Section 6

What you will find in this section...

Section 6

What you will find in this section...

Task 1

- **Find the chemicals Peter works with in the NIOSH Pocket Guide.**
- **Use Fact Sheets, the section of MSDS below and the Pocket Guide to answer the six questions.**

Peter, a worker at your facility, has come to you because he is concerned about a product he works with. He says it hurts his eyes and gives him a headache. He asked his supervisor, but the supervisor said that according to the MSDS it is "safe if used as directed." You're not so sure, so you want to look it up in the ***NIOSH Pocket Guide to Chemical Hazards***. The first step is to look up the main ingredients in the Pocket Guide.

In your groups, please use the following to answer the questions on this and the next page:

- Excerpt from the MSDS (See below)
- Fact Sheets #1-6 in this section
- The NIOSH Pocket Guide

SECTION I - HAZARDOUS INGREDIENTS/EXPOSURE LIMITS

HAZARDOUS INGREDIENTS	CAS NUMBER	TLV/ PEL	UNITS	AGENCY	TYPE OF LIMIT
STODDARD SOLVENT	8052-41-3	100	PPM	OSHA	TWA
		100	PPM	ACGIH	TWA
		100	PPM	MSHA	TWA
		200	PPM	MSHA	STEL
		100	PPM	CALOSHA	TWA
PERCHLORO-ETHYLENE	127-18-4	25	PPM	OSHA	TWA
		50	PPM	ACGIH	TWA
		300	PPM	CAL OSHA	CEIL
		200	PPM	CAL OSHA	EXCUR
		100	PPM	MSHA	TWA
AMYL ACETATE	628-63-7	100	PPM	OSHA	
		100	PPM	ACGIH	

Task 1
CONTINUED

- **Find the chemicals Peter works with in the NIOSH Pocket Guide.**
- **Use Fact Sheets, the section of the MSDS on the previous page and the Pocket Guide to answer the six questions.**

1. Will the NIOSH Pocket Guide always list the chemicals you are looking for?

2. Why do you have to look up each ingredient separately?

3. Ingredient #1 is Stoddard Solvent. What page of the NIOSH Pocket Guide is it listed on? How did you find that page?

4. Ingredient #2 is perchloroethylene. What page of the Pocket Guide is it listed on? How did you find the page? What is another name for this chemical?

Task 1
CONTINUED

- **Find the chemicals Peter works with in the NIOSH Pocket Guide.**
- **Use Fact Sheets, the section of the MSDS (p.2) and the Pocket Guide to answer the six questions.**

5. Ingredient #3 is amyl acetate. What page of the Pocket Guide is it listed on? How did you find it?

6. You will find listings for n-Amyl acetate and sec-Amyl acetate in the NIOSH Pocket Guide. These are different chemicals with different health effects. Which one is in the product Peter is asking about? How can you tell?

List of Abbreviations

This section is full of abbreviations that are impossible to decipher. Here is a list of most of the abbreviations and what they stand for.

Abbreviation	Stands for
ACGIH	American Conference of Governmental Industrial Hygienists (a private group)
Ca	Cancer-causing agent; same as carcinogen
CAS number	Chemical Abstracts Service (private)
Ceil or C	Ceiling level for air contaminants
DOT	Department of Transportation (a federal agency)
Excur	Excursion limit, same as a ceiling level
IDLH	Immediately Dangerous to Life or Health
mg/m^3	Milligrams per cubic meter (a unit of measurement for air contaminants)
mcg/m^3	Micrograms per cubic meter (one thousand times less than a milligram per cubic meter)
MSHA	Mine Safety and Health Administration (a federal regulatory agency)
NIOSH	National Institute for Occupational Safety and Health (a federal research agency)
OSHA	Occupational Safety and Health Administration (the federal agency that regulates workplace safety)
PEL	Permissible Exposure Limit for air contaminants see page 6-24 for definition

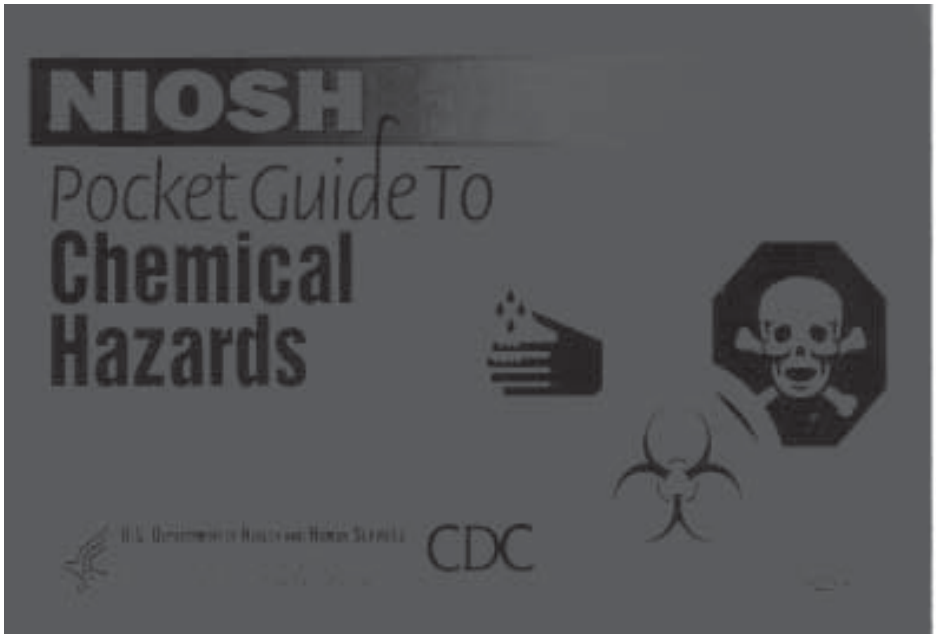
ppm	Parts per million (a unit of measurement for air contaminants)
RTECS	Registry of Toxic Effects of Chemical Substances (put together by NIOSH)
STEL	Short Term Exposure Limit for air contaminants; see page 6-24 for explanation
TLV	Threshold Limit Value for air contaminants
TWA	Time Weighted Average for air contaminants; see page 6-24 for explanation

NOTE: *Bold-faced print in the NIOSH Pocket Guide indicates new items that NIOSH has added to the latest edition of the Guide.*

Fact Sheet #1

NIOSH Pocket Guide: Another Source of Information

If you're not sure that the MSDS tells you all the hazards, there are many reference books with information about chemicals. It is always a good idea to check at least two sources of information to make sure you know the full picture. The *NIOSH Pocket Guide to Chemical Hazards* is one useful and compact book. The Pocket Guide has a lot of information, but it uses a lot of abbreviations. It can be hard to understand until you get used to it. On the next few pages, you will find tips on how to use the Pocket Guide.



The Pocket Guide is published by the National Institute for Occupational Safety and Health (NIOSH). This is a government agency that does research on health and safety on the job. It does not enforce any laws.

Use at least two references to get full information on the hazards of a chemical. The NIOSH Pocket Guide is one useful source of information on about 700 chemicals.

Fact Sheet #2

Get the Names From the MSDS

There are thousands and thousands of chemicals in existence. The Pocket Guide only lists 677 of the chemicals that OSHA has set exposure limits for. Chemicals are listed in alphabetical order by their chemical name, not brand names. The Pocket Guide does not list chemicals with more than one ingredient. It only lists single chemicals.

