



2015 LANDFILL MANAGEMENT EXCELLENCE AWARD



OUTAGAMIE COUNTY RECYCLING & SOLID WASTE NORTHEAST REGIONAL LANDFILL



“A Component of Regional Disposal & Diversion Solutions”

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Service Area Population: 500,000
Outagamie County Municipal Rate: \$44.20/Ton
Operating Budget: \$28 Million Annually

EXECUTIVE SUMMARY

Landfill management excellence achieves environmental protection, public acceptance, and program sustainability. Vision and leadership can produce integrated materials management to minimize landfilling and move toward zero-landfill. Outagamie County, Wisconsin, exemplifies these ideals. It owns the Northeast Regional Landfill as a component of regional disposal and diversion solutions through the Tri-County partnership. Visionary landfill management was a catalyst to launch sustainability with a regional single-stream MRF. The SWANA 2010 award-winning Tri-County MRF achieves remarkable success and is believed to be the largest publically-owned and publically-operated MRF in North America. Outagamie County operates the regional Northeast Landfill and regional MRF at its integrated 450-acre site. Synergies from sharing equipment and personnel yield increased efficiency and reliability. The regional landfill business launched a regional MRF, and the two together launch additional integrated materials management. Each program builds upon and benefits from the other. This is landfill management excellence.

SECTION 1: GENERAL INFORMATION

Outagamie County, Wisconsin, is the geographically-central member of the Brown-Outagamie-Winnebago Tri-County partnership (BOW) formed in 2001 through intergovernmental agreement.

Outagamie County's landfill site has operated 40 years with potential for 60 more and a total service life of 100 years. The current Northeast Regional Landfill, owned and operated by Outagamie County, exemplifies landfill management excellence and reinforces the Tri-County integrated materials management goal of long-term sustainability. Functioning integrated materials management systems at the Outagamie site include: (1) co-composting yard materials and wastewater biosolids; (2) diverting C&D materials away from landfill disposal; (3) beneficial landfill use of residuals received from a local C&D MRF; and (4) operating additional waste minimization and diversion programs to address electronics, pharmaceuticals, oil filters and absorbents, mattresses, business waste reduction, yard trimmings, appliances, scrap metal, vehicle and household batteries, agricultural clean sweep, and household hazardous waste.

Innovations implemented at the new Northeast Regional Landfill which handles 500,000 tons per year from the Tri-County service area include: (1) "flat-cell" waste placement and compaction to maximize densities, (2) spray-on ADC to save airspace and achieve monolithic waste placement to reduce impermeable barriers for leachate and gas flow, and (3) organic stabilization to improve landfill environmental management. See Section 5 for state-of-art innovations.

Outagamie County innovation advanced landfill management state-of-art over its 40-year history. When the landfill opened in 1975, Outagamie launched pioneering technologies to improve landfilling and recover metals for reuse. Outagamie practiced MSW shredding before disposal. Innovation during the 1970s was followed by ongoing state-of-art advancements, some first in the industry. The Outagamie East Landfill received the American Consulting Engineers Council excellence award in 1987.

Outagamie County began residential recycling in 1993 when it initiated a dual-stream MRF and contracted curbside collection for all 32 cities, villages and townships. To ensure strong recycling program development, Outagamie built its MRF and began curbside collection with financial assistance from landfill tipping-fee funds. Outagamie leveraged its strong landfill program giving financial support to launch integrated materials management in the form of recycling. Using effective landfill management as a catalyst to develop sustainable systems continues today as evidenced by the Tri-County MRF, possibly the largest of its kind.

Landfill management committed to environmental protection, public acceptance, program sustainability, innovation, and excellence can lead the industry from a single mission of disposal to a broader mission of integrated materials management. Outagamie County demonstrates this vision and commitment, building from its foundation of historically strong landfill management perfected with innovation and leadership.



Outagamie County's Northeast Regional Landfill Exemplifies Landfill Management Excellence

SECTION 2: SITING, DESIGN & CONSTRUCTION

Landfill Siting

For 25 years Outagamie County has successfully worked with neighbors and regulators to obtain full approvals for Northeast Landfill development and operation. Issues addressed included: (1) special studies to characterize complex glacial geology, (2) operational measures and special approvals because the site borders a four-lane highway that recently achieved Interstate status and is located in an area undergoing urbanization, and (3) negotiation with three communities to achieve host approval. The Northeast Landfill is close to Outagamie County's most populous communities and midway between Brown and Winnebago Counties. Traffic access is excellent for local haulers and regional transfer station vehicles. The location achieves optimally-efficient hauling for the Tri-County's 65 communities.

Site Life & Capacity

The Northeast Landfill will comprise 7,955,000 cubic yards of capacity, provide 10.7 years of site life for the service area of Brown, Outagamie and Winnebago Counties, and operate until at least 2022. Recent advanced landfill compaction techniques and use of spray-on ADC will save airspace and extend projected site life beyond 2022.

Geology & Hydrogeology

Environmental protection begins with proper site selection and continues with in-depth understanding of the site geology and hydrogeology. Therefore, uniquely detailed subsurface studies were completed to fully understand groundwater conditions and complete the Northeast Landfill permitting process.

The Outagamie County Northeast Landfill securely manages waste in the world-renowned glacial geology of Wisconsin. Site soil and geologic characteristics are ideal for long-term environmental integrity of landfill management. Outagamie chose the site for these reasons and placed it into operation during 1975. Rigorous Northeast Landfill investigations by CH2M Hill confirmed site suitability for long-term landfill operation. The site may serve Outagamie County's landfill management needs for 100 years or more.



Phase II Sub-Grade Excavation

Soils: The soil system was formed during the most recent period of glaciation. On-site low-permeability soils are particularly suitable for clay-liner construction. The deeper soils and geology provide natural redundancy or backup to the liner systems. No wetlands, ponds or streams exist within the site.

