

**Residual Risk from Abrasive Blasting
Emissions:
Particle Size and Metal Speciation**

Presented by:

Bhaskar Kura, PhD, PE

Outline

- Background Slides
 - EPA's Toxicity Ratings for Metals
 - Residual Risk Process for Dry Abrasive Blasting
 - UNO Abrasive Test Program (EPA/ONR funded)
- Objectives
- Methodology
- Results
- Conclusions

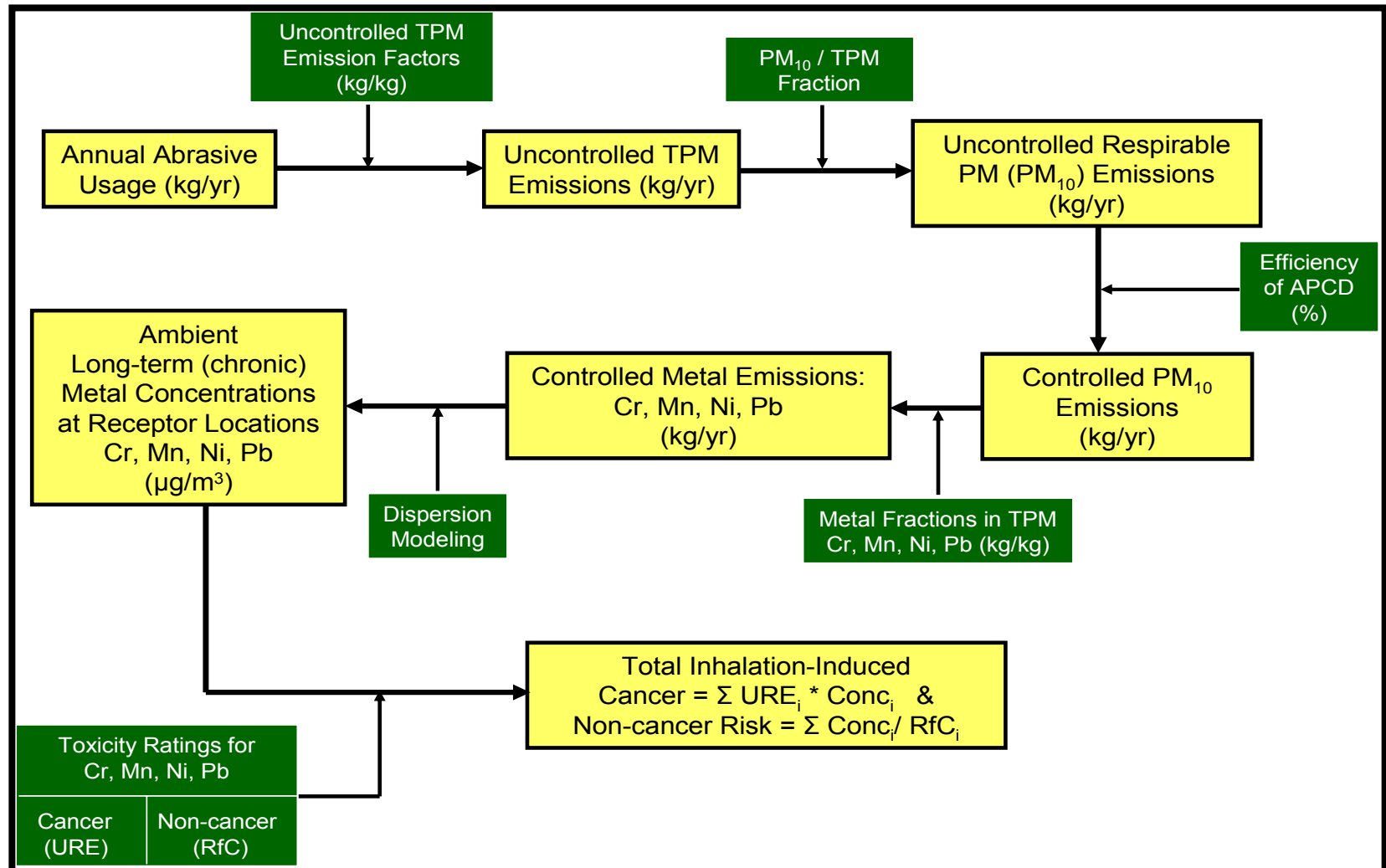
Inhalation Induced Health Risks Considered by EPA

