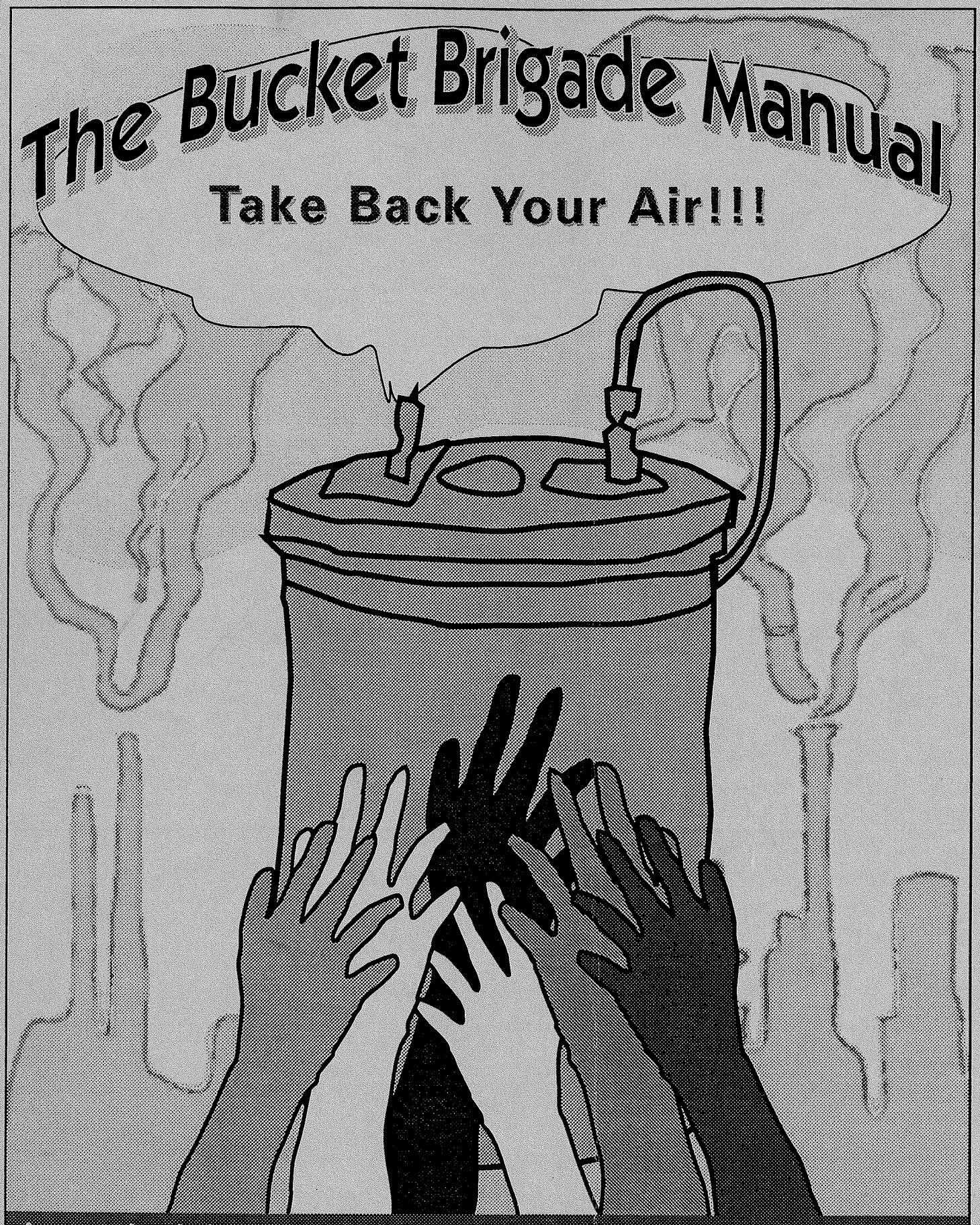
The Bucket Brigade Manual

Take Back Your Air!!!



A manual to help you build your own community based air sampling project

Communities for a Better Environment

About CBE and NORAN

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Communities for a Better Environment (CBE) is an urban environmental health and justice organization that fights for clean air, clean water, and toxic free communities. Our mission is to transform a vision of a healthy, sustainable future into effective advocacy and citizen action that prevents pollution and reduces environmental health hazards in urban communities. Founded in 1978, CBE integrates grassroots organizing with scientific and legal expertise. For more than a decade, CBE has successfully worked to win reductions of emissions, storage, as well as the use of hazardous chemicals at nearby oil and chemical plants. CBE's "nuts and bolts" technical, scientific, and policy work has resulted in the adoption of "state of the art" technology by refineries, the development of models for community organizing, and major reductions in toxic emissions and releases.

The National Oil Refinery Action Network (NORAN), a project of CBE, is a multi-organization collaboration sharing information and resources to reform, on a national level, the oil refining industry through increasing the effectiveness of local and regional network members, winning national pollution prevention commitments, and advocating sustainable alternatives. CBE is committed to an inclusive strategy which can help ensure more substantial and long lasting pollution prevention gains. Membership in the network is free, and consists of community, environmental, and labor groups working to improve specific oil refinery practices and policies in their communities, as well as national organizations working on petrochemical industry issues.

Thanks

Dedicated to All Communities struggling for Health & Environmental Justice & the Bucket Brigade of Contra Costa County, CA.

Community members in the Regional Accident Coalition (RAP Coalition) from Crockett, Rodeo, Richmond, Martinez, Pittsburg and all over Contra Costa County deserve the credit for influencing their elected officials to support a new idea–community air sampling.

In particular, CBE thanks:

Sarah Eeles (Richmond),
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Credits

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Disclaimer: Please use common sense in making and using this air sampling equipment. Using these buckets can help you learn about the risks you may be exposed to, but please do not unnecessarily expose yourself to unhealthy or toxic conditions. We cannot be responsible for injuries that happen while you are using this booklet or the bucket you make from it. Your health is more important than data.

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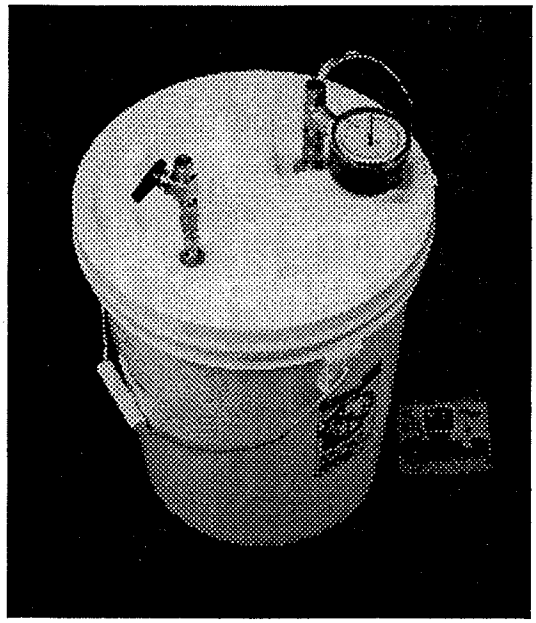


Preface
Why Community Based Air Sampling?

- **You can use buckets to measure everyday pollution levels** or to respond to accidental releases at an oil refinery or chemical facility. The Buckets are able to take a "grab sample", or a snapshot of pollution levels at any time, day or night, weekday or weekend.
- **You can watchdog Industry.** Generally they behave better when they know someone is watching. Buckets are a powerful Right-to-Know technique that will help you in your role as an industrial watchdog.
- **Government agencies are more likely to take their own measurements** and respond to community concerns if they know you are taking a sample.
- **You can use the data to make connections between health concerns and pollution** and gain a deeper understanding of the environmental issues we all face.
- **Knowledge is power.** Specific technical information allows you to track problems to their sources and figure out ways to solve them–that's effective pollution prevention.
- **Buckets are a great organizing tool!** They provide an exciting educational and hands on activity in which everyone can participate.

History of the Bucket Brigade

An air sampling "bucket" will allow you to get reliable data on gaseous pollutants in the air you breathe, just like the RAP Coalition in Contra Costa County, CA does.

Members of West County Toxics Coalition in Richmond , CA

In 1994, CBE worked with the Regional Accident Prevention Coalition (RAP)[1] to set up the first Bucket Brigade in Contra Costa County, CA. The Bucket was designed by a creative and well-qualified engineer and the initial funding came from an unusually supportive toxic tort (personal injury) lawyer.

RAP Coalition members who were frustrated at the lack of solid information from government agencies and industry public relations departments, and tired of their children becoming ill after major refinery releases decided to take action! The next time the smells came through, neighbors were out taking air samples. Chemicals were found in our samples that are not usually found in the Air District's samples[2].

In the fall of 1996, RAP released its **Six Point Agenda**. The item at the top of the list was the Bucket Brigade. Community members successfully influenced the Contra Costa County Board of Supervisors to mandate that the County Health Services Department set up a Bucket Brigade in partnership with the community and CBE. The Community/County Bucket Brigade now allows us the resources to get more buckets into our community and **Take Back Our Air!**

Kasha Kessler (SEA) and Paulette Lagana (CAPIT)

The Bucket air sampling device is an accurate, low cost way to measure the toxic chemicals present in the air we breathe. Community members who live near the oil refineries and chemical facilities in Contra Costa County, CA and around the nation have now taken air samples. Since 1994, the Bucket has also been used in Portland, OR, Los Angeles, CA, Avila Beach, CA, & Lake Charles, LA. We have learned a lot about the Bucket as an effective community air sampling device and this revised manual reflects these experiences.

1 The Regional Accident Prevention Coalition (RAP) is comprised of community members from all over Contra Costa County that live near oil refineries and chemical facilities: including–Communities for a Safe Environment (Martinez), Shoreline Environmental Alliance (Crockett), Rodeo Citizens Association, West County Toxics Coalition (Richmond), CAP-IT (Pittsburg/Bay Point/Antioch), and Communities for a Better Environment (CBE).

2 Our samples showed a toxic soup, including an unexpected and hazardous compound–Carbon Disulfide (CS_2). In the past, industry and government officials assumed sulfur smells were from Hydrogen Sulfide (H_2S). CS_2 can cause health problems, such as impaired color vision, mood swings, and other neurological problems. The industry and the BAAQMD (Air District) did not find CS_2 simply because they were not testing for it.

Build a Bucket Brigade in Your Community in Partnership with CBE

Communities for a Better Environment (CBE) pioneered the Bucket Brigade Project, an innovative citizen monitoring and Right-to-Know initiative that puts information about air quality directly in the hands of citizens. Our project is based on a successful model in Contra Costa County California where community and environmental groups began the Bucket Brigade, and later partnered with County Health Department officials and Region IX of the US EPA.

CBE is the first community-based group in the nation to gain experience in establishing bucket brigades and negotiating partnerships with government agencies that retain the community-based nature of citizen monitoring. We can provide expert advice on training, scientific and technical issues, and the organizing potential of a Bucket Brigade project. We can also train your group to work with local environmental agencies to ensure credible results, a solid basis for stakeholder dialogue, and follow-up efforts to improve air quality.

A successful collaborative project will benefit all communities by increasing community Right to Know through citizen participation in hands-on monitoring. CBE has a great track record for working throughout the nation as shown by the environmental education workshops and trainings offered to over 2,000 industrial neighbors since 1995. We can provide you with sample grant applications and other materials that will help your project.

Contra Costa County Bucket Brigade, Left to Right: Jorge Argueta (CBE N.C.), Benito Cruz, Ralph Sattler, Simone Brown, Carlos Casteneda, and Veronica Ortiz

We urge communities to consult with us before establishing their own Bucket Brigade so we can all be aware of collaboration opportunities. Please contact us so that we can get feedback on the usefulness of this manual, inform you of advances (some of which are already in the works), and share data.

If you are considering writing a grant, please contact Schuyler Fishman at CBE to discuss a partnership. 415-243-8373 ext. 303.

