

# Point-Of-Use/Point-Of-Entry Devices Cost Considerations

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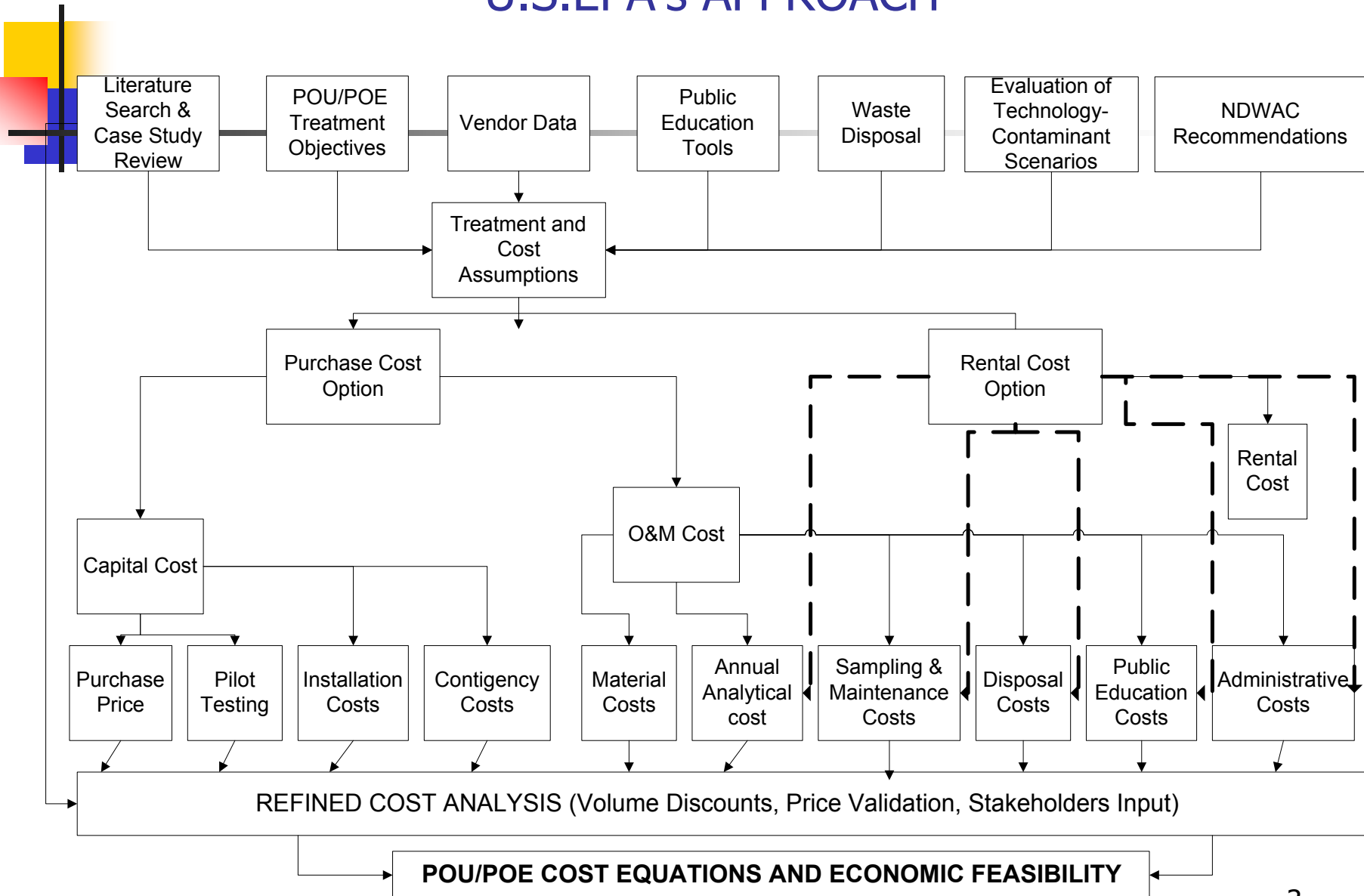