During development over the past 40 years, the site has consistently exhibited a soil surplus. Being "clay-rich" makes construction a relatively smooth process. Special planning is required because liner-quality clay is not present at ground surface but rather 15-30 feet below grade. Overburden soils with lower clay content are used for intermediate cover and the final cover system rooting zone.



Low-Permeability Clay for Liner Construction

Geology: The geology beneath the Northeast Landfill has an average 65 feet of fine-grained, unconsolidated sediment deposited during the most recent glacial period 11,000 to 15,000 years ago. Unconsolidated soil deposits overlie a dolomite bedrock aquifer which is part of Paleozoic formations. The Paleozoic formations underlying the glacial unconsolidated deposits generally represent shallow marine deposition on a Precambrian erosional surface.

Because of Wisconsin's unique glacial history and extensive visual topographic evidence of glaciation, the 1,200-mile long Ice Age Trail has been developed across the State. The trail is administered by the National Park Service and Wisconsin Department of Natural Resources (Wisconsin DNR) and is viewed by thousands of tourists annually. The Outagamie County site exists in the heart of this scientifically-studied internationally-known geologic region.



Hydrogeology: Geology at the Outagamie County site is designated into four hydrostratigraphic units by CH2M Hill for the purpose of understanding and interpreting hydrogeology. The units are labeled A, B, C and D, with "A" being the uppermost unit and "D" being the deepest. Identification of each unit was based on distinctive properties of the unit as related to unique groundwater transport and water quality conditions. Isotope age-dating studies in the early 1990s indicated young water (post-1952) in Unit A, old water (pre-1952) in Unit B, and both young and old water (post-1952 and pre-1952) in Unit C. Information for each of the four hydrostratigraphic units is provided below. Groundwater monitoring wells are constructed in each of the four units.

Unit A is composed of the uppermost fractured portion of the Glenmore Member, including sand and silt lenses. Unit A is partially saturated with horizontal groundwater transport dominantly occurring within coarse-grained features.

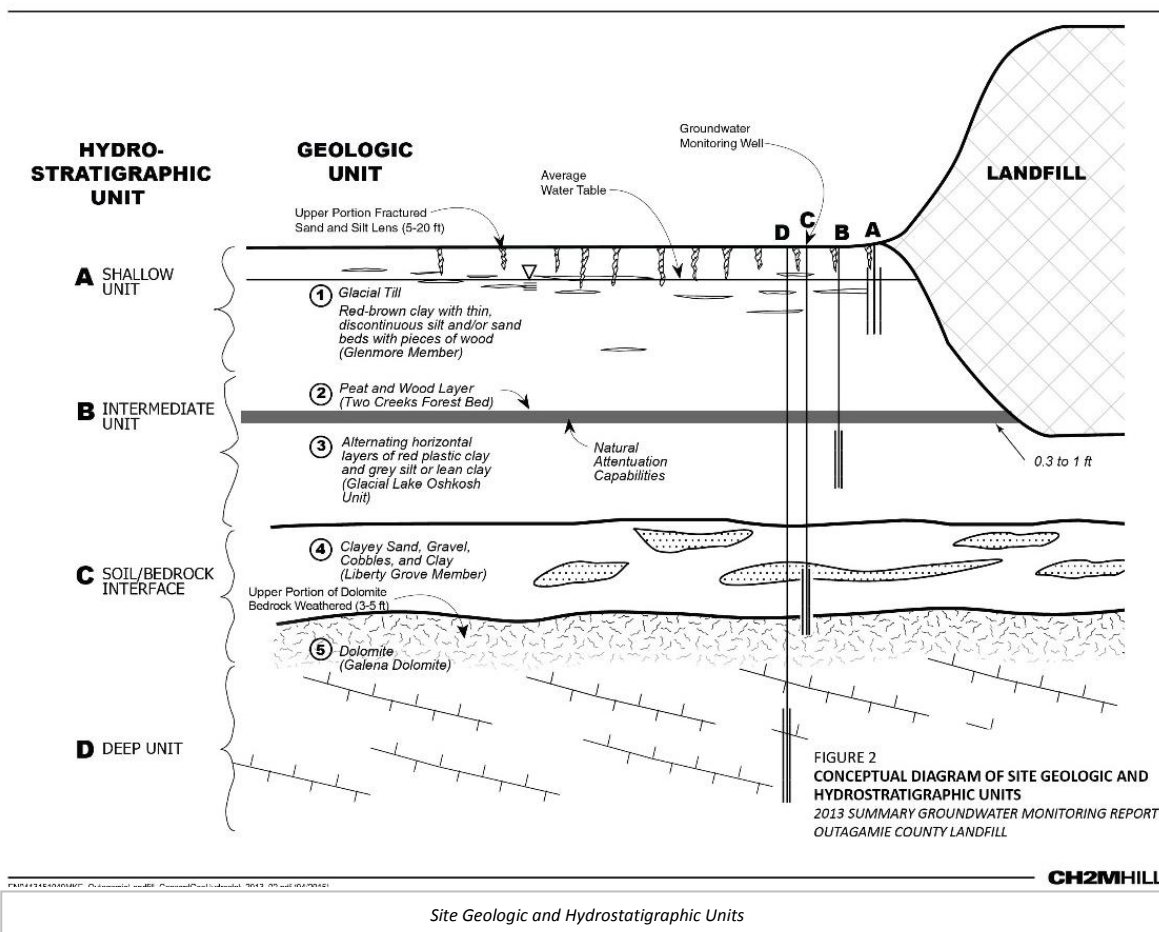
Unit B is composed of the lower, unfractured part of the Glenmore Member, Two Creeks Forest Bed, and Glacial Lake Oshkosh unit. Unit B has varying degrees of saturation, with some locally unsaturated zones because of its fine-grained characteristics.

Unit C is composed of the Liberty Grove glacial till and uppermost weathered/fractured portion of the Galena Dolomite. Parts of Unit C are capable of yielding water to wells (through fractured bedrock or coarse-grained lenses).

