

# Arsenic Treatment – Equipment Configuration

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# Contexts of Arsenic In NH

- Very small PWSs 0-100 gpm
- Without full-time operator presence
- Limited operator skill and experience
- Treatment assumption –
  - adsorptive media treatment almost exclusively
- 700 com./110 Arsenic; 450 NTNC/40 Arsenic.
- 20 Existing Arsenic Treatment Systems;
  - 15-Adsorptive Media; 4 POU/POE (RO); 1-RO (full scale)

# Treatment Concept I POU/POE

- POU typically at kitchen sink
  - Adv: Utility owned, maintained, and monitored
  - Dis: high level of utility and state oversight
- POE typically at foundation wall
  - Adv: Utility owned, maintained, and monitored
  - Dis: high level of utility and state oversight

# POU Treatment



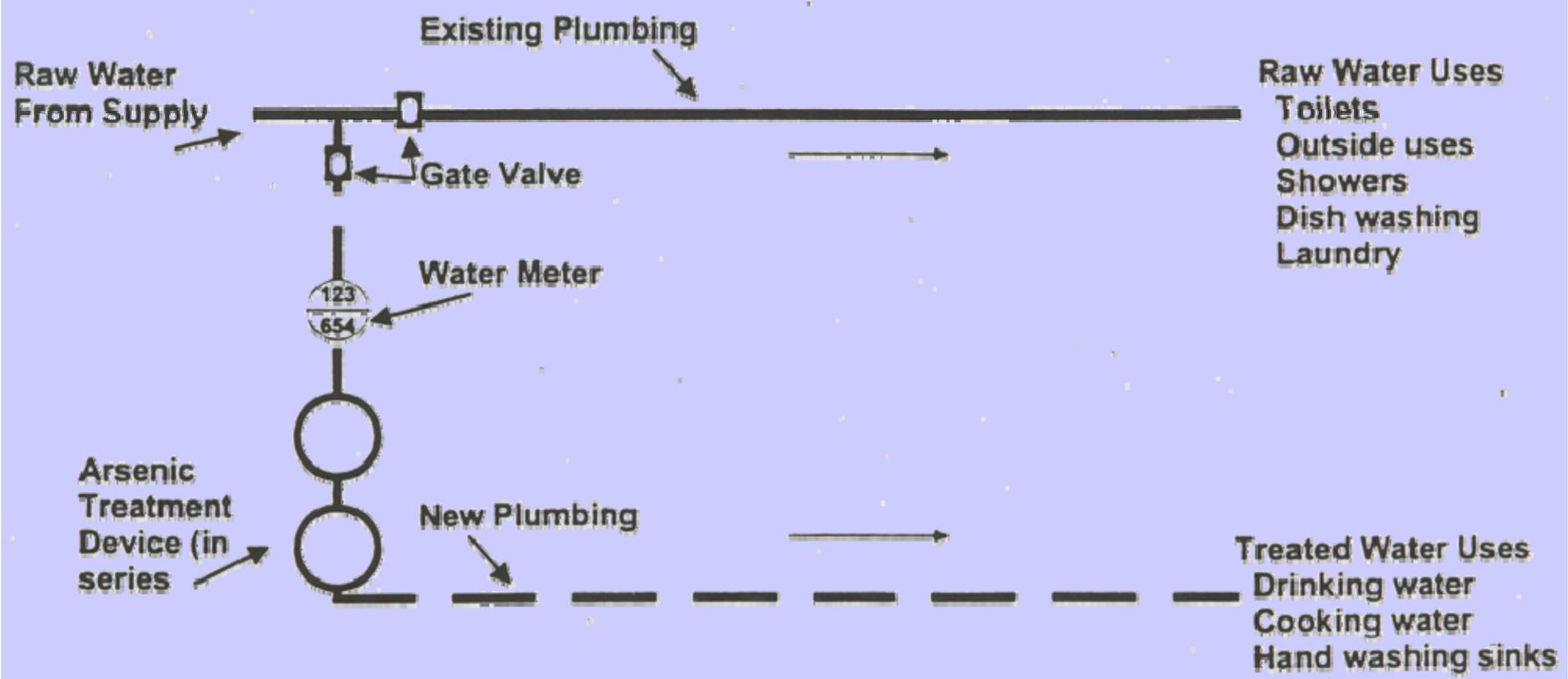
# Treatment Concept IA

## Non-Community Non-transient

### **Modified POU/POE Treatment System.**

- **Develop a dual water system within the building - open interior layout:**
  - Existing plumbing remains—untreated water.
  - New plumbing – has treated water.
- **Requirements:**
  - All faucets must be labeled (Drinking vs Not Treat.)
  - All plumbing requires color coding/25'.

