

# Developing and Implementing Pleated Filter Technology

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## Introduction

- Air-Nu: a liquid and air filtration company.
- Problem: cost control issues due to the power of suppliers of disposable filters to dictate prices.
- Solution: a novel design for permanent filters
  - Previous team developed a design

## Management Objectives

1. Identifying cost-effective frame material with potential manufacturers.
2. Developing work design for media pleating and for servicing permanent filters.
3. Identifying the optimal number of pleats per linear foot to maximize media utilization.

## Frame Material Selection

### Methods

- ▶ Conducting research and utilizing Ashby chart.
- ▶ Building a decision matrix, based on the HoQ.
- ▶ Performing Pareto analysis to select filter sizes.
- ▶ Investigating outsourcing solutions.
- ▶ Performing benefit-cost analysis.

### Outcomes

- ✓ ABS plastic for 36 (out of 44) sizes.
  - Injection molding with inserts
  - CS Prototyping, USA
- ✓ 26-gauge galvanized steel for 8 larger sizes.
  - Conventional metal fabrication
  - ATSM Engineering, South Korea

## Permanent Filter Prototypes



Figure (1): ABS Plastic Filter Figure (2): Galvanized Steel Filter <sup>1</sup>

## Work Design Development

### Methods:

- ▶ Time studies and work sampling to analyze current system.
- ▶ Job safety analysis (JSA) for each task.

### Outcomes

- ✓ Standard operating procedures (SOP's) for:
  - Pleating media
  - Preparing service box-kits
  - Servicing permanent filters
- ✓ Workstation design for pleating media
- ✓ Evaluating hazards and identifying controls

## Media Pleat Specification

- ▶ Designed a statistical experiment to investigate optimal number of pleats per linear foot.
- ▶ Built an assembly to conduct the experiment.
- ▶ Experiment was not performed because the sponsors' priorities changed.

## Testing, Validation, and Simulation

### Holding Capacity Test

- No difference in holding capacity between permanent and disposable filters.<sup>1</sup>

### Durability Test

- Both filters can undergo 35 service cycles or 8 years.

### Drop Test

- ABS plastic filter: 32 drops from waist height with no visible deformities.
- Galvanized steel filter: 40 drops from chest height with no visible deformities.<sup>1</sup>

### Work Design Simulations

- Rate of pleating media = 83 media sheet/hour
- Rate of preparing box-kits = 130 media sheet/hour
- Rate of servicing permanent filters = 38 filter/hour

## Economic Analysis

### Cumulative Total Costs for Disposable vs. Permanent Filters

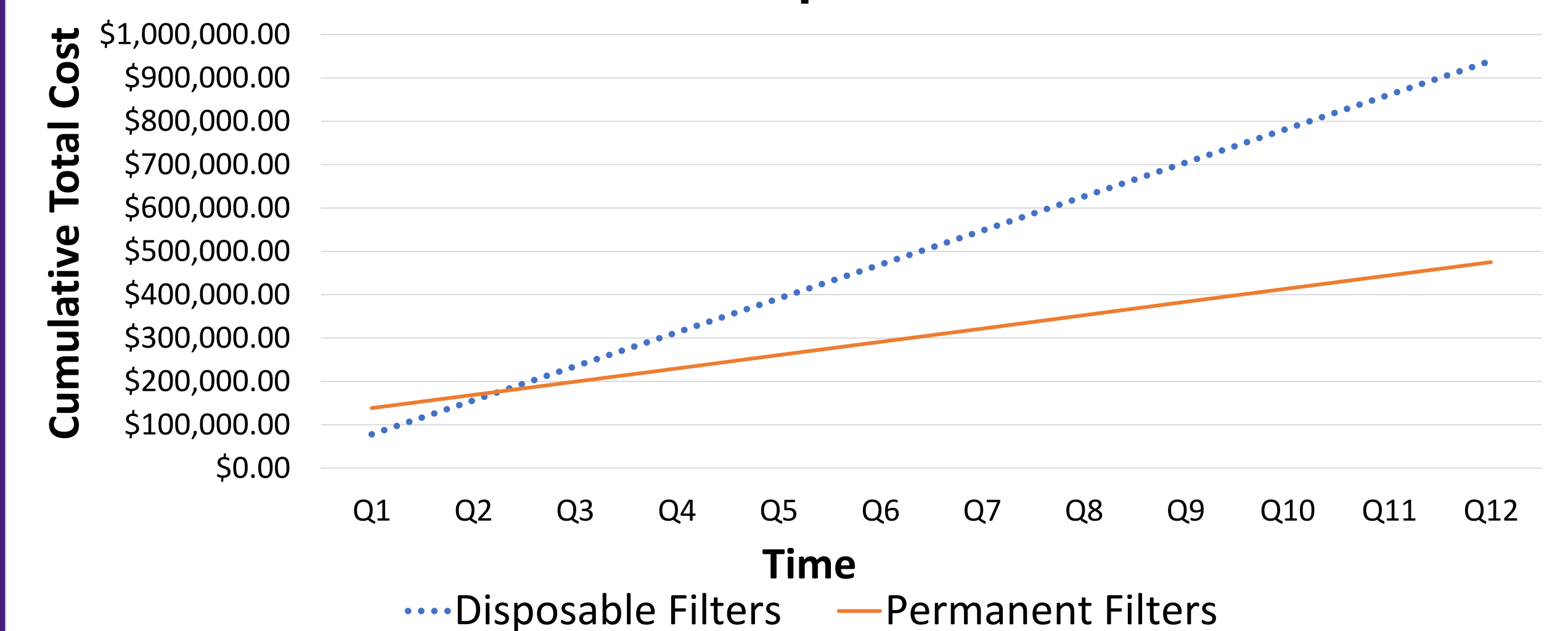


Figure (3): Cumulative Total Costs over Time

- Payback period: 3 quarters
- Savings: \$83,000 after 1st year, \$464,249 after the 3d
- Material costs for permanent filters: 4.91 times lower

Sponsor: Robert Darbonne

Advisers: Laura Ikuma, Cliff Gillio, AJ McPhate