WORKPLACE PROTECTION FACTOR TESTING

COST ANALYSIS

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A major element of Workplace Protection Factor testing is cost. The total cost is made up of labor hours required and direct cost.

The requirements for a good test consist of a number of steps.

1. Preparation
2. Pretest Visit
3. On-site Testing
4. Sample Analysis
5. Data Analysis
6. Report Writing

PREPARATION

	People Weeks
Scouting or locating good site	3
Cleaning and preparing equipment for shipment	2
Preparing samples	1
Total - people weeks	6

Preparation consists of locating a potential test site. This is done thru the Sales Representatives, Distributors, or other professional contacts. The object is to find a site that uses the appropriate respirator in the workplace, with a contaminant that can be measured with good sensitivity, and will cooperate with the testing. Locating such a site will take approximately three weeks with preparing equipment and samples requiring an additional three weeks.

After the tentative site has been determined, the next step is a Pretest Visit. Experience has shown that this step is required and will save money in the long run.

PRE-TEST VISIT

PURPOSE - Assure test site is suitable

POINTS TO CHECK -

Contaminant - analytical sensitivity
- concentrations

Number of workers

Respirator usage - continuous or intermittent

Logistics

Respirator program

Test site cooperation

During this visit, the contaminant can be determined - is it one that offers good analytical sensitivity? The concentration can be determined by taking area and personal samples in representative operations.

Other questions to be answered at this time include the number of workers wearing respirators - is it a representative population? Is the respirator usage long enough for adequate sample times?

Logistics covers things like a relatively clean area to train workers, fit test, and change sample cassettes. Other considerations include accessibility to the work area and safety concerns and equipment required for the test observers.

It is also good to review the respirator program at the site. Since the object of the test is to test the capability of the respirator, tests should not be conducted under conditions of misuse.

Test site cooperation is very important as the actual testing will require a number of outsiders in the work area and some disruption is unavoidable.

PRE-TEST VISIT

COST

PEOPLE - 3 people days

DIRECT COST

Travel $1200

Sample cost - $2.50 x 10 samples = $25

Analysis - $35 x 10 samples = $350

Total direct cost $1575

The costs of the Pretest Visit will be about three people days plus a direct cost of $1575 that includes travel, samples, and sample analysis.

Assuming the results of the Pretest Visit were satisfactory, the next step is the actual on-site.

ON-SITE TESTING

To obtain - 50 to 100 data points

PEOPLE

5 observers x 5 days	25 people days
1 record keeper x 5 days	5 people days
Total on-site	30 people days

DIRECT COST

Travel - $1350 x 6 people	$7950
Sample - collection media - $2.50 x 400	$1000
Respirators for test - variable	$1000
Total direct	$9950

In most of the tests completed and reported at this time, we attempted to gather 50 to 100 data points. We generally planned one sample set per worker before the lunch break and one after the lunch break. Therefore, two samples per day per worker and observer requires five observers for five days to gather fifty data sets. If the contaminant concentrations allowed shorter sample time, the same group may gather up to 100 sample sets.

Each sample set consists of an inside sample, outside sample, and a blank so we are handling up to 300 cassette samples. In addition, more recent tests have also added sampling, such as cascade impactors, for particle size distribution. One person is assigned to keep records and to organize and keep track of the 300 or 400 cassettes being used. Again, experience has shown this to be the best way to assure data is reliable.

The costs for on-site testing will then require 30 people days and $9950 direct cost as shown.

SAMPLE ANALYSIS COST

300 samples x $35	$10,500

Assumes PIXEA analysis for particulate contaminant. Other contaminants may require more costly analysis methods.

The cost for sample analysis is for Proton Induced X-ray Emission Analysis that has been used for most particulate contaminants because of its excellent sensitivity. If we knew how to do gases and vapors, more costly analysis methods may be required that would significantly increase the $10,500 figure shown.

FINISHING COST

Tabulating and Analyzing Data - 4 people weeks

Report writing and completion - 4 people weeks

Finishing the test will require about four people weeks to tabulate and analyze the data and another four weeks to prepare the reports for presentation, publishing and archival filing.

COST TOTALS

People

Preparation - 40 hrs. x 6 people weeks people hours	= 240
Pretest visit - 8 hrs. x 3 people days	= 24
On-site testing - 8 hrs. x 30 people days	= 240
Data analysis - 40 x 4 people weeks	= 160
Report writing - 40 x 4 people weeks	= 160
Total people hours	824

People - 824 x $90 per hours	$74,160
Direct cost	
Pretest visit	$ 1,575
On-site testing	$ 9,950
Sample analysis	$10,500
Total cost per study	$96,185

Totalling the labor required for a typical study results in 824 people hours. While people cost will vary, professional personnel will conservatively cost $90/hr. where salary, benefits, and overhead are included. The people cost is then $74,160. Adding to this the direct costs shown, results in a study cost of $96,185.

Cost Analysis

Typical Full-line manufacturer

50 sample sets taken yields 25 "good" data points

$$\frac{\$96,185}{25 \text{ good data points}} = \$3847 \text{ per data point}$$

$3847 x 126 data points (NIOSH suggested) =

$484,722

NIOSH Approval Submissions

New products or product modifications:

20 submissions x $484,722	$9,694,440

Update earlier approvals

30 submissions x $484,722	$14,541,660
Cost per full-line manufacturer	$24,236,100

Analyzing this cost for a typical full line manufacturer: The 50 sample sets taken will probably yield only 25 "good" data points. The reduction is caused by a number of uncontrollable variables such as inside concentrations below detection limit, overloaded outside samples, pump or equipment failure during test, human error, or accidental sample contamination.

Therefore, at $96,000 for 25 points yields a cost of $3847 per good data point. If we were to attempt to gather 126 "good" points as suggested in the NIOSH draft, the cost per study would be $484,722. This is for one respirator; one contaminant.

If each submission carried this requirement, the cost multiplies rapidly. A full line manufacturer with a steady stream of new products and product improvements may make 20 submissions to NIOSH for approval per year. The workplace testing cost would exceed nine million dollars. To backfill, or update earlier approvals, would require another 30 submissions based on the NIOSH suggested 3 contaminants per approval. The total cost to a full line manufacturer then exceeds 24 million dollars.

While many of the costs used in this analysis are approximations, most are based on actual testing experience. But no matter how you analyze the numbers, the cost is huge.