This appendix describes the cost modeling assumptions and procedure used by EPA in developing cost estimates supporting the proposed RCRA Phase IV Land Disposal Restrictions (LDR) cost and economic impact analyses for mineral processing wastes. In general, the cost modeling was performed by manipulating the input data to determine portions of material sent to treatment and disposal, as well as storage prior to recycling. These portions of material were then used to determine the average facility and total sector costs associated with treatment and disposal, and storage prior to recycling for each baseline and option considered. The costs attributable to this rule were calculated by subtracting the cost of the baseline from the cost of each regulatory option. Appendix G presents a detailed example of the cost model calculations for the titanium and titanium dioxide sector.

Determine Portion of Waste Stream Considered to Be Hazardous

To account for the uncertainty in the data caused by the lack of documented information on both waste characteristics and recyclability, EPA developed a range consisting of minimum, expected, and maximum estimates of waste volumes potentially affected by the various options. Then EPA weighted these volume estimates for each waste stream to account for the degree of certainty in whether the particular waste stream exhibited one or more of the RCRA hazardous waste characteristics.

As shown below in Exhibit F-1, EPA used a matrix to account for the uncertainty in waste characterization. Each waste stream was assigned a multiplier in each costing scenario (i.e., minimum, expected, and maximum) based on the whether the waste stream was known to be hazardous (Y) or only suspected to be hazardous (Y?). Therefore, in the expected value case, if a waste stream was only suspected to be hazardous, only half of it was counted in the analysis and the rest was assumed to be non-hazardous. In the minimum value scenario, the stream would drop out of the analysis, and in the maximum value case the entire stream would be counted as if it was known to be hazardous.

Exhibit F-1
Portion of Waste Stream Considered to Be Hazardous (Percent)

Costing Scenario	Hazard Characteristic(s)	
	Y	Y?
Minimum	100	0
Expected	100	50
Maximum	100	100

where:

Y means that EPA has data **demonstrating** that the waste exhibits one or more of the RCRA hazardous waste characteristics; and
Y? means that EPA, based on professional judgment, believes that the waste may exhibit one or more of the RCRA hazardous waste characteristics.

Determine Portion of Waste Stream Sent to Treatment and Disposal and the Amount Recycled

EPA also used a set of matrices to divide the hazardous portion of each waste stream sent into a

component sent to treatment and disposal and a component stored prior to recycling. EPA used the tables in Exhibits F-2 and F-3 to determine each of these portions for the appropriate baseline or option. For example, in the modified prior treatment baseline, 15 percent of the hazardous portion of a waste believed to be fully recyclable (Y?) is assumed to be sent to treatment and disposal while 85 percent of the hazardous portion is assumed to require storage prior to recycling.

Exhibit F-2
Proportions of Waste Streams Treated and Disposed (in percent)

Baseline or Option	Affected Material	Percent Recycled				
		Certainty of Recycling				
		Y	Y?	YS	YS?	N
Prior Treatment	SL/BP	0	15	25	80	100
Prior Treatment	SM	0	25	35	85	100
Modified Prior Treatment	All	0	15	25	80	100
No Prior Treatment	All	0	100	60	100	100
Option 1 from PT	Bevill	100	100	100	100	100
	Non-Bevill	30	65	100	100	100
Option 2 from PT	Bevill	100	100	100	100	100
	Non-Bevill	0	25	35	85	100
Option 3 from PT	All	0	25	35	85	100
Option 4 from PT	All	0	15	25	80	100
Option 1 from MPT	Bevill	100	100	100	100	100
	Non-Bevill	30	65	100	100	100
Option 2 from MPT	Bevill	100	100	100	100	100
	Non-Bevill	0	25	35	85	100
Option 3 from MPT	All	0	25	35	85	100
Option 4 from MPT	All	0	15	25	80	100
Option 1 from NPT	Bevill	100	100	100	100	100
	Non-Bevill	20	100	90	100	100
Option 2 from NPT	Bevill	100	100	100	100	100
	Non-Bevill	0	30	40	85	100
Option 3 from NPT	All	0	30	40	85	100
Option 4 from NPT	All	0	15	25	80	100

Notes:

Y means that EPA has information indicating that the waste stream is fully recycled.
Y? means that EPA, based on professional judgment, believes that the waste stream could be fully recycled.
YS means that EPA has information indicating that a portion of the waste stream is fully recycled.
YS? means that EPA, based on professional judgment, believes that a portion of the waste stream could be fully recycled.
Bevill means that secondary materials are recycled through beneficiation or Bevill process units
Non-Bevill means that secondary materials are not recycled through beneficiation or Bevill process units

Exhibit F-3
Proportions of Waste Streams Stored Prior to Recycling (in percent)

