Grobbel Environmental & Planning Associates
PO Box 58 Lake Leelanau Michigan 49653

November 10, 2019

Delaware Department of Natural Resources and Environmental Protection
Attn: Theresa Newman, Office of the Secretary
89 Kings Highway
Dover, DE 19901

RE: Public Comment - NaturaLawn of America Application for Sludge Distribution and Marketing (Docket #2019-P-W-0025).

Dear Ms. Newman,

NaturaLawn of American, Inc. seeks a wastewater sludge marketing and distribution permit the Delaware Department of Natural Resources and Environmental Control (DNREC), Surface Water Discharges Section.[1] *Due to inadequacies with this permit application, as detailed herein, and the inherent environmental threats and human health risks threat posed by wastewater sludge as proposed for marketing in and distribution for lawn fertilizer, we urge DNREC to deny this application as proposed*.

Based on information and belief, the applicant NautraLawn of America proposes to utilize five (5) tons of Class A biosolids annually from two Chicago-area wastewater treatments plants as a "minor component of … fertilizers" NaturaLawn spreads on residential lawns.[2] Pathogens within the sludge are proposed to be treated prior distribution/use through "heat drying."[3] *Importantly, Section 9: Sewage Sludge Generation or Preparation of the DNREC application detailing sludge use, treatment and distribution has not been filled out by the Applicant (i.e., merely B.3 is provided). The application is thereby administratively incomplete and thereby the permit may not be issued as provided.*

---

[1] Application for a Permit to Utilize Wastewater Sludge in Delaware, NaturaLawn of America, Inc., 1 E. Church St., Frederick, MD, March 27, 2018.

[2] *Ibid.*

[3] *Ibid.*

A. Toxic Substances in Wastewater Sludge

According to data submitted by the Applicant, the laboratory analysis of the biosolids proposed for fertilizer use have been documented to contain heavy metals, purgeable aromatic hydrocarbons (i.e., PAHs), polynuclear aromatics (PNAs), phthalates, polychlorinated biphenyls (PCBs), and pesticides - known carcinogens and/or sources of other human health risks and/or aquatic toxicity.

1) Heavy Metals

a) Cyanide

Specifically, biosolid analyses submitted by the Applicant document Total Cyanide at 7.2 mg/kg or parts per million (i.e., "ppm").[4] Concentrations of Cyanide above 4.0 ppm are considered above the acceptable risk level for soils/solids leaching to groundwater used for residential drinking water, concentrations above 0.1 ppm are toxic for groundwater venting to surface waters (i.e., gsi), and above 12.0 ppm are considered toxic to human direct dermal contact.[5]

Human health effects from Cyanide exposure include the rapid onset of profound central nervous system disorder (i.e., excitement, dizziness, nausea, vomiting, headache, and weakness. As poisoning progresses, drowsiness, tetanic spasm, lockjaw, convulsions, hallucinations, loss of consciousness, and coma may occur), and cardiovascular and respiratory effects. Exposure to low concentrations of Cyanide may produce eye irritation, headache, confusion, nausea, and vomiting followed in some cases coma and death.[6]

---

[4] *Ibid.* Cyanide concentrations above 100 ppb are toxic to aquatic resources. see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

[5] E.g., see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

[6] Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

b) **Arsenic**

Arsenic was reported in representative biosolids by the Applicant at 12.9 ppm.[7] Concentrations of Arsenic above 4.6 ppm are considered above acceptable risk level for soils/solids leaching to groundwater used for residential drinking water and gsi, and above 7.6 ppm are considered toxic to human direct dermal contact.[8]

Chronic exposure of humans to inorganic arsenic in the drinking water has been associated with excess incidence of miscarriages, stillbirths, preterm births, and infants with low birth weights. Animal data suggest that arsenic may cause changes to reproductive organs of both sexes, including decreased organ weight and increased inflammation of reproductive tissues, although these changes may be secondary effects. However, these changes do not result in a significant impact on reproductive ability. Animal studies of oral inorganic arsenic exposure have reported developmental effects, but generally only at concentrations that also resulted in maternal toxicity. Arsenic is a known human carcinogen by both the inhalation and oral exposure routes. By the inhalation route, the primary tumor types are respiratory system cancers, although a few reports have noted increased incidence of tumors at other sites, including the liver, skin, and digestive tract. In humans exposed chronically by the oral route, skin tumors are the most common type of cancer. In addition to skin cancer, there are a number of case reports and epidemiological studies that indicate that ingestion of arsenic also increases the risk of internal tumors (i.e., mainly of bladder and lung, and to a lesser extent, liver, kidney, and prostate).[9]

---

[7]Analytical Results, Biosolids Monthly, Pace Analytical analyzed on June 21, 2019.