Unit D is composed of competent bedrock within the Galena Dolomite unit, immediately below Unit C weathered fractured portion. Secondary porosity features (solution channels, fractures, joints, and bedding planes) are significantly decreased relative to Unit C.

Valuable understanding of groundwater conditions was gained by CH2M Hill and other consultants from numerous studies over decades. Units A-C were conceptualized by CH2M Hill during the 1990s. Unit D was characterized during the past 10 years through uniquely detailed studies required for permitting the Northeast Landfill. These most recent studies included: (1) surface geophysical survey using seismic refraction and electrical resistivity, (2) bedrock coring to obtain direct visual observation of bedrock stratigraphy, lithology and secondary porosity, (3) downhole geophysics including spontaneous potential, gamma, caliper, and optical television logging, along with stressed and unstressed heat pulse flow measurements, and (4) piezometer construction to perform hydraulic monitoring of bedrock.

The groundwater investigations and landfill design and construction features demonstrate Outagamie County's commitment to environmental protection.



Design & Site Development

The Northeast Landfill was designed with extensive environmental protection features which include a Resource Conservation and Recovery Act (RCRA) composite liner. Progressive installation during filling of leachate recirculation and gas collection piping provides one measure of bioreactor technology. Engineering, environmental protection, monitoring and regulatory reporting features include:

- Composite base liner meeting Wisconsin Administrative Code s. NR 504.06, including: 12-inch granular protection and drainage layer, cushioning geotextile layer, 60-mil HDPE geomembrane liner, and 4-foot compacted clay liner
- Full leachate collection system, including: leachate flow distance above herringbone-contoured liner system of 130 feet maximum, internal sumps eliminating liner penetrations, leachate piping side slope risers allowing cleaning from both ends of 1,100-foot long lengths, submersible leachate pumps with high-level alarms sent to mobile phones of technicians, and double-walled piping with leak detection transmitting leachate to sanitary sewer to avoid need for trucking
- Leachate recirculation system to enhance organic stabilization and landfill environmental management
- Active landfill gas (LFG) collection system
- Surface water sedimentation basin
- Comprehensive environmental monitoring and annual reporting with over 500 pages of text and data
- Composite final cover system with 5-foot total thickness, including vegetative and topsoil layer, rooting zone soil, geocomposite drainage layer, geomembrane liner, clay barrier layer, and foundation layer above waste
- Rigorous construction quality assurance (CQA) including liner leak detection
- Leachate treatment at primary wastewater facility with backup treatment at secondary facility
- Pioneering cogeneration LFG conversion to renewable electricity with 4.8 megawatt Caterpillar system

Construction & Sequencing

The Northeast Landfill is being constructed and operated in three phases progressing from the east end nearest urban development toward the west. This arrangement will screen landfill operations from public view at the earliest possible time. The phases are 22, 15 and 16 acres in size. Phase 1 was one of the largest cell construction projects in Wisconsin. Phase 3 operations will include overlay filling to final grades for Phases 1 and 2. Timing of construction completion for each phase takes into account time required for documentation report completion and Wisconsin DNR approval before filling begins.

An efficient technique is used to construct the four-foot compacted-clay low-permeability liner. Abundance of suitable in situ clay allows for a highly-efficient "flip-flop method". Excess volumes of clay are removed leaving the clay volume required for liner construction within the cell. Side slopes are first excavated or filled to design subbase elevation. Then a "bay" or section of the floor is excavated down to subbase elevation with the excavated material placed as compacted lifts creating the clay liner on the slope. Upon completion of side slope clay liner and excavation of the first bay to subbase, the liner construction "flip-flop" begins whereby an equally-sized section or bay is excavated and placed as compacted clay liner in the previously excavated bay. This method provides a much shorter haul/cycle than other methods, expediting placement and compaction of clay liner while using minimal equipment and no stockpiling.



Phase II Sub-Grade Excavation



Phase II Flip-Flop Method



Phase II Liner Installation

Overall Planning & End Use

Community involvement is essential in planning final end use. Green-space legacy discussions will be at the forefront of planning to best serve the community at-large. The Outagamie County Parks Department sponsors a dog park in the southwest portion of the site. Pet owners have enjoyed the park since 1997. Nature-trail corridors will also be considered, including walking, biking and hiking options. Other considerations will include status of transfer station, landfill or recycling operations; possible eco-park or resource-recovery park development; and last-chance mercantile or other material recovery options. In addition, future development area for other Outagamie County departments may be considered.



450-Acre Outagamie County Complex



Popular Dog Park on Landfill Site



Outagamie County Complex in Lower Fox River Basin

SECTION 3: ENVIRONMENTAL CONTROLS & MONITORING

Surface Water, Erosion & Sediment Management

Surface water runoff from the Northeast and East Landfills drains to one sedimentation basin. The West Landfill is served by a second basin. Both discharges are analyzed monthly for suspended solids, turbidity, field conductivity and pH, hardness, chloride and COD. Upstream sediment generation is minimized by using best management practices for erosion control.



Landfill Sedimentation Basin & Future County Development Area

Groundwater & Hydrogeology

A total of 128 groundwater wells are monitored twice each year. The monitoring wells are distributed within the 450-acre site and at off-site locations. Wells surround each landfill. Some are incremental distances from waste limits. The monitoring wells are screened at different depths and each is located in one of the four hydrostratigraphic units described in Section 2. Uniquely detailed studies for permitting the Northeast Landfill, including geophysical and downhole investigations, provided valuable information to better understand site groundwater and hydrogeologic conditions. A total of 11 off-site private wells are also monitored.

Numerous constituents are analyzed annually as follows: (1) 18 inorganic and 44 organic parameters in groundwater samples, and (2) 27 inorganic and 110 organic parameters in leachate samples. Chain-of-custody documentation is prepared. Laboratory and field quality assurance/quality control is performed. Hard-copy and electronic data is presented in DNR submittals. Geochemistry and statistical analyses are compiled to watch for any groundwater impact. These groundwater monitoring programs demonstrate Outagamie County's commitment to environmental protection.

