Responses to Comments Document:

MACT Standard for Primary Magnesium Refining

Metals Group
Emission Standards Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency

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1. Introduction

Only one short comment and one substantive comment were received on the proposed rule. The short comment suggested we cut the proposed standard by 50 percent. However, the commenter did not provide any information or rationale to support such a request. Consequently, we could not consider it further and made no changes to the rule as a result of the comment. Substantive comments (Docket Item OAR-2002-0043-0002 dated February 20, 2003) were received from US Magnesium LLC and are addressed in the following sections.

2. Comments and Responses

2.1 Dioxin/Furan Limit Not Needed

Comment: The commenter stated that a dioxin/furan emission limit is not appropriate for the primary magnesium industry because EPA has applied these limits primarily to facilities that burn wastes. Other industries, such as petroleum refineries and iron and steel foundries, are known to emit dioxin/furan; however, EPA did not propose limits for them. The commenter also stated that the dioxin/furan limit cannot be justified on the basis of health risk because the facility is in a remote location, and the nearest resident is 25 miles away. The commenter recommended that EPA use PM as a surrogate for dioxin/furan emissions from the melt reactor because: (1) EPA established MACT for dioxin/furan as the PM control devices on the melt reactor, (2) PM is used as a surrogate for other pollutants in this rule and has been used as a surrogate for dioxin/furan in other rules, (3) the dioxin/furan emissions are mainly in particulate form, (4) the dioxin/furan limit will obtain no additional reduction beyond that obtained using PM as a surrogate, and (5) the dioxin/furan limit will add significantly to the cost of stack testing with no apparent gain.

Response: We set a dioxin/furan limit because it is a HAP of concern with respect to toxicity, we have adequate test data (two tests composed of three runs each) to characterize emission control performance, and dioxin/furan formation and control is not always correlated to PM formation and control. First, the formation of dioxin/furans in combustion devices with an available source of chlorine is well documented, and it is not a concern only for facilities that burn waste. The test data from this industry confirms the formation and emissions of dioxin/furans from this emissions source. In this case, it is more appropriate to set a limit for dioxin/furan rather than to use PM as a surrogate. Second, we do not agree that the control device for PM will adequately control the emissions of dioxin/furans. There are factors other than the PM control device which may affect the formation and control of dioxin/furan, such as the composition and concentrations of precursors, temperature, and process conditions. Dioxins are formed in acid gases leaving the combustion device, and the means of control is not necessarily the particulate control system but quenching of gases to control the temperature in the device (to assure that temperature does not fall in the range which optimizes dioxin/furan formation).

The MACT control system for dioxin/furans is the entire scrubber train - the packed tower scrubbers (for HCl control) and the venturi scrubber (for PM control) - and not just the PM control device. That is, the control of dioxin/furans includes the rapid cooling of the exhaust gas that occurs in the packed tower absorbers, which limits the dioxin/furan formation. Therefore, we believe a dioxin/furan limit is necessary to ensure that process and control device operations do not change in the future in a manner that might increase the formation and release of dioxin/furan, even if the overall PM control level remains the same.

The dioxin/furan limit is not based on a determination that health risks exist; it is based on technology and the floor level of control that has been achieved. We do not believe that stack testing every 2.5 years is costly or unreasonable to provide assurance that the dioxin/furan limit is being achieved. Moreover, the commenter did not provide any information as to how this stack testing will add significantly to the costs of compliance with the NESHAP.

2.2 <u>Dioxin/Furan Emission Limit</u>

Comment: The commenter disagreed with the approach used to set the emission limit for dioxin/furan and claimed it does not provide a reasonable margin of safety to ensure continuous compliance. The commenter suggests a level of 50 ng TEQ/dscm is statistically valid. However, the commenter recommended that a minimum safety factor of three be applied to the average of results from the two stack tests (21.5 ng TEQ/dscm) to develop a limit of 65 ng TEQ/dscm rather than a limit of 36 ng TEQ/dscm as proposed. The commenter believes this is reasonable because of the high variability in the test results and because of the inherent inaccuracies in the dioxin/furan sampling and analysis, especially at these extremely low levels of detection.

Response: We chose 36 ng TEQ/dscm because it was the highest result from any of the six runs. This approach accounts for inherent variability, and an additional margin of safety is provided by determining compliance from the average of three runs. It appears that the commenter considered the six test runs in developing a standard deviation of ± 9.5 ng TEQ/dscm and estimating a 99th percentile for single test runs. The variability of the average of three runs is more appropriate than the variability of a single test run because compliance is determined from the average of three test runs rather than for each single test run.

To illustrate the impact of using the average of three runs, we performed a Monte Carlo simulation of 5,000 runs based on a normal distribution developed from the test results for six runs. (Details are given in Appendix A.) From the simulation, the 99th percentile for individual runs was 44 ng TEQ/dscm compared to a 99th percentile of 32 ng TEQ/dscm for the average of three runs. Consequently, since the emission limit is enforced based on three-run averages, the proposed limit of 36 ng TEQ/dscm is close to the 99th percentile of performance. We believe that the limit as proposed is achievable, and the simulation indicates it accounts for variability.