For example, if you work with a cutting fluid called "Magic Lube," you won't find it under "M" in the Pocket Guide.

First, get the MSDS for the product. Look up the hazardous ingredients, then look for those chemicals in the Pocket Guide.

Excerpt from the MSDS for Magic Lube:

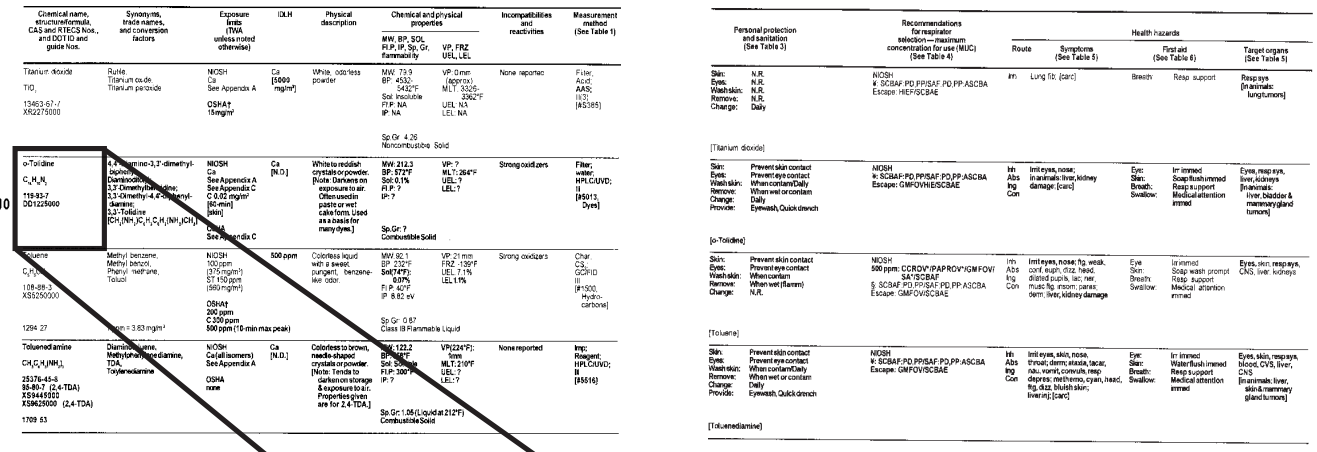
MSDS Section II: Hazardous Ingredients						
CAS Registry Number	% Weight	Chemical Names	Table Z-1-A			Carcinogen
			TWA mg/M³	STEL mg/M³	CEILING mg/M³	
141-43-5	0-10%	Ethanolamine	6	15	—	No
471-90-44	0-5%	s-Triazine-1,3,5-triethanol	–	Not established		No
6474-25-25	0-7%	Mineral Oil, Petroleum Distillates	5	—	—	No

The main ingredient in Magic Lube is ethanolamine (10%), so look this up in the Pocket Guide under "e."

Fact Sheet #3

Looking Up Chemical Names in the NIOSH Pocket Guide

Chemicals are listed alphabetically in the Pocket Guide. Chemical names appear in the first column on the left hand side of the Pocket Guide. The information about one chemical extends all the way across the row from the left page to the right page.



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Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties: MW, BP, SOL, FP, IP, Sp, Gr, flammability	Chemical and physical properties: VP, FRZ, UEL, LEL	Incompatibilities and reactivities	Measurement method (See Table 1)
Titanium dioxide TiO₂ 13463-67-7 XR2275000	Rutile Titanium oxide Titanium peroxide	NIOSH Ca See Appendix A OSHA† 15mg/m³	Ca [5000 mg/m³]	White, odorless powder	MW: 79.9 BP: 4532-5432°F Sol: Insoluble FP: NA IP: NA Sp.Gr: 4.26 Noncombustible Solid	VP: 0 mm (approx) MLT: 3326-3362°F UEL: NA LEL: NA	None reported	Filter; Acid; AAS; [I-3]; [#S385]
o-Toluidine C_7H_9N 119-93-7 DD1225000	4,4'-Methylenebis(2-methylaniline) Dianisidine 3,3'-Dimethylbenzidine; 4,4'-Bi-o-toluidine; 3,3'-Dimethyl-4,4'-biphenyldiamine; 3,3'-Tolidine [$CH_3(NH_2)C_6H_3C_6H_3(NH_2)CH_3$]	NIOSH Ca See Appendix A See Appendix C C 0.02 mg/m³ [60-min] [skin] OSHA See Appendix C	Ca [N.D.]	White to reddish crystals or powder. [Note: Darkens on exposure to air. Often used in paste or wet cake form. Used as a basis for many dyes.]	MW: 212.3 BP: 572°F Sol: 0.1% FP: ? IP: ? Sp.Gr: ? Combustible Solid	VP: ? MLT: 264°F UEL: ? LEL: ?	Strong oxidizers	Filter; water; HPLC/UVD; II [#5013, Dyes]
Toluene $C_6H_5CH_3$ 108-88-3 XS5250000 1294 27	Methyl benzene, Methyl benzol, Phenyl methane, Toluol Conv. = 3.83 mg/m³	NIOSH 100 ppm (375 mg/m³) ST 150 ppm (560 mg/m³) OSHA† 200 ppm C 300 ppm 500 ppm (10-min max peak)	500 ppm	Colorless liquid with a sweet, pungent, benzene-like odor.	MW: 92.1 BP: 232°F Sol(74°F): 0.07% FI.P: 40°F IP: 8.82 eV Sp.Gr: 0.87 Class IB Flammable Liquid	VP: 21 mm FRZ: -139°F UEL: 7.1% LEL: 1.1%	Strong oxidizers	Char; CS_2; GC/FID II [#1500, Hydrocarbons]
Toluenediamine $CH_3C_6H_3(NH_2)_2$ 25376-45-8 95-80-7 (2,4-TDA) XS9445000 XS9625000 (2,4-TDA) 1709 53	Diaminotoluene, Methylphenylenediamine, TDA, Tolylenediamine	NIOSH Ca(all isomers) See Appendix A OSHA none	Ca [N.D.]	Colorless to brown, needle-shaped crystals or powder. [Note: Tends to darken on storage & exposure to air. Properties given are for 2,4-TDA.]	MW: 122.2 BP: 536°F Sol: Soluble FLP: 300°F IP: ? Sp.Gr: 1.05 (Liquid at 212°F) Combustible Solid	VP(224°F): 1mm MLT: 210°F UEL: ? LEL: ?	None reported	Imp; Reagent; HPLC/UVD; II [#5516]

