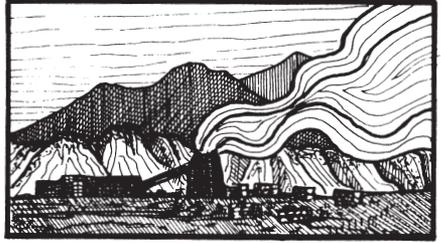




## Why These Tips?

Environmental issues aren't simple. It's easy to quote reports, but their technical terms and unfamiliar units are off-putting to many readers. These tips are designed to help journalists make math and science more accessible.



1. **Identify the Facts**
2. **Explain the Terms**
3. **Get the Units Right**
4. **Offer a Visual**
5. **Make Connections between Environmental Hazards and Health**
6. **Identify Routes of Exposure**
7. **Relate Unfamiliar Hazards to Common Ones**
8. **Explain the Averages**
9. **Seek Out the Data to Complete the Picture**
10. **Acknowledge Changing Science**

## How This Guide Works

Every tip is followed by examples.

Examples with grey shading show writing that is insufficient.

Examples with no shading exemplify the tip.

At the bottom of each page is the name of an activity or data source provided by the *Statistics for Action* (SfA) project at TERC.



SfA Activities are at [sfa.terc.edu/materials/activities.html](http://sfa.terc.edu/materials/activities.html)



SfA data sources are at [sfa.terc.edu/data/public.html](http://sfa.terc.edu/data/public.html)



## 1. Identify the Facts

Depending on regulations, companies can legally operate until environmental studies or health studies show proof of harm.

### MSNBC reported ...

Nitrate-contaminated water is a well-documented fact in many of California's farming communities. The agricultural industry, however, has maintained that it is not solely responsible because nitrates come from many sources.

3/13/2012  
openchannel.msnbc.com

He says one thing; they say another. What am I supposed to believe?



It's easy to get mired in accusations. An alternative to the blame game is to present the data. Report on the facts, and your audience can decide for themselves.

But, according to the UC Davis report, 96 percent of nitrate contamination comes from agriculture and only 4 percent can be traced to water treatment plants, septic systems, food processing, landscaping and other sources.

3/13/2012  
openchannel.msnbc.com

Demonstrating harm with indisputable environmental or health data is a high burden of proof that favors the business. Your audience may want the burden of proof to be reversed: Can alleged polluters prove they are *not* causing contamination, affecting human health, or reducing property values? Ask industry representatives what testing they have conducted to ensure safety for workers, residents, and the environment at all stages of their process.

## 2. Explain the Terms



Because environmental professionals give common words like “pump”, “treat”, and “buffer” specific meanings, writers need to explain terms.

### **The Portland Press Herald reported ...**

The company installed a pump-and-treat system, but Nilson said no one knows the extent of the contamination.

3/18/10

What does this term even mean? Are they pumping in cleansers?



Use a parenthetical or offer a sentence or two of explanation as in the example below.

The company installed a pump-and-treat system. With pump-and-treat cleanups, the polluted groundwater is pumped directly into holding tanks and from there into a treatment system. The harmful chemicals are destroyed or removed and disposed of. The cleaned water is tested before it is put back into the ground or into a sewer system.

[www.clu-in.org](http://www.clu-in.org)



For more, see the *EPA Terms and Acronyms Search Page*.



### 3. Get the Units Right

Environmental data are often reported with a variety of unfamiliar units. Treat the unit with respect. It is more than a decoration. Check that the quantities being compared are in the same unit.

The truth? I wish I could remember a way to think of it.



#### Maximum Contamination Levels (MCL) for Drinking Water

Contaminant	EPA MCL in micrograms per liter	EPA MCL in parts per billion	EPA MCL in parts per million
Mercury	2 $\mu\text{g/L}$	2 ppb	0.002 ppm
Arsenic	10 $\mu\text{g/L}$	10 ppb	0.010 ppm

Converting to parts per million and parts per billion can be confusing.

A milligram (mg) is one thousandth of a gram, and one millionth of a kilogram. One liter (L) of water (but not other liquids) has a mass of one kilogram (kg). So, one mg/L (mg of contaminant per L of water) is equivalent to one part per million (ppm). A microgram per liter ( $\mu\text{g/L}$ ) is equivalent to one part per billion (ppb).

Comparisons or analogies help readers make sense of unfamiliar units. Follow amounts in unfamiliar units with an analogy to help get across the relative size of an allowable amount or actual amount. For example, one part per million is like:

- A drop of water in a large kitchen sink
- An inch in 16 miles
- One penny in \$10,000.00
- One car in a line of bumper-to-bumper traffic from Cleveland to San Francisco



For more, see the resource *Common Units*.

## 4. Offer a Visual



Environmental issues are loaded with unfamiliar units and quantities that are too large or too small for most people to visualize. Bring big numbers to a human scale.

How much is that?  
I want to picture it.

