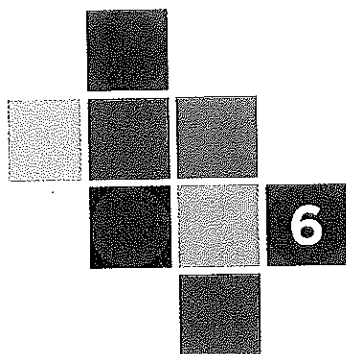




Designing Illustrations

In communicating technical information, you will often need to use illustrations either in addition to words or instead of words to convey your message. How do you determine whether illustrations are really desirable? Ask yourself two questions:

- What do you want the reader to do or think after reading your document?
- How will illustrations help you to achieve your objective?

Quick Tips

Illustrations divide into two categories: tables and figures. Tables display numbers and words in columns and rows. Every other kind of illustration is a figure.

If you want to summarize information to make it easier to remember or retrieve, use a table.

If you want to emphasize information to clarify or reinforce its meaning, use a figure.

CREATING ILLUSTRATIONS

In deciding when and how to use illustrations, remember the following guidelines:

- **Simplify your illustrations.** Keep your illustrations as simple as possible so that your reader has no difficulty understanding your message. Avoid distracting your reader with unnecessary details or decorative flourishes.
- **Use computer applications critically.** Graphics applications and clip art allow you to include a wide variety of illustrations in your document. To make

sure your tables and figures are effective, however, you must evaluate the choices available. Graphics applications, for example, might create artistic but misleading graphs, and clip art might exhibit a pictorial style that isn't quite serious enough or detailed enough to do justice to your subject. It is your job to choose illustrations that display your information clearly and correctly.

- **Consider size and cost.** Calculate the impact of illustrations on the expected length of your document. Illustrations will often increase the size of a document and, if printed, add to the cost of production and distribution.
- **Title your illustrations.** Give each table and figure a title that clearly indicates the message you wish it to convey.
- **Number your illustrations.** If you use several illustrations in your report, number them. Number the tables and figures separately (e.g., Table 1, Table 2, Figure 1, Figure 2).
- **Alert your readers.** Always alert your readers to illustrations by referring to them in the text. Every time you refer to the illustration, use the table or figure number (e.g., see Table 1). Announce the illustration—what it is or shows—then add any verbal explanation your reader will need to fully understand it. Don't lead readers through a complicated explanation and only later refer to the illustration. Point them to the illustration immediately so that they can shift back and forth between the explanation and the illustration as necessary.
- **Position your illustrations strategically.** Place each illustration as close to the passage it explains as possible.
- **Identify your sources.** If you borrow or adapt a table or figure from another source, identify that source (and, if necessary, permission to use it) below the illustration (e.g., *Source: A Practitioner's Guide to Statistical Illustrations*, p. 157, by Xiling Xiao. Copyright 2014 by Oxford University Press. Reprinted by permission.).

Tables.

- Note that the purpose of a table is to summarize information in specific categories to assist the viewer in accessing and retrieving this information.
- Every column in a table should have a heading that identifies the information below it. In a table of numbers, include the unit of measurement, such as "miles per hour." For large numbers, add a designation such as "in thousands" or "in millions" to the column heading (and delete the corresponding zeros from the numeric data). Headings should be brief. If headings need more explanation, include this information in a footnote below the table. Use lowercase letters, numbers, or symbols (e.g., a, *, or 1) to indicate footnoted material.
- If possible, box your table to separate it from surrounding paragraphs.
- Keep tables as simple as possible. Include only data relevant to your purpose.
- Consider omitting lines between rows and columns to avoid giving your table a crowded appearance. If possible, use white space to separate rows and columns.

Figures 6-1 through 6-3 show three ways of presenting tabular data.

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Table 4.**Refugee Arrivals by Age, Sex, and Marital Status: Fiscal Years 2010 to 2012**

Characteristic	2012		2011		2010	
	Number	Percent	Number	Percent	Number	Percent
AGE						
Total	58,179	100.0	56,384	100.0	73,293	100.0
0 to 17 years	18,876	32.4	19,232	34.1	25,373	34.6
18 to 24 years	9,700	16.7	9,588	17.0	11,853	16.2
25 to 34 years	13,491	23.2	11,802	20.9	14,954	20.4
35 to 44 years	7,446	12.8	7,124	12.6	9,587	13.1
45 to 54 years	4,409	7.6	4,230	7.5	5,727	7.8
55 to 64 years	2,441	4.2	2,438	4.3	3,218	4.4
65 years and over	1,816	3.1	1,970	3.5	2,581	3.5
SEX						
Total	58,179	100.0	56,384	100.0	73,293	100.0
Male	31,380	53.9	29,436	52.2	38,624	52.7
Female	26,799	46.1	26,948	47.8	34,669	47.3
MARITAL STATUS						
Total	58,179	100.0	56,384	100.0	73,293	100.0
Married	22,322	38.4	22,095	39.2	28,567	39.0
Single	32,608	56.0	31,324	55.6	41,022	56.0
Other*	3,249	5.6	2,965	5.3	3,704	5.1

*Includes persons who were divorced, separated, widowed, or of unknown marital status.

Source: U.S. Department of State, Bureau of Population, Refugees, and Migration (PRM), Worldwide Refugee Admissions Processing System (WRAPS).

FIGURE 6-1 Table This table is effectively designed using thin vertical lines and generous white space to separate the columns and thin horizontal lines to separate the three categories of information, making the entire table look easy to navigate. Note that the row labels are aligned on the left for easy reading, while the numerical data in the rows are aligned on the right (or on the decimal point) to allow the easiest possible comparison of information across the rows and columns. The column headings are centered, while the subheadings ("Number" and "Percent") are aligned on the right with their corresponding rows of numerical data. The column headings and subheadings are displayed in bold, making the use of color here nice but unnecessary. The use of all capital letters for the headings of the three major categories is also unnecessary but consistent and unlikely to disrupt reading. Note that the title of this table is "Fiscal Years 2010 to 2012" but the columns are arranged left to right from 2012 to 2010, creating a possibility for misinterpretation. Changing the subtitle to "Fiscal Years 2012, 2011, and 2010" or putting the columns in chronological order from left to right would avoid this potential confusion.

Source: US Department of Homeland Security, Office of Immigration Statistics. *Refugees and Asylees*; 2012. Washington, DC: GPO, 2013. p. 4. <http://www.dhs.gov/publication/refugees-and-asylees-2012>

il Years 2010 to 2012

2010		
Percent	Number	Percent
100.0	73,293	100.0
34.1	25,373	34.6
17.0	11,853	16.2
20.9	14,954	20.4
12.6	9,587	13.1
7.5	5,727	7.8
4.3	3,218	4.4
3.5	2,581	3.5
100.0	73,293	100.0
52.2	38,624	52.7
47.8	34,669	47.3
100.0	73,293	100.0
39.2	28,567	39.0
55.6	41,022	56.0
5.3	3,704	5.1

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Table 3. Bus driver's preaccident activities (March 9–12, 2011).

Wednesday, March 9		
Time	Activities	Location
9:00 p.m.	Arrive for duty, World Wide Travel terminal	Brooklyn, NY
9:15 p.m.	Depart terminal	Brooklyn
10:00 p.m.	Pick up passengers; depart en route to Mohegan Sun	Flushing, NY
Thursday, March 10		
Time	Activities	Location
1:00 a.m.	Arrive Mohegan Sun casino, drop off passengers, and move motorcoach to parking lot	Uncasville, CT
1:20–3:15 a.m.	Sleep in bus (self-reported)	Parking lot
5:15 a.m.	Pick up passengers	Bus lobby entrance
5:30 a.m.	Depart Mohegan Sun en route to New York	I-95 south
8:58 a.m.	Return World Wide Travel terminal	Brooklyn
10:00 a.m.–4:00 p.m.	Sleep (self-reported) ^a	Residence
9:30 p.m.	Arrive for duty, World Wide Travel terminal	Brooklyn
9:45 p.m.	Depart terminal	Brooklyn
10:30 p.m.	Pick up passengers; depart en route to Mohegan Sun	Flushing
Friday, March 11		
Time	Activities	Location
1:56 a.m.	Arrive Mohegan Sun, drop off passengers	Uncasville
~2:00 a.m.–6:00 a.m.	Sleep in bus (self-reported)	Parking lot
~6:30 a.m.	Depart Mohegan Sun en route to New York	I-95 south
~9:50 a.m.	Arrive World Wide Travel terminal	Brooklyn
11:00 a.m.–4:00 p.m.	Sleep (self-reported) ^b	Residence
6:15 p.m.	Arrive for duty, World Wide Travel terminal	Brooklyn
7:40 p.m.	Pick up passengers; depart en route to Mohegan Sun	Bowery, New York City, NY
10:36 p.m.	Arrive Mohegan Sun, drop off passengers	Uncasville
10:54 p.m.	Drive to casino parking lot	Parking lot
11:46 p.m.	Drive from parking lot to casino for lost item	Bus lobby entrance
11:55 p.m.	Return to casino parking lot from bus lobby entrance	Parking lot
~11:55 p.m.–3:17 a.m.	Sleep on bus	Parking lot
Saturday, March 12		
Time	Activities	Location
3:17 a.m.	Receive incoming cell phone call (32 seconds)	Parking lot
3:19 a.m.	Pick up passengers	Bus lobby entrance
3:48 a.m.	Depart Mohegan Sun en route to New York	I-95 south
5:38 a.m.	Accident	I-95, near New York City

^aThe driver's cell phone was in use multiple times between 10:15 a.m.–12:03 p.m. Additionally, a 24-second incoming call occurred at 3:39 p.m.

^bThe driver's cell phone was in use numerous times during this period, with the longest period of nonuse between 11:38 a.m.–12:17 p.m. (39 minutes).

FIGURE 6-2 Table This table is easy to read with effective spacing to separate the columns and rows of information. Major headings are centered and displayed in distinctive white type on black horizontal bars. The subheadings are consistently centered and displayed in bold black type on gray horizontal bars. Two notes are used to clarify important abbreviations. The result is a table that viewers could readily navigate to compare and contrast information or to retrieve specific pieces of evidence. Times in the left column would be easier to read if aligned on the colon.

Source: National Transportation Safety Board. *Motorcoach Run-Off-the-Road and Collision with Vertical Highway Signpost, Interstate 95 Southbound, New York City, New York, March 12, 2011.* Highway Accident Report NTSB/HAR-12/01. Washington, DC: GPO, 2012. p. 22.

Table 4
Pedalcyclists Killed and Injured and Fatality and Injury Rates by Age and Sex, 2011

Age (Years)	Male			Female			Total		
	Killed	Population (thousands)	Fatality Rate*	Killed	Population (thousands)	Fatality Rate*	Killed	Population (thousands)	Fatality Rate*
<5	3	10,300	0.29	2	9,863	0.20	5	20,162	0.25
5-9	17	10,384	1.64	9	9,950	0.90	26	20,334	1.28
10-15	27	12,717	2.12	8	12,145	0.66	35	24,862	1.41
16-20	44	11,339	3.88	6	10,745	0.56	50	22,083	2.28
21-24	42	8,963	4.69	11	8,594	1.28	53	17,558	3.02
25-34	59	21,044	2.80	12	20,746	0.58	71	41,790	1.70
35-44	72	20,223	3.56	6	20,404	0.29	78	40,628	1.92
45-54	130	22,019	5.90	27	22,699	1.19	157	44,718	3.51
55-64	98	18,358	5.34	10	19,704	0.51	108	38,062	2.84
65-74	50	10,476	4.77	8	12,005	0.67	58	22,482	2.58
75-84	23	5,573	4.13	0	7,602	0.00	23	13,175	1.76
85+	9	1,894	4.75	0	3,843	0.00	9	5,737	1.57
Total†	578	153,291	3.77	99	158,301	0.63	677	311,592	2.17
Age (Years)	Male			Female			Total		
	Injured	Population (thousands)	Injury Rate*	Injured	Population (thousands)	Injury Rate*	Injured	Population (thousands)	Injury Rate*
<5	**	10,300	**	**	9,863	**	**	20,162	**
5-9	2,000	10,384	175	1,000	9,950	57	2,000	20,334	117
10-15	5,000	12,717	409	2,000	12,145	137	7,000	24,862	276
16-20	6,000	11,339	497	3,000	10,745	257	8,000	22,083	380
21-24	3,000	8,963	360	1,000	8,594	129	4,000	17,558	247
25-34	5,000	21,044	252	2,000	20,746	83	7,000	41,790	168
35-44	4,000	20,223	213	**	20,404	**	5,000	40,628	116
45-54	5,000	22,019	236	1,000	22,699	57	7,000	44,718	145
55-64	4,000	18,358	243	1,000	19,704	41	5,000	38,062	138
65-74	2,000	10,476	155	**	12,005	**	2,000	22,482	80
75-84	1,000	5,573	110	**	7,602	**	1,000	13,175	48
85+	**	1,894	**	**	3,843	**	**	5,737	**
Total†	38,000	153,291	245	11,000	158,301	67	49,000	311,592	154

* Rate per million population.

