Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

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MONITORING AND RESEARCH DEPARTMENT

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September 2015

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 312-751-5600

MONITORING AND RESEARCH DEPARTMENT

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Monitoring and Research Department
Thomas C. Granato, Director

September 2015

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LIST OF ACRONYMS

Abbreviation/Acronym	Definition
ABL	Analytical Bacteriology Laboratory
ALD	Analytical Laboratories Division
Argonne	Argonne National Laboratory
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
CIP	Capital Improvement Program
CDC	Center for Disease Control and Prevention
CAWS	Chicago Area Waterway System
DO	Dissolved Oxygen
EC	E. coli
EBPR	Enhanced Biological Phosphorus Removal
EM&RD	Environmental Monitoring and Research Division
FC	Fecal Coliform
GIS	Geographical Information System
HASMA	Harlem Avenue Solids Management Area
IEPA	Illinois Environmental Protection Agency
Strategy	Illinois Nutrient Reduction Loss Strategy
IT	Information Technology
Kirie	James C. Kirie Water Reclamation Plant
Egan	John C. Egan Water Reclamation Plant
LIMS	Laboratory Information Management System
LASMA	Lawndale Avenue Solids Management Area
M&O	Maintenance and Operations
District	Metropolitan Water Reclamation District of Greater Chicago
M&R	Monitoring and Research
NELAC	National Environmental Laboratory Accreditation Conference
NPDES	National Pollutant Discharge Elimination System
P	Phosphorus
PIMS	Pretreatment Information Management System
Planning	Process Facilities Planning
O'Brien	Terrence J. O'Brien Water Reclamation Plant
TOC	Total Organic Carbon
TARP	Tunnel and Reservoir Plan
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAS	Waste Activated Sludge
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WRP	Water Reclamation Plant

ACKNOWLEDGMENT

Special thanks to all staff in the Monitoring and Research Department for their tireless contribution to the department and the District.

DISCLAIMER

The mention of trade names and specific products dose not constitute endorsement of them by the Metropolitan Water Reclamation District of Greater Chicago.

MONITORING AND RESEARCH DEPARTMENT CONTACT PERSONNEL

Executive Section
Thomas C. Granato
Director of Monitoring and Research
100 E. Erie St., Chicago, IL 60611
(312) 751-5190
thomas.granato@mwrd.org

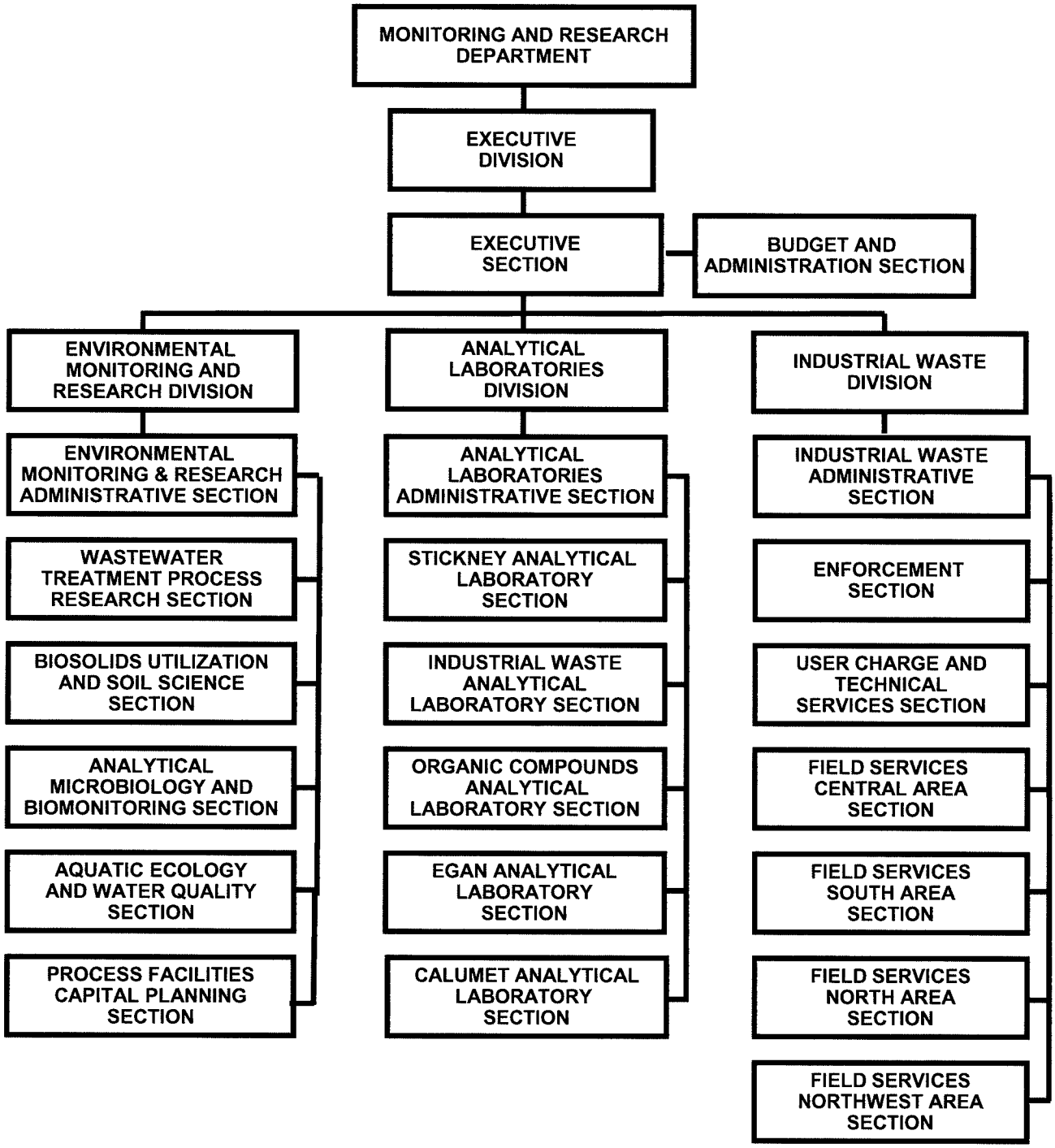
Budget and Administrative Section
Michael Cohen
Supervising Budget and Management Analyst
111 E. Erie St., Chicago, IL 60611
(312) 751-3037
michael.cohen@mwrd.org

Analytical Laboratories Division
Donna Coolidge
Assistant Director of Monitoring and Research
Stickney Water Reclamation Plant
6001 W. Pershing Rd., Cicero, IL 60804
(708) 588-4061
donna.coolidge@mwrd.org

Environmental Monitoring and Research Division
Heng Zhang
Assistant Director of Monitoring and Research
Stickney Water Reclamation Plant
6001 W. Pershing Rd., Cicero, IL 60804
(708) 588-4059
heng.zhang@mwrd.org

Industrial Waste Division
Mathew Joseph
Assistant Director of Monitoring and Research
111 E. Erie St., Chicago, IL 60611
(312) 751-3040
mathew.joseph@mwrd.org

MONITORING AND RESEARCH DEPARTMENT
ORGANIZATION CHART FOR 2014



ENSURING FINANCIAL STABILITY

The Monitoring and Research (M&R) Department's 2014 budget appropriation was $30,368,961 in the Corporate and Construction Funds, an increase of $1,198,160, or 4.1 percent from 2013. Approximately 84 percent, or $25,514,400, was appropriated for salaries and compensation-plan adjustments (such as severance pay, sick leave incentive pay, step increases, and paid overtime), and the remaining appropriation of $4,854,561 was used to fund acquisition of equipment, supplies, and services to operate the M&R Department's laboratories, technical support projects, and environmental and industrial monitoring programs. The department has continuously sought to make improvements to its business practice and to maintain a clear focus on its mission. The department had 288 budgeted positions in 2014, down from 355 positions in 2000.

User Charge Program

The M&R Department generates an important revenue stream through recovery of operations, maintenance, and replacement costs incurred from providing treatment to discharges from Commercial, Industrial, and Tax-Exempt Users of the sewerage system, and the costs of administering the Metropolitan Water Reclamation District of Greater Chicago's (District) Pretreatment and User Charge Programs. The User Charge Program assesses charges to recover costs that are beyond those recovered through payment of *ad valorem* property taxes based on the volume of water discharged and the concentration of waste it contains. The 2014 User Charge revenue was $48,849,976 (Table 1).

TABLE 1: FIVE-YEAR TREND IN USER CHARGE REVENUE INCLUDING 2014

Year	User Charge Receipts
2010	$48,666,789
2011	$48,614,202
2012	$77,743,336
2013	$54,007,347
2014	$48,849,976

In 2014, the M&R Department administered 3,802 accounts. Of these accounts, 917 (703 Commercial-Industrial and 214 Tax-Exempt Users) were processed manually. The department conducted 1,365 inspection and sampling events, and processed 2,610 reports and filings to reconcile User Charge liabilities for these manual accounts. The remaining 2,885 accounts, which are all Tax-Exempt Users, were approved by the department for automated processing. The M&R Department remains vigilant in identifying and classifying new users, and in 2014, 38

new Large Commercial-Industrial and Tax-Exempt Users and 38 Small Nonresidential Commercial-Industrial User accounts were created.