Denny Larson (CBE N.C.), Carlos Porras(CBE S.C..) with the Palos family: members of CBE LA CAUSA in Los Angeles

Air Pollution 101

Sources & Pollutants

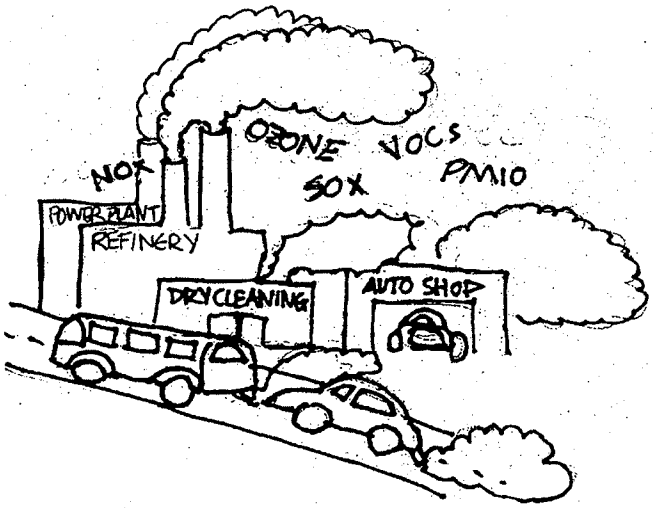
Pure air is mostly made up of nitrogen, oxygen, water vapor, and some other trace elements. Unpolluted air contains dust and other chemicals such as sulfur and phosphorus from natural weathering, and chemical and biological processes. Air pollution is considered to be any chemical or physical entity that enters the air that would not "normally" be there. Air pollution can cause respiratory and other health problems, limit visibility, and damage buildings and public property.

There are many sources of air pollutants in the urban environment that can impact your health. Cars and trucks are a big mobile source of air pollution. In addition, there are many stationary sources of air pollution such as oil refineries, chemical plants, power plants, waste dumps (toxic or not), waste water facilities, medical and municipal waste incinerators, construction and demolition sites, paint manufacturers, auto body shops, dry cleaners, and many more.

There are many different kinds of air pollution but air pollutants can be characterized in two ways - as Particulate Matter (PM) & Gases:

Particulate Matter: PM10, PM 2.5, dust, heavy metals, lead, soot, other solids

PM can come from incinerator stacks, power plants, road traffic, construction, and many other sources. It is usually referred to by the largest particle's diameter. So PM10 refers to particulate matter smaller than 10 microns in diameter (a micron = 10^{-6} m = 1 millionth of a meter). Mechanically generated dust particles are generally larger and don't stay in the air too long. Particles that come from combustion sources are smaller so they tend to stay in the air longer and are worse for your health because they can settle into your lungs. There are currently national air quality standards for PM10. New national standards for PM2.5 are being developed.



Gases: ammonia, chlorine, ozone (smog), NOx, CO2, sulfur gasses, VOC's such as benzene, toluene etc.

Many air pollutants are not in solid form like PM but instead are found in a gaseous form. These gases may react with sunlight and other gases in the air to form ground level ozone, or smog (not to be confused with ozone in the upper atmosphere which protects the earth from harmful UV rays). VOC stands for Volatile Organic Compounds. Organic refers to the presence of carbon in the molecule. Chemicals present in gasoline are VOC's because they are molecules of carbon and hydrogen atoms combined with other elements. Volatile refers to the fact that this chemical will change quickly from liquid to gas. That is why you see vapor recovery equipment on the gas pumps; it's to capture the liquid gasoline that has become gas and would normally escape into the air while you are pumping. Health effects of gaseous pollutants differ greatly. Many can cause breathing difficulties, some cause cancer and reproductive harm, some can cause harm to your nervous or immune system. The cumulative health effects from exposure to multiple VOCs have not been adequately studied and are poorly understood.

How the Bucket Works

The bucket takes an air sample using a "grab" sampling technique. The bucket traps a few liters of air in a Teflon-type bag which you can then send in to a laboratory for analysis. It's that simple.

Are the results credible?

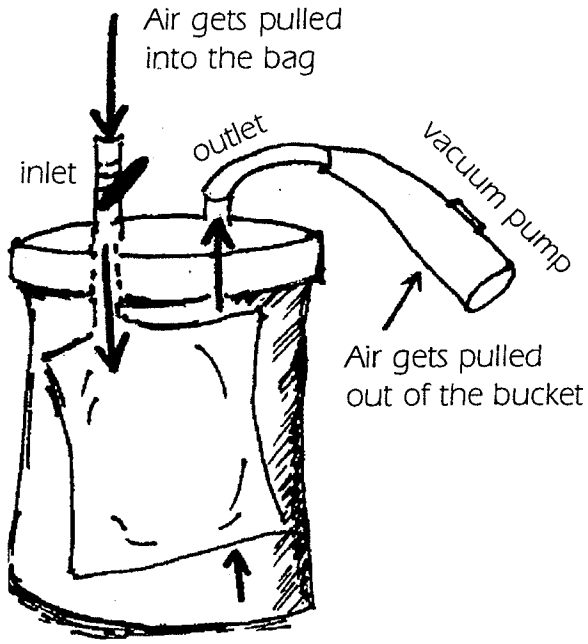
Grab Sampling is a well-established technique in the environmental monitoring industry. The US EPA has established standard techniques for taking and analyzing air samples. Industries and government agencies use this technique for many of their own air quality measurements. The buckets employ the same principles. Side-by-side testing performed by CBE and the Bay Area Air Quality Management District gave similar results. Quality assurance and quality control measures provide additional scientific information and increase the credibility of the bucket samples.

Are the Buckets difficult to use?

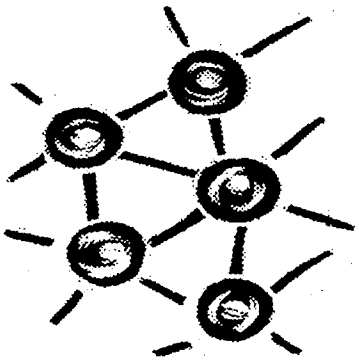
The bucket design is well suited for community use. Sturdy and easy to use, the buckets provide a cheaper way of obtaining the same measurements that our governmental agencies obtain. With reasonable accuracy, you can identify and measure gaseous air pollutants. This information will help you ask informed questions and express legitimate, documented concerns. The buckets represent sound scientific data and can contribute to a better understanding of the environmental problems in your area.

How does the bucket take an air sample?

A plastic bucket serves as a rugged enclosure for a standard "Tedlar" sampling bag and for the equipment needed to fill the bag with outside air. A small vacuum sucks air out of the bucket. When you open the valve attached to the sampling bag, air rushes in to fill the bag. After taking a sample, a trained person, like the Bucket Brigade Coordinator, removes the sampling bag and sends it in for analysis. The Bucket Coordinator also puts on a new bag; then you are ready to take another sample.



What the Buckets Do and Don't Do



What Pollutants do the Buckets test for?

The Buckets collect gases from the air. Using the Bucket, you take an air sample in a special "tedlar" plastic bag which you then send to an analytical laboratory. For testing around oil refineries and chemical plants, we commonly request two different analytical procedures: one for ***VOC's (Volatile Organic Compounds)and inorganic gases***, and one for ***Sulfur compounds*** *(see box to the right).*

There are limitations to the bucket sampling capacity.

The laboratory can only analyze the Bucket air samples for gases.

- Buckets cannot measure for PM, including heavy metals, soot, dust, and other solids.
- Buckets cannot measure for toxins that normally attach themselves to particles, such as dioxins.
- Buckets cannot measure for acid rain or radiation.

Buckets can not sample particulate matter. For information on how to sample PM, and on other sampling devices, see Appendix D.

Volatile Organics and Inorganics

The U.S. Environmental Protection Agency (US EPA) developed the "TO-14" procedure, for measuring many important volatile organic and inorganic gases (VOCs). With Bucket samples, the lab can detect many of these compounds at parts per billion (ppb) levels . Performance Analytical Labs–the lab we currently use-charges about $250 for a 43-chemical analysis ("EPA TO-14") and $320 for an 81-chemical test ("Modified TO-14").

Some examples of TO-14 compounds are: Benzene, Toluene, 3 types of Xylenes, Methylene Chloride, Tetrachloroethene, Acetone, and others

Sulfur Compounds

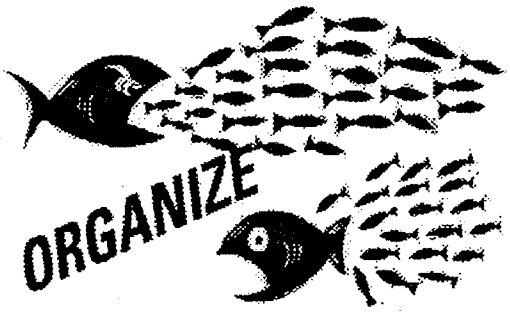
The laboratory has separate procedures for measuring sulfur compounds. These tests are called "Reduced Sulfur Gases": or "Modified EPA 16", this analysis test for 20 sulfur compounds. These compounds can also be detected at levels below 1 ppb, and the procedure costs $150 per sample at the lab we use.

Some examples of sulfur compounds: Hydrogen Sulfide, Carbonyl Sulfide, Carbon Disulfide, 7 types of mercaptans and 5 types of Thiophenes

For a full list of compounds tested for with these methods see Appendix A.

How to Set Up a Bucket Brigade

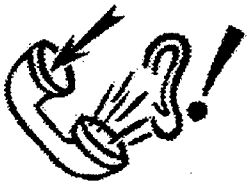
1. Get Your Neighbors Involved!



Your Bucket Brigade will be more successful if you can involve your neighbors. The more people available to take samples or alert those who do, the better your chances of getting a good sample during a chemical release. You can also find out if you are experiencing similar health problems or smelling similar odors.

There are two major ways people can get involved: as Sniffers and Samplers. Sniffers are people who don't have a bucket but have a good nose. Sniffers alert those who have a bucket -Samplers- when they smell or experience something suspicious. Samplers are people who have been trained to take air samples and have a bucket. Here are some steps you can take to build your Bucket Brigade:

a. Have a house party and invite your friends and neighbors. You can call CBE and ask us to come and make a presentation. If not, you can study this manual and present the information on your own.



b. Identify the most reliable people to be Sniffers and Samplers. Identify a person to be a Bucket Brigade Coordinator. (see Sniffers, Samplers and Bucket Brigade Coordinator responsibilities on page 7). Make a phone tree and give everyone a copy. When choosing Samplers, use a map to determine who lives in the best location for taking a sample. Example: you might want to have one Sampler upwind and one Sampler downwind of the major facility in question.

c. The next step is organizing to raise money to build your Buckets and pay for the analysis. You might try to locate a laboratory that would donate or provide the analysis at a low cost.

d. Figure out how you will interpret and share information after you take samples and get your results. (see page 26) How will you act on this information? Ex: call a community meeting, notify the media, or make a presentation at your local public school.

A Bucket Brigade can be as simple as one committed neighbor who raises a couple of hundred dollars for each lab analysis. Or it can be as complex as a ring of Samplers around a refinery or chemical facility supported by a phone tree of "Sniffers-".

How to Set Up a Bucket Brigade

Samplers and Sniffers

Sniffers

Responsibilities

- Alert the Samplers when you think a sample needs to be taken (either because you smell something, see smoke, or have heard there has been a release).
- Call the appropriate government agencies to notify them of the problem.
- Keep a Log or Diary of what you experience. Please see the sample log provided in Appendix E.

Qualities Important for a Sniffer:

- A good nose.
- A phone and motivation to call the Samplers to make sure they get a sample.
- Wilingness to take good notes about what you experience.
- Company workers who care about community - remember, they are protected by federal "whistle blower" laws.

CAUTION: You should not choose particularly susceptible people as Samplers or Sniffers: pregnant or breast-feeding women, chemically-sensitive people with a history of problems due to chemical exposure, and people in generally poor health. And remember, no one should unnecessarily expose themselves to dangerous environments. The information is not worth the risk.

Samplers

Responsibilities

- Respond quickly to a "Sniffers" alert.
- Take the air samples and follow QA/QC procedure.
- Take detailed notes on what you do and experience.
- Make the necessary phone calls to get the sample analyzed.
- Store the Bucket in your home or place of work.

Qualities Important for a Sampler:

- Lives or works in a location that often receives emissions and odors from an industrial facility.
- Is home often, usually in town, reachable by telephone, and will return messages.
- Willing to stand outside and activate the Bucket during an industrial accident (but NOT when officials have told people to stay inside, to evacuate, or it is too dangerous to do so).
- Able to drop your tasks to take a sample.
- Has a car and if necessary will drive across town to take a sample.

