

Chapter 1

Introduction

The Solid Waste Management Technical Working Group was established on October 24th, 2005, by the Secretary of Delaware's Department of Natural Resources and Environmental Control (DNREC), John Hughes, pursuant to a directive from Delaware Governor Ruth Ann Minner. Governor Minner set forth the task of the working group as follows:¹

The working group will perform a feasibility review of available municipal solid waste management alternatives and recommend a municipal solid waste management program or programs capable of being implemented that would best serve Delaware's long-term and short-term municipal solid waste management needs.

The Governor directed the Working Group to prepare a report that includes:

- Identification of public policy issues and impending problems or benefits resulting from a continuation of present solid waste policies;
- A summary of the municipal solid waste management systems and technologies reviewed. This summary will present an assessment of Delaware's current municipal solid waste management systems and technologies in relation to:
 1. Environmental impacts both negative and positive.
 2. Capital and operational costs;
 3. Reliability and experience with the technologies and management systems;
 4. The economic feasibility of implementing the technologies and management systems; and
- Recommendations, including legislative action necessary to implement the recommendations.

Secretary Hughes established a 14 member Technical Working Group in response to this directive. The Working Group included experts in a variety of disciplines, several of whom have had extensive experience in solid waste management both throughout the United States and internationally.²

The Working Group held its first meeting on November 7, 2005, and has met at least once a month since then. All meetings of the Working Group have, pursuant to the requirements of Delaware's Freedom of Information Act, been open to the public, and all

¹ Governor Minner's full directive is included as Appendix A to this report.

² Appendix B of this report is a listing of the members of the working group along with short biographies.

reference documents used by the Working Group have been made available to the public through a web site established in support of this review.

In carrying out its study, the Working Group reviewed over 200 reference documents analyzing solid waste management activities in the United States and abroad. Several of these documents were assessments, similar to the one undertaken here, recently completed by other governmental units such as New York City, Los Angeles City and County, and the State of California.³ The group also asked vendors representing different solid waste management processes (See Acknowledgements, page ii) to make presentations to the group and address a series of questions that the working group developed.⁴

The Working Group adopted a series of seven criteria for evaluated the suitability for Delaware of alternative solid waste management and conversion technologies. These criteria are discussed in Chapter 3. The criteria do not cover all the considerations that need to be taken into account in making a decision about the future of solid waste management in Delaware. They only include the technical considerations that were the focus of Governor Minner's charge. The results of these evaluations and the conclusions and recommendations of the Working Group are presented in Chapters four and five.

Solid Waste Management in Delaware

In the 1970's Delaware was facing a severe problem of ground and surface water contamination from open dumps of municipal, commercial and industrial solid wastes. In response, Governor Sherman Tribbitt proposed the establishment of a statewide authority that would take over the responsibility for solid waste disposal from municipalities and county governments. As a result, in 1975 a self-financing entity called the Delaware Solid Waste Authority (DSWA) was established as an independent public authority that would have

...responsibility for implementing solid waste disposal and resource recovery facilities systems and facilities and solid waste management services where necessary and desirable throughout the state in accordance with a state solid waste management plan and applicable statutes and regulations.⁵

Solid waste collection activities remain with private companies and local governments, although the DSWA licenses firms engaged in these activities. The authority owns and oversees the operation of all the MSW disposal facilities in the state as well as the associated transfer stations.⁶ It is prohibited from accepting wastes generated outside Delaware, and does not export any waste out of state for disposal in landfills.⁷

³ Appendix C is a listing of the major multiple process evaluations.

⁴ Appendix D includes "Questions for Vendors" and Appendix E tabulates the list of vendors and others making presentations to the Working Group.

⁵ 7 Del C. § 6401(b)(8).

⁶ DSWA typically contracts the actual operation of the facilities out to private companies.

⁷ However, DSWA has utilized recycling and waste to energy facilities out of state.

DSWA initially began operations with a large scale mixed waste recycling plant and three modern landfills. The recycling facility (a mixed waste materials recovery facility) started commercial operations in 1982 with capacity to process 1000 tons of MSW and up to 350 tons of sewage sludge per day. The plant recovered mixed colored glass, ferrous and non-ferrous metals, refuse derived fuel, and aerobically cured compost. It operated for 11 years until, in 1993, The Delaware Department of Natural Resources and Environmental Control (DNREC) ordered it shut down.

The landfills were initially designed to serve each county's projected disposal needs for a 20-year period, and DSWA's goal is to maintain a minimum of 15 years of capacity in order to keep disposal costs stable and cost effective.