** Less than 500 injured, injury rate not shown.

† Total includes 4 males killed of unknown age.

Source: Fatalities — Fatality Analysis Reporting System, NHTSA. Injured — General Estimates System, NHTSA. Population — Bureau of the Census projections.

FIGURE 6-3 Ineffective Table This table tries to offer a lot of information in a single location but makes reading and retrieval difficult as a consequence. Notice that bold, centered type displayed in horizontal blue bars, used for both first-level and second-level headings, occurs both at the top of the table (which is to be expected) and again in the middle of the table (which would be unexpected). Similarly, a row of totals in a lighter blue bar occurs at the bottom of the table (which is to be expected) but also in the middle of the table (which would be unexpected). Unnecessary vertical grid lines and cells with double asterisks only exacerbate the visual confusion. At least two separate tables would make for easier reading: one for numbers and one for percents and/or one for fatalities and one for injuries.

Source: US Department of Transportation, National Highway Traffic Safety Administration. *Bicyclists and Other Cyclists*. Traffic Safety Facts DOT HS 811 743. Washington, DC: GPO, 2013. p. 3.

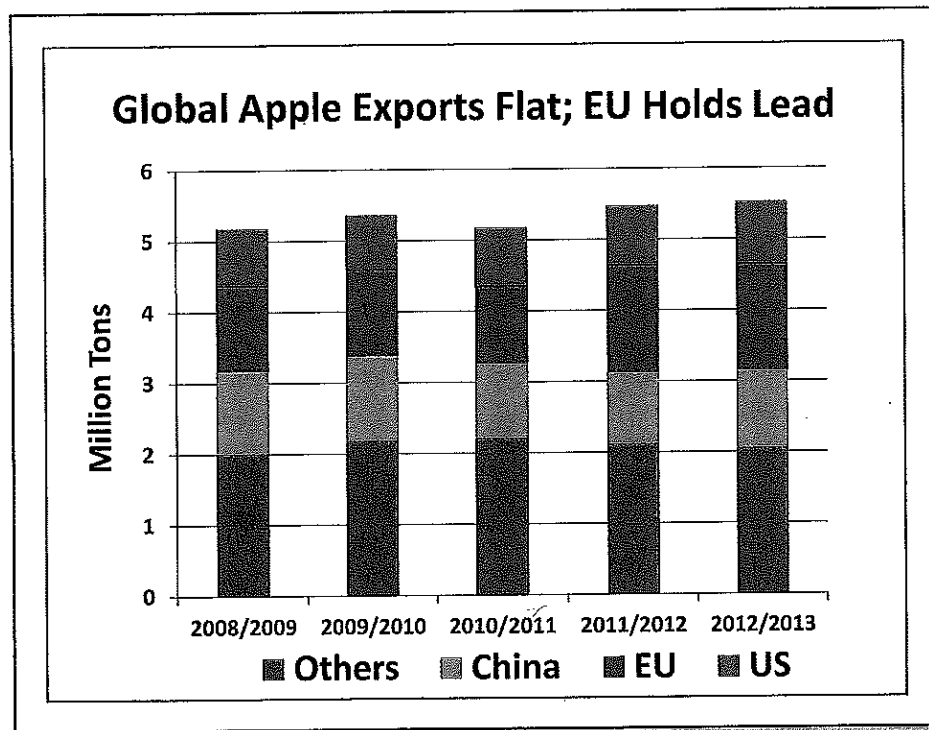


FIGURE 6-4 Column Graph This divided column graph is clean and concise and makes its two key points explicit in the title. The columns are labeled clearly for each period, arranged in chronological order from left to right, and spaced generously. The colors used for the sections of each column are bright and distinctive from each other. Numerical labeling of each section and a total for each column would offer more specific information, but the horizontal grid lines here are sufficient to support the claim in the title. Instead of the inefficient use of a separate legend to identify the meaning of each color (as well as the potentially confusing position of this legend along the horizontal axis), the sections of the last column could be labeled "US," "EU," "China," and "Other" for quicker and easier access to the same information.

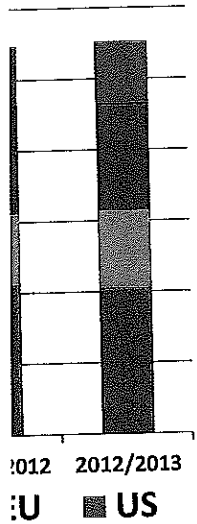
Source: US Department of Agriculture, Foreign Agricultural Service. *Fresh Deciduous Fruit (Apples, Grapes, & Pears): World Markets and Trade*. Washington, DC: GPO, 2013. p. 1.

Chart 1.1

Norway
Switzerland
Belgium
Denmark
Sweden
Germany
Australia
Finland
Austria
Netherlands
France
Ireland
Canada
Italy
Japan
United States
United Kingdom

FIGURE 6-5 This issue at different from largest to making rapid its position or nations higher making the ve also unnecessary information (i. about each na contrast and € Source: US Depart Compensation Co. 2012. p. 1.

Holds Lead



clean and concise and are labeled clearly for each and spaced generously. and distinctive from each each column would offer e are sufficient to support arate legend to identify the g position of this legend could be labeled "US," "EU," same information.

Deciduous Fruit (Apples, Grapes, &

Chart 1. Hourly compensation costs in manufacturing, U.S. dollars, 2011

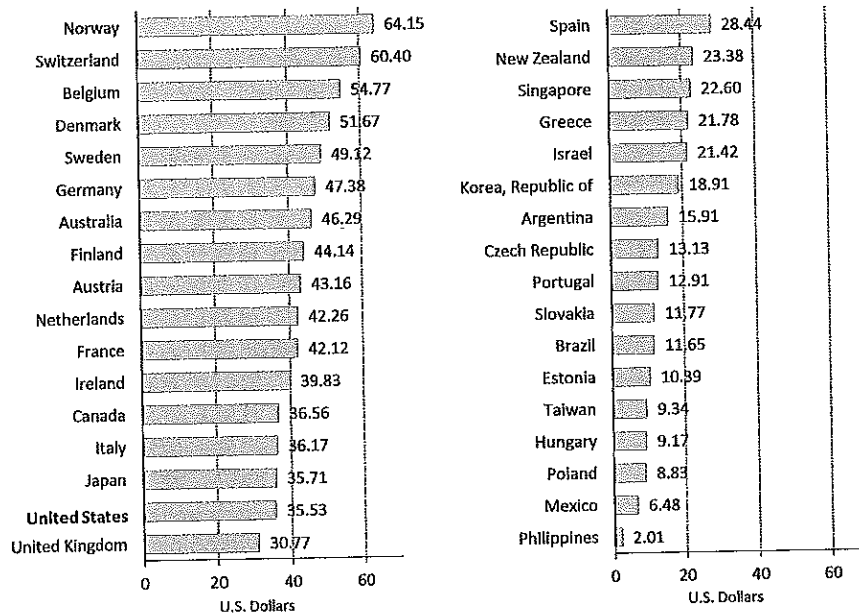


FIGURE 6-5 Bar Graph This bar graph is a coherent display of the same issue at different locations at the same point in time. The ordering of the bars from largest to smallest assists the viewer in navigating the 34-nation list and making rapid sense of it. The United States is listed in bold type to emphasize its position on the list and to facilitate comparison and contrast with nations higher and lower on the list. Each bar carries its numerical identity, making the vertical grid lines unnecessary. The blue coloring of the bars is also unnecessary but at least uniform, indicating clearly that it is the same information (i.e., labor costs per hour in US dollars) that is being displayed about each nation on the list: dark blue instead of light blue would offer better contrast and easier viewing against the white background.

Source: US Department of Labor, Bureau of Labor Statistics. *International Comparisons of Hourly Compensation Costs in Manufacturing, 2011*. News Release USDL-12-2460. Washington, DC: GPO, 2012. p. 1.

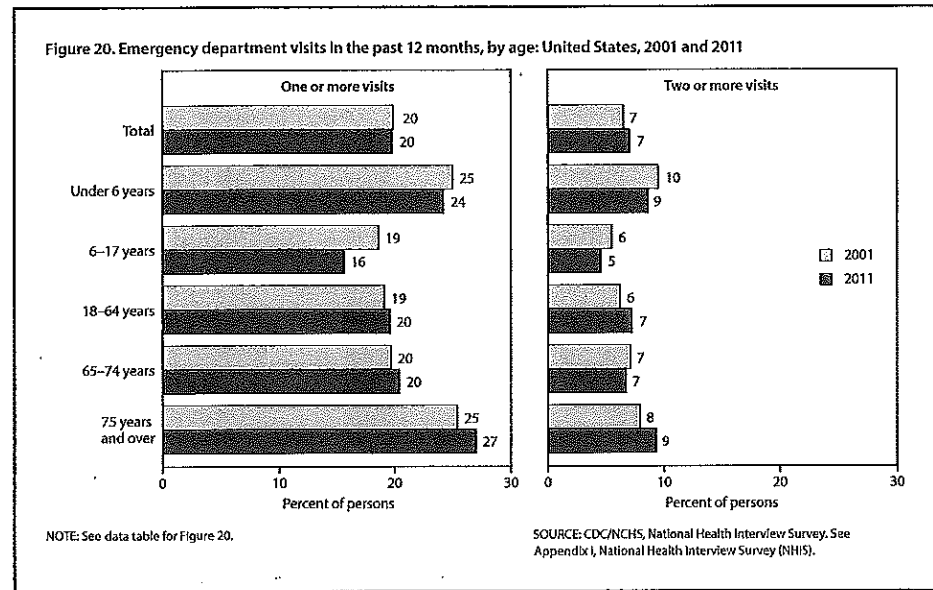
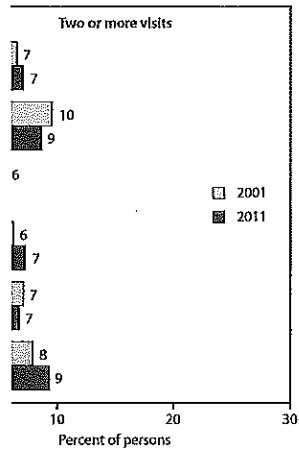


FIGURE 6-6 Bar Graph This bar graph makes a clear and vivid point regarding the frequency of emergency room visits of people of various ages at two different points in time. The two years, 2001 and 2011, are easily identified by obviously different colors, as explained in a legend conveniently positioned inside the graph but visibly separated from the bars. The age categories are all crisply labeled for easy reading and understanding. The categories are positioned on the graph according to age. The major distraction of the graph is the separation into two grids, "One or more visits" and "Two or more visits," instead of a single display with divided bars. The separated display might disrupt or delay recognition that "two or more" is included in "one or more" and thus lead to misinterpretation. Each bar is numerically labeled (making grid lines unnecessary), but it would be wise to specify the numbers to at least one decimal point, instead of rounding, to eliminate the likely confusion created by the different size bars both labeled "20" and the different size bars both labeled "7" in the "Total" and "65-74 years" categories.

