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Assessment of Human Exposure to NOA at the Clear Creek Management Area

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EPA IX

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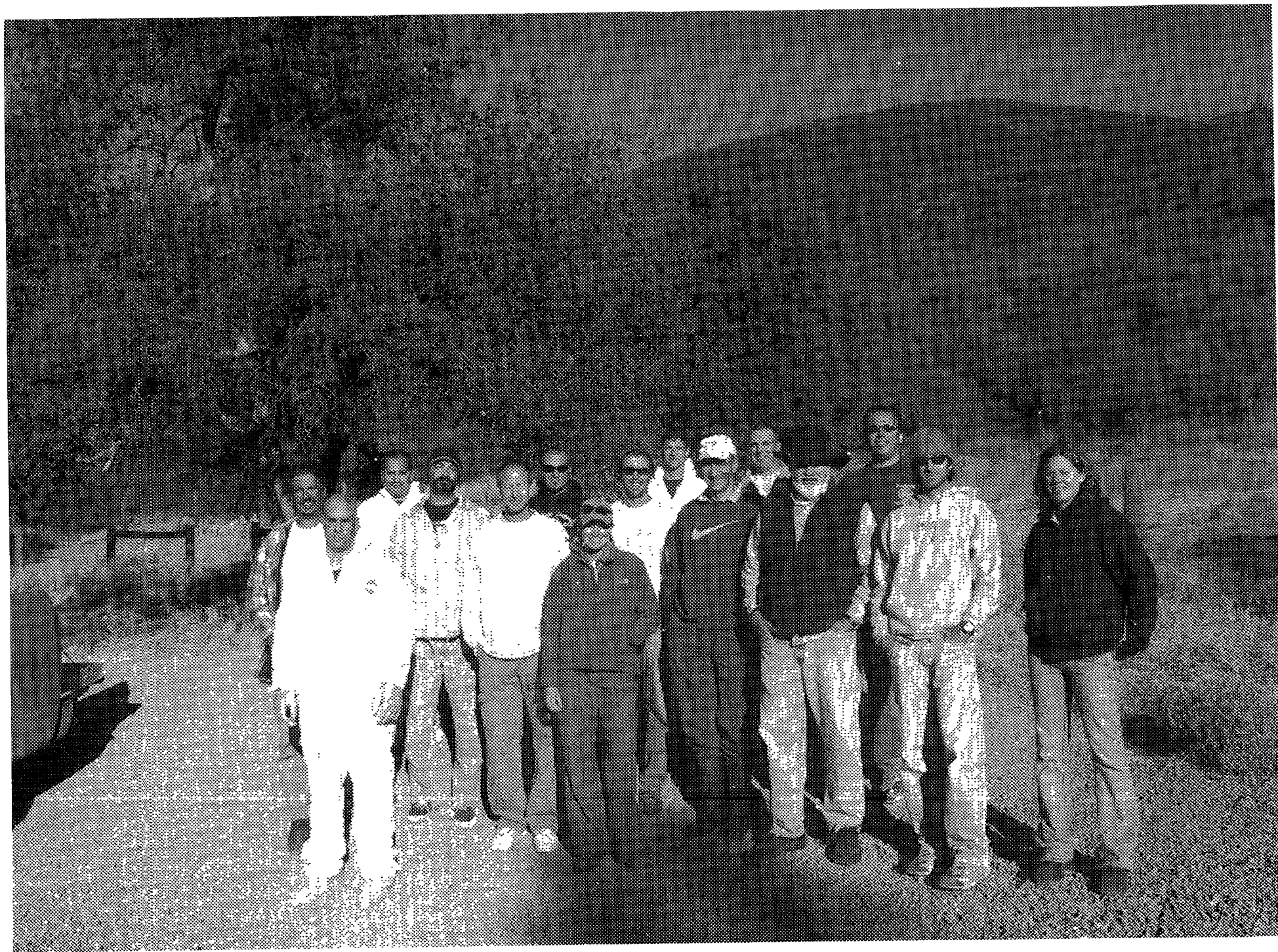
EPA ERT

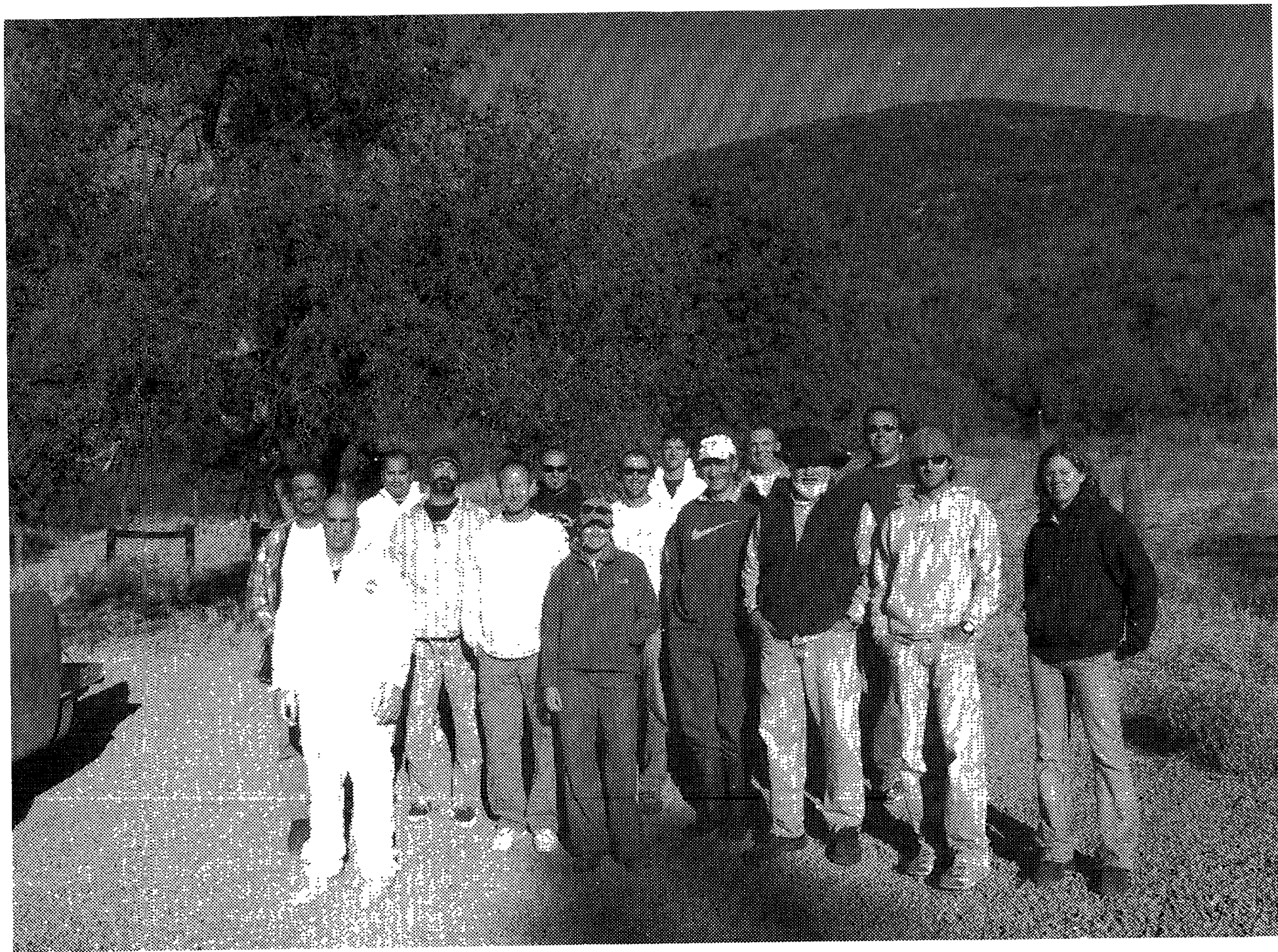
Brian Brass
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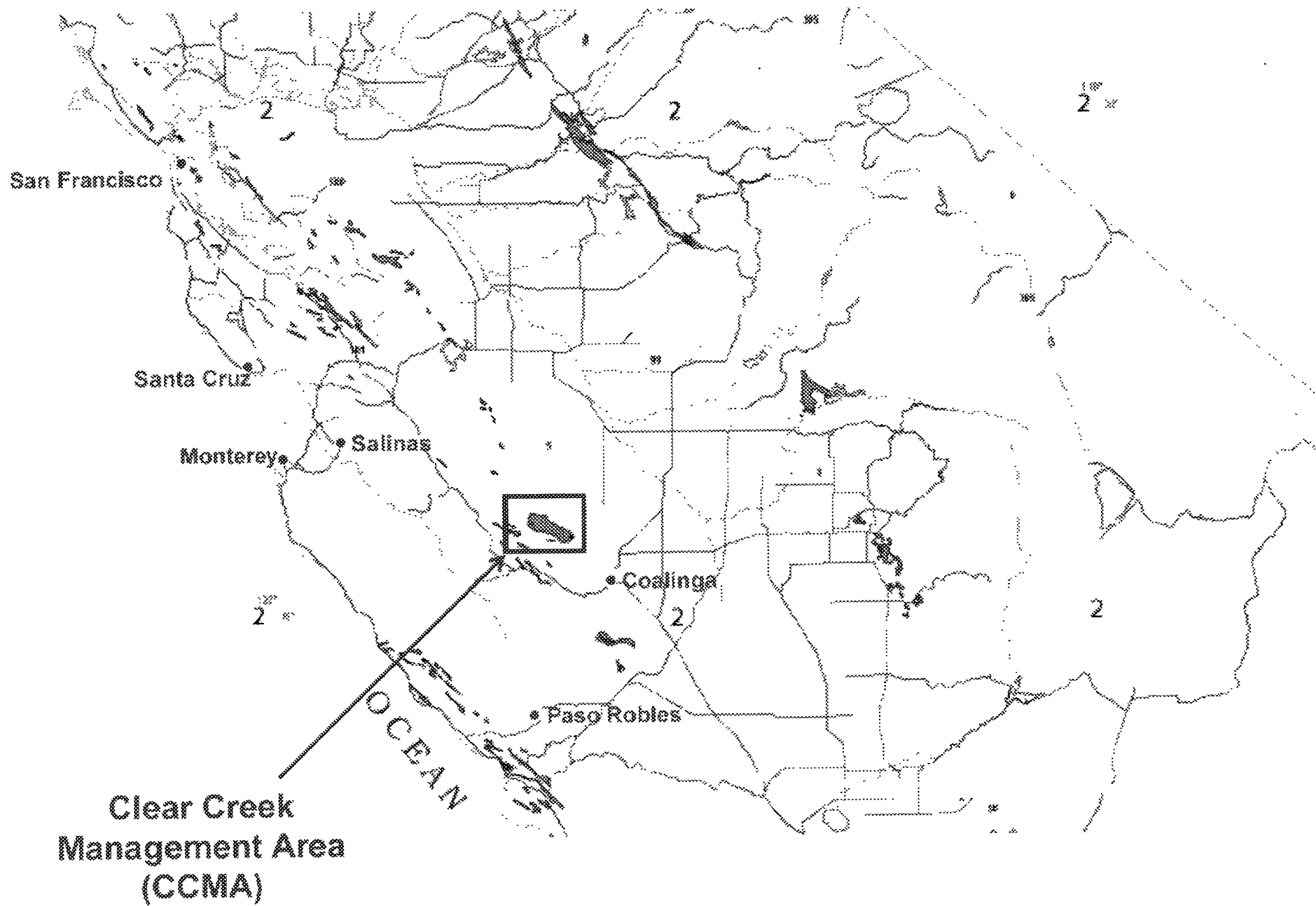
CalEPA

Steve Ross
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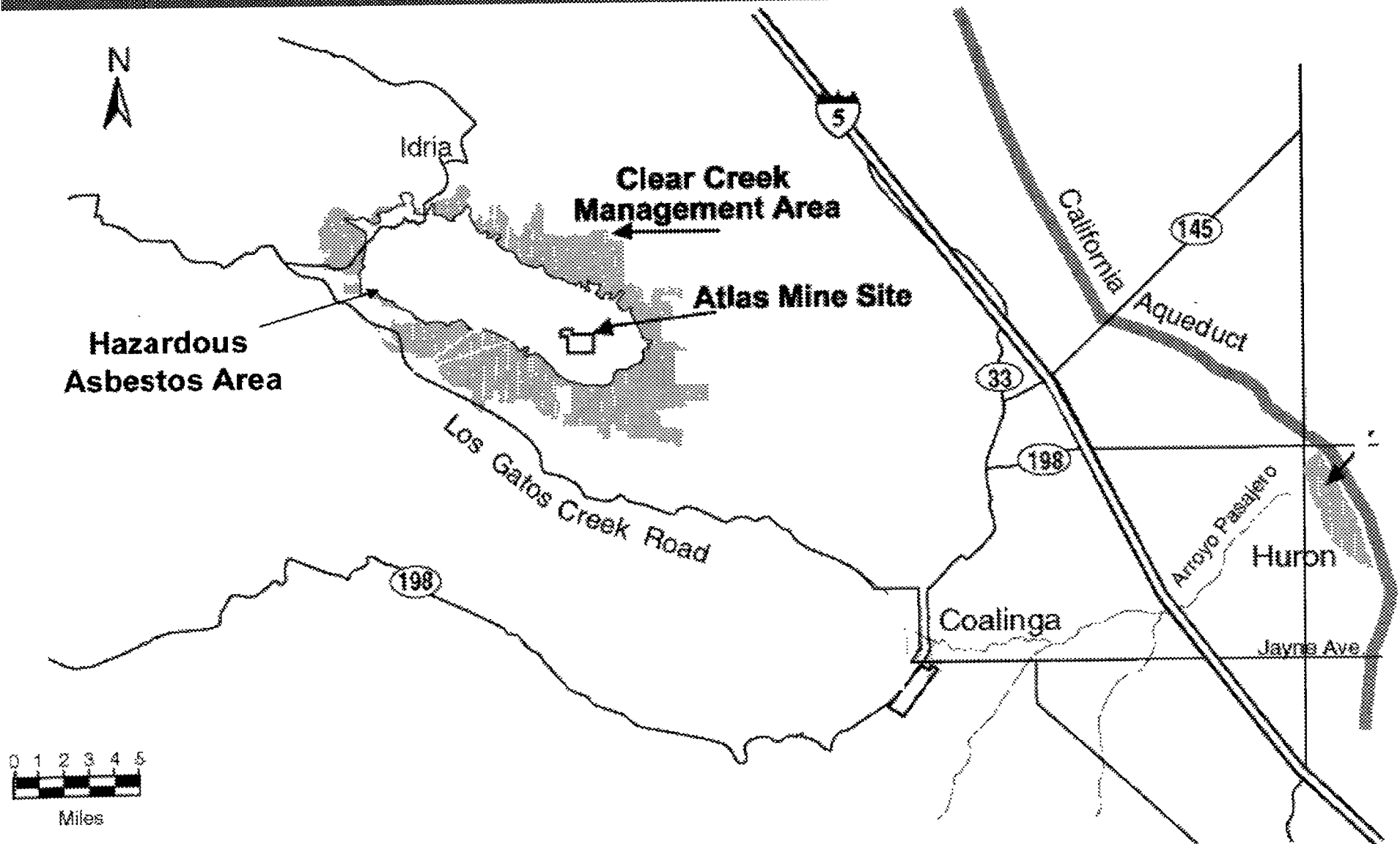
December 5, 2006







STUDY AREA



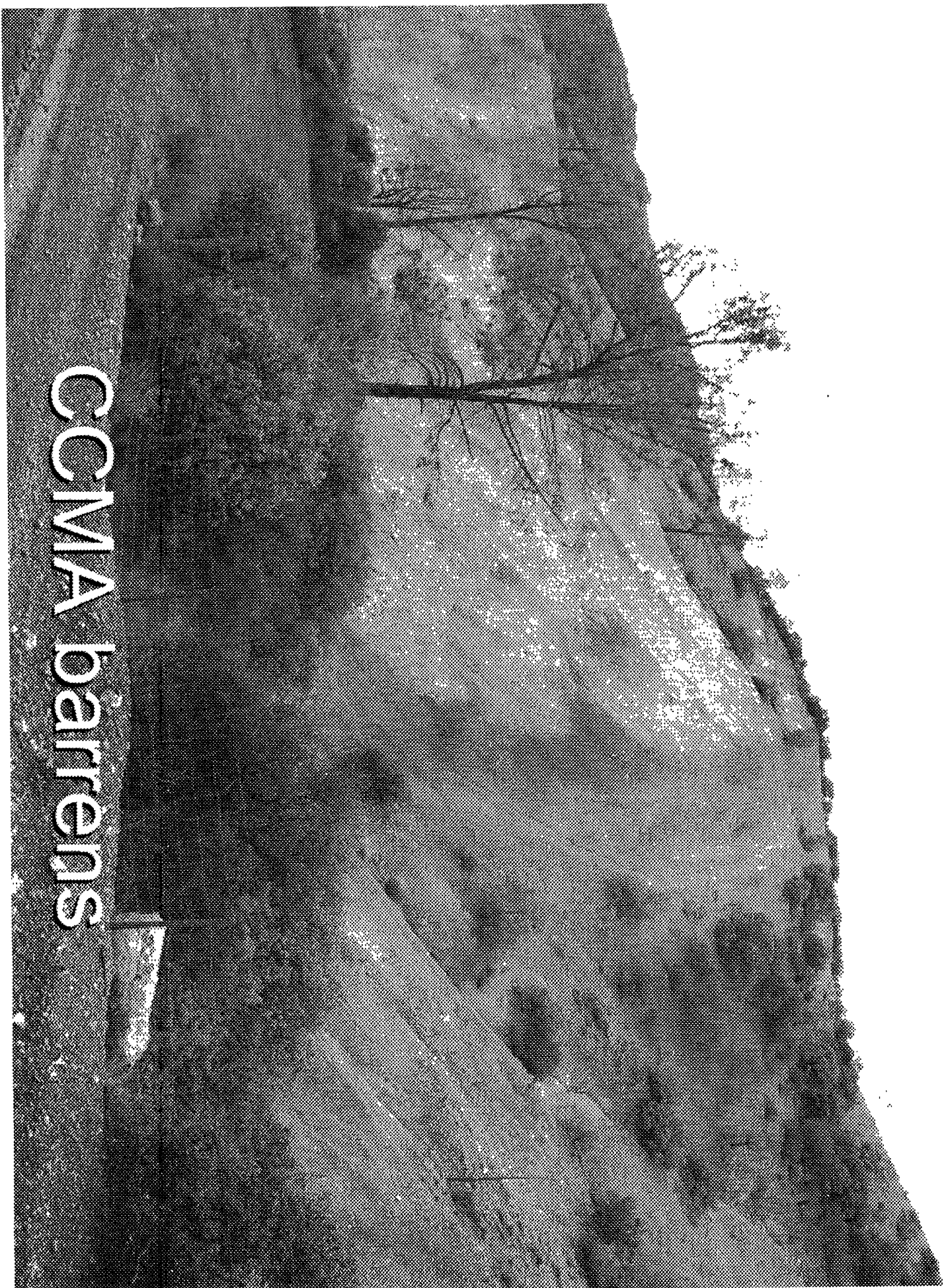


Atlas Asbestos Mine Superfund Site



CCMA Landscape

CCMA barrenés



A black and white photograph of a San Benito Evening Primrose plant. The plant has a single flower in bloom, which is light-colored with a darker center. The flower is attached to a long, thin stem that curves upwards. There are several large, dark, oval-shaped leaves visible on the plant. The background is dark and out of focus.