# Overview of Presentation

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- U.S.EPA's Approach
- POU/POE Treatment and Cost Assumptions
- Purchase/Rental Cost Options
- Refinement in Cost Analysis
- POU/POE Cost Equations and Economic Feasibility
- Next Steps: Issues Under Evaluation

# POU/POE COST CONSIDERATIONS U.S.EPA'S APPROACH



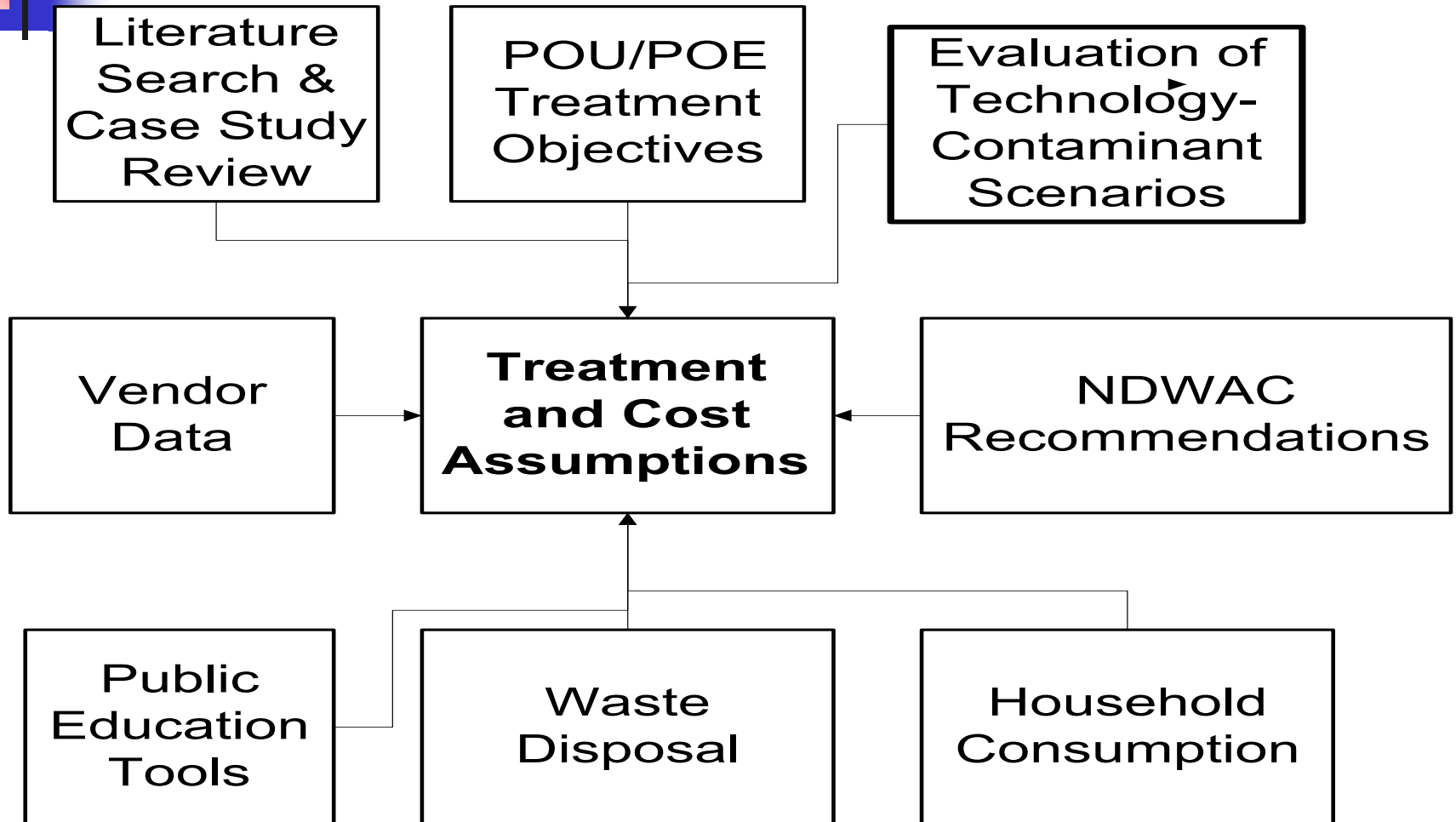


# U.S.EPA's Approach

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- Holistic Approach To Cost Development
  - Identified Key Cost Elements
  - Ascertained Affect of These Elements on Cost Of POU/POE Compliance Strategy
  - Developed Costs Based on Assumptions on These Elements
  - Determined Economic Feasibility of POU and POE Compliance Strategies for Different Size Systems

# Development of POU/POE Treatment and Cost Assumptions





# Development of POU/POE Treatment and Cost Assumptions

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- Reviewed Data on Performance and Cost From 35 Major Case Studies
  - Contaminants Included: Arsenic, Fluoride, Radium, TCE, Aldicarb and Atrazine
- POU/POE Treatment Objectives
  - Initially (1998) 6 Contaminants (Arsenic, Copper, Alachlor, Radon, Trichloroethylene, Nitrate) were Chosen for Cost Evaluation
  - Last Year Added 6 More Contaminants (F, Radium, Uranium, Aldrin, Dieldrin & Lindane)



# Development of POU/POE Treatment and Cost Assumptions

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- Evaluation of Technology-Contaminant Scenarios
  - Multiple Technologies may Remove the Same Contaminant.
  - The Relative Performance and Suitability of These Technologies may Vary Dramatically Based on Site-Specific Characteristics.
  - 3 Main Evaluation Criteria
    - Technical Efficacy
    - Administration
    - Cost



# Development of POU/POE Treatment and Cost Assumptions

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- Vendor Data

- Obtained Information on : Operational Performance, Unit Cost, Availability of Volume Discounts and Cost of Replacement Parts