How to Set Up a Bucket Brigade

2. Choose Your Bucket Brigade Coordinator!

The Bucket Brigade Coordinator role is filled by one or more individuals. The Bucket Brigade Coordinator is the only individual who changes the bags and sends the samples to the lab. This helps to ensure the credibility of the sample and centralizes the Bucket Brigade. This role could rotate so different individuals are able to take on this responsibility.

The Bucket Brigade Coordinator's duties include:

- Removing the sample bag from the Buckets
- Filling out the chain of custody records
- Placing a new bag in the Bucket
- Performing a visual inspection of the Bucket each time used
- Sending the bag to lab for analysis – quickly (see specific protocol on page 22).

3. I.D. the Best Places for the Buckets!

If you can afford them, your Brigade should consist of several Bucket Samplers surrounding the industrial site.

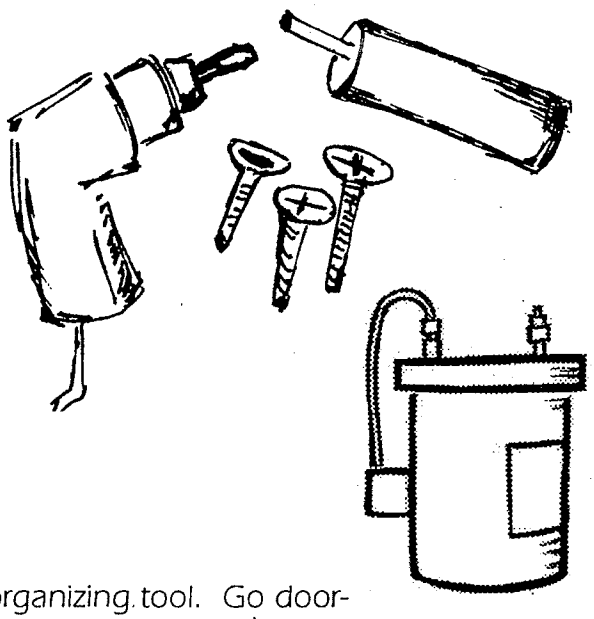
- Sit down with your neighbors, a map of the town, and the addresses of concerned people.
- Share your common experiences and determine which parts of town are most impacted.
- Use your knowledge of the prevailing wind directions to determine who lives directly downwind from the source. You can also call the National Weather Service in your area to get the average d data.

- Determine which neighborhoods are most affected and choose your preferred locations of the Samplers and the Sniffers. You will also determine where you need to get more of your neighborhood involved.

- Try to cover the whole area–at least one bucket per neighborhood. If you cannot cover all the major neighborhoods, try to find at least one "mobile Sampler", someone who can dash out at a moment's notice to take a sample at the polluter fence line or an appropriate location. If you can, try to take measurements both upwind and downwind facility. That way you can test to see if the smells are coming from your nearby facility and not from another facility further upwind.

How to Set Up a Bucket Brigade

4. Build Your Own Buckets! How much will it cost?



- **Per Bucket:** Building the Buckets is not too expensive - materials cost about $200 per Bucket. You might need $20 - $50 in tools to begin.

- **Per Lab Analysis:** Performing the analysis is more expensive: Roughly, $250 per sample for most organic and inorganic gases - Volatile Organic Compounds (VOC's), and about $150 extra for sulfur compounds. The lab can run more than one analysis on a sample bag. You will also need to raise some funds to do some quality control and quality assurance tests.

Where can we get the money?

- **Door-Knocking:** Buckets can be a great organizing tool. Go door-to-door with a bucket and the results of a lab analysis. Ask for $5 to $25 per person to help pay for the next community air sample. You'll collect funds and get names and addresses at the same time!

- **Tort Lawyers:** The first Bucket Brigade in Contra Costa County, CA was funded in part by a Toxic Tort (personal injury) lawyer who was very supportive of the community and was involved in a number of personal injury law suits against a nearby refinery.

- **Local Government:** In Contra Costa County, CA the RAP Coalition was able to get a resolution passed by the Board of Supervisors, mandating that their Health Services Department fund and work in partnership with the community to design a larger Bucket Brigade.

- **Other Important Allies:** The workers are the most important ally. In Contra Costa County, the pipe fitters' union paid for tests while they pushed for a more stringent hazardous materials ordinance. Pollution prevention protects worker health.

- **The Media:** Your local newspaper, radio, or TV stations may want your data and be willing to pay for the lab fee.

- **Grants:** A local foundation may be willing to fund community air sampling. If you apply for grants, please see our policy on Bucket Brigade Partnerships on page 2.

Quality Assurance and Quality Control (QA/QC)

After you build your Bucket, you will need to do some initial tests to make sure your Bucket is working properly. See page 18 for more information on QA/QC.

How to Set Up a Bucket Brigade

5. When to Take a Sample

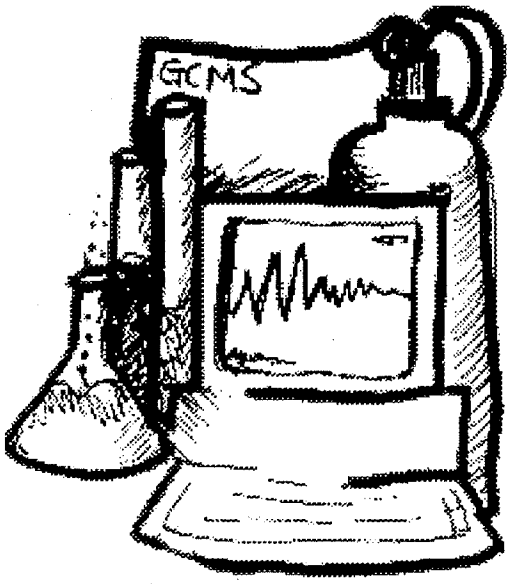
There can be many reasons to take a Bucket sample. You may want to take a sample when you experience noxious smells or experience eye irritation, or see dark smoke or any other indication of pollution problems from an industrial facility. You can also use the Buckets to find out what's in the air you breathe everyday.

How do we analyze our samples?

Locate an analytical laboratory. We have had good results with Performance Analytical in Southern California.

Performance Analytical Inc.,
2665 Park Center Drive. Suite D
Simi Valley, CA 93065
Ph. 805 526 7161 Fax 805 526 7270

If you want a local laboratory, ask around at government agencies and universities, look in your yellow pages, or call the Citizen's Environmental Laboratory, 617-876-6506. Ask for an environmental lab that specializes in air analysis. Labs that mostly analyze soil and water samples may not have the proper equipment for your air samples and their indoor atmosphere may contaminate your samples.



Whatever lab you choose, ask for their standard operating procedures for method TO-14 and reduced sulfur analysis, the lab's certification status, a credit application, some Chain of Custody Records, and a Project Manager – the person at the lab that specializes in air analysis. Some labs will take a credit card for one analysis, but it is a good idea to set up an account.

Ask if the lab is open on the weekend, sometimes you might have to take a sample and get it analyzed before the weekend is over. If they are not open, you might want to find an alternative, or have a back up lab in mind for those occasions.

How To Build a Bucket

It's not hard! Most of the materials you will need to build a Bucket are available in a hardware store or can be ordered over the phone. You may already have most of the tools you need. If you can drill a hole and turn a wrench, you can build a Bucket!

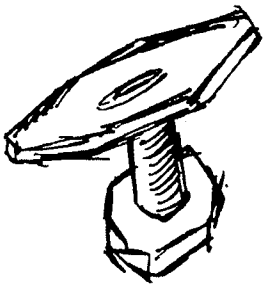
There are a few things you will not find in your local hardware store. The "Swagelok" plumbing and valves and the sampling bags are specialty equipment. It is important to get the right materials. The parts list includes phone numbers of local and national distributors and manufacturers. If you have a credit card, you can order everything by phone.

Step 1

Look at the Parts Checklist and the assembly diagrams (page 12-17). The Bucket lid is where the action is: a stainless steel "Whitey" valve, stainless steel Swagelok plumbing, and the sampling bag form the "inlet air" path. Some brass plumbing, the plastic tubing, and the pump form the "outlet air" path.

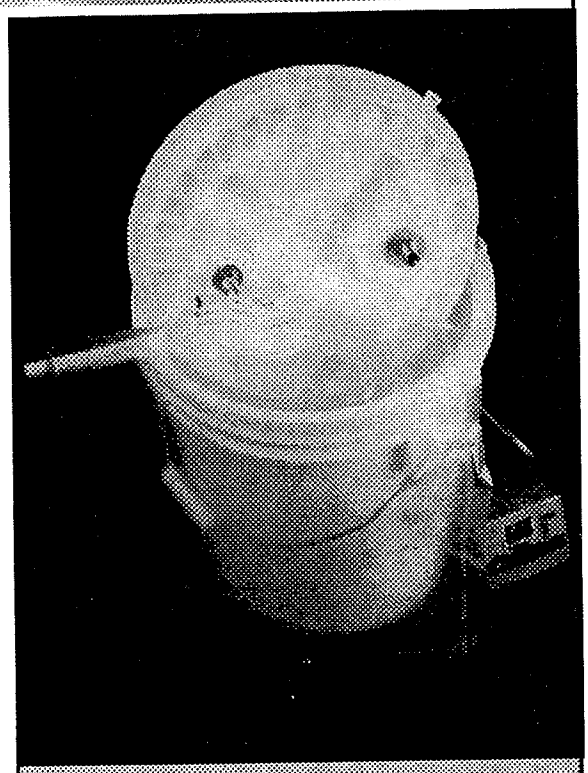
Step 2

Look through the Tools list (page 13). This is a short list. You might already have most of the tools with the exception of the Swagelok Inspection Gauges (see the box to your right). Appendix B includes product sheets for some of the unusual supplies for the Bucket.



Step 3

Read the assembly instructions (pages 14-17). This section is a little longer, and it is important that you follow the instructions carefully, especially when connecting the Swagelok parts. When you gather all the pieces together, set aside about an hour to build your first Bucket.



What is "Swagelok"?

"Swagelok" is laboratory quality plumbing with "compression fittings" similar to the tubing on air conditioners or refrigerators. Swagelok parts will make sure you can keep sufficient vacuum to inflate the sampling bag. The stainless steel Swagelok parts will make sure your sample is not contaminated.

Most large cities have a Swagelok distributor. They often have customers with small or unusual orders. Don't be embarrassed to ask for a salesperson. They can drop by and give you a full explanation of the parts. See the parts list for the phone number and address of the Swagelok manfacturer and of our local distributor in the San Francisco area.

Parts Checklist

#	part number	description	where to find it	approx. price
☐ 1	none	5-gallon round plastic bucket*	any hardware store	$4.35
☐ 1	GammaSeal lid	Snap on lid for 5-gallon bucket with screw-on inner ring and O-ring seal	Select hardware stores (call around) Gamma Plastics (manufacturer), 619-272-5099	$6.50
☐ 1+	232-10L or 232–05L	Tedlar Sample Bag either 5 or 12 liter capacity**	SKC West Inc. 800-752-9378 (Fullerton CA 92634) SKC Technical Service 1-800-752-8472 (334 Valley View Rd. RRI Box 334, Eight-Four PA 15330	$14.50 ea. in boxes of 10
☐ 1	Catalog No. 61-2504A	Radio Shack "enervac" Battery Powered Mini Vacuum Cleaner, plus 4 AA batteries	Radio Shack, check your local phone book or call 1-800-843-7423 for catalog ordering or a store near you	$9.95 ea.
☐ 4	none	1/2""-3/4" #8/32 machine screws	Any hardware store	$1-3 for misc. hardware and plexiglass
☐ 4	none	#8/32 machine screw nuts		
☐ 8	none	washers for #8 screws		
☐ 2	none	3/8" washers		
☐ 2	none	9/16" washers***		
☐ 1	none	2 3/4" by 2 3/4" piece of plexiglass (>1/8 thick)****		
☐ 1	none	12 - 24" of Polyethylene (PE) or Tygon tubing 3/8" outside diameter, 1/4" inside diameter	Any hardware store	$0.49/ft
☐ 1	B-600-61	Swagelok Brass Bulkhead for 3/8" tubing	Distributor: Oakland Valve and Fitting, 510-676-4100, 510-7989-833 fax (Attn: Mark Walrath, 2441 Sprig Court- -Unit A, Concord CA 94520) OR See Valves in your yellow pages or business yellow pages - look for a business that distributes "Swagelok" fittings OR Contact the Swagelok Company Distributor Locator, 216-349-5934. 31400 Aurora Rd, Solon OH 44139	$4.40
☐ 1	SS-300-61	Swagelok Stainless Steel Bulkhead Union for 3/16" tubing		$15.80
☐ 1	SS-400-R-3	Swagelok Stainless Steel Reducer: 1/4" to 3/16" tubing		$8.30
☐ 1	SS-400-PC	Swagelok Stainless Steel Port Connetor for 1/4" tubing		$3.90
☐ 1	SS-42S4	Whitey Stainless Steel 2-Way On-Off Valve for 1/4" Swagelok tubing*****		$63.90

Tool list
and some notes on parts

Tool List

These are fairly common tools that you may be able to borrow from your friends, so ask around before running to the hardware store. In Berkeley, CA, they have a tool lending library. You can also get great deals on tools at local flea markets.