Through its industrial surveillance program, the department maintains records of loadings that result from discharge of wastewater from all user accounts. In addition to formulating the basis for User Charge billing, this information is also useful for long-term capital planning. These data are maintained in the department's Pretreatment Information Management System (PIMS) database.

Section 7f of the District's User Charge Ordinance makes provision for automated filing and clearing of User Charge accounts. An additional 26 users were placed on automatic billing in 2014, bringing the total now to 2,885. This reduces costs for the District and the Users. In 2014, M&R also identified 26 Users who were eligible for reduced reporting and self-monitoring requirements under Sections 7g, 7h, 7i and 7l of the Ordinance, which reduces the District's oversight costs and the User's cost for determining their User Charges.

Optimizing Business Practice

The M&R Department is committed to automating and streamlining its business practice. During 2014, consultants began work with staff from the M&R and Information Technology (IT) Departments to upgrade the Laboratory Information Management System (LIMS) to increase data processing and reporting, and to enhance data acquisition from automated instruments. The upgrade was completed and put into production in October 2014.

Implementation of the new PIMS was completed in 2014. This updated and enhanced PIMS enables the department to maintain its Industrial Waste Program data in a single database and increase staff efficiency. Separate User Charge/Finance Department modules were integrated and brought online in the PIMS in December 2013. These modules started streamlining the assessment, invoicing, and collection of User Charges, penalties and noncompliance enforcement charges, as well as simplifying calculation methods where feasible in 2014. The M&R Department will streamline its programs through implementation of electronic industrial user reporting and electronic management of District and industrial user records and correspondence a soon as PIMS fully stabilizes.

The M&R Department has been working with the IT Department to create geographical information system (GIS) layers for its industrial and tax-exempt user databases to facilitate more efficient inspection, surveillance, and sampling, and to conduct forensic operation during facility upset events. The department GIS will also be useful for future planning, including identification of potential water reuse corridors. In 2014, the department updated the list of users and updated flagging of users in significant noncompliance.

In 2014, the M&R Department completed a major upgrade to its LIMS, which was originally developed in 1995 and is one of the longest, continuously running LIMS in the United States. Simultaneously, the M&R Department, working with the Finance and IT Departments, completed implementation of its second generation PIMS.

The M&R Department provides quality control data to the Maintenance and Operations (M&O) Department for various materials purchased by the District, which allows verification that contract requirements are met. These materials, such as lubricants, sodium hypochlorite, bisulfites, bioxides, polymers, and ferric chloride, are used for such purposes as operating plant machinery, disinfection, odor control, and biosolids processing.

DEVELOPING ALL EMPLOYEES

The M&R Department is committed to providing continuing education and professional development to all of its employees. The department conducts a monthly environmental issues and research seminar series at the Lue-Hing Research and Development Complex, which is video-conferenced to the Main Office Building Board Room and five other facilities, and is archived in streaming on-line video format through the web portal.

The M&R Department's Seminar Series is approved by the Illinois Society of Professional Engineers for professional development credits and is available to all employees and the local community. In 2014, attendance at the Lue-Hing Research and Development Complex Auditorium and the Main Office Building Board Room was 2,045, and video conferencing was expanded to include the Calumet, John E. Egan (Egan), Terrence J. O'Brien (O'Brien), and James C. Kirie (Kirie) Water Reclamation Plants (WRPs) and the Lawndale Avenue Solids Management Area (LASMA).

The employees of the M&R Department benefited from attendance at 67 local, regional, and national professional society meetings and workshops (Appendix AI), and often participated on the meeting programs as speakers, session chairs and moderators, or committee chairs or members. The M&R Department also economizes where possible by providing its employees access to webinars, which are presented by the Water Environment Federation (WEF), Water Environment Research Foundation (WERF), United States Environmental Protection Agency (USEPA), American Chemical Society, and others.

In 2014, M&R staff made 17 presentations at conferences and meetings, published 4 papers in conference proceedings or peer-reviewed journals, and the department published 59 numbered reports, which are available on the District website.

The M&R Department administers the District's Radiation Safety Program, including maintaining a Radioactive Material License issued to the District by the Illinois Emergency Management Agency, Division of Nuclear Safety, assuring that activities are conducted according to the license conditions and regulations. The department also maintains a Chemical Hygiene Plan for its laboratories and conducts bacteriological monitoring of drinking water sampled from various District facilities to ensure the safety of drinking water to District employees.

IMPROVING PUBLIC IMAGE

The M&R Department engages in activities to benefit the public and in the process, strives to improve the District's image. The major activities include odor monitoring, the Biosolids Controlled Solids Distribution Program, maintaining native prairie landscapes, participating in local parades with the District float, and providing waterway boat tours.

The M&R Department staff continued to promote public awareness and acceptance of District operations. On a regular basis, department staff attended meetings and provided support to public outreach activities such as participation in science fairs and hosting tours of the M&R Department's laboratories.

In 2014, the M&R Department participated in 11 local parades with the District float and provided 8 tours of the Chicago Area Waterway System (CAWS) on the M&R Department research and monitoring vessel to various groups, including area legislators.

The District conducts an Odor Monitoring Program to determine the potential for, and minimize the occurrence of, odor nuisance to the communities surrounding its facilities. During 2014, the M&R Department, in collaboration with the Maintenance & Operations (M&O) Department, monitored unit processes at the District's wastewater treatment facilities as well as biosolids drying areas for odors. Extreme odor conditions were reported to the respective plant managers. The 2013 monitoring results were summarized in an annual report in 2014 (Report No. 14-22).

In 2014, the M&R Department initiated the development of a District-wide plan to identify and mitigate significant sources of odor. Early focus of this effort will be on the Calumet WRP.

The District is committed to reducing the odors generated in its collection systems. The M&R Department undertook a full-scale field study to evaluate the effectiveness of injecting a calcium nitrate solution at multiple locations in the Upper Des Plaines interceptor system to mitigate the odors and minimizing the corrosion in sewer conduits. Results of this monitoring study were reported in 2014. Additionally, sewer cleaning in a reach of this interceptor system was performed by the M&O Department and its effectiveness was evaluated by the M&R Department.

The District conducts a Biosolids Controlled Solids Distribution Program under a permit issued by the Illinois Environmental Protection Agency (IEPA). Under this program, exceptional quality air-dried biosolids are used as a soil amendment and fertilizer in the Chicago metropolitan area. During 2014, the M&R Department staff worked with 37 biosolids users to ensure regulatory compliance and help them derive economic and agronomic benefits from biosolids use. The M&R Department staff conducted a Sustainability Workshop and distributed promotional materials to park districts, school districts, golf courses, and other land managers to expand the program and make the public aware of the benefits of utilizing biosolids.

The M&R Department conducted marketing activities and technical support on projects in the Chicago metropolitan area, where 8,844 dry tons of biosolids were used as a soil conditioner or fertilizer topdressing on various sites, including 4 schools/athletic fields, 62 parks, 5 golf courses and 2 landscaping companies (Table 2).

The M&R Department staff continued to promote public awareness and acceptance of District operations. On a regular basis, department staff attended meetings and provided support to public outreach activities such as participation in science fairs and hosting tours of the M&R Department's laboratories.

TABLE 2: MARKETING EFFORTS ARE INCREASING LOCAL BIOSOLIDS USE UNDER THE CONTROLLED SOLIDS DISTRIBUTION PROGRAM

	2006	2007	2008	2009	2010	2011	2012	2013	2014
No. of Users*									
Total	12	37	35	39	43	60	48	35	37
New (1st Time)	10	35	16	11	10	20	11	13	13
Repeat Users	2	2	19	28	33	40	37	22	24
Biosolids Qty. -- (dry tons)									
Total	1,900	4,800	4,000**	6,274	6,863	7,279	11,050	6,231	8,844

*Not all customers use biosolids every year.

**Construction at Highlands GC (10,000 DT), and reclamation at Miller Meadows (4,000 DT) and USX (2,000 DT).

BE ENVIRONMENTALLY RESPONSIBLE

The M&R Department works in partnership with the M&O and Engineering Departments to ensure regulatory compliance of its operations and to seek to continually increase the efficiency of the District's treatment processes to bring about progressive and sustainable improvement of the aquatic, terrestrial, and atmospheric environment in the District's service area and beyond.

Industrial Waste Pretreatment Program

The M&R Department is committed to stopping pollution at its source by operating an effective Industrial Waste Pretreatment and Source Control Program in full compliance with all federal and state statutes. During 2014, the administration of the District's Industrial Waste Pretreatment Program required the issuance or renewal of Discharge Authorizations for 75 Significant Industrial Users; the review of 714 Continued Compliance Reports; and 7 Spill Prevention, Containment, and Countermeasure Plans. As a result of the Industrial Waste Pretreatment Program, the District's biosolids continue to exceed the minimum requirements that define Exceptional Quality in the USEPA's federal regulations (Table 3).

TABLE 3: COMPARISON OF 2014 AVERAGE Cd, Hg, AND Pb, CONCENTRATIONS IN STICKNEY AND CALUMENT WATER RECLAMATION PLANTS BIOSOLIDS WITH USEPA EXCEPTIONAL QUALITY CONCENTRATION LIMITS

	Cd	Hg	Pb
	----------	mg/Kg	----------
USEPA Limit	39	17	300
Calumet	2	0.83	84
Stickney	3	1.10	114

During 2014, the M&R Department conducted 3,683 inspections associated with administering the District's Sewage and Waste Control Ordinance and randomly sampled and analyzed 954 of the 1,875 chemical toilet disposals at the Stickney WRP. In 2014, the department issued 75 Cease and Desist Orders to Industrial Users who were found to be in significant noncompliance with the District's Industrial Waste Pretreatment Program requirements (Table 4). In accordance with the public participation requirements of the Pretreatment Program, the identity of 35 significant violators of the program in 2014 will be published in 2015.