Leachate Management

Leachate management includes collection, treatment and monitoring as well as recirculation to achieve one measure of bioreactor technology. At the Northeast Landfill leachate must be managed in close coordination with LFG because recirculation increases gas production. Details of leachate liner containment and collection are described in Section 2. Leachate head monitoring confirms compliance. Two regional wastewater treatment facilities provide primary and backup leachate disposal options. Redundancy ensures continuous and reliable leachate treatment over the long term.

Leachate sampling and analysis are performed for each pump station at each of the three landfills based on requirements of both Wisconsin DNR and the wastewater plant performing treatment. Data includes leachate composition and quantity. West Landfill leachate is treated by the Appleton Regional Wastewater Treatment Plant. East Landfill and Northeast Landfill leachate is treated by the Heart-of-the-Valley Metropolitan Sewerage District. The County's consultant performs semi-annual sampling in February and August. The District performs sampling in May and November.

Collected quantities of leachate were largest in 2012 because the site opened in February that year. Smaller quantities were collected in 2013 and 2014 because the increasing quantity of in-place waste absorbed much of the precipitation. Moisture intake and absorption promotes LFG production. Production shows that LFG quantities are progressively increasing.

Annual Leachate Quantities for Northeast Landfill			
Year	2012	2013	2014
Quantity (gallons)	6,946,000	2,990,000	2,768,000

Landfill Gas Beneficial Use, Collection, Monitoring & Odor Control

Outagamie County pioneered LFG cogeneration in 1991 when it developed possibly the first such system in the United States.

- The \$4 million combined-heat-and-power facility, privatized in 2007 to have Outagamie focus more strongly on “core business”, employs Caterpillar engines that produce 4.8 megawatts of renewable electricity
- Warm jacket water is used to heat the adjacent 95,000-square-foot Highway Department building
- Renewable electricity is produced sufficient for the equivalent of 3,500 homes
- The 2007 public-private partnership has improved sustainable energy production reliability and financial results
- Outagamie has already accrued \$1.5 million income in its Enterprise Fund from 24/7 LFG sale and estimates another up to \$8 million during the Northeast Landfill life



Aerial View of Co-Gen Facility



Co-Gen Facility Caterpillar Engines



Co-Gen Facility Heats Highway Building

Landfill gas systems are designed to begin collection during earliest stages of Northeast Landfill operation. They send LFG under vacuum to the cogeneration system. Collection for all three landfills, including extraction well, header pipe and condensate systems, is operated and maintained by Outagamie County personnel. Fine-tuning includes wellhead monitoring of vacuum, oxygen, methane and other parameters to optimize collection, renewable energy production, and regulatory compliance. The 1988-2012 East Landfill pioneered LFG collection from horizontal leachate piping at the landfill bottom. The Northeast Landfill is highly proactive employing horizontal collection piping along with leachate recirculation systems. The horizontal collectors are placed at specific waste lifts and elevations throughout the landfill. They deliver consistently high-quality and high-quantity gas and will do so over 10-20 years or more. Presently 1,500 standard cubic feet per minute of LFG are delivered to the energy plant, 850 SCFM of which comes from the Northeast Landfill.

Formal LFG monitoring and Wisconsin DNR reporting is comprised of monitoring extraction systems, property boundaries and on-site structures, including: monthly monitoring of all extraction wellheads; monthly reporting of permit deviations and follow-up resolutions; semi-annual submission of LFG information to DNR database; semi-annual submission of reports on quarterly serpentine path and penetration point surface-emission monitoring; and annual report submissions for LFG system performance, air-permit compliance certification, air-emission inventory, and greenhouse gas emissions.

If any odors arise during daily operations, LFG system inspections are performed to locate and solve the problem. Any odors associated with actual waste are solved by applying additional daily cover.

Environmental Quality & Sustainability

Outagamie County has a long and successful history of environmentally-sound landfill management. Groundwater is foremost in importance. Extensive studies and documentation have been completed and others continue. By monitoring 128 wells in the four stratigraphic units, progressing from shallow to deep geologic zones, rigorous groundwater tracking is performed for all three landfills. Limited groundwater impact is observed in small areas close to the old West Landfill, which was constructed 40 years ago before current regulations. Through annual groundwater reporting to DNR, the condition is closely monitored and managed. No off-site or public effects have occurred.

Each year Outagamie County submits environmental monitoring information including text and data comprising over 500 pages. **Annual groundwater quality evaluations utilize information in the comprehensive CH2M Hill database containing about 300,000 historic records dating back to 1975 and adding 12,000 new records annually.**

Because of effective environmental management over many years, the 450-acre site has potential capacity for another 60 years and a total site life of 100 years or more. Facility longevity is critical for landfilling and sustainable integrated materials management. Section 4 will demonstrate how the Outagamie landfill operation is foundational to launching integrated systems, including the highly-acclaimed SWANA award-winning Tri-County MRF. **The site with its long service life and environmental compatibility is critically important to (1) resource conservation and (2) sustainable program advancement.**

SECTION 4: REGULATORY COMPLIANCE

Landfill Permits & Approvals

The Outagamie County Northeast Landfill complies with all State and Federal regulations, including: (1) Wisconsin administrative codes governed by State Statutes found within Chapter 289 Solid Waste Facilities and (2) Code of Federal Regulation, Title 40, Part 258 Criteria for Municipal Solid Waste Landfill, Subpart D Design Criteria.