1. Drill
2. Drill bits: 11/64", 3/8" and 9/16", 1-1/2". With the exception of 1 - 1/2" bit, you may save money if you can buy all the bits in one set.
3. Screwdriver or screwdriver bit for drill with either a flat head or phillips head depending on what kind of #8/32 screws you buy; either will do.
4. Table Saw or fine toothed hack saw for cutting plexiglass
5. Safety goggles
6. Vise grips
7. Household scissors for cutting polypropylene tubing, do NOT use a single-blade such as a knife
8. 8" crescent wrench AND/OR set of fixed wrenches including 3/4",9/16, 1/2" (9/64" and a 11/64") nut driver.
9. Swagelok Gap Inspection Gauges: part no. MS-IG-468 ($10) for 1/4" and 3/8" Swagelok connections. Source: See part list for Swagelok distributor information. (note: because the parts will not be under high pressure, this part is NOT that critical).
10. Clear Silicone sealant - any kind will do as long as it will make an airtight seal.

Notes on the Parts List

*Make sure you buy the kind that will fit the Gamma Seal lid. We recently bought the wrong kind because they looked so similar, and we could not fit the Gammaseal lid onto the bucket. You want the one with the thinner lip. Usually these ones have a white plastic handle, NOT the black plastic handle.

** We have recently switched to 5 liter bags because they are smaller, fit into the buckets easier, and are easier to handle. But you might want to use the 12 liter bag because it provides a longer sample time which can provide greater sample accuracy. ALSO, generally you should purchase these bags from your analytical laboratory already cleaned and purged with pure laboratory grade nitrogen gas. We will discuss purging in the section on Quality Assurance (p 18).

*** This size may be hard to locate. If you can't find it, don't sweat it. We recently built the bucket without this part and it worked fine.

****You can go to a specialty plastics/glass shop such as TAP Plastics, and have these pieces pre-cut for you. Otherwise you have to cut them down yourself with a saw.

***** This is the most expensive part. Jeff Hobson, a Contra Costa County Employee who works on the bucket brigade identified a cheaper way to build the bucket without this valve, but we are still testing to see if this option is viable. For more info on this option, call us at CBE. 415-243-8373.

****** For an additional $46.00 you can add a vacuum gauge to the buckets which will tell you if the vacuum is working while you take a sample. For more information on this option call us at CBE at 415-243-8373

Building the Bucket

Step 1. Observation Window

You use the observation window to watch the bag inflate

1. Drill 1 1/2" hole in the center of the bucket lid. Wear your safety goggles.

2. Cut a 2 3/4" x 2 3/4"plexiglass square using a saw, or buy one precut. If you are cutting it yourself please make sure you have a clear space to work and that the plexiglass is secured using vice grips on a stable surface. Wear your safety goggles!

3. Place the plexiglass square in the center of the bucket over the hole. Drill a 11/64" hole through the plexiglass and the bucket about 1/2-1/4" inch away from the 1 1/2"hole in the bucket. See page 16 for hole placement diagram.

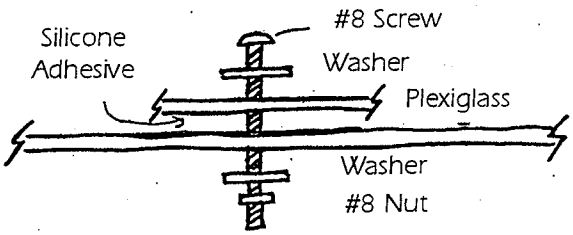
4. First start to screw one of the #8/32 machine screws into the hole by hand with a screw driver. After a couple of turns you can use the screw driver bit of your drill to drive the screw in all the way. *(By doing this you will make sure the plexiglass does not move while you drill the other holes. You could also repeat this and put one more screw in before drilling the other holes)*

5. Now that the plexiglass window is screwed in place. Hold it still and drill three more holes through the window and the bucket on each side of the hole. Make sure you do not drill these holes too close to the large hole in the center of the bucket.

6. Using your drill or a screwdriver, remove the machine screw(s) from the plexiglass and the bucket. Apply a thin layer of silicone caulk on the top of the bucket lid surrounding the 1 1/2" hole. Apply caulk around the four smaller holes.

7. Place the plexiglass back onto the bucket carefully positioning the window to line up the holes for the #8/32 machine screws. Place a #8/32 washer over each of the smaller holes, then screw in the four machine screws.

8. Turn the bucket over and place a washer and a nut on each screw. Tighten them to get a secure seal. The window needs to be air-tight.

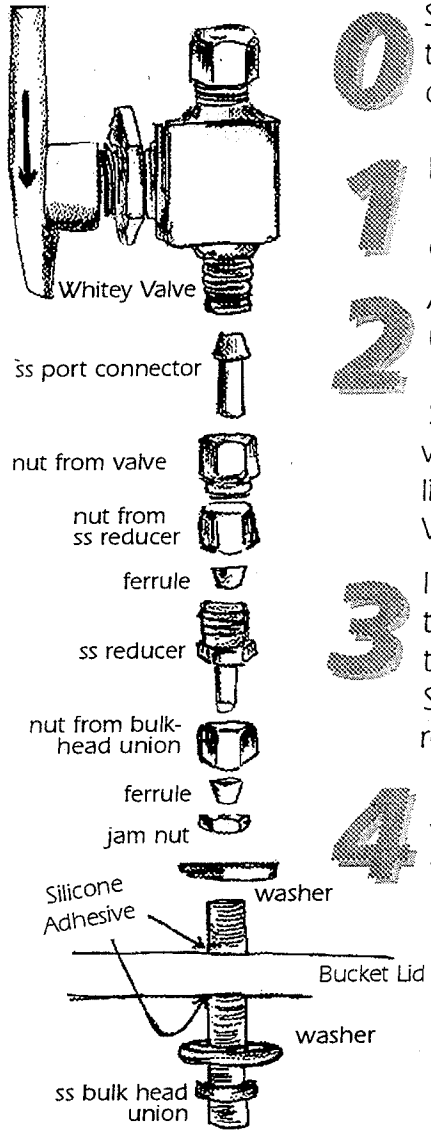


Building the Bucket

Step 2. Building the "The Inlet Side"

The inlet side is how air enters the sampling bag

Before beginning work, clean your hands and keep them clean while assembling the bucket. This is especially important while handling the stainless steel parts and the sampling bag. Also please read the instruction cards that come with your Swagelok part about tightening the swagelok connections. If you did not get these instructions, call your distributor and ask for them.



0 Snap the bucket lid onto the bucket. Its easier to work on the lid this way. You can unscrew the center part of the lid and turn it over to work on the underside of the lid.

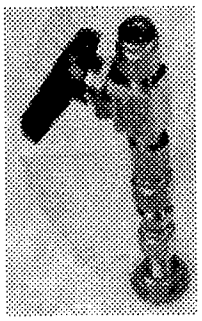
1 Drill 3/8" hole in one of the triangular sections of the bucket lid. (see bucket lid diagram on the next page) Wear your safety goggles.

2 Apply a thin line of silicone caulk around the hole, (top side and underside). Place a 3/8" washer on top of the caulk. Push the longer side of the **stainless steel bulkhead union** (part number SS-300-61) up through from the underside of the lid. Use a wrench to lock it down with the "Jam Nut" on the outside of the lid. You need to remove the top nut and the ferrules to do this. When you are done, replace them but do not tighten them yet.

3 Insert the **stainless steel reducer** (part number SS-400-R-3) in the top nut of the **stainless steel bulkhead union**. Use a wrench to tighten the top nut of the bulkhead union. Pay attention to the Swagelok instructions about tightening the connection. The reducer will fit tightly when you have tightened it enough.

4 Unscrew the nut and ferrules from the bottom of the **Whitey valve** (part number SS-42S4), remove the larger ferrule and insert the non conical shaped side of the **stainless steel port connector** (part number SS-401-PC) into the nut.

5 Insert the other side of the **stainless steel port connector** (part number B-SS-401-PC) into the nut on the top side of the reducer. Tighten the nut. Pay attention to Swagelok instructions about tightening the connection. Use your Swagelok inspection gauges to check that the gap between the reducer and the port connector is ok.



6 Attach the stainless steel **Whitey valve** to **stainless steel port connector**– Pay attention to the Swagelok instructions about tightening the connection.

Building the Bucket

Step 3. Building the "The Outlet Side"

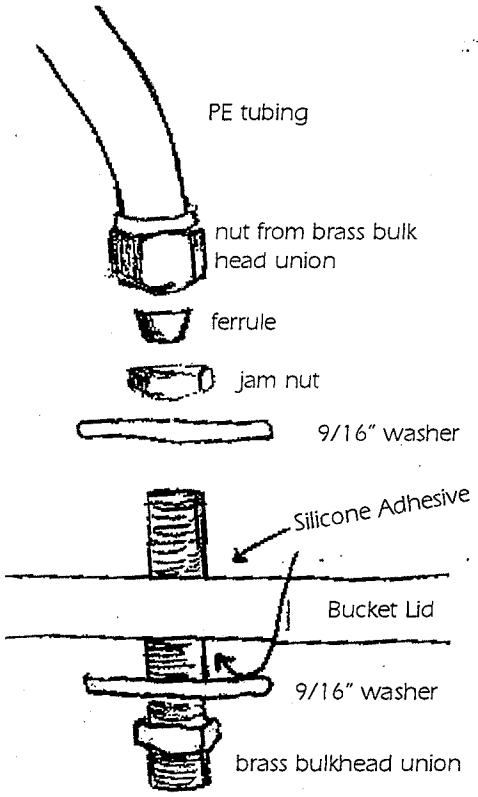
The outlet side is how you create a vacuum by sucking the air out of the bucket.

1. Drill a 9/16" hole in one of the triangular sections of the bucket lid opposite from the "inlet side". Wear your safety goggles.

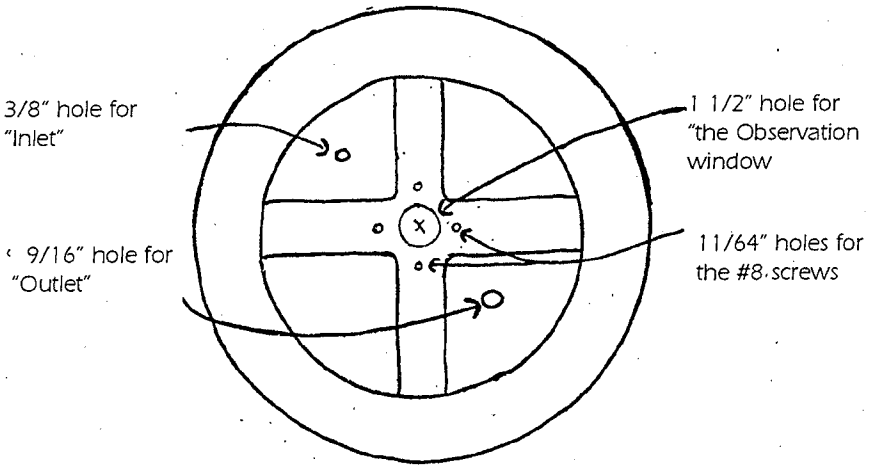
2. Apply a thin line of silicone caulk around the hole, (top side and underside). If you have them, place a 9/16" washer on top of the caulk. Push the longer side of the **brass bulk-head union** (part number B-600-61) up through from the underside of the lid. Use a wrench to lock it down with the "Jam Nut" on the outside of the lid. You need to remove the top nut and the ferrules to do this. When you are done, replace them but do not tighten them yet

3. Insert the **PE tubing** into the top nut of the bulk head union. Tighten the nut. Pay attention to the Swagelok Instructions about tightening the connection.

