

IONIZING RADIATION

2. Number of employees exposed to radiation and their locations
3. Chemical and physical states of the radioactive material and the nature of its use
4. Incidents likely to occur and their possible locations
5. Nonradiation hazards involved
6. Nature of the probable radiation exposure or release of radioactive material.
 - a. A controlled or supervised release as in a disposal operation
 - b. An accidental release or exposure which cannot be sensed by warning alarm signals generated by radiation detection instruments.
 - c. A violent release of dust, droplets, gases, or vapors through fire, temperature increase, or explosion.
 - d. A contact spread of contamination as the result of its adherence to other material or of spillage
7. Inherent danger of the material because of its internal or external effect on man. (This danger depends upon the isotopic identification and chemical form of the material. See NBS Handbooks 59 and 69.)
8. Probability of detection of harmful situation by routine surveys or monitoring. (Current knowledge of conditions is essential in order to determine the acceptability of the risks involved.)
9. Possible effects of accidents on operation, such as interruption of production, loss of occupancy of space, loss of equipment, and cost of cleanup.

Consider employee exposure potential

The industrial accidents which may produce radioactive contamination are usually no more difficult to control than the common types of industrial accidents, but there is an added, compelling reason to control them—the probability of absorption by humans of radioactive materials.

External radiation. Under ordinary operating conditions and barring accidents, the level of exposure to external radiation usually will be immediately known through constant monitoring alarm devices, the use of monitoring instruments, dosimeters, or previous measurements of radiation fields for identical operations. The problem is then reduced to limiting the rate of ex-

posure or the length of exposure time. Measurement of the exposure by instruments will indicate what advantage is to be obtained by installing additional shielding or by having personnel work farther from the source.

Under emergency conditions with high-exposure levels, it is advisable to rotate personnel in order to reduce the exposure of any one individual to guide levels. Emergency exposure levels for extreme conditions have been published in NBS Handbook 59. These are essentially once-in-a-lifetime allowances for handling a really serious situation. See also "Exposure to Radiation in an Emergency" by the National Committee on Radiation and Measurements, listed in "References."

Occasionally, an unexpectedly high reading will appear on a personal dosimeter. For any one of a number of reasons, the reading may be invalid, but an accident investigation will determine the validity of the reading and indicate the corrections needed to prevent recurrences.

Internal emitters. Commonly, the introduction of radioactive materials into the body is most serious if entry is through the lungs. Subcutaneous injection can even be worse.

Inhalation of dusty or finely divided radioactive materials is possible if unknown to the employees, materials are released and become air-borne. Routine air sampling may detect the concentration, but a constant air-monitoring system will signal such releases. More important, employees may recognize conditions which in the past have released materials, thus they can act promptly to minimize exposure (Fig 42-9).

Simple calculations will show that if persons working in dusty trades retained in their lungs all the insoluble dust particles that they breathe, their lungs would become filled. Fortunately, certain protective mechanisms of the lung prevent this result.

Except for air passages below a certain size, the interior walls of the lung's breathing airways are constantly and rapidly being swept clear. Some inhaled particles are swept back out of the lung to be swallowed or coughed and expectorated. Also scavenger blood cells remove foreign materials from the lung. Some inhaled material is subsequently exhaled.