The Wisconsin DNR permitting process for the Northeast Landfill began in the late 1980's. All necessary permits and approvals were received, with the following being the most recent main events:

- Wisconsin DNR Opinion Letter for Initial Site Inspection concluding proposed Northeast Landfill complies with location and performance criteria as specified in Wisconsin Administrative Code NR 504.04, dated May 25, 1995
- Wisconsin DNR Feasibility Determination for the Northeast Landfill, dated October 2, 2009
- Wisconsin DNR Plan of Operation approval for Northeast Landfill, dated June 21, 2010
- Issuance of State of Wisconsin Solid Waste Facility Permit, License No. 3235, dated January 4, 2012
- Issuance of Operating Permit annually on June 30

Compliance with Regulations

Wisconsin DNR has rigorous requirements that must be fulfilled to receive approvals and permits as listed above. They include both solid waste and air quality administrative codes. Outagamie County complied with the extensive regulations for permitting of the Northeast Landfill, including: (1) conducting feasibility studies, (2) completing conceptual and final designs, (3) developing detailed construction plans, (4) performing construction and documentation of conformance to both regulations and design, and (5) obtaining final DNR approval before accepting waste.

During completion of these projects, Outagamie County interacted frequently with Wisconsin DNR to ensure that documents and information submitted for approval met all regulatory requirements. That liaison occurred over many years and resulted in DNR issuance of necessary permits for the Northeast Landfill.

The Outagamie County landfill complex has had a long-standing cooperative and supportive relationship with the Wisconsin DNR. A video documentary on landfills and garbology was filmed at the Outagamie County site in 2004 based on DNR recommendation (see link to video in Section 7).

The Northeast Landfill has been in environmental compliance over the three years it's been in operation since its inception and first accepting waste in February 2012.

Landfill as Foundation to Integrated Solid Waste Management

The sanitary landfill's role in the local community's integrated solid waste management plan and system is epitomized at Outagamie County. **Outagamie has long committed to having its sanitary landfill function as a catalyst to launch sustainable systems through integrated materials management.** Section 1 describes how Outagamie leveraged from landfill funds to launch its highly-effective and growing recycling program.

Outagamie County demonstrated long-term vision, going back more than 40 years, for landfilling as a resource to launch efforts toward integrated system goals of waste reduction and diversion. The present Northeast Landfill is a component of ongoing regional disposal and diversion solutions. Outagamie County's Northeast Landfill is a financially strong and sustainable Tri-County business. It is ultimately a facility for waste disposal, but the business model is built on deep historical roots of both waste reduction and diversion.

The Northeast Landfill business mission continues Outagamie County's long-held commitment to reduce landfilling and increase sustainable material uses. The facility is now a regional hub that supports ongoing Tri-County strategic planning to minimize waste and maximize better and higher uses of materials.

From the Northeast Landfill hub emerges an ongoing and evolving regional materials management system. Following are examples of progress already made by Outagamie and the partnership toward diversion and sustainable materials management under a business model developed for the Northeast Landfill and predecessor facilities: (1) co-composting of yard materials and wastewater biosolids; (2) renewable energy production from landfill gas with cogeneration technology believed to be one of the first such facilities in the nation; (3) installation of landfill gas systems to maximize capture of renewable energy; (4) incorporation of leachate recirculation piping to achieve one form of bioreactor technology; (5) diversion of usable materials to save airspace and prolong landfill service life; (6) recycling of C&D materials; (7) active management of universal wastes; (8) conversion to single-stream curbside and commercial recycling through development of regional MRF; (9) development of on-site beneficial landfill uses for residual MRF materials; and (10) preparation of joint procurements by the Tri-County group to seek best possible solutions for electronic, pharmaceutical, tire, household hazardous waste, and C&D material management. Because 3 counties work together on behalf of 65 communities, new and better opportunities are created for sustainable materials management at a level not possible without the integrated regional program.



The Tri-County partnership is a public-sector business although it includes outsourcing and privatization of certain functions. Outsourcing allows each County to focus on its core business of managing solid waste, recycling program, and waste diversion strategies. Public-sector leadership and control of the overall business, including the sanitary landfill, makes launching of sustainable materials management possible. If the business were entirely privatized, vision and implementation steps needed for ongoing advancement into sustainable materials management would be constrained. Financial and market-share strengths of the Northeast Landfill create a strong foundation to maximize opportunities for non-landfill solutions such as waste reduction and diversion.

The vision of landfill diversion and sustainable materials management has roots in Outagamie County back to 1975, "day one" of the County's landfill development. When the first landfill phase opened in 1975 as a county-wide facility to replace dozens of local dump sites, Outagamie launched pioneering technologies striving to improve landfilling and recover metals for reuse. Pioneering and innovation began during the mid-1970s when Outagamie County implemented MSW shredding and metal recycling as a step preceding landfill disposal. Subsequent moisture addition with industrial wastes began in 1979 and continued during the 1980s and 1990s. These early practices enhanced waste decomposition. Decades after Outagamie's pioneering landfill stabilization and recovery of reusable materials, recycling became commonplace. Bioreactor technology through moisture addition became a goal for modern landfill operations to enhance waste stabilization and environmental protection. Outagamie's landfill practice has long been a catalyst to promote better environmental solutions and sustainable systems.

As demonstrated above, the sanitary landfill is a foundation from which integrated solid waste management solutions can develop. The successful regional landfill operation allowed the Tri-County partnership to develop a \$10 million regional single-stream MRF which received the 2010 SWANA Gold Award for Recycling Systems. Since opening in 2009, the MRF has become one of the largest publically-owned and publically-operated facilities in the United States. Our Tri-County landfill and MRF businesses, with the financial strength and regional market share they embody, will provide additional opportunities in future years to develop innovative integrated solid waste management solutions.

SECTION 5: PLANNING & OPERATIONS

Tonnage Trends

Tonnage and revenue trends for the regional landfill and MRF facilities have been strong over the past 5 years. The Outagamie County and Tri-County programs are experiencing healthy financial trends. Launching from a solid landfill business, a strong MRF business has also been established. Having the two businesses combined at one site under common management is unique compared with other operations in both the public and private sectors. The two businesses support each other providing operational synergies and efficiencies.