4. When you are ready to take a sample you will attach the vacuum pump to this tubing. You need an airtight seal where the bulkhead inserts into the bucket, so if you did not use the washer, you might want to add more silicone caulk around the bulkhead now.

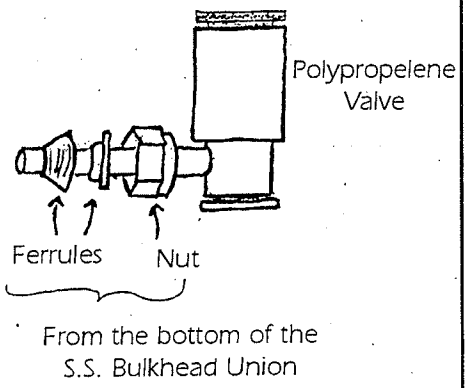


Top View of the Bucket Lid



Building the Bucket
Step 4. Attaching the Sampling Bag

1 Refer to the Swagelok instructions on attaching the nuts and ferrules (the small metal part inside the nut) to plastic tubing.



2 Take the stainless steel nut and ferrules from the bulkhead union on the underside of the bucket lid; put the nut and ferrule onto the short polypropylene tube coming off the sampling bag.

3 Make sure the stainless steel valve is closed. Close the valve by turning the black plastic handle so that it is perpendicular to the tubing. Attach the nut on the sampling bag to the stainless steel port on the inside of the bucket lid; pay attention to Swagelok instructions about tightening the connection.

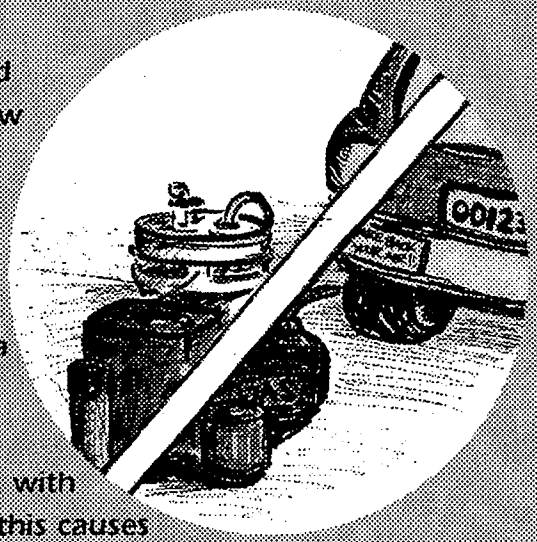
4 Grasp the body of the polypropylene valve on the sampling bag and turn it counter-clockwise (open) one turn. If there is a lock nut on the valve, loosen it before opening the valve and tighten it afterwards.

Put it All Together!

5
- Screw the bucket lid onto the bucket. Be careful not to pinch the sampling bag.
- Make sure the vacuum is attached to the Polyethylene tubing.
- Let the bucket rest for at least 24 hours, to allow the silicone caulk to harden.

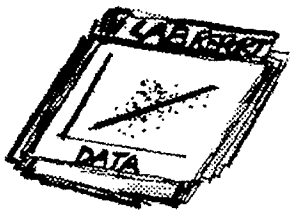
Celebrate! You Built a Bucket!

Storing the Bucket and Sampling Bags



- It is very important to take care in storing your bucket and sampling bags. Remember, you will use the bucket to show what is, or is not, in the air around your house or work.
- Store the bucket in a clean place. In the garage next to your car's exhaust pipe or an open bottle of paint thinner is not a good idea.
- Protect the bucket plumbing from contamination: drape a sheet over the plumbing to keep grit from falling into the valve opening.
- Store the bags in their original container--a cardboard box with perforations to protect the valves. DO NOT fold the bags--this causes small creases that can tear when you use the bag.

Quality Assurance/Quality Control (QA/QC)



After you build your bucket, there are a few things you need to consider before jumping right in and taking a sample. Quality Assurance and Quality Control are procedures you should follow to make sure your test results are valid. If you can afford it, you might want to do a few test runs with your buckets and conduct some "QA/QC" before you use your bucket to sample a real incident. The following are some guidelines you can follow.

General Principles of QA/QC

- Always be careful and methodical.
- Write down exactly and specifically what you do and when.
- Follow the specific QA/QC procedures. When unsure, talk to your Bucket Brigade Coordinator.

Time Frame for Sample Analysis

- Most government agencies require that their samples be analyzed within 72 hours of being taken.
- The preferred time frame is within 24 hours for suflur analysis; the chemicals in the sampling bag will degrade over time.
- The Bucket Brigade should strive to send in samples within 24 hours of the time the samples are taken; however, within 72 hours is acceptable.

Performance Certification

You might want to have an independent lab help you create a performance standard sample. This is a sample bag with known quantities of air and chemicals in it. Then you send the sample bag to your lab and compare the results with the known amounts. You want the results fromt he lab to be with 70% - 130% of the amounts that they put in there. By doing this, you can identify if there are any chemicals your lab cannot accurately detect.

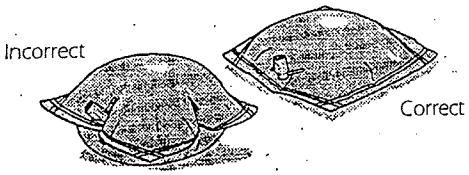
Duplicate testing and Field Blanks

- **Duplicate samples**: Duplicates are important because they ensure that the bucket is operating properly. Take a side-by-side sample with an additional bucket. Optimally, duplicate samples should be performed for each new bucket, and then on an annual basis, during an event, or even as a background sample.
- **Field Blanks**: A field blank is when you put a second sampler in the same conditions that you would to take a sample, but you don't actually take a sample. It allows you to check for contamination that may occur in the field. Perform Quarterly.

Quality Assurance/Quality Control
continued

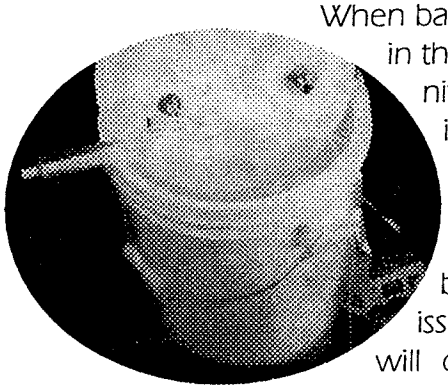
The procedure for field blanks:

Proper Inflation
Avoid filling bag more than 80% of it's volume



1. Place two buckets in the same storage areas with clean new bags.
2. When you sample, put the buckets side-by-side. Sample from only one bucket.
3. Record on the Chain of Custody Sheet all vital information - include time and storage location.
4. The Bucket Brigade Coordinator sends the two bags to the lab. Have the blank empty. Follow the usual protocol. Except:
5. Write BLANK on the Chain of Custody Sheet for the blank. Ask the lab to fill bag with NO2.

Nitrogen Purge



When bags come from the manufacturer, they may have residual chemicals in them that will show up in your sample. We have seen small but significant levels of acetone, toluene, and other compounds show up in our field blanks. In order to ensure a good sample you will want to ask your analytical laboratory to send you bags that have been filled and purged with research grade pure nitrogen. You can also purchase research grade nitrogen and a regulator and purge the bags three times yourself. However, because of cost and storage issues, it is usually simpler to get your lab to do it for you. Most labs will do it free of cost when you purchase the bags from them.

Lab Protocol

o Lab Blanks: Your analytical lab should regularly conduct their own analysis on "Lab Blanks" (at least daily). The lab tests a "clean" sample (usually pure nitrogen) to test their own equipment for contamination.

o Lab Duplicates: Your analytical lab should regularly conduct their own analysis on "Lab Duplicates" (at least once every 10 samples). The lab tests your sample twice to check their own equipment for consistency. Ask your lab for their "Method Summary and Quality Control Procedures."

I M P O R T A N T !
We have new information about compounds that can permeate the teddlar bags. Please contact CBE for more QA/QC information and a copy of our detailed QA/QC plan.

Quality Assurance/Quality Control
continued

Data Protocol

o The lab should be able to give the Bucket Brigade results within 10 working days, but often receive results more quickly.

o How will you interpret the results? If your main purpose is to identify pollutants you did not know were in your air, just look at the lab results. If you took any background samples, you can compare the results to those samples. You can also call your local EPA or local regulatory agency and ask them for a list of chemicals that are routinely in the air, and at what levels. You may want to seek some assistance: find local expertise—friendly consultants, university professors and lab personnel.

See page 26 and Appendix D for more information resources that will help you interpret your data.

o Be aware that a result of Non-Detect (ND), does NOT mean a chemical is not present; it simply means that it may be present below the level of detection (LOD). The LOD is the lowest amount of a chemical that can be detected by the lab procedure. Your lab may have some flexibility with these numbers, so ask them.

Organize your lab reports

Comparing your results over time is a great way to see if there is any pattern or any chemicals that are consistently being released. You can also compare your results from incidents to any background samples you might take. Keeping all your results in one organized place makes it easier to do this. You can create a file or if you have a computer you can create a database with the following: raw data reports from the lab, a summary of what was found in the sample, who interpreted your data, a copy of the chain of custody forms, and any other helpful information.

References for QA/QC Information

"EPA Guidance for Quality assurance project plans" (EPA QA/G -5), US EPA Office of Research and Development, Quality Assurance Division (872412), August 1997.

"Volunteer Monitor's Guide to Quality Assurance Project Plans" (EPA 841 - B – 96 - 003) US EPA Office of Wetlands, Oceans and Watersheds (4503F), September 1996.

How to Take a Sample

Sampling Protocol

1. When to Take a Sample:

- Do you smell something noxious or experience something unusual - such as health changes: sore throat, nausea, irritated eyes, headaches, or do you see black smoke or fire. Do you hear unusual sounds - pressure released or explosions?
- Does it smell like rotten eggs, gasoline/oil, or some other noxious chemical?
- When in doubt, TAKE A SAMPLE! You cannot go back afterwards, it will be too late! If the sample was not necessary, all you have lost is some time
- CAUTION! Don't hurt yourself! If you feel immediate health effects or are concerned about possible long term effects, LEAVE AT ONCE. Health is more important than data.

2. How to take a Sample:

Setting Up

- Get out your bucket and set it outside in a clear area.
- Make sure your sampling area is away from other sources of contamination: Your car, sewer openings, large roads, smoking cigaretteres. You want a clear sample of the polluter's release.
- Record in the Chain of Custody form: Location, date, time.

Taking a Sample

- Set the vacuum pump on the bucket lid or on the ground - outflow from the pump could contaminate the sample.
- Start the vacuum pump and keep it running.
- After a minute or two open the black plastic valve handle by turning it parallel with the inlet tubing. Record the time on the Chain of Custody Sheet.
- Check to see if the bag is inflating by looking through the Plexiglass window in the bucket lid. If the bag is not inflating make sure that the black plastic handle is turned so that it is paralllel with the inlet tubing.
- Keep running the vacuum until the bag is about half full. This takes about 3 minutes with the vacuum.
- Close the black plastic valve by turning it perpendicular to the inlet tubing. This is VERY important; otherwise you will contaminate your sample.
- Record the time ending on the Chain of Custody Sheet.
- Turn off vacuum.

After Taking a Sample

After Taking a Sample

- Fill Out the Chain of Custody Record.
  - A. Include the date, time of day, and location of the sampling site.
  - B. Include any observations (smells, local conditions, possible sources of gases), and other pertinent information (wind direction, weather conditions such as clouds, fog, rain, or unusual smoke).
- Call the other members of your Bucket Brigade. Ask if they took samples.
- If the odor appears to come from an industrial site, call the company and your local government officials to complain. If they don't hear from you, they will think no one was affected. Call your local health department, your local air pollution agency, the Environmental Protection Agency, and any other local regulators.
- Call your Bucket Brigade Coordinator immediately to pick up the sample. The bag must be analyzed within 72 hours after taking the sample (24 hours for sulfur analysis).
- Keep the sampler in a cool dark place. (see storage tips on page 17)

How to Get Your Sample Analyzed
Instructions for the Bucket Brigade Coordinator

How to get Your Sample Analyzed

You are the Bucket Brigade Coordinator of the Local Bucket Brigade–the person responsible for collecting bags and sending them off for analysis

You are responsible for QA/QC (Quality Assurance and Quality Control). You must make sure everything is in order, that people taking the samples followed the instructions properly, and that the bags get safely and quickly on their way to the analytical laboratory. Remember, to meet most government agency standards, the sampling bag must be analyzed within 72 hours of the time the sample was taken. So you must collect bags and put them in the mail quickly.