Source: US Department of Health and Human Services, National Center for Health Statistics. *Health, United States, 2012: With Special Feature on Emergency Care*. DHHS Publication No. 2013-1232. Washington, DC: GPO, 2013. p. 22.

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Figure 9
Proportion of Drivers Involved in Fatal Crashes with BAC = .08+ by Vehicle Type, 1982-2011

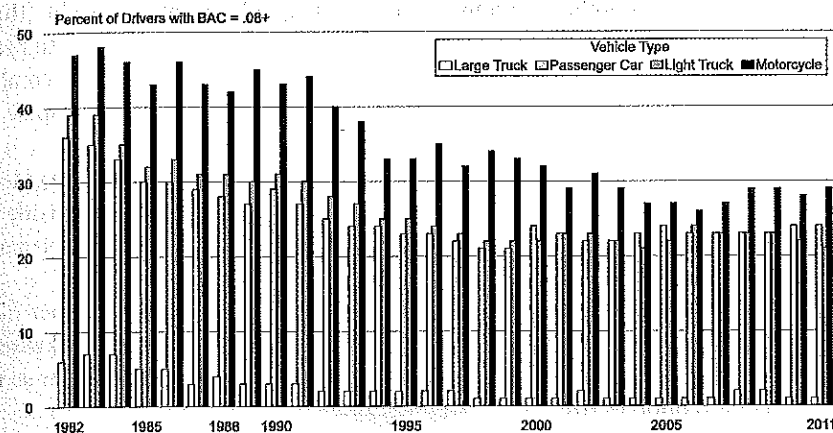


FIGURE 6-7 Ineffective Column Graph This column graph is difficult to decipher because it displays too many columns at too many points in time in too narrow a space. The distracting visual effect makes the data look crowded and cramped instead of readily accessible. The graph would be more effective, for example, if only the odd-numbered years were displayed. The alternative, of course, is to allow the entire graph more horizontal space. In addition, the color of the columns for the large truck category is almost indistinguishable from the white background of the graph, making these particularly short columns easy to overlook in the visual clutter: gray would have been a better color choice for this category of vehicle. At least the explanatory legend is conveniently positioned inside the graph and sticks to simple solid colors instead of using dots and diagonal lines.

Source: US Department of Transportation, National Highway Traffic Safety Administration. *Traffic Safety Facts 2011*. DOT HS 811 754. Washington, DC: GPO, 2013. p. 37.

Circle graphs.

- Note that the purpose of a circle graph (also referred to as a "pie chart") is to display the number and relative size of the divisions of a subject.
- Restrict the number of segments in a circle graph to seven or eight. This is the limit on the number of segments into which a circle can be divided before comprehension of the relative sizes is jeopardized. If necessary, combine several smaller segments and create a second circle graph to display the composition of that combined segment.
- Watch for possible distortion when you use three-dimensional circle graphs.
- Clearly label all segments. Whether they are placed inside or outside the circle, labels should be horizontal for easier reading. Avoid using explanatory legends (or keys).
- As you segment the graph, begin with the largest section in the upper right-hand quadrant. The remaining segments should be arranged clockwise, in descending order. Color the sections clockwise from darker to lighter so that color reinforces size.

See Figure 6-8 for an example of a circle graph.

Line graphs.

- Note that the purpose of a line graph is to show the degree and direction of change relative to two variables.
- Label each axis clearly. Like bar and column graphs, line graphs must have clearly labeled scales to show the variables you are measuring. Ordinarily, the independent variable is placed on the horizontal, or x , axis and the dependent variables are placed on the vertical, or y , axis (and, in a three-dimensional graph, on the diagonal, or z , axis).
- Choose the scale of each axis to show the appropriate steepness of the slope of the line. Typically, the scales start at zero, with the intervals equally spaced on each axis.
- The major difficulty in designing line graphs lies in choosing the spacing for each axis so that the steepness (slope) of the line accurately measures the actual trend suggested by the data. Typical graphics applications will allow you to adjust the intervals on the x axis and the y axis, but your job is to decide whether the slope of the graph accurately depicts your data or gives a distorted impression.
- Avoid using more than three data lines in one graph unless they are separated by visible space. Graphs with lots of overlapping and intersecting data lines are usually difficult for readers to interpret.
- Keep the data lines in your graph distinctive by using either different colors or different styles for each line.
- If possible, label each data line. Avoid explanatory legends (or keys) because these will slow reader comprehension.

See Figures 6-9 and 6-10 for examples of line graphs.

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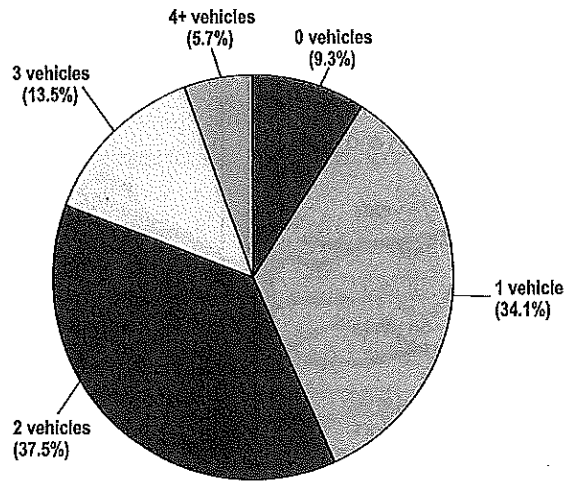
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3-6 Households by Number of Motor Vehicles: 2011



Note: Data cover the household population and exclude the population living in institutions, college dormitories, and other group quarters.

Source: U.S. Department of Commerce, U.S. Census Bureau, 2011 American Community Survey, table B25044, available at <http://www.census.gov/facts> accessed September 2012.

FIGURE 6-8 Circle Graph This circle graph uses clear labels for each of its five sections and consistently positions the labels outside the circle adjacent to each respective section. While effective circle graphs typically order their sections from largest to smallest, this circle graph is nevertheless logically organized (proceeding clockwise from 0 vehicles to 4+ vehicles). This logical ordering of the sections makes the graph easier to decipher. The coloring of the sections, however, is entirely decorative. For example, instead of the darkest color used for the largest section and the lightest color used for the smallest section, color here is arbitrarily assigned instead of systematically applied. And given the wide variety of available colors, it is curious (and potentially confusing) that two shades of yellow are adopted.

Source: US Department of Transportation, Bureau of Transportation Statistics, *Pocket Guide to Transportation*. Washington, DC: GPO, 2013. p. 19.

Figure 6. Respondent-reported lifetime heart disease prevalence among adults aged 18 and over, by sex and age: United States, average annual, 2000–2001 through 2010–2011

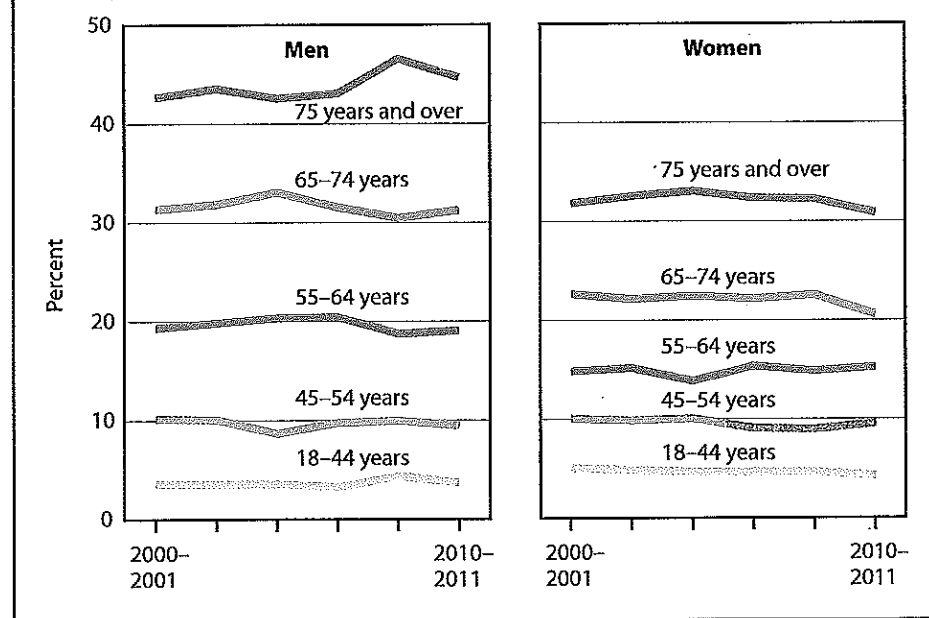
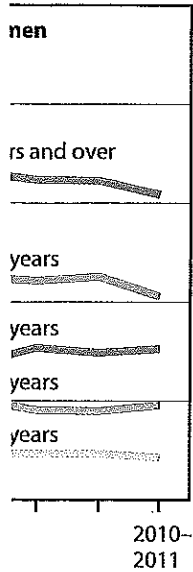


FIGURE 6-9 Line Graph This pair of line graphs uses clear labeling to identify and differentiate five data lines. It also uses color to allow easy comparison and contrast of the data lines across the two graphs, making evident that men and women have similar rates of heart disease until about age 55. Horizontal grid lines assist viewers in deciphering the relative positions of the paired data lines, while vertical grid lines prove unnecessary for the essentially static 10-year period. Unlike Figure 6-6, the two separate grids here are appropriate for the two separate and mutually exclusive sets of data.

Source: US Department of Health and Human Services, National Center for Health Statistics. *Health, United States, 2012: With Special Feature on Emergency Care*. DHHS Publication No. 2013-1232. Washington, DC: GPO, 2013, p. 10.

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Figure 10
Proportion of Drivers in Fatal Crashes with BAC = .08+ by Age, 1982–2011

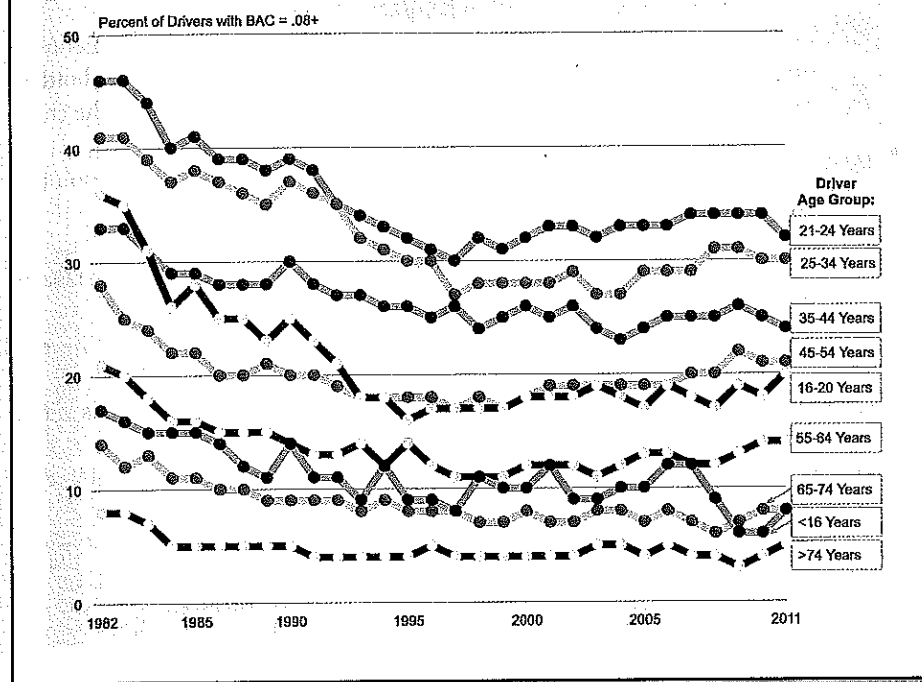


FIGURE 6-10 Ineffective Line Graph This could be the least effective line graph ever designed because it focuses the viewer's attention on all the unnecessary circles instead of the data lines themselves. The graph does include a label for each line, but the nine labels are located on the right side of the graph, making it necessary for readers to read each data line from right to left instead of left to right. The graph also uses three different color combinations to differentiate the nine data lines—itsself a confusing practice—but the use of color is also arbitrary: the key point of the graph is that alcohol-related driver fatalities in all age groups dropped from 1982 to 2008 but most precipitously in the 16–20 age group. Greater emphasis on this point would be achieved if this were the only group displayed with a black data line.