Personal protection and sanitation (See Table 3)	Recommendations for respirator selection—maximum concentration for use (MUC) (See Table 4)	Health hazards: Route	Symptoms (See Table 5)	First aid (See Table 6)	Target organs (See Table 5)
Skin: N.R. Eyes: N.R. Wash skin: N.R. Remove: N.R. Change: Daily	NIOSH ir: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: HIEF/SCBAE	inh	Lung fib; [carc]	Breath	Resp sys [in animals: lung tumors]
[Titanium dioxide]					
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam/Daily Remove: When wet or contam Change: Daily Provide: Eyewash, Quick drench	NIOSH ir: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/HIE/SCBAE	Inh Abs Ing Con	Irrit eyes, nose; in animals: liver, kidney damage; [carc]	Eye: Irr immed Skin: Soap/flush immed Breath: Resp support Swallow: Medical attention immed	Eyes, resp sys, liver, kidneys [in animals: liver, bladder & mammary gland tumors]
[o-Toluidine]					
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam Remove: When wet (flamm) Change: N.R.	NIOSH 500 ppm: CCROV*/PAPROV*/GMFOV/SA*/SCBAF §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Irrit eyes, nose; hlg, weak, conf, euph, dizz, head, dilated pupils, lac; rhin; muscinc, resp; paras; derm: liver, kidney damage	Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed	Eyes, skin, resp sys, CNS, liver, kidneys
[Toluene]					
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam/Daily Remove: When wet or contam Change: Daily Provide: Eyewash, Quick drench	NIOSH ir: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Irrit eyes, skin, nose, pharynx; dizz, insom, head, nau, vomit, convuls, resp depres; methemo, cyan, haad, fig, dizz, bluish skin; liver inj; [carc]	Eye: Irr immed Skin: Water flush immed Breath: Resp support Swallow: Medical attention immed	Eyes, skin, resp sys, blood, CVS, liver, CNS [in animals: liver, skin & mammary gland tumors]
[Toluenediamine]					

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Chemical name, structure/formula CAS and RTECS Nos., and DOT ID and guide Nos.

Toluene ← Chemical name

$C_6H_5CH_3$ ← Structure/formula

108-88-3 ← CAS registry number (Chemical Abstract Service)

XS5250000 ← RTECS number (NIOSH's Registry of Toxic Effects of Chemical Substances)

DOT ID number → 1294 27

Guide number from DOT Guidebook

Fact Sheet #4

Spelling Counts

When you look up a chemical, it's important to know the exact spelling of its name. For example, propanal (with an a) and propanol (with an o) are very different chemicals. Propanal can kill or permanently hurt you at 2 parts per million (a very small amount). Propanol doesn't "get" you until you reach a level of 2000 parts per million (ppm) - 1,000 times more than propanal.

It's also important to get the right numbers if there are any in the chemical name. **For example, 1,1,1-trichloroethane (a solvent used as a cleaner or thinner) is quite different from the chemical called 1,1,2 trichloroethane.** 1,1,1- Trichloroethane is another name for methyl chloroform, which causes permanent nerve damage, but **doesn't** cause cancer. 1,1,2 Trichloroethane **does** cause cancer. The numbers tell you about the way that the parts of a chemical are arranged.

Why are there so many chemical names? Companies can name their chemicals and products whatever they want. There are no agencies that have to approve the name. Some names are chemical names that can tell a chemist something about the product, like methane. Other names are just brand names, like "Strip Brite," "Comet," or "Contact Cement" that don't tell you anything about the product.

If you cannot find your chemical in the Pocket Guide, keep on reading. The next two fact sheets explain more ways to look up chemicals.

Know the exact spelling of a chemical name. Make sure you get the right numbers and letters that appear before the name.

Fact Sheet #5

One Chemical Goes by Many Names

A chemical can be identified by many different names or identification numbers. For example:

- 2-Butanone
- Methyl ethyl ketone
- MEK
- Methyl acetone
- CAS # 78-93-3

} **These are different names for the same chemical**

Fortunately, the NIOSH Pocket Guide has some tables in the back of the book that can help you find the chemical.

The Synonym Index starts on page 389 of the Pocket Guide. Synonyms are different words that mean the same thing. If you look up methyl ethyl ketone in this index, this is what you will find:

SYNONYM AND TRADE NAME INDEX (Continued)

Methyl azinphos, 22
Methyl benzene, 310
3-Methyl-2-butanol, 176
3-Methyl-2-butanone, 212
1-Methylbutyl acetate, 16
Methyl butyl ketone, 164
Methyl chlorobromide, 62
Methylchloromethyl ether, 66
Methyl cyanide, 4
Methyl dinitrobenzene, 118
Methylene dichloride, 208
[illegible] 198
Methyl ethyl ketone, 36
[illegible]
Methyl isobutenyl ketone, 194
Methyl isobutyl ketone, 164
4-Methyl 2-pentanone, 164
4-Methyl phenol, 78
1-Methyl-1-phenylethylene, 216
Methyl phosphite, 320
2-Methylpropane, 176
2-Methyl-2-propanol, 40
1-Methylpropyl acetate, 38
Methyl propyl ketone, 244
Methylstyrene, 332
Methyl sulfate, 116
Methyl systox®, 206
Methyl tribromide, 34
Mevinphos, 252
MIBK, 164
Mineral spirits, 286
MIPK, 212
MOCA, 206
Monobromoethane, 200
Monochloroethane, 134
Monochloromethane, 202
Monoethanolamine, 128
Monoethylamine, 132
Monomethylamine, 200
Monomethylhydrazine, 210
Monoxide, 54
MPK, 244

The Synonym Index tells you to turn to page 36. If you look at page 36 in the Pocket Guide, you will see that MEK is actually listed at the top of the page under the name of 2-Butanone.

Fact Sheet #6

CAS Numbers

Using the CAS number is another way to find a chemical. CAS stands for Chemical Abstracts Service which is run by a private group. Each chemical is given a unique CAS number. The chemical may have many names, but it only has one CAS number.

The **CAS Number Index** starts on page 377 in the Pocket Guide. If you look up CAS #78-93-3, the number for MEK, here's what you will see:

CAS NUMBER INDEX (Continued)

75-86-5: 4	78-82-0: 178	83-79-4: 274	92-87-5: 26
75-99-0: 100	78-83-1: 176	84-15-1: 296	92-93-3: 226
76-01-7: 242	78-87-5: 268	84-66-2: 108	92-94-4: 298
76-03-9: 314	[illegible]	84-74-2: 94	93-76-5: 292
76-06-2: 66	78-93-3: 36	85-00-7: 122	94-36-0: 26
76-11-9: 298	[illegible]	85-44-9: 256	94-75-7: 88
76-12-0: 298	79-01-6: 316	86-50-0: 22	95-13-6: 170
76-13-1: 316	79-04-9: 60	86-88-4: 20	95-47-6: 334
76-14-2: 102	79-06-1: 6	87-68-3: 158	95-48-7: 78
76-15-3: 66	79-09-4: 266	87-86-5: 242	95-49-8: 68
76-22-2: 48	79-10-7: 8	88-72-2: 232	95-50-1: 96
76-38-0: 196	79-20-9: 196	88-89-1: 258	95-53-4: 312
76-44-8: 156	79-24-3: 228	89-72-5: 42	95-63-6: 320
77-47-4: 158	79-27-6: 6	90-04-0: 18	95-80-7: 310
77-73-6: 102	79-34-5: 300	91-20-3: 220	96-12-8: 92
77-78-1: 116	79-41-4: 194	91-59-8: 222	96-18-4: 316
78-00-2: 302	79-44-7: 112	91-94-1: 96	96-22-0: 106
78-10-4: 142	79-46-9: 230	92-06-8: 296	96-33-3: 198
78-30-8: 322	80-62-6: 214	92-52-4: 120	96-45-7: 138
78-34-2: 120	81-81-2: 334	92-67-1: 14	96-69-5: 306
78-59-1: 178	83-26-1: 258	92-84-2: 248	97-77-8: 122

The index tells you to turn to page 36 of the Pocket Guide.

