

Response to reviewer 2

General comments:

The authors made a great effort on the estimation of Hg emission from iron and steel production (ISP) during 2010-2015 in China by using technically-based emission factor method with up-to-date parameters through national sampling and literature review, which has reduced the associated uncertainty of Hg emission from ISP. Given the updated Hg emission database, this work provides meaningful results to health-related study and is helpful to make control policy. Frankly speaking, many sections in this paper just reported the numbers but didn't provide further insight beyond those facts.

Response: Discussions were added as follows.

“The slower AAGR of Hg emissions (7.2%) than that of crude steel production (13%) reflected the impact on Hg emission reduction due to energy saving and environmental protection in ISP. On one hand, Hg input to produce unitary crude steel decreased from 0.17 to 0.12 g/t, which mainly benefited from the improvement of coke production efficiency and energy utilization efficiency of sinter/pellet plant and blast furnace. Since 2004, indigenous coke production method with high coal consumption has been gradually replaced with machine coke production method. The coke ratio in sinter/pellet plant has been reduced from approximately 388 kg/t pig iron produced in 2000 to 363 kg/t in 2015 (CISIA, 2001-2016). On the other hand, the improvement of APCDs increased the overall Hg removal efficiency from 47% in 2000 to 65% in 2015 (Fig. 3). APCDs for coke oven have shown the largest Hg removal efficiencies (64%-87%) while pollution control in sinter/pellet plant contributed most to the rapid Hg reduction speed during 2000-2015. The replacement of CYC and WS with ESP and FF in sinter/pellet plant improved Hg removal efficiency from 21% in 2000 to 44% in 2010. The application of FGD in addition to dust collectors was the main driver of Hg reduction in sinter/pellet process during 2011-2015. Hg removal efficiency in sinter/pellet plant was 53% in 2015.”

See revised manuscript, Page 10, Line 232-247.

“The comparison of emissions from different types of process combination in this study indicated the significance of including emissions from roasting plant and coke oven in the ISP emission inventories. The proportion of emissions from these two processes accounted for 22%-34% of ISP's emissions during the whole study period. In addition, these two processes were important in shaping the trends of ISP Hg emissions. For example, Hg emissions of all processes showed an increasing during 2007-2008 (Red line in Fig. 6). However, if these two processes were not considered, we will observe a decreasing trend (Green and orange line in Fig.6). Moreover, given the impact of APCDs on the emission estimation, inventories in ISP should also apply distinct APCD profiles for different processes so as to reduce the uncertainty of inventories.”

See revised manuscript, Page 13-14, Line 325-334.

Specific comments:

My main concern is the credible of dataset. Does the “SV” in Table 1 means standard deviation value? If it does, how can the authors get SV when they just have one Limestone sample in Shanghai and Gansu?

Response: All collected samples were analyzed in triplicate or more times to obtain parallel results. In Table 1, if only one sample was collected, the standard deviation of the parallel Hg

concentrations of this sample was signed as the SD in Table 1. To avoid confusion, we have deleted the data.

See revised manuscript, Page 20, Table 1.

And in Table 2, the emissions of Hg in Hainan in 2000/2005/2010/2015 were 0.0 but it has an average annual growth rate of 26%. Is that because the emission amount of Hg in Hainan was quite low so that it doesn't show the true value when you only keep one decimal fraction?

Response: Yes. To keep the true value of the data, we revised the unit of the data in Table 2 from "t" to "kg".

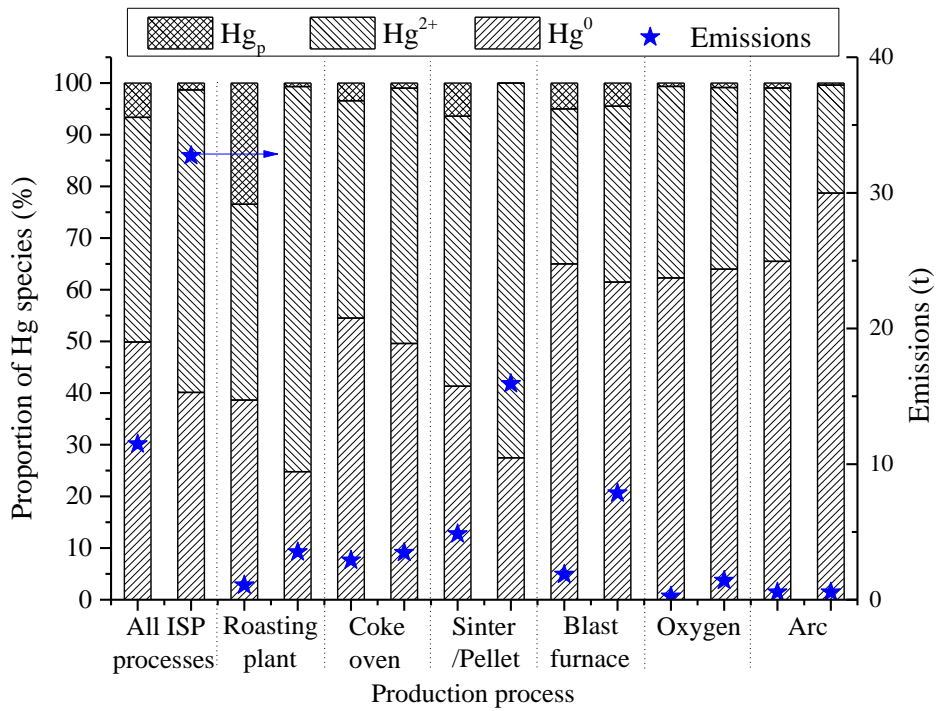
See revised manuscript, Page 22, Table 2.