# Appendix D: POE/POU Concept - Dual Plumbing System



**Goals:**  
Smaller treatment cost  
Less arsenic waste

# Treatment Concept II

## Parallel Configuration

Pat Cook

State of Michigan

# Treatment Concept III

## Series Configuration

Two tanks per train:

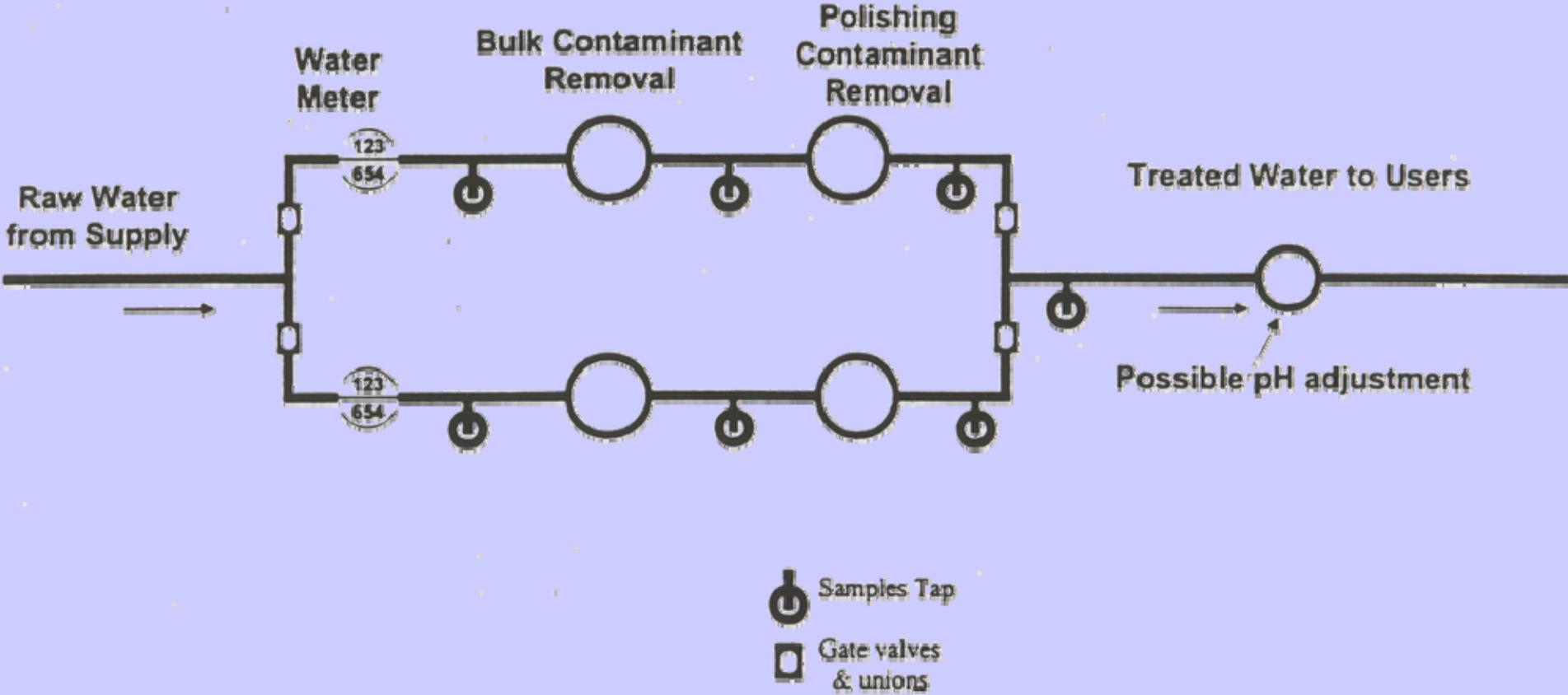
Lead tank does the majority of removal.

Lag tank polishes and addresses breakthrough.