San Benito Evening Primrose

© 2002 California Native Plant Society

Typical CCMA Activities

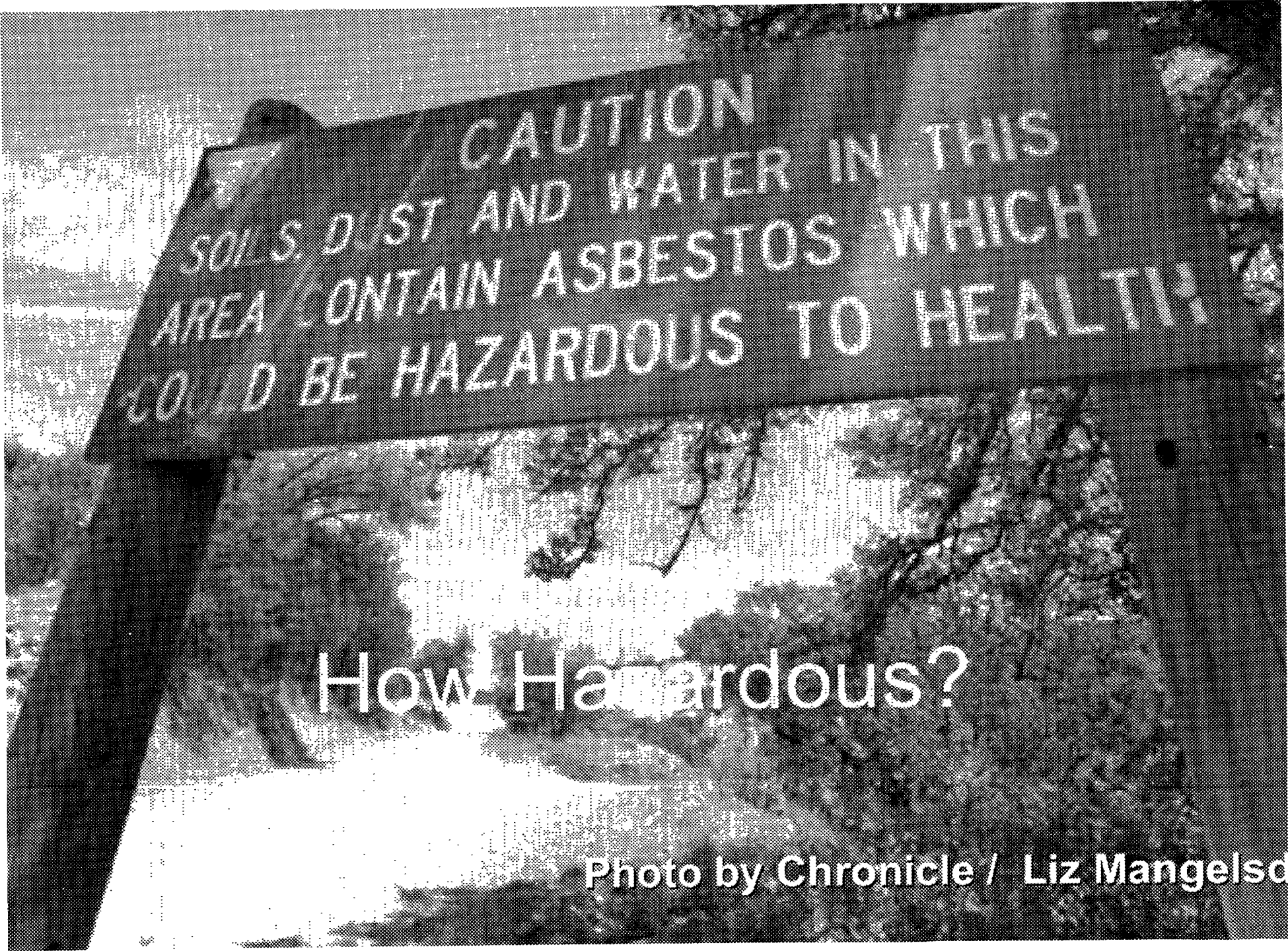
- Off-Highway Vehicle Riding:
Motorcycles, ATV's, SUVs
- Hiking, Botanizing, Rock Hunting,
Camping, Hunting, Native American
Ceremonies



Photo by Chronicle / Liz Mangelsdorf

Soil: Percent Asbestos

CCMA Route	Range	Mean
Motorcycle	2% – 15%	6.0 (n=5)
ATV	2% - 15%	5.5 (n=6)
SUV	1%– 10%	3.9 (n=9)
Hiking	2% - 8%	4.9 (n=4)



CAUTION
SOILS, DUST AND WATER IN THIS
AREA CONTAIN ASBESTOS WHICH
COULD BE HAZARDOUS TO HEALTH

How Hazardous?

Photo by Chronicle / Liz Mangelsdorf

Study Goal

- Obtain information to assist the Bureau of Land Management in making management decisions to protect human health

Study Questions

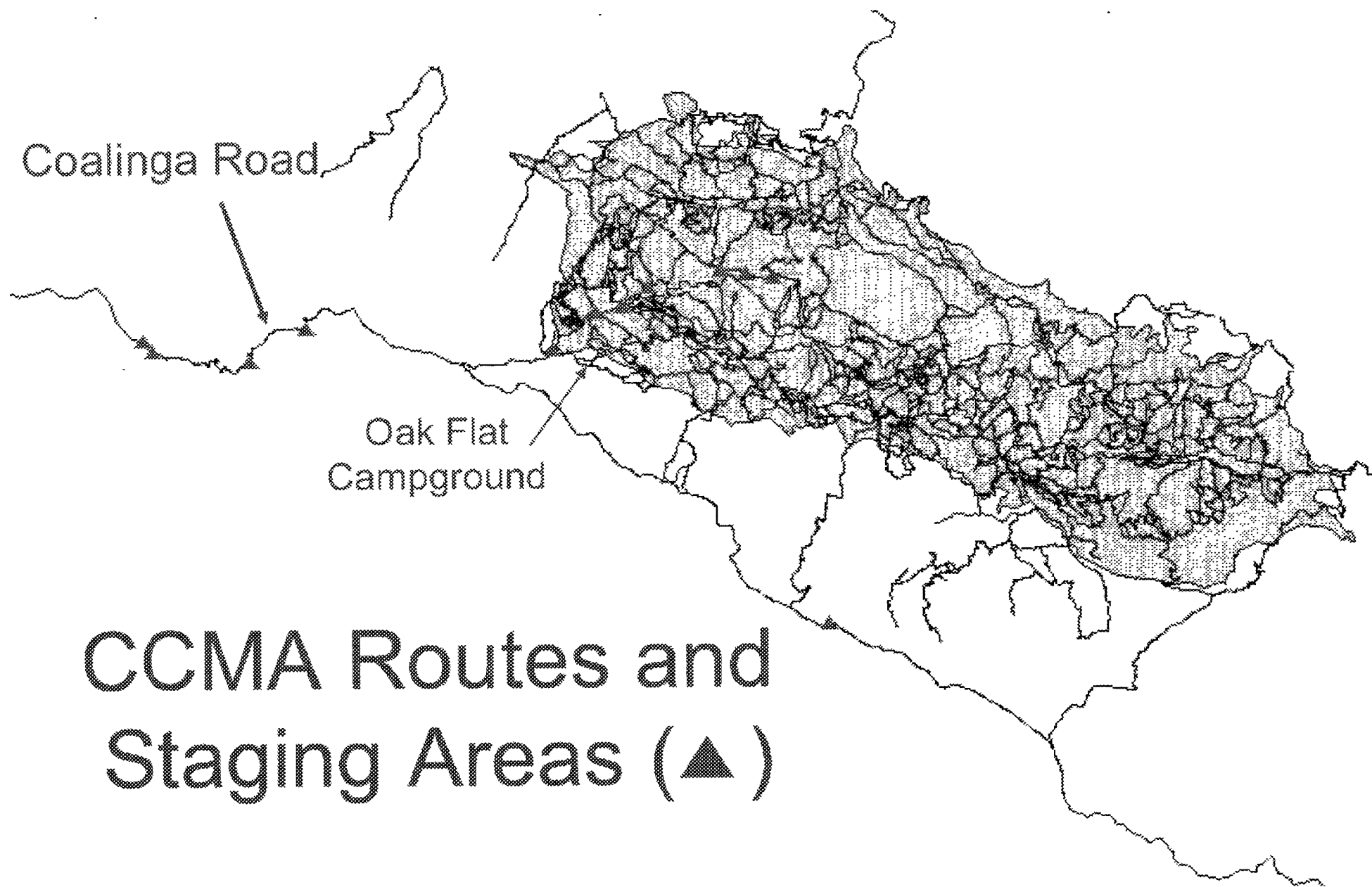
- **How is asbestos exposure related to:**
 - Specific Recreational Activities?
 - Child vs. Adult?
 - Variations with weather, soil moisture and asbestos concentrations?
- **What are the cancer risks?**

Study Design

- **Monitoring Exposure**
- **Quantifying Exposure**
- **Assessing Variation**
- **Assessing Risk**

Monitoring Exposure

- Activity-based Sampling
 - Motorcycle and ATV riding, SUV driving, hiking, camping, SUV washing/vacuuming, fence-building
- Child vs. Adult Exposures
 - Height-related differences in exposure
- Stationary (ambient) Sampling
 - Inside/outside of the hazardous zone





Staging Area 2

Monitoring Exposure:

Activity-based Sampling



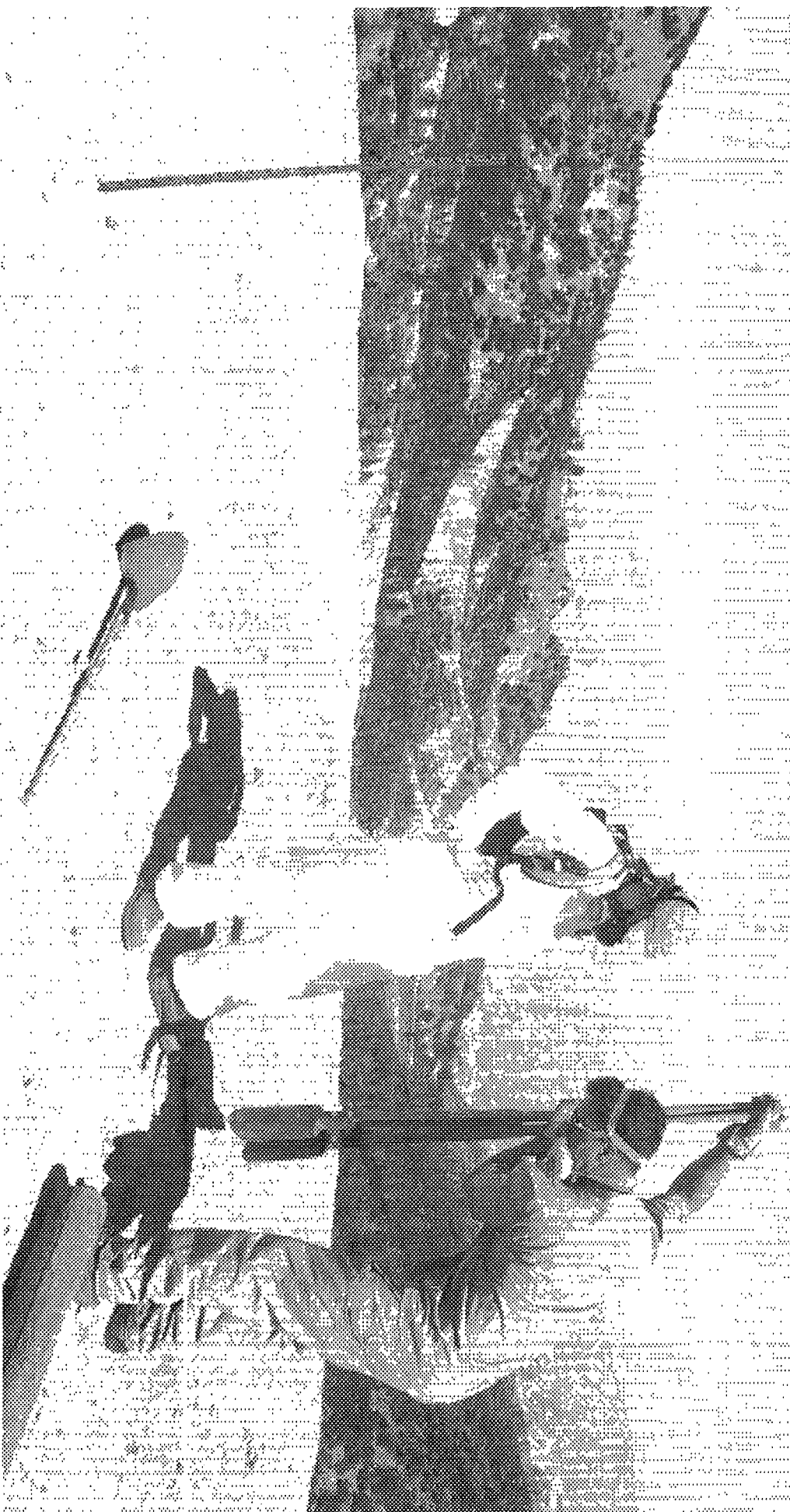






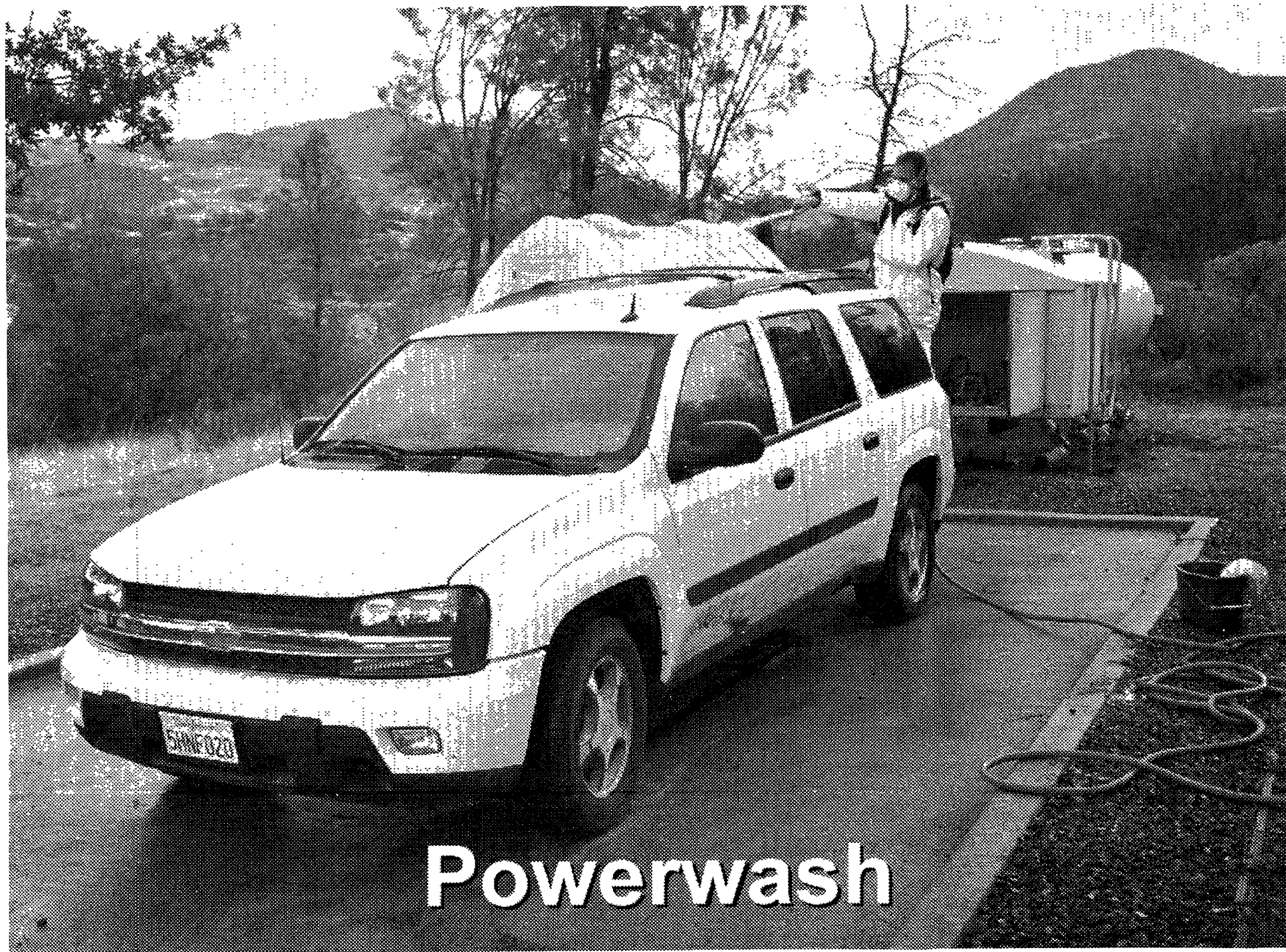
Tent, Staging Area 2

Fence Building



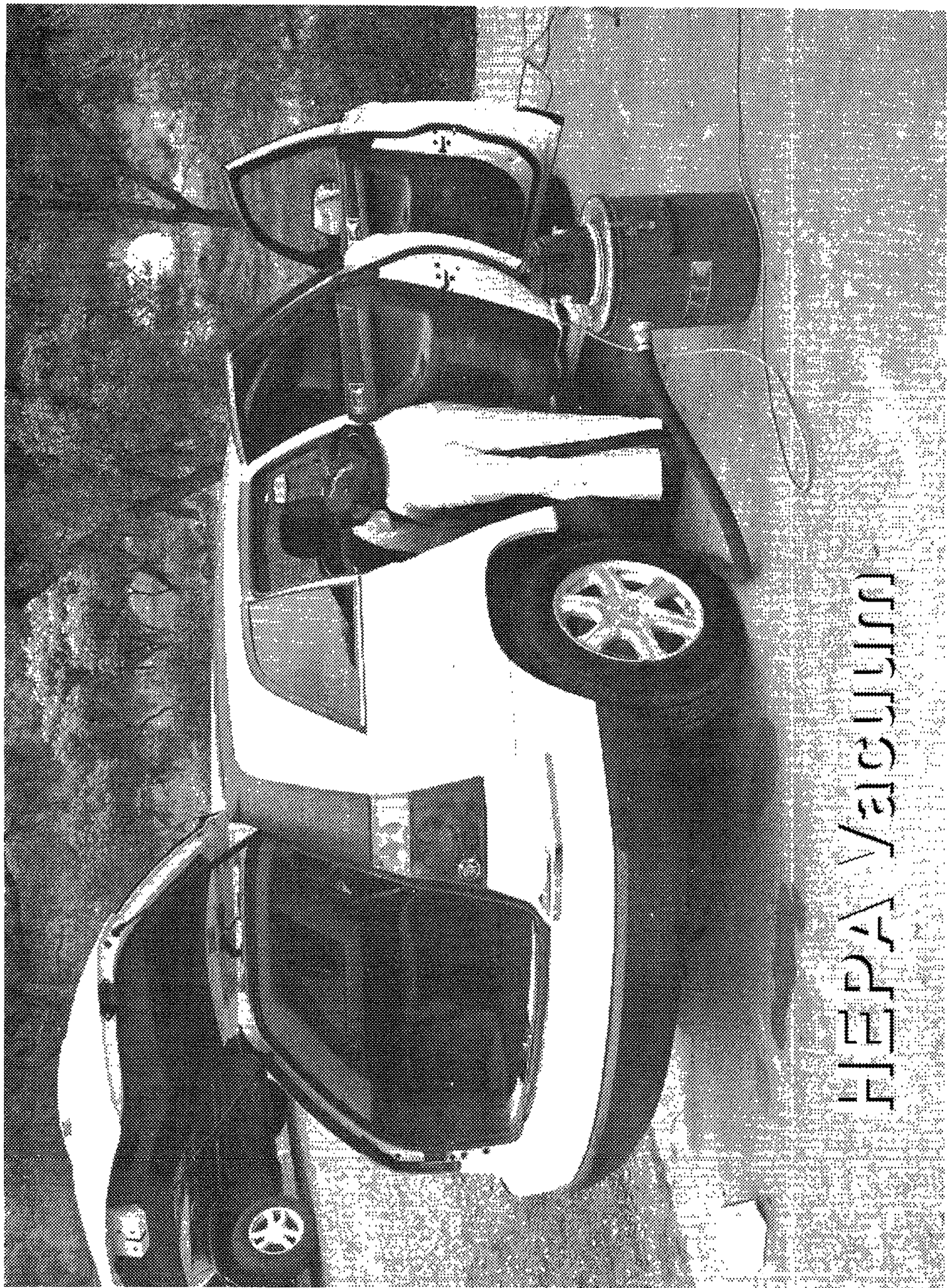


Muddy SUV



Powerwash

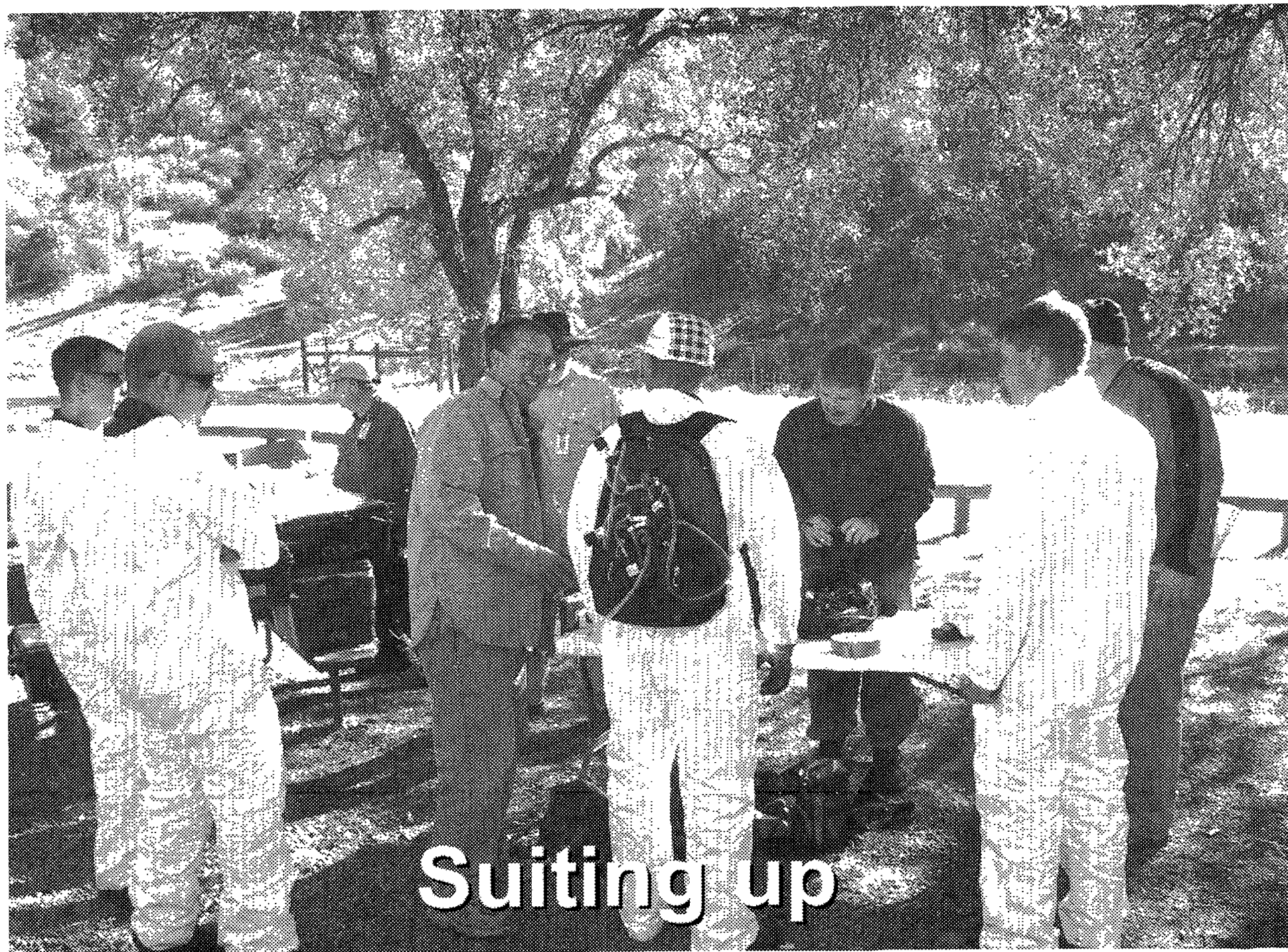
HEPA Vacuum



Creating Solutions





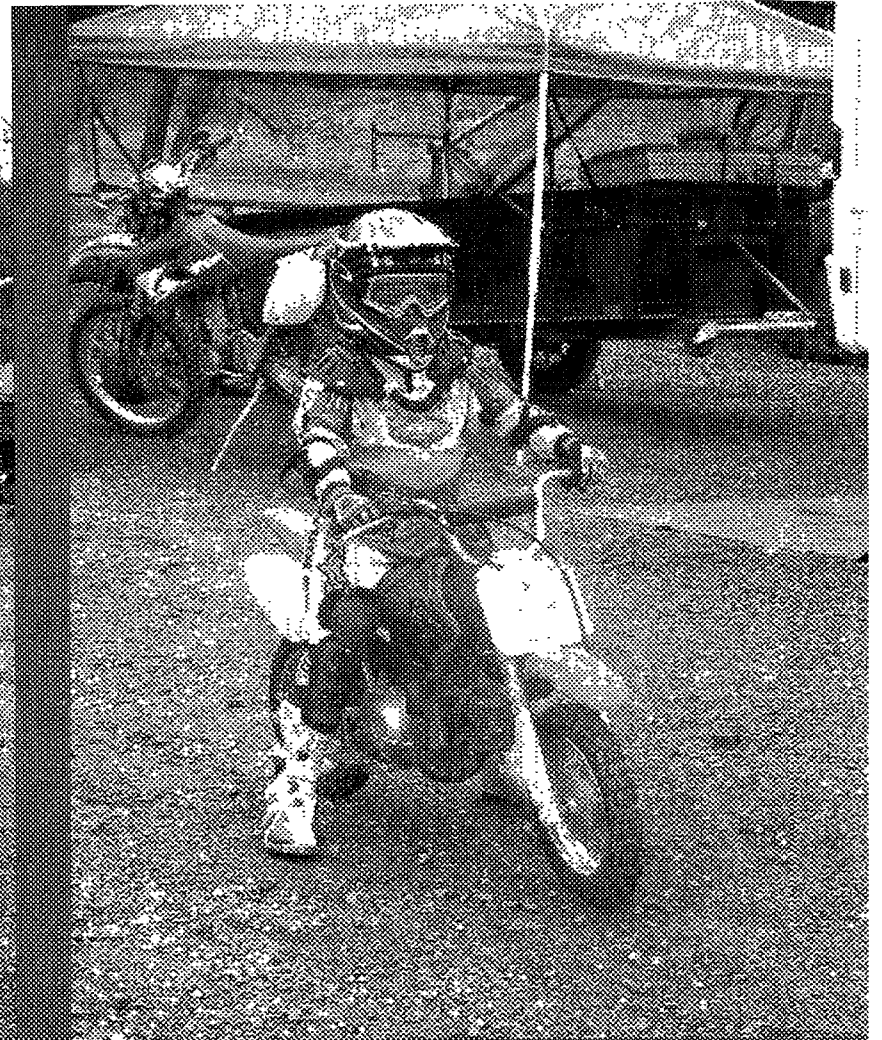




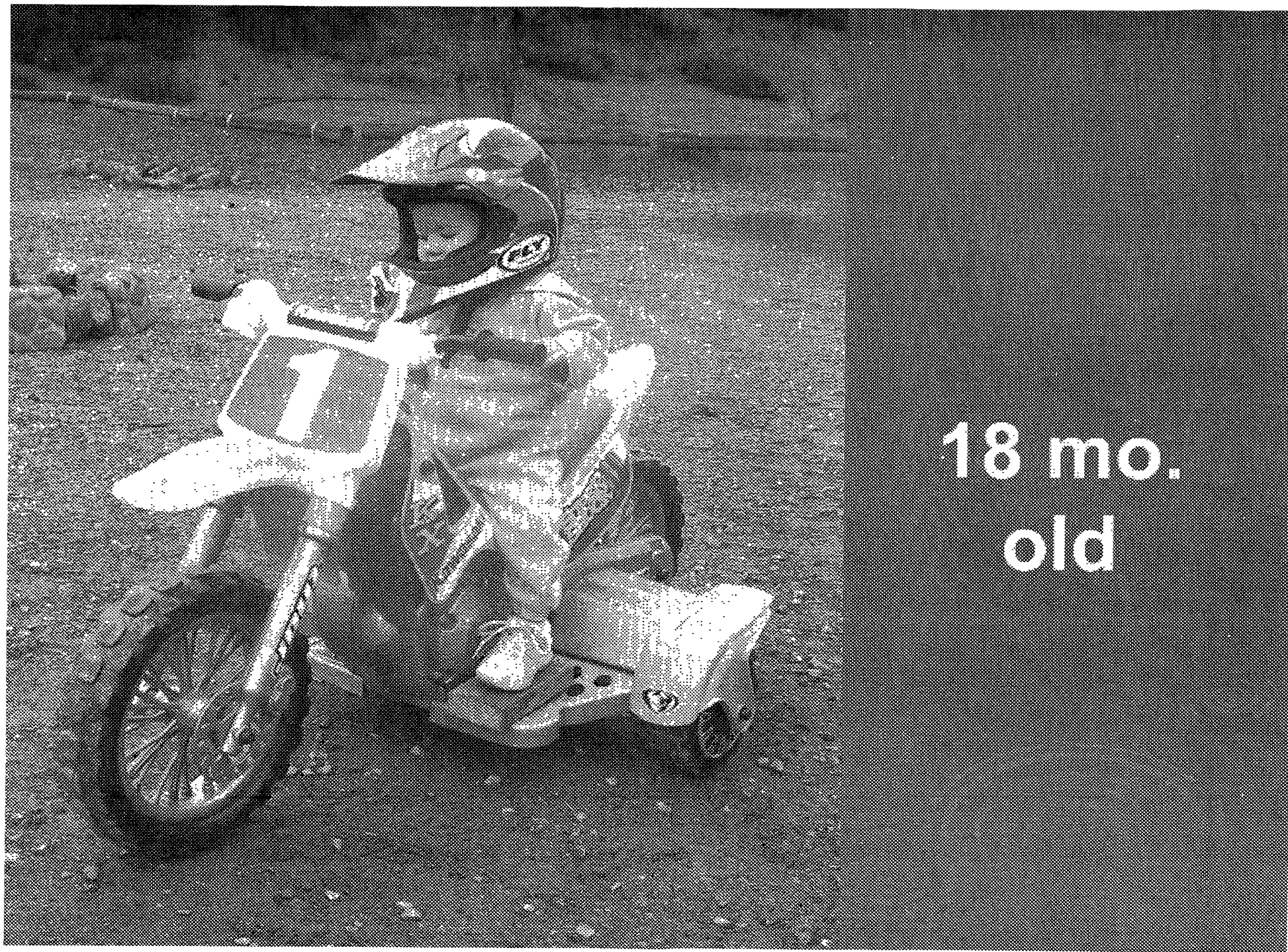
Full Protection

Monitoring Exposure:

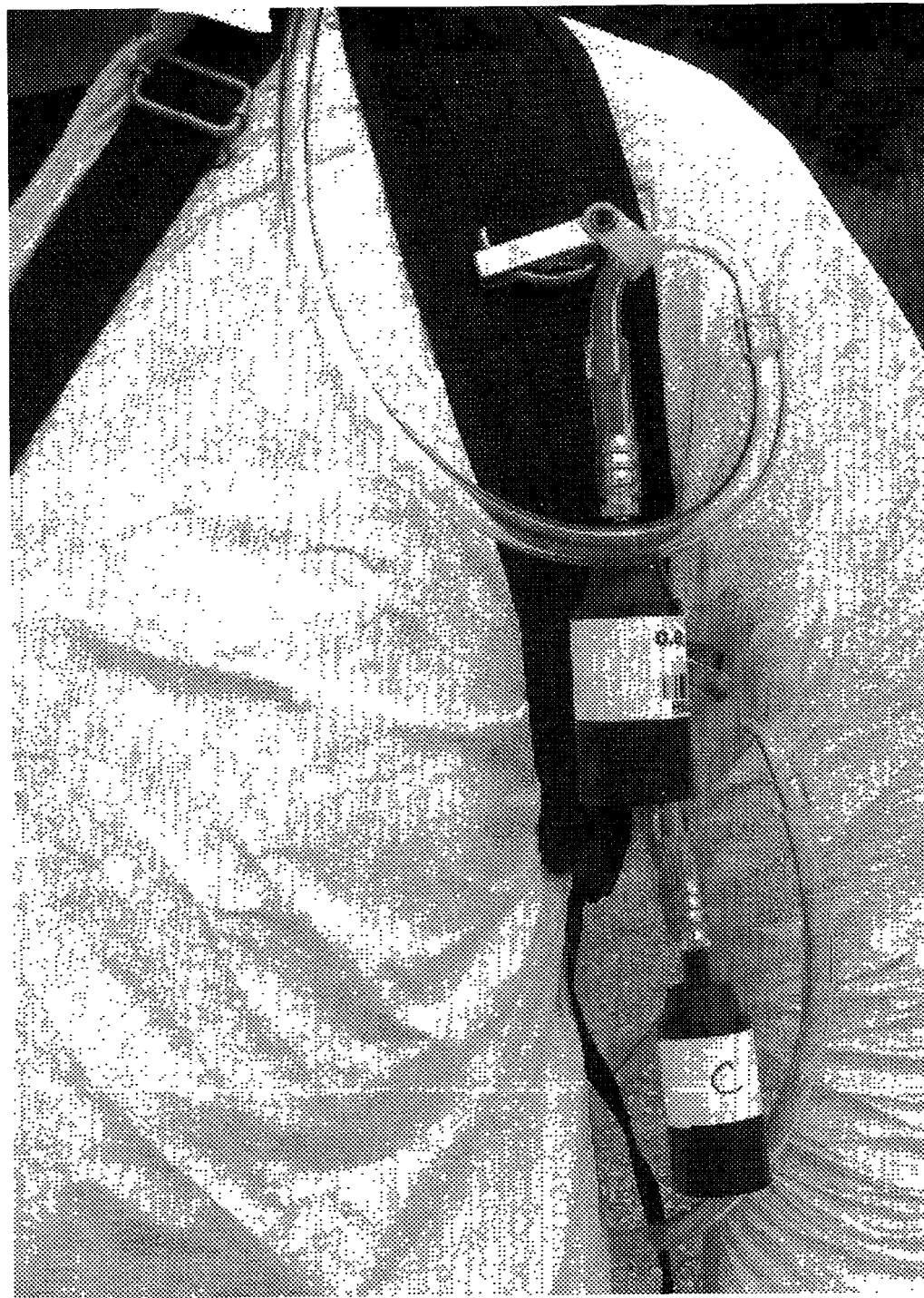
Child vs. Adult

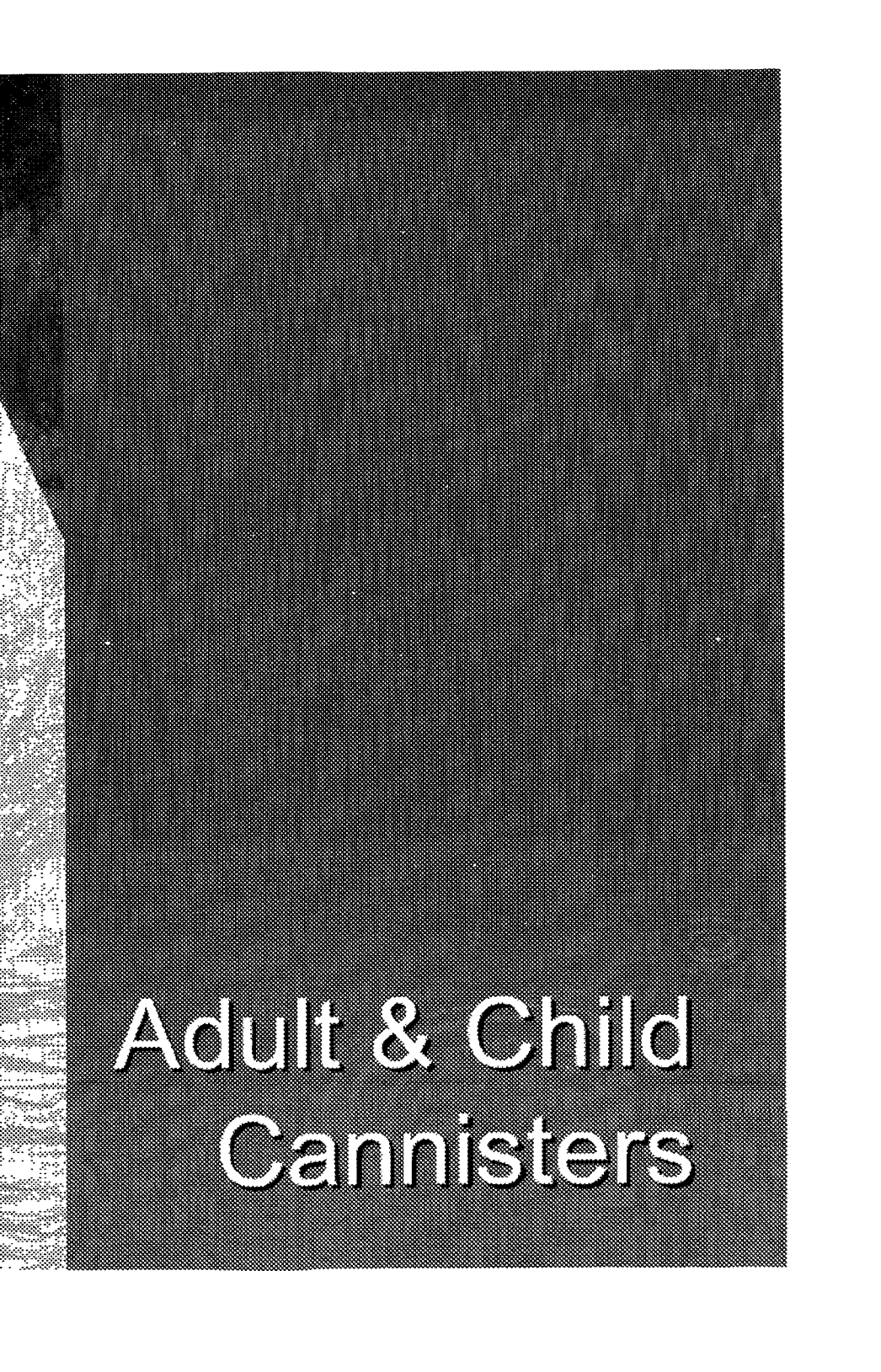


6 yr. old



18 mo.
old





Adult & Child Cannisters



SUV Co-located Child Samplers

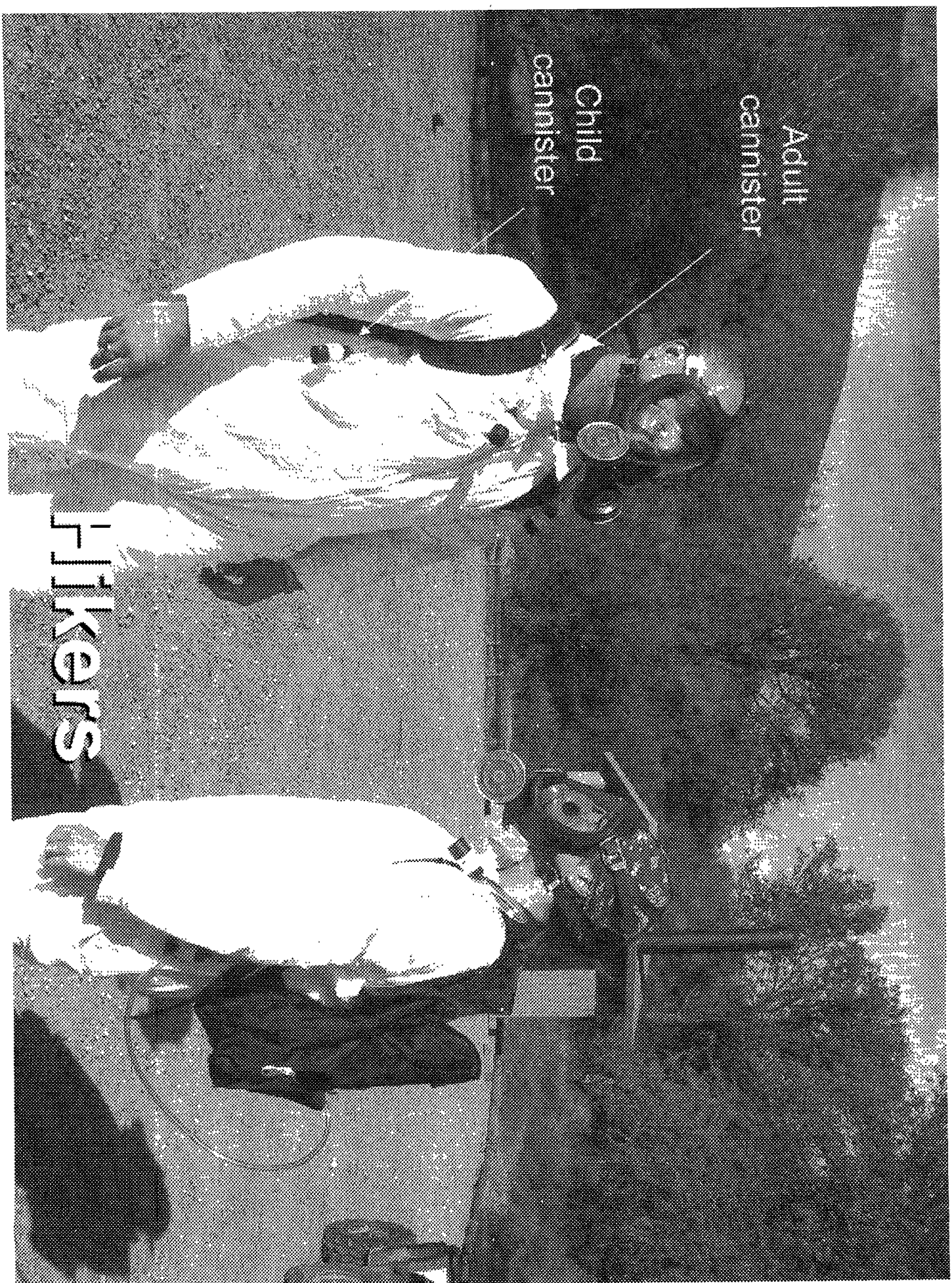
SUV
Co-located
Adult Samplers



Adult
cannister

Child
cannister

Hikers



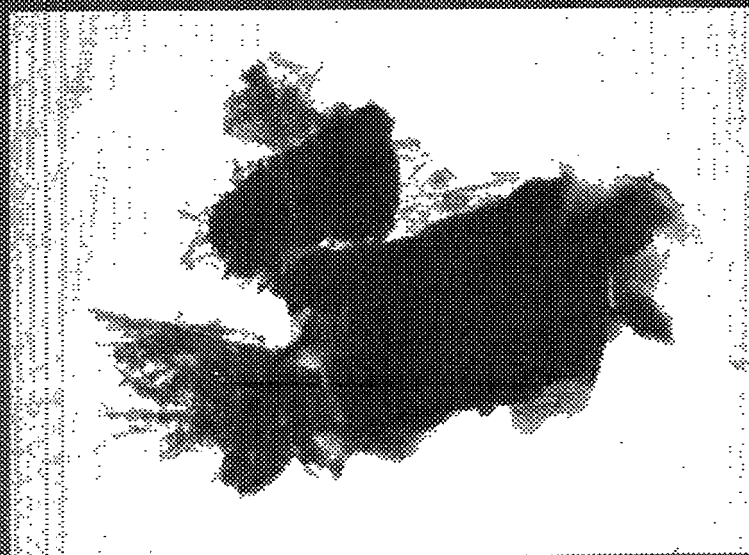
Study Design

- **Monitoring Exposure**
- **Quantifying Exposure**
- **Assessing Variation**
- **Assessing Risk**

Quantifying Exposure

- **Transmission Electron Microscopy**
- **International Standard ISO 10312**
 - Standard definitions of fiber types
 - Counting Rules
 - QA/QC
- **Binning**
 - Phase Contrast Microscope equivalent (PCME) fibers
 - Other fiber categories

CCMA Chr



ysotile

Structure Types:

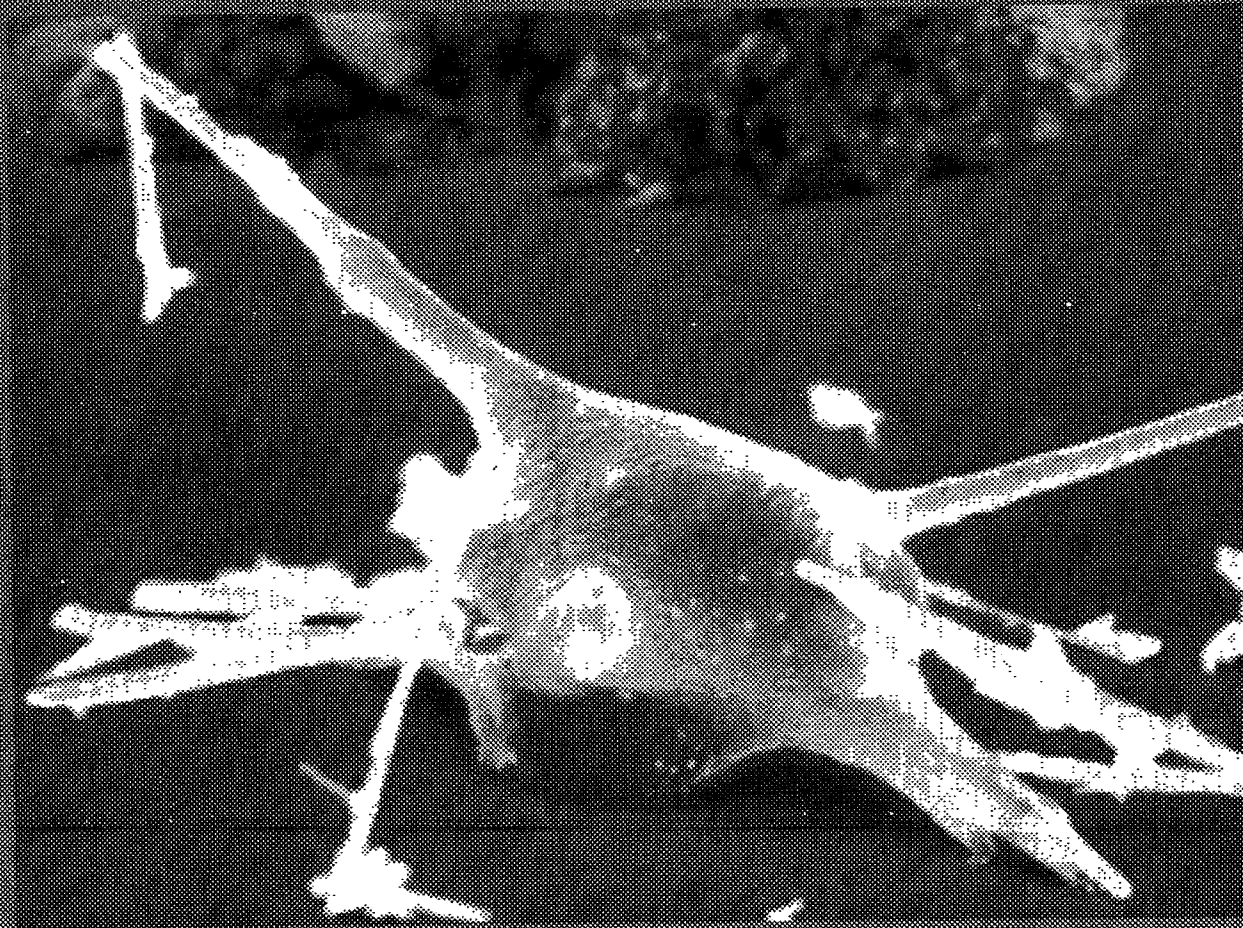
Fibers
Bundles
Matrices
Clusters



Phagocytosis of asbestos fibers

pulmonary alveolar macrophage cell attempting to engulf and ingest several long crocidolite asbestos fibers

incomplete ingestion of asbestos fibers can lead to extensive 'selective release' of proteolytic enzymes and ROS from the 'frustrated' PAMs



CCMA asbestos Short and Amphibole-Free???