TABLE 4: FIVE-YEAR TREND IN ENFORCEMENT ACTIVITIES INCLUDING YEAR 2014

Year	Cease and Desist Orders	Board Orders	Legal Actions
2010	82	3	0
2011	87	0	0
2012	118	0	0
2013	94	0	0
2014	75	0	1

The M&R Department provided first response services for hazardous materials emergencies and complaints of pollution by conducting 130 investigations in response to requests from federal, state and local agencies, municipalities, and private citizens; 37 investigations were conducted in response to self-reported industrial activities; and 21 investigations were conducted in response to requests from the M&O Department in 2014.

As a result of the District's Industrial Pretreatment Program, all of the biosolids produced by the District met the highest quality criteria in USEPA's Part 503 Regulation and the WRP effluents met all National Pollutant Discharge Elimination System (NPDES) permit limits for regulated industrial pollutants.

Environmental Monitoring Program

Surface and Groundwater. The M&R Department monitors the effectiveness of the District operations in improving the environment and documents compliance with state and federal regulations and operating permits. In 2014, the department collected and analyzed over 1,000 water quality samples from the Chicago area waterways. The department also successfully met the District's National Pollutant Discharge Elimination System (NPDES) permit requirements for continuous dissolved oxygen (DO) monitoring and completed a chlorophyll survey of the Chicago, Calumet, and Des Plaines River Systems.

The M&R Department's Environmental Monitoring and Research Division (EM&RD) implemented enhanced water quality monitoring in the Calumet River System to document baseline conditions for two years preceding the completion of the Calumet Tunnel and Reservoir Plan (TARP) System's Thornton Composite Reservoir. Pre- and Post-completion data under wet and dry weather conditions will be compared to water quality standards to assess the effectiveness of TARP. In 2014, data were collected for 16 sampling events under various dry and wet weather conditions.

The M&R Department's EM&RD collected fish at 12 stations in the Calumet River System, Tinley Creek, and Salt Creek for bio-assessment on various projects. The sampled fish were identified, weighed and measured for length, and examined for parasites and disease.

All of the Ambient Water Quality Data, Continuous DO Monitoring Data and Biological Survey Data for the local waterways is reported annually and is available to the public on the District website.

In 2014, 422 samples from 110 TARP groundwater monitoring wells for the deep tunnels and 2 reservoirs (and their adjacent wells) were collected and analyzed. Based on the monitoring results, the M&R Department compiled six annual monitoring reports for the 4 TARP tunnel systems including Mainstream, Calumet, Des Plaines and Upper Des Plaines, and 2 reservoirs, including the Gloria Alitto Majewski Reservoir and the Thornton Transitional Reservoir to meet operating permit requirements of these facilities. The groundwater elevation in 44 observation wells were also recorded bi-weekly and included in these reports. The reports were submitted to the IEPA. During the year, major repairs, such as desilting, flushing, and replacement of pumps were also performed on 6 wells.

The M&R Department also conducts groundwater monitoring at seven biosolids management facilities, including the Hanover Park Fischer Farm, in accordance with permits issued by the IEPA. In 2014, 28 monitoring reports were submitted to IEPA.

Air. The M&R Department provides compliance monitoring and reporting support to the M&O Department for the District's Clean Air Act Permits. At the Egan WRP, the M&R Department performed monthly monitoring of hydrogen sulfide levels in biogas at the facility's compressor room in compliance with its Federally Enforceable State Operating Permit. Additionally, as part of the IEPA's Environmental Emissions Reduction Market System, an Annual Hazardous Air Pollutants Report was filed. During 2014, the department also conducted odor monitoring at the District's biosolids drying areas in compliance with the IEPA permits for operation of the drying areas.

Analytical Laboratories

The Analytical Laboratories Division (ALD) has five National Environmental Laboratory Accreditation Conference (NELAC) accredited laboratories, generating accurate, reliable, and defensible data for samples from various District functional programs. The laboratories are audited internally by the M&R Department's Quality Assurance Coordinator annually and by the IEPA biennially. The laboratories are also audited annually by the Chemical Hygiene Officer for compliance with fire and safety requirements. In 2014, the total number of analyses performed by the laboratories was 1,465,377 (Table 5).

The Analytical Microbiology and Biomonitoring Section has five state-of-the-art laboratories: Analytical Bacteriology Laboratory (ABL); Molecular Microbiology Laboratory; Parasitology Laboratory; Virology Laboratory; and Wastewater Microbiology Laboratory that provide high quality microbiological monitoring and research support services for various District programs. These laboratories conducted a total of 6,424 (Table 6) microbial analyses in 2014.

TABLE 5: TOTAL NUMBER OF ANALYSES PERFORMED BY THE MONITORING AND RESEARCH DEPARTMENT'S NELAC ACCREDITED LABORATORIES IN 2014

Program	Nutrients	Oxygen Demands	Metals	Solids	Organic Compounds	Others	Program Total
4652 Liquid Monitoring*	157,019	70,211	163,032	67,205	26,104	99,671	583,242
TARP Reservoirs	93	0	22	0	0	33	148
Treatment Facilities	156,926	70,211	163,010	67,205	26,104	99,638	583,094
4653 Solids Monitoring	11,573	504	16,969	123,395	5,534	25,941	183,916
4666 Sewage & Waste Control	2,727	44	353,141	1,456	37,553	10,005	404,926
4663 User Charge	12	30,393	0	9,060	0	18,838	59,995
4671 Lake Michigan	0	9	0	0	0	16	27
4672 Waterways	5,471	1,566	50,936	2,194	46,152	7,971	114,289
4674 Groundwater	4,676	1,439	3,761	611	0	3,325	13,812
4681 Assistance to M&O	6,125	640	4,871	805	0	6,503	18,944
4682 Assistance to Others	2,054	101	318	17	1,529	171	4,188
4684 Engineering	30,827	4,268	4,989	5,531	0	2,161	47,777
4690 Operations & Research	14,471	409	13,938	858	5,194	1,080	35,951
Total Group	234,955	109,585	611,955	211,134	122,066	175,681	1,465,377

*4652 Liquid Monitoring is the sum of TARP and Treatment Facilities.

TABLE 6: TOTAL NUMBER OF ANALYSES PERFORMED BY THE MONITORING AND RESEARCH DEPARTMENT'S ANALYTICAL MICROBIOLOGY LABORATORY IN 2014

Program	Total Coliform/ Fecal Coliform/ E. *Coli*/HPC[1]	Pathogens[2]	Other[3]
4652 Liquid Monitoring	691	--[4]	--
4653 Solids Monitoring	83	65	115
4666 Sewage & Waste Control	12	--	--
4671 Lake Michigan (Bypass)	15	--	--
4672 Waterways	381	--	6
4674 Groundwater	400	--	--
4681 Assistance to M&O	--	--	2,399
4682 Assistance to Others	93	7	2126
4690 Operations & Research	882	--	1056
Total	2,560	72	3,792

[1]HPC = Heterotrophic Plate Count.
[2]Includes *Salmonella, enteric virus, and Ascaris ova* (Helminth Ova).
[3]Includes filament, ammonia oxidizing bacteria (AOB), nitrite oxidizing bacteria (NOB), and phosphorus accumulating organism (PAO).
[4]No analyses.

The ALD of the M&R Department maintained its National Environmental Laboratory Accreditation Conference (NELAC) accreditation by adhering to the strict standards established by The NELAC Institute. The Bacteriology Laboratory of the EM&RD passed its 2014 certification inspection by the Illinois Department of Public Health with 'Excellent Performance" and staff from the ABL were recognized for this achievement. The accreditation and certification ensure that all results generated by the M&R Department laboratories are accurate, reliable, and defensible.

Treatment Process Control and Optimization

The M&R Department monitors the liquid and solids process trains daily at multiple critical control points for each of the seven WRPs to inform process control and to improve operations and the quality of effluents and biosolids. This includes chemical and microbiological monitoring including characterization of changes in microbial communities associated with operations performance metrics to assess process stability and provide early warning of process upset such as appearance of excess filamentous bacteria in mixed liquor. A total of 2,331 analyses were conducted on 259 activated sludge samples for microbial characterization. The DMR-QA test for whole effluent toxicity tests with fish (*Pimephales promelas*) and daphnids (*Ceriodaphnia dubia*), which are required by NPDES permits, were conducted in 2014.

In 2014, the M&R Department provided the support to address treatment operation upset at the Stickney, Egan, Hanover Park and Kirie WRPs. This support included chemical analyses of influent, mixed liquor and effluent samples, and evaluation of microbial floc, ammonia oxidizing bacteria, and nitrite oxidizing bacteria in activated sludge, as well as microbial respiratory testing. The information generated was used to determine the potential causes, provide recommendations to restore the treatment operation conditions, and monitoring the progress of system recovery. The department also provided emergency support to the Egan WRP in response to a fecal coliform (FC) exceedance in 2014 by conducting intensive post-exceedance monitoring to ensure that the effluent NPDES permit limits would be met. The M&R Department also conducted general chemistry and microbiological analyses on samples collected in response to one storm event that resulted in backflow of combined sewer overflow to Lake Michigan.