Airborne Metal	EPA's Carcinogen Currently?	URE, per ug/m ³	EPA's Non carcinogen Currently?	Specific Health Effect?	RfC, mg/m ³
Arsenic (As) Compounds	Yes	4.3 E-03	Yes	Irritation of mucous membrane in humans	3.0 E-05
Barium (Ba)	No		No		
Cadmium (Cd) Compounds	Yes	1.8 E-03	Yes	Kidney damage in humans	2.0 E-05
Lead (Pb) Compounds	Yes	1.2 E-05	Yes	Neurobehavioral effects (CNS) in humans	1.5 E-03
Cobalt (Co) Compounds	No		No		
Chromium (Cr) Compounds	Yes	1.2 E-02	Yes	Lung injury in rats	1.0 E-04
Copper (Cu)	No		No		
Mercury (Hg) Compounds	No		Yes	Neurobehavioral effects (CNS) in humans	3.0 E-04
Manganese (Mn) Compounds	No		Yes	Neurobehavioral effects (CNS) in humans	5.0 E-05
Molybdenum (Mo)	No		No		
Nickel (Ni) Compounds	Yes	4.8 E-04	Yes	Respiratory track inflammation in rats	2.0 E-04
Selenium (Se)	No		No		
Titanium (Ti)	No		No		
Zinc (Zn)	No		No		
Iron (Fe)	No		No		

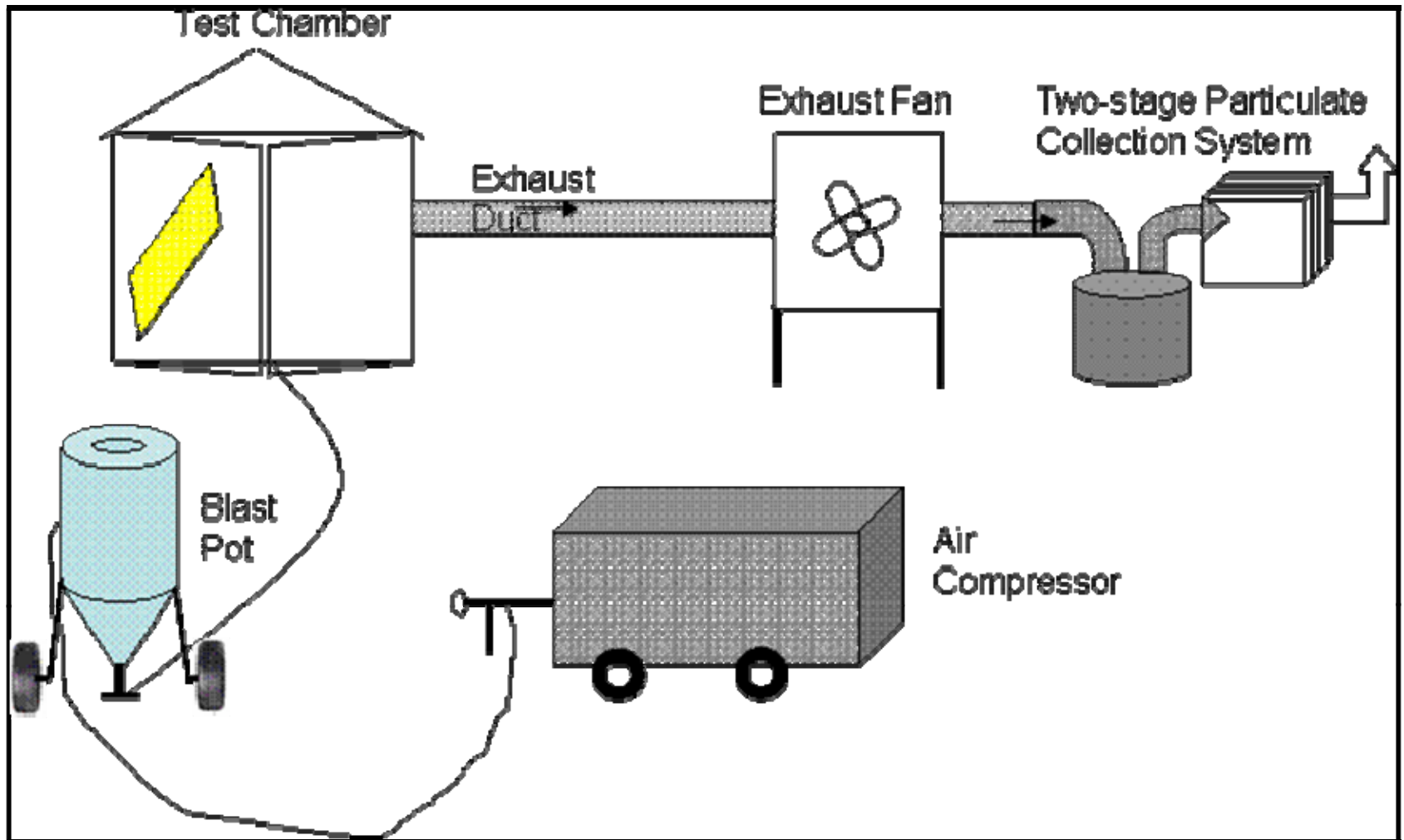
Source: US EPA; Health Effects Information Used in Cancer and Noncancer Risk Characterization for the NATA 1996 National-Scale Assessment