Source: US Department of Transportation, National Highway Traffic Safety Administration. *Traffic Safety Facts 2011*. DOT HS 811 754. Washington, DC: GPO, 2013. p. 39.

Organization charts.

- Note that the purpose of an organization chart is to map the various divisions and levels of responsibility within an organization.
- Make the chart as simple as the organization itself, with the levels of hierarchy organized highest to lowest and positioned on the chart from top to bottom. The more levels of hierarchy in the organization, the more vertical the chart; the more divisions in the organization, the more horizontal the chart.
- Use the same shape in the same size for all divisions of the organization that are at the same level in the hierarchy.
- Label each division of the organization.
- If space allows, put the labels directly on the division; if not, attach the label to the subject with thin rules (never arrows).
- Position all the labels on the horizontal so that the viewer doesn't have to rotate the page or screen to read the labels.
- Connect each level of the organization to the higher and lower levels with a clear line (never arrows).
- Connect optional, informal, or temporary relationships with a dotted line.

See Figure 6-11 for an example of an organization chart.

FIGURE 6-11 Organization Chart (see facing page) This organization chart effectively depicts the multiple levels of authority at the US Nuclear Regulatory Commission: for example, regional administrators report to a deputy executive director, who reports to the executive director, who reports to the chair of the commission. Notice also that certain officials in the organization report to the chair, while others report to the entire commission. Instead of the usual boxes with position title only, here photographs and names of the individuals in each position, diminishing in size according to their level in the hierarchy, bring a sense of humanity to the organization.

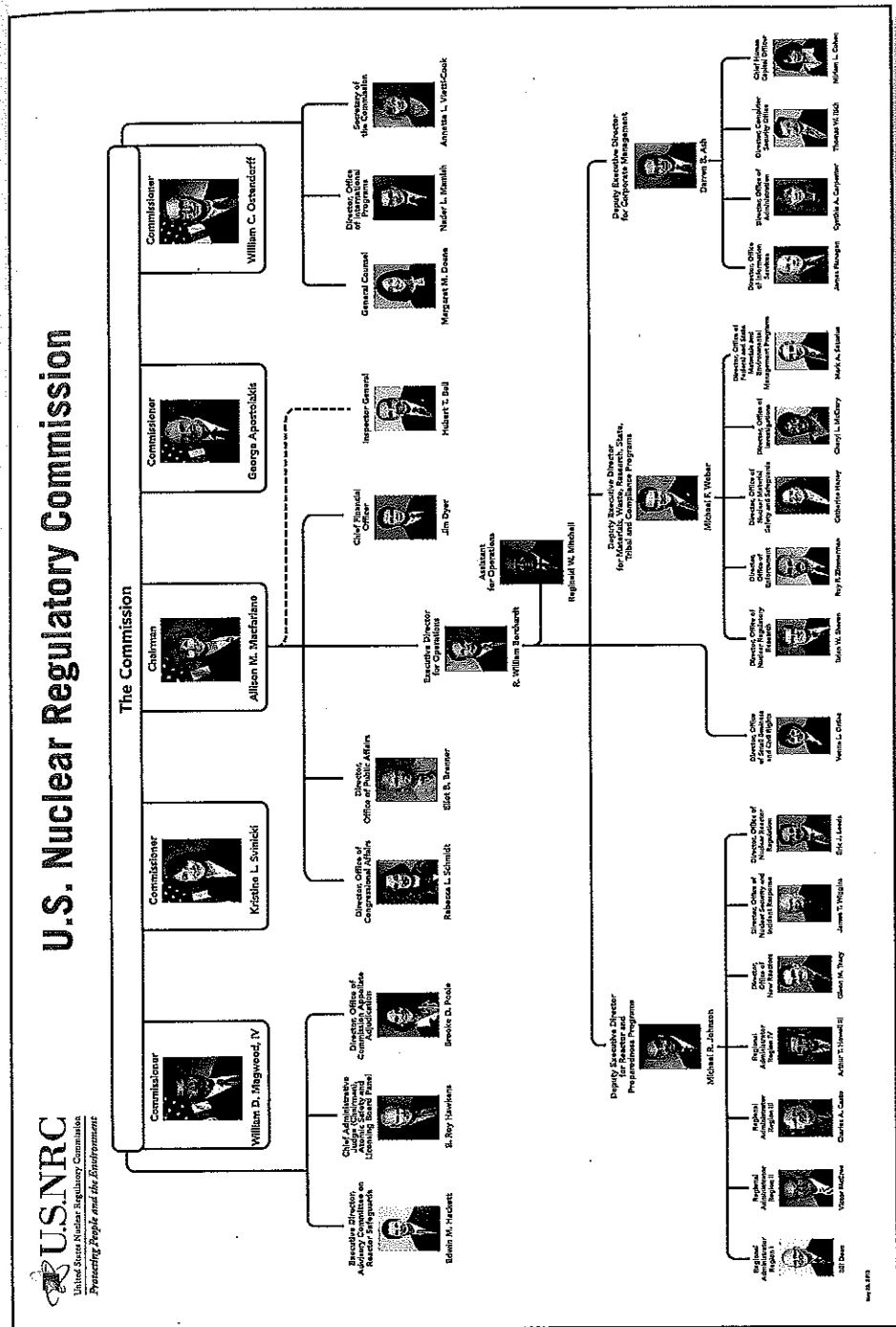
Source: US Nuclear Regulatory Commission. NRC Organization Chart. Washington, DC: GPO, 2013. <http://www.nrc.gov/about-nrc/organization/nrcorg.pdf>

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Flow charts.

- Note that the purpose of a flow chart is to show the sequence of steps in a process or procedure.
- Make the flow chart as simple as the process itself. If a process is simple, design the flow chart so that it progresses in a single direction, usually top to bottom or left to right. Complicated designs that spiral and zigzag imply a more complicated process.
- Use the same shape in the same size for all equivalent steps or phases but different shapes for steps or phases of a different kind (e.g., circles for the stages in researching a document, squares for the stages of writing, and diamonds for the production stages of printing and binding).
- Label each of the steps or phases.
- If space allows, put the labels directly on the step; if not, attach the label to the step with thin rules (never arrows).
- Position all the labels on the horizontal so that the viewer doesn't have to rotate the page or screen to read the labels.
- Connect each step or phase in the sequence to the next step or phase with a clear directional arrow.
- Connect reversible or interactive steps or phases with double-headed arrows.
- Connect recursive or cyclical steps or phases with circular arrows.
- Connect optional steps or phases with dotted-line arrows.

See Figures 6-12 and 6-13 for examples of a flow chart.

FIGURE 6-12 Flow Chart (see facing page) This flow chart uses several levels of redundancy to simplify a process that might otherwise mystify or intimidate a prospective filer of a patent application. The process is organized in three columns: the number of each step, the agent of action, and the corresponding action itself. Actions are displayed in blue rectangles, while decision points are displayed in white diamonds. Arrows direct the viewer to the next step in the process and reinforce the numbering. Links to more information are included in almost every step but always opening as new pages in the viewer's browser to make it easy to preserve this overview of the entire process.

Source: US Department of Commerce, Patent and Trademark Office. *Process for Obtaining a Utility Patent*. 2013. <http://www.uspto.gov/patents/process/index.jsp>

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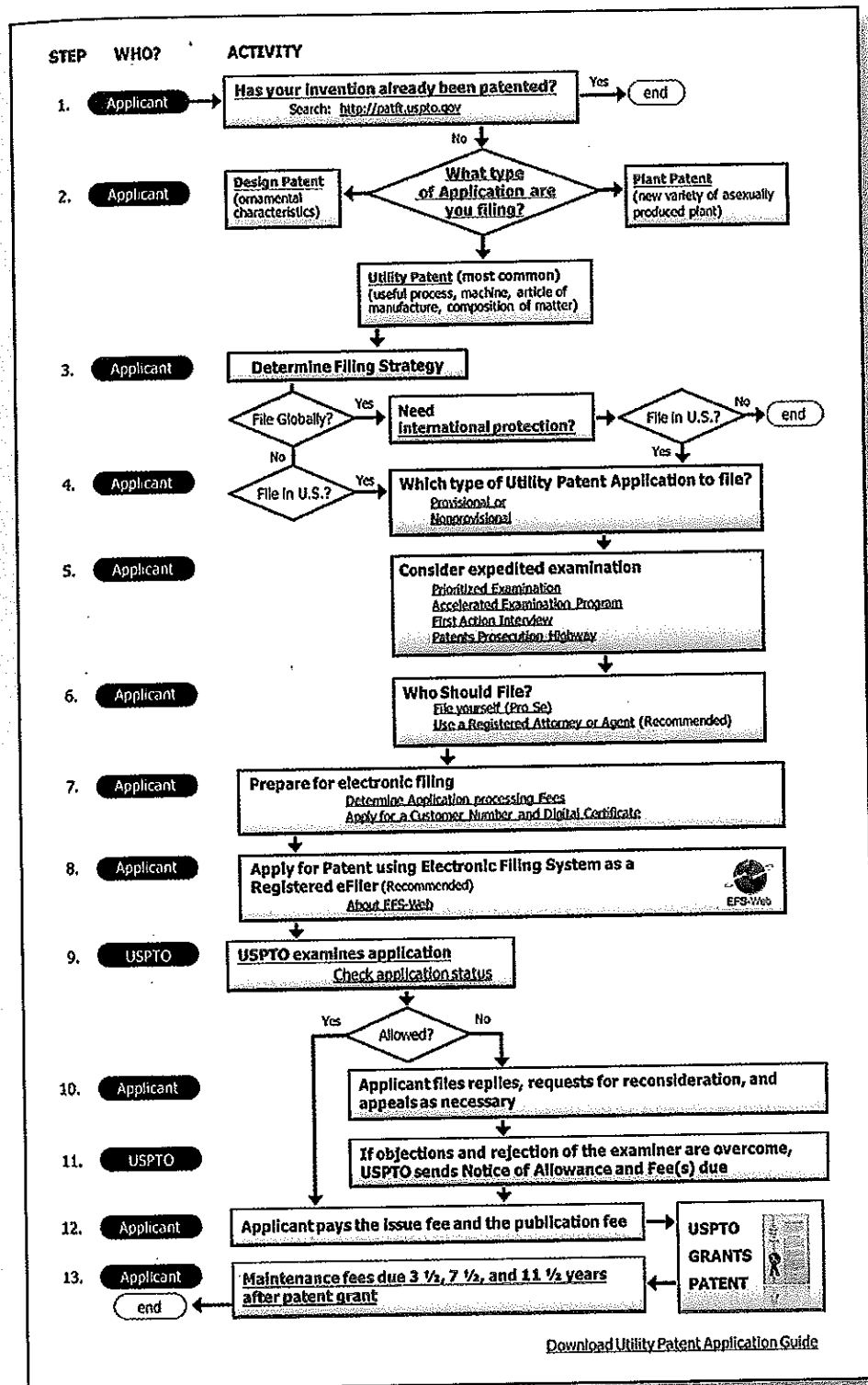
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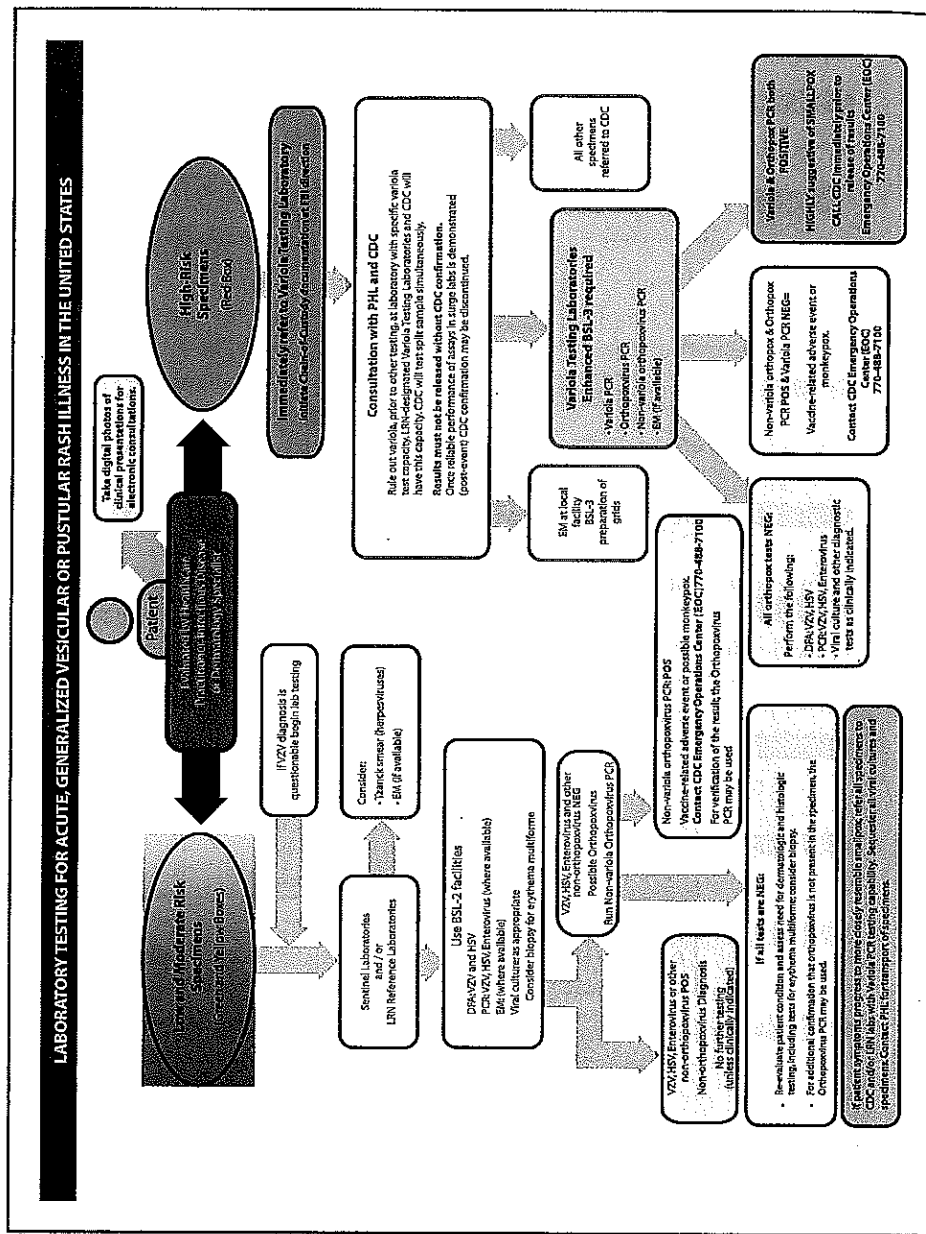