In addition to its disposal facilities, DSWA operates a voluntary recycling program utilizing recycling bins at locations throughout the state. Over 95% of the materials collected in this program is sent to various brokers and end users. DSWA also provides opportunities to recycle discarded tires, motor oil and oil filters, batteries, plastic bags and electronic goods. Starting in 2001, DSWA extended electronic goods recycling program to all schools, colleges, government offices, businesses and residents in the state.⁸

Although it has a monopoly on the disposal of MSW within the state of Delaware, haulers can take their waste to facilities in other states. Thus, DSWA has to maintain its tipping fee at a level competitive with the fees commercial disposal operations charge in neighboring states in order to adhere to its goal of managing the state's wastes within the state. Because the authority is completely self-supporting, these fees have to cover not only the disposal costs but also the costs of the recycling and other programs DSWA provides. In 1993 it adopted a uniform, statewide, disposal fee that covers all of its costs. This allows both small and large solid waste collection companies compete on a level playing field for market share and equalizes the disposal costs for both urban and rural dwellers.

DSWA can choose what wastes it will accept at its facilities. It accepts construction and demolition (C&D) wastes and yard wastes at all three landfills but accepts asbestos for disposal only at the Cherry Island facility. DNREC can also control what wastes the authority accepts through permit conditions or Secretary's orders.

DSWA currently has three solid waste disposal facilities, one in each county. All three are EPA Subtitle D sanitary landfills constructed with impermeable liners, leachate collections systems and landfill gas collection systems.⁹

⁸ DSWA reports that Delaware is the only state currently offering statewide access to electronic goods recycling.

⁹ Leachate is the liquid, resulting from rainfall and other sources of water that passes through the landfill. It is likely to have high levels of contamination. Landfill gas is naturally produced as a result of decomposition of waste. It is generally a mixture of combustible gases.

Sussex County - Southern Solid Waste Management Center (SSWMC):

The landfill serving Sussex County began operations in 1984. It is located approximately 7 miles west of Millsboro, near Jones Crossroads. The landfill occupies a 572-acre site with 95 acres currently developed into landfill cells. Approximately 130 acres have potential for additional landfilling activity. The landfill is constructed entirely above ground because of the high water table. Structural fill is placed on top of the ground to provide at least five foot of separation between the landfill's synthetic liners and the top of the seasonal high groundwater table. SSWMC accepts Municipal Solid Waste (MSW) generated in Sussex County.

The landfill is designed to operate as a bioreactor landfill and DSWA has applied to DNREC to operate cells 3 and 4 in this manner. Leachate collected from the primary and secondary collection systems will be injected into the waste through recirculation fields.¹⁰

The collected leachate is currently transported to DSWA's Cherry Island Landfill where it is disposed of in the Wilmington Waste Water Treatment Plant. If this facility is unable to accept the leachate, it is taken to the Secure Environmental Treatment (SET) facility located in Deepwater, NJ and operated by the DuPont Company.

The landfill gas, which is approximately 50% methane, is collected and is currently flared.¹¹ However, DSWA has recently entered an agreement with Ameresco Incorporated to combust the landfill gas in engines driving small generators that will produce "green" electrical energy.¹²

Because of the rapid development occurring in Sussex County, the amount of waste being disposed of at this facility has increased at an average rate of 9.8 percent per year over the past 10 years. Nevertheless, DSWA estimates that this facility has sufficient capacity to handle the county's wastes through 2036. The estimated cost of disposal at this facility is \$31.27 per ton. The tipping fee charged haulers is higher than this to cover management costs and other operations of the authority.

Kent County - Central Solid Waste Management Center (CSWMC):

The landfill serving Kent County, sited at Sandtown, approximately 13 miles southwest of Dover, is located on a 834-acre site, with 200 acres to be used for landfilling purposes. This landfill began operations in 1980, and is also designed and operated as a bioreactor landfill, and disposes of excess leachate in the Wilmington Waste Water Treatment Plant. The facility currently collects and flares the landfill gas, but here too DSWA has recently entered an agreement with Ameresco to produce "green" electrical energy. In addition, DSWA has implemented a research project to assess the efficacy of created wetlands to treat landfill leachate.

¹⁰ There are separate leachate collection systems for the primary and secondary liners.

¹¹ As the wastes in a landfill decompose, gasses such as methane and carbon dioxide are released.

¹² The generation of green energy derived from landfill gas is anticipated to begin in 2006.

