

## Developing Fact Sheets for Diverse Audiences

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### Abstract

The National Pesticide Information Center (NPIC) specializes in providing risk communication about pesticides through real-time verbal information and online content. Here, we discuss our process to develop fact sheets for pesticide active ingredients based on our experience in responding to questions and concerns from across the United States. Issues are presented that include: 1) addressing the scope, design, and review of informational materials; 2) targeting diverse audiences for general and technical content; and 3) branding NPIC as a recognizable source for objective pesticide information.

**Keywords:** fact sheets, online, branding, risk communication

### Introduction

Extension and outreach personnel often need to communicate controversial information to diverse stakeholders. The widespread use of pesticides in urban and agricultural environments ensures that nearly everyone is a stakeholder. Frequently, information sources for pesticides can be incomplete, out-of-date or contradictory. Media and advocacy groups may deliberately or unintentionally influence the message, which can skew public perception and ultimately affect legislative and regulatory efforts (Peterson and Higley, 1993). All of these factors influence the selection, presentation, and delivery of scientific information.

The National Pesticide Information Center (NPIC) (<http://npic.orst.edu>) provides science-based information and risk communication on pesticides to a very broad audience ranging from the general public to medical personnel, researchers and regulators. Although much of the Center's service is provided by telephone, a growing audience online prompted the Center to emphasize fact sheets to convey complex information. In many situations, fact sheets can be as effective as verbal communication (Woodson, Lindner and Lawver, 2008).

NPIC has developed dozens of fact sheets that 1) reflect questions commonly asked by the public, 2) are written for diverse audiences including general and technical readers, and 3) brand NPIC as a credible source for pesticide information. In addition, NPIC has developed a consistent process to write, review, and publish fact sheets. This consistency helps to standardize our scope and content, as well as promoting our organizational brand.

## Methods

### *Targeting the Audience*

NPIC tracks the general identity of its callers, differentiating between the general public, industry professionals, government agencies, and medical personnel among others. This information revealed that 90% of all telephone inquiries come from the general public. However, the service also provides timely information to other user groups, including medical professionals. NPIC therefore developed two separate but parallel production lines for fact sheets: general fact sheets intended for lay audiences with little to no scientific background and approximately an eighth grade reading level; and technical fact sheets intended for experienced professionals. These two types are developed for specific pesticide active ingredients that generate multiple inquiries from the public.

NPIC received and archived over 25,000 telephone and e-mail inquiries in 2010. These data provide insight into common questions and concerns among broad audiences. A focused scope is important, particularly for less technical fact sheets, because readers can retain a finite amount of information before being overwhelmed (Di Vesta and Di Cintio, 1997). In addition, many scientific publications are too technical or impersonal to maintain the reader's interest (Sand-Jenson, 2007). We therefore tailored our general fact sheets to focus on common questions received by NPIC staff, acknowledging that information presented to the public should address societal concerns and values (Frewer, 2004).

We used an iterative process to develop a series of standard topic headings, ensuring that they addressed the most commonly asked questions and concerns. Technical fact sheets were designed both for use by NPIC specialists as well as external professionals. NPIC specialists frequently use these resources when answering specific questions about chemical behavior in the environment, health effects, signs of exposure, or mechanisms of action. In both fact sheet types, subject headings reflected the information needs of the users (Table 1).

**Table 1: Example headings in NPIC's general and technical fact sheets.**

General Fact Sheet Questions	Technical Fact Sheet Content
How Might I Be Exposed to X?	Physical/Chemical Properties Mode of Action Acute Toxicity
What are Some Symptoms from a Brief Exposure to X?	-Oral -Dermal -Inhalation
What Happens to X When it Enters the Body?	Signs of Animal Toxicity Signs of Human Toxicity
Is X Likely to Contribute to the Development of Cancer?	Chronic Toxicity -Animals -Humans
Are Children More Sensitive to X than Adults?	Endocrine Disruption Carcinogenicity
Has Anyone Studied Non-cancer Effects from Long-term Exposure to X?	Reproductive/Teratogenic Effects Fate in the Body Medical Tests and Monitoring

We organized the headings to reflect logical information flow based on our conversational experience with diverse callers. All active ingredient fact sheets begin with a brief summary of the chemical, its origin, and its uses. People using our services most frequently ask about exposures to people and pets, and less frequently about environmental fate or effects. Fact sheets relay information regarding acute exposures first, followed by chronic health concerns. Signs of toxicity are provided before medical testing information. Environmental fate and ecotoxicology information are covered at the end of each fact sheet.

