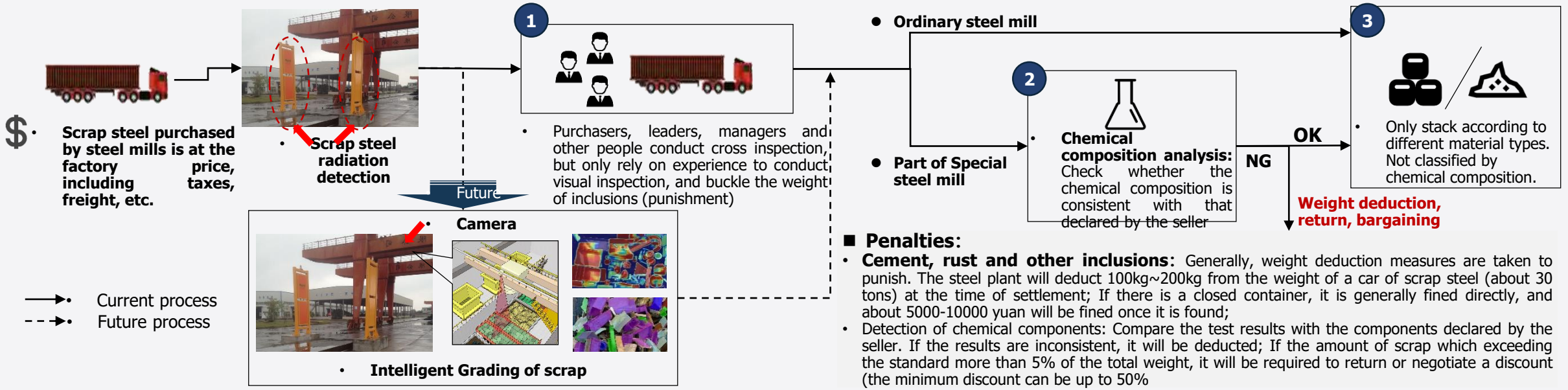
06 China Scrap Steel Quality Analysis

Scrap inspection and warehousing process: the steel plant mainly judges the grade and checks the cleanliness through manual visual inspection



■ **Penalties:**

- **Cement, rust and other inclusions:** Generally, weight deduction measures are taken to punish. The steel plant will deduct 100kg~200kg from the weight of a car of scrap steel (about 30 tons) at the time of settlement; If there is a closed container, it is generally fined directly, and about 5000-10000 yuan will be fined once it is found;
- Detection of chemical components: Compare the test results with the components declared by the seller. If the results are inconsistent, it will be deducted; If the amount of scrap which exceeding the standard more than 5% of the total weight, it will be required to return or negotiate a discount (the minimum discount can be up to 50%

Scrap grade (mainly through appearance and thickness) judgment and inclusion detection:

■ At present: Mainly depends on the experience of purchasers and inspectors to judge the grade of scrap artificially. **There are differences in the definition of standards among different personnel, lack of quantitative standards, and the quality results cannot be unified. It is easy to be affected by personnel's mood and other factors, and there is a phenomenon that steel mill employees collude with scrap yard to take kickbacks;**

■ Future trend: **intelligent grade determination has been gradually applied in steel mills, and it is expected to be applied on a large scale in the next five years**; It will further improve the consistency of scrap grade determination, ensure the stability of scrap quality, and reduce the overall purchase and use cost of scrap raw materials.

- **Main functions**:
  1. Scrap grading: by scanning scrap, scrap is graded and quantitative indicators of each level are given.
  2. Impurity alarm: determine whether the scrap seen contains cement blocks, serious oil stains, closed containers and other rejected products.
  3. Impurity deduction guidance: using the results of grading and impurity alarm, give guidance on the impurity deduction ratio and return of the whole vehicle (or unloaded part).
- **Effect:** Liheng steel, Delong steel and other enterprises have been applied now, and the correct rate of classification / impurity reminder / weight deduction recognition is more than 90%, while the false alarm rate is less than 20%

Chemical composition test:

■ **Ordinary steel mill**: They will not test the chemical composition of scrap, but directly store it according to different grades of scrap;

■ **Part of Special steel mill**: **They will spot check and detect the chemical composition of each truck**, generally detect P, S, Cu, Zn and other elements, and also focus on the content of Cr, Mn or other specified alloy elements according to the production plan. The general detection cost is 20-40 yuan/ton.

Warehousing and storage:

■ **At present, most steel mills only stack scrap according to different grades**, such as heavy waste, medium waste, broken materials, etc;

■ **Only a few special steel production plant will classify and store according to the chemical composition**, such as low sulfur scrap, ultra-low sulfur scrap, ordinary scrap, etc.

Usage and purity upper limit of various types of steel in different industries

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Proportion of steel types applied in different industries in 2020

	Construction	Machinery	Automobile	Home appliance	Others	Cu %	Sn %	Cr %	Ni %
Structural	28.38	14.720	0.000	0.000	25.090	0.85%	N/A	1.25%	1.50%
Hi quality structural[1]	3.58	0.770	0.000	0.000	3.850	0.20%	N/A	N/A	N/A
Bars	192.30	8.150	0.000	0.000	66.850	1.00%	N/A	N/A	N/A
Rail	0.00	0.000	0.000	0.000	3.300	0.15%	N/A	0.40%	0.15%
Plates	9.02	120.870	32.400	0.000	47.700	0.50%	N/A	1.20%	2.00%
Sheets	0.00	75.150	28.150	14.930	22.580	0.30%	N/A	0.30%	0.30%
Hi quality sheets[2]	0.00	43.470	4.180	2.220	13.530	0.10%	N/A	N/A	N/A
Wires	93.74	0.000	2.590	0.000	65.270	0.30%	N/A	1.00%	0.80%
Pipes	61.25	2.200	0.630	0.400	21.920	0.20%	N/A	1.10%	0.30%
Others	8.14	3.940	2.280	0.520	11.020	0.20%	N/A	N/A	N/A
Total	396.41	269.27	70.23	18.07	281.11	-	-	-	-