Original Paper

**Indoor Built
Environment**

Indoor Built Environ 1998;7:18-31

E. Ilgren^a
E. Chatfield^b

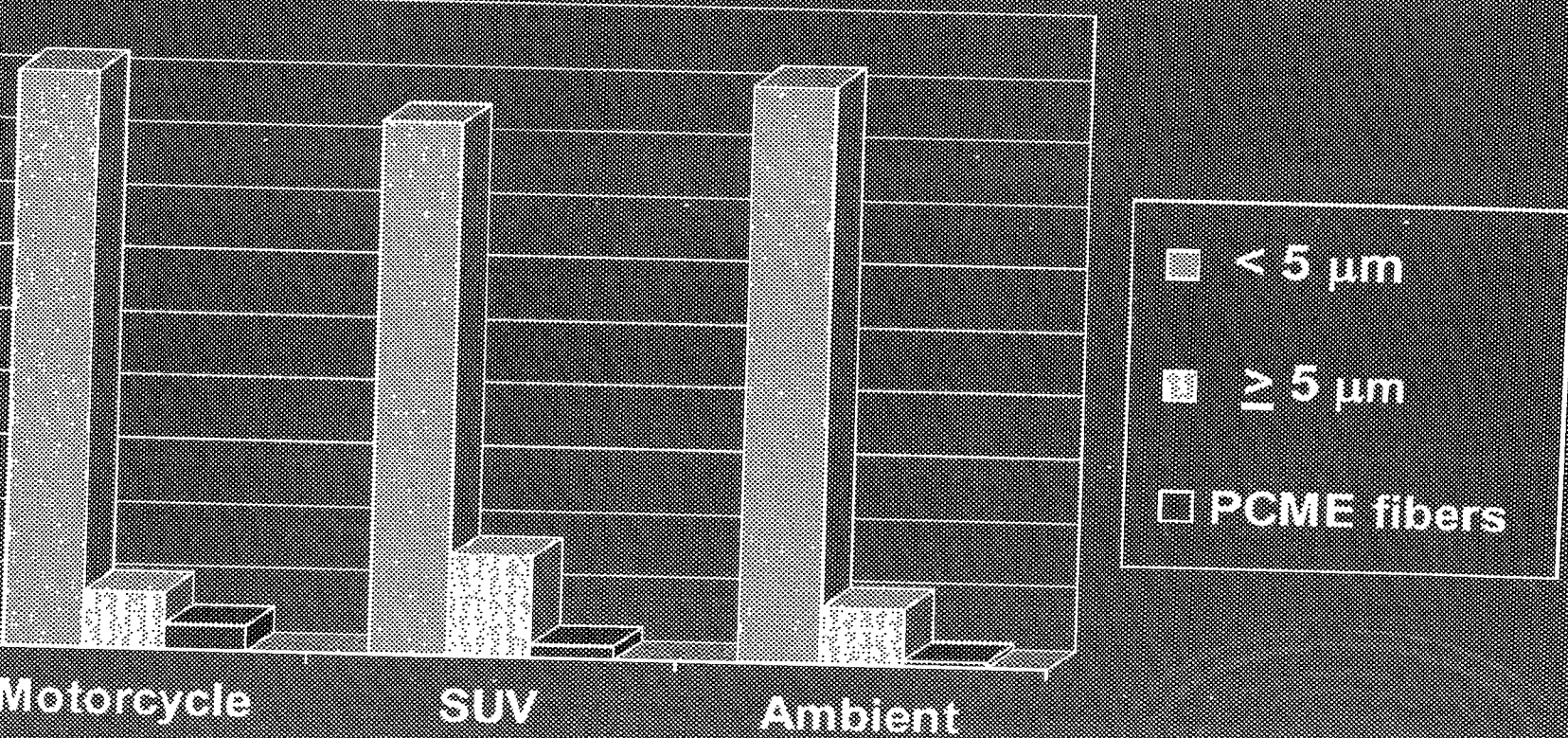
^a Consultant Physician,
Bryn Mawr, Pa., USA;

^b Consultant Industrial Hygienist,
Toronto, Canada

Coalinga Fibre – A Short, Amphibole-Free Chrysotile

Part 2: Evidence for Lack of Tumourigenic Activity

Chrysotile Dimensions vs. Scenarios (Dry Season)

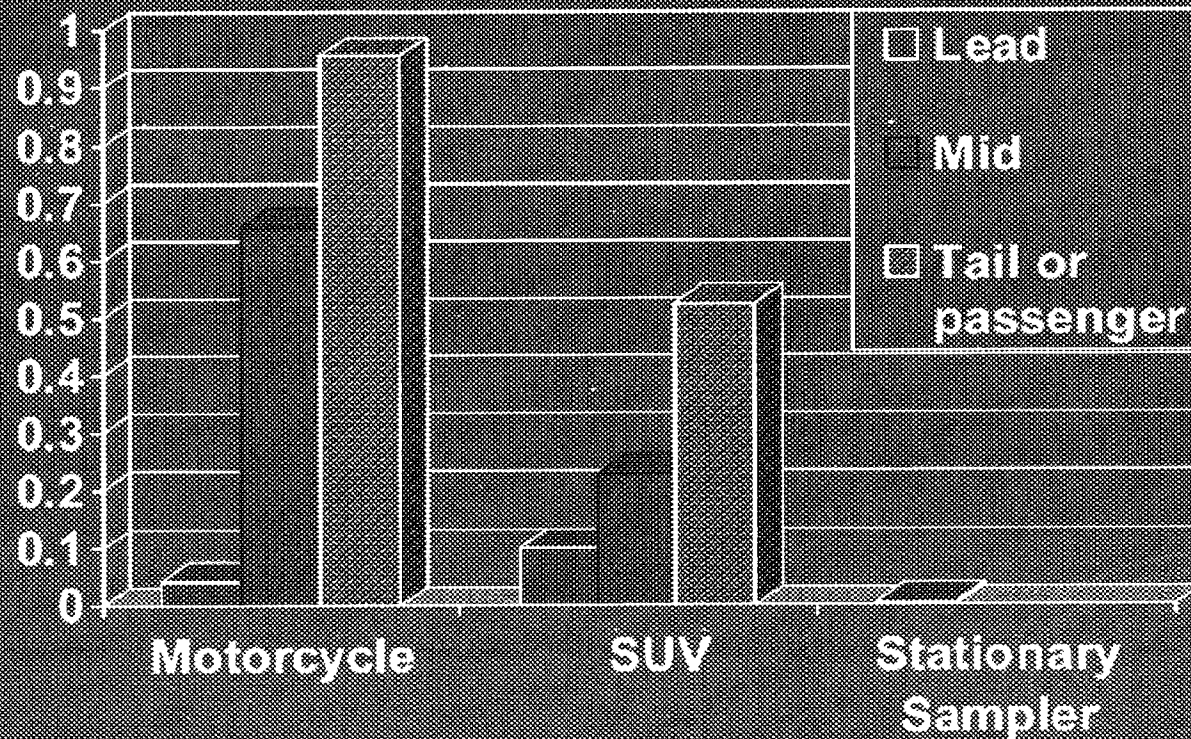


September (dry soil) Asbestos Concentrations (PCME fibers/cc)

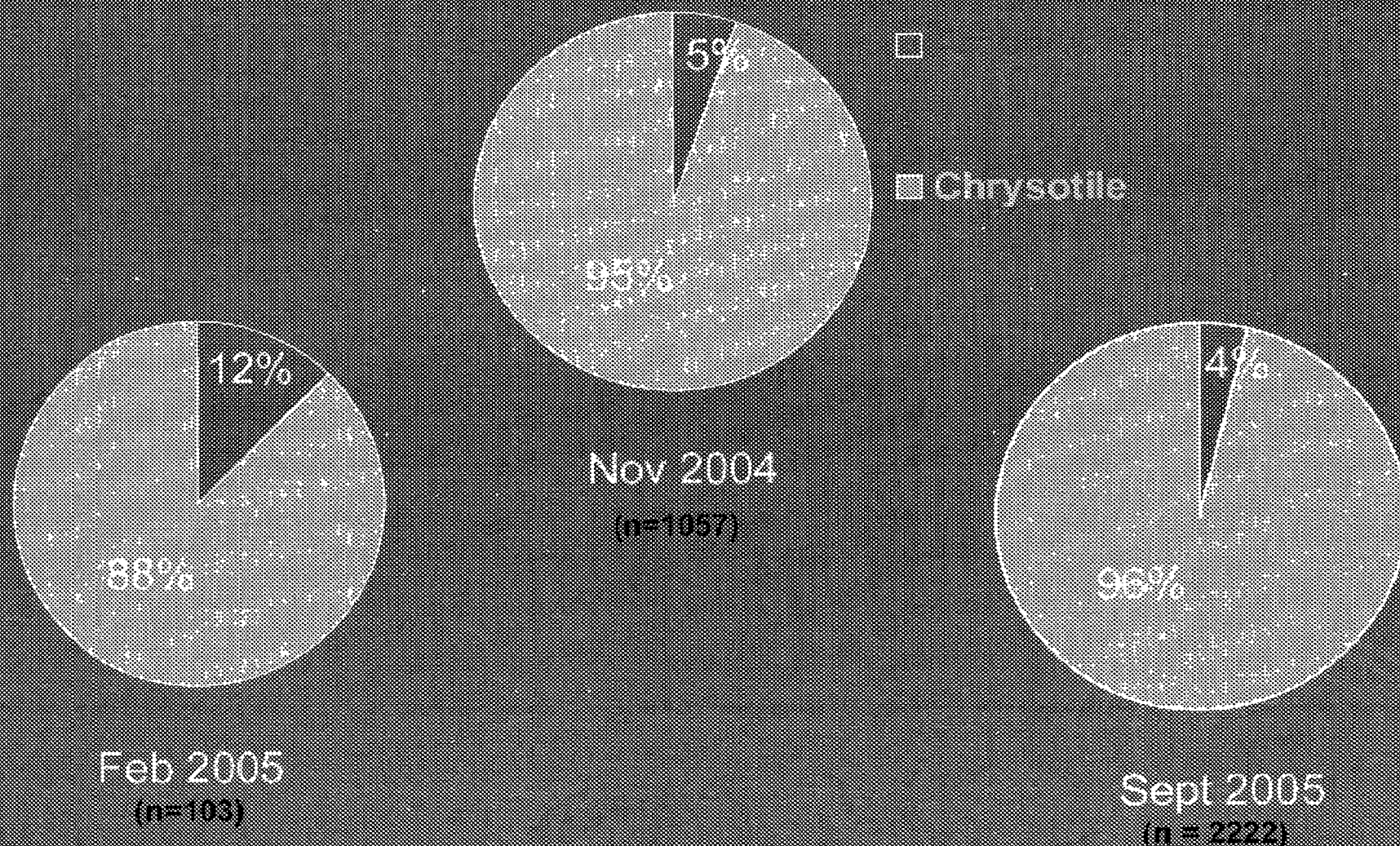
OSHA
30 min
Excursion
Limit



OSHA
PEL



Percentage of amphibole vs. chrysotile PCMe structures during 3 sampling events



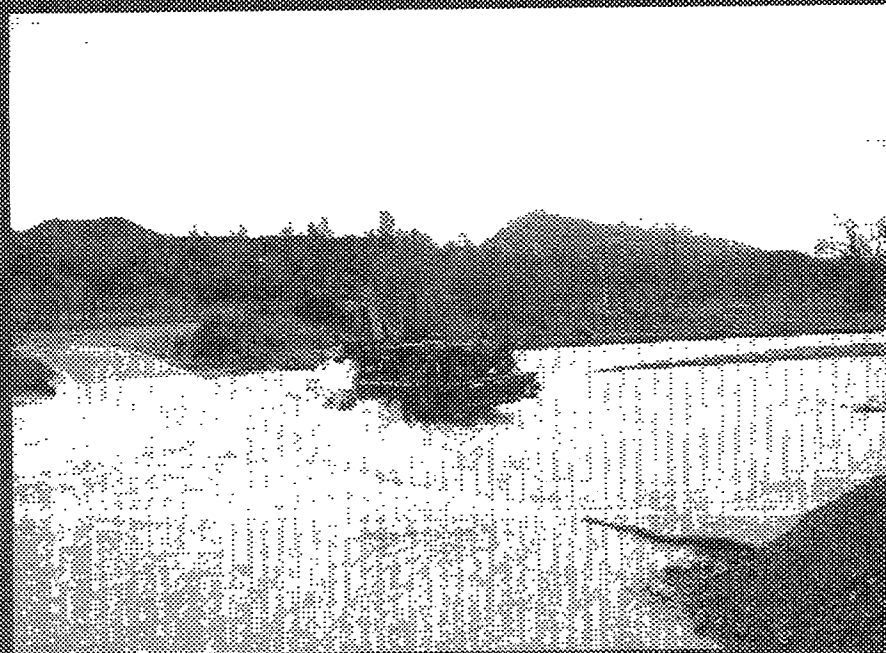
Study Design

- Monitoring Exposure
- Quantifying Exposure
- Assessing Variation
- Assessing Risk

Assessing Variation

- Scenario repetition
 - 1-2 times/day X 2-3 days

- Seasonal sampling
 - September, 2004 (dry)
 - November, 2004 (moist)
 - February, 2004 (wet)
 - September, 2005 (dry)



DRY
(September)

**Pacific Strike Team
crossing
San Benito Creek**

WET
(February)

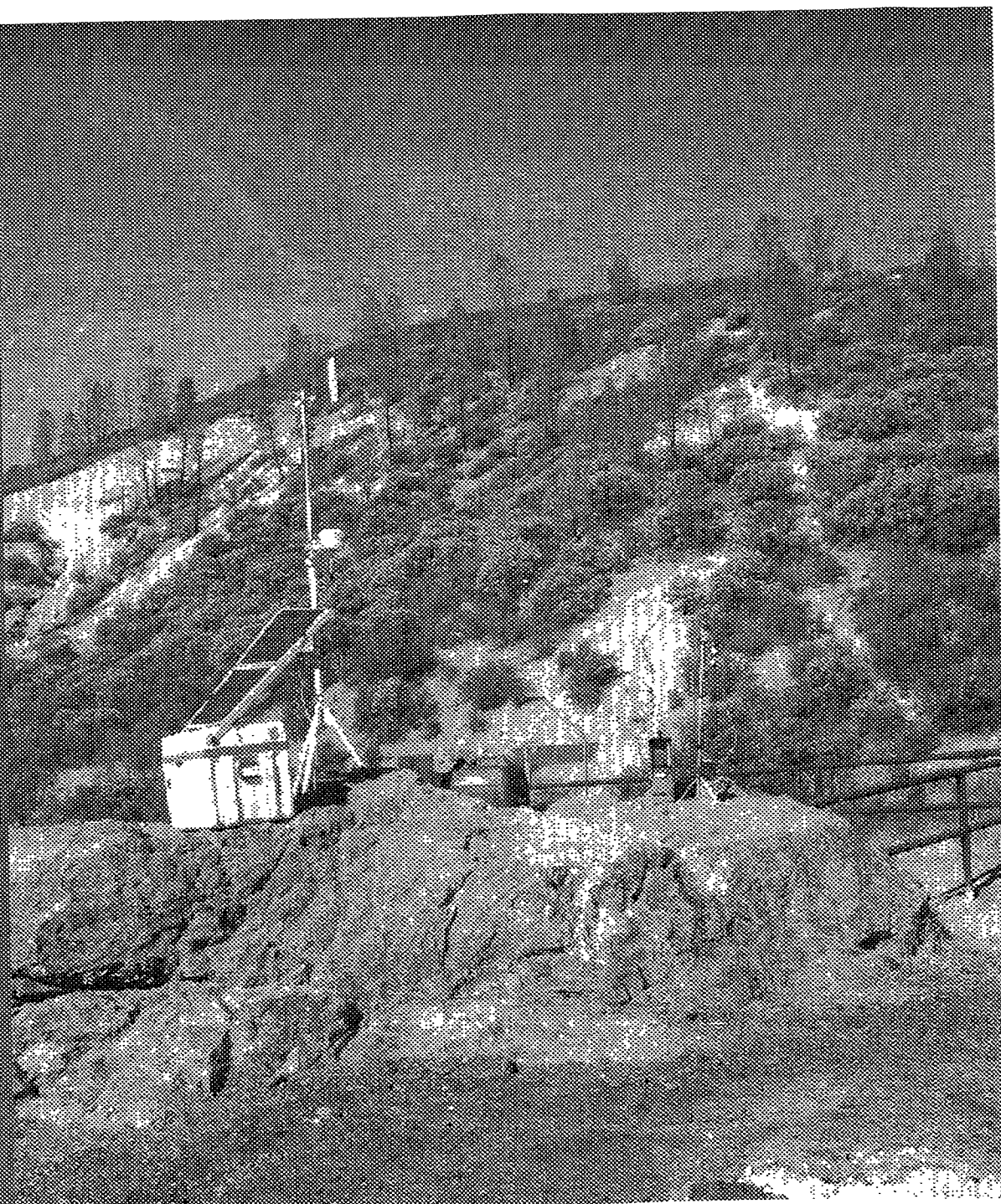
Assessing Variation

- **Ambient air and weather monitoring**
 - 4 stations/event
 - Upwind/downwind
- **Soil moisture and asbestos concentrations**
 - 3 samples/route/day
- **Dust generation**
 - Photodocumentation of dust plumes/event

Assessing
Variation:

Ambient Air
and
Meteorological
Monitoring

Staging Area 2



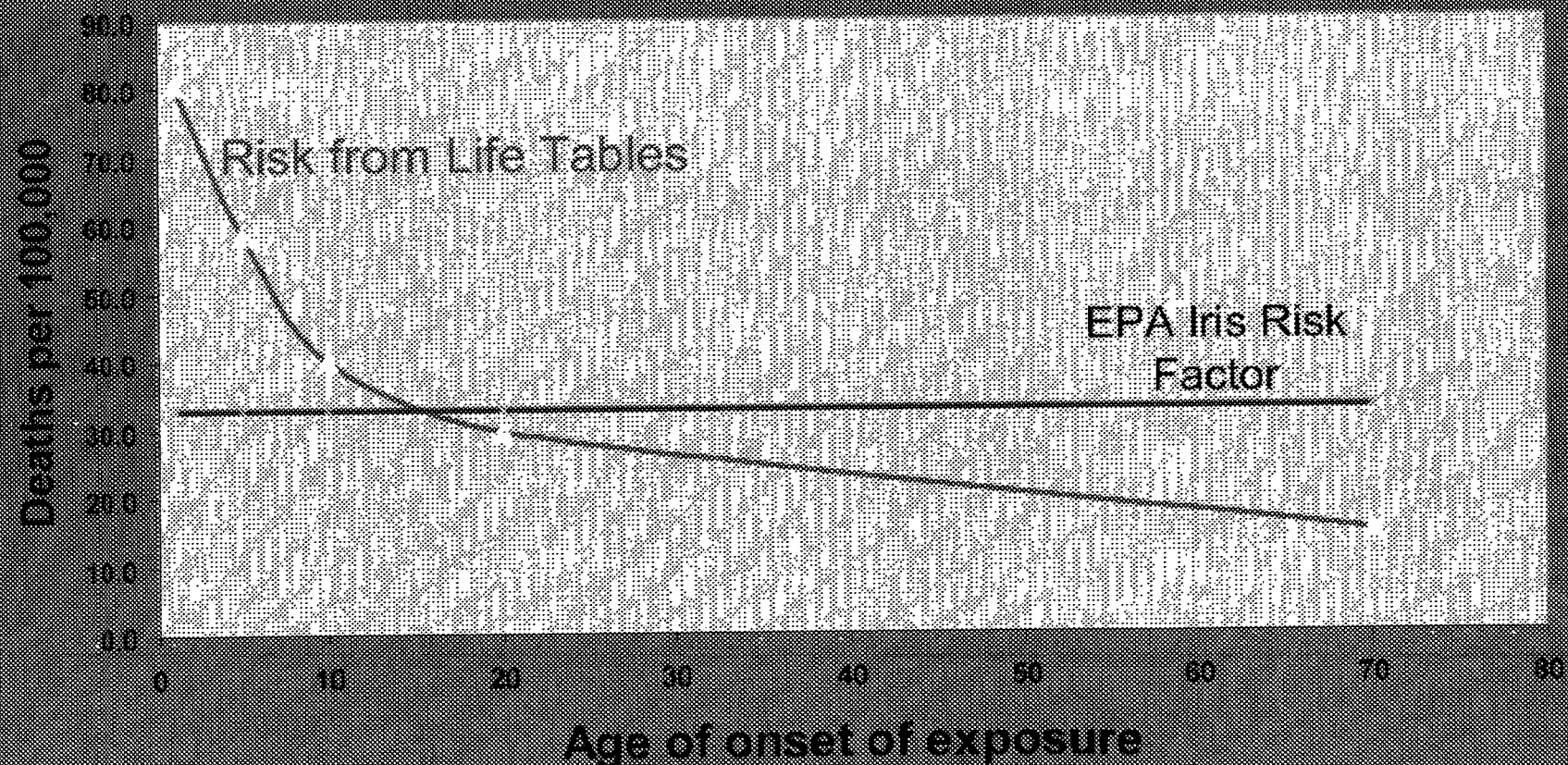
Study Design

- **Monitoring Exposure**
- **Quantifying Exposure**
- **Assessing Variation**
- **Assessing Risk**

