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RADIATION PROTECTION

*Recommendations of
the International Commission on
Radiological Protection*

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on
Permissible Dose for Internal Radiation
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DOE ARCHIVES

Table 1. Maximum permissible body burdens and maximum permissible concentrations of radionuclides in air and in water for occupational exposure

| Radionuclide and type of decay | Organ of reference* (critical organ bold face) | Maximum permissible burden in total body g(μ c) | Maximum permissible concentrations | | | | |
|---|--|--|--|--|--|--|----------------------|
| | | | For 40 hr week | | For 168 hr week | | |
| | | | (MPC) _w (μ c/cm ³) | (MPC) _a (μ c/cm ³) | (MPC) _w (μ c/cm ³) | (MPC) _a (μ c/cm ³) | |
| ³ H ² (HTO or H ₂ O); β^- [(sol.)] | Body tissue | 10 ³ | 0.1 | 5 × 10 ⁻⁴ | 0.03 | 2 × 10 ⁻⁴ | |
| | Total body | 2 × 10 ³ | 0.2 | 8 × 10 ⁻⁴ | 0.05 | 3 × 10 ⁻⁴ | |
| (H ₂) (submersion) | Skin | | | 2 × 10 ⁻³ | | 4 × 10 ⁻⁴ | |
| ⁷ Be ² (sol.) α, γ | GI (LLI) | | 0.05 | 10 ⁻⁴ | 0.02 | 4 × 10 ⁻⁴ | |
| | Total body | 600 | 6 | 6 × 10 ⁻⁴ | 2 | 2 × 10 ⁻⁴ | |
| | Kidney | 800 | 9 | 8 × 10 ⁻⁴ | 3 | 3 × 10 ⁻⁴ | |
| | Liver | 800 | 9 | 8 × 10 ⁻⁴ | 3 | 3 × 10 ⁻⁴ | |
| | Bone | 2 × 10 ³ | 20 | 2 × 10 ⁻⁴ | 7 | 6 × 10 ⁻⁴ | |
| | Spleen | 4 × 10 ³ | 50 | 4 × 10 ⁻⁴ | 20 | 2 × 10 ⁻³ | |
| | (insol.) | Lung | | | 10 ⁻⁴ | | 4 × 10 ⁻⁷ |
| | GI (LLI) | | 0.05 | 9 × 10 ⁻⁴ | 0.02 | 3 × 10 ⁻⁴ | |
| ¹⁴ C ² (CO ₂) (sol.) β^- | Fat | 300 | 0.02 | 4 × 10 ⁻⁴ | 8 × 10 ⁻³ | 10 ⁻⁴ | |
| | Total body | 400 | 0.03 | 5 × 10 ⁻⁴ | 0.01 | 2 × 10 ⁻⁴ | |
| | Bone | 400 | 0.04 | 6 × 10 ⁻⁴ | 0.01 | 2 × 10 ⁻⁴ | |
| | (submersion) | Total body | | | 5 × 10 ⁻³ | | 10 ⁻³ |
| ¹⁸ F ² (sol.) β^+ | GI (SI) | | 0.02 | 5 × 10 ⁻⁴ | 8 × 10 ⁻³ | 2 × 10 ⁻⁴ | |
| | Bone and teeth | 20 | 0.2 | 3 × 10 ⁻³ | 0.06 | 9 × 10 ⁻⁴ | |
| | Total body | 20 | 0.3 | 4 × 10 ⁻³ | 0.09 | 10 ⁻³ | |
| | (insol.) | GI (ULI) | | 0.01 | 3 × 10 ⁻⁴ | 5 × 10 ⁻³ | 9 × 10 ⁻⁷ |
| | | Lung | | | 2 × 10 ⁻⁴ | | 6 × 10 ⁻⁴ |
| ²² Na ²³ (sol.) β^+, γ | Total body | 10 | 10 ⁻³ | 2 × 10 ⁻⁷ | 4 × 10 ⁻⁴ | 6 × 10 ⁻⁴ | |
| | GI (LLI) | | 0.01 | 2 × 10 ⁻⁴ | 3 × 10 ⁻³ | 7 × 10 ⁻⁷ | |
| | (insol.) | Lung | | 10 ⁻⁴ | 9 × 10 ⁻⁴ | 3 × 10 ⁻⁴ | 3 × 10 ⁻⁴ |
| | | | | 2 × 10 ⁻⁷ | | 5 × 10 ⁻⁴ | |
| ²⁴ Na ²³ (sol.) β^-, γ | GI (SI) | | 6 × 10 ⁻³ | 10 ⁻⁴ | 2 × 10 ⁻³ | 4 × 10 ⁻⁷ | |
| | Total body | 7 | 0.01 | 2 × 10 ⁻⁴ | 4 × 10 ⁻³ | 6 × 10 ⁻⁷ | |
| | (insol.) | GI (LLI) | | 8 × 10 ⁻⁴ | 10 ⁻⁷ | 3 × 10 ⁻⁴ | 5 × 10 ⁻⁴ |
| | | Lung | | | 8 × 10 ⁻⁷ | | 3 × 10 ⁻⁷ |