Provide Technical Assistance to Other Departments and Agencies

Polymer Studies. The District's dewatering polymer chemical costs are about $5,000,000 annually. The M&R Department is working with the M&O Department to optimize post-digestion centrifuge operations at the Stickney WRP with respect to reducing polymer consumption. The M&R Department prepared a centrifuge operational manual and procedures in 2014. The guidance in this manual will be implemented in 2015, and polymer savings will be evaluated. Additionally, the department conducted polymer quality control testing throughout the year to verify the consistency of polymer quality and provided the M&O Department the summary of results monthly.

Aeration Diffuser Evaluation. In 2014, The M&R Department analyzed the data collected from the off-gas testing of the Egan WRP South Aeration Basin conducted in 2011 and 2013 to compare the oxygen transfer efficiency of the original diffuser plates installed in 1975 and the new replacement installed in 2012. The data analysis showed that there was no significant difference in oxygen transfer efficiency in the new diffuser plates relative to the old diffuser plates. A final memorandum report was submitted to the M&O and Engineering Departments.

New Technology Evaluation. The M&R Department conducted a new technology review and bench-scale test of THIOGUARD® (magnesium hydroxide solution) efficacy on hydrogen sulfide (H_2S) production and odor mitigation. This study was conducted to determine the potential application in the Calumet WRP service area.

As part of pilot-scale testing for composting biosolids with wood chips obtained from the city of Chicago, the department conducted a pilot-scale evaluation of the GORE® Cover technology, which is an integrated Covered Aerated Static Pile composting system, to determine if this technology will be suitable for adoption by the District. Two pilot-scale batches of composted biosolids were produced in 2014 at the Harlem Avenue Solids Management Area (HASMA). The information on the operating cost of this technology and the compost quality obtained from the pilot-scale test will be evaluated to prepare a recommendation regarding the potential for adoption of the GORE® Cover technology for compost production.

The department's Industrial Waste Analytical Laboratory investigated the use of the Total Organic Carbon (TOC) analysis in place of the Biochemical Oxygen Demand (BOD) analysis. A conversion factor was determined and the analysis change of TOC to BOD will be requested for the next NPDES permit.

Support Energy Neutral Initiatives. The department provided critical review and comments for the Energy Neutral Initiatives. This included gas production and digester capacity analyses for both the Calumet and Stickney WRPs along with evaluation and estimation of numerous external wastes for suitability to District digestion systems. Additionally, a preliminary analysis of criteria for acceptable high strength wastes, as well as digester pretreatment technologies, was performed.

Stormwater Management. In support of the Engineering Department's Stormwater Management Program, the M&R Department continued its collaboration with the United States Geological Survey (USGS) in 2014 to evaluate the effect of green infrastructure Best Management Practices (BMPs), such as permeable pavements, bioswales and planters on stormwater flow, and pollutant load reduction in the Sustainable Streetscape Project located on West Cermak Road between South Halsted Street and South Ashland Avenue, and South Blue Island Avenue between South Ashland Avenue and South Western Avenue. Post-construction monitoring was started in 2013 and continued through 2014, with the goal to evaluate the effectiveness of BMPs.

Phycoremediation. In support of one of District's initiatives, the department continued to participate in the evaluation of phycoremediation-based technologies for nutrient recovery from side streams at some of the District's WRPs. In 2014, a collaborative project using "Revolving Algae Biofilm System" for recovery of nutrients was initiated in collaboration with Iowa State University.

Process Facility Planning. The M&R Department's Process Facilities Planning (Planning) Section led an inter-departmental task force focused on reviewing the District's Capital Improvement Program (CIP). The task force activities included review of regulatory issues, District business initiatives, and financial constraints, which were included in a 20-year conceptual plan. The conceptual plan will be integrated into the final District CIP in 2015.

In 2014, the M&R Department began development of the District-wide Odor Master Plan. The plan will catalog areas that are sources of odor, recommend mitigation measures, and identify prioritization schemes to address odors. In addition, an immediate odor management needs study was initiated for the Calumet WRP aimed at remediating known odorous hot spots to minimize emission of odors to the local neighborhoods and improve working conditions at District facilities.

In 2014, the M&R Department, in collaboration with the M&O Department, completed a draft of Phase I of the Biosolids Master Plan, which addresses past and current status of the District's biosolids management program.

Due to plant capacity limitations associated with the ammonia-rich centrate stream, the Egan WRP routinely conveys its ammonia-rich centrate stream to the O'Brien WRP for treatment. It appears that this is creating odors in the Kirie WRP service area and is leading to corrosion of the sewers. The M&R Department provided technical support for the full-scale implementation of a moving bed biofilm reactor technology called Anita Mox™ using anammox bacteria for removal of ammonia from the centrate.

Phosphorus Task Force. The M&R Department, in conjunction with the Engineering and M&O Departments, formed a Phosphorus Task Force in order to assess and implement enhanced biological phosphorus removal (EBPR) and recovery at four District WRPs. In 2014, the department continued to study and provide guidance in improvement to the EBPR process, including evaluation of carbon needs, secondary clarifier operation, battery solids inventory, and understanding recycle stream impact. Additionally, the M&R Department performed lab-scale studies on sludge fermentation and waste activated sludge (WAS) phosphorus (P) release to provide technical and design support to the Engineering Department to maximize phosphorus recovery at the Stickney WRP via the WAS Stripping to Remove Internal Phosphorus (WASSTRIP®) process.

In 2014, the M&R Department provided technical support to the project in which Battery A at the Calumet WRP was converted to the EBPR process to mimic the Stickney WRP process. The EBPR at the Calumet WRP was not successful due to carbon limitations in the plant influent. In early 2014, a small sequencing batch reactor study was performed to understand

these carbon limitations using MicroC 2000™, a glycerin-based by-product derived from renewable resources, and it showed that sustainable EBPR was achieved. In late 2014, a full-scale demonstration was performed with this product in one of the Calumet WRP batteries. Phosphorus removal increased dramatically in the test battery, and total nitrogen removal was also observed. As an alternative to the purchase of commercial carbon supplement products, such as MicroC 2000™, another task force began to identify and work with industries producing high-strength carbon wastes.

Following an initial evaluation for implementing the EBPR process at the Kirie WRP in 2014, testing was started using a similar approach to the Stickney and Calumet WRPs and will continue into 2015. If unstable EBPR is observed, a number of infrastructure changes are planned, including installation of mechanical mixers, baffles, and pumps, to create a fermentation zone, a quasi anaerobic/anoxic zone, and a swing zone for EBPR optimization.

The M&R Department also assisted in evaluating the following three P removal/recovery strategies at the O'Brien WRP: (1) Reduction of P loading to the plant through source control, (2) Using algae for P removal and recovery from the liquid stream, and (3) Implementing EBPR for P removal from the liquid stream by modification and improvements to the existing facilities. As part of the modification and retrofit option, the M&R Department completed a stress test evaluating two retrofit options to improve the secondary clarifier performance and capacity for future EBPR. It was determined that dispersion plates would improve solids and particulate phosphorus removal. An analysis of the historical plant influent was also performed.

The M&R Department provided microbiological assessment support for the District's biological nutrient removal research projects at the Stickney, Kirie and Calumet WRPs. During 2014, a total of 264 samples were analyzed for phosphorus accumulating organisms as a monitoring tool to evaluate the EBPR process. Laboratory analyses included conventional microscopy and two staining methods for observation of poly-hydroxy butyrate granulated clusters in the anaerobic zone and poly-phosphate granulated clusters in the aerobic zone.

Addressing the USEPA Changes to the Recreational Water Quality Bacteria Criteria Methods. In response to the 2012 USEPA changes to the recreational water quality standards which require adaptation of the modified mTEC method for *E. coli* (EC) bacteria, instead of the FC test currently used, the M&R Department analyzed the CAWS and the final effluents samples by membrane filtration onto two different media – mFC agar for FC determination and modified mTEC agar for *EC* growth. In 2014, for the comparison of FC and EC membrane filtration methods, samples were collected from 13 CAWS sites and from the O'Brien and Calumet WRPs.

If the IEPA adopts the new USEPA recommendations for *EC* analysis to replace FC, the District has two years of data comparing these methods at 5 locations along the Calumet River System and 8 locations along the Chicago River System. Approximately 173 samples were collected for the FC and EC comparison. The FC and EC results collected in 2013 and 2014 are being statistically analyzed to determine a relationship between the two methods. Data analysis will begin in the first quarter of 2015.

Assistance to Outside Agencies. The M&R Department provided access and assistance to the USGS for water sampling on the Chicago Sanitary and Ship Canal at the Lockport Powerhouse. This work was part of a national study to assess the complexity of chemical mixtures and their biological activity in streams.

The M&R Department provided in-kind support for a WERF project to test and refine a trace organics screening tool. The department provided operations and monitoring data for the Egan and Hanover Park WRPs and the receiving streams. Sampling support was also provided for a one-week monitoring event in September 2014.

The M&R Department contributed to the Illinois Nutrient Loss Reduction Strategy (Strategy) developed by the IEPA. The Strategy establishes statewide goals and a strategy for reducing nitrogen and phosphorus discharge from the state as part of a national effort to reduce the Gulf of Mexico hypoxic zone. Department staff participated in the monthly Policy Workgroup meetings during the development of the strategy and reviewed and provided comments on several draft versions of the Strategy document.

