How Pump Tanks can be used to Communicate the Need for Maintenance to the Customer

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- Thank you to Consortium of Institutes for Decentralized Wastewater Treatment for materials assisting this presentation

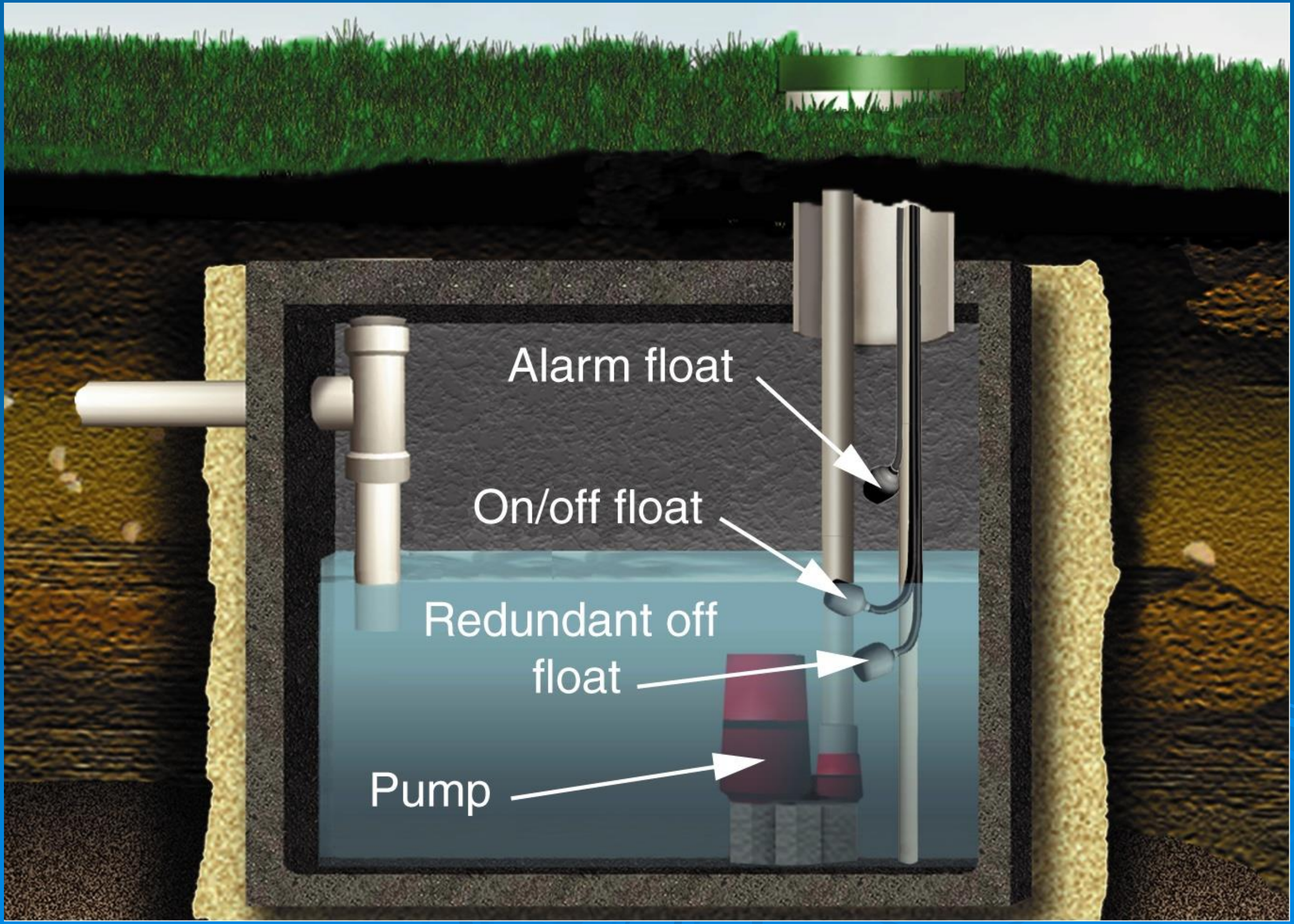
Overview

- Pump tank systems
- Location in the treatment system
- What does a clean/dirty pump tank communicate
- Control panel components
- Calculating flow from a facility
- High water alarms –what does an alarm mean