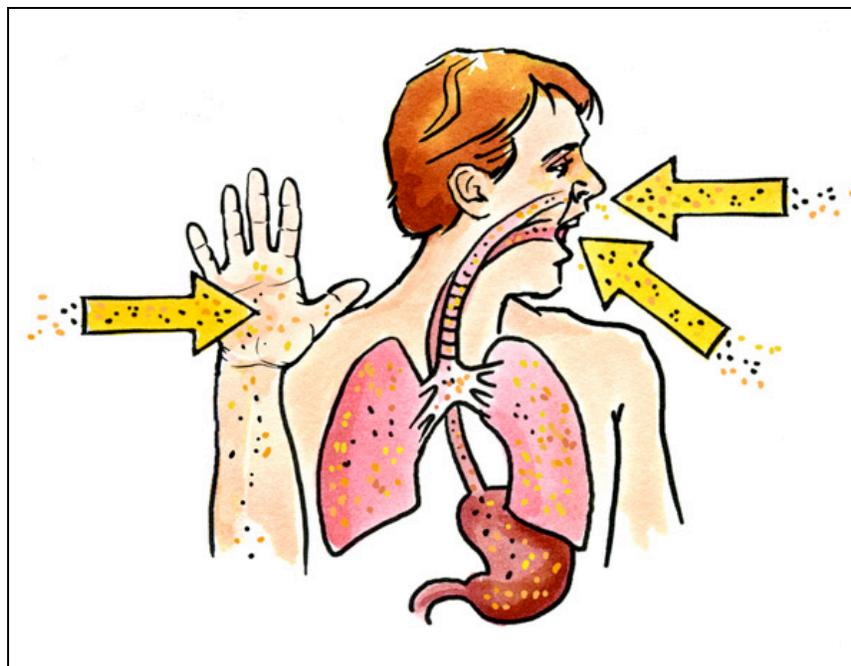
### **Branding**

Building rapport with an audience to develop trust is an essential part of communicating controversial information. We developed a recognizable brand by using consistent design elements that make our fact sheets distinct from other resources available on the Internet. All fact sheets feature a characteristic banner that includes our organization's name and contact information; the toll-free telephone number appears on every page. The consistency of layout, content, and credibility encourages repeat use, building a clientele who will rely on NPIC's services.

We hyperlink information in the fact sheets to content within our website as often as possible. This highlights the source organization and provides the reader with related information, while continuing to build our brand.

We used a graphic artist to design colorful and simple illustrations (Figure 1). They provide visual contrast to the text in the general fact sheets and highlight the content in the corresponding paragraphs. Because the images are featured on the NPIC website, they also serve to identify the general fact sheets as NPIC material, increasing our brand identity.

**Figure 1: Illustration used in NPIC general fact sheets depicting the major exposure routes.**



NPIC staff developed tables with visual elements for the technical fact sheets that aid in information delivery by putting complex information in context. Table 2 is an example; it summarizes the acute toxicity of picaridin (Table 2). The same basic table is used in each technical fact sheet, allowing easy comparison among different active ingredients. Highlighted boxes differ based on the results of laboratory testing.

**Table 2: Highlighted boxes identify research-driven categories of acute toxicity for picaridin.**

TOXICITY CATEGORY - PICARIDIN				
	High Toxicity Category I	Moderate Toxicity Category II	Low Toxicity Category III	Very Low Toxicity Category IV
Acute Oral LD <sub>50</sub>	Up to and including 50 mg/kg (≤ 50 mg/kg)	Greater than 50 through 500 mg/kg (> 50 - 500 mg/kg)	Greater than 500 through 5000 mg/kg (> 500 - 5000 mg/kg)	Greater than 5000 mg/kg (> 5000 mg/kg)
Inhalation LC <sub>50</sub>	Up to and including 0.05 mg/L (≤ 0.05 mg/L)	Greater than 0.05 through 0.5 mg/L (> 0.05 - 0.5 mg/L)	Greater than 0.5 through 2.0 mg/L (> 0.5 - 2.0 mg/L)	Greater than 2.0 mg/L (> 2.0 mg/L)
Dermal LD <sub>50</sub>	Up to and including 200 mg/kg (≤ 200 mg/kg)	Greater than 200 through 2000 mg/kg (> 200 - 2000 mg/kg)	Greater than 2000 through 5000 mg/kg (> 2000 - 5000 mg/kg)	Greater than 5000 mg/kg (> 5000 mg/kg)
Primary Eye Irritation	Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days	Corneal involvement or other eye irritation clearing in 8 - 21 days	Corneal involvement or other eye irritation clearing in 7 days or less	Minimal effects clearing in less than 24 hours
Primary Skin Irritation	Corrosive (tissue destruction into the dermis and/or scarring)	Severe irritation at 72 hours (severe erythema or edema)	Moderate irritation at 72 hours (moderate erythema)	Mild or slight irritation at 72 hours (no irritation or erythema)

Modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling.  
<http://www.epa.gov/oppfead1/labeling/lrm/chap-07.htm>

### **Writing for the Target Audience**

NPIC carefully considers its audience with each of the fact sheet types. The general fact sheets use shorter sentences, avoid technical terms when at all possible or explain the terms at first use. They are also edited for readability. We evaluate the reading level using the Flesch Reading Ease and Flesch-Kincaid Grade Level statistics found in Microsoft Word. These statistics calculate ratings based on the number of syllables per word and how many words are used per sentence. We prevent the chemical names from influencing reading level scores by substituting them for single-syllable words such as “stuff”. After the reading level is determined, it’s easy to find and replace these placeholders.

Technical fact sheets are not evaluated for their reading level, although writers and editors strive to achieve straightforward language using active voice. We realize that some readers do not have the expected background in all technical aspects, and provide text boxes that briefly summarize some of the most common toxicological concepts such as the LD<sub>50</sub> of a pesticide. The reader can refer to the stand-alone text boxes as needed, without interrupting the flow of information to define terms.

### **Choosing Source Material**

NPIC fact sheets attempt to summarize information from a wide variety of sources. Dedicated efforts are made during the research phase to find and utilize reputable, unbiased sources in order to maintain the credibility of the fact sheets and the organization publishing them. When possible, NPIC uses sources that are widely available in the open literature, particularly the peer-reviewed scientific literature. However, much toxicology information exists in unpublished reports. We strive to track

all information back to original sources, and to disclose when we have not been able to obtain any unpublished reports, which are often cited in government documents. Fact sheets are not meant to be exhaustive reviews, and if several sources of information are available, we cite the source that is most easily obtained.

During the research and writing phase, authors print out all sources used in the fact sheet, highlight and flag all cited information. During the review process, the cited information is checked against the original data by editorial staff. These reviewers also address completeness, objectivity and writing style. Hard copies of all cited sources are kept as archives, facilitating immediate identification of the source material by anyone, even a person who is not familiar with the fact sheet. A different member of the editorial staff then reviews the fact sheet for clarity, focusing on a consistent tone with other fact sheets in the collection.

Our general fact sheets do not include detailed lists of references. Rather, each one cites the companion technical fact sheet for the same chemical. This maintains transparency and credibility while minimizing the risk of intimidating readers. Based on our interactions with the public, we determined that bibliographies are occasionally viewed as academic, technical, and/or inaccessible.

### ***Incorporating Controversial or Conflicting Information***

Information about pesticides, particularly health effects, is often contradictory or controversial. Studies with divergent conclusions are included in our fact sheets if: 1) the research examined a topic that has received considerable attention, 2) a high level of uncertainty exists on the topic, or 3) the studies were deemed important using our staff's professional judgment. We strive to present this information in a neutral way, allowing readers to decide their own interpretation. If a single case study's results has generated considerable attention either in the popular media or the scientific literature, we include it, but with appropriate context. Both situations arose for the active ingredient 2,4-D and this fact sheet serves as an illustration for these cases. If only one or a few studies had contrary findings in the face of overwhelming evidence that suggested otherwise, the contradiction is typically not mentioned in our fact sheets.

### ***Standardizing the Process***

A large part of developing credibility and branding is consistency in tone, layout, and content. Nearly all NPIC specialists write fact sheets. With potentially dozens of different authors producing fact sheets over the years, streamlining and standardizing the process was crucial.

We have developed a detailed writing guide that explains the scope and purpose of our fact sheets to new authors. It defines the target audiences and reading levels for each type of fact sheet. It also provides consistent guidance about which information sources to examine, how to cite those sources, and issues of style and content. Training materials emphasize the core goals and values of the fact sheets, which helps maintain consistency and organizational brand.