Assessing Risk

- **PCM-equivalent (PCME) fibers**
($\geq 5 \mu\text{m}$ long, $0.2 - 3.0 \mu\text{m}$ wide, $\geq 3:1$ aspect ratio)
- **EPA (IRIS) Cancer Slope Factor – adult risk**
- **Nicholson (1986) Life Tables – child risk**
- **Exposure Assumptions (BLM, 1992)**

Male Cancer Risk for 10 years Continuous Exposure vs. Age at First Exposure



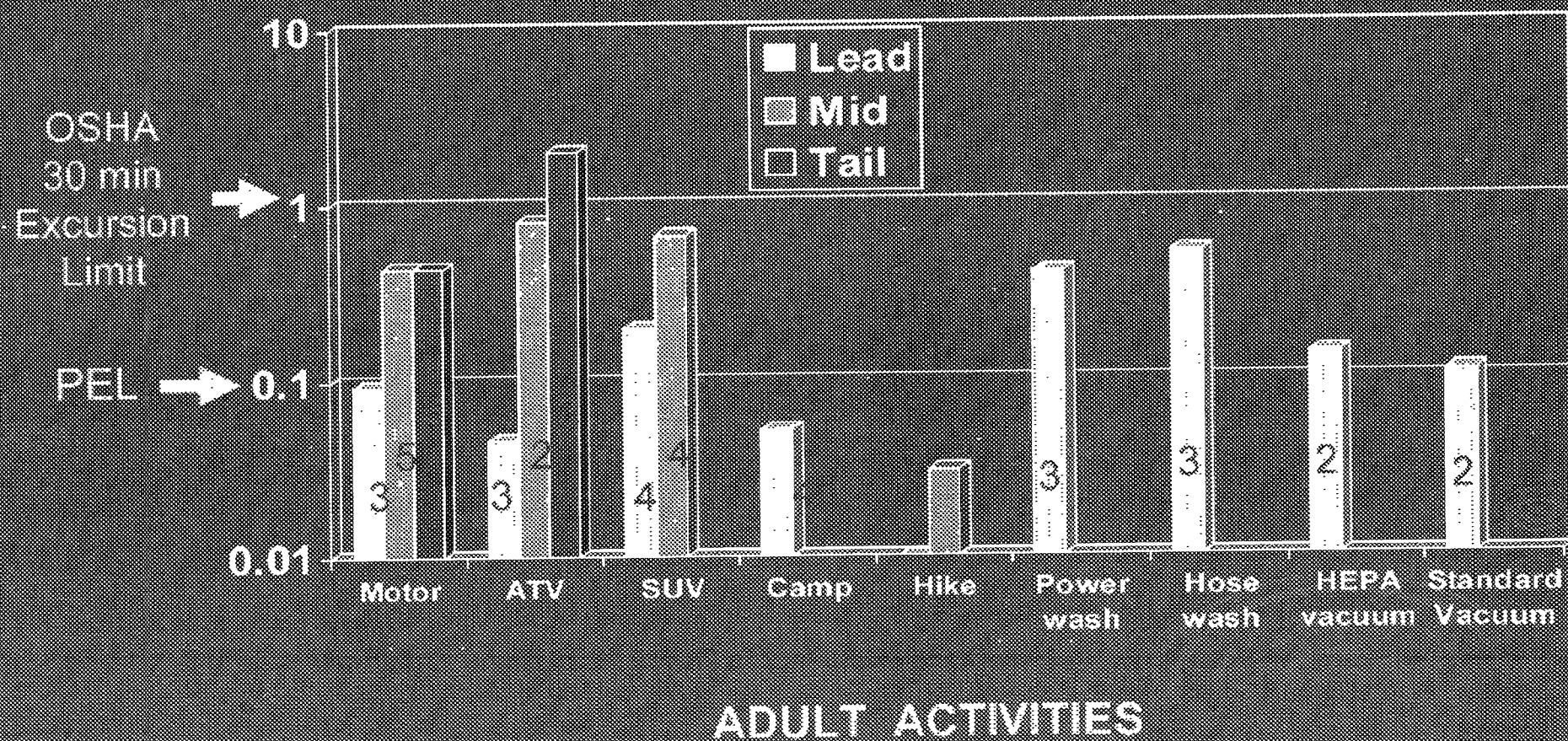
Exposure Assumptions (BLM, 1992)

- 1 day/year
- 5 days/year = Reasonable Maximum Exposure
- 12 days/year = High estimate
- 30 year exposure averaged over 70 year lifespan

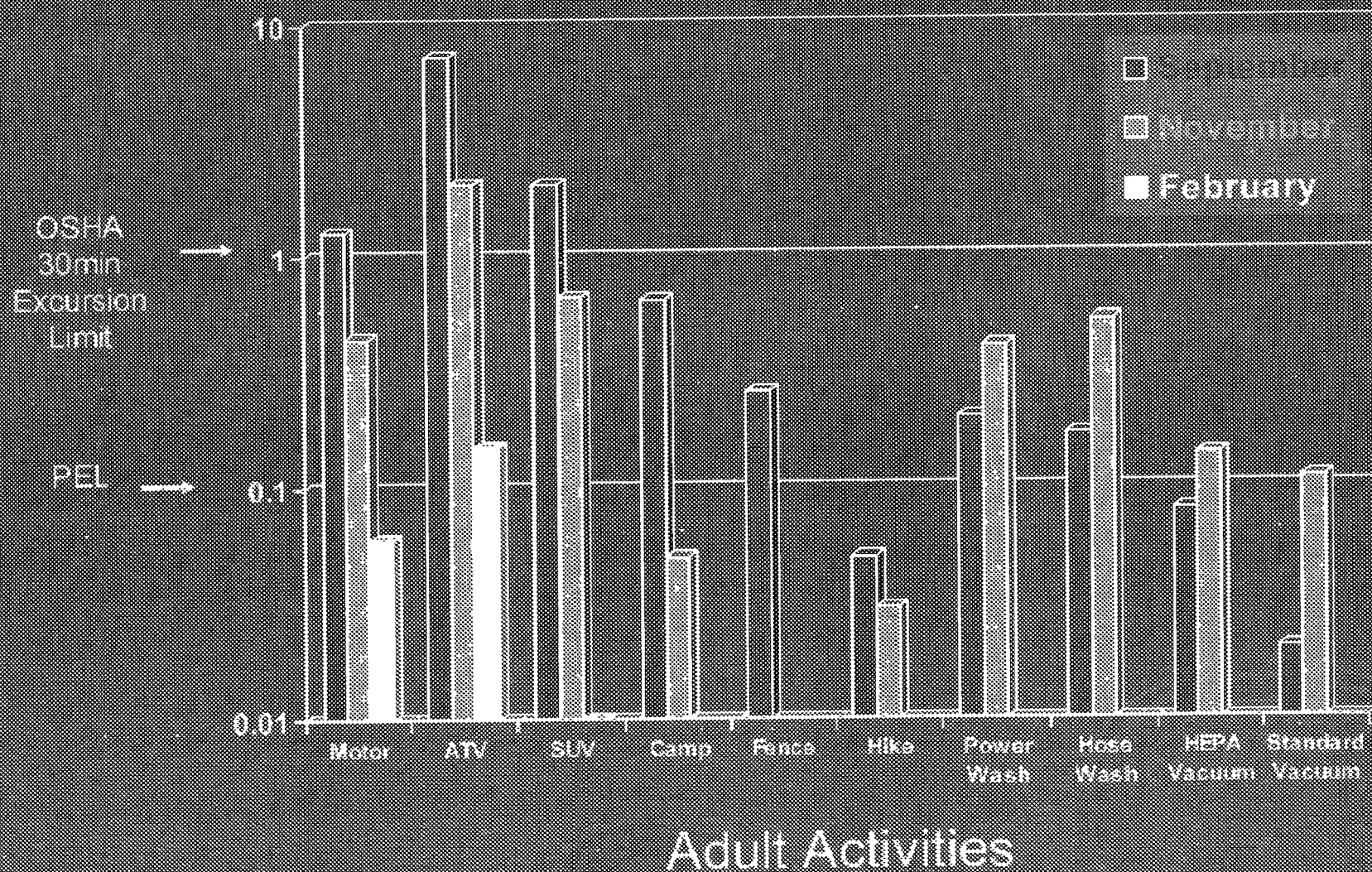
Results

November (moist soil)

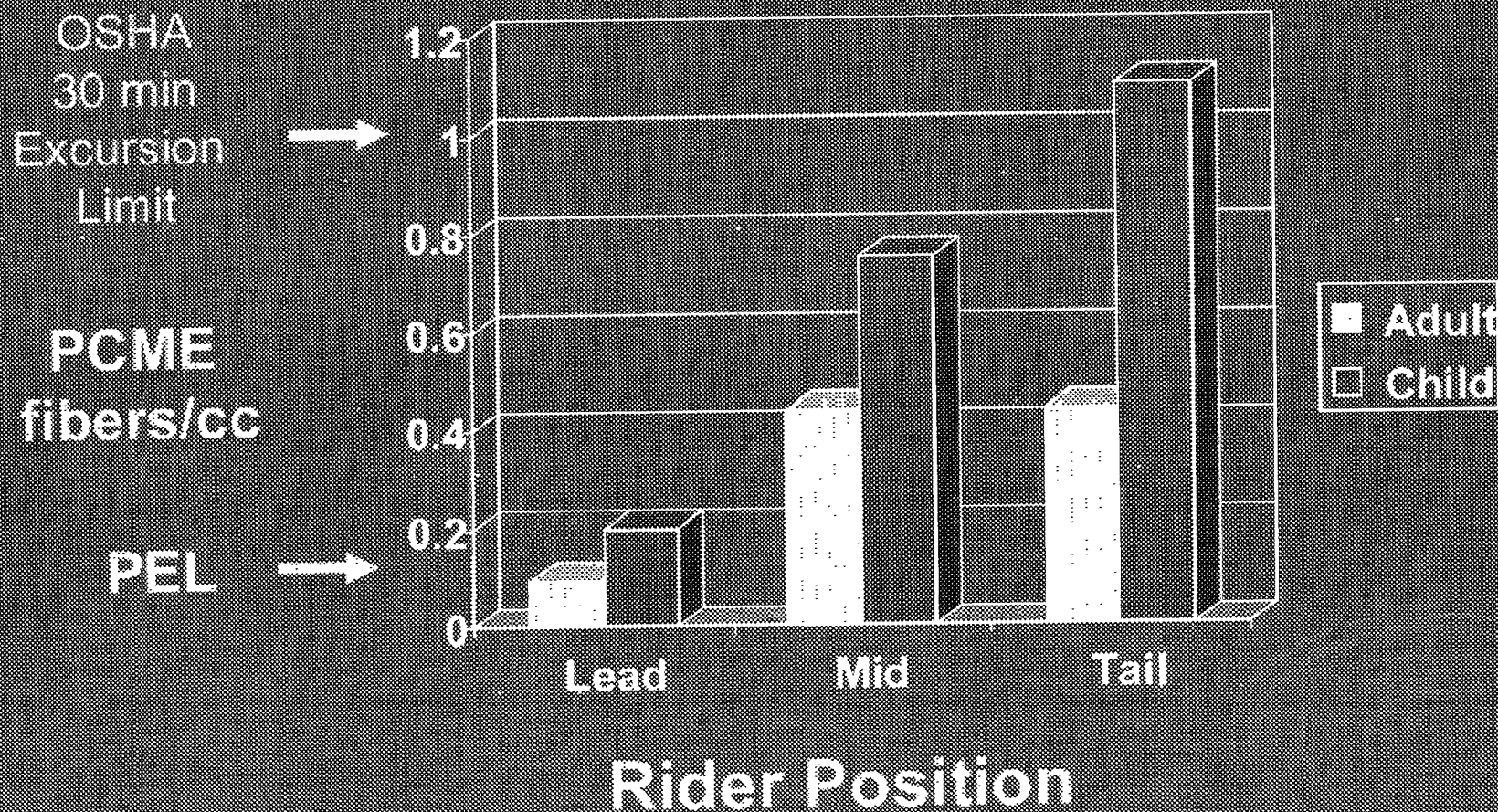
Maximum Asbestos Concentrations (PCME fibers/cc)



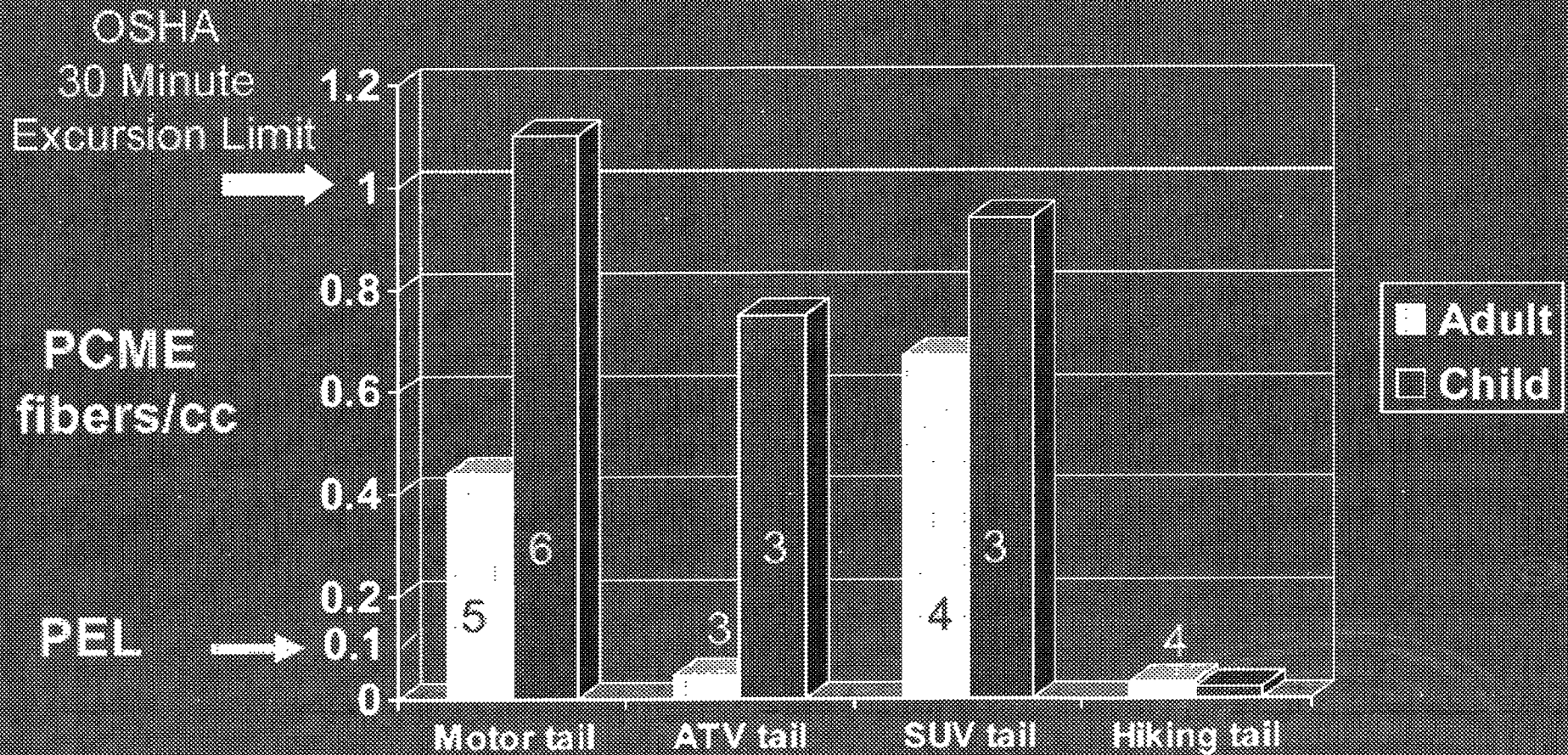
Seasonal Comparison of Maximum Asbestos Concentration (PCME fibers/cc)