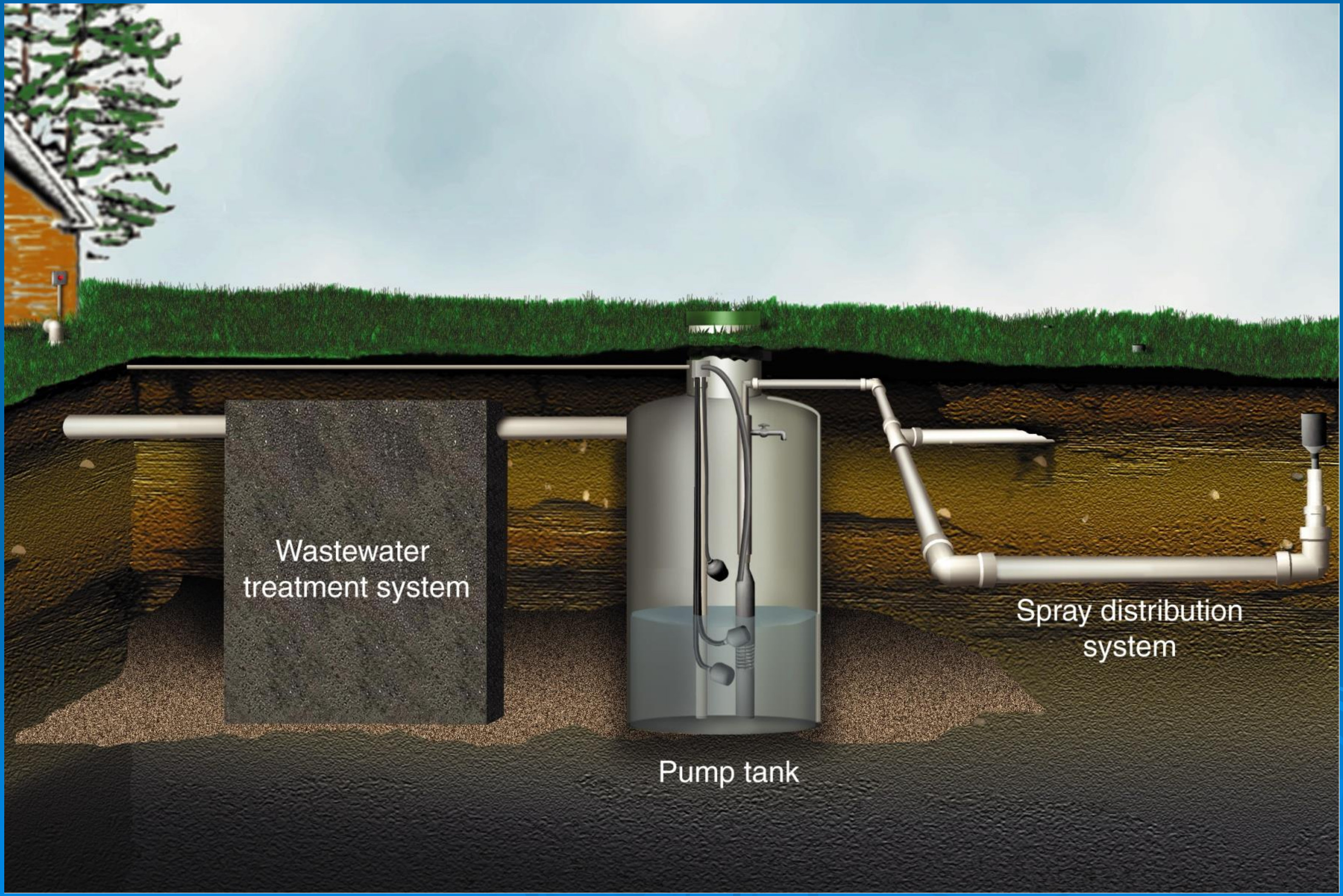
Pump Tank Systems

- Component of pressurized distribution systems
  - Pump tank
  - Pump
  - Water level sensors, generally floats
  - Control panel
  - High water alarm

