						
		1 day	10 days	100 days	1 year	5 years	20 years	40 years
<u>Power Function Retention</u>								
Advanced-Moderate	17	0.220	0.233	0.272	0.298	0.315	0.319	0.320
Advanced-Moderate-Mild	27	0.412	0.421	0.444	0.458	0.463	0.463	0.463
Advanced-Moderate-Mild-Min	44	0.703	0.708	0.722	0.730	0.735	0.735	0.735
<u>Exponential Retention</u>								
Advanced-Moderate	17	0.200	0.237	0.301	0.308	0.305	0.304	0.303
Advanced-Moderate-Mild	27	0.398	0.419	0.444	0.446	0.446	0.446	0.446
Advanced-Moderate-Mild-Min	44	0.704	0.716	0.729	0.730	0.730	0.730	0.730

TABLE 12

PARAMETERS OF LINEAR REGRESSION EQUATION

Total Accumulated Dose at 40 YEARS Calculated with Power Function

Number	X-ray Group	
44	Advanced-Moderate-Mild-Minimal	X-ray score = $2.93 (\pm 1.77) + 0.0069 (\pm 0.0010) \times \text{Dose}$
36	Moderate-Mild-Minimal	X-ray score = $3.70 (\pm 1.16) + 0.0047 (\pm 0.0008) \times \text{Dose}$
27	Advanced-Moderate-Mild	X-ray score = $7.87 (\pm 4.44) + 0.0051 (\pm 0.0019) \times \text{Dose}$
17	Advanced-Moderate	X-ray score = $15.27 (\pm 6.50) + 0.0034 (\pm 0.0026) \times \text{Dose}$
8	Advanced	X-ray score = $22.38 (\pm 15.06) + 0.0025 (\pm 0.0052) \times \text{Dose}$
<hr/>		
44	Advanced-Moderate-Mild-Minimal	Dose = $409.9 (\pm 184.7) + 78.8 (\pm 11.2) \times \text{X-ray score}$
36	Moderate-Mild-Minimal	Dose = $134.4 (\pm 200.1) + 108.6 (\pm 18.2) \times \text{X-ray score}$
27	Advanced-Moderate-Mild	Dose = $1316.4 (\pm 338.0) + 42.1 (\pm 16.1) \times \text{X-ray score}$
17	Advanced-Moderate	Dose = $1640.7 (\pm 576.3) + 30.3 (\pm 23.0) \times \text{X-ray score}$
8	Advanced	Dose = $2337.9 (\pm 951.1) + 14.7 (\pm 30.7) \times \text{X-ray score}$

TABLE 13

PARAMETERS OF LINEAR REGRESSION EQUATION

Total Accumulated Dose at 40 Years Calculated with Exponential Retention

Number

44	Advanced-Moderate-Mild-Minimal	X-ray score = $3.24 (\pm 1.76) + 0.0044 (\pm 0.0006) \times \text{Dose}$
36	Moderate-Mild-Minimal	X-ray score = $3.99 (\pm 1.16) + 0.0030 (\pm 0.0005) \times \text{Dose}$
27	Advanced-Moderate-Mild	X-ray score = $8.66 (\pm 4.33) + 0.0031 (\pm 0.0012) \times \text{Dose}$
17	Advanced-Moderate	X-ray score = $15.92 (\pm 6.29) + 0.0021 (\pm 0.0016) \times \text{Dose}$
8	Advanced	X-ray score = $22.11 (\pm 15.76) + 0.0017 (\pm 0.0036) \times \text{Dose}$
44	Advanced-Moderate-Mild-Minimal	Dose = $594.0 (\pm 287.3) + 120.1 (\pm 17.4) \times \text{X-ray score}$
36	Moderate-Mild-Minimal	Dose = $171.9 (\pm 317.7) + 165.9 (\pm 28.9) \times \text{X-ray score}$
27	Advanced-Moderate-Mild	Dose = $1987.9 (\pm 537.3) + 63.8 (\pm 25.7) \times \text{X-ray score}$
17	Advanced-Moderate	Dose = $2490.2 (\pm 917.2) + 46.1 (\pm 36.6) \times \text{X-ray score}$
8	Advanced	Dose = $3508.1 (\pm 1373.9) + 21.0 (\pm 44.3) \times \text{X-ray score}$