In addition to this, what is the "All ISP processes" means in Fig.4? If it means the sum of Hg emission from all processes, why the total emission of Hg (asterisk in Fig.4) in Roasting plant, Coke oven, Sinter/Pellet, Blast furnace, Oxygen and Arc far exceeding the value in All ISP processes, either in 2000 or 2015?

Response: Yes, the all ISP processes means the sum of Hg emissions from all processes. The value in all ISP processes actually equaled to the total emissions of Hg in roasting plant, coke oven, sinter/Pellet, blast furnace, oxygen and arc (Refer to the right coordinate of Fig. 4). The exact data used to plot the graph were listed in the following table.

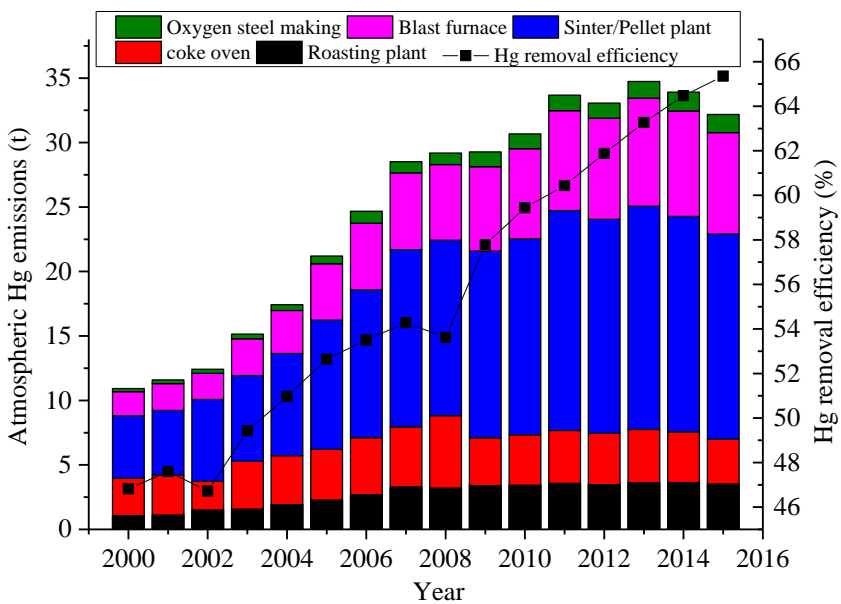
Process	Emissions in 2000 (t)	Emissions in 2015 (t)
All processes	11.5	32.7
Roasting plant	1.1	3.5
coke oven	2.9	3.5
Sinter/Pellet	4.8	15.9
Blast	1.9	7.9
Oxygen	0.2	1.4
Arc	0.5	0.5

To better understand Fig 4, we have re-drawn the figure. An arrow was added to point the right coordinate.



Given that the annual Hg emission proportion (by comparing Fig. 2 and Fig. 3) shows a decreasing trend since 2000, I'd suggest authors add the emission proportion values to Figure 3 because it will provide more insight of the impact of energy consumption and air pollution control on Hg emission.

Response: Hg removal efficiency was added to Figure 3 to provide insight of impact of air pollution control.



Other specific points:

Line 323: the authors stated “: : indicated the significance of our new inventory”, which makes me confused. Please specify what it exact means.

Response: We have specified the meaning of this sentence, which was revised as follows.

“The comparison of emissions from different types of process combination in this study indicated the significance of including emissions from roasting plant and coke oven in the ISP emission inventories. The proportion of emissions from these two processes accounted for 22%-34% of ISP’s emissions during the whole study period. In addition, these two processes were important in shaping the trends of ISP Hg emissions. For example, Hg emissions of all processes showed an increasing during 2007-2008 (Red line in Fig. 6). However, if these two processes were not considered, we will observe a decreasing trend (Green and orange line in Fig.6). Moreover, given the impact of APCDs on the emission estimation, inventories in ISP should also apply distinct APCD profiles for different processes so as to reduce the uncertainty of inventories.”