When someone takes a sample, here is what you do:

1. **Check the Chain of Custody Record (COCR): (See Appendix A for a Sample)**
   - Ask the person who took the sample to fill in any missing sections.
   - Check that the sampler has filled out the chain of custody form properly: name, location, time of sample, observations (odor etc.), wind direction, and time sample ended.
   - On the COCR, the person who took the sample should sign, with time and date, under "Relinquished By", and YOU (Brigade Coordiinator) should sign, with time and date, under "Recieved By". If it has not been done already, write an identification number on the Sampling Bag and the Chain of Custody Record to uniquely identify this sample.
2. **MAKE SURE THE BLACK PLASTIC VALVE ON THE BUCKET IS CLOSED. If it is not closed, you have a problem. The sample is contaminated and you must throw it away.**
3. **Remove the sample bag from the buckets using the following procedure:**
   A. Unscrew the lid.
   B. Lift the lid out of the bucket and turn it upside down on your lap so you are looking at the inflated bag.
   C. Determine that the bag is not over or under inflated–i.e. that there is a viable sample (refer to the diagram on page 23).
   D. If the bag is not inflated, you have a problem. Look for leaks in the bag. If you find a leak, the sample is contaminated and you must throw it away. If you don not find an obvious leak, check the bucket and talk to the person who took the sample. Was the stainless steel valve on the bucket open? Was the polypropylene valve on the bag open? Was there an O-ring around the inside of the screw-top bucket lid? Did the vacuum operate properly?
4. **Close the polypropylene valve on the sampling bag by twisting it clockwise until until it is tight.** If there is a lock nut on the valve, loosen it before closing the valve, and tighten it afterwards. Re-check integrity of the bag - look for holes.

How to Get Your Sample Analyzed
(continued)

5. **Cut the polypropylene tube attaching the sampling bag to the air inlet port.** Use household scissors, wire cutters, or other similar tools. It is not recommended that you use a knife, becuase you might puncture the sampling bag. Place the nut and ferrules aside. DO NOT LOSE THEM, as you will need them for the next sampling bag.

6. **Put the bag in a Federal Express Box Mailer (size large).** If the bag is too full to fit into the box, open the polypropylene valve and push some air out of the bag (only do this if you really have to because it may introduce some contamination in your sample). Make sure to close the valve before putting the bag back into the box.

7. **Re-Check the Chain of Custody Record.** Make a photocopy of the COCR (or use carbon-copies) for your own records, and enclose the original with the sample in the Federal Express Box Mailer.

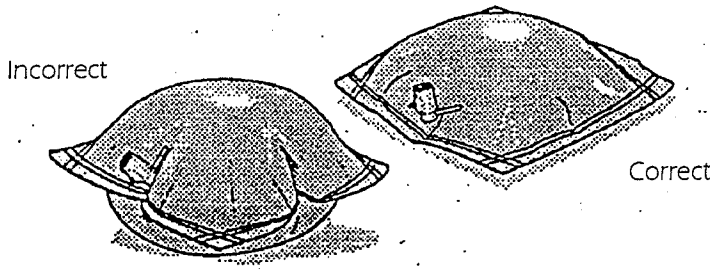
8. **Call the Analytical Laboratory and tell them:**

   A. You are sending in a sample (who you are, what organization, account number, etc.).

   B. What type of analysis you would like completed on the sample (EPA TO-14, reduced sulfur gases, etc.). They can do more than one analysis on the same sample bag.

   C. Fax them a copy of the Chain of Custody Sheet so they will know which sample is yours when it comes through their door.

Proper Inflation
Avoid filling bag more than 80% of it's volume



Getting the Bucket Ready for the Next Sample

1. Take the stainless steel nut, with the remainder of the polypropylene tube, off the air inlet port on the bottom of the bucket lid.

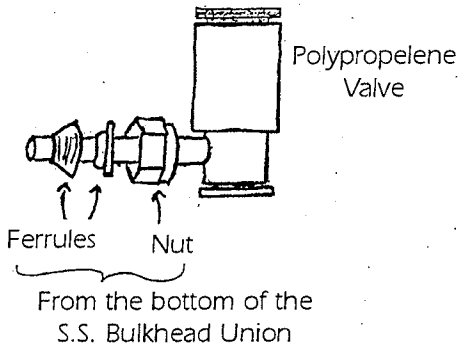
2. Remove the scrap piece of polypropylene tube from the stainless steel ferrules and nut. This is a hassle, but you just have to figure out a way to do it. We have found that mashing the tube with a pair of pliers and snipping off little pieces with a pair of scissors make the tube weak enough and short enough that you can pry the ferrules off.

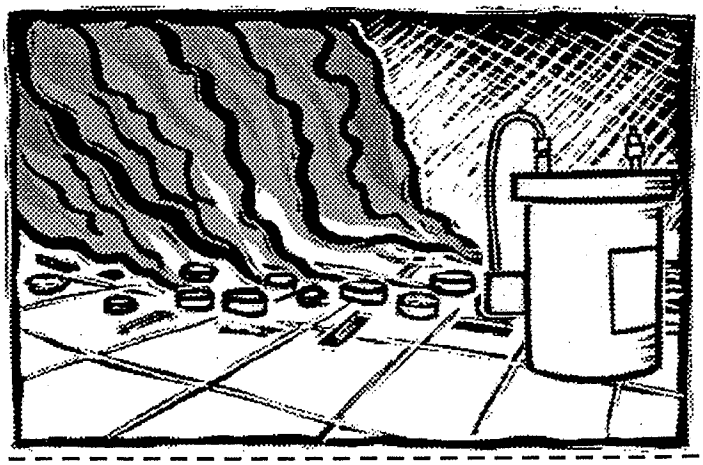
3. Take another sampling bag from your storage cabinet and refer to instructions on how to "Attach the Sampling Bag", page 17. You may also refer to the diagram below. Make sure you have closed the "whitey" valve on top of the bucket before you open the valve on the bag.

4. Perform a visual inspection of the bucket each time a sample is taken and the bag is changed. Check: rubber seal, pump, valve, overall cleanliness of bucket and valves, identify leaks, and ensure that the new bag is secured.

Some Key Points to Remember!

- For the most reliable results, the bucket sample should be analyzed within 72 hours of the time the sample was taken. (24 hours for sulfur analysis)
- The COCR is your official record of what happened. Fill it out carefully and fully.
- Don't waste your money! Don't analyze a bag contaminated by other sources. If the bag did not inflate properly, if the bag has a hole, if the black plastic valve was not closed properly, do not analyze the bag's contents. Take another sample.
- If you must dispose of a bag, put it in your normal garbage container.





How Do I Interpret the Results?

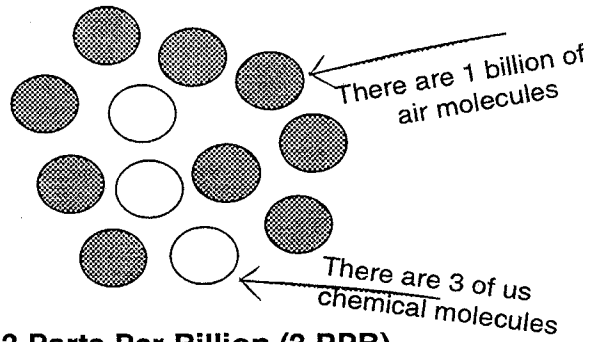
What is a Concentration???

When you get the results back from the laboratory the amount of chemicals in you air is reported in a measurement called a concentration. Our air is made up of many different gasses all mixed together. 70% of the gasses are Nitrogen. There are very small amounts of other chemicals. Air pollution exists in the air in very small amounts.

A CONCENTRATION describes how much of a certain chemical exists in a give amount of air. There are two ways of talking about concentrations are PPB (parts per billion) and ug/m3 (micro grams per meters cubed)

PPB - Parts Per Billion

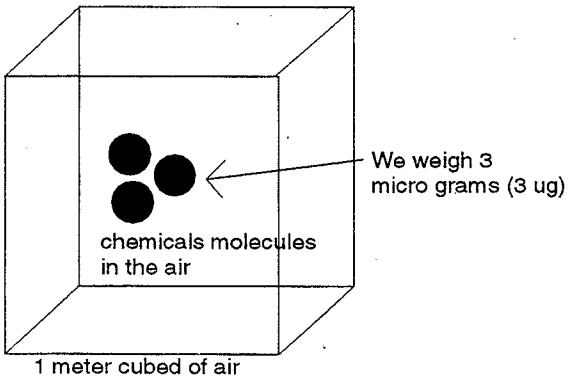
This describes the unit of a chemical are in the same space as a billion units of unpolluted air. A billion is 1,000,000,000 or 109. So basically 1 ppb means there is 1 part chemical for every 1,000,000,000 parts of unpolluted air.



3 Parts Per Billion (3 PPB)

ug/m3 - Micrograms per Meter Cubed

This describes the how much a chemical weighs that is in a volume of air that is 1m^3. Imagine a box filled with air that is 1m on every side. If there were 1 microgram (ug) of a chemical in that box, it would mean that the concentration of that chemical was 1 ug/m3 (1 microgram).
1 micro gram is one millionth of a gram.

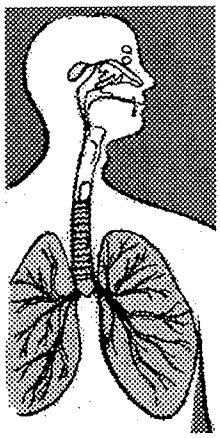


3 micro grams per meter cubed (3 ug/m^3)

How Do I Interpret the Results?
continued

WHAT DO ALL THESE NUMBERS MEAN?

The bucket results tell you how much of certain chemicals were in your air at the exact time when you took the sample. How do you know what the results mean?



Background concentration: Well the first thing you need to do is check to see what is the normal "background" concentration. A background concentration is the amount of chemicals that in the air all the time in both very industrial areas and areas without major sources of pollution. See Appendix D for more information about background samples.

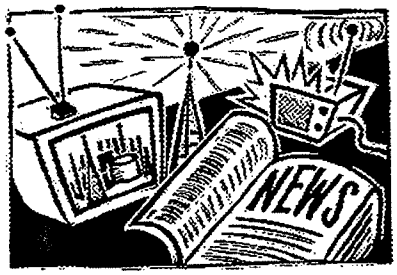
Health effects: If the numbers are significantly larger than background numbers, you want to check out what the health effects might be. Not allot is known about the health effects of these chemicals, although there are some regulatory standards and levels of concern that you can compare the numbers to. CBE can help you find these numbers and determine if the levels you are exposed to are significant. Even if the concentration are below those numbers, you still might feel the effects of these chemicals. See Appendix D for resources about health effects of chemicals.

WHAT DO I DO NEXT? - TAKE ACTION!!!!!!!!!!!!

What are some things you can do with these results?

1. Hold a meeting and talk to you neighbors about the results. Decide together how you will act.

2. Call your county Hazardous materials division, and ask if they knew of any incident that occurred that day. Ask them what they are doing to follow up on your bucket results.



3. Call the papers and/or write a press release to tell the papers that you were exposed to chemicals and that you took a bucket sample.

4. Call the your local Air Quality Management District or Air Pollution Control District and tell them you have a bucket sample with results that concern you. Find out if they took a sample or even came out to inspect your local facility that day. Ask them if they have fined the facility for the incident, if not ask why.

WRITE THEM A LETTER DEMANDING THEY DO THEIR JOB AND TAKE ACTION.

5. Call the local facility that you suspect and tell them you have a bucket sample. Demand an explanation. Or write them a letter demanding a public meeting with the press to discuss the results.