- Allows breakthrough in first tank without the need for immediate operator response.
- Achieves maximum adsorption of arsenic on media.



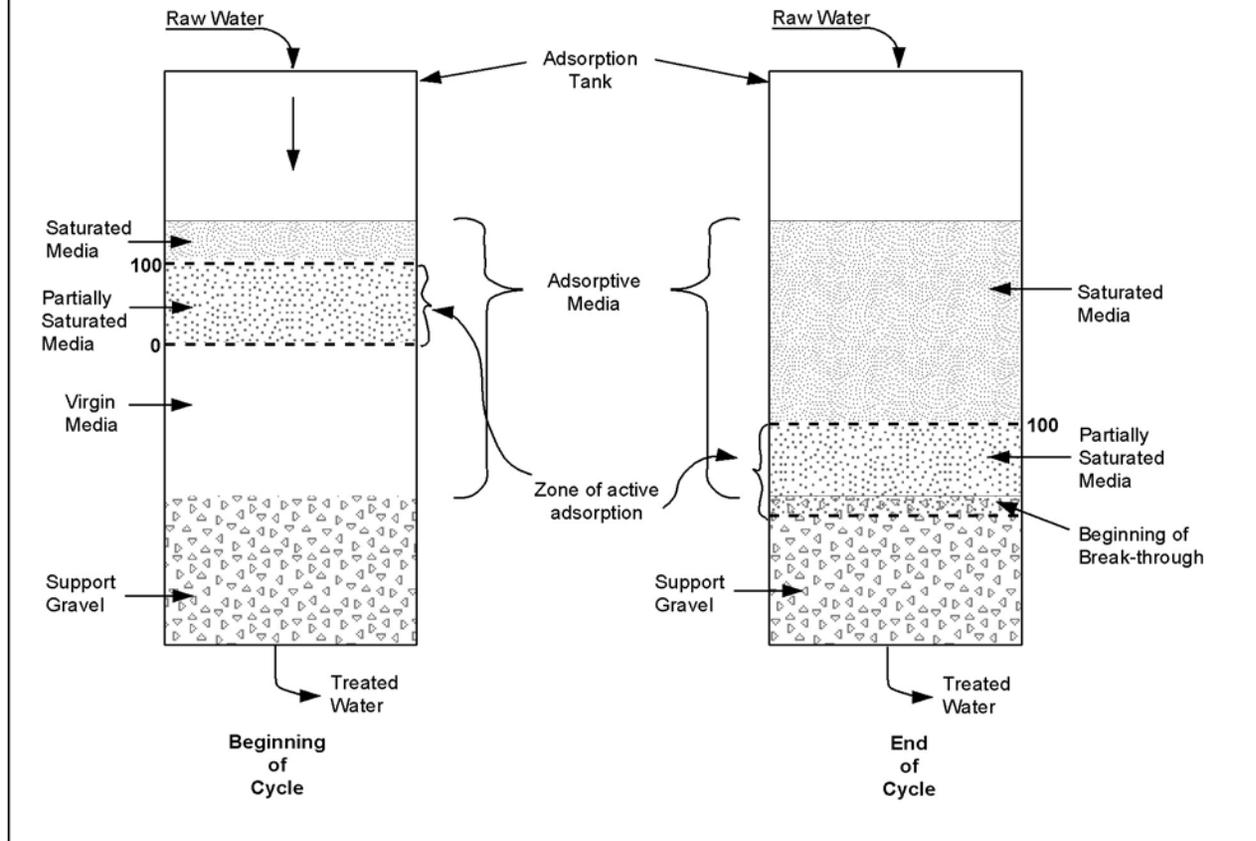
# Appendix E: Adsorption Treatment - Series Configuration



# Adsorption Rules

- **The greater the arsenic concentration the greater the amount that can be held by the adsorbent medias.**
- **Where media is effective for Arsenic III;**
  - **Breakthrough will likely be sooner; total holding capacity will be lower.**
- **Bed is physically backwashed every month. Backwash upsets the boundary of the active absorption band.**
- 
- **Breakthrough will be faster than predicted in literature references due to monthly backwash upset.**