TABLE 14

PARAMETERS OF LINEAR REGRESSION EQUATION

Dose Rate at 1 Day Calculated with Power Function

Number	X-ray Group	
44	Advanced-Moderate-Mild-Minimal	X-ray score = $3.19 (\pm 1.88) + 33.88 (\pm 5.29) \times \text{Dose Rate}$
36	Moderate-Mild-Minimal	X-ray score = $3.43 (\pm 1.20) + 24.96 (\pm 4.20) \times \text{Dose Rate}$
27	Advanced-Moderate-Mild	X-ray score = $8.96 (\pm 4.57) + 23.36 (\pm 10.30) \times \text{Dose Rate}$
17	Advanced-Moderate	X-ray score = $17.96 (\pm 5.54) + 11.75 (\pm 13.42) \times \text{Dose Rate}$
8	Advanced	X-ray score = $31.10 (\pm 13.70) - 3.20 (\pm 23.88) \times \text{Dose Rate}$
44	Advanced-Moderate-Mild-Minimal	Dose Rate = $0.0934 (\pm 0.0377) + 0.0146 (\pm 0.0023) \times \text{X-ray score}$
36	Moderate-Mild-Minimal	Dose Rate = $0.0366 (\pm 0.0377) + 0.0204 (\pm 0.0034) \times \text{X-ray score}$
27	Advanced-Moderate-Mild	Dose Rate = $0.2734 (\pm 0.0674) + 0.0073 (\pm 0.0032) \times \text{X-ray score}$
17	Advanced-Moderate	Dose Rate = $0.3599 (\pm 0.1184) + 0.0041 (\pm 0.0047) \times \text{X-ray score}$
8	Advanced	Dose Rate = $0.5733 (\pm 0.2160) - 0.0009 (\pm 0.0070) \times \text{X-ray score}$

TABLE 15

PARAMETERS OF LINEAR REGRESSION EQUATION

Dose Rate at 1 day Calculated with Exponential Retention

Number	X-ray group	
44	Advanced-Moderate-Mild-Minimal	X-ray score = $3.27 (\pm 1.86) + 27.46 (\pm 4.27) \times \text{Dose Rate}$
36	Moderate-Mild-Minimal	X-ray score = $3.63 (\pm 1.19) + 19.81 (\pm 3.38) \times \text{Dose Rate}$
27	Advanced-Moderate-Mild	X-ray score = $9.34 (\pm 4.58) + 18.18 (\pm 8.37) \times \text{Dose Rate}$
17	Advanced-Moderate	X-ray score = $18.47 (\pm 6.55) + 8.58 (\pm 10.83) \times \text{Dose Rate}$
8	Advanced	X-ray score = $34.00 (\pm 15.41) - 6.93 (\pm 21.92) \times \text{Dose Rate}$
<hr/>		
44	Advanced-Moderate-Mild-Minimal	Dose Rate = $0.1113 (\pm 0.0464) - 0.0181 (\pm 0.0028) \times \text{Dose Rate}$
36	Moderate-Mild-Minimal	Dose Rate = $0.0389 (\pm 0.0475) + 0.0254 (\pm 0.0043) \times \text{Dose Rate}$
27	Advanced-Moderate-Mild	Dose Rate = $0.3423 (\pm 0.0842) + 0.0087 (\pm 0.0040) \times \text{Dose Rate}$
17	Advanced-Moderate	Dose Rate = $0.4564 (\pm 0.1481) + 0.0047 (\pm 0.0059) \times \text{Dose Rate}$
8	Advanced	Dose Rate = $0.7466 (\pm 0.2321) - 0.0024 (\pm 0.0074) \times \text{Dose Rate}$

