

"Grind It, Pump It, Screen It... Current Best Practices in Handling Collection Systems Modern Trash"

Bob Domkowski Engineering Consultant Xylem, Inc. – Flygt Products



Do You Recognize Photos Like These? Modern trash challenges











Flushable does not mean 'Flow-able'!

Collection System and Treatment Modern trash challenges









Handling Modern Trash: Current utility choices...



Grind it



Pump it



Screen it





Background Information

Recent News Quotes:



- "85% to 90% of all backups seen today are preventable and are caused by non-flushables"
 - Jerry Ledbetter, Environmental Dept.. City of Claremore, OK
- *"We take out 2 to 3, 5-gallon buckets of wipes every week from each (sewage) pump station "*
 - Pete Jones, Ocean City, MD
- "Wipes are clogging up sewers like nothing else sewer workers have ever seen!"
 - Anne Heyden, San Antonio (TX) River Authority
- *"It's good news for me but bad news for the public"*
 - Scott Levin, Levin Pipe Cleaning Services

What To Flush Quiz...



What items is a collection system designed to handle?

- Toilet paper
- Flushable wipes
- Poop
- Paper hand towels
- Facial tissue
- Dental floss
- Toilet wand pads
- Pee
- Feminine hygiene items
- Cleaning wipes

What To Flush Quiz...



What items is a collection system designed to handle?

- Toilet paper
- Flushable wipes

• Poop

- Paper hand towels
- Facial tissue
- Dental floss
- Toilet wand pads
- Pee
- Feminine hygiene items
- Cleaning wipes

Only 3!



Typical "Modern Trash" Non-woven sheet goods

- Typical manufacturing process:
 - Needle punch
 - Thermal bonding
 - Spunlace
 - Wet layup (Newer)

Typical commercial products

- Household wipes (35% Market)
- Personal care (28% Market)
- Baby wipes (20% Market)
- Cleaning/Cleansing (10% Market)
- Toilet bowl scrubbing pads
- Dryer sheets
- <u>3-4 new products monthly!</u>







Wipes: 2011 – 2020 Market Sales





Wipes – Continued Growth



Portability and convenience, coupled with the hygiene aspect of single usage, has popularized wipes among consumers...

- American market growth will be driven by:
 - Improved economy and higher disposable incomes.
 - Consumers recognize wipes are multi-purpose products
 - Perform same cleaning functions as using liquids and rags
 - Wipes reduce supplies needed; purchased of convenience
- Large, established baby wipes category:
 - Driven by gains in the infant population.
 - Further growth as consumers use wipes for personal use
 - Some reduction as consumers who used less expensive baby wipes for non-diaper applications during economic downturn return to task-specific wipes

Some Newer Non-woven Goods Products

- Personal Care / Specialized Wipes Category
- \$2.8Bn (2017) -> \$4.1Bn (2021)
- Highest net margin segment
 - Make-up removal wipes
 - Personal cooling wipes
 - Bug repellent wipes
 - Self-tanning product wipes









Wipes – Current Trends (Fredonia Report)



- U.S. Wipes demands and sales forecast:
 - Sales have increased by 5.1% per year through 2016
 - Will increase by 3.6% per year through 2018
 - Will increase to \$4.8Bn sales
 - Largest segment gains:
 - Disinfectant wipes / Electrostatic wipes (Dust control)

Competitive landscape:

- P & G (28%)
 - Pads Swiffer-brand floor cleaning
 - Paper brand home care and baby wipes
- J & J (27%)
 - Neutrogena-brand facial and make-up removal wipes

Current Trends - Legal and Legislation



- Wyoming, WI sues (6) wet-wipe manufacturers
 - "Flushable wipes clogging collection system"
 - "Wipes are not degrading"
 - "Significant costs to the city"
 - (4) manufacturers settle with the City
 - Kimberly-Clark is one manufacturer who is fighting
 - Blame is on consumers who flush any and all products
 - K-C "Flush-Clean" flushable wipes do break-down
- Washington, D.C. law severely restricting "flushables"
 - Kimberly-Clark is suing D.C. law violates provisions of the U.S. Constitution
 - Maintain that K-C 'flushable' products do degrade

Flushability - Modern Trash Quest to become unrecognizable...









