United States
Environmental Protection
Agency

Technical Development Document for the Final Effluent Limitations Guidelines and Standards for the Meat and Poultry Products Point Source Category (40 CFR 432)

The full document is available at: http://www.epa.gov/ost/guide/mpp/

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SECTION 12

NON-WATER QUALITY ENVIRONMENTAL IMPACTS

Sections 304(b) and 306(b) of the Clean Water Act require EPA to consider non-water quality environmental impacts (including energy requirements) associated with effluent limitations guidelines and standards. To comply with these requirements, EPA considered the potential impact of the final meat and poultry products (MPP) rule on energy consumption, air emissions, and solid waste generation. A discussion of the selected technology options is given in Section 13 of this Development Document. Considering energy use and environmental impacts across all media, EPA has determined that the impacts identified in this section are justified by the benefits associated with compliance with the final rule. Because the final rule only affects non-small facilities who directly discharge their wastewaters, impacts for those facilities are the only ones discussed here. Section 12.1 discusses the energy requirements for implementing wastewater treatment technologies at MPP facilities. Section 12.2 presents the impact of the technologies on air emissions, and Section 12.3 discusses the impact on wastewater treatment sludge generation.

12.1 ENERGY REQUIREMENTS

EPA estimates that compliance with this rule (Option 2.5) will result in a small net increase in nationwide energy consumption for all subcategories subject to changes resulting from this rule, except Subcategory J, which is projected to have decreased energy requirements. This estimated decrease for Subcategory J is because the facilities will all have decreased aeration requirements due to biochemical oxygen demand (BOD) removal during anoxic processes (before the aeration tank); because the BOD is removed beforehand, less aeration is needed for BOD removal during the aeration process. Although other subcategories may also decrease their aeration requirements, that decrease may be offset by the addition of supplementary BOD to achieve the desired nitrate reduction. For non-small direct discharging facilities nationwide, EPA estimates that there will be a 7.3 percent increase in total annual energy consumption for biological processes. This represents a net increase of approximately

17,700 megawatt-hours per year. This is a relatively small net increase compared with the current total annual amount of energy consumption by non-small direct facilities for wastewater treatment (approximately 243,500 megawatt-hours per year).

Table 12-1 presents the estimates of energy use expected to be needed as a result of this regulation, organized by subcategory. These estimates were developed using the cost models and the information available in the MPP screener and detailed surveys.

Table 12-1. Incremental Energy Use for Existing Non-Small Direct Discharging MPP Facilities

40 CFR 432 Subcategory [a]	Baseline Energy Use for MPP WWTP (KWH/yr)	Incremental Energy Use for MPP WWTP (KWH/yr) [% Increase]
A, B, C, D	62,381,835	8,100,573 [11.5%]
F, G, H, I	1,711,465	51,931 [2.9%]
J	10,440,620	-611,232 [-6.2%]
K	162,511,445	9,891,034 [5.7%]
L	6,470,812	346,789 [5.1%]

It should be noted that these are aggregate national estimates. Individual facilities may have a decrease in energy consumption if they use the anaerobic lagoon effluent as the only source of organic carbon for denitrification while other facilities will see increased energy use due to additional pumping and other requirements. Reductions in aerobic reactor oxygen transfer requirements have been reported in some studies, due to the removal of BOD during anaerobic and anoxic treatment (Randall et. al. 1999).

Under Options 2 and 2+P, a slight increase in energy consumption is expected as additional oxygen is required for removing BOD and ammonia (as nitrogen) using nitrification. However this increase is not significant as most MPP facilities are currently nitrifying, and therefore, will require a limited amount of additional oxygen. Under Option 2.5+P, the energy requirement will be approximately the same as that of Option 2.5. Under Options 2+P and 2.5+P, however, additional energy may be required for a few facilities that require sludge dewatering. In

Option 4, which includes several aeration and anoxic tanks, EPA expects a significant increase in energy requirement because aeration and mixing are required for the tanks. Pumps and sludge dewatering systems also contribute to additional energy requirement under Option 4.

12.2 AIR EMISSIONS IMPACTS

The Agency believes that the wastewater treatment processes included in the technology options for this rule (Option 2.5) will not generate significant air emissions above the current emissions, either directly from the facility or indirectly through an increased air emissions impact from the electric power generation facilities providing the additional energy.