TABLE 16

AVERAGE TOTAL DOSE AT VARIOUS TIMES FOR GROUPS SORTED BY X-RAY IMPRESSION

X-ray Impression	Number of Patients	Elapsed Time							
		1 day	1 year	5 years	10 years	20 years	30 years	40 years	
<u>Power Function Retention</u>									
Advanced	8	262 ±100	411 ±128	814 ±242	1191 ±356	1799 ±540	2310 ±895	2767 ±834	
Moderate	9	192 ±106	297 ±139	583 ±248	851 ±354	1284 ±527	1649 ±673	1975 ±805	
Mild	10	153 ±102	243 ±136	487 ±246	714 ±354	1080 ±529	1388 ±678	1663 ±810	
Minimal	17	23 ±29	41 ±54	84 ±120	125 ±181	191 ±277	246 ±358	295 ±430	
Negative	148	6 ±13	11 ±18	22 ±35	33 ±53	51 ±80	65 ±103	78 ±123	
<u>Exponential Retention</u>									
Advanced	8	328 ±118	509 ±156	1180 ±336	1908 ±543	3003 ±858	3725 ±1068	4194 ±1204	
Moderate	9	240 ±142	369 ±198	849 ±417	1370 ±655	2154 ±1014	2670 ±1250	3006 ±1403	
Mild	10	191 ±132	298 ±181	697 ±375	1130 ±588	1782 ±909	2212 ±1121	2491 ±1258	
Minimal	17	27 ±34	45 ±59	112 ±155	185 ±260	295 ±418	367 ±523	414 ±590	
Negative	148	7 ±17	13 ±25	32 ±56	52 ±90	83 ±142	104 ±176	117 ±198	

TABLE 17

FERTILITY EXPERIENCE AND INFANT MORTALITY AMONG RADIUM DIAL PAINTERS

MARRIED	0.001	PARA 0	GRAVIDA 0		3-438-15A
MARRIED	0.001	PARA 0	GRAVIDA 0		3-439-15A
MARRIED	0.001	PARA 4	GRAVIDA 4	(3RD PREG. TOXEM.)	3-440-15A
MARRIED	0.001	PARA 1	GRAVIDA 3	(2 MISCARRIAGES)	3-453-15A
MARRIED 1931	0.001	PARA 0	GRAVIDA 1	(1 MISCARRIAGE)	3-537-15A
MARRIED 1939	0.001	PARA 2 2	GRAVIDA 2		3-541-15A
MARRIED 1938	0.001	PARA 1 1	GRAVIDA 1		3-543-15A
MARRIED 1931	0.001	PARA 0	GRAVIDA 0		3-545-15A
MARRIED 1926	0.001	PARA 1 1	GRAVIDA 2	(1 MISCARRIAGE)	3-557-15A
MARRIED 1932	0.001	PARA 1 1	GRAVIDA 1		3-682-15A
MARRIED 1926, 29	0.001	PARA 3 3	GRAVIDA 3		3-683-15A
MARRIED 1943	0.001	PARA 2 2	GRAVIDA 2		3-695-15A
MARRIED	0.001	PARA 3	GRAVIDA 3		3-411-15A
MARRIED	0.001	PARA 2	GRAVIDA 2		3-413-15A
MARRIED	0.001	PARA 2 1	GRAVIDA 1		3-436-15A
MARRIED	0.001	PARA 2 1	GRAVIDA 2	(1 DIED AT 7 HOURS)	3-443-15A