The amount of waste disposed of at Sandtown has increased at an average annual rate of 2.7 percent over the past ten years and is estimated to have sufficient capacity to handle Kent County's wastes through the year 2050.¹³ The disposal cost at the facility is \$46.79 per ton.

DSWA also conducts a research program at Sandtown to evaluate the effectiveness of various designs, materials, and landfill gas and leachate collection systems. This facility has produced most of the available information on the effectiveness and management of bioreactor landfills.¹⁴

New Castle County - Northern Solid Waste Management Center (NSWMC)

The landfill serving New Castle County is located at Cherry Island, across from the Wilmington Wastewater Treatment Plant. Cherry Island began operation in 1985. It is a 527-acre site with 238 acres used for landfilling purposes. Another 200 acres is used by the US Army corps of Engineers for the disposal of the material they dredge from the Delaware and Christina River channels to maintain navigation and access to the Port of Wilmington. Because this landfill is constructed on top of approximately 50-60 feet of dredged material having a very low permeability, it does not require a synthetic liner to collect and prevent leachate from migrating off site (See Figure 1.1). The leachate collection system is constructed at the base of the landfill above the dredged material and the collected leachate is pumped to the Wilmington Waste Water Treatment Plant for treatment.

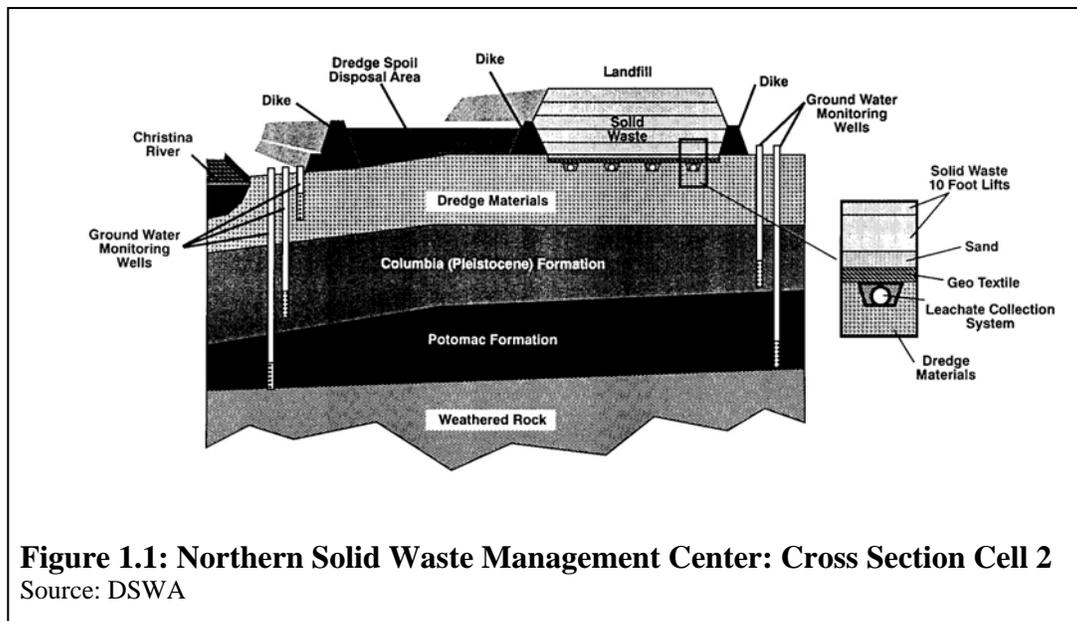


Figure 1.1: Northern Solid Waste Management Center: Cross Section Cell 2

Source: DSWA

Since 1995, DSWA has been collecting, cleaning, and compressing the gas generated by this facility, and then sending it through a pipeline to the Conectiv Edgemoor power plant

¹³ However, a requirement in a permit DNREC issued in January 2006 may result in some wastes being diverted to this facility from New Castle County, filling it at a faster rate than projected.

¹⁴ Presentation by Roger Green, Waste Management, Inc to the Working Group on January 9, 2006.

where is it used to generate electricity.¹⁵ However, before improvements in the collection system were recently made, it is estimated that only half of the gas generated by the landfill was being collected, resulting in gas sales falling far short of projections.¹⁶ The recent improvements have reportedly increased the percentage efficiency to 80 percent. After deducting the revenues from the gas sales, the net cost of disposal at this facility is approximately \$13.21 per ton.