* The abbreviations GI, S, SI, ULI and LLI refer to gastrointestinal tract, stomach, small intestine, upper large intestine, and lower large intestine, respectively.

| Radionuclide and type of decay | Organ of reference (critical organ bold face) | Maximum permissible burden in total body g(μ C) | Maximum permissible concentrations | | | | |
|---|---|--|--|--|--|--|--------------------|
| | | | For 40 hr week | | For 168 hr week | | |
| | | | (MPC) _w (μ C/cm ³) | (MPC) _a (μ C/cm ³) | (MPC) _w (μ C/cm ³) | (MPC) _a (μ C/cm ³) | |
| ¹³⁴ Cs β^- , γ | (sol.) | Total body | 30 | 2×10^{-3} | 4×10^{-7} | 9×10^{-4} | 10^{-7} |
| | | Liver | 60 | 5×10^{-3} | 7×10^{-7} | 2×10^{-3} | 2×10^{-7} |
| | | Spleen | 80 | 7×10^{-3} | 10^{-4} | 2×10^{-3} | 4×10^{-7} |
| | | Muscle | 90 | 8×10^{-3} | 10^{-4} | 3×10^{-3} | 4×10^{-7} |
| | | Kidney | 100 | 8×10^{-3} | 10^{-4} | 3×10^{-3} | 4×10^{-7} |
| | | GI (SI) | | 0.02 | 5×10^{-4} | 8×10^{-3} | 2×10^{-4} |
| | | Bone | 400 | 0.03 | 4×10^{-4} | 0.01 | 2×10^{-4} |
| | | Lung | 800 | 0.06 | 9×10^{-4} | 0.02 | 3×10^{-4} |
| | | (insol.) | Lung | | | | |
| | | | GI (LLI) | | 2×10^{-3} | 3×10^{-7} | 6×10^{-4} |
| ¹³⁷ Cs β^- , γ , e^- | (sol.) | Total body | 30 | 4×10^{-4} | 6×10^{-3} | 2×10^{-4} | 2×10^{-3} |
| | | Liver | 40 | 5×10^{-4} | 8×10^{-3} | 2×10^{-4} | 3×10^{-3} |
| | | Spleen | 50 | 6×10^{-4} | 9×10^{-3} | 2×10^{-4} | 3×10^{-3} |
| | | Muscle | 50 | 7×10^{-4} | 10^{-2} | 2×10^{-4} | 4×10^{-3} |
| | | Bone | 100 | 10^{-3} | 2×10^{-7} | 5×10^{-4} | 7×10^{-3} |
| | | Kidney | 100 | 10^{-3} | 2×10^{-7} | 5×10^{-4} | 8×10^{-3} |
| | | Lung | 300 | 5×10^{-3} | 6×10^{-7} | 2×10^{-3} | 2×10^{-7} |
| | | GI (SI) | | 0.02 | 5×10^{-3} | 8×10^{-3} | 2×10^{-4} |
| | | (insol.) | Lung | | | | |
| | | | GI (LLI) | | 10^{-3} | 2×10^{-7} | 4×10^{-4} |
| ¹³¹ Ba α , γ | (sol.) | GI (LLI) | | 5×10^{-3} | 10^{-4} | 2×10^{-3} | 4×10^{-7} |
| | | Total body | 50 | 0.1 | 2×10^{-4} | 0.03 | 7×10^{-7} |
| | | Bone | 80 | 0.1 | 3×10^{-4} | 0.05 | 10^{-4} |
| | | Liver | 10 ³ | 20 | 4×10^{-4} | 7 | 10^{-4} |
| | | Muscle | 2×10^4 | 40 | 7×10^{-4} | 10 | 2×10^{-4} |
| | | Lung | 2×10^4 | 40 | 7×10^{-4} | 10 | 2×10^{-4} |
| | | Spleen | 3×10^4 | 60 | 10^{-3} | 20 | 4×10^{-4} |
| | | Kidney | 4×10^4 | 70 | 10^{-3} | 20 | 5×10^{-4} |
| | | (insol.) | Lung | | | | |
| | | | GI (LLI) | | 5×10^{-3} | 4×10^{-7} | 2×10^{-3} |
| ¹⁴⁰ Ba β^- , γ | (sol.) | GI (LLI) | | 8×10^{-4} | 2×10^{-7} | 3×10^{-4} | 6×10^{-3} |
| | | Bone | 4 | 6×10^{-3} | 10^{-7} | 2×10^{-3} | 4×10^{-3} |
| | | Total body | 9 | 0.01 | 3×10^{-7} | 5×10^{-3} | 10^{-7} |
| | | Liver | 10 ³ | 2 | 5×10^{-3} | 0.9 | 2×10^{-3} |
| | | Lung | 3×10^3 | 4 | 9×10^{-3} | 2 | 3×10^{-3} |
| | | Spleen | 3×10^3 | 5 | 10^{-4} | 2 | 4×10^{-3} |
| | | Kidney | 4×10^3 | 6 | 10^{-4} | 2 | 4×10^{-3} |
| | | | | 8 | 2×10^{-4} | 3 | 5×10^{-3} |
| | | (insol.) | Lung | | | | |
| | | | GI (LLI) | | 7×10^{-4} | 10^{-7} | 2×10^{-4} |