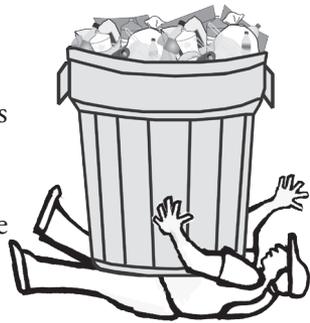


### South Coast Today reported ...

The report ... counts 19 hazardous waste generators in the city, producing at least 1,000 kilograms per month.

3/26/2010

Comparisons help readers visualize quantities to make facts meaningful. Scaling down, 1,000 kilograms (kg) per month is about 3 pounds an hour. 1,000 kg of hazardous waste is like the weight of one family's garbage for *five years*.



BP spilled 172 million gallons. **That is enough oil to ...**

... fill the Giant Ocean Tank at the New England Aquarium **866 times**.

... fill more than **2 medium** Dunkin Donuts iced coffee cups for every person in the US.

7/23/2013  
boston.com



For examples of different ways of saying and showing tricky numbers, see the handout in *Memorable Messages* and *Memorable Graphs*.



## 5. Make Connections between Environmental Hazards and Health

Use current issues and well-known environmental stories to make connections between environmental hazards and health effects.

### Maine Newspapers reported ...

The property at 2 Eisenhower Drive was contaminated by trichloroethylene, a carcinogen, in the 1990s ...

Where have I heard about this chemical before? Will I get sick from touching the water or drinking it or both?



Help readers understand the specific health risks associated with contamination.

Provide basic information for each chemical as in the example below.

- Describe its sources and uses
- Explain how it enters the environment
- Refer to a TV show, a big news story, or a familiar movie like *A Civil Action* that involves the same contaminants
- List its health effects

### Farming communities facing crisis over nitrate pollution, study says ...

High nitrate levels in drinking water have been linked to thyroid cancer, skin rashes, hair loss, birth defects and “blue baby syndrome,” a potentially fatal blood disorder in infants.

3/13/2012  
mscnbc.com



For summaries about many different toxic substances, see the *ATSDR ToxFAQs* and *ATSDR Toxicological Profiles*.



## 6. Identify Routes of Exposure

Build readers' awareness of exposure pathways. Regulators may issue boil-water orders for drinking water, but there are other routes of exposure. All kinds of everyday activities can lead people to have contact with contaminants.

Risk can increase with:

- Cleaning up: skin contact with dust, soil, or pooled water
- Showering: skin contact with well water, breathing fumes
- Swimming: swallowing water; skin contact

Should I be eating vegetables from my garden? If there's a water pollution problem, could that affect the food I'm growing nearby?



A study in Hardemann County, Tennessee where carbon tetrachloride, trichloroethylene, and other volatiles (chemicals that evaporate easily) were found in the drinking water showed that a fifteen-minute shower caused more exposure than drinking two liters of the water.

Common Questions about Health Effects, [chej.org](http://chej.org)

In particular, some scientists worry that atrazine may be safe during many periods of life but dangerous during brief windows of development, like when a fetus is growing and pregnant women are told to drink lots of water.

[nytimes.com/2009/08/23/us/23water.html](http://nytimes.com/2009/08/23/us/23water.html)



To read about differences in exposure, see *Risk: Points of Contact*.



To learn how people are commonly exposed to different toxic substances, see the *ATSDR ToxFAQs* and *ATSDR Toxicological Profiles*.

## 7. Relate Unfamiliar Hazards to Common Ones



Make it relative by comparing state or EPA standards for unfamiliar hazards to standards for recognizable contaminants.

How bad is it? I know cyanide is deadly and lead causes problems for brain development. How bad is cadmium in drinking water by comparison?



Chemicals	CASRN Number	Standards
		MCL (mg/L)
Cadmium	7440-43-9	0.005
Chloramine <sup>3</sup>	10599-90-3	4 <sup>4</sup>
Chlorine	7782-50-5	4 <sup>4</sup>
Chlorine dioxide	10049-04-4	0.8 <sup>4</sup>
Chlorite	7758-19-2	1
Chromium (total)	7440-47-3	0.1
Copper (at tap)	7440-50-8	TT <sup>6</sup>
Cyanide	143-33-9	0.2
Fluoride	7681-49-4	4
Lead (at tap)	7439-92-1	TT <sup>6</sup>

<sup>6</sup> Copper action level 1.3 mg/L; lead action level 0.014 mg/L

Above, 0.005 mg of cadmium is as hazardous in drinking water as 0.2 mg of cyanide. That means 0.2 mg of cadmium – 40 times the standard – would be 40 times as toxic as the same amount of cyanide. So, you can tell readers that cadmium is 40 times as toxic as cyanide in drinking water.

### The New Orleans Times-Picayune reported ...

Other studies said while the chemical helped degrade the oil, the resulting mix of Corexit and oil was 52 times more toxic than the oil alone.

4/19/2013  
nola.com



For practice comparing the toxicity of various substances, see *As Toxic As...*?