In recent years The Cherry Island facility has had to deal with odor problems. In part, these resulted from the fact that the facility is located in an urban area so that any problems, such as odors caused by uncollected landfill gas, are more quickly and widely observed. Further, the efficiency of the collection system, operated by a private contractor, was in need of major improvement. However, since then considerable progress was made in expanding the landfill gas collection system and the quantity of gas collected was increased almost threefold. As a result, there have been no verified odor complaints in the past two years.

DNREC issued a revised permit with special conditions for this facility on January 6, 2006. This permit limits the height of the Cherry Island landfill to 195 feet and requires the DSWA to develop a plan for diverting materials from landfill disposal “with a goal of recycling 40 percent of the municipal solid waste (MSW) stream in New Castle County, by December 31, 2007.”¹⁷ Assuming that the permit conditions are adhered to, the facility is expected to last until 2025.

Trends in Waste Generation

The amount of waste that DSWA has to dispose of in its facilities is determined by several factors.

The first is the number of households, commercial establishments, and industries generating wastes. Delaware has traditionally seen higher population growth rates than the United States as a whole. From 2000 to 2004, the state’s population increased almost 7 percent – about one and one-half times the national average. The second is the amount of waste generated per household and per business establishment. Nationally, the waste generation per household almost doubled between 1960 and 1990 (equivalent to an annual average growth rate of about 2.4 percent per year).¹⁸ Between 1990 and 2000, however, this rate held constant according to EPA. Periodic data on generation rates in Delaware are not available. However, a report prepared for DSWA in 2002 indicates a per capita generation

¹⁵ From 1990 to 1995 the gas was collected, but flared off as at the other two landfills.

¹⁶ W. Michael McCabe and Ciara O’Connell, “An Assessment of Waste and Dredging Issues Relating to Landfill Capacity in the State of Delaware”, Final Draft, McCabe and Associates, November, 2005, p. 17

¹⁷ The two major diversion requirements incorporated in the permit are prohibitions against a) disposing of yard wastes at the facility and b) disposing of wastes from the Pine Tree Corner transfer station located in southern New Castle County at this facility.

¹⁸ Source EPA, “Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2003.

rate of 5.7 pounds per day for Delaware in the year 2000.¹⁹ The per capita rate of disposal was slightly higher – 5.9 pounds per day.²⁰ Thus Delaware’s generation rate appears to be higher than the national average. Per capita generation rates are strongly influenced by economic conditions. Delaware’s per capita income was somewhat higher than the national average in 2000, and increased 20 percent (in constant dollars) from 2000 to 2005. This rate of growth was about 50 percent higher than the national average.²¹

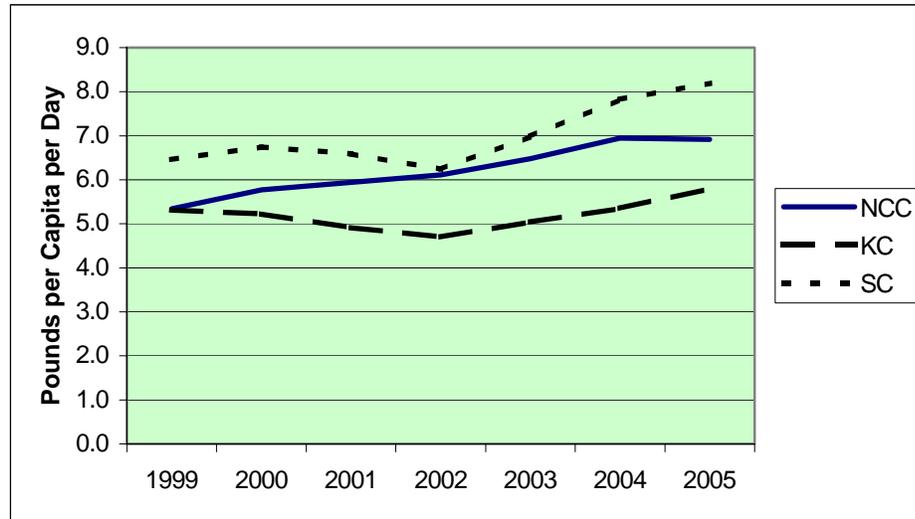


Figure 1.2 Per Capita Rates of Waste Disposal in Delaware Counties

Source: Data provided by DSWA

These trends suggest that Delaware’s per capita generation rate is likely growing faster than the national average.²² This is reflected in Figure 1.2, which shows the increase in per capita waste disposal rates in the three counties from 1995 through 2005. For the entire state, the already high rate of 5.9 pounds per capita per day for the year 2000 had increased to an average of 7.0 pounds per capita per day by 2005. The generation rate in Sussex County was higher than the other two counties, reflecting the large number of seasonal visitors there who are not included in the population.

