



***GOT A MINUTE?***

**. . . I HAVE ANOTHER QUICK  
GENERATOR QUESTION.**

Or...

***STATIONARY AND PORTABLE  
STANDBY GENERATOR DESIGN  
CONSIDERATIONS FOR WATER  
AND WASTEWATER  
PROFESSIONALS***



# PRESENTED BY

- Steve Muther, P.E.
- Mark Brunner, P.E.



**Wisconsin Wastewater Operators Association  
2019 Conference**



# PURPOSE

- To equip municipal personnel with knowledge regarding the many factors to consider when specifying or selecting a standby generator.



- What regulations do I need to know about?
- DNR?
- Any others?



# REGULATORY REQUIREMENTS

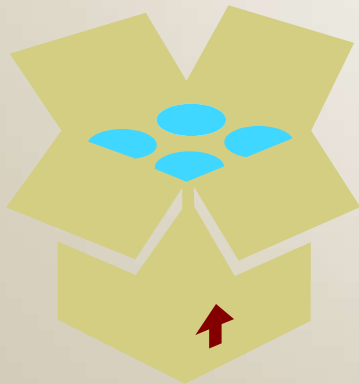
- Wisconsin Administrative Codes (Many)
- IBC – International Building Code(s)
- NFPA – National Fire Protection Association
- NEC – National Electrical Code
- Utility Company Requirements (Gas and Electric)
- EPA – Environmental Protection Agency
- UL – Underwriters Laboratories

- Where should it go?
- Location
- Location
- Location



# PACKAGING

- Indoor
- Outdoor
- Portable (Towable)





# Indoor

- BUILDING
  - HVAC
  - ELECTRICAL
  - FUEL STORAGE (LIMITS)
- MAINTENANCE
  - EASY ACCESS
  - PROTECTED
- AESTHETICS



# Outdoor

- Clearances and Setbacks
  - BUILDING
  - UTILITY SERVICE
  - TANK
- Orientation
  - PREVAILING WINDS
- ENCLOSURE OPTIONS
  - SOUND
  - COLOR
  - CORROSION RESISTANCE
  - RODENT RESISTANCE



# Outdoor

THIS PRINT SUPERSEDES ANY EARLIER DATE. DESTROY SAME			
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ORIGINAL ISSUE	4/1/2019	

**NOTES**

- COLLISION PROTECTION BARRIERS REQUIRED FOR UNITS IN VEHICLE TRAFFIC AREAS SEE CODE: ATCP 93.430 OCT 2013
- MIN DISTANCE FROM LOT LINE PER NFPA 30 TABLE 2.3.2.1.1 (b)
  - <275 GAL FUEL TANK 5 FT
  - 275 TO 750 GAL FUEL TANK 10 FT
  - >750 GAL FUEL TANK 15 FT

**SETBACKS FROM EXISTING POTABLE WATER SUPPLIES: ATCP 93.260 TABLE 93.260**

POTABLE WATER SUPPLY SETBACKS TANK TYPE	MIN DISTANCE TO WATER SUPPLY REGULATED BY NRS11	MIN DISTANCE TO WATER SUPPLY REGULATED BY NRS12
FARM LIST OR AST W/ SINGLE WALL	1200	100
FARM LIST W/ DOUBLE WALL W/ ELECTRONIC INTERSTITIAL MONITORING	600	50
FARM AST W/ DOUBLE WALL OR OTHER SECONDARY CONTAINMENT UNDER A CANOPY	600	50
ONE OR TWO FAMILY RESIDENTIAL HEATING OIL LIST OR AST SYSTEM	300	25
EMERGENCY OR STANDBY POWER SYSTEM AST W/ DOUBLE WALL AND CONTINUOUS ELECTRONIC INTERSTITIAL MONITORING	10	10
OTHER LIST OR AST SYSTEM W/ SINGLE WALL	1200	100
OTHER LIST SYSTEM W/ DOUBLE WALL AND WITH ELECTRONIC INTERSTITIAL MONITORING	600	50
OTHER AST SYSTEM W/ DOUBLE WALL, OR W/ OTHER SECONDARY CONTAINMENT THAT IS UNDER A CANOPY, AND W/ ELECTRONIC INTERSTITIAL MONITORING FOR DOUBLE WALL OR ELECTRONIC SENSOR FOR OTHER SECONDARY CONTAINMENT	600	50