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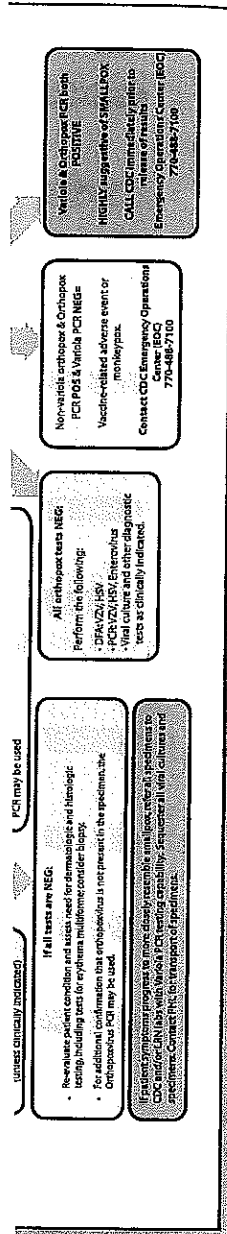


FIGURE 6-13 Ineffective Flow Chart (see facing page) This flow chart uses a confusing array of rectangles in various sizes and colors, but the figure has a fairly straightforward organization: left or right then top to bottom. Some of the boxes carry clear labels in bold type, others have only bold type, and still others have only plain type or combinations of bold and plain type. Some of the boxes are outlined in red, one is outlined in green, and most are outlined in black. The significance of these typographical and color variations is not immediately clear. Neither is it evident why some of the boxes are white, while others display a variety of colors. The unexplained variations make deciphering the process unnecessarily challenging.

Source: US Department of Health and Human Services, Centers for Disease Control and Prevention. *Acute, Generalized Vesicular or Pustular Rash Illness Testing Protocol in the United States*. 2012. <http://www.emergency.cdc.gov/agent/smallpox/diagnosis/pdf/poxalgorithm1-5-12.pdf>

Project schedule charts.

- Note that the purpose of a project schedule chart (also referred to as a “Gantt chart,” after its creator, Henry Gantt) is to display the start and stop dates for all consecutive and simultaneous tasks related to a project. It offers a quick picture of tasks in progress at any given point in time, as well as how much work has been completed on each task and how much work remains.
- Make the project schedule chart as simple as the project itself, with one horizontal bar for every major task or activity and vertical grid lines for each reporting period (e.g., daily, weekly, monthly). Excessive division of the project into a multitude of minor tasks or milestones will create a chart that is difficult to decipher. Also avoid abbreviations and symbols and their explanatory legends (or keys).
- List the tasks from top to bottom in order of their start date.
- Extend a horizontal bar for each task from its start date to its anticipated date of completion or specified deadline.
- Fill in (or color) each bar from left to right as work on the task proceeds.
- If you don’t have access to applications that will generate a project schedule chart, create a table in your word processing program with a row for each task and a column for each reporting period and fill in cells from left to right as progress is made.
- Incorporate additional information for each task as necessary and appropriate (e.g., names of task managers, facilities and resources assigned for each task, funds budgeted and expended in each reporting period), but realize that every extra level of detail complicates the illustration and slows interpretation.

See Figure 6-14 for an example of a project schedule chart.

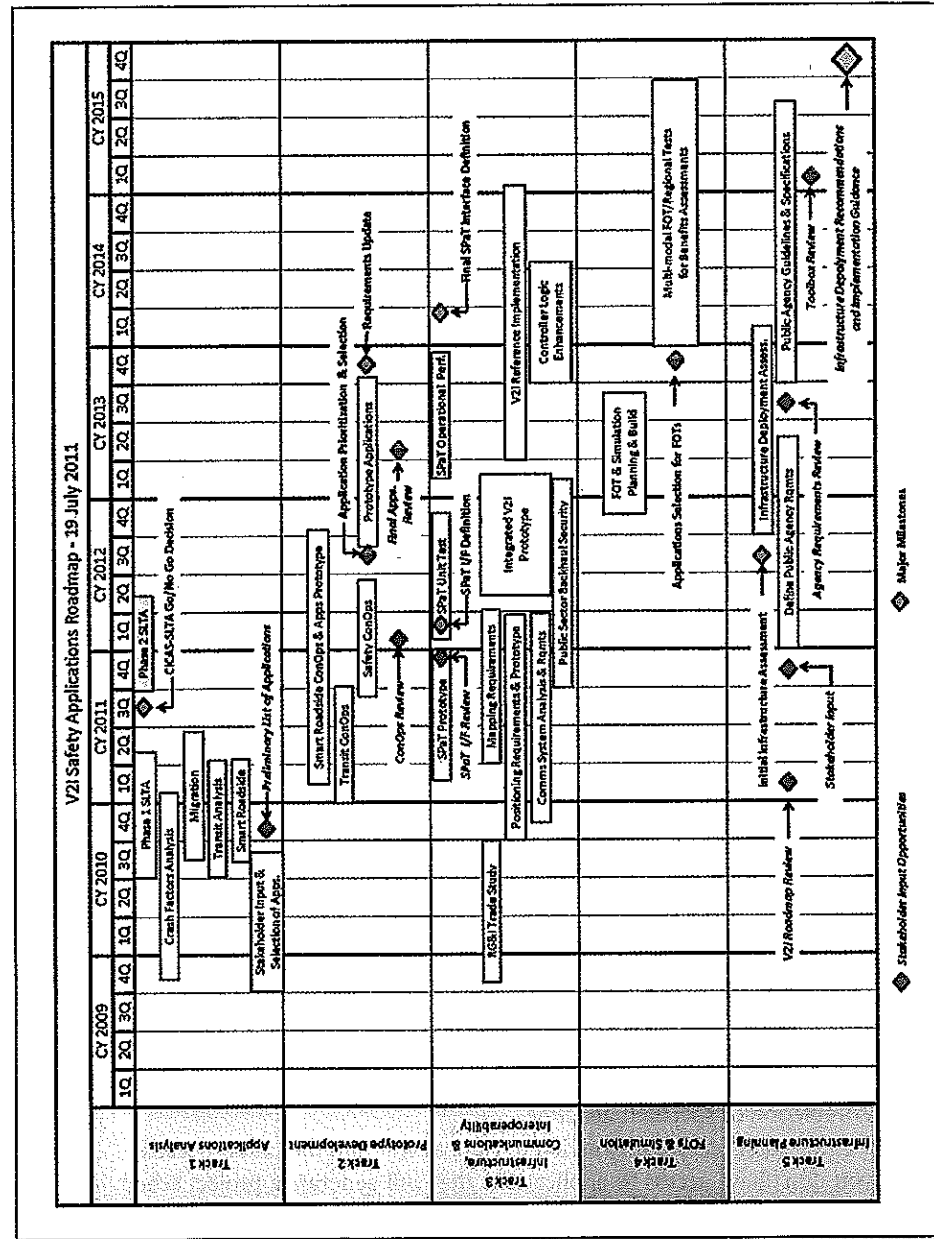


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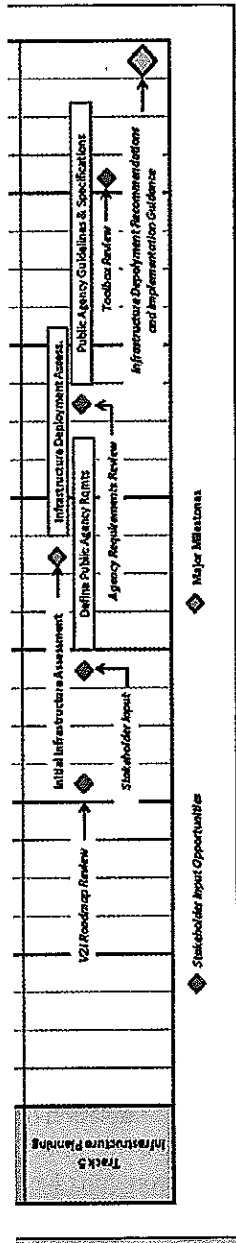


FIGURE 6-14 Project Schedule Chart (see facing page) This project schedule covers five tasks across 7 years, with each year divided in quarters. The five tasks are displayed in cells of different colors, a nice but unnecessary decoration devoid of meaning. Color is used more productively to identify opportunities for stakeholder input and major milestones in the schedule: the purple and green diamonds are readily visible among all the white rectangles and horizontal and vertical grid lines, and each diamond is clearly labeled with arrows running from label to diamond. Putting white rectangles on a white grid does create a visual challenge and make for slower reading: light coloring of the grid background would make it easier for viewers to recognize the borders of the rectangles and thus the start/stop times of tasks in the schedule.