Pump Tank



Pump Tank / Spray System

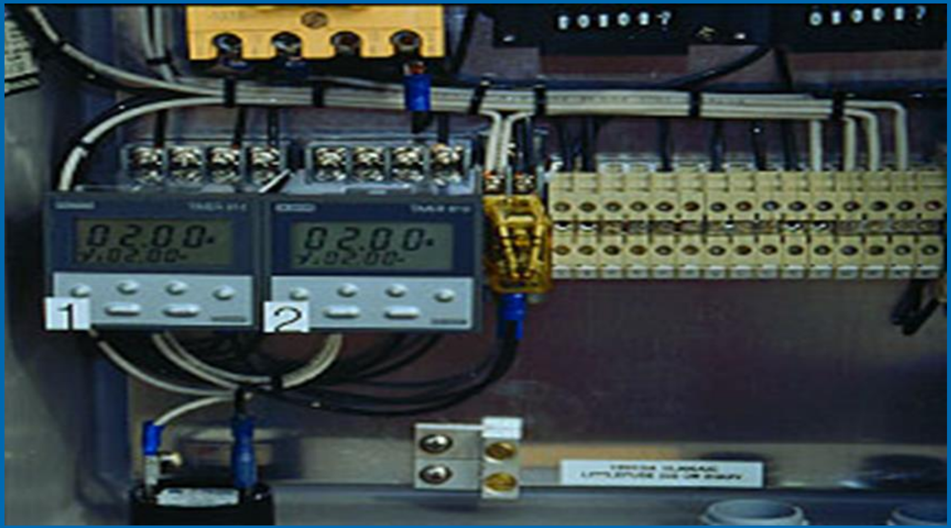


Water Quality in Pump Tank?

- Water runs through components to pump tank
- After treatment:
  - Clear water = treatment
  - Trash, solids, debris – why is the material in the pump tank?

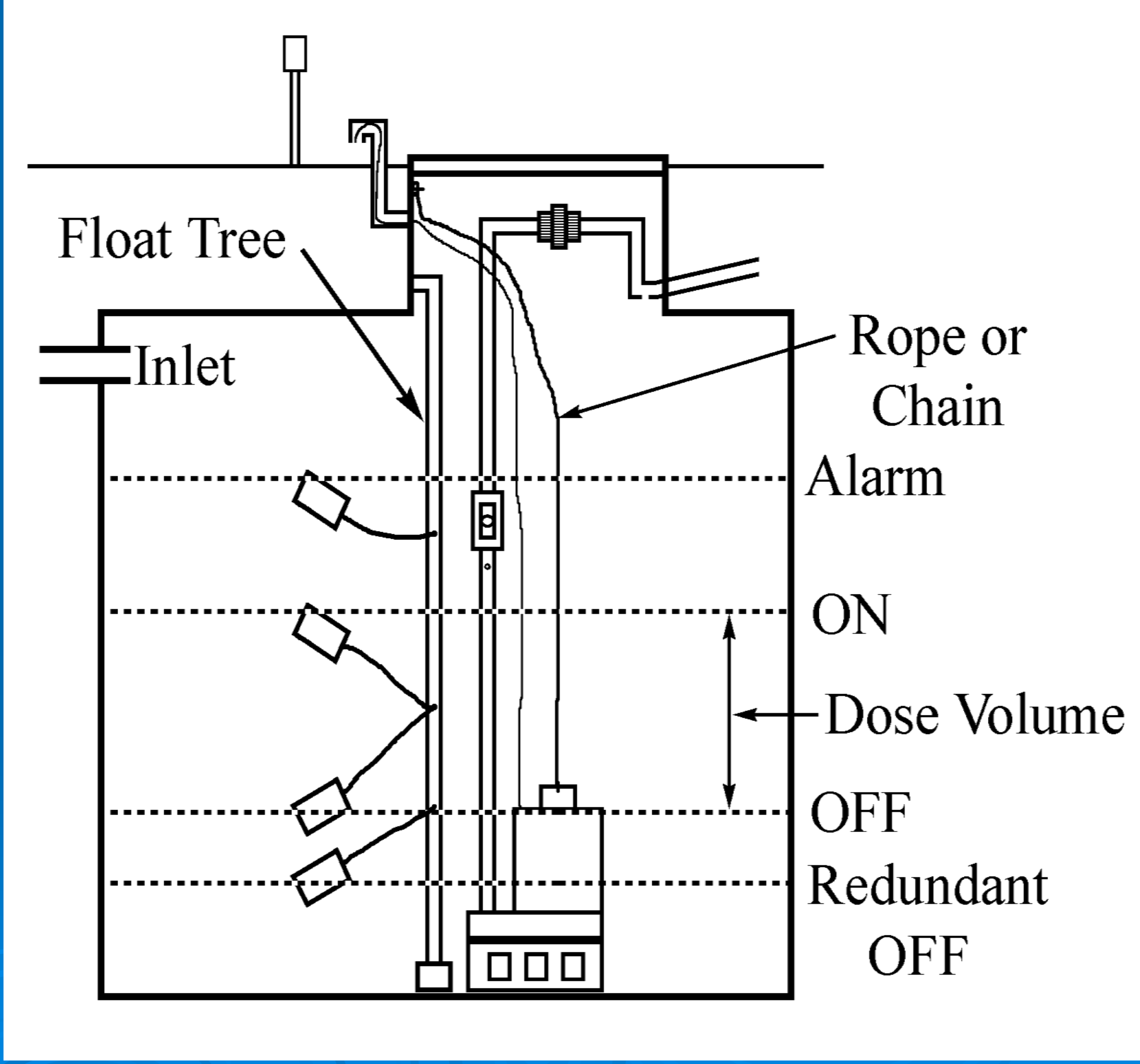
Control Panels

- Housing for components needed to control a system.
- Record valuable operational information
- Provide a means to monitor the system
- Works in cooperation with floats & sensors