**\*\*\*THIS IS A GUIDE ONLY\*\*\***

- PLEASE REFER TO GUIDELINES FOUND IN WISCONSIN ADMINISTRATIVE CODE CHAPTER ATCP 93
- CHECK LOCAL ORDINANCES AS THEY MAY BE MORE RESTRICTIVE THAN WI STATE CODE

ITEM NO.	QTY.	DESCRIPTION	MATERIAL
↑ PARTS LISTING ↓			
DWG NO.	PROJECT NO.	PART NO.	REV.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:			
DECIMALS	FRACTIONS		
.X ± .006	± 1/32		
.XX ± .030			
.XXX ± .010			
SURFACE FINISH	ANGLES		
✓ MAX	± 1/2°		
TOTAL ENERGY SYSTEMS RESERVES THE RIGHT TO SUBMIT THIS DRAWING TO CHANGES WITHOUT PRIOR NOTICE.			
SCALE: AS SHOWN		SHEET: SHEET 1 of 1	

# Portable/Towable

- Storage Location
- Tow Vehicle
- Loads to be Served
- Cord Storage
- Cord End Receptacle
- Options No Longer Available
  - Multiple Output Voltages
  - Multiple Plug Configurations

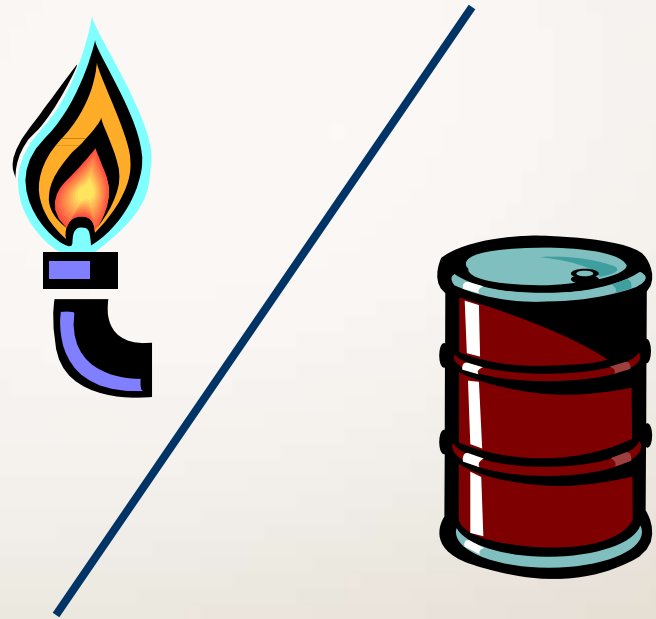


# COST COMPARISON

	STANDBY	TOWABLE
• 50 KW DIESEL	\$25,250	\$34,500
• 125 KW DIESEL	\$34,250	\$71,500

# FUEL

- Diesel
- Natural Gas
- LP



# DIESEL

- Wisconsin Requirements for Fuel System
  - Permit Required for Diesel Tanks
- Fuel Conditioning
- Exercise Under Load
- Impact of Recent EPA Requirements
- Sizing considerations
  - Typically want to exercise under load to at least 1/3 of capacity.

# NATURAL GAS and LP

- Typically 125 KW and Below
  - Cost Escalates at 150 KW and Above.
- Fuel Availability Considerations
  - Gas service may be curtailed in a severe storm
- LP as Primary or Back-up Option
  - Vaporizer may be required.