The commenter mentioned process variability and uncertainty associated with sampling and analysis as reasons for a higher limit. However, the variability in the process, sampling, and analysis are inherently included in the runs we used to derive the limit, and using the highest run accommodates this variability. In addition, there is no need to artificially increase the limit by multiplying the average of the test results by three because the statistical simulation shows that the proposed limit is reasonable. With testing performed every 2.5 years and a limit at about the 99th percentile, the limit would be exceeded no more than once every 250 years if the process and control device are operated as they were during the two performance tests.

While we were evaluating the data discussed by the commenter, we discovered an error in the 1998 test report. The test contractor inadvertently switched the TEF for two congeners. The net effect is that the overall average for six runs is 18 ng TEQ/dscm instead of 21.5 ng TEQ/dscm. This correction had no effect on the highest run and did not change the limit that was originally proposed.

2.3 Use Updated Toxicity Equivalence Factors (TEF)

Comment: The commenter believes that the World Health Organization's 1998 TEF scheme should be used to assign toxic equivalency, and this scheme should be stated in the final rule.

Response: Based on our dioxin reassessment report, we agree with the commenter and have incorporated the updated TEF scheme in the final rule. The effect on the test results was small, and the highest run remained at 36 ng TEQ/dscm. Consequently, the level of the standard was not changed. Details are provided in Appendix B.

2.4 Health Effects of Manganese

Comment: The commenter stated that manganese emissions from the facility are very low. Workers at the plant do not show any evidence of the health effects described in the preamble for chronic exposure to high levels of manganese by inhalation.

Response: We did not imply in the preamble that the workers at this plant exhibited the characteristics of exposure to manganese. The preamble contained a generic description of the health effects of several HAP, including manganese, and was provided only as background to show why these pollutants are hazardous air pollutants.

2.5 Modern Electrolytic Cells

Comment : The commenter believes the rule should include descriptions and requirements for modern electrolytic cells and the proper handling and collection of the cell off-gases. The modernization of electrolytic cells and chlorine capture equipment has reduced chlorine emissions by 75 percent.

Response: We did not include a detailed description of the modern cell technology, and we agree that we should point out that the old cell technology (known as the IG Farben cells) has been replaced. The new cell technology is a closed system and has resulted in reductions in chlorine emissions. The old cell technology allowed chlorine gas to escape from the anode section of the cell and infiltrate into the cathode section, where it was difficult to capture and control. The improvement in emission control is evidenced by the reduced chlorine emissions as reported for the Toxics Release Inventory (TRI).

Our proposed rule is based on the most current permit requirements at the time of proposal (permit dated October 11, 2001). This permit reflects the operating conditions after the old cell technology was replaced, and the permit specifies the old cell technology must be replaced by October 1, 2001. Consequently, the rule and operating permit reflect current operations after the replacement of the old IG Farben cells.

APPENDIX A. RESULTS OF THE MONTE CARLO SIMULATION OF TEQ RUNS

Issue

EPA proposed a dioxin limit of 36 ng/m^3. Commenter OAR-2002-0043-0002 (US Magnesium LLC) stated that the 99th percentile is 50 ng/m^3 and requests a standard of 65 ng/m^3 because of variability and inherent inaccuracy associated with sampling and analysis.

Background

- The test results are given in Table A-1. EPA chose the highest single run (36 ng/m^3) as the limit. The limit is based on the average of 3 runs, which further allows for variability.

Table A-1. Dioxin Test Results[1]

Run (year)	ng/m^3
Run 1 (2000)	24.2
Run 2 (2000)	36.0
Run 3 (2000)	10.5
Run 1 (1998)	13.6
Run 2 (1998)	7.4
Run 3 (1998)	17.4
Average	18.2
Standard deviation	10.5
Maximum	36

Monte Carlo Simulation

- According to the Shapiro-Wilke test, the individual runs are normally distributed.
- A Monte Carlo simulation was performed for the normal distribution and results for 5,000 runs were simulated. Three-run averages were calculated. Summary statistics are given in Table A-2.
- The 99th percentile for single runs is 44 ng/m^3. Averaging over 3 runs reduces the variability and results in a 99th percentile of 32 ng/m^3.

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[1] From the test reports listed as Docket Items II-A-4 (1998) and II-A-7 (2000) in Docket No. A-2002-0027.

Conclusion

- The proposed limit adequately accounts for variability, especially considering the limit is enforced based on 3-run averages.

Table A-2. Results of the Monte Carlo Simulation (5,000 Runs)

	Individual runs (ng/m^3)	3-run averages (ng/m^3)
Average	18.2	18.2
Standard deviation	10.5	6.3
99th percentile	44	32
Maximum	53	42

APPENDIX B. UPDATED TOXICITY EQUIVALENCE FACTORS

Tables B-1 and B-2 present the calculated toxicity equivalence (TEQ) based on the toxicity equivalence factors (TEF) recommended by the World Health Organization (WHO) in 1998. The most significant change in terms of these test results was that the TEF for 1,2,3,7,8-PeCDD increased from 0.5 to 1. Other TEFs that changed include a reduction by a factor of 10 for OCDD and OCDF.