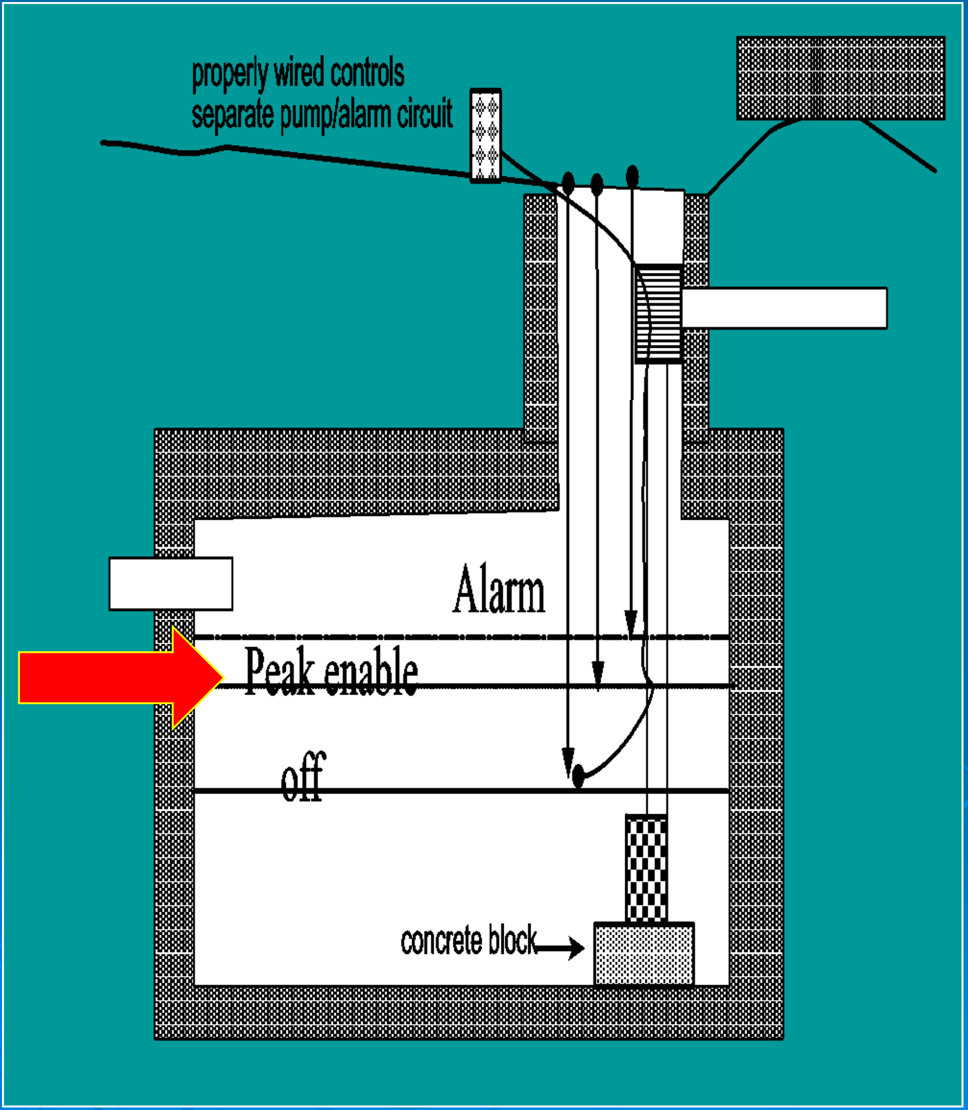
Floats Functions

- Off
  - Redundant off
- On
- Dose volume is between Off &On
- Alarm
- Alarm volume
  - Critical for owner



Sensor Functions

- Off
  - Turns timer off
- On
  - Timer operates the pump
- Alarm
  - Turns on the alarm
- Peak enabler
  - Changes the dosing frequency (PLC)
- Amber alarm
  - Management response to extra water



Critical Controls for measuring flow through a system

- Meter readings
  - Elapsed time meter (ETM) present:
    - Present reading____________(PTR)
    - Last reading_____________(LTR)
  - Cycle/event counter (CC) present:
    - Present reading____________(PCR)
    - Last reading_____________(LCR)