[8] E.g., see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

[9]Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

c) **Chromium**

Chromium was reported by the Applicant in representative biosolids at 100 ppm.[10] Concentrations of Chromium above 30 ppm are considered above acceptable risk level for soils/solids leaching to groundwater used for residential drinking water, and above 3.3 ppm is toxic for aquatic organisms, i.e., gsi.[11]

Health effects of chromium compounds can vary with route of exposure, with certain effects specific for the exposure pathway. For example, respiratory effects are associated with inhalation of chromium compounds, but not with oral and dermal exposures, and gastrointestinal effects are primarily associated with oral exposure. However, effects of chromium are not limited to the portal of entry, with hematological, immunological, and reproductive systems also identified as targets for chromium. In addition to non-cancer health effects, results of occupational exposure studies and chronic-duration animal studies indicate that inhalation and oral exposures to chromium (VI) compounds are associated with respiratory and gastrointestinal system cancers.

d) **Molybdenum**

Molybdenum was reported at 12.3 ppm.[12] Concentrations of Molybdenum above 1.5 ppm are considered above acceptable risk level for soils/solids leaching to groundwater used for residential drinking water.[13]

---

[10] Analytical Results, Biosolids Monthly, Pace Analytical analyzed on June 21, 2019.

[11] *Ibid.*, see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

[12] Analytical Results, Biosolids Monthly, Pace Analytical analyzed on June 21, 2019.

[13] *Ibid.*, see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

e) **Selenium**

Selenium was reported by the Applicant at 5.4 ppm in biosolids.[14] Concentrations of Selenium above 4.0 ppm are considered above acceptable risk level for soils/solids leaching to groundwater used for residential drinking water, and above 0.4 ppm is toxic for aquatic organisms, i.e., gsi.[15]

Selenium commonly enters the air from burning coal or oil. Selenium that may be present in fossil fuels combines with oxygen when burned, which may then react with water to form soluble selenium compounds. Airborne particles of selenium, such as in ash, can settle on soil or surface water. Disposal of selenium in commercial products and waste could also increase the amount of selenium in soil. The forms and fate of selenium in soil depend largely on the acidity of the surroundings and its interaction with oxygen. In the absence of oxygen when the soil is acidic, the amount of selenium that can enter plants and organisms should be low. Selenium compounds that can dissolve in water are sometimes very mobile. Thus, there is an increased chance of exposure to these compounds. Selenium may enter surface water in irrigation drainage waters. Some evidence indicates that selenium can be taken up in tissues of aquatic organisms and possibly increase in concentration as the selenium is passed up through the food chain. Selenium concentrations in aquatic organisms have been a problem as a result of irrigation runoff in some areas of the United States. Dizziness, fatigue, and irritation of mucous membranes have been reported in people exposed to selenium. In extreme cases, collection of fluid in the lungs (i.e., pulmonary edema) and severe bronchitis have been reported. Upon contact with human skin, industrial selenium compounds have been reported to cause rashes, redness, heat, swelling, and pain. Brief, acute exposure of the eyes to selenium dioxide as a dust or fume may result in burning, irritation, and eye tissue tearing.

---

[14] Analytical Results, Biosolids Monthly, Pace Analytical analyzed on June 21, 2019.

[15] *Ibid.*, see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

f) **Total Mercury**

Finally and very importantly, Total Mercury was reported by the Applicant in biosolids at 480 ppb.[16] Concentrations of Mercury above above 1.2 ppm are toxic aquatic organisms, and concentrations above 1,700 ppb are considered above acceptable risk level for soils/solids leaching to groundwater used for residential drinking water.[17]

Mercury is know to bio-accumulate in the environment and has been documented to have contaminated whole food chains. The human nervous system is very sensitive to mercury. People who have eaten fish contaminated with large amounts of methylmercury or seed grains treated with methylmercury or other organic mercury compounds have developed permanent damage to the brain and kidneys. Exposure to inorganic mercury can also personality changes (i.e., irritability, shyness, nervousness), tremors, changes in vision (i.e., constriction or narrowing of the visual field), deafness, muscle incoordination, loss of sensation, and difficulties with memory. Human's kidneys are also sensitive to the effects of mercury, because mercury accumulates in the kidneys and causes higher exposures to these tissues, and thus more damage. All forms of mercury can cause kidney damage if large enough amounts enter the body. If the damage caused by the mercury is not too great, the kidneys are likely to recover once the body clears itself of the contamination. Skin contact with metallic mercury has been shown to cause an allergic reaction (i.e, skin rashes) in some people. In addition to effects on the kidneys, inorganic mercury can damage the stomach and intestines, producing symptoms of nausea, diarrhea, or severe ulcers if swallowed in large amounts. Effects on the heart have also been observed in children after they accidentally swallowed mercuric chloride. Symptoms included rapid heart rate and increased blood pressure. There is little information on the effects in humans from long-term, low-level exposure to inorganic mercury.[18]

---

[16] Analytical Results, Biosolids Monthly, Pace Analytical analyzed June 21, 2019.