Table B-1. Summary of TEQ Results - US Magnesium (March 1998)

Congener	WHO TEFs (1998)	PCDD/PCDF (ng/m^3)			TEQ (ng/m^3)		
		Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
2,3,7,8 -TCDD	1	0.05	0.04	0.05	0.050	0.040	0.050
1,2,3,7,8-PeCDD	1	0.14	0.08	0.22	0.140	0.080	0.220
1,2,3,4,7,8-HxCDD	0.1	0	0	0	0.000	0.000	0.000
1,2,3,6,7,8-HxCDD	0.1	0.1	0.1	0.2	0.010	0.010	0.020
1,2,3,7,8,9-HxCDD	0.1	0.1	0.1	0.1	0.010	0.010	0.010
1,2,3,4,6,7,8--HpCDD	0.01	0.1	0.1	0.1	0.001	0.001	0.001
OCDD	0.0001	0.1	0	0.1	0.000	0.000	0.000
2,3,7,8-TCDF	0.1	17.2	9	18.5	1.720	0.900	1.850
1,2,3,7,8-PeCDF	0.05	21.9	13.4	30.7	1.095	0.670	1.535
2,3,4,7,8-PeCDF	0.5	7.9	4.7	9.9	3.950	2.350	4.950
1,2,3,4,7,8-HxCDF	0.1	13.1	8.8	18.5	1.310	0.880	1.850
1,2,3,6,7,8-HxCDF	0.1	7.7	4.7	11.1	0.770	0.470	1.110
2,3,4,6,7,8-HxCDF	0.1	4.4	2.6	5.1	0.440	0.260	0.510
1,2,3,7,8,9-HxCDF	0.1	0.8	0.6	1.2	0.080	0.060	0.120
1,2,3,4,6,7,8-HpCDF	0.01	8.3	4.6	11.1	0.083	0.046	0.111
1,2,3,4,7,8,9-HpCDF	0.01	1.9	1.2	2.5	0.019	0.012	0.025
OCDF	0.0001	0	4.9	8.3	0.000	0.000	0.001
Total TEQ (ng/m^3)					9.7	5.8	12.4
Percent O_2					11.0	10.0	11.0
O_2 Correction Factor					1.4	1.3	1.4
Total TEQ (ng/m^3 at 7% O_2)					**13.6**	**7.4**	**17.4**

Table B-2. Summary of TEQ Results - US Magnesium (May 2000)

Congener	WHO TEFs (1998)	PCDD/PCDF (ng/m^3)			TEQ (ng/m^3)		
		Run 2	Run 3	Run 4	Run 2	Run 3	Run 4
2,3,7,8 -TCDD	1	0.04	0.06	0.03	0.040	0.060	0.030
1,2,3,7,8-PeCDD	1	0.26	0.47	0.16	0.260	0.470	0.160
1,2,3,4,7,8-HxCDD	0.1	0.18	0.29	0.05	0.018	0.029	0.005
1,2,3,6,7,8-HxCDD	0.1	0.53	0.91	0.16	0.053	0.091	0.016
1,2,3,7,8,9-HxCDD	0.1	0.44	0.74	0.13	0.044	0.074	0.013
1,2,3,4,6,7,8--HpCDD	0.01	0.97	1.86	0.27	0.010	0.019	0.003
OCDD	0.0001	0.78	1.17	0.14	0.000	0.000	0.000
2,3,7,8-TCDF	0.1	7.64	9.82	5.67	0.764	0.982	0.567
1,2,3,7,8-PeCDF	0.05	21.16	32.05	9.25	1.058	1.603	0.463
2,3,4,7,8-PeCDF	0.5	12.12	21.08	8.45	6.060	10.540	4.225
1,2,3,4,7,8-HxCDF	0.1	36.69	71.22	11.13	3.669	7.122	1.113
1,2,3,6,7,8-HxCDF	0.1	21.33	39.79	6.15	2.133	3.979	0.615
2,3,4,6,7,8-HxCDF	0.1	9.73	17.31	2.91	0.973	1.731	0.291
1,2,3,7,8,9-HxCDF	0.1	8.45	15.31	2.48	0.845	1.531	0.248
1,2,3,4,6,7,8-HpCDF	0.01	41.17	72.04	12.3	0.412	0.720	0.123
1,2,3,4,7,8,9-HpCDF	0.01	17.41	30.9	3.12	0.174	0.309	0.031
OCDF	0.0001	124.15	185.83	18.13	0.012	0.019	0.002
Total TEQ (ng/m^3)					16.5	29.3	7.9
Percent O_2					11.4	9.6	10.4
O_2 Correction Factor					1.5	1.2	1.3
Total TEQ (ng/m^3 at 7% O_2)					**24.2**	**36.0**	**10.5**