Source: US Department of Transportation, Research and Innovative Technology Administration. Vehicle-to-Infrastructure Safety Applications Roadmap. 2011. http://www.its.dot.gov/roadmaps/v2i_roadmap.htm

Diagrams.

- Note that a diagram should identify parts of a subject and their spatial or functional relationship.
- Keep the diagram as simple as possible, avoiding unnecessary details or distracting decorations and focusing the viewer's attention on the key features or parts of the subject.
- Label each of the pertinent parts of the subject.
- If space allows, put each label directly on its corresponding part or adjacent to it; if not, connect the label to the part with a thin rule or arrow.
- Position all the labels on the horizontal so that the viewer doesn't have to rotate the page or screen to read the labels.

See Figure 6-15 for an example of a diagram.

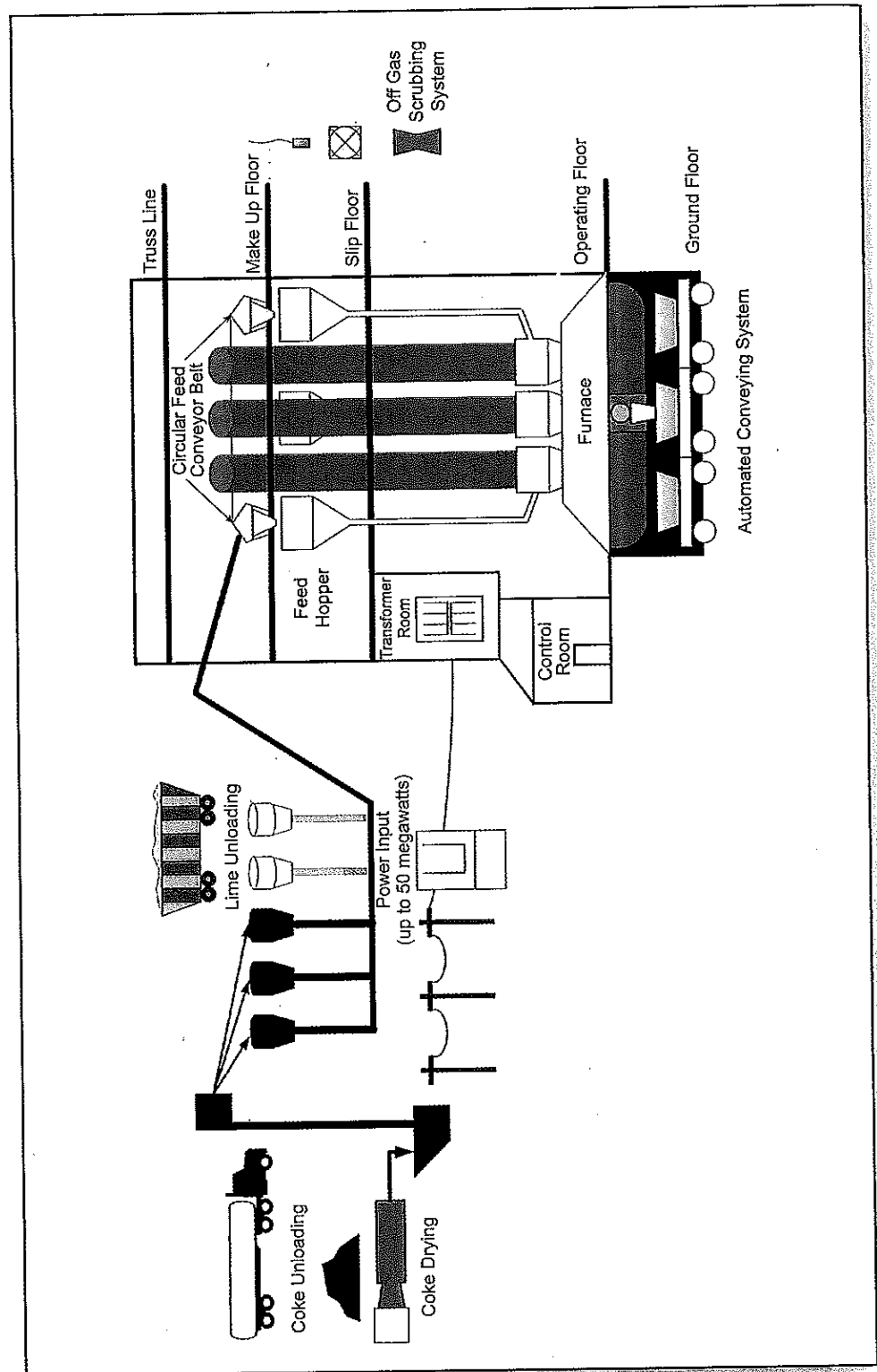


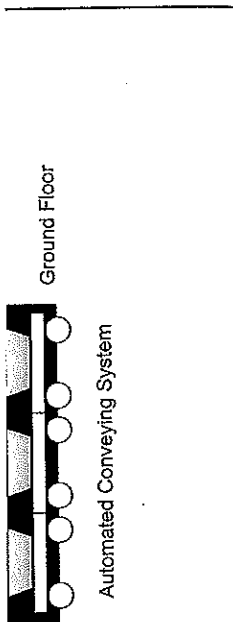
FIGURE 6-15 Diagram (see facing page) This diagram of the calcium carbide process focuses on the details pertinent to the investigation of the explosion and fire that killed two and injured two at a five-floor facility. As the diagram makes clear with its concise labels and simplified drawings, coke is unloaded, dried, mixed with lime, and brought by conveyor to a furnace fueled by electricity; exhaust gases are scrubbed before release into the atmosphere, and the resulting product is transported away by automatic conveyor. Note the inconsistent use of color: while red (implying heat) might be appropriate for the coke-drying equipment as well as for the furnace, the red stripes on the vehicle unloading line are entirely decorative. It might also be appropriate to add human icons to the control room: this is where operators are located during the process, and this was the location of the individuals killed and injured during the accident in question.

Source: US Chemical Safety and Hazard Investigation Board. *Carbide Industries, LLC, Louisville, Kentucky, Electric Arc Furnace Explosion, March 21, 2011*. Case Study No. 2011-05-I-KY. Washington, DC: GPO, 2013. p. 16.

Photographs.

- Note that photographs show what a subject looks like in realistic detail.
- Keep the photograph as simple as possible, focusing the viewer's attention on the key features or parts of the subject.
- Exercise caution in editing or polishing the photograph. Never insert or delete images. Viewers typically expect a photograph to be a representation of reality, and ethical communicators strive to meet that expectation. Cropping a photograph in order to close in on a subject and eliminate distractions in the background is a standard practice, but never insert or delete objects or change the size or color of objects in a photograph.
- If appropriate or necessary for the viewer's understanding, apply labels for each of the pertinent parts of the subject to direct the viewer's attention.
- If space allows, put each label directly on its corresponding part or adjacent to it; if not, connect the label to the part with a thin rule or arrow.
- Position all the labels on the horizontal so that the viewer doesn't have to rotate the page or screen to read the labels.

See Figures 6-16 and 6-17 for examples of photographs.



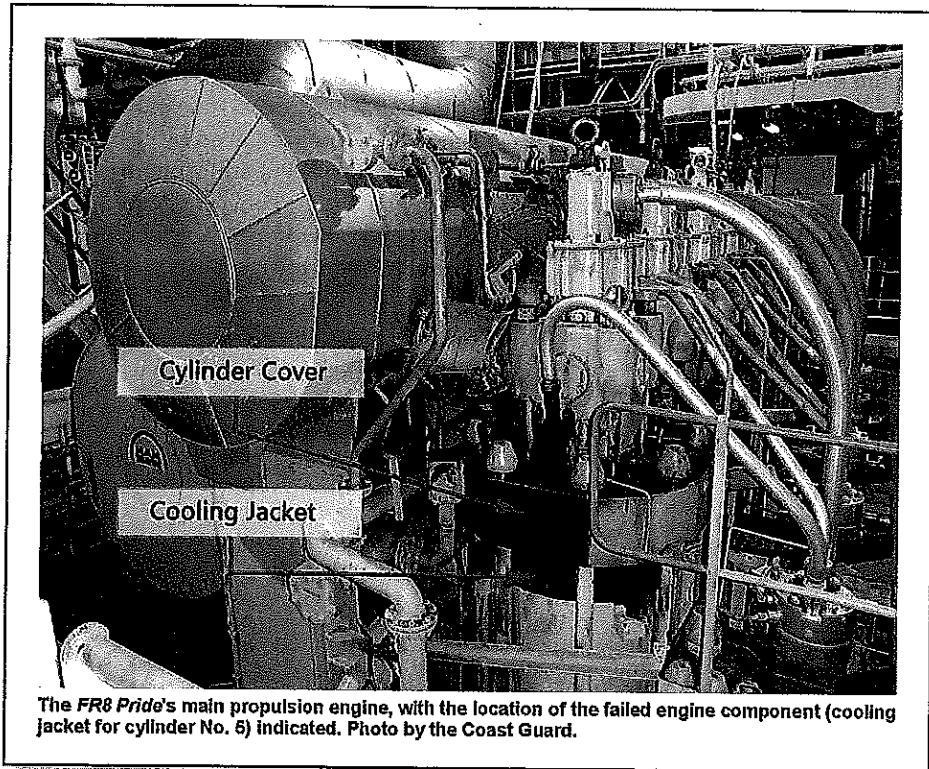
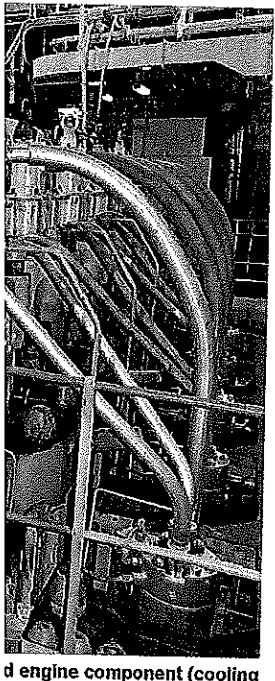


FIGURE 6-16 Photograph This photograph carries clear labels to identify the pertinent components of a ship engine that failed and caused the collision of two vessels (with no injuries but \$16-17 million in damages). The photograph puts viewers in the engine room and makes visible (and almost tangible) the complexity of the technology, while the arrows direct attention across all the pipes, wires, hoses, and valves to the source of the engine failure.

Source: National Transportation Safety Board. *Marine Accident Brief: Collision of Oil Tanker FR8 Pride with MODU Rowan EXL I*. NTSB/MAB-13/13. Washington, DC: GPO, 2013. p. 5.



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Figure 5. Suppression of the fire.

FIGURE 6-17 Ineffective Photograph This photograph is designed to display the suppression of fire following the horrific collision of two trains, but viewers are likely to focus their initial attention at least on the four firefighters standing in the foreground and watching the suppression effort. The photograph thus does a disservice both to the severity of the collision, which is here backgrounded, and to the heroic efforts of the firefighters, who are here depicted as passive observers. A more effective photograph would either exclude the distraction of the inactive firefighters and direct attention to the burning trains being doused with water or include active firefighters engaged in the fire-suppression effort.

Source: National Transportation Safety Board. *Head-On Collision of Two Union Pacific Railroad Freight Trains Near Goodwell, Oklahoma, June 24 2012*. Railroad Accident Report NTSB/RAR-13/02.

Washington, DC: GPO, 2013. p. 6.

Infographics.

- Note that infographics make information easier to understand and easier to remember.
- Keep the pictorial images of the infographic as simple and straightforward as possible, avoiding unnecessary details or distracting decorations and focusing the viewer's attention on key traits.
- Choose pictorial images appropriate to your likely viewers (especially their age, level of education, and culture). Make sure the image clarifies without insulting or irritating your viewers.
- Choose pictorial images appropriate to the gravity of your subject (especially for issues related to safety). Make sure the image neither trivializes nor distorts the subject.
- Reinforce the pictorial image with a minimum of explanatory text, labels, or captions.