MARRIED 1925, 51	0.001	PARA 2 2	GRAVIDA 4	(2 MISCARRIAGES)	3-464-15A
MARRIED	0.001	PARA 1 1	GRAVIDA 3		3-475-15A
MARRIED	0.001	PARA 2 2	GRAVIDA 2		3-476-15A
MARRIED	0.001	PARA 3 3	GRAVIDA 3		3-480-15A
MARRIED 1947	0.001	PARA 2 2	GRAVIDA 2		3-482-15A
MARRIED 1927	0.001	PARA 0	GRAVIDA 0		3-483-15A
MARRIED 1936	0.001	PARA 0	GRAVIDA 0		3-485-15A
MARRIED 1926	0.001	PARA 3 2	GRAVIDA 3	(1 PRE. DEC. 3 DAYS)	3-495-15A
MARRIED 1925	0.001	PARA 0	GRAVIDA 1	(1 MISCARRIAGE)	3-498-15A
MARRIED 1923	0.001	PARA 4 4	GRAVIDA 5	(1 MISCARRIAGE)	3-500-15A
MARRIED 1948	0.001	PARA 1 1	GRAVIDA 1		3-517-15A
MARRIED 1920	0.001	PARA 1 1	GRAVIDA 1		3-526-15A
MARRIED 1932	0.001	PARA 2 2	GRAVIDA 2		3-566-15A
MARRIED 1926	0.001	PARA 3 3	GRAVIDA 3		3-570-15A
MARRIED 1930	0.001	PARA 5 5	GRAVIDA 6	(1 MISCARRIAGE)	3-574-15A
MARRIED 1946	0.001	PARA 3 2	GRAVIDA 3	(1 DEC. AT 2 MONTHS)	3-575-15A
MARRIED 1930	0.001	PARA 3 3	GRAVIDA 3		3-595-15A
MARRIED 1925	0.001	PARA 0	GRAVIDA 0		3-600-15A
MARRIED 1927	0.001	PARA 1 0	GRAVIDA 1	(DIED AFTER BIRTH)	3-628-15A
MARRIED 1935	0.001	PARA 2 2	GRAVIDA 2		3-801-15A
MARRIED	0.002	PARA 2	GRAVIDA 2		3-430-15A
MARRIED 1936	0.002	PARA 0	GRAVIDA 0		3-447-15A
MARRIED	0.002	PARA 2 2	GRAVIDA 2		3-451-15A
MARRIED 1927, 51	0.002	PARA 1	GRAVIDA 1		3-465-15A
MARRIED 1934	0.002	PARA 2 2	GRAVIDA 2		3-496-15A
MARRIED 1926	0.002	PARA 0	GRAVIDA 0		3-580-15A
MARRIED 1913	0.002	PARA 6	GRAVIDA		3-692-15A
NOT MARRIED	0.003				3-414-15A
MARRIED	0.003	PARA 2 2	GRAVIDA 3	(1 STILLBIRTH)	3-472-15A
MARRIED 1927	0.003	PARA 1 1	GRAVIDA 4	(3 MISCARRIAGES)	3-511-15A
MARRIED 1930	0.003	PARA 6 6	GRAVIDA 6		3-534-15A
NEVER MARRIED	0.003				3-605-15A
MARRIED	0.004	PARA 2	GRAVIDA 3	(1 MISCARRIAGE)	3-421-15A
MARRIED	0.004	PARA 3	GRAVIDA 3		3-425-15A
MARRIED	0.004	PARA 3 3	GRAVIDA		3-457-15A
MARRIED	0.004	PARA 2 2	GRAVIDA 2		3-466-15A
MARRIED 1927	0.004	PARA 2 2	GRAVIDA 2		3-494-15A
MARRIED 1941	0.004	PARA 3 3	GRAVIDA 3		3-688-15A
MARRIED	0.005	PARA 5 4	GRAVIDA 5	(1 DEC. AT 2 YRS)	3-478-15A

