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 Through: Director, National Institutes of Health  
 Chief, Bureau of State Services  
 Chief, Division of Occupational Health

April 11, 1952

Proposed Cooperative Project between the Division of Occupational Health and the National Cancer Institute - Establishment of a Safe Concentration of Radon, RAA and RaC' for Use in Mines and Other Industrial Establishments

The matter of workers' exposure to radon and its daughter products has long been a controversial subject. In 1940, the United States Committee on X-Ray and Radium Protection adopted a value of 10 micromicrocuries per liter of radon as a maximum allowable concentration for an 8-hour exposure. This value was derived from the German-Czechoslovakian mines where a value of 1000 micromicrocuries per liter existed. It was the reasoning of this committee that if this concentration caused 50% morbidity among the miners in this area, the value should be decreased by a factor of 100 in order to arrive at a safe concentration. This value was also adopted by the American Conference of Governmental Industrial Hygienists Committee on Threshold Limits in 1951. These values have not been difficult to meet in industrial establishments because the manner in which radium and radon is used was adaptable to local exhaust ventilation and other engineering controls. Experience has indicated that this level is quite safe. In fact, a level of 100 micromicrocuries has been used in Great Britain without known health damage.

The concentrations that we have encountered in the uranium mines range from 25 - 80,000 micromicrocuries per liter, with a median value of 3000 micromicrocuries per liter. Work that has been done by this Division in other mining areas such as copper, silver, lead, zinc, where mineable grades of uranium do not exist indicates that miners have been working in concentrations from 25 - 500 micromicrocuries per liter for as long as 70 years without reported health damage. These figures have been obtained from various mining districts in the intermountain area, ranging from Southern Utah to Middle Montana and from the front range of the Rockies to Eastern Nevada.

Although we recognize the desirability of meeting the value of 10 micromicrocuries in the uranium mines, it is an impossible standard to meet and still allow the mines to operate. After due consideration of this data and theoretical derivations, this office proposed a working level of 100 micromicrocuries per liter of RAA plus RaC'. Assuming a 50-week work year, 8 hours per day, the radiation dose received by the miner at this level of RAA and RaC' ranges from 25 - 575 rem per year. This range is obtained by certain assumptions that one has to make with respect to dust retention by the lung, biological effectiveness of the

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Alpha particles, and other variables. In other words, the maximum dose under these assumptions is 575 rem and the minimum dose is 25 rem. At the Cincinnati meeting of the advisory committee (January 1952), we were informed by Dr. Austin Brues that in his opinion a dose of 2000 rem per year would cause definite damage to the lung tissue.

We realize that the value of 100 micromicrocuries based on RaA plus RaC', which we are proposing as a working standard in the uranium mines, will be a controversial one. Certain well-known authorities in this country, despite recent information, still maintain that 10 micromicrocuries should be used as a maximum allowable concentration.

The mines are the only important industrial establishments where workers in this country are, or have been, exposed to concentrations of radon above 10 micromicrocuries per liter for extended periods.

In order to establish a maximum allowable concentration for radon and RaA and RaC' which will be safe and still include a reasonable factor of safety, it is necessary to determine levels that have existed in these mines with and without resultant health damage. This office has very nebulous information which indicates that some health damage may have been experienced in certain mining areas. However, it must be borne in mind that negative information is equally as important as positive information in a project of this type.

It is therefore proposed that a cooperative project be instituted between the National Cancer Institute and the Division of Occupational Health. This project should include environmental studies of certain mining areas in the United States to determine present radon and RaA and RaC' levels, as well as an attempt to estimate the levels that may have existed in the past. In order to supplement this environmental data, the National Cancer Institute would be expected to conduct epidemiological studies in these areas to determine mortality and morbidity causes among these workers for as long a period as is possible. We propose these studies be carried out in the following areas where radon is known to be present in the mines:

Butte, Montana - copper  
Coeur d'Alene, Idaho - lead, zinc  
Aspen, Colorado - silver, lead  
Front range of Rockies - all non-ferrous metals  
Leadville-Creed area, Colorado - all non-ferrous metals

The following areas are suspected mining areas in which radon may exist:

Certain iron mines in Michigan  
Arizona mining areas

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We are at a loss at this time to suggest control areas for this study except possibly the iron mines of Alabama.

This study is almost imperative in order to arrive at a safe concentration of radon and RAA and RaC' for use in the uranium mines and other industrial establishments. We have previously stated that the value of 100 micromicrocuries is a temporary level which may be changed as further information is developed. A study of this nature would also be a valuable contribution to the medical literature, as we have no record of human studies being made except in the Schneeberg and Joachimstal mines. Animal experiments are being conducted by certain universities but it will be impossible to apply these findings to human subjects without supporting information.

We have made no attempt in this communication to outline the project. The basic facts are presented herein for discussion.

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