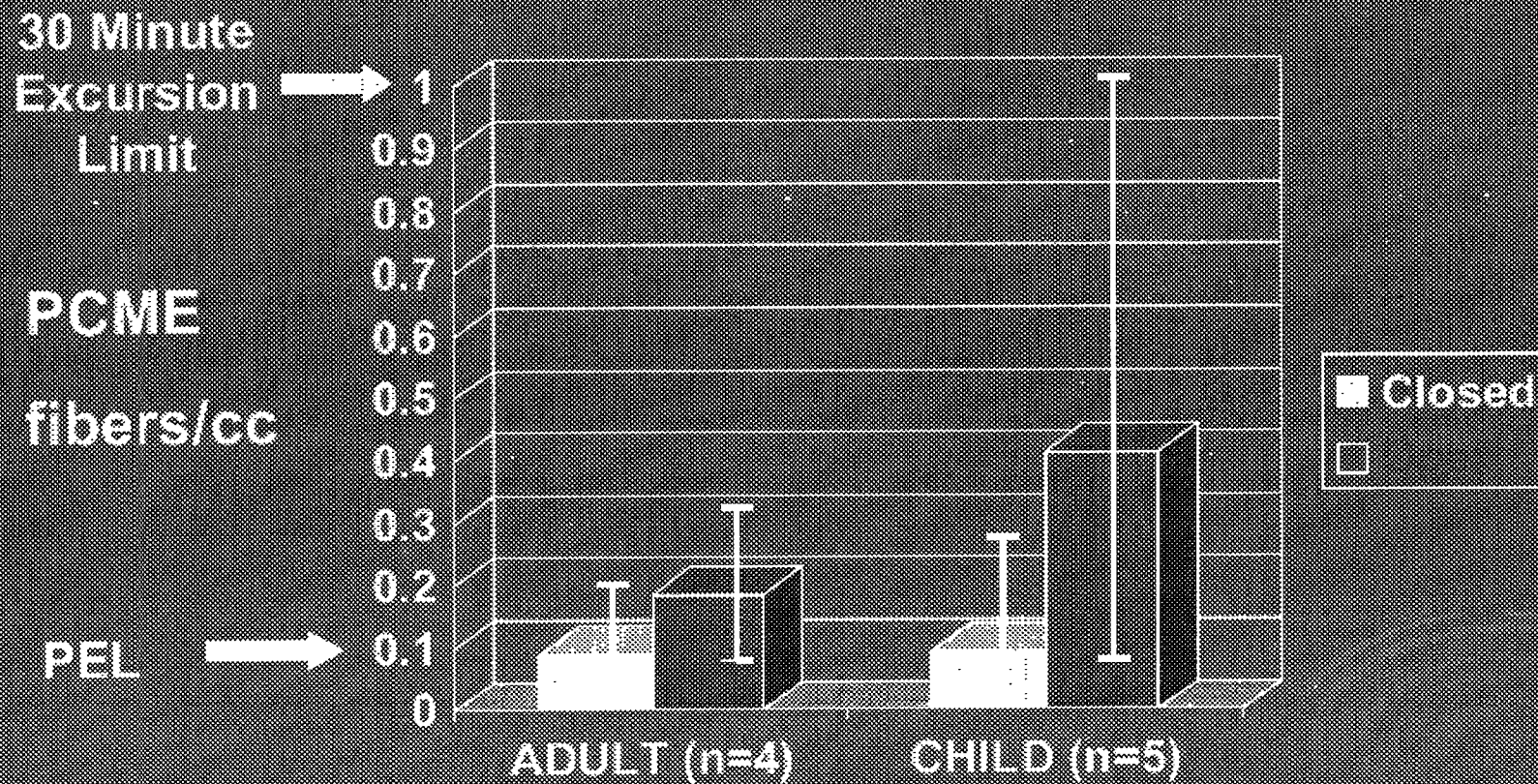
Adult vs. Child Motorcyclist (PCME fibers/cc)



Adult vs. Child Max. Exposures (PCME fibers/cc)



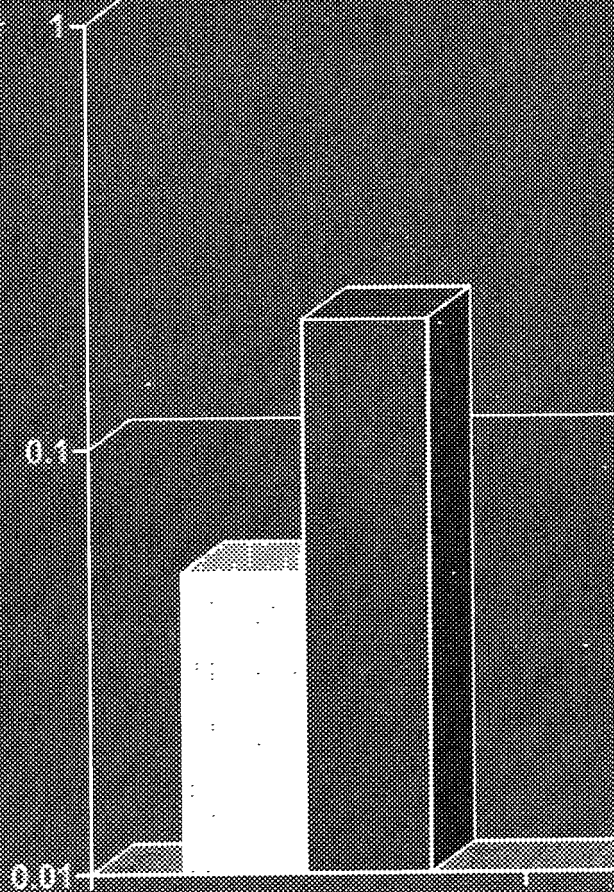
Average Exposure (PCME) with Closed vs. Open Windows



PCME Exposures during Activities (PCME)

OSHA
30min
Excursion
Limit

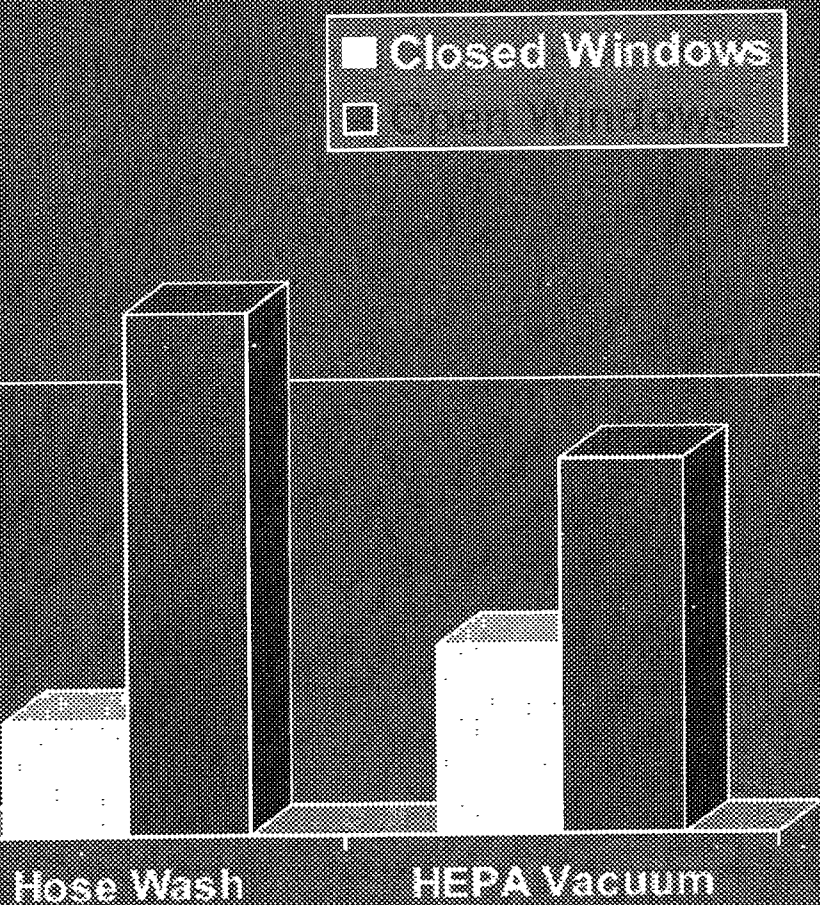
PEL



Power Wash

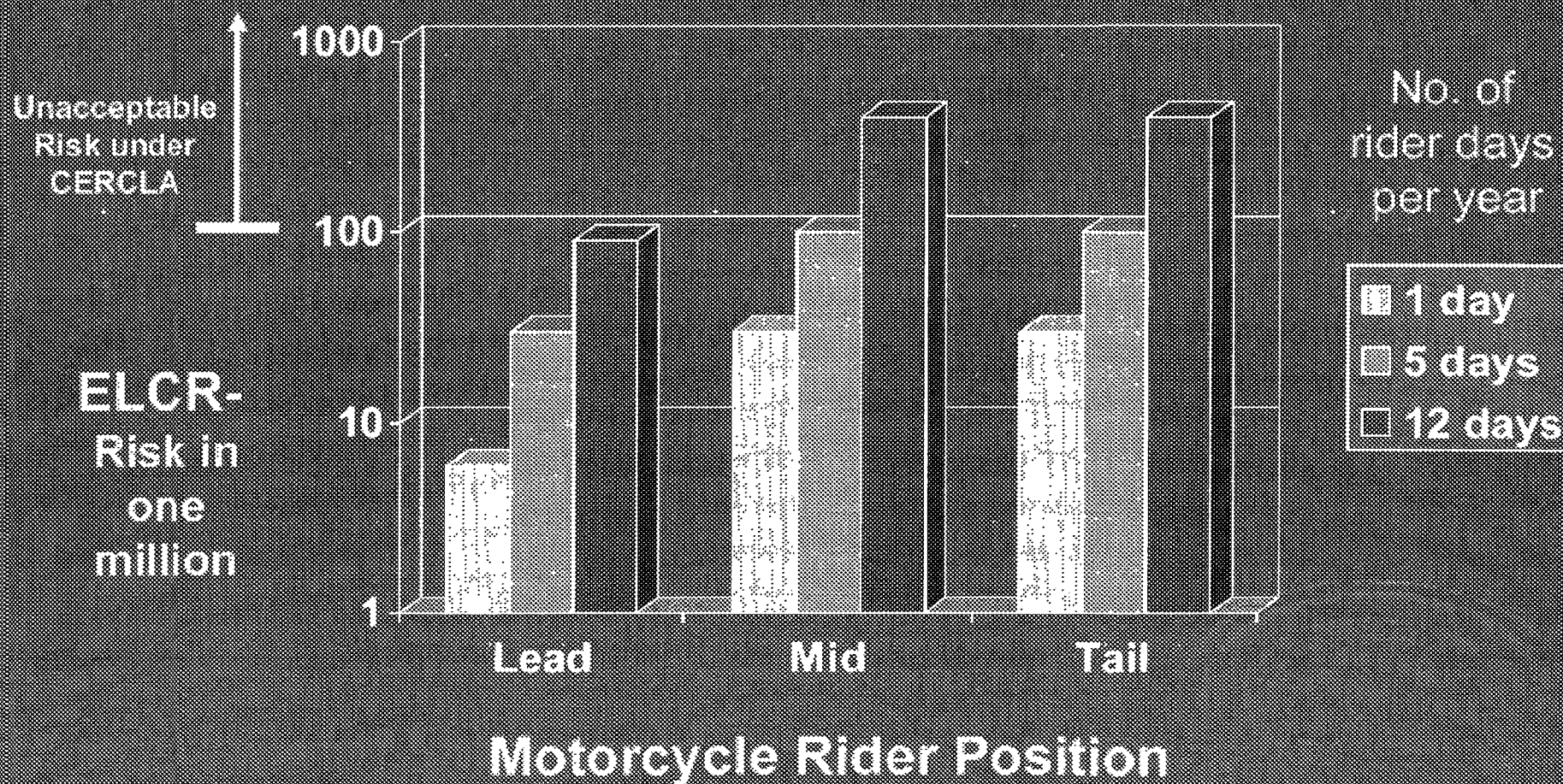
SUV Cleaning

During SUV Cleaning (CME fibers/cc)

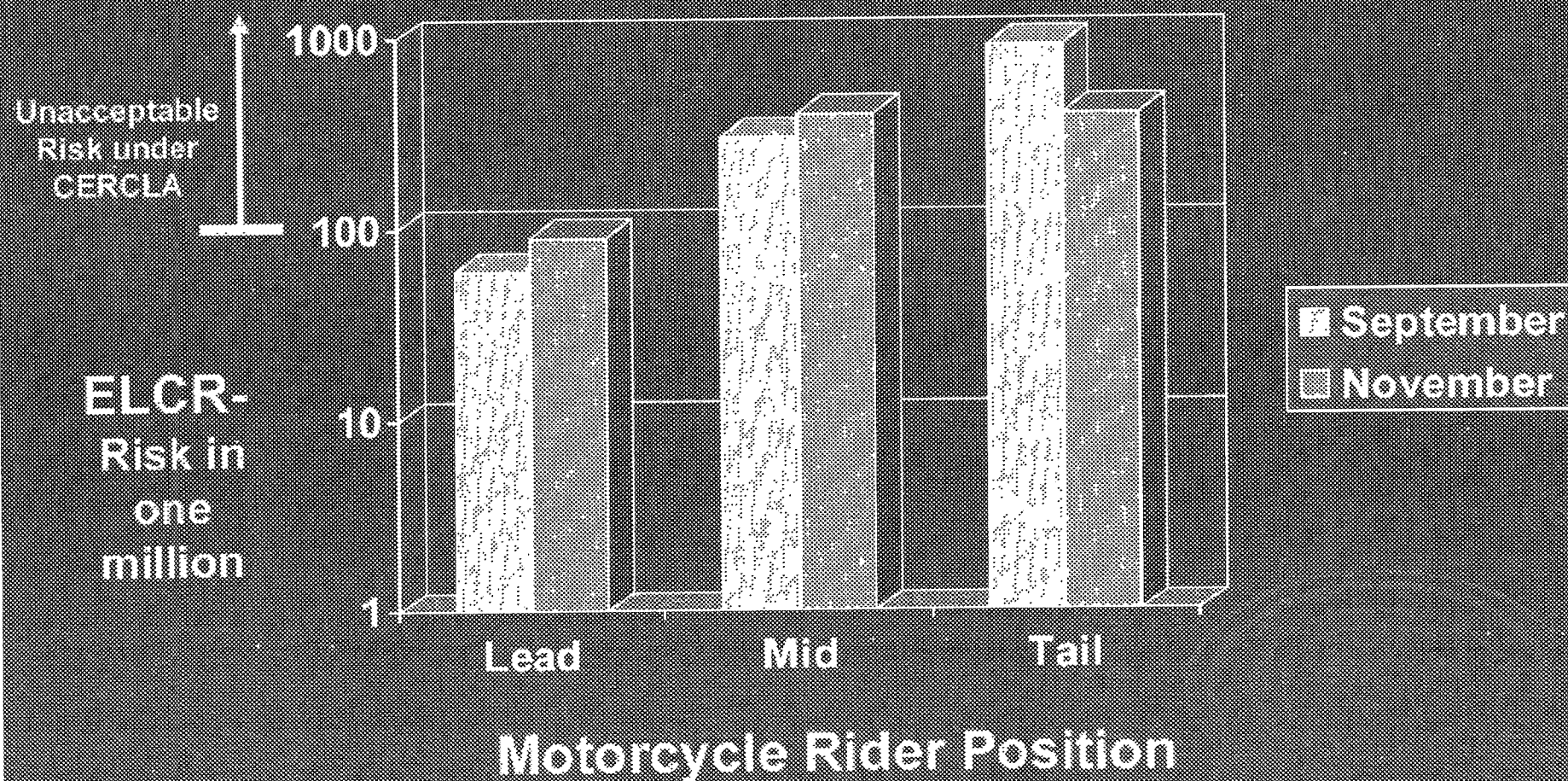


Cleaning Activities

Excess Lifetime Cancer Risk (ELCR) vs. Motorcycle Rider Position and Exposure Scenario (Nov.)



Comparison of September and November Max. Excess Lifetime Cancer Risk (ELCR) for Motorcycle riding



Conclusions To Date

- Asbestos exposure is greatest for trailing OHV riders
- Exposure for trailing riders frequently exceed OSHA PEL
- Exposure for trailing riders sometimes exceeds the 30 minute Excursion Limit
- Cancer risk exceeds 1×10^{-4} for trailing riders

Conclusions (cont.)