MARRIED 1951	0.005	PARA 2 2	GRAVIDA 3	(1 MISCARRIAGE)	3-492-15A
MARRIED 1929	0.005	PARA 0	GRAVIDA 0		3-497-15A
MARRIED 1949	0.005	PARA 0	GRAVIDA 0		3-527-15A
MARRIED	0.005	PARA 0	GRAVIDA 0		3-544-15A
MARRIED 1927	0.005	PARA 2 2	GRAVIDA 2		3-640-15A
MARRIED 1951	0.006	PARA 0	GRAVIDA 0		3-461-15A
MARRIED	0.007	PARA 0	GRAVIDA 0		3-418-15A
MARRIED	0.007	PARA 2	GRAVIDA 3	(1 MISCARRIAGE)	3-435-15A
MARRIED	0.007	PARA 1 1	GRAVIDA 1		3-470-15A
MARRIED 1924	0.007	PARA 1 1	GRAVIDA 1		3-493-15A
MARRIED 1933	0.007	PARA 3	GRAVIDA 4	(1 ECTOPIC)	3-501-15A
MARRIED 1937	0.007	PARA 1 1	GRAVIDA 1		3-556-15A
MARRIED 1929	0.007	PARA 5 5	GRAVIDA 5	(1 OST.SAR. AT 18 YR.)	3-576-15A
MARRIED	0.008	PARA 1 1	GRAVIDA 1		3-403-15A
MARRIED 1929	0.008	PARA 3	GRAVIDA 3		3-448-15A
MARRIED 1936	0.008	PARA 2 2	GRAVIDA 2		3-514-15A
MARRIED 1927	0.008	PARA 3 3	GRAVIDA 3		3-613-15A
MARRIED 1934	0.009	PARA 2 2	GRAVIDA 2		3-562-15A
MARRIED 1925	0.009	PARA 0	GRAVIDA 0		3-596-15A
MARRIED 1935	0.009	PARA 2 2	GRAVIDA 2		3-599-15A
MARRIED 1930	0.009	PARA 3 3	GRAVIDA 3		3-674-15A
NEVER MARRIED	0.010				3-463-15A
MARRIED	0.010	PARA 1 1	GRAVIDA 1		3-469-15A
MARRIED 1922	0.010	PARA 2 2	GRAVIDA 2		3-508-15A
MARRIED 192	0.010	PARA 3 3	GRAVIDA 3		3-521-15A
MARRIED 1933	0.010	PARA 3 3	GRAVIDA 5	(2 MISCARRIAGES)	3-564-15A
MARRIED 1924	0.010	PARA 1	GRAVIDA 1		3-604-15A
MARRIED 1942	0.010	PARA 0	GRAVIDA 0		9- 46-15A
MARRIED 1926	0.011	PARA 3 3	GRAVIDA 4	(1 MISCARRIAGE)	3-512-15A
MARRIED 1933	0.011	PARA 6 6	GRAVIDA 8	(2 MISCARRIAGES)	3-515-15A
MARRIED JULY	0.011	PARA 2 2	GRAVIDA 3	(1 MISCARRIAGE)	3-518-15A
MARRIED 1934	0.011	PARA 2 2	GRAVIDA 2		3-555-15A
MARRIED	0.012	PARA 2 2	GRAVIDA 2		3-460-15A
MARRIED 1924	0.012	PARA 2 2	GRAVIDA 2		3-507-15A
MARRIED	0.013	PARA 2	GRAVIDA 4	(1 AND 4 ADN. DEV.FET)	3-409-15A
MARRIED	0.013	PARA 3	GRAVIDA 3		3-442-15A
MARRIED	0.013	PARA 0	GRAVIDA 4	(4 MISCARRIAGES)	3-471-15A
MARRIED 1929	0.013	PARA 2 2	GRAVIDA 2		3-550-15A
MARRIED 1926	0.013	PARA 1 1	GRAVIDA 1		3-581-15A
MARRIED 1927	0.013	PARA 1 1	GRAVIDA 1		3-587-15A
MARRIED 1923	0.014	PARA 1 1	GRAVIDA 2	(1 MISCARRIAGE)	9- 1-15A
MARRIED	0.015	PARA 0	GRAVIDA 1	(1 MISCARRIAGE)	3-415-15A
MARRIED	0.015	PARA 0	GRAVIDA 0		3-434-15A
MARRIED	0.015	PARA 1	GRAVIDA 1		3-454-15A
MARRIED	0.015	PARA 2 2	GRAVIDA 3	(1 MISCARRIAGE)	3-467-15A
NEVER MARRIED	0.015				3-539-15A
MARRIED 1939	0.015	PARA 5 5	GRAVIDA 8	(3 MISCARRIAGES)	3-563-15A
DIVORCED	0.015	PARA 1 0			3-642-15A
MARRIED 1929	0.016	PARA 2 1	GRAVIDA 3	(1 MISC., 1 DEC.6 DAY)	3-533-15A
MARRIED 1923	0.016	PARA 2 2	GRAVIDA 3	(1 MISC.)	9- 29-15A
MARRIED	0.017	PARA 0	GRAVIDA 0		3-458-15A
MARRIED 1946	0.017	PARA 2 2	GRAVIDA 2		3-506-15A
MARRIED 1927	0.017	PARA 2 2	GRAVIDA 2		3-559-15A
MARRIED 1932	0.017	PARA 0	GRAVIDA 0		3-578-15A
MARRIED 1929	0.017	PARA 1 1	GRAVIDA 4	(3 MISCARRIAGES)	3-593-15A
MARRIED	0.018	PARA 4 2	GRAVIDA 4	(1 AT BIRTH, 1 RET.	3-420-15A
MARRIED 1929	0.018	PARA 4 4	GRAVIDA 4		3-516-15A
MARRIED	0.019	PARA 5 5	GRAVIDA 5		3-474-15A
NEVER MARRIED	0.019				3-525-15A
MARRIED 1930	0.019	PARA 3 3	GRAVIDA 4	(1 MISCARRIAGE)	3-547-15A
MARRIED 1928	0.019	PARA 2 2	GRAVIDA 2		3-684-15A

