

SUPPLEMENT F

Health Physics Memo No. 3  
Release of Radioactive Material to the Sanitary Sewage System

nm/2/f

HEALTH PHYSICS  
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MEDEC-YHP  
MEMO 3

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RELEASE OF RADIOACTIVITY TO THE SANITARY SEWAGE SYSTEM

1. In accordance with ANNEX N, WRAMC Reg 40-10, disposal of radioactive material by release into the sanitary sewage system is permitted under certain conditions which allow the user to release a quantity not to exceed ten (10) times the amount listed in the Appendix to ANNEX N, in any one day.

2. However, Title 10 CFR Part 20.303 requires:

a. The quantity which if diluted by the average daily quantity of sewage released into the sewer by the licensee, will not result in an average concentration greater than the limits specified in Appendix B, Table 1, Column 2 of 10 CFR Part 20.

b. The quantity which if diluted by the average monthly quantity of sewage released into the sewer by the licensee, will not result in an average concentration greater than the limits specified in Appendix B, Table 1, Column 2 of 10 CFR Part 20.

c. "The gross quantity of licensed and other radioactive material released into the sewerage system by the licensee does not exceed one curie per year."

d. The sum of the ratios for each radionuclide in the mixture and the limit otherwise established in Appendix B for the specific nuclide not in a mixture may not exceed "1" (i.e., "unity").

3. Determination of method for compliance:

a. A maximum daily limit of activity was established for each isotope that is allowed to be released into the WRAMC sanitary sewage system according to the following formula:

$$\frac{(MPC_a) (\text{Flow Rate})}{(\# \text{ of sinks}) (\# \text{ of isotopes to be released})}$$

NOTE: Flow rate through WRAMC Main Post has been established as  
 $2.61 \times 10^9$  ml/day

b. The values calculated by the method in subparagraph A above was compared to ten (10) times the corresponding values listed for each isotope in Appendix C, 10 CFR 20; the lower of the two values was selected.

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c. Contaminated laundry is washed under the supervision of Health Physics personnel. The total activity released is extracted by calculation and dose rates.

d. Radioactive waste in hold-up tanks is released at a rate such that the daily average concentration in the sewage system is less than  $4 \times 10^{-7}$  uCi/ml.

e. All releases are documented by date, time, location, isotope and total activity. This data is reviewed monthly for compliance and the total gross activity released for the month is recorded.

2 Incl

1. Sample Calculations
2. Appendix to ANNEX N,  
WR 40-10

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SAMPLE CALCULATIONS

1. Maximum daily limit for each sink (C1-36)

$$\frac{(\text{MPC}_d) (\text{Flow Rate})}{(\# \text{ of sinks}) (\# \text{ of isotopes to be released})} =$$
$$\frac{(2 \times 10^{-3} \mu\text{Ci/ml}) (2.61 \times 10^9 \text{ ml/day})}{(50) (100)} = 1,000 \mu\text{Ci/day}$$

This value was then compared to 10 times the limit listed in Appendix C, 10 CFR 20 (100  $\mu\text{Ci/day}$  for C1-36), and the lower of the two was selected. This procedure increases the probability of compliance.

2. Contaminated Laundry. On the assumption that 100% of the radioactivity on contaminated laundry is washed off in the normal wash cycle of the standard commercial washing machine, the following calculations are submitted:

a. General.

(1) Maximum contamination level put into laundry: 2 mR/hr @ 1 ft.

(a)  $I_{\gamma}$  for  $^{131}\text{I}$  = 0.25 mR/hr/ $\mu\text{Ci}$  at 1 yard or  
2.25 mR/hr/ $\mu\text{Ci}$  at 1 foot

(b)  $I_{\gamma}$  for  $^{198}\text{Au}$  = 0.27 mR/hr/ $\mu\text{Ci}$  at 1 yard or  
2.43 mR/hr/ $\mu\text{Ci}$  at 1 foot (approximately  
the same as  $^{131}\text{I}$ )

(2)  $\frac{2.0 \text{ mR/hr}}{2.25 \text{ mR/hr}/\mu\text{Ci}} = 0.88 \mu\text{Ci max } ^{131}\text{I (or } ^{198}\text{Au) in system}$

b. Dilution Factor. The washer that is primarily the one used for washing of contaminated laundry uses between 450 and 500 gallons of water per wash load. For the purpose of this calculation 450 gallons was assumed to be the minimum volume.

(a) (450 gal) (3.785 x 10<sup>3</sup> cc/gal) = 1.705 x 10<sup>6</sup> cc

(b) Therefore: 0.88  $\mu\text{Ci}/1.705 \times 10^6 \text{ cc} = 5.17 \times 10^{-7} \mu\text{Ci/cc}$

c. Effluent activity from the wash water = 5.17 x 10<sup>-7</sup>  $\mu\text{Ci/cc}$

WR 40-10, C-1

APPENDIX (RADIOACTIVE WASTE DISPOSAL SINK DUMP LIMITS)  
to ANNEX N (RADIOACTIVE WASTE)

THE RADIOACTIVE MATERIAL DISCHARGED THROUGH THIS SINK MUST BE READILY SOLUBLE OR DISPERSIBLE IN WATER. THE QUANTITIES OF THE COMMONLY-USED RADIONUCLIDES DISCHARGED THROUGH THIS SINK IN ANY ONE DAY MUST NOT EXCEED TEN (10) TIMES THE AMOUNT SPECIFIED BELOW (For isotopes not listed, call Ext. 3481 for limits).

<u>Material</u>	<u>Microcuries</u>	<u>Material</u>	<u>Microcuries</u>
Antimony-124-----	10.00	Iron-59-----	10.00
Arsenic-74-----	10.00	Manganese-54-----	10.00
Barium-140-----	10.00	Manganese-56-----	10.00
Bismuth-210-----	1.00	Mercury-197-----	100.00
Bromine-82-----	10.00	Mercury-203-----	10.00
Cadmium-109-----	10.00	Molybdenum-99-----	100.00
Cadmium-115-----	40.00	Nickel-63-----	10.00
Calcium-45-----	10.00	Phosphorous-32-----	10.00
Calcium-47-----	10.00	Potassium-42-----	10.00
Carbon-14-----	100.00	Rubidium-86-----	10.00
Cerium-141-----	100.00	Selenium-75-----	10.00
Cerium-144-----	1.00	Sodium-24-----	10.00
Cesium-131-----	1000.00	Strontium-85-----	10.00
Cesium-137-----	10.00	Strontium-89-----	1.00
Chlorine-36-----	10.00	Strontium-90-----	0.10
Chromium-51-----	1000.00	Sulphur-35-----	80.00
Cobalt-58-----	10.00	Tantalum-182-----	10.00
Cobalt-60-----	1.00	Technetium-99m-----	100.00
Copper-64-----	80.00	Technetium-99-----	10.00
Fluorine-18-----	1000.00	Thallium-204-----	10.00
Gold-198-----	100.00	Thorium (natural)-----	10.00
Hydrogen-3-----	1000.00	Tin-113-----	10.00
Indium-113m-----	100.00	Uranium (natural)-----	20.00
Iodine-125-----	1.00	Zinc-65-----	10.00
Iodine-129-----	0.10	Zinc-69m-----	100.00
Iodine-131-----	1.00	Zirconium-95-----	10.00
Iridium-192-----	10.00		
Iron-55-----	100.00		