Note: Metal analysis results reported in this report in subsequent tables correspond to total elemental chromium (not hex-chrome), elemental metals but not their compounds.

Residual Risk from Blasting: Role of Particle Size and Metals



UNO Emissions Testing from Dry Abrasive Blasting



Total PM Emissions Monitoring Using EPA's Stack Testing Procedure



Objectives

Use the previously collected and saved filters from the UNO Abrasive Study to:

- Determine PM₁₀/TPM fraction
- Metal Speciation: Total Chromium (Total Cr), Manganese (Mn), Nickel (Ni), and Lead (Pb)

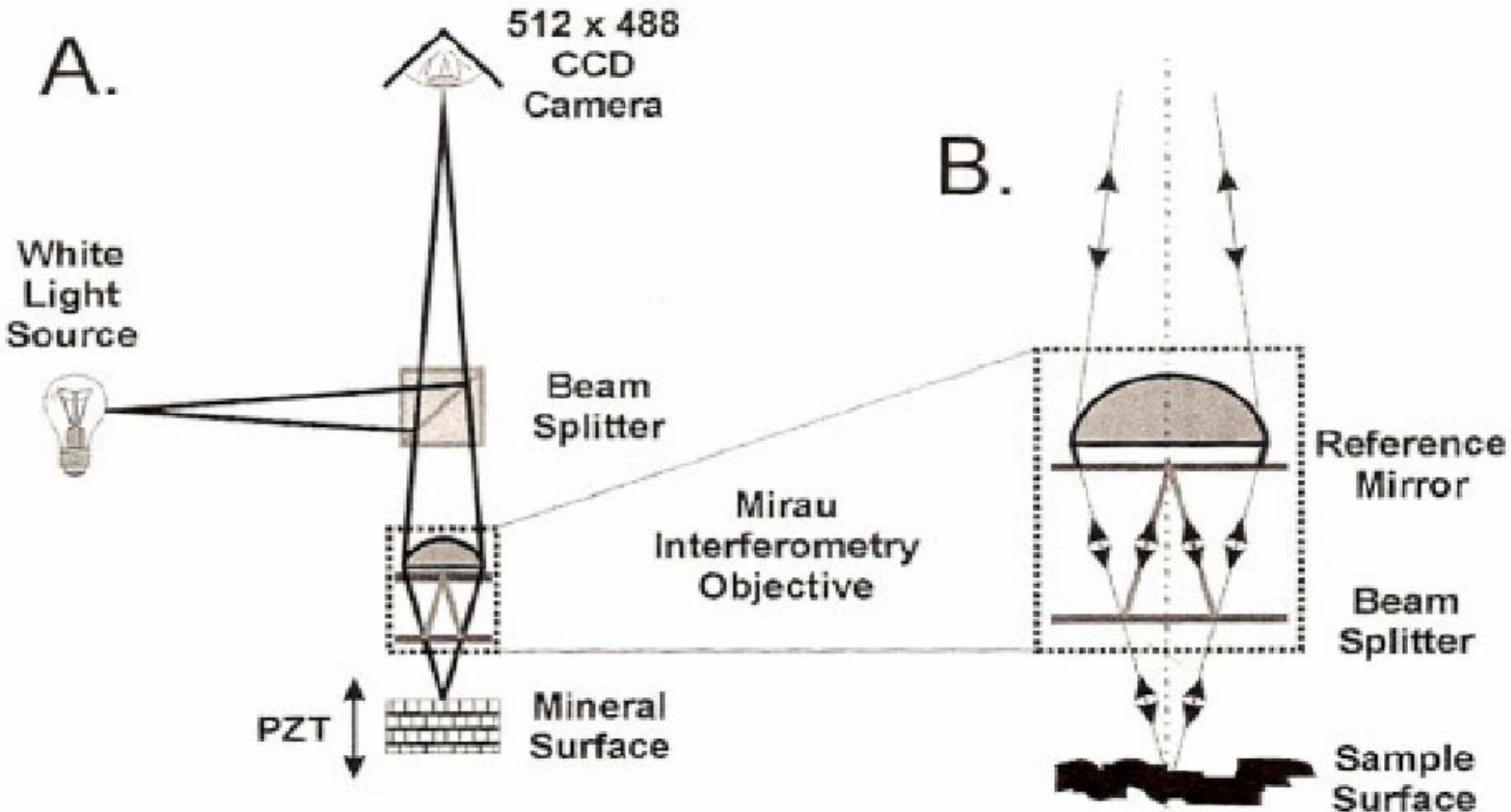
Methodology

- Filters saved from previous study on six abrasives were used:
 - Copper Slag
 - Coal Slag
 - Hematite / Barhsot
 - Steel Grit/Shot
 - Garnet
 - Specialty Sand

Methodology

- Particle size was accomplished through:
 - Micro Sieve Analysis
 - Interferometry
 - Single Particle Optical Sensing (SPOS)
- Metal Analysis was accomplished through:
 - X-Ray Fluorescence (XRF) Spectrometry