MARRIED	0.020	PARA 2	GRAVIDA 3 (1 TUBAL PREG.)	3-450-15A
MARRIED 1948	0.020	PARA 3 3	GRAVIDA 4 (1 MISCARRIAGE)	3-481-15A
MARRIED 1942	0.020	PARA 4 4	GRAVIDA 6 (2 MISCARRIAGES)	3-549-15C
MARRIED 1933	0.020	PARA 4 4	GRAVIDA 5	3-565-15A
MARRIED 1934	0.022	PARA 2 2	GRAVIDA 2	3-504-15A
MARRIED 1922	0.023	PARA 1 1	GRAVIDA 1	3-523-15A
MARRIED 1942	0.023	PARA 1 1	GRAVIDA 1	3-615-15A
MARRIED	0.025	PARA 5 3	GRAVIDA 5 (DIED AT 10, 34 MON.)	3-444-15A
MARRIED 1923, 28	0.026	PARA 0	GRAVIDA 10 (MULT. MISCARR.)	3-553-15A
MARRIED 1921, 44	0.028	PARA 0 0	GRAVIDA 3 (3 MISCARRIAGES)	3-573-15A
MARRIED	0.028	PARA 0	GRAVIDA 0	3-686-15A
MARRIED 1922	0.028	PARA 2 2	GRAVIDA 2	9- 2-15A
MARRIED	0.029	PARA 4	GRAVIDA 4	3-422-15A
MARRIED	0.029	PARA 0	GRAVIDA 2 (2 MISCARRIAGES)	3-468-15A
NEVER MARRIED	0.029			3-490-15A
MARRIED 1937	0.029	PARA 0	GRAVIDA 0	3-591-15A
MARRIED 1923	0.030	PARA 0	GRAVIDA 0	3-542-15A
MARRIED 1926	0.030	PARA 2 2	GRAVIDA 2	3-579-15A
MARRIED	0.033	PARA 4	GRAVIDA NOT KNOWN	3-456-15A
MARRIED 1920	0.033	PARA 3 3	GRAVIDA 3	9- 7-15A
MARRIED 1928	0.035	PARA 3 3	GRAVIDA 4 (1 MISCARRIAGE)	3-536-15A
MARRIED 1934	0.041	PARA 2 2	GRAVIDA 2	3-531-15A
MARRIED 1929	0.041	PARA 2 2	GRAVIDA 2	3-594-15A
MARRIED	0.042	PARA 0	GRAVIDA 0	3-452-15A
NOT MARRIED	0.043			3-427-15A
MARRIED	0.045	PARA 1 1	GRAVIDA 1	3-432-15A
NOT MARRIED	0.045			3-567-15A
MARRIED 1942	0.051	PARA 0	GRAVIDA 0	3-687-15A
MARRIED	0.055	PARA 3	GRAVIDA 3	3-437-15A
MARRIED 1920	0.055	PARA 3 3	GRAVIDA 5 (2 MISCARRIAGES)	9- 72-15A
MARRIED	0.056	PARA 1	GRAVIDA 1	3-441-15A
MARRIED 1926	0.056	PARA 1 1	GRAVIDA 1	3-491-15A
MARRIED 1926	0.056	PARA 1 1	GRAVIDA 1	3-645-15A
MARRIED 1931	0.057	PARA 3 3	GRAVIDA 3	3-679-15A
MARRIED	0.060	PARA 0	GRAVIDA 0	3-410-15A
MARRIED 1926	0.061	PARA 0	GRAVIDA 0	3-549-15A
MARRIED 1929	0.067	PARA 0	GRAVIDA 0	3-524-15A
MARRIED 1951	0.067	PARA 0	GRAVIDA 0	3-561-15A
MARRIED	0.072	PARA 1 1	GRAVIDA 1	3-479-15A
MARRIED 1924	0.077	PARA 3 3	GRAVIDA 4 (1 MISCARRIAGE)	3-589-15A
MARRIED 1923	0.081	PARA 0	GRAVIDA 3 (3 MISCARRIAGES)	3-577-15A
MARRIED 1924	0.086	PARA 4 4	GRAVIDA 4	3-572-15A
MARRIED 1927	0.095	PARA 1 1	GRAVIDA 1	3-546-15A
MARRIED 1929	0.097	PARA 2 2	GRAVIDA 2	3-532-15A
MARRIED 1925	0.098	PARA 0	GRAVIDA 2 (2 MISCARRIAGES)	3-519-15A
MARRIED 1927	0.110	PARA 1 1	GRAVIDA 1	3-509-15A
MARRIED 1923	0.113	PARA 2 2	GRAVIDA 2	3-585-15A
MARRIED 1946	0.115	PARA 0	GRAVIDA 0	3-558-15A
MARRIED 1930	0.120	PARA 2 2	GRAVIDA 2	3-489-15A
MARRIED 1927	0.120	PARA 5 5	GRAVIDA 5	3-568-15A
MARRIED 1918, 24	0.125	PARA 4 4	GRAVIDA 4	3-503-15A
MARRIED 1920, 23	0.126	PARA 3 2	GRAVIDA 3	3-590-15A
MARRIED	0.130	PARA 3 3	GRAVIDA 3	3-446-15A
MARRIED 1932	0.130	PARA 1 1	GRAVIDA 1	3-487-15A
MARRIED 1925	0.130	PARA 1 1	GRAVIDA 1	3-689-15A
MARRIED 1926	0.135	PARA 6 5	GRAVIDA 6 (1 DIED AT 6, BURNS)	3-513-15A
NOT MARRIED	0.137			3-614-15A
MARRIED 1924	0.144	PARA 0	GRAVIDA 0	3-569-15A
MARRIED 1929	0.154	PARA 0	GRAVIDA 0	3-597-15A
MARRIED 1923	0.155	PARA 2 2	GRAVIDA 2	3-529-15A