# Adsorptive Process



# Series Configuration

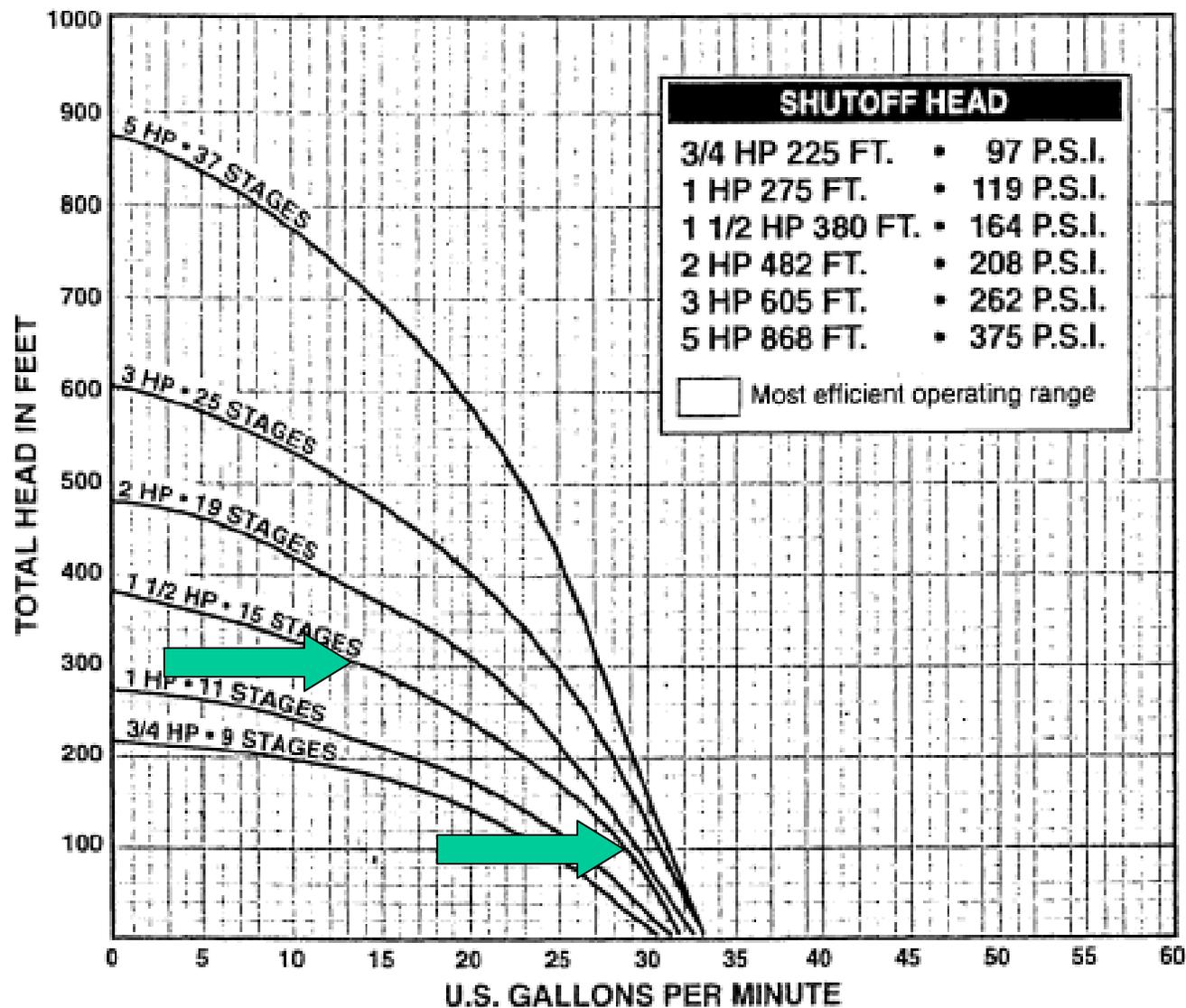
- In NH series is the recommended configuration.
  - **Media: Use once then rebed**
  - **pH: Do not adjust ambient pH.**
- Series is much more operator friendly/tolerant.
- Some savings realized in adsorptive media per change out.
- Higher first capital cost and initial media cost.