Task 2

- **Tell Peter about the health effects of the product he works with.**
- **Use the health information from the NIOSH Pocket Guide to answer the questions below.**

Now look up the health information in the NIOSH Pocket Guide so you can tell Peter more about the product he works with. Perchloroethylene is the main ingredient. Focus on this chemical in the Pocket Guide.

In your groups, please use the Pocket Guide to answer the questions below. Try to figure out what the medical terms mean, not just what they stand for. (See Fact Sheet #8, "What Does 'Euph' Mean?" for help.)

1. What symptoms does the Pocket Guide say you would feel if you were over-exposed? (See “Symptoms” in the Pocket Guide.)

2. What parts of your body would be affected by this chemical? (See “Target Organs” in the Pocket Guide.)

Task 2
continued

- **Tell Peter about the health effects of the product he works with.**
- **Use the health information from the NIOSH Pocket Guide to answer the questions below.**

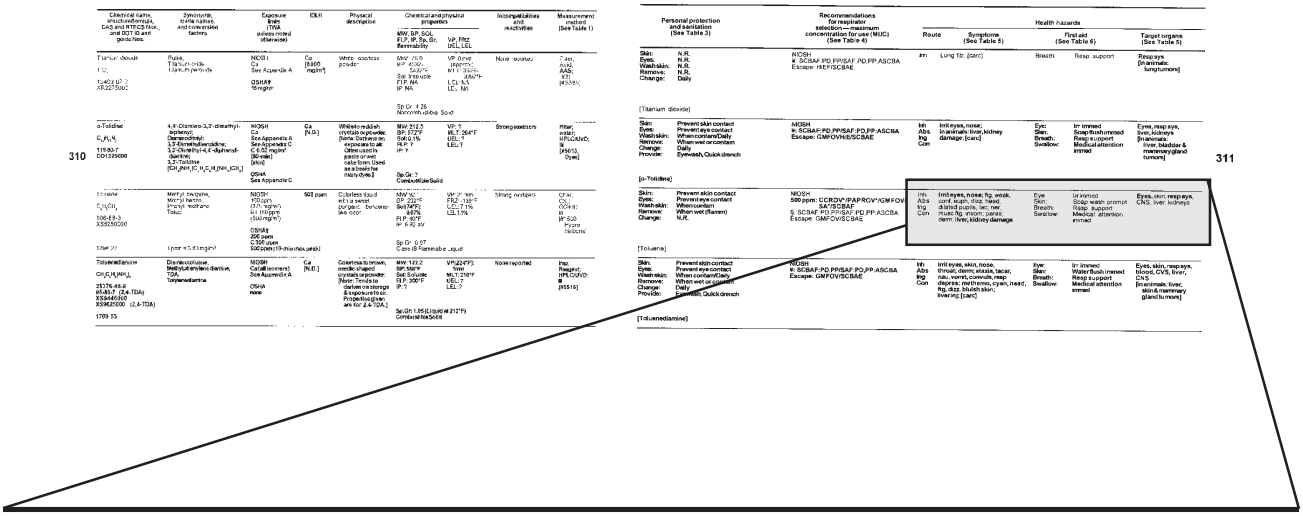
3. Does the Pocket Guide say it causes cancer? (Look for information about tumors or cancer in [brackets] under symptoms in the Pocket Guide.)

4. What would you tell your co-worker Peter about this product?

Fact Sheet #7

Finding Health Information in the NIOSH Pocket Guide

Health information is listed on the far right-hand side of the Pocket Guide. For now, focus on these columns only. The terms used in these columns are explained in Tables 5 and 6 in the Pocket Guide on pages



Health Hazards

Route	Symptoms (See Table 5)	First Aid (See Table 6)	Target Organs (See Table 5)
Inh	Ftg., weak; conf., euph.	Eye: Irr immed	CNS, liver
Abs	dizz, head; dilated pupils,	Skin: Soap wash prompt	kidneys, skin
Ing	lac; ner, musc ftg, insom;	Breath: Resp support	
Con	pares; derm	Swallow: Medical attention immed	

Inh = Inhalation (breathing)
Abs = Skin absorption
Ing = Ingestion (swallowing)
Con = Skin and eye contact

Sources: NIOSH *Pocket Guide to Chemical Hazards*, 1994.

Fact Sheet #8

What Does "Euph" Mean?

One thing that makes the Pocket Guide hard to use is all of the abbreviations and technical terms. Here are some of the abbreviations used in the Pocket Guide and their meaning:

Symptoms

Abbreviation	Stands for	Means
anor	anorexia	no appetite
arrhy	arrhythmia	irregular heartbeat
ataxia	ataxia	not coordinated
[carc]	carcinogen	causes cancer
cyan	cyanosis	blue lips — not enough oxygen
derm	dermatitis	flaky, dry, red skin
dysp	dyspnea	trouble breathing
eryt	erythema	red skin
equi	equilibrium	lose sense of balance
euph	euphoria	feeling "high"
halu	hallucinations	seeing things that aren't there
hema	hematuria	blood in urine
hemog	hemoglobinuria	blood in urine (any word with "hem" has to do with blood)
inco	incoordination	clumsy
lac	lacrimation	watery eyes
lass	lassitude	no energy
narco	narcosis	feeling sleepy, slow, in a stupor
pares	paresthesia	tingling, shooting pains in arms/legs
pulm edema	pulmonary edema	build up of fluid in lungs, "drowning" in your own fluids
sens	sensitization	become allergic
som	somnolence	sleepy
terato	teratogenic	causes birth defects
vert	vertigo	loss of balance

Fact Sheet #8 (continued)

Target Organs – The specific part(s) of the body that a chemical injures.

Abbreviation	Stands for	Means
CNS	Central nervous system	brain and spinal cord
CVS	Cardio-vascular system	heart, veins, arteries, and blood
GI tract	Gastro-intestinal tract	mouth, stomach, and intestines
Hemato sys	Hematopoietic system	blood-making system, includes bone marrow
PNS	Peripheral nervous system	nerves (other than the brain)
Resp Sys	Respiratory system	nose, throat, bronchia, lungs

To look up the meaning of other terms used in the Pocket Guide, ask for a medical dictionary in your local library.

Sources: Clayton L. Thomas, MD, MPH, ed., *Taber's Cyclopedic Medical Dictionary, edition 16*, Philadelphia: F.A. Davis, 1989.

Task 3

- **Use Column 3 in NIOSH Pocket Guide, "Exposure Limits."**
- **Figure out your advice to Peter.**

Peter has more news for you. His supervisor came back to him yesterday to say, "Just to ease your mind, I asked the Industrial Hygienist about that chemical. He showed me the air monitoring results for your work area. No problem — they got a reading that was about half of OSHA's standard."

Peter wants to know what you think about his supervisor's statement. Focus on perchloroethylene, since this is the major ingredient in the product.

Answer the questions below to help you figure out your advice to Peter. Use column 3 in the NIOSH Pocket Guide called "Exposure Limits." Also use the fact sheets on the following pages in this section to answer these questions.