MARRIED 1927	0.157	PARA 1 1	GRAVIDA 1	ADOPTED 1	3-520-15A
MARRIED	0.160	PARA 2	GRAVIDA 2		3-408-15A
MARRIED 1931	0.162	PARA 0	GRAVIDA 1	(1 MISCARRIAGE)	3-552-15A
MARRIED 1949	0.167	PARA 0	GRAVIDA 0		3-685-15A
MARRIED 1928	0.170	PARA 1 1	GRAVIDA 1		3-488-15A
MARRIED 1921	0.170	PARA 1 1	GRAVIDA 2	(1 STILLBIRTH)	3-502-15A
MARRIED 1937	0.180	PARA 2 2	GRAVIDA 2		3-505-15A
MARRIED 1928	0.190	PARA 1 1	GRAVIDA 1		3-548-15A
MARRIED 1929	0.194	PARA 2 2	GRAVIDA 2		3-607-15A
MARRIED 1924	0.194	PARA 3 3	GRAVIDA 3		3-727-15A
MARRIED 1918	0.197	PARA 1 1	GRAVIDA 2	(1 MISCARRIAGE)	3-522-15A
MARRIED 1923	0.197	PARA 2 2	GRAVIDA 3	(1 MISCARRIAGE)	3-592-15A
MARRIED	0.220	PARA 4 4	GRAVIDA 4		3-426-15A
MARRIED 1924	0.260	PARA 2 2	GRAVIDA 2		3-499-15A
MARRIED 1920	0.286	PARA 3 3	GRAVIDA 3		9- 31-15A
MARRIED 1939	0.310	PARA 1 1	GRAVIDA 2	(1 MISC.)	3-535-15A
MARRIED 1911, 24	0.330	PARA 6 6	GRAVIDA 6		3-412-15A
MARRIED	0.364	PARA 3	GRAVIDA 3		3-424-15A
MARRIED 1931	0.400	PARA 2 2	GRAVIDA 2		3-486-15A
MARRIED 1925	0.445	PARA 3 2	GRAVIDA 4	(1 MISC.)	3-588-15A
NEVER MARRIED	0.450				3-612-15A
MARRIED 1943	0.480	PARA 0	GRAVIDA 0		3-462-15A
MARRIED, DIV	0.523	PARA 1 0	GRAVIDA 6	(5 MISC.)	3-530-15A
MARRIED	0.550				9- 4-15A
MARRIED 1929	0.625	PARA 2 2	GRAVIDA 2		3-405-15A
MARRIED 1929	0.710	PARA 1 1	GRAVIDA 2	(THER. AB., TOXEMIA)	3-428-15A
MARRIED 1928	0.740	PARA 1 1	GRAVIDA 1		3-419-15A
MARRIED	0.765	PARA 2 2	GRAVIDA 4	(2 SPON. AB., 1 MONG.)	3-423-15A
MARRIED	0.810	PARA 3 3	GRAVIDA 3		3-455-15A
MARRIED 1933	0.890	PARA 2 1	GRAVIDA 2		3-417-15A
MARRIED 1943	0.894	PARA 0	GRAVIDA 0		3-510-15A
MARRIED 1926	0.980	PARA 0	GRAVIDA 0		3-404-15A
MARRIED 1927	1.100	PARA 0	GRAVIDA 1	(1 SPON. ABORT.)	3-571-15A
MARRIED 1925	1.160	PARA 3	GRAVIDA 3		3-459-15A
MARRIED 1928, 44	1.200	PARA 1 1	GRAVIDA 1		3-402-15A
MARRIED 1926	1.200	PARA 0	GRAVIDA 0		3-551-15A
MARRIED 1926	1.260	PARA 1 1	GRAVIDA 1		3-473-15A
MARRIED 1927	1.270	PARA 1 1	GRAVIDA 1		3-586-15A
MARRIED	1.350	PARA 1 1	GRAVIDA 3	(2 MISCARRIAGES)	3-433-15A
MARRIED 1929	1.400	PARA 2 2	GRAVIDA 2		3-407-15A
MARRIED 1929	1.430	PARA 1 1	GRAVIDA 1		3-416-15A
MARRIED 1925	1.500	PARA 5 5	GRAVIDA 5		3-431-15A
MARRIED 1924	1.500	PARA 1 1	GRAVIDA 1		3-619-15A
MARRIED 1922	1.550	PARA 0	GRAVIDA 0		3-484-15A
MARRIED 1935	1.610	PARA 0	GRAVIDA 1		3-449-15A
MARRIED 1927	1.620	PARA 4 4	GRAVIDA 4		3-445-15A
MARRIED 1924	1.630	PARA 1 1	GRAVIDA 1		3-528-15A
MARRIED 1927	2.100	PARA 6 5	GRAVIDA 6	(1 DEC. AT 2 DAYS)	3-429-15A
MARRIED 1926	2.200	PARA 1 1	GRAVIDA 2		3-540-15A
NOT MARRIED	2.450				3-401-15A
MARRIED	14.000				3-617-15A