In April through October of 2014, the department collected and analyzed monthly water samples from a sampling location on Buffalo Creek for the Buffalo Creek Clean Water Partnership. Sampling will resume for another year in April of 2015.

The M&R Department provided sampling support to the University of Illinois at Urbana-Champaign to characterize the microorganisms in the EBPR and anaerobic digester systems at the Stickney WRP. Sampling support at the Stickney WRP was also provided to Argonne National Laboratory (Argonne) for digester and membrane technology research.

In response to the Village of Oak Lawn's Midwest Medical Center's inquiry regarding the Centers for Disease Control and Prevention (CDC) guidance on Ebola preparedness, the M&R Department staff prepared a factsheet addressing concerns and questions as a guide to address potential public health emergencies. The factsheet is based on information from the World Health Organization and CDC reports and webcast sponsored by the WEF and the WERF on the spread and safety of the Ebola virus to wastewater workers.

Technical Support for Biosolids Program. The M&R Department provides technical support to the District's Biosolids Farmland Application Program in which biosolids are applied by a contractor as a fertilizer for production of row crops in nearby counties. Technical support includes implementing a Public Relations Program and review and approval of fields for biosolids application. The activities conducted during 2014 included the following:

- Review of 177 field information packages to evaluate suitability for land application of biosolids.

- Field inspections in response to public complaints regarding land application activities.

- Participation at a field day organized by the land application contractor.

Applied Research to Achieve Operational Improvement and Cost Reductions

Biosolids. Since 1973, the District has been conducting a corn fertility experiment on calcareous mine spoil at the Fulton County site. The purpose of this experiment is to evaluate the effect of long-term applications of anaerobically digested biosolids on crop yields, crop chemical composition and mine spoil chemical composition. The experiment was designed to simulate biosolids application to fields at the site at agronomic and reclamation rates, and to provide information that can be used for management of biosolids and crops. During 2014, crop yields were measured and soil and plant tissue samples were collected from the plots for analysis.

Fulton County Nutrient Reduction. In 2014, the District initiated a research and demonstration program at the Fulton County site to develop and test best management practices to reduce non-point source (agriculture) nutrient loss, leading to reduction in amount of nitrogen and phosphorus leaving the state. This program will also serve to foster the District's collaboration between point and non-point source of nutrients to address nutrient loss at a statewide level. During 2014, the concept was developed, a work plan drafted, and initial meetings with the individuals from the agricultural sector were conducted.

Resource Recovery. The District is evaluating various approaches, such as source control, EBPR, and sidestream recovery, to reduce P in WRP effluent and receiving waters to meet pending regulatory standards. During 2014, the M&R Department continued to work on a study on the sources of P in influent wastewater. This study included a review of sampling and analysis of industries likely to have high P use or discharge concentration focusing on the O'Brien and Calumet WRPs' service area. The M&R Department formed a Phosphorus Source Control Task Force charged with identifying measures for source P-reduction.

Mainstream Short-Cut Nitrogen Removal. In 2014, M&R completed a technology review of short-cut nitrogen removal approaches to reduce aeration energy in mainstream secondary treatment. Two approaches, nitritation/denitritation and partial nitritation/ deammonification, have been considered pertinent to the District's existing infrastructure and treatment processes. Four process options have been identified for further evaluation. Two of these will be evaluated at the laboratory scale and two at the plant pilot scale. Work is anticipated to kick off in 2015.

Routine Nitrification. Nitrification performance is critical at all of the District's seven WRPs to meet their respective NPDES permits. The M&R Department developed a method to monitor the nitrification rate in the District's WRP aeration batteries. This is very beneficial to detect any nitrification problems and provide feedback and advice to the M&O Department for operational control to improve plant nitrification capacity. The routine nitrification rate monitoring program will start in 2015.

Aquatic Environment. The M&R Department provided in-kind support to St. Cloud State University, University of St. Thomas, and the College of Wooster for a project funded by a National Science Foundation grant to investigate the fate and impact of endocrine active compounds after disinfection is initiated at the O'Brien and Calumet WRPs. The department conducted monthly water sampling, four mobile exposure laboratory trailer experiments, two wild fish collections, and two caged fish experiments. This project will continue through 2017.

The M&R Department continued to study three off-channel slips located in the South Branch of the Chicago River. A total of six cross-sectional DO profiles were completed in the slips and two locations in the adjacent main channel, during wet and dry weather. Also in 2014, macroinvertebrates were collected and fish sampling was completed in the slips.

In 2014, the department continued a seven-year Microbiome Project in collaboration with Argonne , which began in 2013, to get information on the microbial source in the CAWS that can be used to guide decisions on water quality in the CAWS. This study will track the microbial sources in the CAWS and will aid in evaluating the impact of future disinfection activities and TARP reservoir operations on CAWS water quality. The study will be conducted in three phases. The years 2013–2014 will represent the pre-disinfection baseline condition, the years 2015–2017 will represent the completion of the TARP Thornton Reservoir and implementation of disinfection, and the years 2018–2019 will represent the completion of Phase I of the TARP McCook Reservoir and post-disinfection. Argonne is using the metagenomics approach to identify the sources of microorganisms in the CAWS.

In 2014, approximately 600 samples (water, sediment, and effluent) were collected from 12 CAWS locations for the CAWS Microbiome Project. In addition, two final effluent waters from the O'Brien and Calumet WRPs were collected. Fecal bacteria and *EC* analyses were done on the samples and the filtered samples and sediments were submitted to Argonne. Argonne conducts the genomic DNA extraction from WRP effluent, and CAWS water and sediment samples using amplicon sequencing that gives information about the taxa of microbes present, and shotgun metagenomics sequencing that gives information about the functional potential of the microbial community.

LOOKING AHEAD

In 2015, the M&R Department will continue its organizational redesign by initiating a restructuring of its Industrial Waste Division to provide geographically focused, unified service centers to administer its ordinances. It is envisioned that this will entail redividing the District's service area into fewer regions, developing account administrators to handle all ordinances that apply to each industrial account, and develop better coordination and partnership between account administration and field surveillance operations. These steps, in combination with continued development of the PIMS computerized system for maintaining records and automating data analysis, correspondence, and business flow, will result in reduced program administrative costs. The department will continue to support the attainment of the goals of the District's strategic plan in 2015 and beyond.

The department will contribute to developing all employees in 2015 by continuing to offer its monthly seminar series, maintaining its chemical hygiene plan, and increasing access to webinars and web-based training. During 2015, the department will also be proactive in taking advantage of any relevant training opportunities to meet the twenty-four hours of professional development training for employees.

In 2015, the M&R Department will continue to contribute to developing a better understanding of water quality in the CAWS by continuing: its microbial source tracking study with Argonne , the completion of a 3-dimensional hydrodynamic and water quality model with the University of Illinois, and its ambient water quality monitoring to characterize conditions prior to the TARP reservoir completion.

In 2015, department workgroups will begin to implement guidelines for document generation and management redesign to streamline the documentation process.

In 2015, the M&R Department Stickney laboratory will start to renovate its Heating, Ventilating, and Air Conditioning system under contract 04-128-3P.

In 2015, the Planning Section will continue to lead the District-wide effort of updating the District's CIP, addressing long-term capital needs based on projected regulatory requirements and District major initiatives. This section also will continue work on the District's Biosolids Master Plan and address Odor Planning needs for District facilities. Recommendations to improve Calumet WRP biosolids operations and address odorous hot spots are expected in 2015.

In 2015, the department will contribute to improving the District's public image by continuing outreach and education to the public to promote the Biosolids program by participating in public meetings and by developing informational materials and presentations on the District's mission, operational achievements, and water quality improvements. The M&R Department will also continue working with the M&O Department to move to full-scale production of a value-added product by co-composting biosolids and wood chips for distribution under the Controlled Solids Distribution Program.

In 2015, the M&R Department will contribute to being environmentally responsible by continuing to lead the phosphorus removal and recovery task force, undertaking research to address odor issues at District facilities, and partnering with the M&O Department and the city of Chicago to compost vegetative waste generated in Chicago and biosolids to produce a value-added product that can be used by the city and other communities.

APPENDIX I

APPENDIX I

MEETINGS AND SEMINARS 2014

January 2014

Illinois Association of Wastewater Agencies, Technical Committee Meeting (and follow-up meetings throughout the year), Utica, Illinois.

Illinois Water Environment Association and the Illinois Section of the Central States Water Environment Association, 2014 Government Affairs, Burr Ridge, Illinois.

Industrial Water, Waste, and Sewage Group Meeting (and follow-up meetings throughout the year), Chicago, Illinois.

Midwest Water Analyst Association, Winter Expo 2014 (and follow-up meetings throughout the year), Kenosha, Wisconsin.

United States Composing Council's 22nd Annual Conference, Oakland, California.

Water Environment Research Foundation, 9th Annual Research Forum, New Orleans, Louisiana.

February 2014

DuPage River Salt Creek Workgroup, Annual Meeting (and follow-up meetings throughout the year), Lombard, Illinois.

Gasvoda and Associates, Latest Evolution in Flow Monitoring and Technologies Seminar, Calumet City, Illinois.

Illinois Fisheries Society Geographic Information System for Fisheries Science Workshop, Macomb, Illinois

Midwest Stream 5th Annual Restoration Symposium, La Crosse, Wisconsin.