Authors of pesticide active ingredient fact sheets use standard templates to guide the research and writing process. Fact sheet templates standardize content by default.

They also allow automatic inclusion of information common to all fact sheets, and guarantee consistency of layout.

Authors write technical fact sheets first. During this process, they gather and archive source material that will also be used to write the general fact sheet for the same active ingredient. Authors have become subject experts in their active ingredient at the completion of the technical fact sheet, allowing them to focus on style and readability when writing the general fact sheet. We have found that this process uses authors' writing time most efficiently.

### ***Getting the Message Out***

NPIC maintains an extensive website used by the public at large and by specialized professionals. Fact sheets are only one of many resources available on the website. However, the website channels traffic to NPIC materials before presenting outside links. NPIC publications are prominently featured on the site's home page, along with other original publications. Specialists routinely guide callers to fact sheets during their discussions. We also maintain a list of interested individuals, and contact them by email when new fact sheets are published. The opportunity to sign up is available on our website.

### ***Applying the Model in Two Examples: Picaridin and 2,4-D***

Pesticide active ingredients vary widely in their registered uses, toxicity, and the amount of available research in the open literature. We designed the fact sheet templates to be flexible, with the option to expand or omit sections based on the characteristics of each active ingredient. For example, a table was necessary to present all of the physiochemical properties for each one of the nine chemical forms of 2,4-D (<http://npic.orst.edu/factsheets/2,4-DTech.pdf>). In contrast, the insect repellent Picaridin (<http://npic.orst.edu/factsheets/Picaridintech.pdf>) only occurs in one form and did not require a physiochemical properties table.

It can be challenging to create a fact sheet when too much or too little credible information exists. In the case of picaridin, few resources were located in the primary literature. We used practically all of the available information from reputable sources, such as Re-registration Eligibility Documents (REDs) published by the Environmental Protection Agency (EPA), to produce the most complete synopsis possible. In contrast, 2,4-D has been the subject of extensive research and has a long and complex regulatory history. In the case of 2,4-D, we placed the emphasis on review articles that summarized prior studies. We took a weight of evidence approach to succinctly summarize the high volume of available information.

Contradictory information is another challenge when writing fact sheets. One example is the uncertainty surrounding occupational exposure to 2,4-D and the incidence of non-Hodgkin's lymphoma (Garabant and Philbert, 2002; U.S. EPA, 2005). In our fact sheet on 2,4-D, we present the major studies with conflicting results and acknowledge the discrepancies, informing but allowing the readers to draw their own conclusions. As another example, researchers found a link between lymphoma in dogs living in households that used 2,4-D on their lawns. This study's results were not replicated, but it received widespread attention and is discussed in a number of comprehensive

reviews of 2,4-D's health effects. We therefore included this study in our fact sheet along with language that indicated that the finding was controversial.

### Discussion

Because pesticides continue to be the subject of considerable controversy, objective, science-based information is needed for effective risk communication and decision-making (Whitford, 1993). Utilizing our experience discussing a wide range of pesticide-related topics with a diverse audience, we designed fact sheets that address the questions posed most often by the public. We also organized and responded to the questions using words, phrases, references and approaches that have proven to be effective during our conversations with callers. By directing callers to our fact sheets and listening to them skim, read and react to the material, we have learned the importance of providing general and technical content in separate formats. Although fact sheets are a traditional source of information, we have attempted to improve their usability and target specificity to increase the likelihood that they will be useful in risk communication and decision-making.

As professionals and the general public increasingly rely on the Internet to find information, there is a growing need for objective and tailored fact sheets. In 2010, NPIC received 446,250 web hits to our fact sheet collection, which includes ten topic fact sheets in addition to the active ingredient fact sheets described here. For active ingredient fact sheets, the whole collection of general fact sheets received 164,489 hits; technical fact sheets received 174,013 hits. Since we redesigned the visual and informational content of our fact sheets in 2008, the number of web hits per year for the whole collection has doubled. Although it is possible that news items or other external factors played a role in the increased web traffic, the fact that all of the fact sheets received increases in use suggests to us that the change in format is at least partially responsible.

In summary, the approach outlined by NPIC to develop fact sheets for the public and professionals can be adapted and used by other Extension-based programs that need to convey complex health, environmental and regulatory information. We believe that effective risk communication should go beyond providing relevant content, and strive to tailor the message and delivery method to meet the variable needs of a diverse audience.

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