Annual Tonnages for Tri-County Facilities					
Year	2010	2011	2012	2013	2014
Tri-County Landfill at Winnebago County (MSW)	604,334	601,946			
Tri-County Landfill at Outagamie County (MSW)			670,139	633,711	608,172
Tri-County MRF (Single-Stream Recycling)	49,983	52,800	67,245	82,221	97,999

Landfill tonnages vary year-to-year depending on special construction and demolition projects, accounts being won, and decisions by private haulers to use the Tri-County facility or their landfill. During original planning for the MRF, maximum capacity was estimated at 80,000 tons per year. That goal was surpassed in 2013 and far exceeded in 2014. MRF tonnage growth required establishment of a 2-shift operation in 2013. The second shift was instituted after successful negotiations with private haulers to deliver additional tonnages.

Several factors and conclusions regarding the annual-tonnage trends are important:

- Exceptional MRF tonnage growth resulted from capturing increased market share and service area. Additional growth resulted from progressive community implementation of automated cart collection.
- Growth in MRF tonnages strengthens the operation and yields improved financial returns for participating communities.
- MRF performance demonstrates the value of having a strong landfill program launch a recycling facility.
- Landfill tonnages have been stable and allow the program to support further integrated materials management.
- MRF tonnage growth and landfill tonnage stability provide a two-pronged business with solid market share and financial returns.

Favorable 5-year tonnage trends for both businesses strengthen the foundation of the Tri-County program. With both businesses solidly in place, each program builds upon and benefits from the other. The two together can launch additional integrated materials management.

State-of-Art Innovations & Awards

The Outagamie County Northeast Landfill with its many associated integrated systems is “state-of-art.” The landfill and preceding Outagamie landfills incorporated numerous innovations. National and international awards were received for the landfill and integrated system innovations. Some innovations are recent and others were created progressively during the long site history. The summaries below demonstrate state-of-art landfill management by Outagamie County.

Historic Innovations: Innovations to advance state-of-art spanned 30 years.

- 1985-1986: Designed unique landfill bottom system to collect LFG from leachate piping, believed to be first such U.S. landfill with dual-extraction system and greatest LFG recovery concentration per acre; created innovative leachate system to incorporate 150 times the gravel and 10 times the perforated piping for LFG collection than conventional vertical-well systems.
- 1985-1986: Developed dual-extraction piping with easy-access pipe bends and risers for convenient hydraulic-jet cleaning and closed-circuit television-camera inspection to provide reliable maintenance and viewable pipe integrity information.
- 1988: Opened East Landfill making it the first U.S. landfill designed with features for joint leachate and LFG management and convenient internal television-camera inspection; presented the innovations at national and international conferences. Dual extraction allows LFG collection to start as soon as production begins. Advanced state-of-art provides: (1) maximum renewable energy capture with landfill-bottom systems and (2) minimum greenhouse gas and odor emission.

- 1991: Pioneered LFG cogeneration to develop possibly the first such system in the U.S.; under privatization during 2007-2015 the system produced \$1.5 million income from 24/7 LFG sale, and over \$8 million additional income is expected over the next 10 years; developed supervisory control and data acquisition (SCADA) system for technician 24/7 monitoring, later expanded to award-winning Tri-County MRF believed to be first of its kind to employ such innovation.

Recent Innovations: Recent Northeast Landfill innovations are highlighted below, including organic stabilization to improve landfill environmental management.

- “Flat-cell” waste placement and compaction to maximize densities, equipment use and litter control, with potential air space savings from “flat-cell” and spray-on ADC valued at \$4-6 million.
- Spray-on ADC less than ¼-inch thick to save airspace and achieve monolithic waste to reduce impermeable barriers for leachate and gas flow, improve environmental management, and save time in daily cover placement.



Posi-Shell Layer Provides Daily Cover



Flat-Cell Method of Compaction

- Landfill gas monitoring stations located at the four landfill corners. They send vacuum, flow rate and oxygen data to office and mobile phone recipients via a fiber-optic hardwire network. This 24/7 data reporting keeps technicians informed of field conditions on a real-time basis. Special Wisconsin DNR approval was required to use the four monitoring stations in place of flow monitoring at each individual wellhead.
- 14,000 lineal feet or 2.6 miles of leachate collection piping at landfill bottom used in dual-extraction mode for leachate and LFG removal, with dual extraction originated by Outagamie decades earlier as described above.
- 37,000 lineal feet or 7.0 miles of leachate recirculation piping at various elevations throughout the waste to increase decomposition, compaction and density, and LFG production, thereby enhancing organic stabilization and environmental management of the landfill.
- 34,000 lineal feet or 6.4 miles of horizontal LFG collection piping at various elevations throughout the waste.
- 85,000 lineal feet or 16.0 miles leachate and LFG piping systems including dual-extraction/integrated features.

Awards & Recognitions:

- Launching from strong Tri-County landfill business, the \$10 million regional single-stream MRF received the 2010 SWANA Gold Award for Recycling Systems, believed to be the largest publically-owned and publically-operated such facility in North America.
- Outagamie’s East Landfill received the American Consulting Engineers Council national excellence award in 1987, based on innovative, easy-access for closed-circuit televising and hydraulic jet cleaning, dual-extraction piping system designs for joint leachate and LFG management.
- Recognized with facility photographs and schematics in SWANA’s August 2012 MSW Management journal publication, entitled “Celebrating 50 Years of SWANA.”

Long-Term Landfill Resource & Asset Management

Outagamie County has always taken a long-term view regarding best use of its landfill as a resource. Through careful planning, the 450-acre complex has potential for 100 years of landfilling as well as leveraged support for integrated materials management. Significant acreages outside of waste footprints are available for sustainable integrated systems.

The 100-acre northwest portion of the site will be used for landfill development in future years. To gain maximum capacity and site life, consideration will be given to mining waste from the northern part of the old West Landfill and then creating a large-footprint modern facility. Long-term planning is underway.