- This Information was Obtained from National Providers with Franchised Vendors, Local Distributor and National Hardware Chain to Capture the Geographic Variability in Prices and Non-Availability Premiums



# Development of POU/POE Treatment and Cost Assumptions

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- Public Education

- On-going Public Education is a Key to Successful Implementation of POU/POE Compliance Strategy
  - Homeowners Buy-In Essential
  - Make Homeowners Aware of Need for treatment, Pros and Cons of Various Alternatives and their Responsibilities
  - Considered Various Communication Tools
  - Effectiveness of These Tools Would Depend on Local Conditions and Community Size



# Development of POU/POE Treatment and Cost Assumptions

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## NDWAC Arsenic Cost Working Group Recommendations

### ■ Costs

- Update costs to reflect current data
- Evaluate device rental vs. purchase
- Include costs of pilot testing
- Agreed with EPA's approach of sampling 25% of the units each year after first year

### ■ Implementation

- Consider use of POU and POE by larger systems
- Address issues associated with unit access; adjust technology cost estimates appropriately



# Development of POU/POE Treatment and Cost Assumptions

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- Household Water Consumption
  - Only One Tap is Treated per Household (POU)
  - Treat All Water Entering Household (POE)
  - Household Size = 2.6 Individuals (3, 1998)
  - Daily Drinking & Cooking Water Demand=2 liters/day/person (3.78 L, 1998)
    - 500 gal/yr/hh
  - Total Annual Water Consumption=100 gallon/d/person
    - 95,265 gal/yr/hh (109,500 gallons/yr/hh - 1998)
- Note: Assumes that There are No Non-Residential Connections Served by the CWS
  - Community Water System Survey Data Supports This Approach for Systems < 100
  - May Need to Estimate Demand for Non-Residential Taps for Systems Serving > 100 People

