General Methodology

Data from submittals of Electronic Discharge Monitoring Report was retrieved (*e*DMR). This data contained amount land applied (**Dry tons**) monthly, and also contained analytical data on the frequency that it was required by the permit (quarterly, semiannual).

Generating facilities were contacted or visited to obtain any additional analytical data and land application records that were available for periods prior to their commencement of using the *e*DMR.

Billing records were then retrieved from WVDEP's computer system. These records showed the annual amount billed for the "sewage sludge land application fee", billed based on a $5 per dry ton fee. Back to 2001, the billing was based on the actual amount reported by the facility to have been land applied. From 1994-2000, the billing was based on the design flow of each generating facility land applying sewage sludge – or more specifically, the design standards for quantity of sludge production for a facility with a given design flow. Though not as accurate as actual production numbers, this still gives a decent estimate of sludge production. All of the sewage sludge produced was assumed to be land applied, unless the facility provided information to the contrary at the time when the billing occurred.

Specific rules governing sewage sludge land application were not effective in West Virginia until 1994. Although the facilities that land applied during the period 1985-1994 are known, there are no analytical, production, or application area records available. 1995 monthly data were used from 1985 through 1994 for facilities judged to be land applying during that period.

Acres

Acres were calculated from sludge production data and permitted loading rates.

Facilities are not required to track actual acres used – only the total loading to each permitted field (acres are known) is tracked to ensure compliance with the permitted maximum loading rate for that field. Generally, areas of a field are loaded to near the maximum loading rate (agronomically based) and then the applier moves on to another area of the same field to load it. So fields are loaded more "an acre at a time" rather than by attempting to spread each load evenly over an entire field. Given this loading approach, WVDEP believed the best way to represent acres used for land application was to divide the total dry tons of sludge applied each month by the permitted loading rate (dry tons/acre).

Given the information on crop types, other sources of nutrients used, etc. that are considered when the permitted loading rate is calculated; and given the required buffer zones at all sewage sludge land application sites (for streams, wells, surface water collection points, etc.) and excluded areas (flood plains, high groundwater table, etc.), WVDEP classed all the acres used for land application as being under a nutrient management plan.

Analytical

WVDEP provided all available biosolid nutrient quality analytical results. WVDEP used professional judgment to determine recommended inputs for periods for which direct monitoring results are not available. Facility-specific monitoring results were considered in the calculation of mean values, with

weight given to contemporary information. Calculated inputs are shown in blue font in contrast to the reported monitoring results shown in black.

Note that the WVDEP sludge program does not required nitrate or nitrite biosolids monitoring. Those species are assumed to be negligible components of total nitrogen, consistent with the findings of EPA's 2009 national sewage sludge survey. As such, recommended NO3 inputs are zero for all sources through time.

The spreadsheet contains recommended inputs for total phosphorus quality because our sludge program does not require monitoring of phosphorus species. The need to use a default mechanism to fill this gap is recognized; we accept default speciation based upon adjacent state data or other approaches based on the best available information.

WVDEP requires percent solids to be reported, rather than percent moisture, so the compilation of data in this spreadsheet contains percent solids. This is supplemental information to the Column H applied amounts reported on a dry basis. Similarly, rules governing land application of sewage sludge in West Virginia do not require mineralized nitrogen or mineralized phosphorus. All nitrogen and phosphorus analyses that were required in West Virginia are included in this spreadsheet.

Other Assumptions

Some assumptions had to be made to input data on the time scale and level of detail requested.

For periods prior to monthly land application records/reports being available for review, the amount of biosolids land applied monthly was calculated by dividing the annual amount land applied by 12 (except for one facility with antiquated sand drying beds that lacked the ability to produce dry sewage sludge for land application in January and February – the sludge production was spread over 10 months instead of 12). Biosolids land application is often biased away from winter months when it is too wet to get on to fields; however, storage at land application sites is permitted for up to three months – so sludge may be reported as "land applied", when in reality it was actually stored at the land application site. Given that there is no way for WVDEP to account for these variations, an even distribution over the 12 months was assumed.

It was assumed that no land application occurred on corn producing fields between May and October, or on hay producing fields between April and September.

The Berkeley County PSSD permit for the Opequon-Hedgesville treatment plant (WV0082759) was consolidated with the Baker Heights plant (WV0020061) in 2005. Records for each individual plant were available back through April 2009. For the time between 2005 (when billing for land application of biosolids was consolidated) and 2009 when records were available, WVDEP assumed 50% of the total production was from each of the two treatment plants. This split was estimated by calculating the average production of each facility from April 2009 through the end of 2012 when biosolids from the Opequon-Hedgesville was no longer land applied. Though the land application ratio between the two plants varied from year to year, the average was an almost even split between the two plants.

Spray Irrigation

Spray irrigation data is provided for an apple processing facility that applied treated wastewater from 1986 through November 2008. Applied volume data are available from January 2003, but wastewater nutrient quality data are available only for the last year of operation. The permit writer for the facility indicated that wastewater volume and characteristics associated with the operation were stable over time. As such, the medians of reported nutrient concentration values were used for the period January 1986 through November 2007 and the median of reported monthly volume data were used for the period January 1986 through December 2002.