# COST

## NATURAL GAS vs. DIESEL

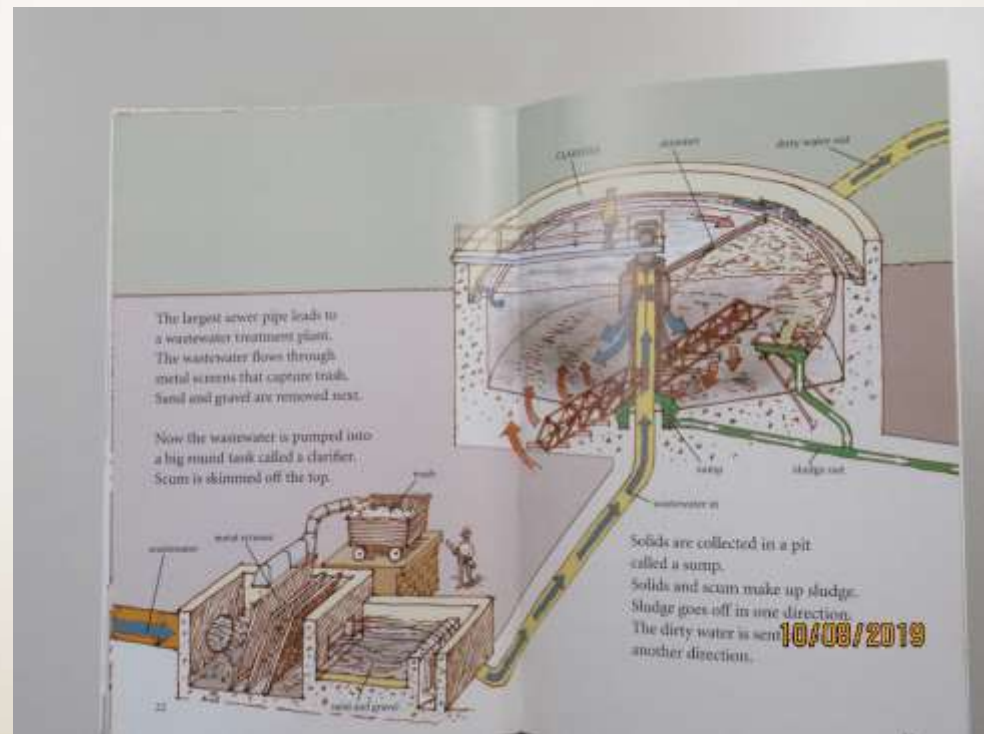
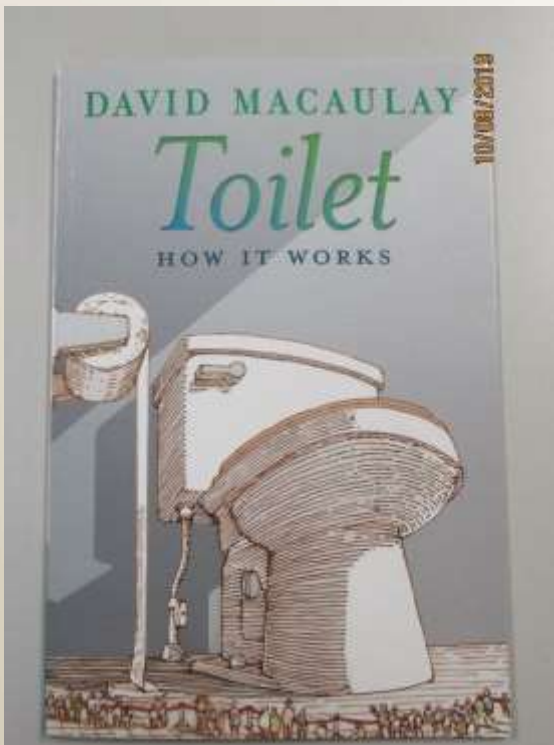
<u>KW</u>	<u>Nat Gas</u>	<u>Diesel</u>
125kW	\$30,900.00	\$36,440.00
150kW	\$42,400.00	\$38,080.00
180kW	\$74,560.00	\$43,246.00