¹⁹ Franklin Associates, Ltd., Assessment Of Delaware Solid Waste Discards In 2000 And The Potential For Recycling Of Materials, September 2002. Some reviewers have said that these estimates are high, particularly the estimates for yard wastes. Reducing the estimate of yard trimmings by 50% gives a per capita generation rate of 5.0 pounds per capita per day. The Franklin Associates estimates were generated in large part by applying national averages to Delaware.

²⁰ Based on data provided by DSWA.

²¹ All information on personal income from the US Government Bureau of Economic Analysis, Department of Commerce.

²² The relationship between per capita income and per capita waste generation is not linear. Indeed, the information for the United States as a whole that per capita generation rates did not increase from 1990 to 2000 despite the substantial increase in per capita income suggests that the one may not be associated with the other after a certain level of consumption is reached, and increased expenditures tend to be focused on non solid waste generation activities.

The third factor affecting the amount of waste to be disposed of is the amount of the waste that is diverted from the waste stream before it reaches the disposal facility. Nationally, much of this diversion has occurred through recycling efforts, with the national recycling rate reaching 28 percent.²³ Delaware's recycling rate, however, falls substantially below the national rate (see Chapter 2). Diversion can also result from waste generators handling their own wastes, either by processing the wastes themselves or shipping the wastes to a private disposal company. For instance, Delaware's poultry processing plants generate approximately 350,000 tons of waste a year, but almost all of this is converted into animal feed and fertilizer, eliminating the need for disposal.²⁴ Another effort at diversion is a proposed ban on the disposal of yard wastes in landfills that is intended to encourage households to leave grass clippings and other yard wastes to compost naturally in the yard and garden rather than dumping them in the trash.²⁵

All three of these factors have operated to result in Delaware's waste disposal needs growing faster than the national average - the population growth rate has been higher; the per capita income has grown faster; and the household recycling rate has been lower. The net result is shown for the three counties in Figure 1.3, which shows that the amount of waste being disposed of in all three counties has increased rapidly since the year 2000. In New Castle and Kent Counties, the increase has been about 25 percent.²⁶ On a percentage basis, the amount being disposed of in Sussex County has grown even faster - about 35 percent - between 2000 and 2005.

Delaware's ability to effectively and economically manage its solid wastes in the future will depend on these trends. Over the past 5 years, they have not been encouraging. And only one of the three factors is amenable to management. The state does not want to limit population or economic growth. And it has very little ability to limit the amount of waste generated per capita, which is largely a function of economic well being, personal preferences, and decisions made outside the state on such things as packaging. This leaves only the third variable, the amount of waste diverted from the waste stream, as susceptible to significant modification. The opportunities for affecting this variable are the subject of Chapter 2.

²³ Source: EPA, <http://www.epa.gov/epaoswer/non-hw/muncpl/recycle.htm>.

²⁴ Information provided by DSWA from a study expected to be completed in May 2006.

²⁵ Delaware Yard Waste Management Committee, "Yard Waste Management Committee Consensus Points" released in December 2005.

²⁶ The large variations in the disposal rates for New Castle County reflect alternative processes that were used temporarily for handling the solid waste generated in this county. In the early part of the period shown, an incinerator at Pigeon Point was taking some of the waste. In the mid-1990s, a substantial amount of waste was being converted into Refuse Derived Fuel (RDF) and shipped to a waste-to-energy facility in Pennsylvania. Although the average growth rate for waste disposal in New Castle County has been high in recent years (about 5% per annum) over the longer period from 1985 to 2005, it was only about half as high, averaging 2.7% per year.