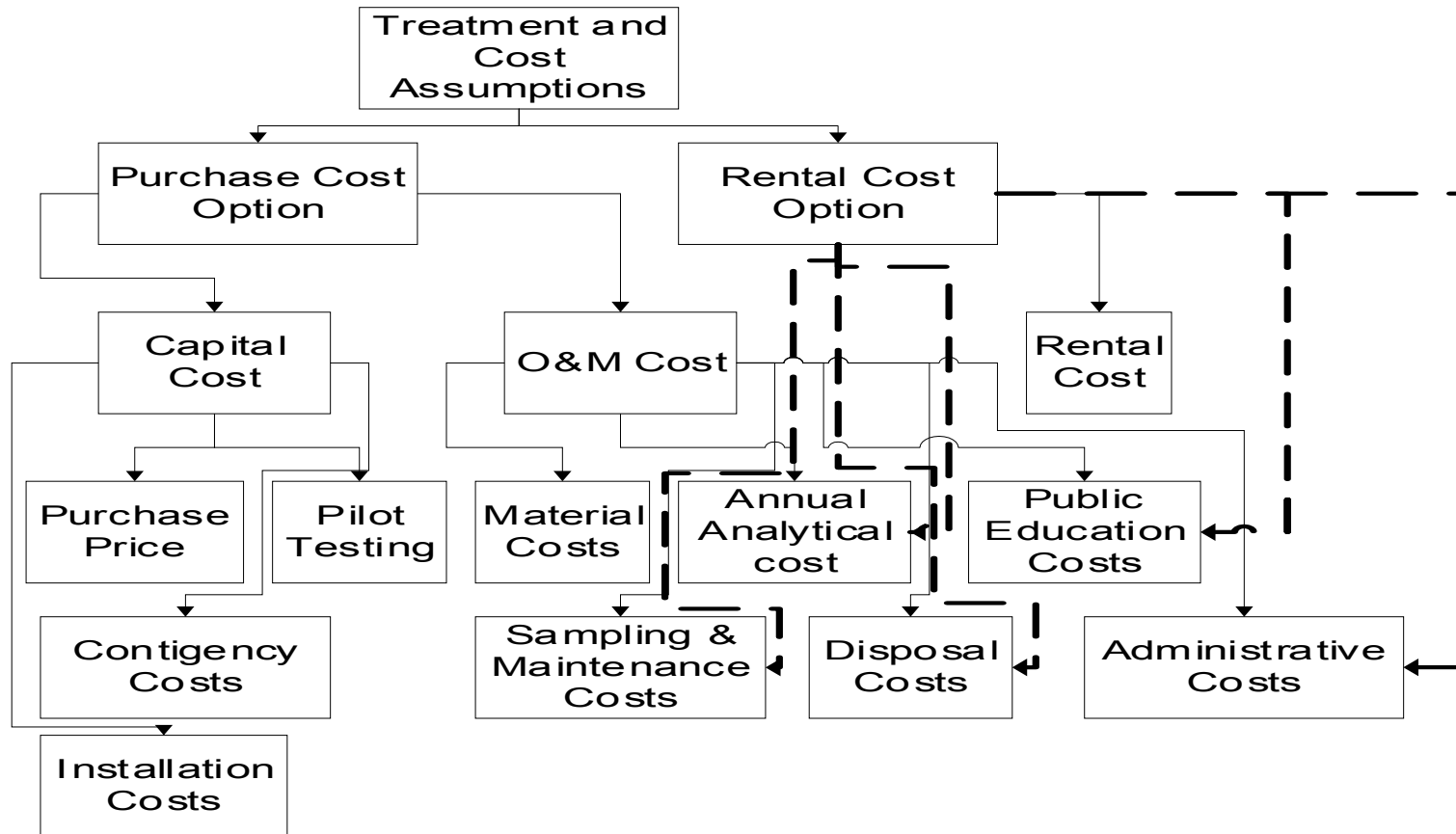


# Development of POU/POE Treatment and Cost Assumptions

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- Waste Disposal
  - Considered Characteristics of Waste Streams
    - Volume Generated
    - Contaminant Concentration (Conservative Replacement Frequency)
    - Hazard or Radioactivity of Waste
  - POU Wastes to be Disposed of in Household Trash
  - POE Wastes to be Disposed of in Landfill