Table 18

Summary of Fertility Experience and Infant Mortality Among Radium Dial Painters

Radium Content Range	Number of Patients	Para	Para per Patient	Gravida	Infertile Union		Miscarriages		Infant Deaths 1st yr.
					N	percent	N**	percent	
0.001 - 0.003	45	78	1.73	92	8	17.8	12/8	26.7/17.8	3
0.003 - 0.01	34	63	1.85	69	7	20.5	5/4	14.7/11.8	0
0.01 - 0.03	48	93	1.94	124*	6	12.5	24/15*	50.0/31.3	3
0.03 - 0.1	25	38	1.52	45	6	24.0	9/5	36.0/20.0	0
0.1 - 0.3	29	55	1.89	59	4	13.7	3/3	10.3/10.3	1
0.3 - 1.0	15	27	1.80	37	3	20.0	9/4	60.0/26.7	0
1.0 - up	<u>17</u>	<u>28</u>	<u>1.64</u>	33	<u>2</u>	<u>11.8</u>	3/2	<u>17.5/11.8</u>	1
Total	213	382			36				
Average			1.79			16.9		30.5/19.2	

* Data from one patient who had 10 miscarriages and no live births omitted from group.

** The number above the slash is the total number of miscarriages while the number below the slash is the number of women who had miscarriages.