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Environmental Land Management
1602 11th Drive NE
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RE: Agronomist Review for Smithfield Packaged Meats in Sioux Center, Orange City, and Sioux City, IA Permit # 84-SDP-11-22.

The following is an agronomic review of waste products applied from the Smithfield Packaged Meats facilities to land in Plymouth County, Iowa, under permit #84-SDP-11-22. Waste was applied in the 2025 crop year. A brief description of the regulated waste product will be given to provide context of the review and a brief discussion of the land application sites, application rates and site characteristics will be done as well.

2025 Product Description:

Smithfield Packaged Meats is recommended to apply up to 5,000 gallons per acre per year (approximately 2.1 dry tons per acre per year) on the notified land application site(s). Based on an average of 10 by-product tests from 2021-2025, an application of rate of approximately 5,000 gallons per acre will supply about 77 pounds of available nitrogen (N). It also contains about 55 pounds of P2O5 and 18 pounds of K2O. The organic nitrogen in the product will be slowly converted to plant available nitrate as soil microbes convert it – thus, its availability will depend on numerous environmental conditions including, soil temperature, moisture, drainage and pH. It should be noted that the product does not contain significant levels of arsenic, lead or mercury.

A corn crop with a yield of 200 bushels per acre will require approximately 180-190 pounds of nitrogen and will remove about 64 pounds of phosphorus and 44 pounds of potassium per acre. A soybean crop with a yield of 50 bushels per acre will require approximately 190 pounds of nitrogen (fixed on its own), 36 pounds of phosphorus and 60 pounds of potassium per acre each year. From an agronomic perspective, soil fertility in the high range is preferred. This translates to ±41 ppm for phosphorus using the Mehlich-3 ICP test and ±201 ppm for Potassium (Ammonium Acetate or Mehlich-3). The opinion in this review will be based on characteristics and rates of the applied waste product, current soil tests and land application site conditions.

Site	Notified Acres	Acres Applied	Rate	Dry Tons	By Product	Application Period
Langel Garfield 8	315	169	1.4	234.4	Industrial Sludge	2nd Quarter
Langel Henry 28	266	143	1.5	210	Industrial Sludge	4th Quarter
Site 10 Krienert	140	70	1.6	109.1	Industrial Sludge	2nd Quarter
Site 11 Krienert Home	190	187	1.7	312	Industrial Sludge	4th Quarter
Site 12 Krienert	48	48	1.8	86	Industrial Sludge	4th Quarter
Site 13 Krienert	156	156	1.5	230.3	Industrial Sludge	2nd Quarter
Site 18 Krienert	153	153	1.8	276	Industrial Sludge	4th Quarter
Tentingers	173	35	1.5	53	Industrial Sludge	4th Quarter
Vanderschaaf	140	140	1.2	164.1	Industrial Sludge	4th Quarter

The fields used for land application were evaluated for soil phosphorus levels, salts and soil pH. Farms with a soil pH below 6.0 should receive an application of agricultural lime. Salt levels should be managed to maintain levels below 1.0. Fields with a phosphorus level exceeding 40 ppm in the Mehlich-3 ICP should be managed so that fertility levels do not increase, thus applying nutrients at crop removal rates. A summary of field characteristics is shown below – site specific discussion follows:

Farmer	Site	pH	MEH-3 P	Salts	Net P2O5	Net K2O
Cole Langel	Langel Garfield 8	6.0	73	0.4	-36	-42
Dan Langel	Langel Henry 28	5.6	44	0.4	-32	-40
Stan Krienert	Site 10 Krienert	5.8	47	0.3	-30	-40
Dan Langel	Site 11 Krienert Home	6.0	89	0.2	-25	-38
Phil Krienert	Site 12 Krienert	6.3	33	0.3	-20	-35
Ed Krienert	Site 13 Krienert	5.9	33	0.3	-31	-39
Ed Krienert	Site 18 Krienert	5.7	28	0.2	-19	-35
Jim Tentinger	Tentingers	5.9	16	0.2	-23	-35
Wally Vandershaaf	Vanderschaaf	6.3	105	0.3	-40	-42

Land Application Sites for 2025 Crop Year:

Langel Garfield 8: This farm received 234.4 dry tons of product applied on approximately 169 acres in the 2nd Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 235 Bushels per acre was harvested on the farm. Based on this yield, approximately 75 lbs. of P2O5 and 52 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4.1%, the phosphorus ranges from a minimum of 53 and a max of 102 with an average of 73 ppm; the Very High range according to Iowa State University. Soil potassium averages 273 ppm; the Very High range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -36 lbs of P2O5 and -42 lbs of K2O are calculated on these acres. Average soil pH is 6 - Slightly Acidic and should be monitored to maintain soil pH near 6.5. Reported salt (EC) levels are 0.4 mhoms/dm and there are no concerns related to current measured salt levels.

Langel Henry 28: This farm received 210 dry tons of product applied on approximately 143 acres in the 4th Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 230 Bushels per acre was harvested on the farm. Based on this yield, approximately 74 lbs. of P2O5 and 51 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4.3%, the phosphorus ranges from a minimum of 32 and a max of 68 with an average of 44 ppm; the Very High range according to Iowa State University. Soil potassium averages 203 ppm; the High range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -32 lbs of P2O5 and -40 lbs of K2O are calculated on these acres. Average soil pH is 5.6 - Very Acidic and should be treated with agricultural lime to raise the pH to 6.5. Reported salt (EC) levels are 0.4 mhoms/dm and there are no concerns related to current measured salt levels.