Appendix A
Compounds analyzed in EPA Modified Method TO-14

Organic/Inorganic Gases Analyzed by EPA *Modified* Method TO-14
81 Compounds

Acetone
Acetenitrile
Acrolein
Acrylonitrile*
Allyl Chloride*
Benzene*
Benzyl Chloride***
bis-(-2-Chloroethyl) Ether*
Bromodichloromethane*
Bromoform*
Bromomethane
1,3-Butadiene*
2-Butanone
Butyl Acetate
Carbon Disulfide**
Carbon Tetrachloride*
Chlorobenzene
Chloroethane*
Chloroform*
Chloromethane
cis-1,2-Dichloroethane
cis-1,3-Dichloropropene
Cumene
n-Decane
Dibromochloromethane
1,2-Dibromo-3-Chloropropane (DBCP)*
1,2-Dibromoethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane*
1,2-Dichloroethane
1,1-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane*
trans-1,2-Dichoropropene
Dichlorotetrafluoroethane
Dimethyl Disulfide
1,4-Dioxane*
n-Dodecane
Epichlorohydrin*
Ethanol
Ethyl Acetate
Ethylbenzene
4-Ethyltoluene
1-Heptanol
Hexachlorobutadiene
n-Hexane
2-Hexonone
Isopropyl Alcohol
d-Limonene
Methyl tert-Butyl Ether (MTBE)
Methylene Chloride (Dichloromethane)*
3-Methylpentane
4-Methyl-2-pentanone
Naphthalene
Nonane
1-Nonanol
Octane
a-Pinene
beta-Pinene
Propene
Propylene Oxide*
Styrene
1,1,2,2-Tetrachloroethane*
Tetrachloroethene
Toluene**
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane((TCA)
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
Trichlorotrifluoroethane
1,2,4-Trimethylbenzene
1,3,5-TrimethlyBenzene
n-Undecane
Vinyl Acetate
Vinyl Chloride*
m- & p-Xylene
o-Xylene

***Chemicals known to the State of California to cause either cancer(*), reproductive toxicity(**), or both (***). These Chemicals are on California's Proposition 65 list. Companies must legally notify workers and neighbors when they expose them to a certain level.**

Appendix A
Compounds analyzed by EPA Method TO-14 and Method 16

Organic/Inorganic Gases Analyzed by EPA Method TO-14
43 Compounds

Acetone
Benzene*
Bromodichloromethane*
Bromoform
Bromomethane
2-Butanone
Carbon Disulfide**
Carbon Tetrachloride*
Chlorobenzene
Chloroethane*
Chloroform*
Chloromethane
cis-1,2-Dichloroethane
cis-1,3-Dichloropropene
Dibromochloromethane
1,2-Dibromoethane*
1,2-Dichlorobenzene*
1,3-Dichlorobenzene*
1,4-Dichlorobenzene
1,1-Dichloroethane*
1,2-Dichloroethane
1,1-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
trans-1,2-Dichoropropene
Ethylbenzene
2-Hexonone
Methyl tert-Butyl Ether (MTBE)
Methylene Chloride (Dichloromethane)*
4-Methyl-2-pentanone
Styrene
1,1,2,2-Tetrachloroethane*
Tetrachloroethene
Toluene**
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
Trichlorotrifluoroethane
Vinyl Acetate
Vinyl Chloride*
m- & p-Xylene
o-Xylene

Sulfur gases analyzed by Modified EPA Method 16
Reduced Sulfur Gases
20 Compounds

Hydrogen Sulfide
Carbonyl Sulfide
Methyl Mercaptan
Ethyl Mercaptan
Dimethyl Sulfide
Carbon Disulfide**
Isopropylmercaptan
tert-Butyl Mercaptan
n-Propylmercaptan
Ethyl Methyl Sulfide
Thiophene
Isobutyl Mercaptan
Diethyl Sulfide
n-Butylmercaptan
Dimethyl Disulfide
3-Methylthiophene
Tetrahydrothiophene
2-Ethylthiopehen
2,5-Dimethylthiophene
Diethyl Disulfide

Performance Analytical Inc.
Air Quality Laboratory

20954 Osborne Street
Canoga Park, California 91304
Phone 818 709-1139
Fax 818 709-2915

Chain of Custody Record
Analytical Services Request

Client/Project Name	Address/Phone	ANALYSES	PAI Project No.
Project Location	Client Project No.		
Contact	Sampler (Signature)	P.O. No.	

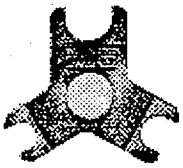
Sample Identification No.	Date	Time	Lab Sample No.	Type of Sample							Expected Turnaround Time	Remarks

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Disposal Method			White Copy : Accompanies Samples		
Disposed by: (Signature)	Date	Time	Yellow Copy : Sampler		

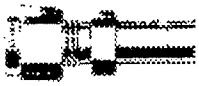
Appendix B
Parts

Bulk Head Union

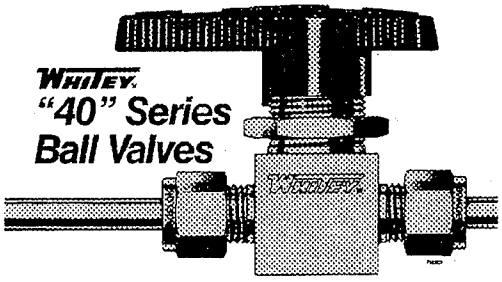
Gap Inspection Gages



Port Connector



Reducer



SKC INC.
LIMITED WARRANTY FOR TEDLAR SAMPLE BAGS

1. SKC warrants that its Tedlar sample bags provided as collection media for use with SKC Inc. instruments are free from defects in workmanship and materials only under the normal and proper use of Tedlar sample bags in strict accordance with the operating instructions provided with said Tedlar sample bags.

This warranty does not cover claims whatsoever due to abuse, misuse, neglect, alteration, or accident, or use in application for which the Tedlar sample bags were either not designed or not approved by SKC Inc., or due to the buyer's failure to maintain normal maintenance, improper selection or misapplication. This warranty shall further be void if changes or adjustments to the Tedlar Sample Bags are made by other than an employee of the seller, or if the operating instructions furnished at the time of purchase are not strictly complied with.

2. SKC Inc. hereby expressly disclaims all warranties either expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose, and neither assumes nor authorizes any other person to assume for it any liability in connection with the sale of these Tedlar sample bags. No description of the Tedlar sample bags being sold has been made a part of the basis of the bargain or has created or amounted to an express warranty that the goods will conform to any such description. Buyer shall not be entitled to recover from SKC Inc. any consequential damages, damages to property, damages for loss of use, loss of time, loss of profits, or income or other incidental damages. Nor shall buyer be entitled to recover from SKC Inc. any consequential damages resulting from defect of the Tedlar sample bags including, but not limited to, any recovery under section 402A of the Restatement, Second of Torts.

3. This warranty extends only to the original purchaser of the warranted Tedlar sample bags during the term of the warranty.

4. The buyer may be required to present proof of purchase in the form of a paid receipt for the Tedlar sample bags.

5. This warranty covers the Tedlar sample bags purchased and each of its component parts.

6. In the event of a defect, malfunction, or other failure of the Tedlar sample bags not caused by any misuse or damage to the Tedlar sample bags while in possession of the buyer, SKC Inc. will remedy the failure or defect, without charge to the buyer. The remedy will consist of repair or replacement of the Tedlar sample bags, or refund of the purchase price, at the option of SKC Inc. However, SKC Inc. will not elect refund unless it is unable to provide replacement, and repair is not commercially practicable.

7. The term of this warranty begins on the date the Tedlar sample bags are delivered to the buyer, and continues for the normal period of use of such Tedlar sample bags.

8. (a) To obtain performance of any obligation under this warranty, the buyer shall return the Tedlar sample bag freight prepaid, to SKC Inc., at the following address:

SKC Inc.
National Service Center
863 Valley View Road
Eighty Four, PA 15330 USA

(b) To obtain further information on the warranty performance you may telephone 412-941-9704 at the address above.

9. This warranty shall be construed under the laws of the Commonwealth of Pennsylvania which shall be deemed to be the situs of the contract for purchase of SKC Inc. Tedlar sample bags.

10. No other warranty is given by SKC Inc. in conjunction with this sale.

Form 3781 Rev 9502

® Tedlar and Teflon are registered tradenames of DuPont de Nemours Corporation

Operating Instructions

SKC
863 Valley View Road, Eighty Four PA 15330

Tedlar® Sample Bags 232 Series

A single polypropylene fitting is supplied for filling the bag and for removing the sample for analysis. This fitting contains both a syringe port with Teflon® lined septum and a hose connection. It also acts as a shut-off valve for the hose connection.

Guidelines for Bag Sampling

1. Use only Tedlar film bags.
2. Connect the sample bag to the sample source with Teflon tubing.
3. Use a Teflon-lined septum for sealing the bag opening.
4. Before using, flush the bag thoroughly with purified air or nitrogen.
5. Analyze the sample as soon as possible after collection.
6. Do not use bags to sample unstable or highly reactive compounds.
7. Do not ship sample bags by air unless the cargo cabin is pressurized.
8. Under some limited conditions it may be possible to re-use Tedlar bags. To do so requires thorough cleaning with purified air or nitrogen and verifying background levels before sampling. Since re-use is dependent on many varying conditions of use, SKC can only extend its warranty to a single use of Tedlar bags.

Operation

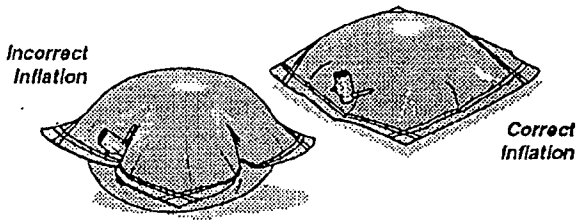
1. Flush the bag at least 3 times with purified air or nitrogen before use.

Filling Bags Using negative Pressure

The SKC Vac-U-Chamber is a rigid air sample box which allows the direct filling of an air sample bag using negative pressure provided by most personal air sampling pumps. When using the Vac-U-Chamber, the air sample enters the bag directly, without passing through the pump. This eliminates the risk of contaminating the pump or sample. The Vac-U-Chamber has rigid walls which will not collapse under vacuum conditions, thus eliminating possible errors. All surfaces in contact with sample are constructed of stainless steel or Teflon.

Proper Inflation

Avoid filling any bag more than 80% of its maximum volume. At the end of the sampling period, turn the pump off and close the valve on the bag.



Caution

SKC Tedlar bags are designed for sampling air at atmospheric pressure only. Attempting to pressurize the bag will result in bag rupture and sample loss. Do not ship bag samples by air freight in non-pressurized cargo cabin. Bags will burst under such conditions.

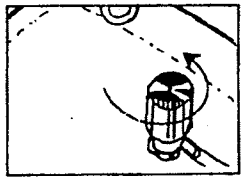
Tedlar bags are not intended for storage of hazardous materials. If you suspect that your sample bags may contain hazardous materials in concentrations above safe levels defined by NIOSH, OSHA, or DOT, special federal and state packaging and transporting regulations may apply.

SKC makes sample bags in sizes from 1/2 to 100 liter capacity. In addition to the single polypropylene fitting, SKC bags are available with either single or dual stainless steel fittings.

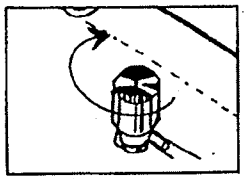
Sample Bag Accessories

Replacement Septums, Teflon coated	232-01-RS
Gas flushing kit	231-9-08
Color detector tube adapter kit	231-9-12
Vac-U-Chamber	231-939
Teflon tubing, 1/4 inch ID	231-937

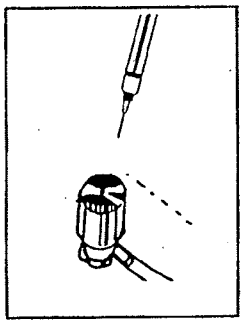
For more product information or assistance with applications, contact SKC Technical Service at 800-752-8472



3. To open the shut-off valve, hold the side stem and turn the entire upper portion of the fitting (including the brown syringe port and the white section to which it is attached) counterclockwise one revolution.