# PRODUCT GRADE

- Used/Surplus
- Residential/Commercial
- Industrial



# A BRIEF WORD FOR CHILDREN TOILET! A BOOK BY DAVID MACAULAY



# USED/SURPLUS

- Age and Run Hours
- Availability of Parts and Service
- Design Life of Project vs. Equipment Life
- Cost of Testing and Refurbishing
- Evaluation of Risk/Benefit
- EPA Considerations
  - Are You the Current Owner?
  - Does it meet Current EPA Emissions?
- "If in Doubt . . . Throw It Out!"



# RESIDENTIAL/ COMMERCIAL



- Significant Construction Differences
- Limited Fuel Options
- Limited Generator/ATS Options
- Service and Support

# INDUSTRIAL

- Product Quality
- Service and Support
- Extended Warranty
- Long Term Parts Availability



# Sizing Considerations

"You'll never earn a gold star  
for under sizing a generator!"

Abraham Lincoln

# MOTOR AND LOAD TYPES

- Motor Starting Code Letter
- **Submersible Centrifugal Pumps**
- High Inertia Loads
- VFD/AFD Applications
- Constant Torque vs. Variable Torque
- Single Phase Loading





# MOTOR STARTER TYPES

- Across the Line (FVR, FVNR)
- Reduced Voltage (SSRV)
- Drives (VFD/AFD)

# LOAD CONTROL STRATEGIES

- Identify Critical Loads
- Hard-wired Control
- Load Shedding through Plant PLC

# TRANSFER SWITCHES

- Manual
- Automatic
  - Paralleling
  - Distributed Generation
- Grounding and Bonding!

# MANUAL TRANSFER SWITCH

- Chosen for Smaller, Less Critical Applications
- Double Throw Switch (no overcurrent protection)
- Service Entrance Rated Mechanically Interlocked Circuit Breakers with Utility Main Breaker and a "SUSE" Label.
- Kirk-Key Interlocked (No longer allowed by Alliant)

# AUTOMATIC TRANSFER SWITCH

- Unattended Operation
- Permanent/Fixed or Portable Generator Installations
- Adjustable Control Parameters
- Metering and Event Logging
- Packaged with Generator
- Enclosure Options - Indoor/Outdoor/MCC

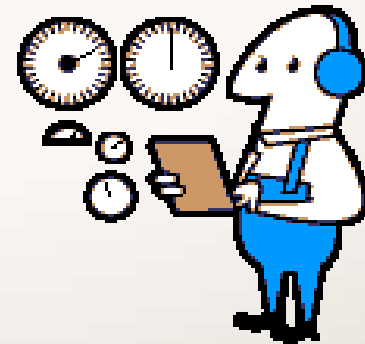
# AUTOMATIC TRANSFER SWITCH

- Combined Main Disconnect/ATS
- 3-pole or 4-pole
- Open or Closed Transition



# MONITORING/MAINTENANCE

- Monitoring Options
  - Local Basic
  - Analog or Digital
  - Remote Annunciator
  - Dry Contacts to SCADA
  - Network SCADA Interface
  - Remote Wireless (via Generator supplier)



# MONITORING/MAINTENANCE

- Exercising
  - Manual
  - Automatic
  - Load
  - No-Load
- Minimum is Once per Month.
  - Recommend Weekly, Under Load
  - Annual or Every Two Years for Lightly Loaded Diesels





# CONCLUSIONS



- Each project has unique requirements.
- It's important to evaluate your options with appropriate from Supervisors, Operators, Engineer, and Generator Suppliers.

# CONCLUSIONS



- Standby Power Systems are critical components in reliable water and wastewater systems.
- Recognize and evaluate the appropriate factors when selecting your next standby generator.



Steve Muther, P.E.  
Mark Brunner, P.E.

608-273-3350  
[www.tcengineers.net](http://www.tcengineers.net)