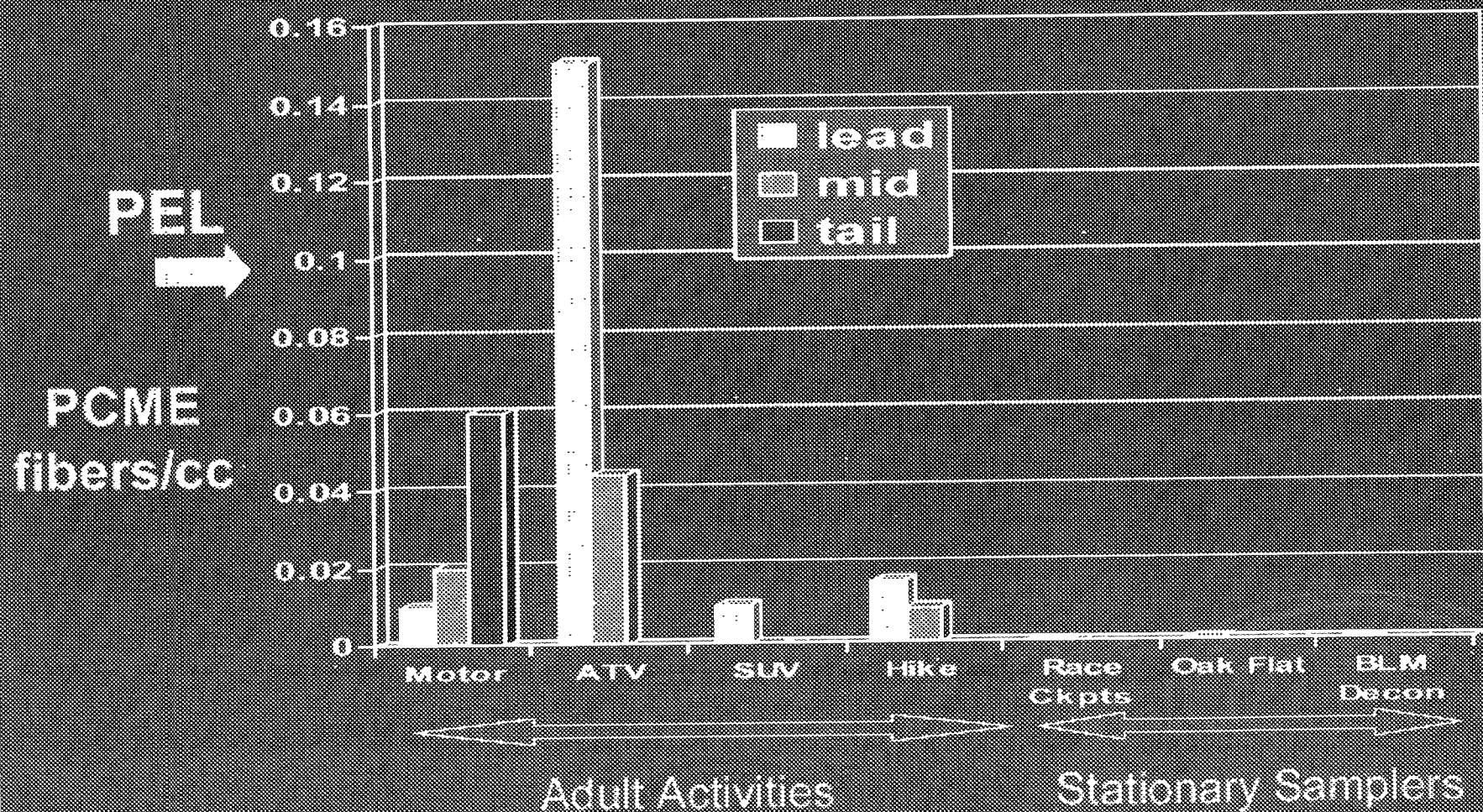
- Child exposure greater than adults for same activities
- Exposures exceeding OSHA standards can occur during moist (November) or wet (February) conditions
- Reasonable Maximum Exposure (RME) Risk can exceed 1×10^{-4} (CERCLA risk management range) during moist conditions
- Exposure is not correlated with differences in soil asbestos or soil moisture at levels reported to date



More Results to Come

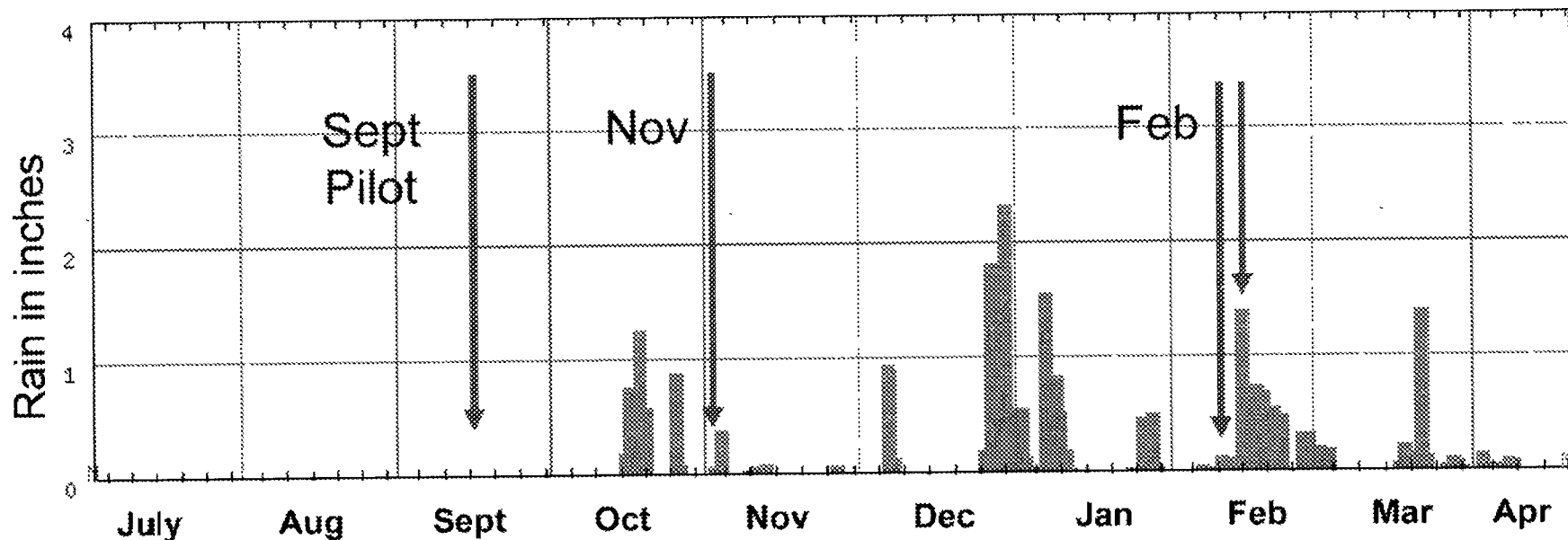
<http://www.epa.gov/region09/toxic/noa/clearcreek>

February (wet soil) Max. Asbestos Concentrations (PCME fibers/cc)



Assessing Variation: Rainfall vs. Sampling Events

Precipitation

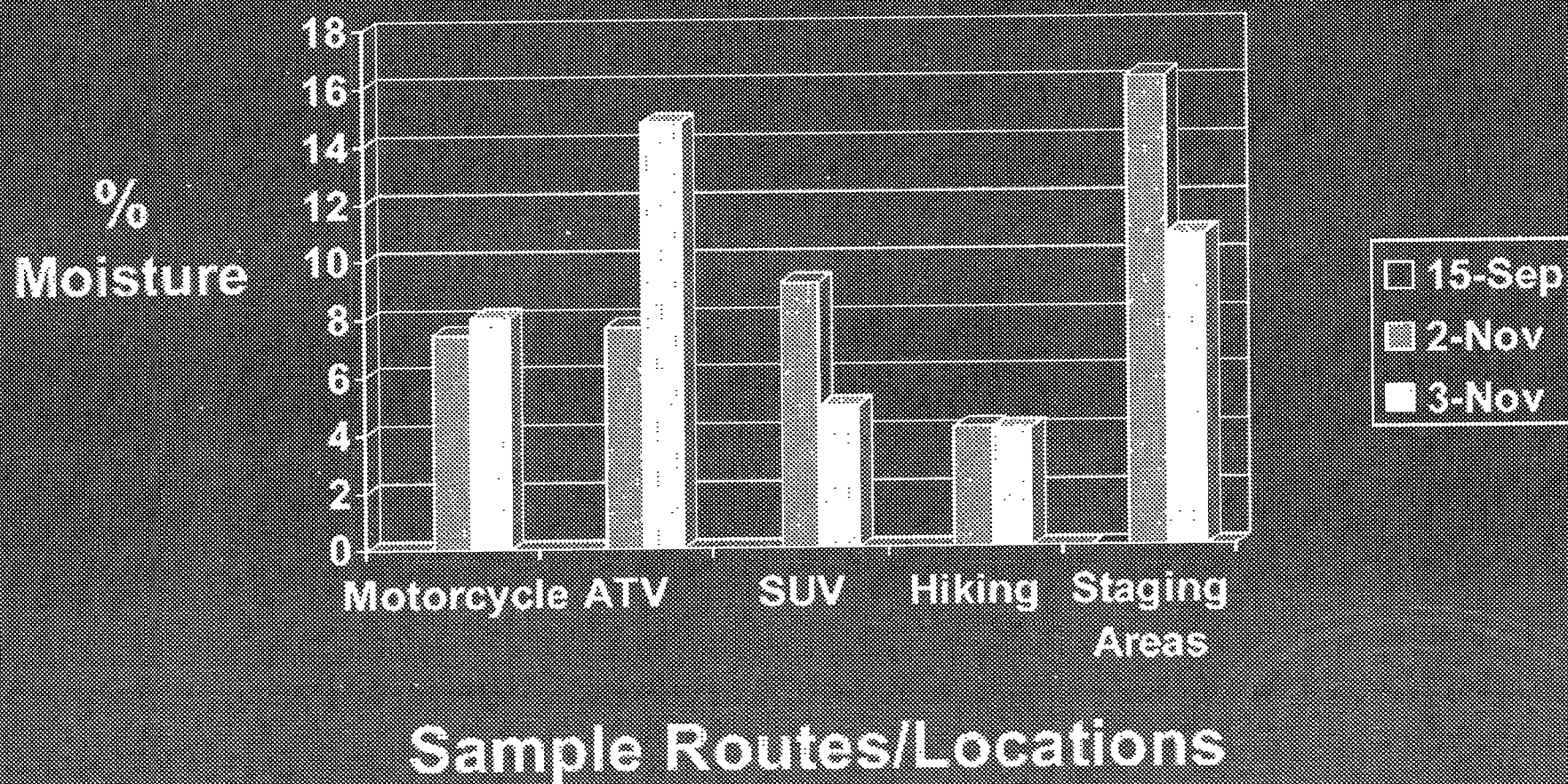


Dry

Moist

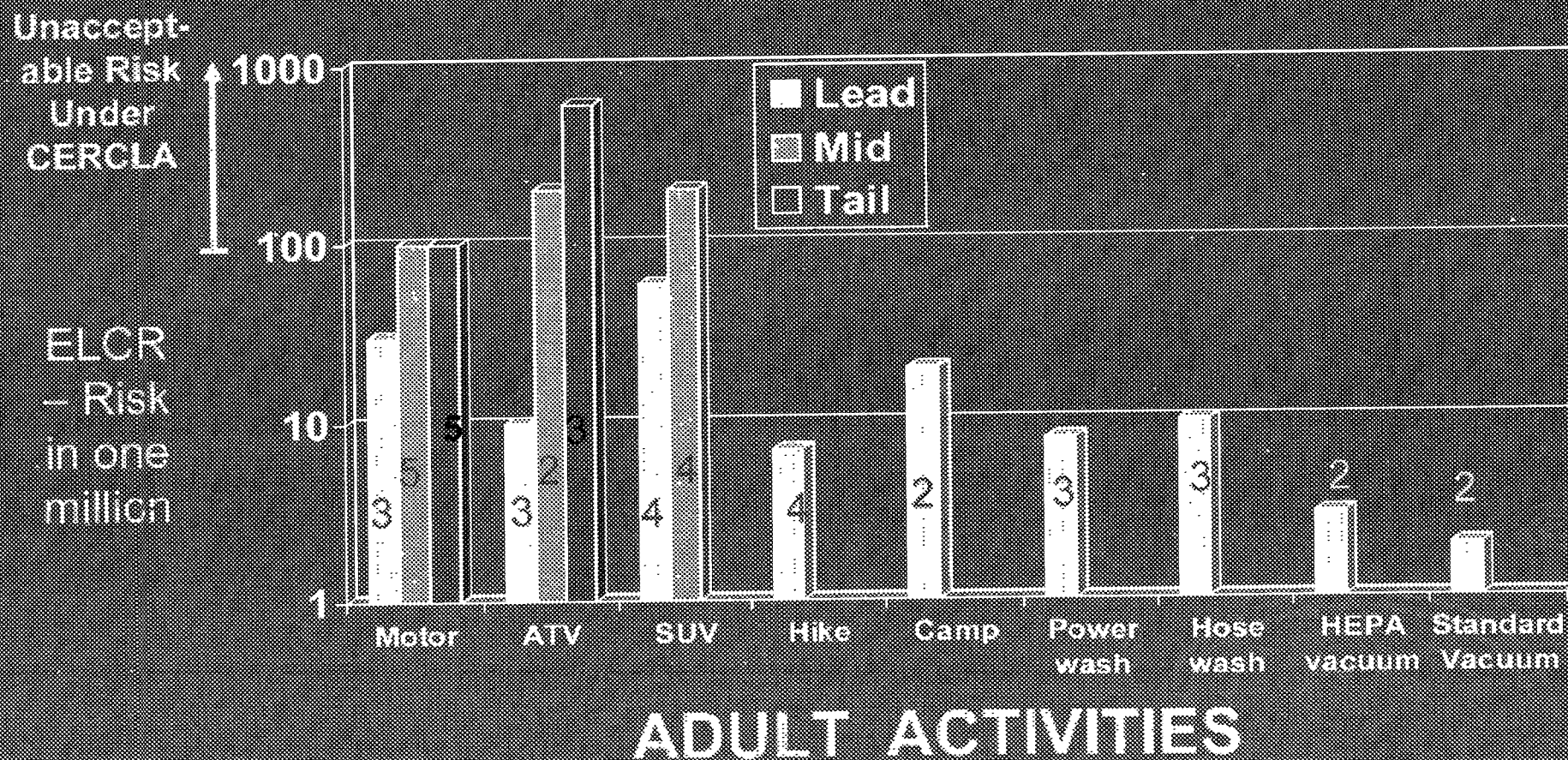
Wet

Mean Soil Moisture: Dry (Sept) and moist (Nov)

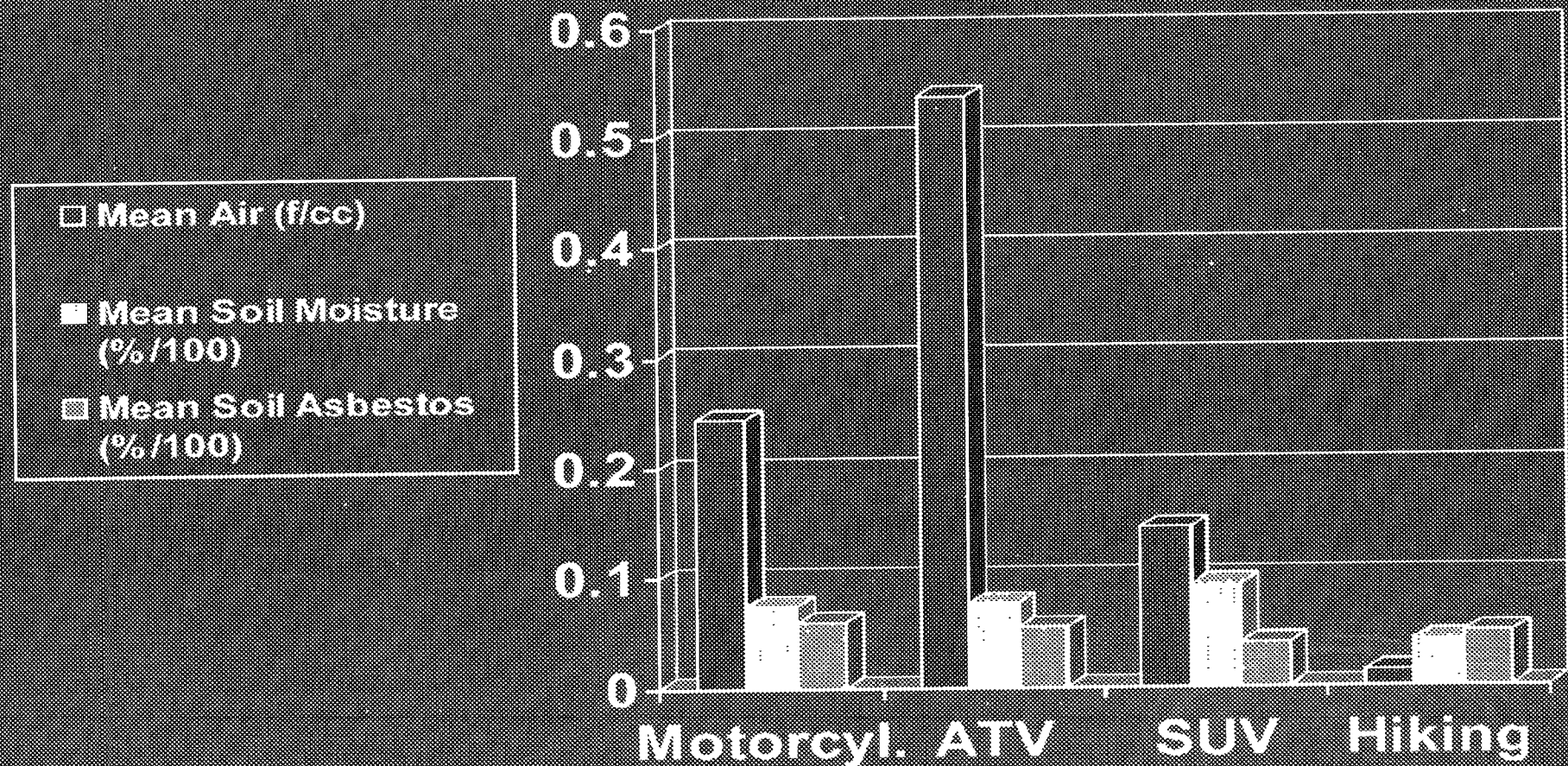


November (moist)

RME Excess Lifetime Cancer Risk (ELCR)



Asbestos exposure levels, soil moisture, and soil asbestos concentrations



Staging Area 4