# POU/POE Treatment and Cost Assumptions





# Purchase Cost Assumptions POU & POE

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## ■ General Assumptions

- In-Line or Line Bypass Plumbed-In to Separate Tap (POU)
- For POU, Only Water Intended for Consumption is Treated (drinking+cooking)
- Only Devices Certified under ANSI/NSF standards are Used
- Five Treatment Strategies Considered in Cost Analysis
  - AA (As, F), GAC (Atrazine, Alachlor, Aldrin, Dieldrin, Lindane, TCE, Radon, etc.), IX (Pb/Cu, Ra, U) , RO (As, Nitrate, Atrazine, Alachlor, Aldrin, Dieldrin, etc), and Aeration (Radon & TCE)



# Purchase Cost Assumptions POU & POE

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## ■ Treatment Trains

- AA => Pre-Filter, Flow Meter, AA POU/POE Device
- AX/CX => Pre-Filter, Flow Meter, AX/CX POU/POE Device
- RO => Pre-Filter, Flow Meter, TDS Meter GAC Pre- and Post Filter, RO POU/POE Device, Storage Tank, UV Device
- GAC => Flow Meter, Pre-Filter, GAC POU/POE Device, UV Device
- Aeration => Flow Meter, Pre-Filter, Aeration (POE), UV Device
- Central Distribution is Already In-Place, All Systems provide Central Disinfection



# Purchase Cost Assumptions POU & POE

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- Capital Costs
  - Purchase Price:
    - Model System Scenarios were Developed, 3-5 Vendor Quotes were Obtained for Devices
    - Cost of Flow Meter and Automatic Shut-Off Valve Included
    - Assumed Availability of Equipment Locally
  - Installation Cost:
    - Water System Personnel Install All Equipment
    - All POU Units are Installed Under the Sink
    - All POE Units are Installed Outside/Basement/Garage
    - POU Installation Time= 1 hr/Unit,
    - POE Installation Time=3 hrs/unit; POE Aeration= 6Hrs/unit
    - Travel/Preparation Time Included in Installation=2 hrs/day



# Purchase Cost Assumptions POU & POE

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- Capital Costs
  - Economic Assumptions
    - POU Device Useful Life = 7yrs (5 yrs, 1998)
    - POE Device Useful Life = 10yrs (10yrs, 1998)
    - Labor Cost (loaded) for Minimally Skilled Workers=\$14.50/Hr
      - Install POU, Administration, Sample, Maintenance
    - Labor Cost (loaded) for Skilled Workers =\$28.00/Hr
      - POE Installation and POE Maintenance
    - 7% & 3% Discount Rate (1998 Document, 10%)
  - Contingency Cost
    - 10% of Purchase Price+Installation Cost
  - Pilot Testing Cost
    - 3% of Capital Cost



# Purchase Cost Assumptions POU & POE

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- O & M Costs

- Materials & Maintenance

- All Maintenance Performed by System Personnel
- POU = 45 min/unit
- POE = 2 hrs/unit
- Travel/Preparation Time = 2 hrs/day
- Replacement Frequency (Includes 100% Margin of Safety)
  - AA (As) = 6 months
  - AA (F) = 12 months
  - AX (As) = 2 Months
  - CX (Cu) = 4 Months
  - RO(All Contaminants)=1.5 yrs (2yrs for POE), GAC Pre/Post Filter=6 months, Particulate Filter= 6 months
  - GAC (Atrazine, Alachlor, Lindane, Aldrin) = 9-12 months
  - UV Bulb = 1 yr; UV Quartz Sleeve = 3yrs