- *Data source: NBS, SMM survey*
- *Data source: National standard documents*

Types of scrap produced by steels applied to different industries in 2020

	Construction	Machinery	Automobile	Home appliance	Others
Structural	Heavy	Heavy	/	/	Heavy
Hi quality structural[1]	Heavy	Heavy	/	/	Heavy
Bars	Bundle	Bundle	/	/	Bundle
Rail	/	/	/	/	/
Plates	Heavy	Medium	Light	/	Heavy/Medium/Light
Sheets	/	Light	Light/Shredded	Shredded	Light/Shredded
Hi quality sheets[2]	/	Light	Light/Shredded	Shredded	Light/Shredded
Wires	Bundle	/	Bundle	/	Bundle
Pipes	Light	Light	Light	Shredded	Light/Shredded
Others	Bundle	Heavy	Bundle	Shredded	Heavy/Medium/Light/Bundle/Shredded

Data source: SMM survey

Notes:
1. Hi quality structural: Cu=<0.2%
2. Hi quality sheets: Cu=<0.1%

- Through the official data released by NBS and the research of SMM, we have determined the usage of various types of steel in different industries;
- The composition upper limit of each element can be determined by querying the steel national standard documents with different functions under each steel variety. For example, in structural, we can query more than 30 documents such as 'Quality carbon structure steels (GB/T 699-2015)', 'Structural steel for bridge (GB/T 714-2015)', 'Fire-resistant weathering steels for structure (GB/T 41324-2022)', then we take the maximum index from them; The same is true for the determination of steel composition of other varieties.

Scrap required in the charge to make various steel products (1/2)

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Element content of steel used in 2020

Type	Cu %
Heavy recycling materials	0.47%
Medium recycling materials	0.46%
Light recycling materials	0.34%
Shredded recycling materials	0.33%
Bundled recycling materials	0.26%

Notes:
1. It is assumed that the element composition in steel will not change with the degree of use (physical change) and the passage of time, so the chemical composition in the recycled scrap is consistent with that in production;
2. It is assumed that the recycled scrap does not contain copper metal.
3. The Cu element content in different scraps calculated by the weighted average of the waste generation industry and the corresponding impurity content;

$$\frac{\text{Product max Cu wt.\%} - \text{residuals levels in scrap, wt.\%}}{\text{Scrap Cu, wt.\%} - \text{residuals levels in scrap, wt.\%}}$$

Through this formula, we can calculate the maximum amount of scrap that can be added when producing steel with corresponding copper content.

Vertical axis in scrap Cu, wt.%

Scrap required in the charge to make various steel products

Horizontal axis in product max Cu wt.%

	0.08	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
0.08	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.10	0.0	63.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.15	0.0	41.5	66.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.20	0.0	30.8	49.6	187.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.25	0.0	24.5	39.4	149.0	187.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.30	0.0	20.4	32.8	123.7	155.4	489.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.35	0.0	17.4	28.0	105.7	132.9	418.6	489.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.40	0.0	15.2	24.5	92.3	116.1	365.6	427.6	489.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.45	0.0	13.5	21.7	82.0	103.0	324.5	379.5	434.6	489.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.50	0.0	12.1	19.5	73.7	92.6	291.7	341.2	390.6	440.1	699.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.55	0.0	11.0	17.7	66.9	84.1	264.9	309.8	354.8	399.7	635.4	699.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.60	0.0	10.1	16.2	61.3	77.0	242.6	283.8	325.0	366.1	582.0	640.8	699.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.65	0.0	9.3	15.0	56.5	71.1	223.8	261.8	299.8	337.7	536.8	591.1	645.3	699.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.70	0.0	8.6	13.9	52.5	65.9	207.7	242.9	278.2	313.4	498.2	548.5	598.9	649.3	699.6	N/A	N/A	N/A	N/A	N/A	N/A
0.75	0.0	8.1	13.0	48.9	61.5	193.8	226.6	259.5	292.4	464.7	511.7	558.7	605.7	652.6	699.6	N/A	N/A	N/A	N/A	N/A
0.80	0.0	7.6	12.1	45.9	57.6	181.6	212.4	243.2	274.0	435.5	479.5	523.5	567.6	611.6	655.6	699.6	N/A	N/A	N/A	N/A
0.85	0.0	7.1	11.4	43.2	54.2	170.8	199.8	228.8	257.8	409.7	451.1	492.5	534.0	575.4	616.8	658.2	767.8	N/A	N/A	N/A
0.90	0.0	6.7	10.8	40.7	51.2	161.3	188.6	216.0	243.4	386.8	425.9	465.0	504.1	543.2	582.3	621.4	724.9	767.8	N/A	N/A
0.95	0.0	6.4	10.2	38.6	48.5	152.7	178.7	204.6	230.5	366.4	403.4	440.4	477.4	514.5	551.5	588.5	686.5	727.2	767.8	N/A
1.00	0.0	6.0	9.7	36.6	46.1	145.1	169.7	194.3	218.9	347.9	383.1	418.3	453.4	488.6	523.8	558.9	652.0	690.6	729.2	1035.1

Because the service life of each industry is different, This table is based on the steel consumption data in 2020 as an example, the numbers represent the highest scrap ratio under the product requirement. If we want to know the current year's comparison table, it is necessary to know the proportion of steel types in each industry in the past year.

Scrap required in the charge to make various steel products (2/2)

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