1. What are OSHA's exposure limits for tetrachloroethylene? (Tip — look at Fact Sheets #9 and #10 to help you understand column 3 of the Guide.)

   a. long-term limit

   b. short-term or ceiling limits

Task 3
continued

- **Use Column 3 in NIOSH Pocket Guide, "Exposure Limits."**
- **Figure out your advice to Peter.**

2. What do these limits mean?

   a. long-term limit

   b. short-term limits

3. What does "Ca" mean under the NIOSH limits?

4. What approach does NIOSH recommend for cancer-causing chemicals? (See Fact Sheet #13)

5. What would you say to Peter's supervisor and the Industrial Hygienist about the air monitoring results and why?

6. What would you recommend that the Health and Safety Committee do to address Peter's concerns about this chemical?

Fact Sheet #9

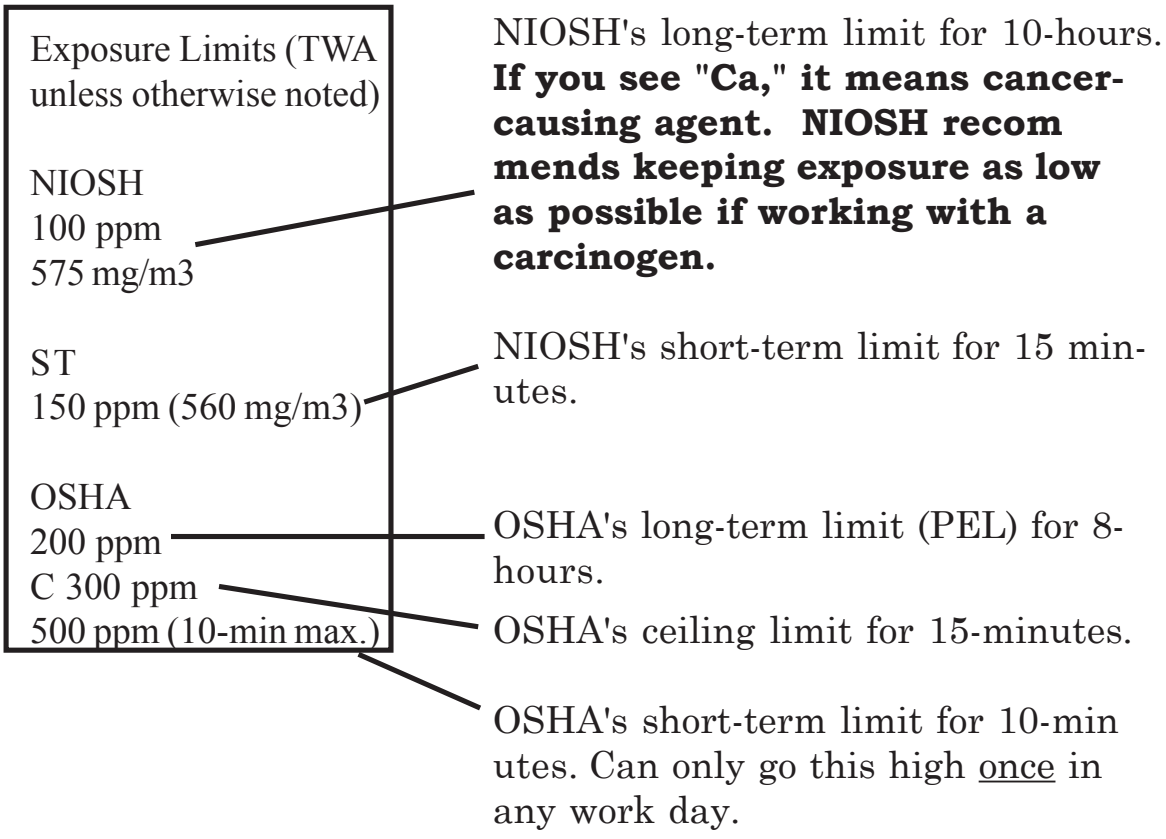
Finding Exposure Limits in the Pocket Guide

The third column in the NIOSH Pocket Guide lists **Exposure Limits**. Exposure limits are based on the idea that a worker can be exposed to some amount of a chemical without being harmed by it. The theory is that a worker's body can tolerate some threshold amount of some chemicals. Lots of people don't agree with this idea, especially when it comes to cancer-causing chemicals. (See next few pages for information on problems with exposure limits.)

Here's what you will often see if you look up Exposure Limits in the Pocket Guide:

	Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties: MW, BP, SOL Fl.P, IP, Sp, Gr, flammability	Chemical and physical properties: VP, FRZ UEL, LEL	Incompatibilities and reactivities	Measurement method (See Table 1)
	Titanium dioxide TiO_2 13463-67-7 XR2275000	Rutile, Titanium oxide, Titanium peroxide	NIOSH Ca See Appendix A OSHA† 15 mg/m³	Ca [5000 mg/m³]	White, odorless powder.	MW: 79.9 BP: 4532-5432°F Sol: Insoluble Fl.P: NA IP: NA Sp.Gr: 4.26 Noncombustible Solid	VP: 0 mm (approx) MLT: 3326-3362°F UEL: NA LEL: NA	None reported	Filter; Acid; AAS; II(3) [#S385]
310	o-Tolidine $C_{14}H_{16}N_2$ 119-93-7 DD1225000	4,4'-Diamino-3,3'-dimethylbiphenyl; Diaminoditolyl; 3,3'-Dimethylbenzidine; 3,3'-Dimethyl-4,4'-diphenyldiamine; 3,3'-Tolidine $[CH_3(NH_2)C_6H_3C_6H_3(NH_2)CH_3]$	NIOSH Ca See Appendix A See Appendix C C 0.02 mg/m³ [60-min] [skin] OSHA See Appendix C	Ca [N.D.]	White to reddish crystals or powder. [Note: Darkens on exposure to air. Often used in paste or wet cake form. Used as a basis for many dyes.]	MW: 212.3 BP: 572°F Sol: 0.1% Fl.P: ? IP: ? Sp.Gr: ? Combustible Solid	VP: ? MLT: 264°F UEL: ? LEL: ?	Strong oxidizers	Filter; water; HPLC/UVD; III [#5013, Dyes]
	Toluene $C_6H_5CH_3$ 108-88-3 XS5250000 1294 27	Methyl benzene, Methyl benzol, Phenyl methane, Toluol 1 ppm = 3.83 mg/m³	NIOSH 100 ppm (375 mg/m³) ST 150 ppm (560 mg/m³) OSHA† 200 ppm C 300 ppm 500 ppm (10-min max peak)	500 ppm	Colorless liquid with a sweet, pungent, benzene-like odor.	MW: 92.1 BP: 232°F Sol(74°F): 0.07% Fl.P: 40°F IP: 8.82 eV Sp.Gr: 0.87 Class IB Flammable Liquid	VP: 21 mm FRZ: -139°F UEL: 7.1% LEL: 1.1%	Strong oxidizers	Char; CS_2; GC/FID; III [#1500, Hydrocarbons]
	Toluenediamine $CH_3C_6H_3(NH_2)_2$ 25376-45-8 95-80-7 (2,4-TDA) XS9445000 XS9625000 (2,4-TDA) 1709 53	Diaminotoluene, Methylphenylene diamine, TDA, Tolylenediamine	NIOSH Ca (all isomers) See Appendix A OSHA none	Ca [N.D.]	Colorless to brown, needle-shaped crystals or powder. [Note: Tends to darken on storage & exposure to air. Properties given are for 2,4-TDA.]	MW: 122.2 BP: 558°F Sol: Soluble Fl.P: 300°F IP: ? Sp.Gr: 1.05 (Liquid at 212°F) Combustible Solid	VP(224°F): 1mm MLT: 210°F UEL: ? LEL: ?	None reported	Imp; Reagent; HPLC/UVD; III [#5516]

Fact Sheet #9 (continued)



Fact Sheet # 10

Exposure Limits: What Are "PEL's" and "STEL's"?