## 8. Explain the Averages

Compare raw data to raw data and averages to averages. Along with the average, provide the ranges and a standard for comparison, such as state or EPA standards.

... the most recent tests of the compost this spring found mean lead concentrations of 260 parts per million (ppm), below the state's safety limit of 300 ppm and the federal standard of 400 ppm. But that was more than double what city officials found in 2005, and some samples taken this year showed concentrations of as much as 480 ppm of lead.

6/4/2012  
boston.com

The average doesn't sound dangerous, so everything is okay?



Reporting an average can obscure the reality of conditions for residents who live with the problem. Giving a high and a low value, as well as the average, is a more accurate way to describe the situation.



To see averages used in incomplete or deceptive ways, see *Inside Averages*.

## 9. Seek Out the Data to Complete the Picture



Environmental consultants may be under pressure to declare a cleanup complete, so they report a level that shows the cleanup has achieved its goal.

In this example, the average vinyl chloride level is below the cleanup goal of 2  $\mu\text{g}/\text{L}$ .

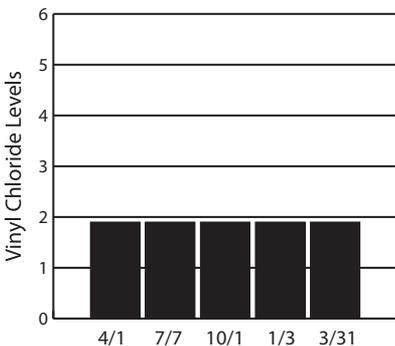
Well #	Vinyl Chloride Levels (in micrograms per liter)					Average
	4/1	7/7	10/1	1/3	3/31	
MZ-17	5.2	0.1	0.3	3.3	0.8	1.9

We need more information. We don't know if the levels are higher or lower than in the past.

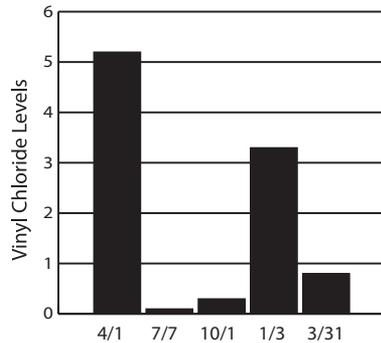


Look beyond the average and report the trend. It might be the case that:

- Recent vinyl chloride readings are above the clean-up objectives
- The levels of other chemicals are increasing as vinyl chloride breaks down
- Vinyl chloride levels have fluctuated due to changes in the water table



What the average over time makes it sound like



Possible actual level by date



To see averages used in incomplete or deceptive ways, see *Inside Averages*. For another story of an official misusing data, see [frameworksinstitute.org/ezone39.html](http://frameworksinstitute.org/ezone39.html)

## 10. Acknowledge Changing Science



Acknowledge changing science, disputed claims, missing facts, and the role of politics. If there is ambiguity, say so. Update readers on potential and recent changes to policy.

Local gardening groups [...] note that the US Centers for Disease Control and Prevention in May lowered by half the amount of lead in children's blood that should be considered harmful. Lead poisoning is now defined as 5 micrograms of lead per deciliter of blood, down from 10 micrograms.

6/4/2012  
boston.com

Last April it was safe.  
What happened?

Offer information on

- Any research underway
- Proposed changes to policy
- Alternative ways to approach the problem



Consult the Environmental Working Group, [ewg.org](http://ewg.org) or the Society for Environmental Journalists, [sej.org](http://sej.org)



## Tips and Resources for Reference

- **Acronyms.** Check [epa.gov](http://epa.gov) and search for EPA Terms and Acronyms Search Page
- **Background on issues.** Refer to Society of Environmental Journalists for issue-based tips on environmental reporting [sej.org/publications/tipsheet/overview](http://sej.org/publications/tipsheet/overview)
- **Exposure effects.** Use the Center for Disease Control's ToxFAQs [atsdr.cdc.gov/toxfaqs/index.asp](http://atsdr.cdc.gov/toxfaqs/index.asp)
- **News.** Consult the Environmental Working Group, a non-partisan organization that shares methodology as well as findings related to consumer goods and human health. [ewg.org](http://ewg.org)
- **Pesticides.** Access toxicological and regulatory information in a searchable format. Trained agronomists, chemists, and analysts track and translate science, making it publicly accessible. [panna.org](http://panna.org)
- **Testing processes.** Get an overview of soil and water testing and the process for hazardous waste site clean-up, see [sfa.terc.edu/materials/guides.html](http://sfa.terc.edu/materials/guides.html)
- **Toxic substances and their properties.** See the ATSDR Toxicological Profiles: [atsdr.cdc.gov/substances/index.asp](http://atsdr.cdc.gov/substances/index.asp)

Developed by *Statistics for Action* at TERC and Toxics Action Center, united in their interest for balanced and complete reporting on environmental issues.



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*Statistics for Action* project educates and empowers people to look critically at data related to environmental regulations, health studies, and environmental policies. For more information see [sfa.terc.edu](http://sfa.terc.edu)