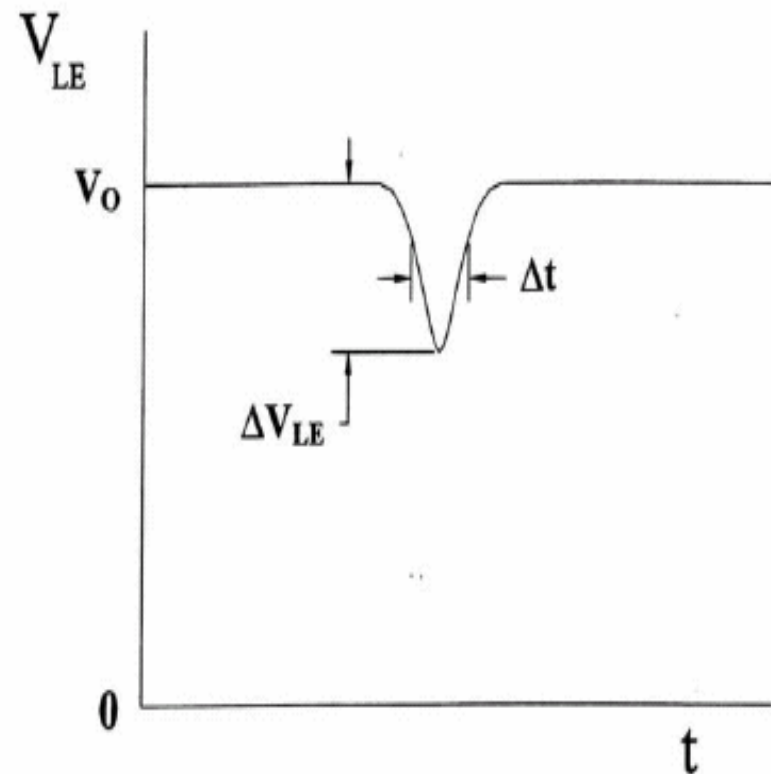
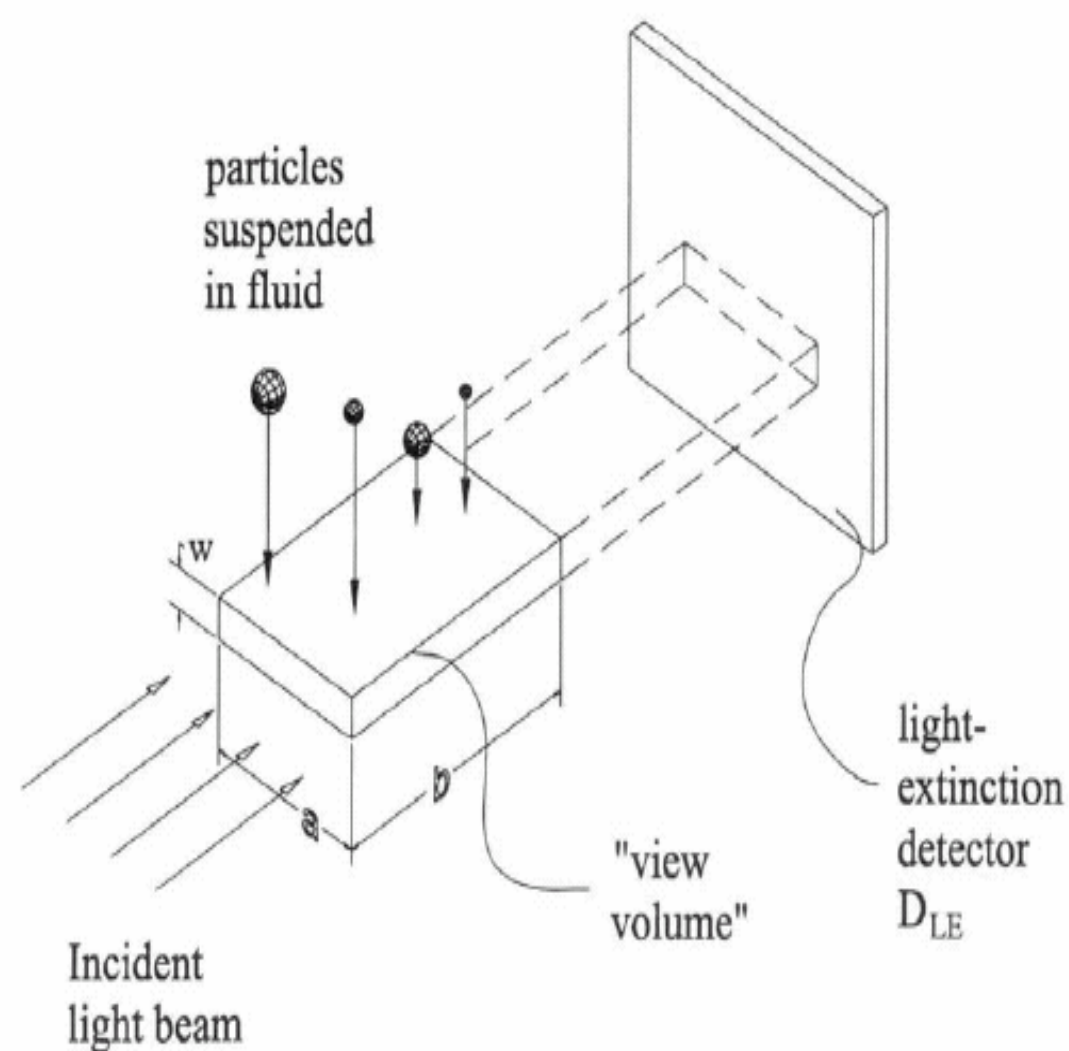
Double Beam Interferometer with CCD Camera for Particle Size



