

DSHM-RAD-05-01 Cleanup Guidelines for Soils Contaminated with Radioactive Materials

I. Summary:

This Policy provides guidance to Department staff on such cleanups for soils contaminated with radioactive materials. This Policy was formally issued on September 14, 1993 as Technical and Administrative Guidance Memorandum (TAGM) Number 4003. The Policy has not been significantly amended but merely updated to reflect a new organizational structure, and reformatted in accordance with Department procedures, in order to make the policy available on the Department's web site.

II. Policy:

The total effective dose equivalent to the maximally exposed individual of the general public, from radioactive material remaining at a site after cleanup, shall be as low as reasonably achievable and less than 10 mrem above that received from background levels of radiation in any one year.

The radiation dose received from an exposure to soils contaminated by radionuclides will strongly depend on the time of exposure and pathways by which the radionuclides or their decay products can come in contact with an individual. For this reason, the estimated annual dose resulting from exposure to any residual radionuclides in the contaminated area is the basis for establishing site-specific cleanup criteria. The dose estimate is to be based on the contaminating radionuclides, but not on background concentrations of any radionuclides that may be at the site. Background radiation refers to:

- (1) local area concentrations of naturally occurring radionuclides;
- (2) cosmic radiation; and
- (3) radionuclides of anthropogenic origin which have been regionally dispersed and are present at low concentrations (such as fallout from the testing of nuclear weapons).

III. Purpose and Background:

The purpose of this cleanup guideline is to provide:

- (1) protection of public health and the environment; and

(2) consistency in implementing remedial actions at sites contaminated with radioactive materials.

IV. Responsibility:

Responsibility for the interpretation and updating of this Program Policy document resides with the Radiation Program within the Division of Solid & Hazardous Materials.

Questions regarding this policy should be directed to:

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V. Procedure:

The process of determining the appropriate cleanup requirements will generally involve measurements of radioactivity at the site, laboratory analysis of soil samples for concentrations of radioactive materials, modeling of expected doses based on the measurements and analyses performed, and evaluation of site remediation alternatives. The modeling will require determination of site characteristics critical to the migration of radionuclides, and will need to be referenced to reasonable scenarios for current and plausible future uses of the land. Consideration of the time period during which the radioactive material is expected to persist at the site will be important in the selection of scenarios for land use. The estimated dose limit of 10 mrem/year refers to land released for unrestricted use. If unrestricted use scenario calculations result in dose estimates that are greater than 10 mrem/year, it may be necessary to invoke institutional controls and/or deed restrictions so that actual doses from allowed uses are not likely to exceed 10 mrem/year.

A. Dose Analysis Methods - Analysis methods used must be acceptable to the New York State Department of Environmental Conservation (Department) Division Solid and Hazardous Materials, Radiation Program. The methods used should be appropriate to the complexity of the contaminated site and to the potential for harm. The primary criterion is that the analysis yield conservative results; i.e., the results of the analysis must predict doses no lower than are likely to actually occur. This principle should be applied to both the analysis methods and to the site-specific inputs required for any models used in the evaluation.

All reasonable pathways of exposure shall be considered when determining the estimated dose to individuals. Approval of the procedures used in, and the interpretation of, each step of the analysis must be obtained from Department. The steps to be followed are:

1. Perform a site assessment. This involves determining exposure levels at the site, the extent of the contamination, and concentrations of radionuclides in the contaminated areas. Care must be taken that the appropriate instrumentation is used for detecting radiation at the site (gamma, beta, alpha, or neutrons). Concentration profiles as a function of depth in the soil should be determined. Where possible, the chemical and physical forms of the radionuclides should be determined. It should be possible from this data to characterize the locations and concentrations of all radionuclides which can significantly contribute to the dose potentially received from the site. When modeling the site characteristics, and the migration of radionuclides within and from the site, it will be necessary to show that the site parameters used will cause the dose estimates to be conservative.

During on-site investigation, Department staff and contractors must abide by all appropriate requirements and Departmental policies related to personal protection and by any applicable health and safety plans. At sites where non-radioactive contaminants are known to be present, Department Radiation Program staff should contact appropriate persons from other involved Bureaus, Divisions, or Agencies as to health and safety and coordination of activities. If non-radioactive chemical contamination (where not previously known) is suspected at a site, be it by observation and/or analysis, the appropriate Department regulatory staff should be notified;

2. Provide a review of current land use and a rationale for potential use of the site. Use this information to estimate possible occupancies for the site and review how different plausible uses of the site can contribute to exposures. Keep in mind that the maximally exposed individual of concern is a member of the general public not associated with the use of radioactive materials. This is usually a resident, but may also be a worker at a business not licensed to use radioactive materials. Radiation exposure to workers at facilities with radioactive materials is regulated by the licensing agency under the New York State Industrial Code (New York State Department of Labor) or the New York State Sanitary Code (New York State Department of Health); and

3. Analyze all reasonable pathways. Only when pathways can be shown to contribute insignificantly to the dose, can they be eliminated from further consideration. Pathways that must be considered are:

(a) Doses from direct exposure to radiation emitted from the contaminated soil and, where applicable, from contaminated ground or surface waters; and

(b) Doses from internal exposure - including inhalation of contaminated dust (including radon progeny if present), ingestion of contaminated soil, ingestion of food raised on contaminated soil, and ingestion of drinking water (both aquifer and surface waters) or contaminants from irrigation water.

B. Analysis of Remediation Alternatives - Remediation techniques should be evaluated for effectiveness at meeting the 10 mrem/year dose limit, at keeping radiation doses as low as reasonably achievable, and at minimizing the creation of radioactive waste. If site remediation is needed to achieve the 10 mrem/year dose limit, it will be necessary to prepare a work plan that is acceptable to Department and other cognizant agencies (NYS Department of Labor, NYS Department of Health).

Acceptable remediation procedures might include:

1. Removal of contaminated soil for disposal at a licensed facility;
2. Isolation of contamination such as covering the contamination with clean soil. This technique may be acceptable for short-lived isotopes assuming that restrictions to land use are used until the radionuclides no longer pose a threat; and
3. Other remediation techniques, if applicable, considered and approved on a case-by-case basis.

Remediation alternatives should be evaluated for exposures which will occur to workers, Department staff, and the general public during corrective action/remedial activities. Appropriate health and safety plans should be prepared or referenced from construction and monitoring activities (see also item C.1 below).

Remedial alternatives should also be evaluated for the potential to cause significant damage to sensitive environmental or historical areas (see also item C.2. below).

Special consideration must be given to sites contaminated with non-radioactive chemicals as to remedial alternatives and disposition of the resultant hazardous or "mixed" waste.

Before a site can be released for unrestricted use, it will be necessary to confirm that the approved work plan has been completed successfully. This confirmation will include measuring exposure rates and/or measurements of residual radionuclide concentrations. The final modeling step will need to show that release of the site, with any radionuclide concentrations still remaining after remediation, will not cause the dose limit to be exceeded.

C. Alternative Procedures - There may be incidents/situations whereby:

1. The health and safety of individuals involved in a cleanup may necessitate acceptance of a dose greater than 10 mrem/year to the maximally exposed individual; or
2. The cleanup may cause irreversible destruction or loss of environmental habitat.

In such situations, remedial options will be evaluated on a case-by-case basis. Final decisions will be made by the Director, Bureau of Hazardous Waste and Radiation Management.

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