[17] E.g., see Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

[18] Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

2) **Other Toxic Substances**

a) **Polynuclear Aromatics (PNAs)**

PNA concentrations reported by the Applicant in representative biosolids include benzo(a)anthracene up to 2,266 ppb; benzo(a)pyrene up to 1,511 ppb; benzo(ghi)perylene at up to 1,396 ppb; benzo(k)flouranthene at up to 1,152 ppb; Chrysene at up to 4,023 ppb; and indeno(1,2,3-cd)pyrene at up to 1,288 ppb. The flouranthene was reported as elevated with concentrations up of 3,907 ppb (i.e., gsi standard for which is 5,500 ppb), and phenanthrene were similarly as reported as elevated at up to 1,903 ppb (i.e., gsi standard is 2,100 ppb)[19] PNAs are found in petroleum products and residue from the incineration of organic matter. While not likely to leach from soil/solids, numerous PNAs are known human carcinogens at high concentrations.

b) **Polychlorinated Biphenyls (PCBs)**

Specifically, biosolids analyses submitted by the Applicant document PCB-Aroclor 1242 at 134 ug/kg (i.e., parts per billion or "ppb"), and PCB-Aroclor 1254 at 155 ppb.[20] The most commonly observed health effects in people exposed to PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage.[21]

c) **Phthalates**

Bis(2-ethylhexyl)phthalate was reported by the Applicant at up to 45,897 ppb. The U.S. Department of Health and Human Services (DHHS) has determined that this compound may reasonably be anticipated to be a human carcinogen. U.S. EPA has determined that it is a probable human carcinogen.

---

[19] *Ibid.*

[20] Analytical Results, Biosolids TS, PCB, CN, Pace Analytical analyzed on February 28, 2019. Federal TSCA, Subpart D Cleanup Standard is 1,000 ppb, and Pace Analytical, TLCP Analysis, TLCP Sampling September 2018.

[21] Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

d) **Purgeable Aromatic Hydrocarbons (PAHs)**

Lastly, Toluene concentrations were present and reported by the Applicant at up to 91.9 ppb in representative biosolids samples. Toluene exposure may cause liver and kidney damage, affect the central nervous system, eyes, skin, respiratory system, and liver. Breathing high levels of toluene during pregnancy has been shown to result in children with birth defects and to retard mental abilities and growth.[22]

e) **Pesticides**

The pesticide Lindane was present at up to 0.24 ppb, and concentrations of the pesticides 4,4'-DDE and 4,4'-DDT were reported at up to 233 and 21 ppb, respectively. Lindane is highly toxic to humans. The acute (short-term) effects of lindane through inhalation exposure in humans consist of irritation of the nose and throat and effects on the blood. Oral animal studies have shown lindane to be a liver carcinogen. U.S. EPA has classified lindane as a Group B2/C, possible human carcinogen.[23] DDT & DDE are known to bio-accumulate in the environment are are causally linked to egg shell thinning and avian egg mortality and species loss.

B. Findings/Recommendations

- *Section 9: Sewage Sludge Generation or Preparation of the DNREC application detailing sludge use, treatment and distribution has not been filled out by the Applicant. The application is thereby administratively incomplete and thereby the permit may not be issued as provided.*

- *High, toxic concentrations of heavy metals including Total Cyanide, Arsenic, Chromium, Molybdenum, Selenium and Total Mercury have been documented in the sludge/biosolids proposed for*

---

[22] Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

[23] Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

residential fertilizer use. The proposed permit is therefore scientifically unsupportable and should be denied as proposed. Concentrations of these heavy metals have been documented above acceptable risk levels for leaching to groundwater used for residential drinking water, aquatic resource toxicity, and/or direct human dermal contact.

- *Pesticides, PNAs, and PCBs are also documented to be present and/or in elevated concentrations within the the sludge/biosolids proposed for residential fertilizer use.*

For the above reasons, we believe that the permit may not be issued as proposed pursuant to 7 Del, C., Section 6003. Based on information and belief, the permit application as submitted is incomplete/ inadequate, and not all relevant data, plans and findings have been made available for public review. Therefore, we strongly urge DNREC to deny this permit as proposed.

Thank you for accepting these comments, and please feel free to contact me at cgrobbel@grobbelenvironmental.com with any questions.

Sincerely,

Grobbel Environmental & Planning Associates

Christopher P. Grobbel, Ph.D.
Sr. Project Manager

References

Agency for Toxic Substances Disease Registry (ATSDR), https://www.atsdr.cdc.gov/mmg/mmg.asp?id=1073&tid=19.

Analytical Results, Biosolids Monthly, Pace Analytical analyzed on June 21, 2019.

Analytical Results, Biosolids TS, PCB, CN, Pace Analytical analyzed on February 28, 2019.

Application for a Permit to Utilize Wastewater Sludge in Delaware, NaturaLawn of America, Inc., 1 E. Church St., Frederick, MD, March 27, 2018.

Authorization to Conduct a Limited Distribution and Marketing Program for the Utilization of Sludge or Sludge Products: DRAFT, NaturaLawn of America, Inc., undated.

Michigan EGLE, Table 2. Soil: Residential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Risk-based Screening Levels, dated December 30, 2013; GSI Protection Criteria Updated January 25, 2018.

Pace Analytical, TLCP Analysis, TLCP Sampling September 2018.