Baseline or Option	Affected Material	Percent Recycled				
		Certainty of Recycling				
		Y	Y?	YS	YS?	N
Prior Treatment	SL/BP	100	85	75	20	0
Prior Treatment	SM	100	75	65	15	0
Modified Prior Treatment	All	100	85	75	20	0
No Prior Treatment	All	100	0	40	0	0
Option 1 from PT	Bevill	0	0	0	0	0
	Non-Bevill	70	35	0	0	0
Option 2 from PT	Bevill	0	0	0	0	0
	Non-Bevill	100	75	65	15	0
Option 3 from PT	All	100	75	65	15	0
Option 4 from PT	All	100	85	75	20	0
Option 1 from MPT	Bevill	0	0	0	0	0
	Non-Bevill	70	35	0	0	0
Option 2 from MPT	Bevill	0	0	0	0	0
	Non-Bevill	100	75	65	15	0
Option 3 from MPT	All	100	75	65	15	0
Option 4 from MPT	All	100	85	75	20	0
Option 1 from NPT	Bevill	0	0	0	0	0
	Non-Bevill	80	0	10	0	0
Option 2 from NPT	Bevill	0	0	0	0	0
	Non-Bevill	100	70	60	15	0
Option 3 from NPT	All	100	70	60	15	0
Option 4 from NPT	All	100	85	75	20	0

Notes:

Y means that EPA has information indicating that the waste stream is fully recycled.
Y? means that EPA, based on professional judgment, believes that the waste stream could be fully recycled.
YS means that EPA has information indicating that a portion of the waste stream is fully recycled.
YS? means that EPA, based on professional judgment, believes that a portion of the waste stream could be fully recycled.
Bevill means that secondary materials are recycled through beneficiation or Bevill process units
Non-Bevill means that secondary materials are not recycled through beneficiation or Bevill process units

Calculate Treatment Cost

"Model facility" generation rates of each type of waste sent to treatment (i.e., wastewaters, wastes with 1 to 10 percent solids, and wastes with more than 10 percent solids) were computed in each sector by summing the total sector quantities of each waste type sent to treatment and dividing by the maximum number of affected facilities in each costing scenario. These data can be found in the input data tables of the Cost Model Appendix (bound separately). These "model facility" generation rates of each type of

waste were used to first determine whether wastes would be treated on- or off-site and then to determine the cost associated with their being sent to treatment. EPA assumed that the most efficient means of treating a number of waste streams was to commingle these streams and build a single treatment facility on-site. This treatment system would sequentially treat each type of waste by first neutralizing liquid streams (wastewaters and wastes with 1 to 10 percent solids), precipitating the metals in these liquid streams, dewatering the residue from precipitation, stabilizing both the residue from dewatering and any solid wastes, and disposing of the stabilized mass. As indicated, each step in the process would generate a residue requiring further treatment or disposal. Therefore, EPA calculated the total quantity requiring neutralization and precipitation (100 percent of the liquid streams), the quantity being dewatered (15 percent of liquid streams), the quantity being stabilized (2.25 percent of liquid streams plus 100 percent of solid streams), and the quantity being disposed (3.49 percent of liquid streams, and 175 percent of solid streams). If the quantity requiring neutralization was below 350 mt/yr, EPA assumed that this waste would be sent off-site for treatment. If the quantity requiring stabilization was below 870 mt/yr, EPA assumed this waste would be sent off-site for treatment and disposal.

EPA then applied these estimated quantities to the treatment and disposal costing functions described in Appendix E to estimate "model facility" treatment costs for each baseline and option. The model facility cost was then multiplied by the maximum number of affected facilities in each sector, to determine the total sector cost.

Calculate Recycling Costs

Recycling costs are specific to each waste stream, based on the assumption that it is important not to commingle materials prior to reclamation. Quantities of individual streams destined for recovery were therefore not totaled.

EPA assumed that the only costs associated with recycling wastes are the costs of constructing and operating storage units. For each waste stream, EPA used the quantity of each waste stream that is recycled to calculate storage costs for the three baselines and three options. EPA then multiplied the average facility recycling cost by the number of facilities generating that waste stream to calculate the total sector cost for each waste stream. The total sector costs were then added for each waste stream to determine the total sector recycling cost in each baseline and post-rule option. EPA then calculated the incremental total sector storage costs by subtracting the total sector baseline recycling storage costs from the total sector post-rule option recycling storage costs.

Calculate Total Sector Costs and Impacts

Finally, EPA calculated the total sector costs by adding the total sector incremental treatment costs to the total sector incremental recycling costs. EPA divided this total sector cost by the number of facilities to determine the average facility cost. EPA then divided the total sector costs by the value of shipments (and multiplied by 100) to determine the percentage impacts in each sector.