See revised manuscript, Page 13-14, Line 325-334.

Line 335: the authors quoted “emissions of pollutants are required to be reduced by 15% for ISP before 2020 in China”. That is unclear to me what the pollutants really are? Does the government required to reduce all pollutants by 15% simultaneously?

Response: The pollutants generally referred to those considered in the emission standards of air pollutants for iron and steel industry, including SO₂, NO_x, PM, dioxin, and fluoride. Yes, the government required that the above pollutants should be reduced by at least 15% at before 2020. Revised as follows.

“On the other aspect, emissions of pollutants (eg., SO₂, NO_x, and PM) are required to be reduced by at least 15% for ISP before 2020 in China (MIIT, 2016).”

See revised manuscript, Page 14, Line 353-355.

Technical correction:

Line 62, 102, 152 and some other places: “filed” should be “field”.

Response: Revised.

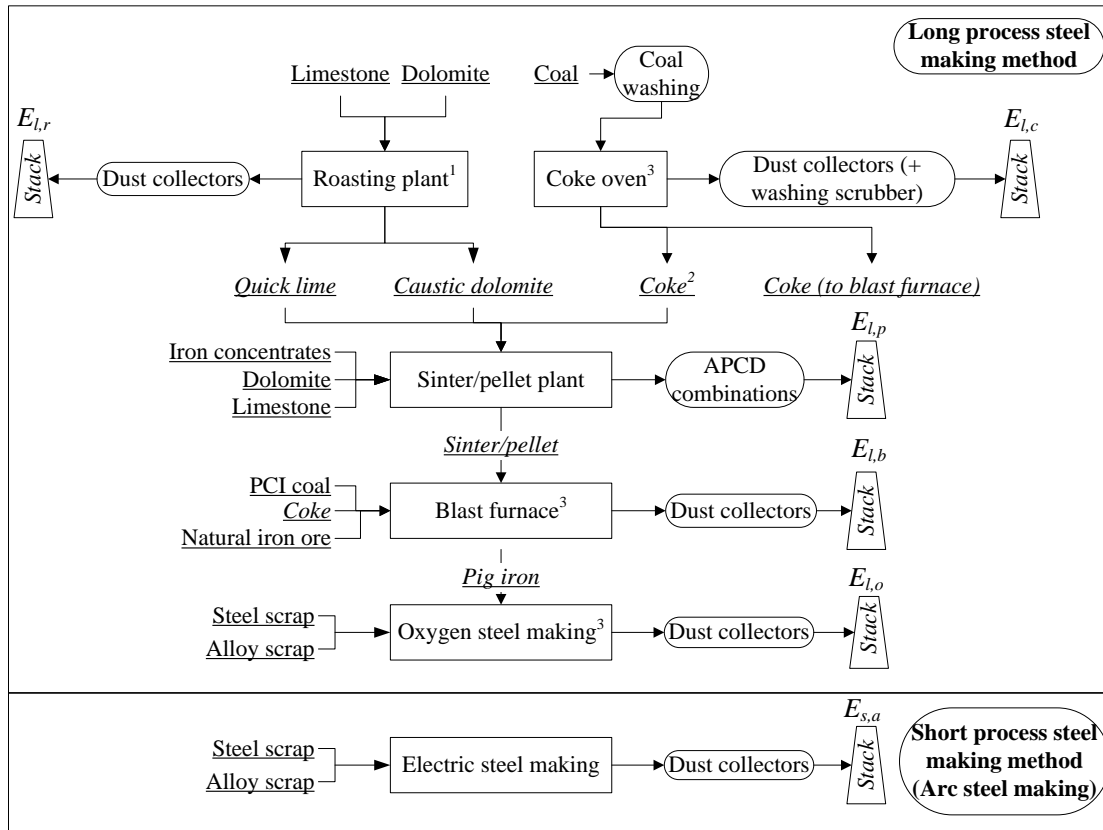
Table 1: “NM” in Note 2 should be revised as “NS”.

Response: Revised.

See revised manuscript, Page 21, Table 1.

Figure 1: what is the numeric “1” in the title of figure 1 used for?

Response: The numeric“1”is a note for figure 1. To be clearer, the note was added at the end of the figure instead of the title.



- Note: 1. Some plants roasted limestone and dolomite separately.
 2. Mainly coke breeze. Some plants also use coal powder as fuel.
 3. The flue gas after dust collectors are collected in gasometer before use.

See revised manuscript, Page 23, Fig. 1.