



Tracking waste contaminants in MineSight

In many operations, waste material contains contaminants that are important to track for environmental or other purposes. Reporting these contaminants is vital when producing short-term plans using MineSight Interactive Planner (MSIP) or MineSight Schedule Optimizer (MSSO). By carrying waste contaminant grades to MSSO we can constrain the contaminant content for each destination in the project.

There are several types of IP configurations, and depending on the initial configuration of MSIP, different steps are needed to consider contaminants. We will discuss the following cases:

- 1) No Ore% Item
 - a. In this type of project, “waste” is not determined by MSIP. “Waste” is determined by how material is routed in the schedule. All waste carries its appropriate grades and no special configuration is required.
- 2) Single Ore% Model
 - a. A WASTE% item must be added to the model that is equal to TOPO%-ORE%. MSIP must be configured using the Multiple Ore% option, listing the ORE% zone and WASTE% zone as two different “Ore” Zones within each block. No items are listed under Waste items.
- 3) Multiple Ore% Model
 - a. All WASTE% items should be configured under the Ore items heading in MSIP, allowing the use of grade items. Waste zone codes must be altered in the model, such that they are no longer equal to any existing ore codes.

There are further complexities to the required Multiple Ore% setup for reporting waste contaminants for Single and Multiple Ore% block models. The rest of this article reviews these complexities.

For example, consider the following multiple ore% case:

- 2 Zones/Seams Per Block
- Ore quality/grade items: YLD (Plant Yield), RASH (Raw Ash), RFSI (Raw Free Swelling Index)
- Waste contaminant items: SUL (Sulfur), HG (Mercury)

A standard multiple ore percent project without tracking waste contaminants is configured in the following manner, with Ore items and qualities listed under the Ore items heading and Waste items listed under the Waste items heading:

Ore Items									
Pct item	Zone item	Density item	Type	Priority	Grade item	Accum	Grade item	Accum	Grade item
COAL1	SEAM1	SG1	SG	0	YLD1		RASH1		RFSI1
COAL2	SEAM2	SG2	SG	0	YLD2		RASH2		RFSI2
			SG	0					
			SG	0					
			SG	0					
			SG	0					
			SG	0					
Waste Items									
Pct item	Zone item	Density item	Type	Priority					
WPCT1	WTYP1		SG	0					
WPCT2	WTYP2		SG	0					
WPCT3	WTYP3		SG	0					

Figure 1: The standard multiple ore percent configuration in MSIP lists Ore Percent items and qualities under the “Ore Items” heading and Waste Percent items under the “Waste Items” heading.

The Waste Items were all coded in a manner that associated Waste material with a specific ore zone. Thus, in the material set table, each material type had corresponding ore and waste items. Because the waste zones need to be listed under “Ore Items” in order to carry grades, we will need to alter the zone codes to ensure that the Ore and Waste material goes to separate bins. A simple strategy is to add a constant to all Waste zone values (you may need to clone the 3DBM to adjust the maximum value for the Waste zone items). This can be done using a simple MineSight Basis Model Calculation (p61201.dat or cp-modelcalctool.pyz). In my example, I added new Waste Zone items (WCTP1-3) and added 900 to each zone.

Once the Waste Zone codes are properly adjusted, the MSIP area should be configured such that all Waste Zone, Percent, and Quality items are configured under “Ore Items”. In the Area tab setup, all grade items must match down each column. Each zone (ore and waste) requires the same grade items to be listed. If a certain grade item does not exist for a particular zone, create a dummy grade item to fill in for those zones. Create a dummy grade item for each type (for example, in this case, I had to create dummy grade items for YLD, ASH, FSI, SUL, and HG).

Figure 2: To report contaminant grades for waste zones, all waste zones are listed under “Ore items”. All grade items must be listed in the same column for each zone, even if the grade item is not valid for that particular zone.

Once the Area tab has been configured, adjust the configuration of the Material Set. Now that all Waste zones are listed under “Ore Items”, adjust the configuration to reflect that these are now “Ore Items” by unchecking the “Waste” box. Note, you must still maintain a single default waste zone. If the Waste zone codes have changed, you must update the bin values to reflect this.

Zone name	Value	Default	Waste	Density	Cutoff
W05	905	<input type="checkbox"/>	<input type="checkbox"/>	2.5000	0.0000
SM05	5	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
W07	907	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
SM07	7	<input type="checkbox"/>	<input type="checkbox"/>	2.5000	0.0000
W09	909	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
SM09	9	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
W11	911	<input type="checkbox"/>	<input type="checkbox"/>	2.5000	0.0000
SM11	11	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
W13	913	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
SM13	13	<input type="checkbox"/>	<input type="checkbox"/>	2.5000	0.0000
W15	915	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000
SM15	15	<input type="checkbox"/>	<input type="checkbox"/>	1.5000	0.0000

Figure 3: The Material Set has been adjusted to reflect the fact that Waste items are now listed as “Ore Items” in the Area, and that the Waste zone bin values have changed.

Once these configuration changes are complete, contaminant grade items can be reported in MSIP using reporting scripts like ip-accum.py, and can be transferred to MSSO through the MineSight Planning Database.

19	Material:	W29	
20	Cutoff	>0.00	Totals
21	Tonnes	285	285
22	Volume (BC)	114	114
23	DMASH	0.00	0.00
24	DMFSI	0.00	0.00
25	DMYLD	0.00	0.00
26	HGW2	0.17	0.17
27	SULW2	4.82	4.82
28	Material:	SM29	
29	Cutoff	>0.00	Totals
30	Tonnes	1244	1244
31	Volume (BC)	876	876
32	DMHG	0.00	0.00
33	DMSUL	0.00	0.00
34	RASH2	12.10	12.10
35	RFSI2	5.10	5.10
36	YLD2	87.00	87.00

Figure 4: Waste contaminants and Ore qualities are now properly reported for ore and waste materials using the reporting script ip-accum.py in MSIP.

Now that we have transferred Waste contaminant grades to MSSO, it's possible to constrain these on the Grades portion of the Constraints panel in MSSO. The Grade title will reflect the grade name given on the first row of the "Ore Items" table in MSIP. In my example, the first row was using dummy Sulfur and Mercury items (DMSUL/DMHG), thus these titles are reflected in MSSO as shown in the figure below. As long as the proper grade items are listed in the same column for the waste zone(s), grades should be reflected properly. Confirm this by viewing the "Full" report in MSSO to check cut by cut grade values.

Constraint Items	Accumulative	Lower Limit	Upper Limit	Period
DMSUL [W25]	<input type="checkbox"/>	0.00	10.00	1-12
DMHG [W25]	<input type="checkbox"/>		0.80	1-12

Figure 5: Following this workflow, it's now possible to constrain Waste destinations by contaminant grades in MSSO.

Note: All material being routed to a particular waste destination must have the waste contaminant grade defined; otherwise the constraint will not be properly respected.