Site 10 Krienert: This farm received 109.1 dry tons of product applied on approximately 70 acres in the 2nd Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 230 Bushels per acre was harvested on the farm. Based on this yield, approximately 74 lbs. of P2O5 and 51 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4.2%, the phosphorus ranges from a minimum of 25 and a max of 93 with an average of 47 ppm; the Very High range according to Iowa State University. Soil potassium averages 159 ppm; the Low range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -30 lbs of P2O5 and -40 lbs of K2O are calculated on these acres. Average soil pH is 5.8 - Very Acidic and should be treated with agricultural lime to raise the pH to 6.5. Reported salt (EC) levels are 0.3 mhoms/dm and there are no concerns related to current measured salt levels.

Site 11 Krienert Home: This farm received 312 dry tons of product applied on approximately 187 acres in the 4th Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 224 Bushels per acre was harvested on the farm. Based on this yield, approximately 72 lbs. of P2O5 and 49 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4.8%, the phosphorus ranges from a minimum of 13 and a max of 180 with an average of 89 ppm; the Very High range according to Iowa State University. Soil potassium averages 242 ppm; the Very High range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -25 lbs of P2O5 and -38 lbs of K2O are calculated on these acres. Average soil pH is 6 - Slightly Acidic and should be monitored to maintain soil pH near 6.5. Reported salt (EC) levels are 0.2 mhoms/dm and there are no concerns related to current measured salt levels.

Site 12 Krienert: This farm received 86 dry tons of product applied on approximately 48 acres in the 4th Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 218 Bushels per acre was harvested on the farm. Based on this yield, approximately 70 lbs. of P2O5 and 48 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4.2%, the phosphorus ranges from a minimum of 7 and a max of 51 with an average of 33 ppm; the Very High range according to Iowa State University. Soil potassium averages 199 ppm; the Optimum range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -20 lbs of P2O5 and -35 lbs of K2O are calculated on these acres. Average

soil pH is 6.3 - Slightly Acidic and should be monitored to maintain soil pH near 6.5. Reported salt (EC) levels are 0.3 mhoms/dm and there are no concerns related to current measured salt levels.

Site 13 Krienert: This farm received 230.3 dry tons of product applied on approximately 156 acres in the 2nd Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 225 Bushels per acre was harvested on the farm. Based on this yield, approximately 72 lbs. of P2O5 and 50 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4%, the phosphorus ranges from a minimum of 18 and a max of 100 with an average of 33 ppm; the Very High range according to Iowa State University. Soil potassium averages 168 ppm; the Optimum range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -31 lbs of P2O5 and -39 lbs of K2O are calculated on these acres. Average soil pH is 5.9 - Very Acidic and should be treated with agricultural lime to raise the pH to 6.5. Reported salt (EC) levels are 0.3 mhoms/dm and there are no concerns related to current measured salt levels.

Site 18 Krienert: This farm received 276 dry tons of product applied on approximately 153 acres in the 4th Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 218 Bushels per acre was harvested on the farm. Based on this yield, approximately 70 lbs. of P2O5 and 48 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4%, the phosphorus ranges from a minimum of 15 and a max of 38 with an average of 28 ppm; the High range according to Iowa State University. Soil potassium averages 191 ppm; the Optimum range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -19 lbs of P2O5 and -35 lbs of K2O are calculated on these acres. Average soil pH is 5.7 - Very Acidic and should be treated with agricultural lime to raise the pH to 6.5. Reported salt (EC) levels are 0.2 mhoms/dm and there are no concerns related to current measured salt levels.

Tentingers: This farm received 53 dry tons of product applied on approximately 35 acres in the 4th Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 205 Bushels per acre was harvested on the farm. Based on this yield, approximately 66 lbs. of P2O5 and 45 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 3.1%, the phosphorus ranges from a minimum of 15 and a max of 16 with an average of 16 ppm; the Optimum range according to Iowa State University. Soil potassium averages 148 ppm; the Low range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -23 lbs of P2O5 and -35 lbs of K2O are calculated on these acres. Average soil pH is 5.8 - Very Acidic and should be treated with agricultural lime to raise the pH to 6.5. Reported salt (EC) levels are 0.2 mhoms/dm and there are no concerns related to current measured salt levels.

Vanderschaaf: This farm received 164.1 dry tons of product applied on approximately 140 acres in the 4th Quarter of the 2024-2025 crop year. A single by-product source was applied to the acres. A reported Corn yield of 228 Bushels per acre was harvested on the farm. Based on this yield, approximately 73 lbs. of P2O5 and 50 lbs. of K2O were removed. Soil test results show that the organic matter levels are approximately 4.9%, the phosphorus ranges from a minimum of 66 and a max of 179 with an average of 105 ppm; the Very High range according to Iowa State University. Soil potassium

averages 410 ppm; the Very High range according to Iowa State University. Based on the cummulative application rate and reported crop yields, a net of -40 lbs of P2O5 and -42 lbs of K2O are calculated on these acres. Average soil pH is 6.3 - Slightly Acidic and should be monitored to maintain soil pH near 6.5. Reported salt (EC) levels are 0.3 mhoms/dm and there are no concerns related to current measured salt levels.

Soil phosphorus and applied nitrogen are the primary nutrients of concern to water quality and public health. The reported rates of Nitrogen do not pose a risk to water quality. The applied phosphorus rates in conjunction with the reported soil phosphorus levels do not pose a significant risk to environmental quality or public health. Applied rates of Sodium should be monitored to ensure that sodicity of soils is not increased. If necessary, added calcium (gypsum) can be used to ensure a proper ratio of calcium, magnesium and sodium is preserved to protect soil health, structure and water infiltration. The reported rates are not likely to negatively impact soil SAR. Best management practices in nutrient management and land application should always be followed.

Regards,

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