# **Other Design Considerations**

## **Varying Source Water Pump Flows**

- In NH the typical well with Arsenic is into bedrock 400 ft deep; Typical static is 50-100 feet.**
- Max. drawdown during pumping is likely to 300 ft.**
- Change in pumping rate between initial and long term pumping can be 25-200 % lower as drawdown increases.**

# Typical Pump Curve



# Response to Pumping Variation

- Possible Responses:
  - **Install flow restrictor to limit flow to no greater than that at maximum drawdown.**
  - **Do not install restrictor and size treatment tank for the flow rate associated with minimum drawdown (static water level). *Preferred Option***

# Other Design Considerations

## Is Preoxidation Needed?

- **Is there Arsenic III ?**
  - **If yes. We recommend oxidation even if the media can remove As III.**
- **Is Arsenic III present seasonally ?**
  - **Oxidation will address the future unknown.**
- **NH Policy**
- **Pretreatment will not be initially required since many medias will address As III. HOWEVER, Arsenic media holding capacity is typically less with As III.**
- **Initial quarterly monitoring. Then begin accelerated monitoring at 75% of estimated bed capacity.**
- **Leave plumbing fittings for oxidant feed as a retrofit.**

# **Other Design Considerations**

## **Dust During Media Rebedding**

- Funnel to guide media into tank.
- Note garden hose and spray nozzle connected to funnel to reduce dust.
- Vent fan needed.
- Dusk mask for workers.



# Other Design Considerations

## Spent Media Removal

- No side tank removal provisions
  - Provide adequate headroom between top of tank and underside of ceiling.
- Discharge port on side wall of tank
  - Wash out media into low rise decant tub.
- Some medias may adsorb radionuclides
  - Proper equipment location, staff training.
  - Recommend exposure badges.





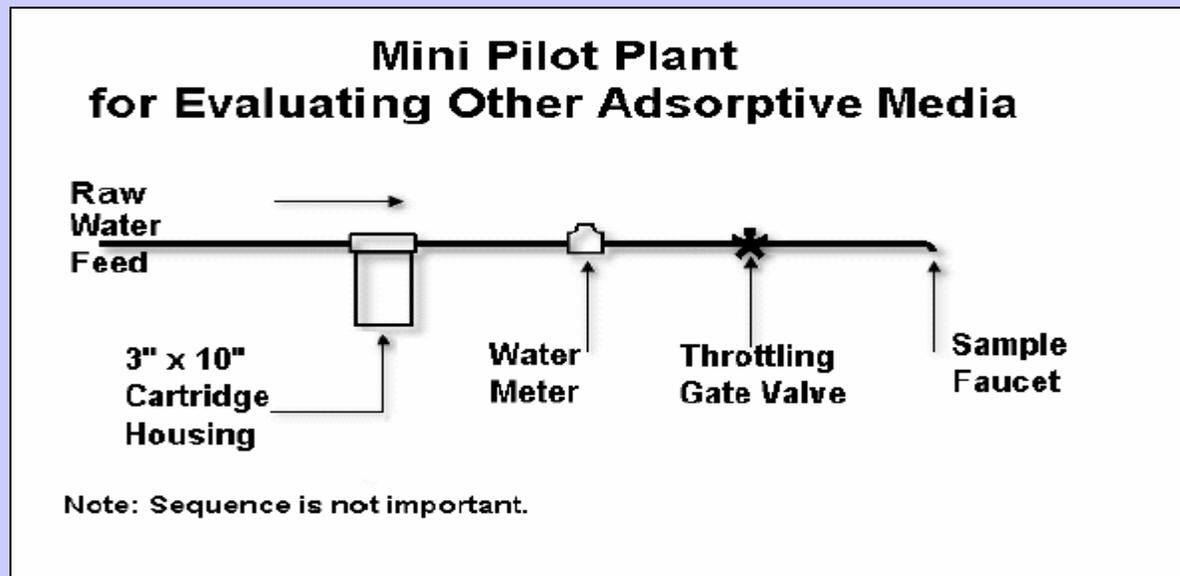
# Other Design Considerations

## Duration of Backwashing

- Problem
  - Fines in adsorptive media need to be backwashed and pH level of media may need to be diluted.
- Solution:
  1. Sample faucet
  2. Transparent spool piping
  3. Air gap in piping
- Influent/effluent pressure gauges

# Evaluating Other Ad. Media

- Set up a small pilot study.
- Run to arsenic breakthrough.
- Keep detailed records; looking for lowest operational cost.
  - Future EPA study



*Any Questions*