# Purchase Cost Assumptions

## POU & POE

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- O & M Costs
  - Sampling and Analytical Cost
    - Sampling Done at the Same Time As Routine Maintenance (no extra trips needed)
    - Sampling Preparation Time = 1hr/day
    - Sampling Time:
      - POU: 15 min/unit ; POE: 30 min/unit
    - Analytes
      - Contaminant of Concern
      - Lab Testing Costs were Obtained from 35 Laboratories
    - Sampling Frequency
      - All Units in First Year, 1/3 of Units In Successive Yrs (As of yet, the Agency has not made any Final Determination on this Issue)



# Purchase Cost Assumptions POU & POE

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- O & M Costs
  - Residual Disposal
    - POU Liquid Waste Disposal
      - POTW or Septic System
    - POU Solid Waste Disposal
      - Generally w/Household Waste if Characterized Non Hazardous
    - POU Waste Disposal Costs
      - Are Negligible
    - POE Waste Disposal
      - More Restrictive; We Assumed Landfill Disposal
      - System should consult with Local POTW/Landfill/State
      - Makes Several POE Treatments Unviable



# Purchase Cost Assumptions

## POU & POE

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- Administrative Costs
  - Increases Exponentially with Number of Households Served (Factor =  $(\#HH^{1.25})/\#HH$ )
- Public Education Costs
  - All Systems Distribute Notices/Brochures On Ongoing Basis
  - Labor Cost Assumed for Design/Production/Distribution of Educational Materials were Based on Input from Advertising Firms, Document Production Firms and Small Systems
  - System serving < 25 Household, Individual Household Visits
  - System Serving 26-100 Households, 2 Public Forums
  - Systems Serving > 100 Household Make 4 Public Forums
  - Systems Serving > 1000 Households, In Addition 1 PSA
  - Each Public Forum
    - 2 Hrs; Posters; Brochures
  - 25 % of Systems Need Bilingual Materials



# Rental Cost Assumptions POU & POE

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## ■ Rental Cost

- Obtained Rental Costs of POU RO Units from 7 Vendors
- Obtained Rental Costs of POE CX Units from 5 Vendors
- Vendors were a mix of Local Distributors and Franchised Vendors for national Providers
- Used WQA Survey to Validate Rental Cost Data
- Cost Comparison was done with/without Costs of UV Rental in the Rental Package
- All O&M Costs Developed for the Purchase Option Except for Replacement Materials were Included in the Rental Option