It's easy to get confused when talking about exposure limits. There are many different types of exposure limits, levels set by different agencies, and lots of short-cut names. Here are the ones you will see in the Pocket Guide and on MSDS's:

Short- and Long-Term Exposure Limits

An exposure limit is supposed to be the highest amount of a chemical that you can work in without harm. Exposure limits are expressed as concentrations: parts per million (ppm), milligrams per cubic meter (mg/m^3), and sometimes micrograms per cubic meter ($mcg/m^{3)}$. For example, 50 ppm of carbon monoxide means that there are 50 parts of carbon monoxide for every 1 million parts of air.

A. Time-Weighted Average is related to long-term exposure.

The theory is that a worker **will not get sick** if he or she works at or below this level for a long time. A "long time" usually means 8 hours per day, 5 days per week for your whole working life. These are averages, which means that your exposure can be higher than this level for part of the day, as long as it is also lower for part of the day.

B. Short-Term Exposure Limit (STEL or ST)

This is the amount you can be exposed to for no more than **15 minutes** — this is also an average. NIOSH uses STEL's.

C. Ceiling limit (C)

Don't exceed this amount at any time. OSHA uses these for some chemicals that are fast-acting or have very serious health effects.

Fact Sheet # 10 (continued)

D. Immediately Dangerous to Life or Health (IDLH)

This is the amount of a chemical that would cause death, permanent injury or disease, or prevent you from escaping. The purpose of IDLH guidelines is to make sure that a worker can escape if his or her respiratory protection failed.

Who Sets Exposure Limits?

Agency	What They Call Their Guidelines	Law or only Recommended
OSHA	**Permissible Exposure Limits = PELs, 8-hour time-weighted average**	**Law**
NIOSH	**Recommended Exposure Limits=RELs, 10-hour time-weighted average**	**Recommended**
ACGIH*	**Threshold Limit Values, or TLVs, 8-hour time-weighted average.**	**Recommended**

* What is ACGIH (American Conference of Governmental Industrial Hygienists)? This is a private group, not a government agency. But, most of OSHA's guidelines came from this group back in 1971.

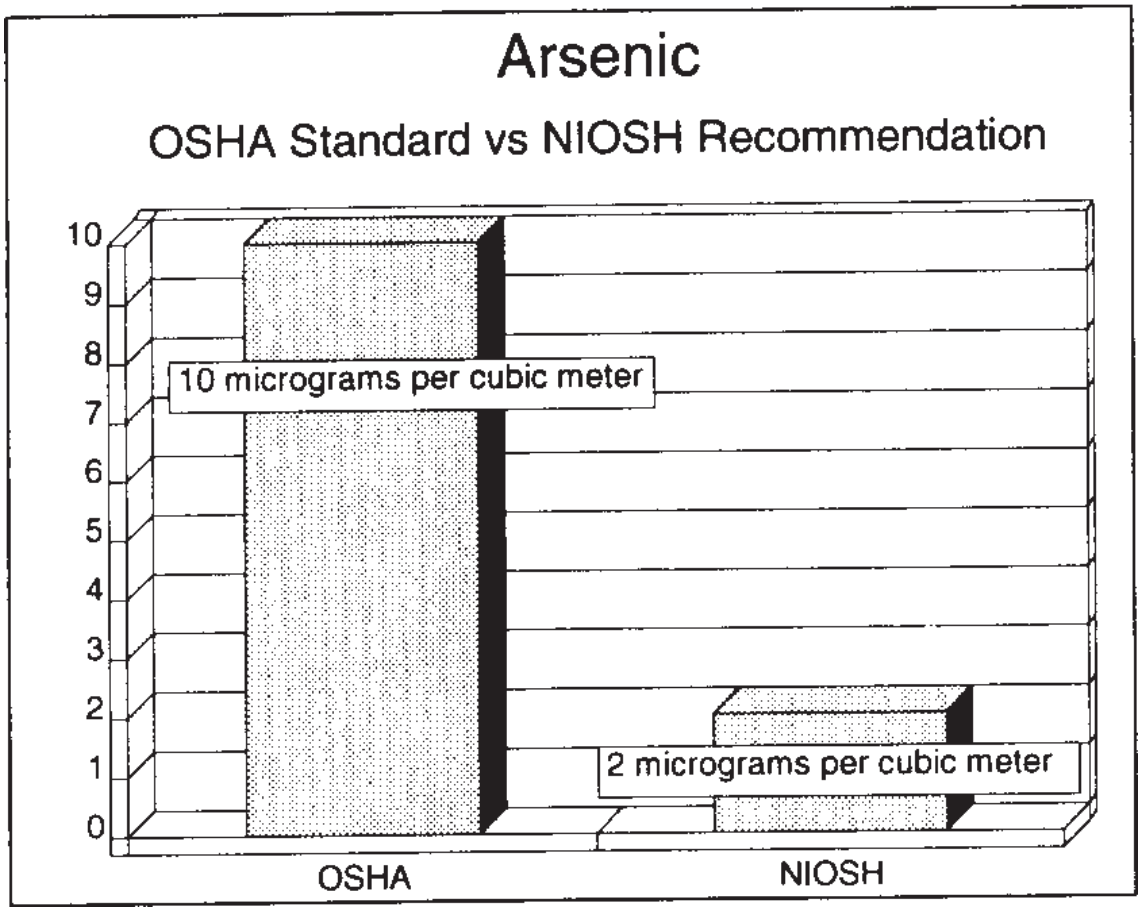
Only OSHA sets the legal standards for air levels. All private industries and federal agencies must follow PELs. In states that have their own OSHA, state and local agencies must also follow OSHA's guidelines.