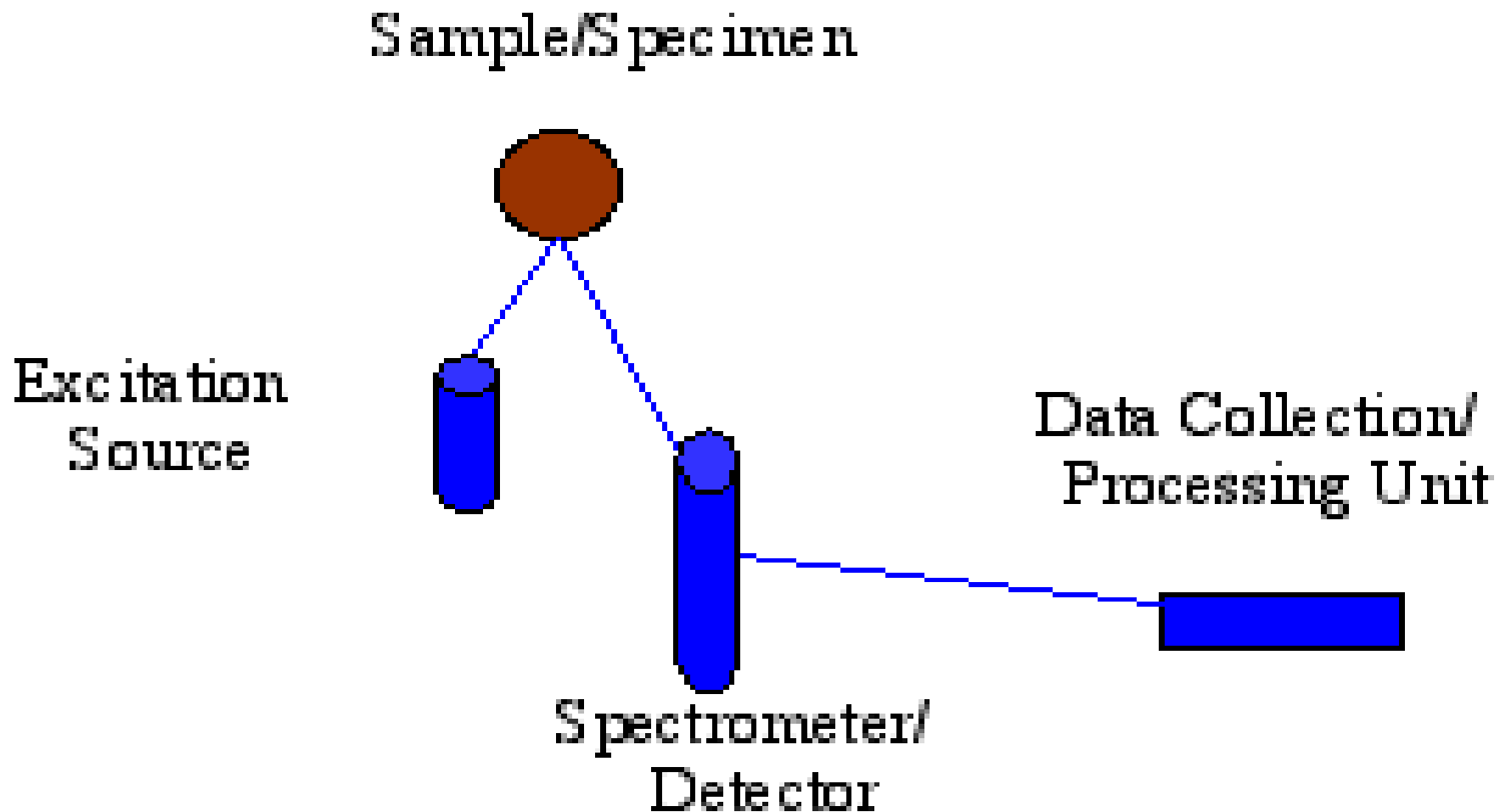
Interferometer Used for Particle Size



Single Particle Optical Sizing (SPOS) Method for Particle Size



XRF Spectrometry for Metal Analysis



Results

Average Metal Concentration in the Total PM (ppm)

Abrasive	Pb	Total Cr	Mn	Ni
Barshot	40.38	2.26	3.87	0.00
Cobalt	5.49	1.66	27.17	1.07
Copper Slag	143.98	10.00	30.45	1.84
Garnet	7.64	7.79	224.54	1.12
Steel Grit	62.74	163.01	595.98	0.00
Specialty Sand	5.74	0.00	7.28	0.05

Conclusions

- PM_{10} fraction of TPM is considerably lower compared to previously compiled data (lowers residual risk)
- Metal fraction of TPM is also considerably lower (lowers residual risk)
- Both the above results have multiplying effect on the final results which should lower the residual risk considerably