Toilet paper (1-min) Current wipes (24-hours)

Hydraspun[™] substrate (20 min to1-hour)



A Mr. Wizzard Experiment



Non-Dispersibles - Price Pyramid





Sales Volume

Non-dispersibles and FOG



- Non-dispersibles are wonderful filtration products...
- Traveling through the collection system they filter:
 - Grit
 - Fats / Oils / Grease
 - Biological material
 - Sand
- Significantly increases surface tension of the non-dispersible
- Materials easily combine and build into large masses



Non-dispersibles and FOG

- FOG + Non-dispersibles combine to create huge challenges for Collection System operators
- "FOG is the mortar, wet-wipes the bricks..."
 - Becky Trotman, Thames Water







Non-dispersibles and FOG

- Combine Until...
 - Laterals clog
 - Conveying lines clog
 - Pumps clog
 - Valves clog
 - Screens blind
 - Huge masses are formed
 - London's 15-ton "Fatburg"
 - 93% of clogs
 - Baltimore overflow
 - Toronto clogs
 - OCSD 971 pump de-rag ops







Typical WWTP (Diurnal) Curve





Sewage flow duration pattern for a typical municipality

Portland Water District (PWD), Portland, ME 'Awareness campaign'







Complications of 'Modern Trash' *"Environment 1992 Conference"*



"Flushability, Transportation and Decomposition of Non-woven Products"

Foretold challenges due to:

- Reduced water component in wastewater
 - EPAct (1994) reduced toilet flush volume to 1.6 gallons
 - Low-flow shower heads
 - Now... Even 'waterless urinals'

•Explosive growth of flushable product sales

+10% market growth per year

Laboratory and field studies predicted

- Difficulties in developing wipes that met both:
- Consumer demands
- Possible regulation

INDA: The Industry's Take on Wipes...





INDA - Flushability Project



Flushability Project... What is flushable?

- 'Flushability' has been left up to individual manufacturers
- High risk to systems:
 - -Non-woven products harm both homeowners and municipalities
- INDA Develops standardized product test rig
 - Products can be compliance tested
- INDA external experts have developed a test program
- Flygt is one such 'external expert' consultant to INDA
 - -I am a consultant to Kimberly-Clark, Proctor & Gamble and WEF

Original Flushability Test... Will flushables make it through the 'S' bend?









Flygt's Laboratory Impeller Clog Testing Professional Clog-Test Rig



Flushability Assessment Decision Tree Product labeling to comply with Code of Practice





Note:

Flygt 3085 3-hp submersible pump is the basis of INDA standardized flushability test for product certification

Today's reality: MWWCA Membership *A Recent Collection System Operations Survey*



87.5% experienced problems with "flushable' products.

61.4% experienced >10 incidents with "flushable" items

84.4% clogging problems in small lift stations due to "flushables"

51.1% clogging problems in large lift stations due to "flushables"

59.6% Costs due to 'flushables' is up to \$1,000 per incident

12.8% Costs due to 'flushables' of up to \$2,000 per incident

88.9% Report that problems with "flushables" are increasing

In 2011: <u>Average annual cost</u> for each Maine city = \$37.5K

Collection System Headaches: 2013 Orange County (Ca.) Sanitary District



- (2) WWTP with total capacity of 210MGD
- Collection system size: (2.3M people)
 - 587 miles of conveying lines (OCSD)
 - 4,513 miles of satellite lines (Others)
 - OCSD owns15 pumping stations





Collection System Headaches: 2013 Orange County (Ca.) Sanitary District



- (2) WWTP with total capacity of 210MGD
- Collection system size:
 - 587 miles of conveying lines (OCSD)
 - 4,513 miles of satellite lines (Others)
 - OCSD owns15 pumping stations
- In 2012-2013 OCSD:
 - Conducted 971 corrective de-ragging actions
 - Spend \$320,000 de-ragging pumps
- Worst single day recorded:
 - I0 employees took 8-hours to clear 5 P.S.
 - (40) 35-gal contractor trash bags of debris were removed from the (20) pump units



NYC DEP – Wastewater Treatment Non-flushable problems



- DEP has spent \$18M over past 6 years manually removing wipes from their collection system
- DEP carts away 110,000 yd³/mo. from WWTPs
 - Waste volume has doubled in past 5 years
 - Estimates: 55,000 yd³ / mo. are non-dispersibles



INDA Case Study: Town of Moraga, Costa County, CA



- Significant number of pump clog incidents per month
- 3" bar screen replaced with 1.5" bar screen
- Case study results:
 - Increased frequency of bar screen cleaning
 - Bar screen blinding by 'pan-caking' of brown towel sheets
 - While reduced, 6-in pumps each still clogged 3-4 times /mo.



Town of Moraga, Costa County, CA Recorded wastewater trash distribution





Case Study: Town of Moraga, Costa County, CA

Pump clogs mainly consisted of:

- Long, twisted, knotted formations
 - Strong non-woven materials
 - Long fibrous products:
 - Personal hygiene products
 - Household cleaning wipes
 - Personal wipes





Town of Moraga, Costa County, CA Typical pump clog sample



Washed pump clog debris





Decomposed debris clog



Modern Wastewater: Wastewater pumping is a tough application!