Partnership for River Restoration and Science in the Upper Midwest, Annual Stream Restoration Symposium, La Crosse, Wisconsin.

Teledyne ISCO, Infiltration & Inflow Monitoring and Profiling Seminar, Lombard, Illinois.

Water Environment Research Foundation, Research Council Meeting, Alexandria, Virginia.

APPENDIX I

MEETINGS AND SEMINARS 2014 (Continued)

March 2014

Illinois Chapter of the American Fisheries Society, 52nd Annual Meeting, Bloomington, Illinois.

Illinois Section of the American Water Works Association and Illinois Water Environment Association, WaterCon 2014, Joint Conference and Exposition, Springfield, Illinois.

Michigan Water Environment Association Annual Conference, Biosolids Optimization, Big Rapids, Michigan.

Midwest Chapter Society of Environmental Toxicology and Chemistry Annual Meeting, Chicago, Illinois.

Occupational Safety and Health Administration Safety Day Seminar 2014, Waubonsee, Illinois.

Pittsburg Conference on Analytical Chemistry and Applied Spectroscopy, 2014, Conference and Expo, Chicago, Illinois.

SET Environmental Inc, Annual Department of Transportation Hazardous Waste and Materials Management Seminar, Lombard, Illinois.

United States Environmental Protection Agency, Advanced Environmental Crimes Investigation Training Program (and follow-up meetings throughout the year), Gynco, Georgia.

University of Chicago Booth School of Business, Chicago Management Conference, Chicago, Illinois.

April 2014

American Dental Association Spill Prevention and Mitigation Spring Seminar, Lisle, Illinois.

Chicago Wilderness Congress, Track Greening Infrastructure, Chicago, Illinois.

Earth Awareness Day and 4th Annual Exposition, South Suburban College, South Holland, Illinois.

National Fish and Wildlife Foundation Chicago Calumet Rivers Fund Meeting (and follow-up meetings throughout the year), Chicago, Illinois.

APPENDIX I

MEETINGS AND SEMINARS 2014 (Continued)

Water Environment Federation: Algae Bioreactors as a Cost-Effective Approach for Enhanced Nutrient Removal-Approaching it from all sides, Webinar, Stickney Water Reclamation Plant, Cicero, Illinois.

May 2014

American Society for Microbiology, 2014 Meeting, Boston, Massachusetts.

Illinois Association of Wastewater Agencies, Technical Committee Meeting (and follow-up meetings throughout the year), Utica, Illinois.

Illinois Environmental Protection Agency, Flexibility for Using Composed Biosolids Under Controlled Solids Program Meeting, Springfield, Illinois.

National Association of Clean Water Agency, Annual Pretreatment and Pollution Prevention Workshop, Minneapolis, Minnesota.

Water Environment Federation, Odors and Air Pollutants Conference, Miami, Florida.

Water Environment Federation Residuals and Biosolids Conference, Sustainability Made Simple: Facilitating Resource Recovery, Austin, Texas.

June 2014

CareerTrack, Project Management: Beyond the Basics Seminar, Chicago, Illinois.

Restek, Gas Chromatography-Mass Spectrometry Fundamental Seminar, Chicago, Illinois.

W2170 Research Group, Soil in the City Decennial Conference 2014, Chicago, Illinois.

Water Environment Federation: What Does the Proposed "Waters of the United.States" Rule Mean for Water Utilities, Webinar, Stickney Water Reclamation Plant, Cicero, Illinois.

July 2014

National Association of Clean Water Agencies, Summer Conference, Portland, Oregon.

Soil and Water Conservation Society, 69th Annual Conference, Lombard, Illinois.

APPENDIX I

MEETINGS AND SEMINARS 2014 (Continued)

Water Environment Federation, Chicago Water Summit 2014: Global Lessons from Great Water Cities, Chicago, Illinois.

August 2014

Chicago Metropolitan Agency for Planning, Green Infrastructure Workshop, Chicago, Illinois.

Fox River Study Group Meeting (and follow-up meetings throughout the year), Elgin, Illinois.

National Environmental Monitoring, The Future of Environmental Measuring and Monitoring Conference, Washington, D.C.

Thermo Scientific, Liquid Chromatography/Gas Chromatography/Inductively Coupled/Mass Spectrometry and Atomic Spectroscopy Seminar, Schaumburg, Illinois.

September 2014

Illinois Association of Wastewater Agencies, Annual Meeting, Lisle, Illinois.

Illinois Water Environment Association, the Illinois Association of Wastewater Agencies, and the Illinois Association of Water Pollution Control Operators Joint 2014 Nutrient Removal and Recovery Workshop, Addison, Illinois.

Water Environment Federation, Technical Exhibition and Conference 2014, New Orleans, Louisiana.

October 2014

American Chemical Society: Planet of Viruses, Webinar, Stickney Water Reclamation Plant, Cicero, Illinois.

Friends of the Chicago River, Annual Chicago River Summit, Chicago, Illinois.

Illinois Environmental Protection Agency Nutrient Standard Workgroup Meeting, Springfield, Illinois.

Illinois Department of Public Health Title 77: Public Health, Part 465, Certification and Operation of Environmental Laboratories Rule Changes, Glencoe, Illinois.

Illinois Water Conference 2014, Champaign-Urbana, Illinois.

APPENDIX I

MEETINGS AND SEMINARS 2014 (Continued)

Illinois Water Environment Association, Plant Operations and Maintenance Seminar, Loves Park, Illinois.

International Water Association Specialist Conference on Global Challenges: Sustainable Water Treatment and Resource Recovery, Kathmandu, Nepal.

iPACS (internet POTW Administrative and Compliance System), Annual User Group Conference, Brunswick, New Jersey.

Marquette University, Emerging Contaminants in Water and Wastewater Short Course, Milwaukee, Wisconsin.

University of Wisconsin-Madison, Essentials of Hydraulics for Civil and Environmental Professionals Course, Madison, Wisconsin.

November 2014

AGree Transforming Food & Ag Policy Event, Washington, D.C.

American Society of Agronomy, Crop Science Society of America and Soil Science Society of America International Annual Meeting, Long Beach, California.

American Water Works Association Webinars: Preparing for Ebola in the Water Sector, Webinar, Stickney Water Reclamation Plant, Cicero, Illinois.

Central States Water Environment Association 2014 Biosolids Mini-Seminar, Chicago, Illinois.

Technical and Policy Advisory Workgroup for the Asian Carp Regional Coordinating Committee, Chicago, Illinois.

Water Environment Federation: How We "See" Pathogens: Using Better Indicators to Detect Pathogen Presence, Webinar, Stickney Water Reclamation Plant, Cicero, Illinois.

Water Environment Federation and Water Environment Research Foundation, Wastewater Worker Safety: Addressing Concerns on Ebola in Wastewater, Webinar, Stickney Water Reclamation Plant, Cicero, Illinois.

APPENDIX I

MEETINGS AND SEMINARS 2014 (Continued)

December 2014

Great Lakes Commission Coastal Science Strategy Workshop, Mount Prospect, Illinois.

Northeastern Illinois Public Safety Training Academy, Hazardous Materials Incident Management System Event, Glenview, Illinois.

Public Health District, Ebola Response Table Top Exercise (TTX), Berwyn, Illinois.

APPENDIX II

APPENDIX II

PRESENTATIONS 2014

January 2014

None

February 2014

None

March 2014

"Fate and Behavior of Pharmaceuticals and Personal Care Products in Land Applied Biosolids," Presented at the Michigan Water Environment Association Annual Conference, Big Rapids, Michigan, by L. S. Hundal. PP

April 2014

"Converting Biosolids to Fertilizer, Where it Comes from, How it's Treated for Safe and Beneficial Uses, and Some Examples of Various Applications," Presented at the 4th Annual Earth Awareness Day and Exposition, South Suburban College, South Holland, Illinois, by L. S. Hundal. PP

"Monitoring Stormwater Best Management Practices in the Chicago Streetscapes Program," Presented at the Chicago Wilderness Congress, Track Greening Infrastructure, by J. Duncker, K. Kumar, and D. Leopold. PP

May 2014

"The Chicago River Microbiome Project: Tracking Microbial Sources," Presented at the American Society for Microbiology 2014 General Meeting, Boston, Massachusetts, by G. Rijal. PS

"Fate and Risk Characterization of Trace Organic Compounds in Land Applied Biosolids," Presented at the Water Environment Federation Residuals and Biosolids 2014, Sustainability Made Simple: Facilitating Resource Recovery, by L. S. Hundal. PP

APPENDIX II

PRESENTATIONS 2014 (Continued)

June 2014

"A Resource Recovery Perspective for Improving Quality and Productivity of Urban Soils," Presented at the Soil in the City Decennial Conference 2014, Chicago, Illinois, by D. Brose, K. Kumar, L.S. Hundal, A. Cox, H. Zhang, and T. Granato. PP

"Challenges to Urban Stormwater Management in the 21st Century." Presented at the Soil in the City Decennial Conference, Chicago, Illinois, by T. C. Granato. PP

"Performance and Challenges of Stormwater Management Using Green Infrastructure at Sustainable Greenscapes," Presented at the Soil in the City Decennial Conference, Chicago, Illinois, by J. Duncker and K. Kumar. PP

July 2014

None

August 2014

None

September 2014

None

October 2014

"Brownfields and Renewing Urban Soils: A Resource Recovery Approach," Presented at Purdue University, West Lafayette, Indiana, by D. Brose. PP