See Figure 6-18 for an example of an infographic.

FIGURE 6-18 Infographic (see facing page) This series of infographics composes a vivid warning about the relative dangers of fireworks. The images of the various kinds of fireworks, from sparklers to public displays, are simplistic but concisely identified. The images of the human beings, however, are almost comical in the ungainly positioning of the bodies and could keep viewers from taking seriously the risk of injuries on which the infographic is reporting.

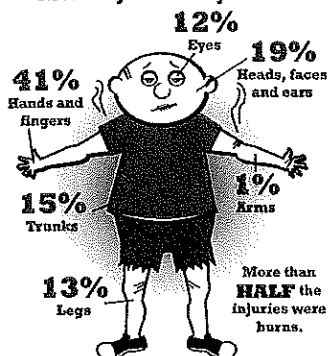
Source: US Consumer Product Safety Commission. *Fireworks Injuries*. 2013. <http://www.cpsc.gov/en/Safety-Education/Safety-Education-Centers/Fireworks/>

Fireworks Injuries

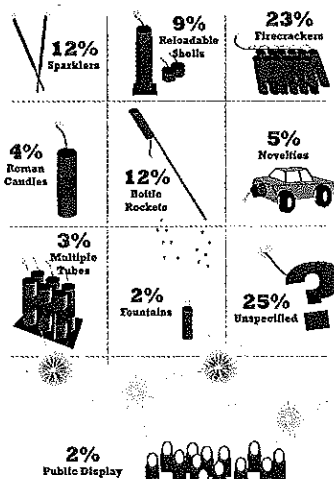
Fireworks. They are synonymous with our celebration of Independence Day. Yet, the thrill of fireworks can also bring pain, and even death. In 2012, CPSC staff conducted a study of fireworks injuries from June 22 through July 22. Here's what we learned.

- ★ **200** people on average go to the emergency room every day with fireworks-related injuries in the month around the July 4th holiday.
- ★ **60%** of these fireworks injuries in 2012 occurred during the month surrounding July 4th.
- ★ **Illegal and homemade fireworks** were involved in all **6** fireworks-related **deaths** reported to CPSC in 2012.

Most Injured Body Parts

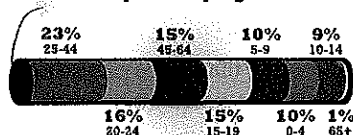


Injuries by Fireworks Type*

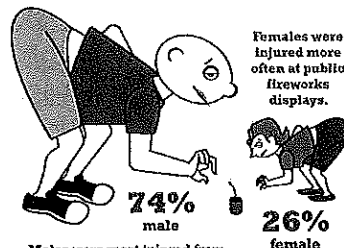


*These percentages do not account for how many products are used.

Injuries by Age



Injuries by Gender



Males were most injured from firecrackers, sparklers, hotfire rockets, novelty devices, Roman candles and reloadable shells.

Fireworks Safety Tips

- ★ Never allow **children** to play with or ignite fireworks.
- ★ **Never** try to **re-light** or **pick up** fireworks that have not ignited fully.
- ★ Keep a **bucket of water** or a **garden hose** handy in case of fire or other mishap.
- ★ Make sure fireworks are **legal** in your area before buying or using them.
- ★ Light fireworks **one at a time**, then **move back** quickly.
- ★ More Fireworks Safety Tips - www.cpsc.gov/fireworks

Source: U.S. Consumer Product Safety Commission 2012 Fireworks Annual Report



U.S. Consumer Product Safety Commission
CPSC Hotline: (800) 638-2772
www.cpsc.gov

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Video Clips.

- Note that video clips illustrate a process, operation, or incident. Film clips depict activity in realistic detail. Animation clips simulate activity that would be impossible, imprecise, or impractical to film.
- Keep the video clip as simple and straightforward as possible, avoiding unnecessary details or distracting decorations and focusing the viewer's attention on the key actors, equipment, and steps or stages in the process, operation, or incident.
- If appropriate or necessary for the viewer's understanding, insert audio narrative or titles and captions that direct the viewer's attention to pertinent information.
- Choose animation images appropriate to your likely viewers (especially their age, level of education, and culture) as well as the gravity of your subject

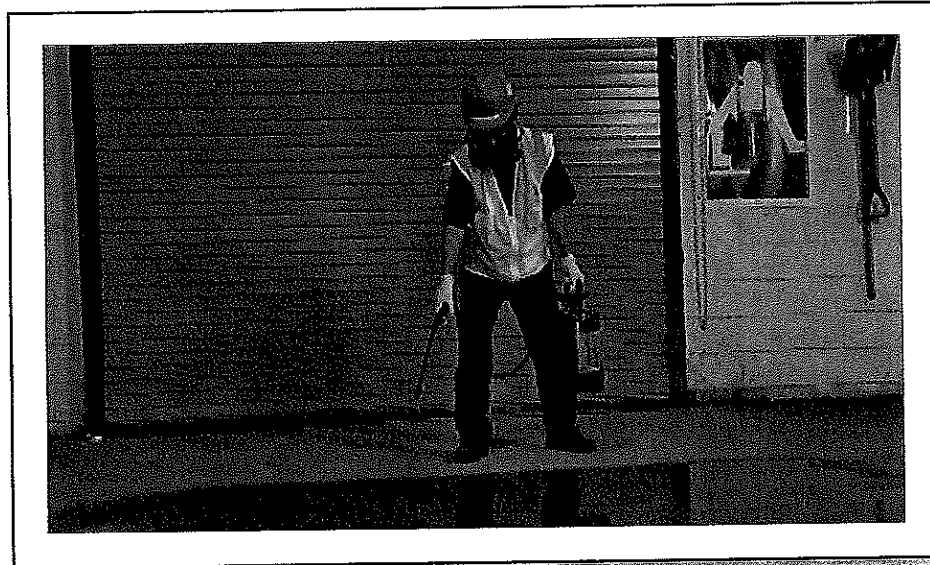


FIGURE 6-19 Film Clip This 10-minute video explains how workers who sometimes must wear a respirator on the job should store and clean this important safety equipment. The film covers a variety of workers in different kinds of jobs using a variety of respirators. Titles and diagrams are inserted periodically during the film to reinforce points made in the audio narration and in the activities depicted. The use of film for this video serves to reinforce the reality of hazardous work environments and the importance of proper care and maintenance of respirators.

Source: US Department of Labor, Occupational Safety and Health Administration. *Maintenance and Care of Respirators*. Video, 2012. https://www.osha.gov/video/respiratory_protection/maintenance.html

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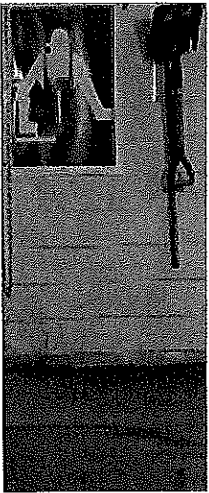
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(especially for issues related to safety). Make sure the animation clarifies without insulting or irritating your viewers and neither trivializes nor distorts your subject.

- Exercise caution in editing or polishing a film clip. Viewers typically expect a film clip to be a representation of reality, and ethical communicators strive to meet that expectation. Editing a film for extraneous material is a standard practice, but never change the speed or sequence of the process, operation, or incident (unless the change is altogether obvious), and always make sure that your editing creates no distortions or misrepresentations. In addition, treat each frame of the film as you would a photograph: never insert or delete objects or actors and never alter the size or color of the items in a frame.

See Figures 6-19 and 6-20 for screen shots of sample video clips.



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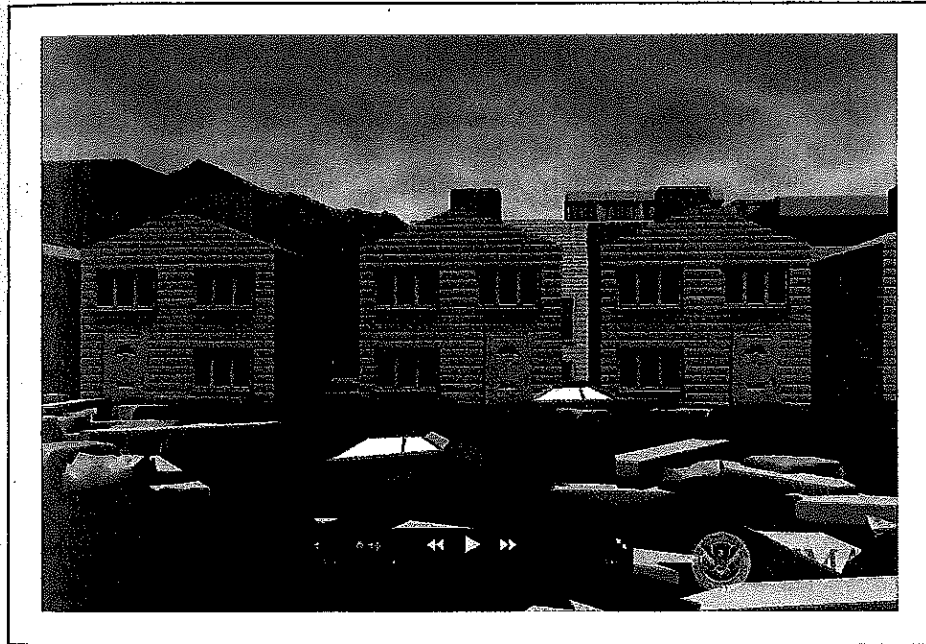


FIGURE 6-20 Animation Clip This 23-second video simulates how flood debris during storms can destroy buildings and create more debris. The use of animation offers a quick, simple, and coherent picture of a process that would be expensive and dangerous to film and that would be neither clear nor vivid in static diagrams or photographs.

Source: US Department of Homeland Security, Federal Emergency Management Agency. *Coastal Animation—Debris Impact Forces*. Video. 2012. http://www.fema.gov/medialibrary/media_records/10513

DESIGNING ILLUSTRATIONS ETHICALLY

Displaying information ethically requires that you make careful choices about the design of your illustrations.

For example, the scale of the x and y axes on a line graph has a significant impact on the data display. In designing a graph, you ordinarily start the x and y axes at zero. Exceptions are possible if beginning at some other point ("suppressing the zero") will not distort information. If several graphs are positioned side by side on a page, thus inviting comparison and contrast of the data, it would be unethical to use differing vertical scales because readers would likely come to incorrect conclusions.

Using distorted graphs, however, isn't the only error that will result in the creation of unethical illustrations. It is unethical to create a drawing that puts features on a product it doesn't really have. It is unethical to design a flowchart that disguises the complexity of a process by making it look relatively simple. It is unethical to stage or doctor a photograph to create a positive or negative impression of your subject that isn't fully justified. It is unethical to edit a film so that a 5-minute operation seems to take only 4 minutes. It is unethical to incorporate illustrations that might be easily misinterpreted.

In addition, if you illustrate information regarding people, you must strive to be sensitive to their humanity. A thoughtless or insensitive illustration could be widely and quickly circulated on the Internet, jeopardizing your organization's reputation for caring about people, especially the people in the communities in which it operates. For example, if you choose a conventional bar graph to depict the human beings killed in mining explosions, you make simple objects of real people who have surviving families and friends. In mapping the damage from a tornado, if you ignore the locations of the people who were killed and focus only on demolished buildings, you both diminish the loss of life and give a distorted picture of the disaster. Always consider ways that you might bring a sense of humanity (and thus greater accuracy) to your illustrations. Notice, for example, how the human dimension of a tragic highway accident is made evident in Figure 6-21 by the inclusion of brief demographic details and icons of the passengers.