Courtesy of Jacksonville Electric Auth. (~1,200 Pump stations)



Courtesy of San Antonio River Auth. (Collection system:189 mi.)



Modern Wastewater: Wastewater pumping is a tough application!



Courtesy of City of Peoria, AZ (24 Pump stations)



A Pumping Perspective

Solids-handling Pumps – An historical overview...



- Mr. A. Baldwin Wood 1915
- Assistant Superintendent, New Orleans S & WB
- *"Father of the 'non-clog' wastewater pump"* developed the Wood "Trash Pump"



Typical 2-channel solids-handling impeller... Large throughlets, blunt <u>vertical</u> vane leading edges

Descendants of the "Wood Trash Pump" 2-channel impeller with blunt vertical leading edges







Mechanical failures

Answer Is Not Larger Impeller Throughlets!



(3) 16-in. dia. pumps are equipped with impellers having2 x 4.5-in. dia. throughlets... each clog regularly!



Modern Technology Pump Hydraulics

Self-cleaning hydraulics providing sustained high hydraulic efficiency

Horizontal vane leading edge

Vane <u>edges are wiped clean</u> at the interface of the relief-groove during each rotation





CEE Consortium for Energy Efficiency



National Municipal Water and Wastewater Facility Initiative

Municipal water and wastewater systems

- Consumes 4% of all U.S. energy
- 52,000 water systems produce 51Bn gallons of water per day
- 16,320 wastewater treatment facilities treat 34.8Bn gallons per day
- Greatest energy consumer in <u>water treatment</u>: **Pumps**
- Greatest energy consumers in <u>wastewater treatment</u> are:
 - -1. Blowers
 - -2. Pumps
 - -3 Sludge handling equipment

Potential energy savings: By motor hp and application (Source: WEF)









A Grinding Perspective

Modern Trash: Grind It



- Comminutor manufacturers Improved designs
 - Minimize long material string passage
 - Promote smaller square cuttings





- But... Where do you take it out?
 - -Using fine screens?
 - -At your clarifier?
 - -In your sludge?
- Sludge disposal...
- Re-knitting issues

Modern Trash: Grind It



- Newer lift-station products
 - Combination comminutor products
 - Screens w/ vertical augers
 - Can minimize P.S. issues
 - Additional equipment to maintain
 - Possible waste collection challenges
 - Hiding equipment
 - Local odors
 - Vermin



A Screening Perspective

Wipes: Screen It – Current Guidelines

- Screening systems improved designs
 - Bar screens (25-mm / 1-in) wide
 - More frequent cleaning cycle











Modern Trash: Screen It – Current Guidelines

- Screening systems improved designs
 - Perforated screens (13mm / ½-in) diameter
 - Frequent brush-cleaning
 - High pressure water wash









"Flushable" wipes causing problems for Thiensville sewer system

Posted on: 9:05 pm, January 15, 2013, by Jenna Sachs





THIENSVILLE (WITI) — Cleaning wipes and towels advertised as "flushable" have been causing problems in Thiensville! If it weren't for workers removing these "flushable" items from the Thiensville sewer system on a daily basis, the system could be in danger of failing.



"Flushable" wipes causing problems for Thiensville sewer system

Posted on: 9:05 pm, January 15, 2013, by Jenna Sachs

Pinterest

8

Recommend





Share

11

Twitter

3

Email

"While public education is important, ultimately we need to invest in improved, modern equipment that can handle this material" Public Works Director – Andy LaFond

THIENSVILLE (WITI) — Cleaning wipes and towels advertised as "flushable" have been causing problems in Thiensville! If it weren't for workers removing these "flushable" items from the Thiensville sewer system on a daily basis, the system could be in danger of failing.

The Director of Public Works Andy LaFond says the blame lies with convenience products, often labeled as "flushable" — including disinfecting wipes, mop refills, toss-in toilet bowl wands and baby wipes.



Putting It All Together

Putting It All Together



 'Modern trash' / non-woven sheet goods / FOG have became the No. 1 enemy of collection systems

- Conventional solids-handling pumps (Wood Trash Pump) proven not to be able to handle 'modern trash'
- Public education so far seems to have a limited benefit
- Maintenance budgets are strained due to needs to repeat pump pulling/cleaning actions
- Problem is getting worse each month
- Proven pump, grinding and screening solutions exist that deliver sustained efficiency and greatly minimize maintenance
- Each utility needs to select the best practice to suit their needs and budgets



"Grind It, Pump It, Screen It... Current Best Practices in Handling Collection Systems Modern Trash"

Bob Domkowski Engineering Consultant Xylem, Inc. – Flygt Products

