Table 4, taken from Handbook H-23 of the National Bureau of Standards, *Radium Protection*, which shows permissible daily exposures (based on the now discarded tolerance level of 0.1 r per 8-hour day) with contingent safe distances of a technician during these exposures.

TABLE 4

Safe Working Distances from Radium

Total daily exposure (mg.-hr.)	Safe distance Meters	Feet	Total daily exposure (mg.-hr.)	Safe distance Meters	Feet
100	1	3	800	2.5	8
200	1.5	4	1600	3.5	11
400	2	6	3200	5.	15

The next factor in order of importance is reduction of the time of exposure. Therefore, provisions should be made to permit all operations involving unusual levels of gamma ray intensity to be carried out in the shortest time consistent with the nature of the operation and with the personnel as far from the radioactive material as can be arranged. Under no circumstances should sources of the order of a millicurie or greater come into contact with any part of the worker's body, especially the fingers. It should be obvious that technicians should not remain in the immediate vicinity of an unshielded source longer than necessary, a precaution that also applies to those not directly concerned with the work in hand. This is particularly important in gamma ray radiography where very strong sources are often used to reduce the time required to obtain a satisfactory negative.

Finally, consideration should be given to protective screens of dense material having a high coefficient of absorption for gamma rays. This material may be lead, iron, or concrete. Screens must be provided whenever operations with strong sources, millicurie level and above, are to be carried out at short range. The thickness of the screens should be adequate to reduce the radiation to a level well below the average tolerance for continuous exposure. Where viewing the source is essential to the operation, thick transparent screens or periscopes must be provided to make the screening complete.

All employees in the radiation area, or having access to it, should wear personnel radiation meters continuously, and these should be collected and read at the end of each day by someone in charge of radiation safety. This assures early detection of any violations of regulations or accidental overexposures. The record of these readings is valuable also as proof of absence of serious overexposures.

Regular medical examinations should be given individuals engaged in this work. The examination should include a blood count as well as a careful check of each of the known possible symptoms of overexposure to radiation. In particular, an examination for evidences of injury to fingers should be made. The frequency with which medical examinations should be made depends somewhat on the conditions of work. Where gamma ray sources of the order of a curie or more are involved, an examination every month would seem to be required. If operations are substantially below this level, and particularly if possibilities of exposure to radiation are infrequent, an examination every six months might be adequate.

3. Storage of Radioactive Sources

The storage of radioactive sources, emitting penetrating gamma radiation with energies of the order of 1 Mev. or greater, presents something of a problem, particularly where large amounts are involved. Industrial radiography is an example. In general, the inverse-square law provides the most economical and effective means of solving this problem. However, a certain amount of lead, or its equivalent, shielding is required to permit approach to the storage vault and to protect those who may require to be temporarily in its vicinity. Where the occupancy of the space about the vault can be rigidly controlled, the thickness of the shielding in any particular direction will depend, for a given amount of radioactive material, upon the distance to the person to be protected, the period of time for which protection is required, and the effect that the required protective screen may have on the intensity of the radiation in other directions where protection may be required. In other words, the scattered radiation must be taken into account and in some cases this can be done only by actual measurement. In any case the combined protective arrangements must reduce the whole body exposure to the tolerance dose.

Storage vaults should be designed with an interior cavity no larger than required to accommodate the sources to be stored. Not only is this more economical but, by reducing the size of the exterior, it also reduces the amount of scattered radiation in the vicinity. When material other than lead is used for this vault the lead equivalent (see Table 5) must be known under conditions similar to those in which the material is to be used. In general, the lead equivalent for gamma rays can be computed by multiplying the thickness of the material by the ratio of its density to that of lead. In computing required thicknesses, it is advisable to increase the thickness of material by about 50 per cent of the value obtained in the above computation.

When designing storage vaults for a number of sources it is desirable to provide separate lead screening for individual preparations. This reduces the exposure of the technician who must remove sources from the vault. It is equally important to adopt a convenient, methodical arrangement for storage so that the time required to select and remove a source is reduced to a minimum. Identifying numbers, readily legible at some distance, illustrate one method of expediting the selection of a preparation. Another suggestion is to code with distinctive colors the sources themselves to permit instant identification. In no case should the dose