APPENDIX M

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CALCULATION OF PACKAGING MATERIALS FOR DIFFERENT CONTAINERS

The calculations for the amount of packaging materials (i.e., steel, plastic, or lead) present in each type of TRU waste container that is currently planned to be shipped to WIPP are based on the packaging material assumptions stated in Chapter 1. The actual calculations to estimate the amount of each packaging material in kilograms per cubic meter (kg/m^3) is presented in Sections M.1 to M.5.

M.1 Packaging Materials for a 55-gallon drum

Steel
Based on the assumption that a 55-gallon drum is made up of steel and weighs 60 pounds, the amount of steel is calculated as follows:

$$\text{Amount of steel} = \frac{60 \text{ lbs} / (2.205 \text{ lbs/kg})}{0.208 \text{ m}^3 \text{ per drum}} = 130.8 \text{ kg/m}^3$$

Plastic
Based on the assumption that the rigid liner in a 55-gallon drum weighs 7.7 kilograms, the amount of plastic packaging in a 55-gallon drum is calculated as follows:

$$\text{Amount of plastic} = \frac{7.7 \text{ kg}}{0.208 \text{ m}^3} = 37.01 \text{ kg/m}^3$$

M.2 Packaging Materials for a Direct-Load SWB

Steel
Based on the assumption that a SWB is made up of steel and weighs 640 pounds, the amount of steel is calculated as follows:

$$\text{Amount of steel} = \frac{640 \text{ lbs} / (2.205 \text{ lbs/kg})}{1.89 \text{ m}^3 \text{ per SWB}} = 153.5 \text{ kg/m}^3$$

Plastic

Based on the assumption that the 11-mil PVC liner in a directly loaded SWB weighs approximately 2.25 kilograms, the amount of plastic packaging in a directly loaded SWB is calculated as follows:

$$\text{Amount of plastic} = \frac{2.25 \text{ kg}}{1.89 \text{ m}^3} = 1.19 \text{ kg/m}^3$$

M.3 Packaging Materials for an SWB Used to Overpack Four 55-gallon Drums

<u>Steel</u>

For the case of four 55-gallon drums overpacked in a SWB, the total weight of steel is a combination of the steel in the SWB and the steel in the four 55-gallon drums. Based on the assumptions made earlier about the weight of a 55-gallon drum (60 lbs) and the weight of a SWB (640 lbs) the amount of steel is calculated as follows:

$$\text{Amount of steel} = \frac{(4 \times 60 + 640) \text{ lbs} / (2.205 \text{ lbs/kg})}{1.89 \text{ m}^3 \text{ per SWB}} = 211.1 \text{ kg/m}^3$$

<u>Plastic</u>

It is assumed that the 11-mil PVC liner for the SWB will not be used when the drums are overpacked in the SWB. Thus, the plastic will be contributed entirely by the rigid liners in the four overpacked drums. Based on the assumption, the amount of plastic packaging is calculated as follows:

$$\text{Amount of plastic} = \frac{4 \text{ drums} \times 7.7 \text{ kg of plastic per drum}}{1.89 \text{ m}^3 \text{ per SWB}} = 16.29 \text{ kg/m}^3$$

M.4 Packaging Materials for a Direct-Load RH Canister

<u>Steel</u>

The total weight of an empty RH Canister is 1,762 lbs, of which 852 lbs is steel and 910 lbs is lead. This does not include the shield plug. Based on the 852 lbs of steel and a volume of 0.89 m^3 for the RH Canister, the amount of steel is calculated as follows:

$$\text{Amount of steel} = \frac{852 \text{ lbs} / (2.205 \text{ lbs/kg})}{0.89 \text{ m}^3 \text{ per RH Canister}} = 434.15 \text{ kg/m}^3$$

<u>Plastic</u>

For a directly loaded RH Canister, it is assumed that there would not be any plastic packaging involved. Therefore, the amount of plastic for this case is zero.

<u>Lead</u>

Based on the 910 lbs of lead in an RH Canister mentioned earlier and a volume of 0.89 m^3 for the RH Canister, the amount of lead is calculated as follows:

$$\text{Amount of lead} = \frac{910 \text{ lbs} / (2.205 \text{ lbs/kg})}{0.89 \text{ m}^3 \text{ per RH Canister}} = 463.7 \text{ kg/m}^3$$

M.5 Packaging Materials for an RH Canister Used to Overpack Three 55-gallon Drums

Steel

For the case of three 55-gallon drums overpacked in an RH Canister, the total weight of steel is a combination of the steel in the RH Canister and the steel in the three 55-gallon drums. Based on the assumptions made earlier about the weight of a 55-gallon drum (60 lbs) and the weight of steel in an RH Canister (852 lbs) the amount of steel is calculated as follows:

$$\text{Amount of steel} = \frac{(3 \times 60 + 852) \text{ lbs} / (2.205 \text{ lbs/kg})}{0.89 \text{ m}^3 \text{ per RH Canister}} = 525.8 \text{ kg/m}^3$$

Plastic

The plastic will be contributed entirely by the rigid liners in the three overpacked drums. Based on the assumption, the amount of plastic packaging is calculated as follows:

$$\text{Amount of plastic} = \frac{3 \text{ drums} \times 7.7 \text{ kg of plastic per drum}}{0.89 \text{ m}^3 \text{ per RH Canister}} = 25.9 \text{ kg/m}^3$$

Lead

Since the 55-gallon drums do not contribute any lead, the calculation for this case is the same as that of a directly loaded RH Canister. Thus, based on the 910 lbs of lead in an RH Canister mentioned earlier and a volume of 0.89 m^3 for the RH Canister, the amount of lead is calculated as follows:

$$\text{Amount of lead} = \frac{910 \text{ lbs} / (2.205 \text{ lbs/kg})}{0.89 \text{ m}^3 \text{ per RH Canister}} = 463.7 \text{ kg/m}^3$$