Fact Sheet #11

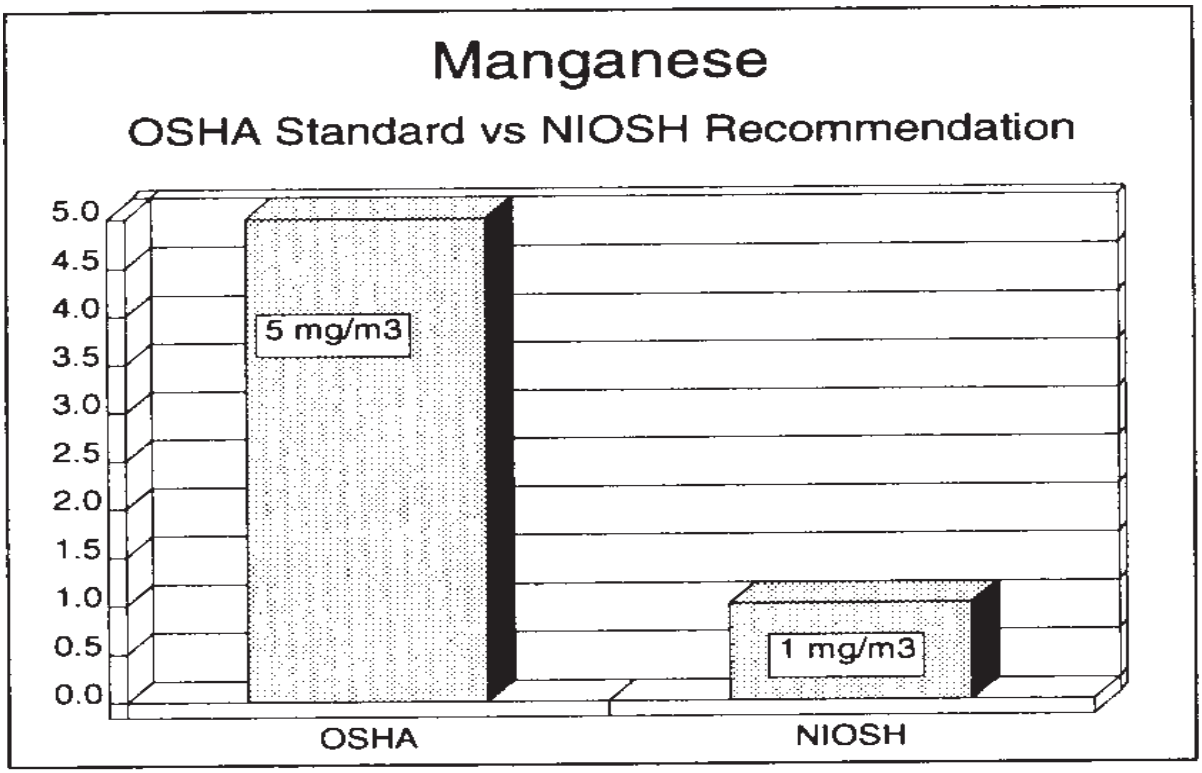
How and Why NIOSH and OSHA Differ

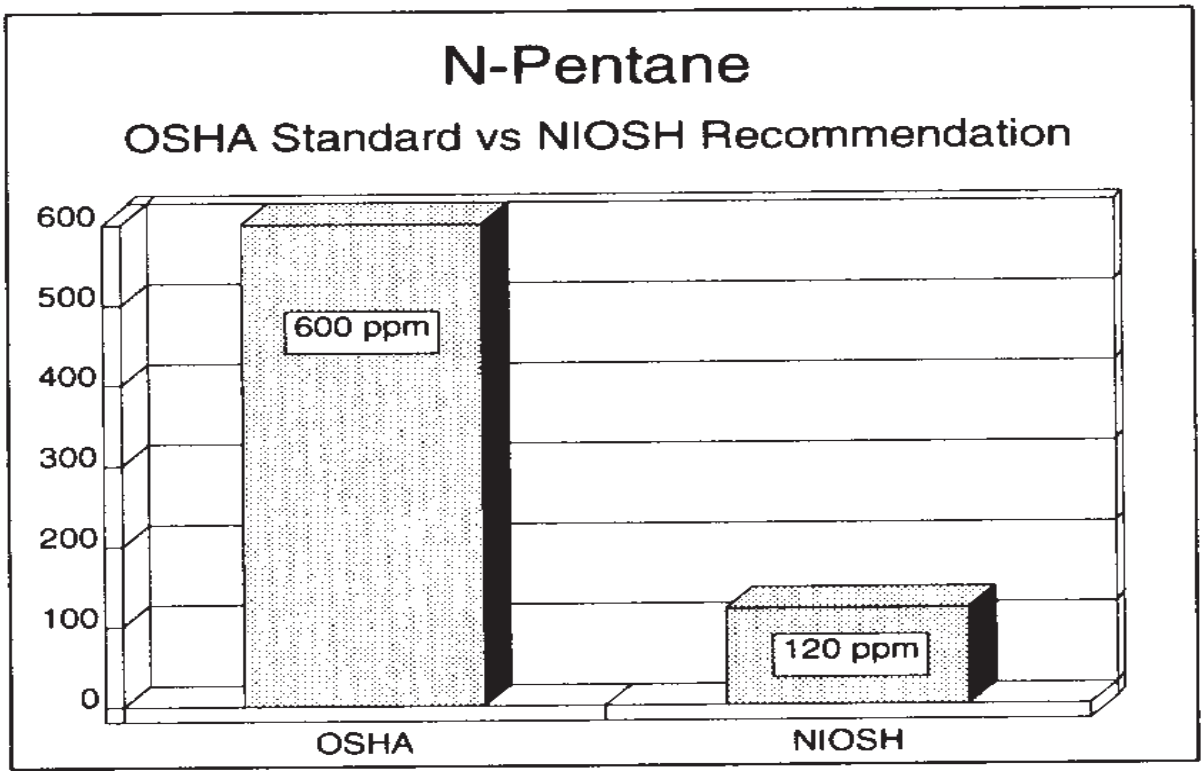
The National Institute for Occupational Safety and Health (NIOSH) recommends standards to OSHA based on scientific studies of hazards. OSHA standards that are eventually enforced are often a compromise among government, industry, and labor. As a result, in many cases, NIOSH's recommended standards are stricter than OSHA levels (see charts). This means that even if an employer is below OSHA standards, a worker may still get sick.

Note: A lower limit is a stronger limit; it protects workers' health more.



Fact Sheet #11, continued





Fact Sheet #12

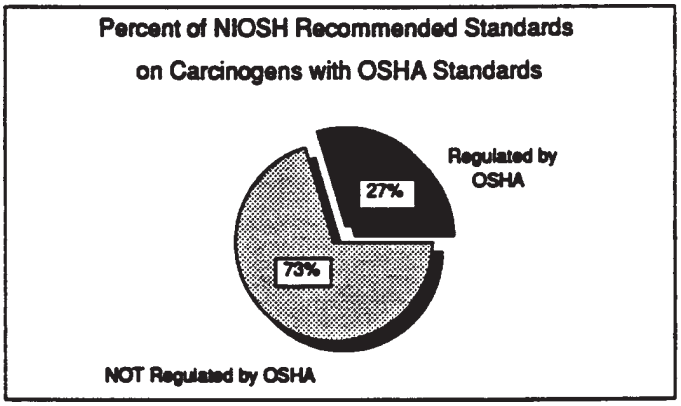
Why OSHA Levels Are Too High

A study by the U.S. Congress Office of Technology and Assessment (OTA) shows that OSHA standards were often set by looking at health effects other than cancer. **If they had been looking at cancer effects or other long-term effects, the legal levels would have been lower.** The study also reports that OSHA has been very slow in regulating suspected cancer-causing agents.

Many OSHA Limits Don't Protect against cancer or other long-term health effects

For example, the 1970 limit for benzene was based on the 1968 standard by ACGIH. This private group set the limit to protect workers from headaches, dizziness, and nausea. This limit did not protect workers from leukemia (cancer of the blood system) that benzene causes.

OSHA is Slow!



OSHA takes an average of three years to come up with a new standard.

NIOSH has the job of doing research on health effects of chemicals and making recommendations about exposure limits. NIOSH bases its recommended standards on the best scientific evidence available. Since 1971, NIOSH has recommended that 71 chemicals or processes be considered as cancer-causing. OSHA has issued standards for only 21 of the 71 chemicals NIOSH studied.