Possible non-odorous gases might be emitted from these processes, including nitrogen and carbon dioxide. Nitrogen gas will be formed during the denitrification process, and will escape to the atmosphere. Since nitrogen comprises over 78% of the Earth's atmosphere and is not considered a greenhouse gas, it's generation is not considered to pose an environmental impact. Carbon dioxide will be released when BOD is oxidized by oxygen-containing compounds. However, the BOD being treated will generally not increase for most facilities, and therefore, there will generally be no incremental increase in carbon dioxide. Carbon dioxide emissions might increase incrementally only for facilities requiring additional BOD for denitrification, which constitutes approximately 20% of the MPP facilities.

Odors are the only significant air pollution problem associated with the treatment of MPP wastewaters, and generally are associated with anaerobic conditions. Thus, flow equalization basins, dissolved air flotation (DAF) units, anaerobic lagoons, and other wastewater treatment unit processes are possible sources of malodors. Potential odorous substances associated with MPP wastewater include ammonia, hydrogen sulfide, and organic compounds. Ammonia in MPP wastewaters is typically formed by the breakdown of more complex substances, and can be released under certain circumstances. However, aerobic nitrifying conditions will cause ammonia to remain in a solution as it is converted to nitrate, meaning that odors will generally be suppressed. In addition, maintenance of pH around neutral conditions will disfavor stripping ammonia, leaving it in the wastewater to be oxidized or assimilated. Thus, the incremental ammonia generation will most likely be minimal.

Hydrogen sulfide is primarily formed by the reduction of sulfates in wastewater. Such generation requires the presence of sulfate in the wastewater, which is typically low in MPP wastes (USEPA, 1974). In most cases the source of sulfates in MPP wastewater is the source water supply (Sneed, 2001). Hydrogen sulfide is mainly generated under anaerobic conditions, which most facilities currently have in place. The rule does not require such lagoons, therefore, additional generation of hydrogen sulfide will be minimal. Hydrogen sulfide may also be formed under anoxic conditions such as in the denitrification reactors. However, the formation of sulfide in an anoxic environment is less favored than the reduction of nitrate to nitrogen. This implies that if the wastewater contains nitrates, then, under anoxic conditions, sulfides will not be formed to a greater degree. Eighty percent of the non-small direct discharging facilities that EPA analyzed for the final rule presently employ anaerobic treatment and/or anoxic treatment (denitrification). Therefore, the sulfates present in the wastewater of those facilities are currently being reduced to hydrogen sulfide and are emitted. For these facilities, promulgation of Option 2.5 would result in practically no additional emissions of hydrogen sulfide. However, for the remaining 20 percent of the facilities that do not presently employ anaerobic treatment and/or anoxic treatment, EPA believes there is at least the potential for increased hydrogen sulfide generation (assuming high levels of sulfate are also present). Thus, EPA does not expect that the technology option selected for the final rule (Option 2.5) should result in a significant increase in emissions of odorous compounds.

Odorous volatile organic compounds can be generated in anaerobic lagoons. However, most facilities currently have such lagoons in place, meaning that incremental additional generation of such substances will be minimal. If specific facilities have odor difficulties, covers over lagoons can be used to capture odorous substances that are subsequently destroyed by some oxidation or combustion process. Such oxidation and combustion processes will potentially result in additional carbon dioxide generation; however, that generation constitutes minimal incremental generation, since the organic substances involved would have gone through oxidation naturally. Typically, odorous organic compounds are well-destroyed in aerobic systems. Overall, the incremental odor problems associated with this regulation are small. However, odor problems are usually significant only when the sulfur content of MPP

wastewaters is high, especially when treatment facilities are not well managed. Generally, MPP wastewater treatment facilities using anaerobic processes for treating wastewater with a low sulfur concentration have few odor problems. At such facilities, maintaining a naturally occurring layer of floating solids in anaerobic contact basins and lagoons generally minimizes odors. Since Option 2.5 does not require anaerobic treatment, the final rule should not increase emissions of odorous compounds from well-managed MPP wastewater treatment facilities. EPA visited several MPP facilities, and none had odor control problems.