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people, you must strive to create a vivid illustration could be by using your organization's data in the communities in a bar graph to depict the damage from a simple objects of real life and give a distorted right bring a sense of human-Notice, for example, how the passengers. Figure 6-21

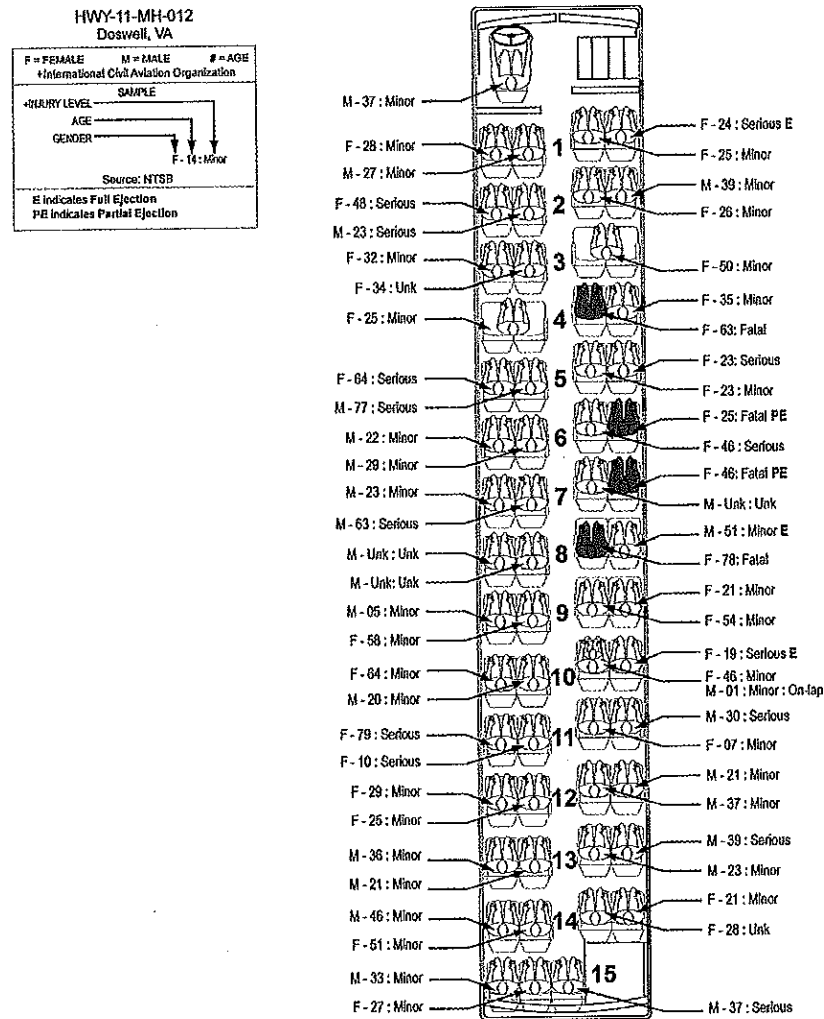


Figure 4. Motorcoach occupant diagram, showing seating location, injury, and ejection information.

FIGURE 6-21 Diagram of Injuries and Fatalities Sensitive to Victims This diagram of passenger locations on a bus involved in a highway accident is sensitive to the humanity of the victims. Implicit in the demographic details of age and sex are the relationships among the passengers (e.g., row 10: F-19, F-46, M-01 On-lap). The human icons (displayed in red for the four passengers killed) make the truly tragic consequences of this accident vivid and undisguised.

Source: National Transportation Safety Board. *Motorcoach Roadway Departure and Overturn on Interstate 95 Near Doswell, Virginia, May 31, 2011*. Highway Accident Report NTSB/HAR-12/02. Washington, DC, 2012. p. 17.

ILLUSTRATION CHECKLIST

Planning

- ☐ What kinds of illustrations is your audience familiar with?
- ☐ Do you have information that could be more easily or quickly communicated to your audience visually or in a combination of words and graphics?
- ☐ Do you have definitions that could be displayed visually in whole or in part?
- ☐ Do you have any processes or procedures that could be depicted in a flow chart?
- ☐ Do you have information on trends or relationships that could be displayed in tables and graphs?
- ☐ Do you have masses of statistics that could be summarized in tables?
- ☐ Do you need to depict objects? If so, what do you need to display about the objects? Do you need to focus attention on specific aspects of the objects with diagrams? Do you require the realistic detail of photographs?
- ☐ Do you need to depict incidents or operations? If so, what do you need to display? Do you need to focus attention on specific aspects through animation? Do you require the realistic detail of film?
- ☐ What are the design conventions of your illustrations?
- ☐ Are there suitable illustrations you could borrow or adapt? Or will you need to create them yourself?

Revising

- ☐ Are your illustrations suited to your purpose and audience?
- ☐ Do your illustrations communicate information ethically?
- ☐ Are your illustrations effectively located and easy to find?
- ☐ Are your illustrations numbered and labeled?
- ☐ Do your verbal and visual elements reinforce each other?
- ☐ Are your illustrations genuinely informative instead of simply decorative?
- ☐ When necessary, have you helped your readers to interpret your illustrations with commentary or annotations?
- ☐ Have you acknowledged the sources for borrowed or adapted tables and figures?

EXERCISES

1. Examine field notes. Don't convert to brief.

2. Zeitgeist divided art project. Achieve you to that year. Historic.

Sales

Empire

Production

Facilities

Location

Salary

Declarative illustrations

3. In design, learn you to disassemble incident photo.

EXERCISES

1. Examine the illustrations used in five journals and magazines in your major field of study. Which types of illustration do you ordinarily find? Which types don't you find? Which occur most often? Which occur least often? What are the conventions for tables and figures in your field? Summarize your findings in a brief oral presentation with slides that display representative illustrations.
2. Zeitgeist Corporation designs games for mobile devices and is looking for individuals with the experience and training to conceive and design state-of-the-art products. It has been a small private corporation for 5 years and hopes to achieve a major expansion. The president of Zeitgeist, Miyuki Sasaki, has asked you to develop recruiting materials. You've compiled the following information that you believe will be pertinent:

History	Founded in 2010, in Long Beach, California, by Miyuki Sasaki, BS in Computer Science, 2007, University of Ohio; MBA, 2009, University of Los Angeles
Sales	2010: \$250,000; 2011: \$750,000; 2012: \$1 million; 2013: \$4 million; 2014: \$7 million
Employees	With specialists in design (3), graphics and animation (4), programming (5), video editing (3), production (2), quality assurance (1), documentation (1), sound (1), and music (1)
Products	5 current products, looking to diversify, especially in action-adventure, newest product: Street Maniac (driving game); biggest seller: Trojan War (fantasy role-playing)
Facilities	State-of-the-art equipment, serves both Android and iOS systems
Location	1221 Alamitos Avenue, Long Beach, California: new environment-friendly building, spacious offices
Salary/benefits	Competitive with industry; exceptional medical coverage, 4 weeks vacation each year, 2 weeks paid community-service time each year

Design recruiting materials for Zeitgeist that incorporate as wide a variety of illustrations as possible.

3. In designing your recruiting materials for Zeitgeist, you are surprised by a dilemma. Miyuki Sasaki is willing to hire people with disabilities and would like you to include that information. At this time, Zeitgeist has no employees with disabilities, but Jacqueline Bailey, a programmer, injured her back in a skiing accident and is temporarily restricted to a wheelchair. Sasaki proposes including a photograph of various Zeitgeist employees (including Bailey in the wheelchair)

to indicate to prospective employees that people with disabilities would find a supportive environment at Zeitgeist. You mention the idea to staff photographer Kishor Mitra, but he objects, claiming such a picture would be deceptive. As project leader, you have to decide who is right and compose one of two e-mail messages: either to convince Sasaki that such a photograph would be unethical or to direct Mitra to take the photograph in spite of his objections. How do you proceed?

4. Examine Figure 6-22. If you were a collaborator on this document and were given 15 minutes to design more effective illustrations, what changes would you make? You likely won't have time to fix everything but must decide quickly which changes will have the greatest impact.

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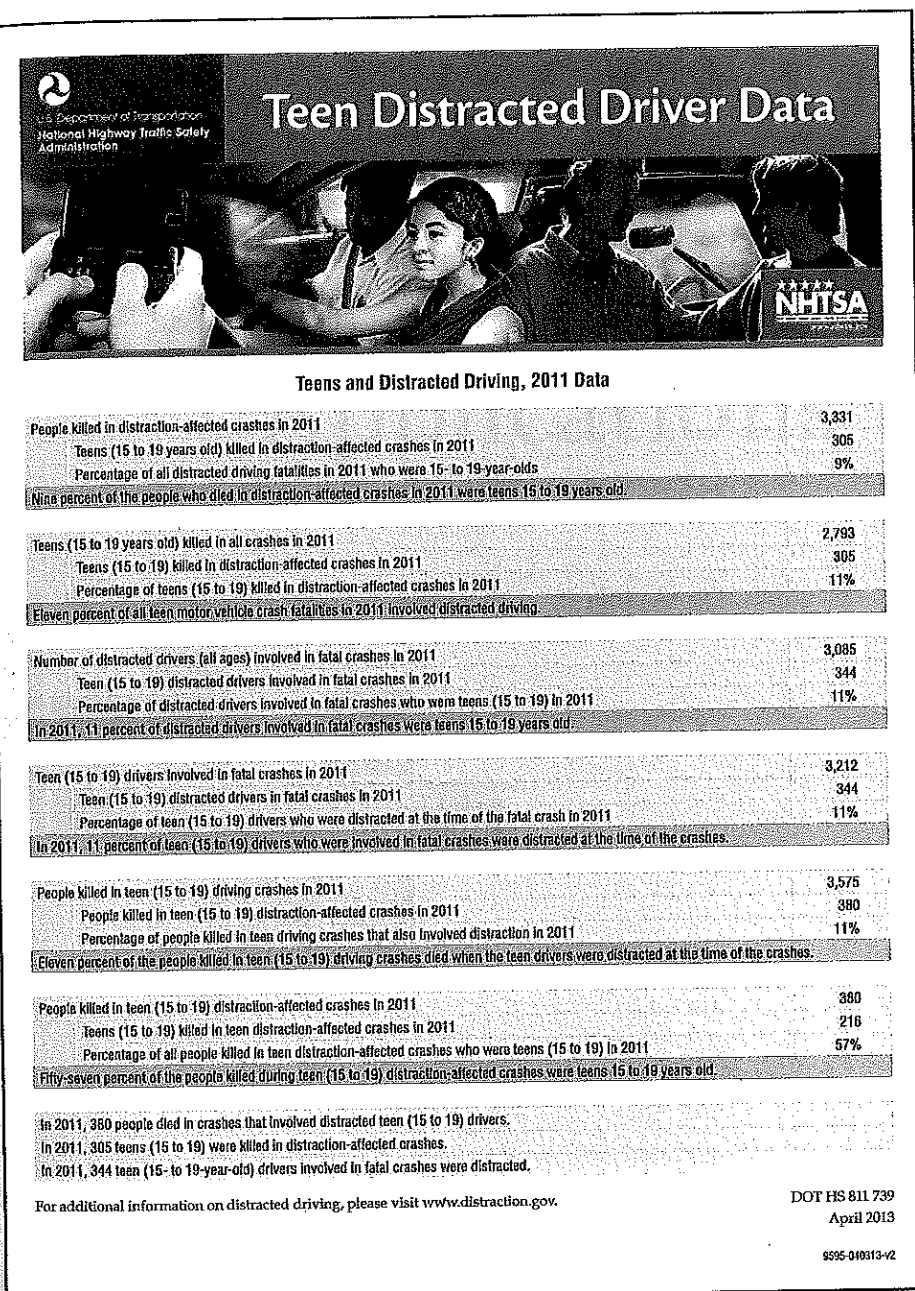


FIGURE 6-22 Document for Exercise 4

Source: US Department of Transportation, National Highway Traffic Safety Administration. *Teen Distracted Driver Data*. 2013. <http://www-nrd.nhtsa.dot.gov/Pubs/811739.pdf>