"Fate and Risk Characterization of Trace Organic Compounds in Land Applied Biosolids," Presented at the Marquette University's Two Day Short Course "Fate, Effects, regulations and Public Relations related to Micropollutants in Drinking Water, Wastewater and Land Applied Biosolids," Milwaukee, Wisconsin, by L. S. Hundal and K. Kumar. PP

APPENDIX II

PRESENTATIONS 2014 (Continued)

"Implementation of a Site-Specific Enhanced Biological Phosphorus Removal Process (AAnO) Using Existing Infrastructure at the Stickney Water Reclamation Plant." Presented at the Water Environment Federation, Technical Exhibition and Conference 2014, New Orleans, Louisiana, by D. Qin. PP and PS

"Introduction to Activated Sludge: Micobiology, Processes and Modeling," Presented at the International Water Association Specialist Conference on Global Challenges: Sustainable Water Treatment and Resource Recovery, Kathmandu, Nepal, by G. Rijal. PP

"Microbiological Assessment of Enhanced Biological Nutrient Removal Processes at the Metropolitan Water Reclamation District of Greater Chicago," Presented at the International Water Association Specialist Conference on Global Challenges: Sustainable Water Treatment and Resource Recovery, Kathmandu, Nepal, by G. Rijal. PP

"Shortcut Biological Nitrogen Removal for Sustainable Wastewater Treatment and Achieving Energy Neutrality." Presented at 2014 Illinois Water Conference in Champaign-Urbana, Illinois, by F. Yang. PP

"Utility Forum: the Metropolitan Water Reclamation District of Greater Chicago," Presented at the International Water Association Specialist Conference on Global Challenges: Sustainable Water Treatment and Resource Recovery, Kathmandu, Nepal, by G. Rijal. PP

November 2014

"Metropolitan Water Reclamation District Initiatives and Regulatory Update." Presented at the Industrial Water, Waste and Sewage Group, November Monthly Meeting, Chicago, Illinois, by T. C. Granato and M. Joseph. PP

December 2014

"Metropolitan Water Reclamation District of Greater Chicago's Efforts of Implementing Enhanced Biological Phosphorus Removal at Its Major Water Reclamation Plants." Presented at the Metropolitan Water Reclamation District of Greater Chicago's Monitoring and Research Department's Monthly Seminar, Cicero, Illinois, by D. Qin and Y. Lefler. PP

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* PP=Available as PowerPoint Presentation
PS=Poster Presentation

APPENDIX III

APPENDIX III

PAPERS PUBLISHED 2014

Lukicheva, I., K. Pagilla, G. Tian, A. Cox, and T. Granato. "Enhanced Stabilization of Digested Sludge During Long-Term Storage in Anaerobic Lagoons." *Water Environment Research,* 86: 291-295, 2014.

Minarik T., J. Vick, M. Schultz, S. Bartell, D. Martinovic-Weigelt, D. Rearick, and H. Schoenfuss, "On-Site Exposure to Treated Wastewater Effluent Has Subtle Effects on Male Fathead Minnows and Pronounced Effects on Carp." *Journal of the American Water Resources Association,* 50(2): 358-375, 2014.

Zarraoniandia, I., J. Marcel, H. Ssegane, M. Urgun Demirtas, G. Rijal, M.C. Negri, J.A. Gilbert, "The Chicago River Microbiome Project: Tracking Pathogen Sources." *American Society for Microbiology,* General Meeting, Abstract Proceedings, 2014.

Zhai, W., D. J. Moschandreas, G. Tian, D. Venkatesan, and K. E. Noll. "Degradation Rate Model Formulation to Estimate Soil Carbon Sequestration from Repeated Biosolids Application." *Soil Science Society of America Journal,* 78: 238-247, 2014.

APPENDIX IV

APPENDIX IV
METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO
MONITORING AND RESEARCH DEPARTMENT 2014 SEMINAR SERIES

January 31, 2014 ***What is Community-Associated Methicillin-Resistant Staphylococcus Aureus (MRSA)?*** Professor Michael David, Assistant Professor of Medicine, Department of Medicine, University of Chicago, Chicago, Illinois

February 21, 2014 ***Metropolitan Water Reclamation District of Greater Chicago (District) Stickney Water Reclamation Plant Nitrification Upset and Response,*** Mr. Brett Garelli, Deputy Director of Maintenance and Operations, Maintenance and Operations Department (M&O), Mr. Joseph Cummings, Assistant Treatment Plant Operator I, M&O and Ms. Auralene Glymph-Martin, Senior Environmental Microbiologist, Monitoring and Research Department (M&R), District, Chicago, Illinois

March 28, 2014 ***Research in Algae for Nutrient Uptake,*** Professor Belinda Sturm, Department of Civil, Environmental, and Architectural Engineering, University of Kansas, Laurence, Kansas

April 25, 2014 ***Generating Energy through Co-Digestion Using Anaerobic Digesters at Wastewater Resource Recovery Facilities in the City of Fort Worth,*** Dr. Ana J. Pena-Tijerina, Technical Services Manager, Village Creek Water Reclamation Facility, Fort Worth, Texas

May 30, 2014 ***Fluorescence Spectroscopy to Quantify Treatment of Wastewater by Ozonation and Advanced Oxidation Processes: On Line Measurement of Trace Organics Removal,*** Professor Gregory Korshin, Department of Civil and Environmental Engineering, University of Washington, Seattle Washington

June 27, 2014 ***Maximizing Community Value: Social, Environmental and Financial Benefit/Cost Analysis at Seattle Public Utilities,*** Mr. Tim Steel, Principal Economist, Seattle Public Utilities, Seattle Washington

July 25, 2014 ***Chicago Beaches Innovative Water Quality Monitoring Approach to Predict Water Quality,*** Ms. Meredith Nevers, Research Ecologist, United States Geological Survey, Porter, Indiana and Ms. Cathy Breitenbach, Director of Green Initiatives, Chicago Park District, Chicago, Illinois

August 22, 2014 ***Fate of Engineered Nanomaterials in Wastewater Biosolids, Land Application and Incineration,*** Professor Paul Westerhoff, School of Sustainable Engineering and The Built Environment, Arizona State University, Tempe, Arizona

September 26, 2014 **Using Thermal Energy in Treated Wastewater Effluent for Building Heating and Cooling,** Mr. Gary Thalken, Sanitary Engineer, Waste Water Treatment Plant, Lincoln, Nebraska

October 24, 2014 ***Science of Climate and Change,*** Professor David Archer, Department of Geophysical Sciences, University of Chicago, Chicago, Illinois

November 21, 2014 **2014 Report Card for Illinois Infrastructure-Including Wastewater Sector**, Mr. Patrick Lach, President of the Illinois Section, American Society of Civil Engineers, Chicago Illinois

December 12, 2014 ***District's Endeavor to Implement Enhanced Biological Phosphorus Removal Update,*** Dr. Joseph Kozak, Supervising Environmental Research Scientist, M&R, District, Chicago Illinois

RESERVATIONS REQUIRED (at least 24 hours in advance); PICTURE ID REQUIRED FOR PLANT ENTRY
CONTACT: Dr. Heng Zhang, Assistant Director of Monitoring and Research, EM&R Division, (708) 588-4264 or (708) 588-4059
LOCATION: Stickney Water Reclamation Plant, Lue-Hing R&D Complex, 6001 West Pershing Road, Cicero, IL 60804; TIME: 1:30 P.M.
NOTE: These seminars are eligible for Professional Development Credits/CEUs

APPENDIX V

APPENDIX V

MONITORING AND RESEARCH DEPARTMENT NUMBERED REPORTS PUBLISHED DURING 2014

Report No.	Report Title	Author(s)	Date	Organization or Conference
2014-1	Annual Biosolids Management Report for 2013	M&R Department Lindo, P., L. S. Hundal, M. Patel, A. Cox, and H. Zhang	February 2014	United States Environmental Protection Agency (USEPA) Region 7
2014-2	Controlled Solids Distribution Report, Fourth Quarter 2013	M&R Department Oladeji, O.	February 2014	Illinois Environmental Protection Agency (IEPA)
2014-3	122nd and Stony Island Avenue Solids Management Area Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA
2014-4	Calumet East Solids Management Area Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA
2014-5	Calumet West Solids Management Area Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA
2014-6	Harlem Avenue Solids Management Area Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA
2014-7	Lawndale Avenue Solids Management Area Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA
2014-8	Ridgeland Avenue Solids Management Area Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA

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2014-9	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, Fourth Quarter 2013	M&R Department Lindo, P.	February 2014	IEPA
2014-10	Ambient Water Quality Monitoring in the Chicago, Calumet, and Des Plaines River Systems: A Summary of Biological, Habitat, and Sediment Quality During 2010	M&R Department Gallagher, D., J. Vick, T. Minarik, and J. Wasik	March 2014	Internal Report
2014-11	Calumet West Solids Management Area Monitoring Report, First Quarter 2014	M&R Department Lindo, P.	May 2014	IEPA
2014-12	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, First Quarter 2014	M&R Department Lindo, P.	May 2014	IEPA
2014-13	Lawndale Avenue Solids Management Area Monitoring Report, First Quarter 2014	M&R Department Lindo, P.	May 2014	IEPA
2014-14	Harlem Avenue Solids Management Area Monitoring Report, First Quarter 2014	M&R Department Lindo, P.	May 2014	IEPA
2014-15	122nd and Stony Island Avenue Solids Management Area Monitoring Report, First Quarter 2014	M&R Department Lindo, P.	May 2014	IEPA
2014-16	Calumet East Solids Management Area Monitoring Report, First Quarter 2014	M&R Department Lindo, P.	May 2014	IEPA