4. To close the shut-off valve, hold the side stem and turn the entire upper portion of the fitting (including the brown syringe port and the white section to which it is attached) clockwise until it is snug.



5. To withdraw samples by needle and syringe, carefully insert the needle into the septum port in the center of the brown cap and pierce the septum.

Caution: Do not allow the needle to puncture the Tedlar film when piercing the septum.

A syringe port is supplied through the top of the fitting for removing the sample. A special Teflon lined septum is used and should be replaced after each use. The septum is accessible by removing the brown screw cap. When replacing the septum be sure the Teflon side (shiny side) is towards the bag.

this step is performed by the analytical lab.

Appendix C
Other Monitoring Devices

Other "Grab Sampling" Devices

The Suitcase

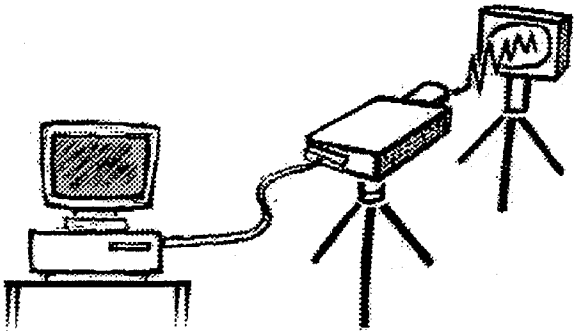
SKC, the makers of the Tedlar bags used in the buckets, also make their own sampler. The sampler is exactly like the bucket but in the shape of a suitcase. The suitcase sampler costs a little more than a bucket, but you don't have to build it yourself. Contra Costa County Hazardous Materials Division uses the suitcase and recommended we use some in our joint bucket Brigade Project. However, we have had some difficulties with our initial quality control tests on the suitcases. If you are interested in the suitcase, call SKC at 1-800-752-8472. and call us for an update on our suitcase QA/QC tests as well.

Summa Canisters

Summa canisters are metal canisters that do not require a bag, the air gets sucked right into the canister. Summa canisters are used widely by the EPA and Regional Air Districts. They are very expensive, and unless you buy a special "Silco Steel" lined canister, they are not very useful for testing sulfur compounds.

Real Time Monitoring

Real-time Optical Sensing Devices:



High-tech monitoring equipment is more accessible to communities than people might think. After a major chemical release, Unocal and TOSCO were required in a Good Neighbor Agreement to work with CBE and neighbors to design a state-of-the-art air pollution monitoring system around their Rodeo, CA plant. We also operated this kind of equipment ourselves after having the good fortune to get an Optical Sensor (OS). OS works by shooting a light beam through the open air toward a mirror up to a kilometer away. When the light hits chemicals in the air, each chemical absorbs the light at a different frequency, so that when the light beam reflects back, it has the unique "fingerprint" of each chemical on it. A detector of these "fingerprints" can give chemical results on a computer screen, pretty much instantly, so no samples need to go to a lab. Hundreds of gases can be detected. Infra-Red, Ultra-Violet, and laser equipment is available. Optical Sensors are expensive and require expertise, but provide real-time, continuous, more permanent monitoring. They can provide early-warning when chemical levels begin to build up at the fenceline of industrial facilities or superfund sites, or determine ongoing emissions. For more info., contact CBE.

Particulate Samplers

There are two kinds of PM samplers; Real Time and High Volume. Real Time samplers use optical sensors to count how many particles are in the air at any given time. You can only determine how much PM is in the air this way, NOT what chemicals are present in the PM.

High Volume samplers suck air through a filter where the particulate matter is deposited. The filter is then weighed to determine how much PM is in the air. High Volume samplers use special inlets to control the size of the particles sampled. You can take the filter from the sampler and run many different tests on it to determine what kinds of chemicals are in the PM. For more information on PM samplers you can contact SKC at 1-800-752-8472 or Rupprecht & Patashnick Co at 518-452-0065.

Appendix D
Technical Resources on Toxics

1. How to Research Chemicals: A Resource Guide, 1995. Contact: Maria Pellerano, Environmental Research Foundation, tel. 410-263-1584, fax 410-263-8944, email erf@rachel.clark.net.

This is an excellent, well written and easy to understand guide on strategies for researching toxic chemicals and their effects. The guide covers information for the non-scientist on chemical properties, how to conduct research, and sources of information and support.

2. ASTDR Toxicological Profiles. Contact: Susie Tucker; Department of Health and Human Services, Agency for Toxic Substances and Disease Registry; tel. 404-639-6300, fax 404-639-6315.

The ASTDR Profiles provide a wealth of information in an easy to understand format on chemicals and their effects, production, releases, regulations and guidelines relevant to the chemicals. The profiles for 117 of the 275 toxic chemicals found at Super fundsites have been completed, and 45 are in draft form. ASTDR also has an on-line database, HazDat, which contains information on hazardous waste sites and community health impacts. The ASTDR profiles are also available on the World Wide Web.

3. New Jersey Department of Health's Hazardous Substance Fact Sheet on Chemicals. Contact: Right to Know Program, New Jersey Department of Health, tel. 609-984-2202.

The fact sheets, developed under the New Jersey Labor and Community Right to Know Law, provide information on 1053 chemicals. For each chemical the six page fact sheet provides the following types of information: health effects, physical properties, workplace exposure limits, medical information, emergency response instructions. The fact sheets are also available on the World Wide Web.

Some Helpful WWW Sites

1. **http://www.igc.org/envjustice/** EcoJustice home page
2. **http://www.envirolink.org/issues/pollution-map/index.html** Pollution Mapping Projects and Toxics Databases
3. **http://rtk.net/** Right To Know Net: Home of the Toxics Release Inventory (http://rtk.net/data/tri_gen.html) and the New Jersey Department of Health's Hazardous Substance Fact Sheet on Chemicals
4. **http://www.epa.gov/enviro/html/emci/chemref/** Envirofacts Warehouse Chemical References Index
5. **http://www.epa.gov/docs/ngispgm3/iris/index.html** U.S. EPA Integrated Risk Information System (IRIS)
6. **http://www.niehs.nih.gov/** National Institute of Environmental Health Sciences Home Page

4. Enviro-Health Clearinghouse. contact: National Institute of Environmental Health Sciences (NIEHS), tel. 1-800-643-4784, fax 1-919-361-9408

NIEHS has set up a clearing house that functions as an easily accessible, free source of information on environmental health effects. The Clearinghouse's technical information specialists can provide information on: health effects of environmental and worker exposure, health hazards posed by toxic waste facilities, and health risks from chemical spills and releases.

Appendix D
Technical Resources on Toxics: What is a Background level?

What is a Background Level?

Background levels are estimates of the average concentrations of pollutants in the air. They represent a good approximation of what the air is like when there is NOT a major incident. Generally background levels come from measurements made far away from major industrial facilities, so if you live near the fenceline, these numbers might not represent your ""background" concentration. You can compare your sample results to background concentrations to see if the numbers are significant, or if they indicate "business as usual." These numbers are generally in the parts per billion (ppb) range. This means that there is 1 part volume of the chemical per 1 billion part volume of air. To get a more general idea of what levels are significant, you might want to compare these numbers and your results with some of the occupational exposure limits available through the resources given on page D1. With some persistence, you can get these numbers from your local Air Quality Agency or through US EPA AIRS data system. (http://www.epa.gov/airsweb/)

Bay Area Ambient Concentrations of Air Toxics
(Median Concentrations of and Interquartile Range, in ppb)

Chemical	Whole Bay Area	Richmond	Concord
Benzene	1.0 (0.6 to 1.6)	1.4 (0.9 to 2.7)	0.9 (0.6 to 1.6)
1,3-Butadiene	<0.5 (<0.5 to <0.5)	<0.5 (<0.5 to <0.5)	<0.5 (<0.5 to <0.5)
Carbon Tetrachloride	0.11 (0.11 to 0.11)	0.11 (0.10 to 0.11)	0.11 (0.10 to 0.11)
Chloroform	<0.02 (<0.02 to <0.02)	<0.02 (<0.02 to <0.02)	<0.02 (<0.02 to <0.03)
Ethylene Dibromide	<0.02 (<0.02 to <0.02)	<0.02 (<0.02 to <0.02)	<0.02 (<0.02 to <0.02)
Ethylene Dichloride	<0.1 (<0.1 to <0.1)	<0.1 (<0.1 to <0.1)	<0.1 (<0.1 to <0.1)
Methylene Chloride	<0.5 (<0.5 to 0.7)	<0.5 (<0.5 to <0.5)	<0.5 (<0.5 to <0.5)
MTBE	0.8 (<0.5 to 1.4)	1.1 (<0.5 to 1.3)	0.6 (<0.5 to 1.4)
Perchloroethylene	0.11 (0.06 to 0.19)	0.08 (0.04 to 0.11)	0.14 (0.08 to 0.27)
Toluene	2.0 (1.3 to 3.2)	2.5 (1.7 to 3.8)	2.0 (1.2 to 3.2)
1,1,1-Trichloroethane	0.39 (0.25 to 0.65)	0.33 (0.24 to 0.45)	0.34 (0.25 to 0.53)
Trichoroethylene	<0.8 (<0.8 to <0.8)	<0.8 (<0.8 to <0.8)	<0.8 (<0.8 to <0.8)
Vinyl Chloride	<0.3 (<0.3 to <0.3)	<0.3 (<0.3 to <0.3)	<0.3 (<0.3 to <0.3)

Sources: Bay Area Air Quality Management District, Toxic Air Contamination Control Program Annual Report, 1994 Volume 11. BAAQMD: 939 Ellis Street, San Francisco CA 94109, 415-749-4900.
Bay Area Air Quality Management District Technical Services Division. Toxics Data, 1992-1995. 415-771-6000.
California Air Resources Board Technical Support Division.

What do these numbers mean?

Median The Median is the concentration in the middle of the measurements; half of the measurements were higher, half were lower.

IQR The Interquartile Range is the range that contains the middle half of the measurements, 25% of the measurements were below this range, 25% were above this range.

<0.5 When you see "<0.5" as an entry, that means the measurement is below the **Limit of Detection (LOD)** for that compound. That doesn't mean the compound isn't there, it means the lab can't tell exactly what the concentration is, but they think it is below the LOD.

How do I interpret these numbers?

How you Should Use them: Use these numbers to decide whether you think measurements reported in the media after industrial accidents are "Back&round Levels" or "Above Background", We use "median" and "interquartile range" because they describe the most common measurements.

How you Shouldn't: If you want to know whether the background level might be hurting you, the"average", or "mean", is usually a better number. Why? The "mean" averages together all the high and low measurements, just like your body does for most compounds. The mean is generally higher than the median, sometimes twice as high.

Appendix E
Sniffer's Log Example

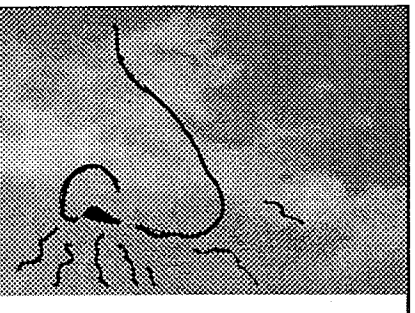
1. WHO YOU GONNA CALL? - Enter important numbers here

Your Bucket Brigade Coordinator _____
Your Bucket Sampler/other Sniffers _____
Communities for a Better Environment 415-243-8373
BAAQMD odor complaint number 1-800-334-ODOR
Contra Costa County Health Services 925-370-5064
Contra Costa Hazardous Material Division 925-646-2286
Your local refinery complaint number _____
Your District Supervisor _____
Your local press numbers: TV _____
Radio _____
Newspaper _____

2. Keep track of what you smell/experience and who you call

Date	Time	What did you experience? (smells, health effects, smoke, noises, etc...)	Who did you call?

Sniffer Log



1. WHO YOU GONNA CALL? - Enter important numbers here

Your Bucket Brigade Coordinator _____

Your Bucket Sampler/other Sniffers _____

Communities for a Better Environment _____

AQMD odor complaint number _____

Your County Health Services _____

Your County Hazardous Material Division _____

Your local refinery complaint number _____

Your District Supervisor _____

Your local press numbers

TV _____

Radio _____

Newspaper _____

2. Keep track of what you smell/experience and who you call

Date	Time	What did you experience? (smells, health effects, smoke, noises, etc...)	Who did you call?