MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF WASTE MANAGEMENT AND RADIOLOGICAL PROTECTION

CLEANUP AND DISPOSAL GUIDELINES FOR SITES CONTAMINATED WITH RADIUM-226

The Michigan Department of Environmental Quality (DEQ), under the authority of the Public Health Code and the *Ionizing Radiation Rules*, has developed the following guidelines to address the remediation of Michigan sites contaminated with radium-226 and its associated decay series:

Cleanup Guidelines

1. For release of facilities, equipment, or land for unrestricted use, the limits listed below will be used by the DEQ to determine acceptable levels of residual contamination during remediation of Michigan sites contaminated with radium-226. Alternatively, the DEQ will consider specific proposals based on the methodology contained in the *Multi-Agency Radiation Survey and Site Investigation Manual* (NUREG-1575 Rev. 1, EPA 402-R-97-016 Rev. 1, August 2000) and, in these cases, will approve a proposal for release for unrestricted use if the maximum individual total effective dose equivalent does not exceed 25 millirems per year under conditions of a reasonable worst-case scenario. Each specific site release proposal must include an "As Low As Reasonably Achievable" (ALARA) analysis.

UNRESTRICTED USE CLEANUP LIMITS

Surface Contamination Limits (dpm/100 cm^2)[a,b]

Measurement	Average[c]	Maximum[d]	Removable[e]
Alpha radiation	1,000	3,000	200
Beta-gamma radiation	1,000	3,000	200

Ambient Exposure Rate Limit[f]

10 microroentgens per hour (µR/hr) above the local background

Dust, Debris, or Recyclable Materials Limit[g]

5 picocuries per gram (pCi/g) of radium-226 above the natural background concentration in any volumetrically defined material

Surficial Soils Limit[h]

5 pCi/g of radium-226 above the local background concentration

[a]Surface contamination by both alpha and beta-gamma emitting nuclides is assumed. The limits established for alpha and beta-gamma emitting nuclides apply independently.

[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c]Measurements of average contamination level should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each object.

[d]The maximum contamination level applies to an area of not more than 100 cm^2.

[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally, and the entire surface should be wiped.

[f]As measured with a properly calibrated exposure rate meter at 1 meter height above any surface averaged over 100 m^2 in outside areas and over 10 m^2 in structure interiors.

[g]Averaged over any individual item or containerized material.

[h]Averaged over any single 15 cm thick soil layer and averaged over any 100 m^2 of land surface.

2. For facilities, equipment, or land for which release under certain restrictions may be appropriate, the DEQ will consider specific site proposals for other release limits based on the methodology contained in the *Multi-Agency Radiation Survey and Site Investigation Manual* (NUREG-1575 Rev. 1, EPA 402-R-97-016 Rev 1, August 2000). In no case will a restricted use release be approved if the maximum individual total effective dose equivalent can exceed 100 millirems per year under conditions of a reasonable worst-case scenario. Each specific site remediation proposal involving restricted use must include an ALARA analysis.

Disposal Guidelines

1. For disposal of radium-226 contaminated materials in the form of bulk waste, such as contaminated soil or contaminated debris, materials containing a radium-226 concentration not exceeding 50 picocuries per gram, averaged over any single shipment, can be accepted without regard to radioactivity in a hazardous waste landfill or a Type II solid waste landfill, as defined in Parts 111 and 115 of 1994 PA 451, as amended. Prior to shipment, the generator must provide the following information to the DEQ's Office of Waste Management and Radiological Protection, Radiological Protection Section:

   a. Verification of radium-226 concentrations based upon representative sampling.
   b. The name and address of the proposed hazardous waste or Type II landfill recipient.
   c. The proposed date of transfer and estimate of the total volume and radioactivity content of the waste.

   Proposed shipments are subject to independent confirmation testing by the DEQ.

2. For disposal of radium-226 contaminated waste materials at concentrations above 50 picocuries per gram, the contaminated wastes should be transferred to a licensed radioactive waste disposal facility.

3. In addition, any naturally occurring radioactive material wastes containing radium-226 at any concentration generated during plugging and abandonment operations of mineral wells or oil and gas wells in Michigan may be disposed downhole, subject to any additional applicable requirements of the DEQ, as specified or authorized under Parts 615 and 625 of 1994 PA 451.

Applicable portions of Michigan's *Ionizing Radiation Rules* containing related requirements and authorizing these guidelines are contained in Rule 123(3)(e); Rule 237(1), (2), and (3); Rule 253; and Rule 272.

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OFFICE OF WASTE MANAGEMENT AND RADIOLOGICAL PROTECTION
525 W ALLEGAN
PO BOX 30241
LANSING MI 48909-7741
517-284-6581

Environmental Assistance Center 1-800-662-9278
Pollution Emergency Alerting System 1-800-292-4706