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2014-17	Ambient Water Quality Monitoring in the Chicago, Calumet, and Des Plaines River Systems: A Summary of Biological Sampling and Habitat Assessments During 2011	M&R Department Gallagher, D., J. Vick, N. Kollias, T. Minarik, and J. Wasik	May 2014	IEPA
2014-18	Controlled Solids Distribution Report, First Quarter 2014	M&R Department Oladeji, O.	June 2014	IEPA
2014-19	Continuous Dissolved Oxygen Monitoring In Chicago Area Wadeable Streams During 2013	M&R Department Minarik, T., D. Gallagher, J. Vick, and J. Wasik	July 2014	Internal Report
2014-20	Concentrations of Pharmaceutical and Personal Care Products in Influent, Effluent, and Waste-Activated Sludge and Biosolids in the Metropolitan Water Reclamation District of Greater Chicago's Seven Water Reclamation Plants	M&R Department Brose, D., A. Liao, L. Hundal, and A. Cox	July 2014	Internal Report
2014-21	Continuous Dissolved Oxygen Monitoring in the Deep-Draft Chicago Waterway System During 2013	M&R Department Minarik, T., D. Gallagher, J. Vick, and J. Wasik	July 2014	IEPA
2014-22	Odor Monitoring Program at the Metropolitan Water Reclamation District of Greater Chicago's Solids Drying and Solids Processing Facilities During 2013	M&R Department Oskouie, A.	July 2014	Internal Report
2014-23	Controlled Solids Distribution Report, Second Quarter 2014	M&R Department Oladeji, O.	August 2014	IEPA

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2014-24	Lawndale Avenue Solids Management Area Monitoring Report, Second Quarter 2014	M&R Department Brose, D.	August 2014	IEPA
2014-25	122nd and Stony Island Avenue Solids Management Area Monitoring Report, Second Quarter 2014	M&R Department Brose, D.	August 2014	IEPA
2014-26	Harlem Avenue Solids Management Area Monitoring Report, Second Quarter 2014	M&R Department Brose, D.	August 2014	IEPA
2014-27	Calumet West Solids Management Area Monitoring Report, Second Quarter 2014	M&R Department Bose, D.	August 2014	IEPA
2014-28	Calumet East Solids Management Area Monitoring Report, Second Quarter 2014	M&R Department Brose, D.	August 2014	IEPA
2014-29	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, Second Quarter 2014	M&R Department Brose, D.	August 2014	IEPA
2014-30	Shortcut Biological Nitrogen Removal Methodologies Literature Review	M&R Department Yang, F., J. Kozak, and H. Zhang	September 2014	Internal Report
2014-32	Tunnel and Reservoir Plan Calumet Tunnel System Annual Groundwater Monitoring Report 2013	M&R Department Brose, D.	September 2014	IEPA
2014-33	Tunnel and Reservoir Plan Des Plaines Tunnel System Annual Groundwater Monitoring Report 2013	M&R Department Brose, D.	September 2014	IEPA

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2014-34	Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report 2013	M&R Department Brose, D.	September 2014	IEPA
2014-35	Tunnel and Reservoir Plan Upper Des Plaines Tunnel System Annual Groundwater Monitoring Report 2013	M&R Department Brose, D.	September 2014	IEPA
2014-36	Tunnel and Reservoir Plan Mainstream Tunnel System Annual Groundwater Monitoring Report 2013	M&R Department Brose, D.	September 2014	IEPA
2014-37	Chlorine Disinfection Process Control Evaluation at the John E. Egan Water Reclamation Plant	M&R Department Bernstein, D.	October 2014	Internal Report
2014-38	Stickney Phosphorus Task Force Technical Memorandum No. 1 Guidance for Battery Conversion to Enhanced Biological Phosphorus Removal for the Stickney Water Reclamation Plant	M&R Department Kozak, J., C. Qin, Y. Lefler, J. Cummings, B. Garelli, and G. Rohloff	October 2014	Internal Report
2014-39	Stickney Phosphorus Task Force Technical Memorandum No. 2 Enhanced Biological Phosphorus Removal Approach at the Stickney Water Reclamation Plant and Dissolved Oxygen Control Summary	M&R Department Kozak, J., C. Qin, Y. Lefler, J. Cummings, B. Garelli, and G. Rohloff	October 2014	Internal Report

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2014-40	Stickney Phosphorus Task Force Technical Memorandum No. 3 Summary of Influential Parameters for Enhanced Biological Phosphorus Removal at the Stickney Water Reclamation Plant	M&R Department Kozak, J., C. Qin, Y. Lefler, J. Cummings, B. Garelli, and G. Rohloff	October 2014	Internal Report
2014-41	Stickney Phosphorus Task Force Technical Memorandum No. 4 Battery D Solids Deposition Summary	M&R Department Kozak, J., C. Qin, Y. Lefler, J. Cummings, B. Garelli, and G. Rohloff	October 2014	Internal Report
2014-42	Stickney Phosphorus Task Force Technical Memorandum No. 5 Stickney Bio-P Influent Channel and Mixed Liquor Fermentation Summary	M&R Department Kozak, J., C. Qin, Y. Lefler, J. Cummings, B. Garelli, and G. Rohloff	October 2014	Internal Report
2014-43	Calumet Phosphorus Task Force Technical Memorandum No. 1 Evaluation of Carbon Addition Technologies for the Calumet Water Reclamation Plant – Summary of Available Carbon Addition Technologies Based on Literature Information	M&R Department Kozak, J., C. Qin, Y. Lefler, P. Connolly, B. Perkovich, and T. Conway	October 2014	Internal Report
2014-44	Calumet Phosphorus Task Force Technical Memorandum No. 2 Evaluation of Carbon Addition Technologies for the Calumet Water Reclamation Plant – Calumet Water Reclamation Plant Carbon Demands and Possible Technologies	M&R Department Kozak, J., C. Qin, Y. Lefler, P. Connolly, B. Perkovich, and T. Conway	October 2014	Internal Report

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2014-45	Calumet Phosphorus Task Force Technical Memorandum No. 3 Evaluation of Carbon Addition Technologies for the Calumet Water Reclamation Plant – Evaluation Matrix Ratings and Results	M&R Department Kozak, J., C. Qin, Y. Lefler, P. Connolly, B. Perkovich, and T. Conway	October 2014	Internal Report
2014-46	Radiological Monitoring of the Raw Sewage, Final Effluent, Sludge, and Biosolids of the Metropolitan Water Reclamation District of Greater Chicago Annual Report 2013	M&R Department Vick, J.	October 2014	Internal Report
2014-47	2013 Annual Summary Report Water Quality Within the Waterways System of the Metropolitan Water Reclamation District of Greater Chicago	M&R Department Abedin, Zainul	November 2014	IEPA
2014-48	122nd and Stony Island Avenue Solids Management Area Monitoring Report, Third Quarter 2014	M&R Department Brose, D.	November 2014	IEPA
2014-49	Calumet East Solids Management Area Monitoring Report, Third Quarter 2014	M&R Department Brose, D.	November 2014	IEPA
2014-50	Calumet West Solids Management Area Monitoring Report, Third Quarter 2014	M&R Department Brose, D.	November 2014	IEPA
2014-52	Lawndale Avenue Solids Management Area Monitoring Report, Third Quarter 2014	M&R Department Brose, D.	November 2014	IEPA

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2014-53	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, Third Quarter 2014	M&R Department Brose, D.	November 2014	IEPA
2014-54	Stickney Phosphorus Task Force Technical Memorandum No. 6 Evaluation of Ortho-Phosphate Release using Waste Activated Sludge Stripping to Remove Internal Phosphorus at the Stickney Water Reclamation Plant	M&R Department Lefler, Y., K. Patel, J. Kozak, and H. Zhang	November 2014	Internal Report
2014-55	Ambient Water Quality Monitoring in the Chicago, Calumet, and Des Plaines River Systems: A Summary of Biological Sampling and Habitat Assessments During 2012	M&R Department Gallagher, D., N. Kollias, J. Vick, T. Minarik, and J. Wasik	July 2014	IEPA
2014-56	Monitoring and Research Department 2013 Annual Report	M&R Department Granato, T., H. Zhang, and A. Cox	October 2014	Internal Report
2014-57	Controlled Solids Distribution Report, Third Quarter 2014	M&R Department Oladeji, O.	December 2014	IEPA
2014-58	Re-Evaluation of Local Pretreatment Limits	M&R Department Kumar, K., G. Yarnik, T. Denning (Retired), D. Moe, D. MacDonald, L. Hundal, H. Zhang, and T. Granato	December 2014	USEPA Region 7/ IEPA

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2014-59	Concentrations of Nonylphenol Diethoxylate, Nonylphenol Monoethoxylate, 4-Nonylphenol, 4-TERT-Octylphenol, and Bisphenol A in Influent, Effluent, and Biosolids and Sludge in the Metropolitan Water Reclamation District of Greater Chicago's Seven Water Reclamation Plants	M&R Department Brose, D., A. Liao, L. Hundal, and A. Cox	December 2014	Internal Report