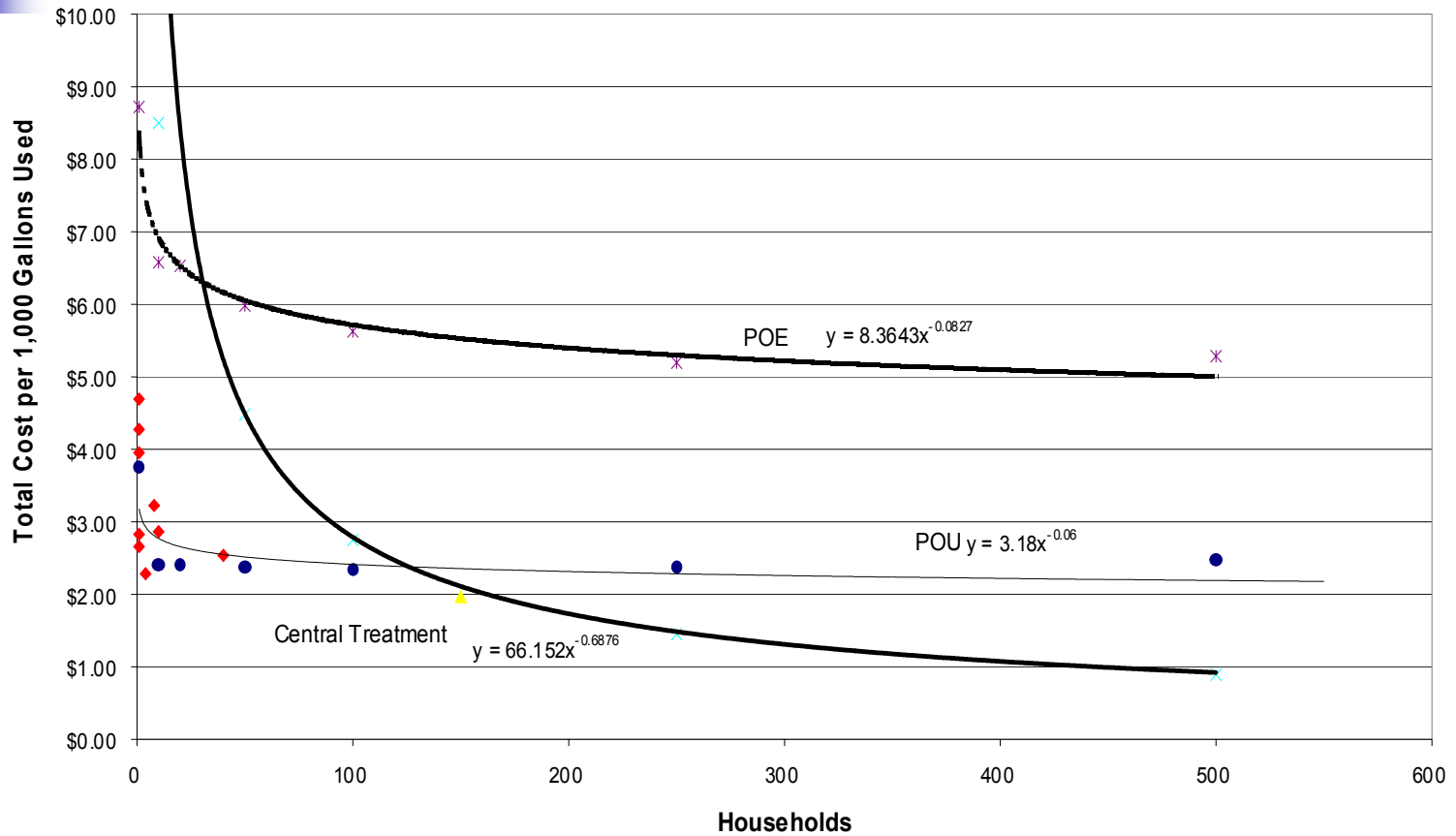


# Cost Analysis- Refined

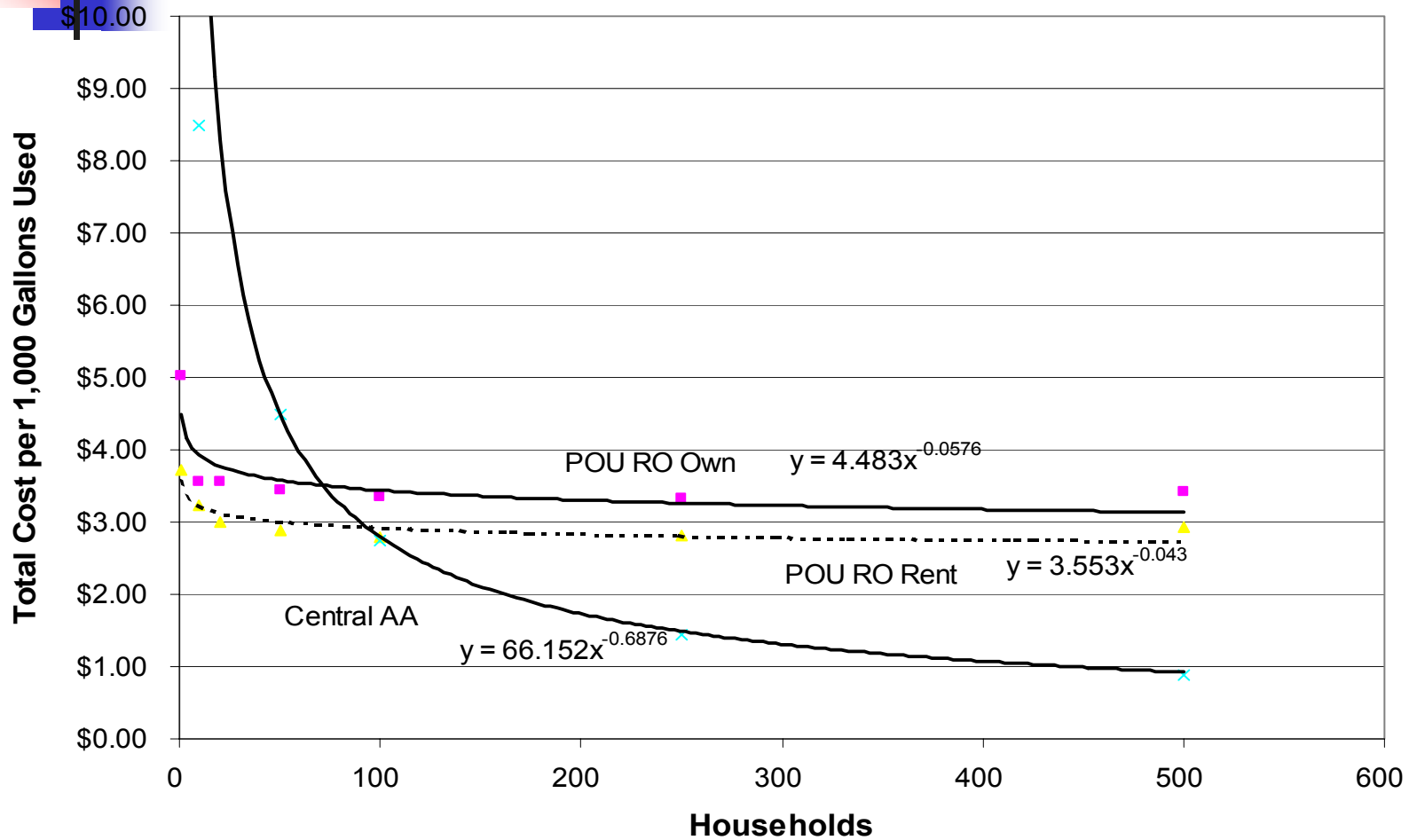
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- Capital and O&M Costs were Refined Based on
  - Cost Information from Case Studies
  - Vendor Provided Volume Discounts for Treatment Equipment
    - Purchase of >10 POU Units =10%, >50 Units =15%, >100 Units =20%, >250 Units =25%
    - For POE Units; >10=15%, >50 Units=25%, >100 Units =33%, >250 Units =50%
  - Volume Discounts for Lab Analyses
    - 20 –49 Samples: 10%, >50 Samples: 20%
  - Volume Discounts on Replacement Parts
    - Identical to Unit Purchase Discounts
  - Experience: Decrease In Installation Time
    - 10 Units, 10% Decrease; 50 Units, 20% Decrease; 100 Units, 33% Decrease

# Total Cost of Arsenic Treatment Using AA



# Total Cost of Arsenic Treatment Using RO





# Next Steps: Issues Under Evaluation

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- Issues that will Affect Costs
  - Representative Monitoring
  - Alternate Number of Taps Treated by POU
  - Less Conservative Safety Margins (Use Full Capacity of POU)
  - Non-Residential Water Consumption in Larger Size Categories
  - Trade off Between Use of UV and Microbiological Monitoring