Even ACGIH standards are updated annually.

Fact Sheet #12

How OSHA Standards Are Changed

Standard setting by OSHA is a political process. It usually takes a very strong effort from worker and public interest groups to get any standard made more protective. Often, **power - in the form of money and lobbying — not just science** — determines which levels are changed and how much they change.

- That's why it took 13 years to lower the benzene standard.
- That's why it took 17 years to get a confined space entry standard.

What Does This Mean?

Exposure limits should be looked at as guides in the control of health hazards. They should not be looked at as fine lines between safe and dangerous concentrations.

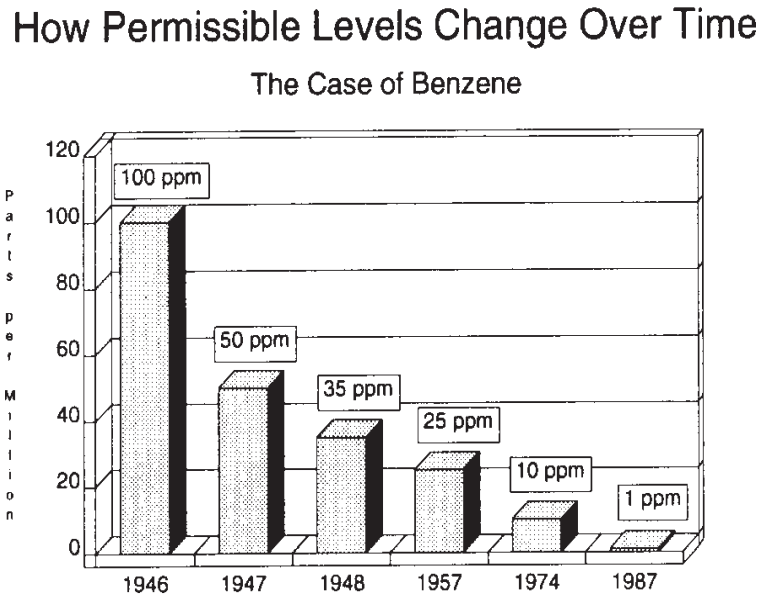
Source: US Congress, Office of Technology Assessment, *Identifying and Regulating Carcinogens,* OTA-BP-H-42 (US Government Printing Office, Washington, DC, 11/87)

Fact Sheet #13

Is There Really a Safe Level?

Unfortunately, there is no proof that there are any safe levels of exposure to some chemicals, especially the ones that cause cancer. **NIOSH takes the safest approach to cancer-causing chemicals — keep your exposure as low as possible.**

The history of "safe levels" shows us that as more scientific data is gathered, it almost always turns out that lower levels are needed. For example, look at how many times the exposure guidelines for benzene have been lowered over the last 50 years.



Benzene was first known to cause leukemia in 1942.

Fact Sheet #13 (continued)

Other Problems with Using Exposure Limits to Guard Health

1. Exposure limits are designed for the "average" worker. People are different, though. Age, gender, and genetics are just a few of the factors that make us respond differently to various chemicals. The amount of formaldehyde that causes one worker to develop nasal cancer won't affect another person.

2. Health studies simply have not been conducted for most chemicals.

3. Most people work with several different chemicals. The combined effects of different chemicals are not considered in the current exposure limits.

The bottom line — you may still get sick, even if your employer is following OSHA's exposure limits. If workers are getting sick from chemicals, your employer should take the steps to reduce the amount in the air, even if the levels are already below the PEL.

Your employer must provide safe work for employees under OSHA's General Duty Clause.

Fact Sheet #14

The Most Important Standard: Keeping Workers Healthy

Companies, industrial hygienists, government agencies, and researchers like exposure limits because they are cold, hard numbers. They can take measurements of what's in the air and compare the results to that number. It makes their work more "objective."

The Problem:

Sticking to OSHA's limits doesn't mean much if workers are getting sick. Workers' health is our only true measuring stick. Preventing diseases is the real purpose that sometimes gets lost in the technical discussions.

Follow the Hierarchy of Controls

The best means to prevent worker injury and illness is to reduce worker exposure to the lowest possible level. Use the hierarchy of controls to confront the issue of dangerous chemicals in the workplace.

1. Replace the culprits with safer chemical substitutes, if any exist.

2. Processes could be changed to get rid of the hazardous substance. For instance, switch to a hot water wash system in stead of a solvent vapor degreaser. Use water-based paints instead of solvent based ones.

3. Processes that make toxic dusts or vapors should have local exhaust ventilation installed or improved to capture the chemicals near the source.

Fact Sheet #14 (continued)

4. Enclose the process to prevent exposure.

5. Make sure that you have the right protective equipment until these other more permanent solutions have been put in place. Are the gloves made of the right material? Have respirator users been fit-tested?

What Your Health and Safety Committee Can Do:

Do a survey

If workers are getting sick, a survey helps you to find out and show that the symptoms are work-related. Your case is much stronger if you can say "Our survey shows that 10 out of 20 people in the Plastics Department have headaches and feel nauseous during work hours. Their symptoms go away on the weekends and over holidays. Their symptoms are worst at the end of the work week." It takes work on your part, but it can work!

(There is a sample survey in this manual. See the Last Section on "Putting Training to Work.")

Develop and negotiate contract language that seeks lower exposure levels through better controls.

The UAW has been able to negotiate lower limits for machining fluids with General Motors, John Deere Company, and J.I. Case Company. *The negotiated limits are one-tenth of OSHA's limit.*

Fact Sheet #14, continued

Encourage workers to report all health problems to the medical department.

Medical records help to document that there may be problem.

Consider having a Health Hazard Evaluation done by NIOSH.

If three or more employees make the request, NIOSH will consider it. Companies can request NIOSH's help, too.

For more information on NIOSH, call: 1-800-35-NIOSH.

Summary

Getting More Information

- NIOSH is a government agency that does research on chemicals. The NIOSH Pocket Guide is a good independent field reference, but should be used only as a guide.

- The NIOSH Pocket Guide lists health hazards, exposure limits, and chemical properties such as flash point, explosive limits, vapor pressure, and solubility in water.

- Always use, at least, two references when you are trying to get a complete picture of the hazards of a chemical. Start with the MSDS to get the names of the chemical ingredients. Then use New Jersey Fact Sheets and the NIOSH Pocket Guide.

- You have to know the exact chemical name of the ingredient you are researching to find it in the NIOSH Pocket Guide. It does not list brand names. If you cannot find the chemical in alphabetical order, use the Synonym Index or the CAS number Index in the back of the Pocket Guide to help you.

- The Pocket Guide does not include all chemicals or all information on a chemical.

- The Pocket Guide uses a lot of abbreviations. Getting used to them takes practice, **before** you need information in an emergency. Use the tables in the front of the Pocket Guide that explain the abbreviations, fact sheets from this manual, and a medical dictionary to help you.

Summary
continued

Getting More Information

* Even if your employer is following OSHA's Permissible Exposure Limits (listed in the Pocket Guide), you may still be exposed to dangerous levels of toxic chemicals. Decreasing exposure to the lowest possible level is the best way to prevent worker illness. This can be done by improving controls on toxic chemicals.