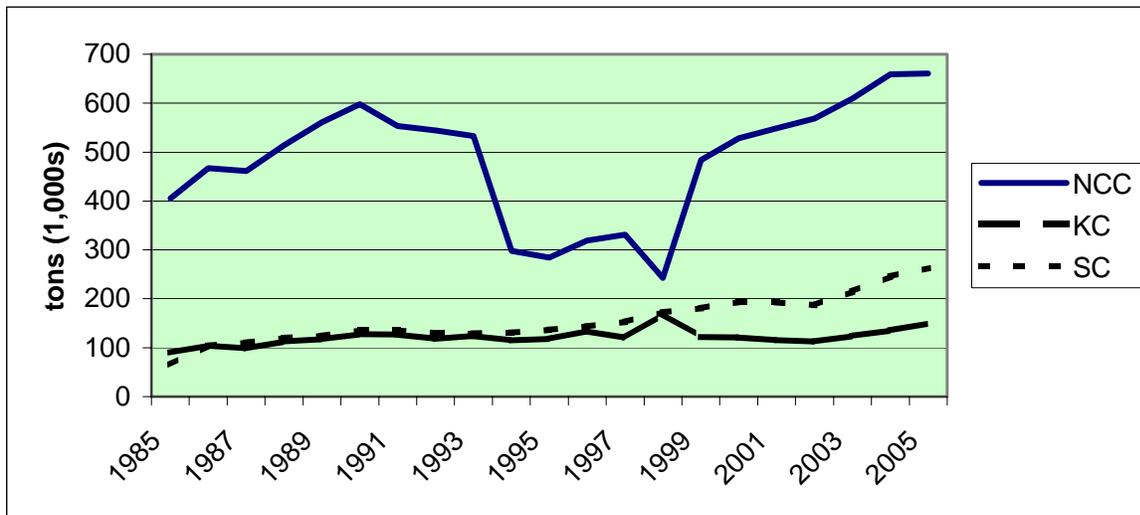


Figure 1.3: Amount of Waste disposed of in Delaware Counties

Source: DSWA

The Most Imminent Problems

These trends in waste generation, combined with the limited disposal capacity, create a particular problem for Northern Delaware. Not only is Northern Delaware running short on landfill capacity, but it is highly unlikely that another landfill could be sited in the county. Even if one could be sited, it would be much more expensive than the current site as a result of: a) rapidly increasing land prices, b) alternative sites would likely be much more expensive to develop than Cherry Island, and, c) the majority of the waste would have to be hauled a longer distance. Thus it strongly behooves Northern Delaware to preserve as much of the available landfill capacity as it can. This is, as indicated above, relatively low cost capacity, and any alternative is likely to cost four to eight times as much.

Solid waste disposal, however, is not the only problem facing Northern Delaware. A recent report has pointed out that The Wilmington Waste Water Treatment Plant will soon run out of room for disposing of its sludge.²⁷ Beginning in 1995, this sludge, after being stabilized by mixing it with fly ash from the Edgemoor Power Plant and other materials, was disposed of by placing it as cover on top of the Pigeon Point and Cherry Island Landfills. However, the material was found to interfere with operations at Cherry Island, resulting in it being placed at a much higher rate than expected at Pigeon Point, rapidly using up this

²⁷ W. Michael McCabe and Ciara O’Connell, “An Assessment of Waste and Dredging Issues Relating to Landfill Capacity in the State of Delaware”, Final Draft, McCabe and Associates, November 2005. Although commonly called the Wilmington Waste Water Treatment Plant, this facility services much of Northern Delaware.

disposal option. Here again, this has been a relatively low cost disposal option, and any alternative is likely to be much more expensive.²⁸

The other immediate problem facing Delaware is the disposal of waste tires. The state has no coherent program for dealing with this waste stream.²⁹ DSWA does accept tires and either cuts them up and disposes of them in the landfills or sends them to out-of-state tire recycling facilities. DNREC prohibits the dumping of tires and schedules free tire drop off days in New Castle County.³⁰ But there are many waste tire “storage” operations scattered through central and southern Delaware, some of which occasionally catch fire, causing significant air and water pollution problems. They also provide breeding grounds for mosquitoes.

Because these three waste streams – solid wastes in New Castle County, sludge from the Wilmington Waste Water Treatment Plant, and tires throughout the state – are the most immediate solid waste management problems Delaware faces, they are the waste streams on which the Working Group focused. Of course, some of the processes investigated by the Working Group could address other waste streams as well. For instance, any of the thermal processes could be used to dispose of infectious wastes that are now incinerated by the hospitals and other generators, and several of the processes could handle yard wastes. The focus, however, was on these three waste streams, and particularly on the problems facing New Castle County.

²⁸ Throughout the rest of the state, the problem of sludge disposal is much less serious than it is in northern New Castle County because the state’s other waste water treatment facilities have sufficient land available to allow for land disposal of their sludge.

²⁹ In fact, neither the DNREC nor DSWA web sites provide any information about what a citizen is supposed to do with waste tires.

³⁰ These drop-off days are scheduled by DNREC’s mosquito control division not by its solid waste division. The purpose is to reduce breeding areas for mosquitoes, not solve a solid waste problem, although the cost of the program is supported by DSWA.