Number of Doses: CC

- Using Cycle Counters (CC)
  - What do I need to have?
  - Days between readings
    - (only when in operation)
  - Designed number of cycles (Dose frequency)
  - Change in value = Total number of cycles (NC)
  - Designed maximum cycles
  - Days x Dose frequency = Max cycles
  - Compare to actual

Cycle Counter Operation

- Cycle Counter Reading:
  - Present reading: 45,289 cycles
  - Last reading: 44,891 cycles
  - Calculate the number of cycles by subtracting Last reading from the Present reading.
  - 45,289 cycles – 44,891 cycles = 398 cycles
- What does it mean?
  - Total times the system turned on/off

Estimating Water Usage Based on Cycle Counter Reading

- Number of cycles over period of time ÷ Days in period of time = Pump cycles per day (CPD)
- Site with annual site visit, design 4-5 CPD
  - 398 cycles ÷ 365 days ≈ 1 CPD
- Same site with 100 days between visits
  - 398 ÷ 100 = 4 CPD
- Another site
  - 3905 cycles ÷ 365 days = 10.6 CPD

Measuring Flow: CC

- Using Cycle Counters (CC)
  - What do I need to have?
  - Days between readings
    - (only when in operation)
  - Change in value = Total number of cycles (NC)
  - Dose Volume (DV) - Use net volume
    - Net volume – Remove drain back from volume pumped
  - Total flow
    - NC x DV = Total flow
  - Total flow ÷ Days = Average Daily Flow

Total Gallons with CC

- Cycle Counter (CC)
  - [(PCR) – (LCR)] x (DV) = ___Total gallons
    - (45,289 – 44,891) x 77.3 gal = 30,765
  - Total gallons ÷ (# of days this period) = GPD
    - 30,765 gal ÷ 365 days = 84 GPD

Measuring Flow: ETM

- Using Elapsed Time Meter (ETM)
  - What do I need to have?
  - Days between readings
    - (only when in operation)
  - Change in value = Total number of units
    - Minutes
    - Hours
  - Pump capacity (gpm)- will not be the net volume
  - Total flow = Elapsed Time x Pump capacity
  - Total flow – (total d-back) ÷ Days = Average daily flow

Total Gallons with ETM

- Elapsed Time Meter (ETM)
  - [(PTR) – (LTR)] x (GPM) = Total gallons
    - (15,703 – 14, 509) x 25.8 gpm = 30,805 gal
  - Total gallons ÷ (# of days this period) = GPD
    - 30,805 gal ÷ 365 days = 84 GPD

Calculating Gallons Per Day (GPD)

- Total gallons ÷ (# of days this period) = gpd
  - CC: 30,765 gal ÷ 365 days = 84 gpd
  - ETM: 30,805 gal ÷ 365 days = 84 gpd
- But only Seasonal Home!
  - CC: 30,765 gal ÷ 100 days = 307 gpd
  - ETM: 30,805 gal ÷ 100 days = 308 gpd
- Design flow = 450 gpd
  - (308 gpd ÷ 450 gpd) x100 = 68%

A difference in the Daily flow estimates communicates?

- Which flow estimation method is accurate? CC or ETM
- What does a CC estimated daily flow measure: number of dose & dose volume
- What does an ETM estimated daily flow measure: pump run time and pump flow rate
- What if CC estimate is 84 GPD and ETM estimate is 168 GPD

What does a High Level in the Pump Tank mean?

It is a soft malfunction

Malfunction

- Defined: Not performing its intended purpose.
- Component malfunction versus System malfunction
- Purpose of treatment system
  - Protect Public Health
  - Protect Public Safety
  - Protect Environmental Health
  - Protect Environmental Safety
- Hard malfunction: component malfunction leads to system malfunction
- Soft malfunction: component malfunction not result in system malfunction

High Level Condition Communicates

- Excess water usage
- Pump malfunction
- System water tightness issue
- Maintenance needed
- Timer malfunction
- Timer settings
- Float settings – tether length
- Float malfunction
- Power was off for a period of time

Summary

- Pump tank system components
- Water quality, debris in tank.
- Flow calculations
  - Cycle counter
  - Elapsed time meter
  - Comparison of the numbers
- High water condition can be an indication of many different issues.
- Soft malfunction - High water alarm

References

- CIDWT. 2009. Installation of Wastewater Treatment Systems. Developed by Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT). Midwest Plan Service. Iowa State University. Ames, IA. December 2009.
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