Outagamie County's vision for the future includes continued increase of integrated materials management and decrease of waste quantities requiring landfilling. The County manages its land as a resource. Investing in a vision to minimize landfill and move toward zero-landfill will allow Outagamie County to realize its commitment to sustainability and provide the highest level landfill management service to its citizens, businesses and institutions.



Meeting Design, Regulatory & Operational Objectives

The complex of facilities at Outagamie County's comprehensive site are managed to meet all design, regulatory and operational objectives. Continual focus is directed to central goals of environmental protection, public acceptance, and program sustainability. Factors important to achieve these goals are reviewed and refined through discussions with: (1) in-house department staff including those at supervisory and staff levels; (2) regulatory personnel focused on solid waste and recycling; (3) public-sector and private-sector customers and stakeholders; (4) County departments such as Corporation Counsel, Finance, Human Resources, Information Technology and Planning; (5) expert consultants engaged from nationwide solicitations; (6) and the County's governing body including County Executive, Board and Committees. In addition, benchmarking of cost and service quality is performed statewide and nationwide. Some benchmarking is performed in-house and some through expert consultants. In addition, periodic strategic planning is performed both within Outagamie County and cooperatively with the Tri-County partnership.

The high goals and objectives established by Outagamie County are being met as the program moves forward. The County recognizes, however, that room for improvement always exists. Challenges arise that need solutions. Therefore, Outagamie County has established a Lean Improvement process which is embraced and used by the Recycling and Solid Waste Department. The Lean Improvement program ensures that most important goals and objectives are achieved and challenges are solved.

Specific programs receive continual attention and direction: (1) collecting curbside recyclables through subcontractors from 65,000 households; (2) scheduling health and safety training as well as operation and maintenance training; (3) conducting frequent waste screening, and (4) supporting and promoting waste diversion and integrated management for programs which involve composting, segregating materials for recycling including C&D, textiles and tires, and managing programs for household hazardous waste and pharmaceutical collections. Public acceptance is high for comprehensive programs as discussed in Section 7.

Using effective management, benchmarking, strategic planning, stakeholder engagement and Lean Improvement, Outagamie County achieves fundamental goals of environmental protection, public acceptance, and program sustainability.

SECTION 6: EQUIPMENT/SYSTEMS & TECHNOLOGIES

Types of Equipment

Introduction: The Outagamie County Recycling & Solid Waste operation manages an integrated system of landfill, transfer station, single-stream recycling, and various resource recovery/landfill-diversion programs. All are operated at the 450-acre complex allowing for equipment and personnel sharing and maximum synergy. The MRF operates 2 shifts usually 5-6 days per week. Comprehensive equipment maintenance and personnel training are provided for the integrated facilities.

Entrance: The entrance consists of 3-lanes, landscaping, weigh scales, and MRF with offices. Automated truck scales accommodate after-hours delivery of single-stream materials to supply the MRF 2-shift operation plus outbound shipping of recyclable commodities. The scales accommodate inbound trucks throughout the day and utilize a fast-track RFID system to identify customer account, source of waste and waste type.



Landfill Operation: The landfill inventory totals \$8 million of the following heavy-equipment: one 836H Caterpillar refuse compactor, one Al-Jon 600 refuse compactor, two Caterpillar D8 dozers, one Volvo 20-yard haul truck, and other support equipment including an excavator, water truck, and roll-off truck. The Posi-Shell spray-on daily-cover system consists of a 2,000-gallon delivery tanker with a hoist-mounted unit for ADC product delivery and a 50-ton silo for the addition of Portland cement. Landfill operations employ integrated GPS technology in key heavy equipment, including the refuse compactor, push dozer, and finish landfill dozer. GPS technology allows Outagamie to optimize each daily cell configuration and sequence.



GPS Technology



Posi-Shell Tanker

MRF Operation: Regional landfill financial performance over many years allowed the Tri-County partnership to develop a \$10 million regional single-stream MRF which received the 2010 SWANA Gold Award for Recycling Systems. In 2014 a second baler and additional sorting equipment were added for an investment of \$2 million, providing redundancy and sorting of more mixed plastics and aseptic cartons. The financial strength and regional market share for the landfill and MRF operations will provide opportunities in future years to develop additional innovative integrated solid waste management solutions.



Tri-County Single-Stream Recycling Facility
 Outagamie County, Wisconsin

Diversion from Landfill: This includes ancillary transfer station equipment that provide loading services and source separation of construction and demolition materials, textiles, shingles, metals, rigid plastics, and other recyclables that can be off-hauled for processing rather than being landfilled.



Clean Wood Diversion



Textile Diversion
Partnered with 100% Non-Profit Goodwill Industries



Shingles Diversion

Synergy, Backup & Contingency Systems

Operating a comprehensive disposal and recycling system at one site provides synergistic opportunities for sharing equipment and personnel. The 2-shift MRF operation, requiring 10 County employees and over 50 subcontracted employees, benefits from availability of personnel sharing. **The regional landfill and regional MRF operations benefit from each other and are thereby made stronger and more efficient.** In addition, being able to share resources between the landfill and MRF provides backup and contingency opportunities not otherwise available.

SECTION 7: PUBLIC ACCEPTANCE, APPEARANCE & AESTHETICS

Public acceptance is achieved at three levels. Each enhances materials management sustainability.

Daily Operations: Daily operations provide public interface and build loyalty between Outagamie County and its users. Operations continually enhance the appearance, aesthetics, and customer service described below.

Periodic Program Changes: Program changes require effective education and community relations. An excellent example is Outagamie County's present goal, using Lean Improvement, to convert more communities from manual curbside recycling collection to automated collection using wheeled carts. This conversion, through community outreach, will encourage increased recycling, decreased landfilling, and strengthened sustainability.



Single-Stream Recycling Truck



City of Appleton Single-Stream Carts Roll-out

Long-term Vision & Leadership: Effective vision and leadership, supported by the public and elected officials, ultimately create great opportunities and successes. Outagamie County's 40-year program progressed based on this belief. Continuing progress results from solid landfill business, innovation and excellence in landfill technology, bold analysis and strategy launching from past successes, and commitment to collaboration and cooperation.