Most MPP facilities are currently nitrifying, therefore EPA expects no significant increase in air emission under Options 2 and 2+P. Like Option 2.5, air emissions under Option 2.5+P will also be minimal. However, in Option 4, which requires full denitrification with 2-stage denitrification process, the post-aeration anoxic environment is likely to produce odors due to the low level of nitrate nitrogen present. It should be noted that if a facility has upstream anaerobic treatment, there is less potential for hydrogen sulfide production in the post-aeration anoxic environment as most hydrogen sulfide emissions already occur in the upstream anaerobic treatment process. Because Option 4 involves complete denitrification with supplemental carbon source, EPA expects facilities with Option 4 technology to have higher nitrogen and carbon dioxide emissions than those facilities with Option 2.5 technology.

12.3 SOLID WASTE GENERATION

The most significant non-water quality impact for this rule is the generation of solid wastes from MPP wastewater treatment. EPA estimates that compliance with the final rule will slightly increase the amount of sludge generated during MPP wastewater treatment for meat first and further processors and will decrease the amount for renderers and poultry first and further processors. For non-small direct discharging facilities nationwide, EPA estimates that there will be a 2.3 percent reduction in total annual sludge production (a net reduction of approximately 3,200 tons per year). This is a relatively small net reduction in comparison with the current total annual amount of sludge production by non-small direct facilities (approximately 138,000 tons/yr). The reduction in sludge generation for renderers and poultry processes is because of the increased use of anaerobic and anoxic processes, which inherently tend to generate less sludge

than aerobic processes, while not having increased sludge generation from total suspended solids (TSS) removal. Table 12-2 presents the amount of wastewater treatment sludge expected to be generated at non-small direct discharging facilities as a result of this regulation. Actual sludge generation at individual facilities will vary from the percentages shown in the table. Depending on the treatment processes currently in place, a facility's sludge generation may increase even though the total amount for the subcategory decreases.

Table 12-2. Incremental Sludge Generation for Non-Small Direct Discharging MPP Facilities

40 CFR 432 Subcategory [a]	Baseline Sludge Generation for MPP WWTP (tons/yr)	Incremental Sludge Generation for MPP WWTP (tons/yr) [% Increase]
A, B, C, D	25,503	675 [2.6%]
F, G, H, I	1,586	0.64 [0.04%]
J	6,514	-568 [-9.5%]
K	96,846	-3,203 [-3.4%]
L	7,606	-126 [-1.7%]

[a] Facilities in Subcategory E are not affected by today's rule, therefore, there is no net incremental sludge generation.

The estimates of sludge production in Table 12.2 are based on the concentrations of BOD entering the biological part of the treatment system after pretreatment (e.g., DAF or anaerobic lagoon), and include sludge generation by facilities that may require a supplemental carbon source for denitrification. In a nitrification/denitrification process, a significant portion of the influent BOD is removed by the denitrification process, which results in a low amount of BOD available for removal by aerobic process. Because the sludge yield coefficient of denitrification process is lower than that of aerobic process, the overall sludge generation of a nitrification/ denitrification process is usually lower than that of a nitrification process. Since, the majority of MPP facilities are currently performing nitrification and have an aeration basin in-place, installing a denitrification unit ahead of the existing aerobic process will result in lower sludge yields for most facilities. Some facilities that require supplemental carbon source for denitrification, however, might observe an increase in sludge generation.

Under Option 2, a slight increase in sludge generation might result from additional nitrification, though this increase is not significant because most MPP facilities are currently nitrifying. Under Option 2+P and 2.5+P, in addition to the incremental sludge generated under Option 2 and 2.5, respectively, a significant amount of sludge may be generated by the phosphorus removal process. In Option 4, which involves both phosphorus removal and complete denitrfication with methanol use, very high volumes of sludge may be generated.

EPA also expects that a greater emphasis on pollution prevention could further reduce sludge generations, although these potential reductions were not calculated. Emphasis may be given to increasing segregation of waste materials that have value as raw materials for the production of rendered products from wastewater flows. For example, using alternatives to fluming to remove viscera from processing areas and initially "dry cleaning" facilities as the initial step in the daily cleaning of processing equipment and facilities may reduce sludge generation. Such practices were noted for some facilities in the industry surveys. If contact with water is prevented, fats and proteins that would otherwise dissolve and pass through screening and dissolved air flotation do not become sources of BOD and ammonia nitrogen, and consequently, sources of additional sludge.

12.4 REFERENCES

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