Appearance, Aesthetics & Customer Service

Appearance, aesthetics and customer service are priorities each day. The following examples are increasingly important because the neighborhood is urbanizing, and the site shares a northern boundary with right-of-way for the divided four-lane U.S. Highway 41 that recently achieved Interstate status:

- Starting in the 1980s, long in advance of Northeast Landfill development, Outagamie constructed and vegetated a 20-foot high, 1-mile long highway screening berm. The entire perimeter was landscaped during the 1980s and 1990s.
- A newly constructed 20-foot-tall litter fence blends with many tree and landscape features beautifying the highway berm. Litter management occurs on and off-site.



Fencing Along Residential Development



Interstate Highway 41 & Screening Berm Along Bottom Residential Development To Left



20-Foot High Fencing Along Interstate

- Daily operations keep the 450-acre landfill and MRF complex neat and clean. Residential development has encroached to within 300 feet of the landfill. High-volume highway traffic passes within 200 feet along the entire north side of the site.
- Video cameras transmitting views to the head office via fiber optic networking are planned around the landfill perimeter to allow continuous visual monitoring of the fencing and litter.
- On-site roads are watered for dust control. Both on-site and off-site roads are swept periodically.
- Birds including gulls are attracted to landfill sites. Outagamie County contracts with the U.S. Department of Agriculture (USDA) Fish and Wildlife Services to provide ongoing bird-abatement services.
- Active landfill gas collection occurs from the leachate piping at the landfill bottom and additional horizontal collectors installed at select elevations during waste filling. Vacuum throughout the collection system draws LFG into main header pipes and ultimately to the renewable energy plant.
- Due to the size of the 450-acre site and the many integrated services provided, extensive signage has been posted to aid the general public.
- Customer service is at the forefront of all services, from the scale house to the landfill working face. Any problems are referred to management staff for resolution. Customer surveys and feedback provide for continuous improvement in service.

Community Relations, Education & Outreach

Community relations, education and outreach are high priorities:

- Maintaining positive relations with community officials and customers is a daily priority. Requests for extended hours and emergency needs receive immediate attention.
- General public outreach and education are ongoing. Business outreach promotes waste reduction and explores landfill diversion possibilities.

www.RecycleMoreOutagamie.org/education-center/		
Link	Video Duration	Key Words
Landfill Design	2 Minutes	Northeast Landfill, Cogeneration from LFG, Tri-County
Landfills & Garbology	4 Minutes	How a Landfill Works, Wisconsin DNR, Waste Sorting Research
MRF Grand Opening	2 Minutes	New Recycling Era, Single Stream, Commodity Revenues
Recycling	2 Minutes	High-Tech Long-Term Solutions, Commodity Sales

Public Acceptance is Confirmed with Local Approval Success

One of the best indications of public acceptance for a facility, policy or program comes when elected officials decide or vote on the issue. Local elected officials reflect the level of public acceptance when they vote.

Outagamie County as operator of a regional landfill and regional MRF has required important decisions and votes from its County Executive, Board and Committees as well as the governing bodies of all 32 cities, villages and townships. Some of the most important votes taken over the past 15 years are summarized below. The votes were successful and confirmed public support.

Favorable voting results over many years allowed the program to advance — moving from 3 counties operating 3 local landfills and 3 local MRFs, to 1 county operating 1 regional landfill and 1 regional MRF. Tri-County regionalization has produced the most modern landfill and recycling technologies and delivery of the most up-to-date services to 65 communities. This entire process demonstrated strong public acceptance within Outagamie County and the Tri-County, starting with the sanitary landfill as a foundation and essential component, and from there growing into sustainability in the form of integrated materials management.

Local Approvals for Northeast Landfill: From the 1970s to present Outagamie County landfill has received strong public acceptance from neighbors, citizens and public officials. Outagamie County successfully negotiated Northeast Landfill local siting approvals during 2005-2007 with the 3 neighboring communities. The Northeast Landfill, located in a semi-urban area, provided capacity expansion and geographic service area expansion. Such expansion factors normally present challenges, however, local approvals were received from elected officials.

Local Approvals for Tri-County Regionalization: Public acceptance in the form of required votes was received for creation of the Tri-County partnership in 2001. Strong support was received from the three counties including over 100 elected officials and the broader public. Three County Executives and 3 County Boards, representing 65 cities, villages and townships, gave support to establish the pioneering Tri-County partnership for regional solid waste landfill and recycling solutions. The partnership launched a new form of government service adopting regionalization efficiencies common in the private sector.

Local Approvals for Single-Stream MRF & Second-Shift Expansion: After 14 years of Tri-County operation, the new business model continues to receive popular public acceptance. During 2007-2008 the Tri-County partnership progressed into new technology of single-stream recycling with formal votes of approval from elected officials and public acceptance. During 2013-2014 the \$10 million SWANA award-winning Tri-County MRF expanded to a 2-shift operation based on successful private partnering for tonnage. The expansion required County Board voting support which did occur. By 2014 annual tonnage had grown from 50,000 to 98,000. Public acceptance and supporting votes produce a financially strong solid waste and recycling program on behalf of the Tri-County partnership representing 10 percent of the State Wisconsin.

Summary

A special thank-you is given to all past and present employees of the Outagamie County Recycling & Solid Waste Department. Their talents and dedication created a nationally-successful program.

A special thank-you is also given to: (1) members of the Brown and Winnebago County departments, (2) numerous supporting departments and professionals within each county, especially Outagamie, which served critical roles in program development, (3) elected officials who gave thoughtful analyses and strategic plan approvals, and (4) individuals, consultants, regulators, customers, companies, and partners integral to success.

Thank-you, SWANA, on behalf of all participants mentioned above for the opportunity to submit this Landfill Management excellence entry.



Award-Winning MRF Launched from Strong Landfill Management