USER-CENTERED DESIGN

20548 Deerwatch Place, Ashburn, VA 20147 TEL: (703) 729-0998

TOXMAP Usability Evaluation

Final Report

August 2011

Submitted by:
User-Centered Design, Inc.
20548 Deerwatch Place
Ashburn, VA 20147
(703) 729-2370
www.user-centereddesign.com

Table of Contents

EXECUTIVE SUMMARY

The National Library of Medicine's (NLM) Division of Specialized Information Services (SIS) is redesigning TOXMAP (http://toxmap.nlm.nih.gov), a Geographic Information System (GIS). It uses United States maps and allows users to visually explore information from the Environmental Protection Agency (EPA) regarding the Toxic Release Inventory (TRI) and Superfund Programs. The goal of the new design is to provide a more interactive map and a more user-friendly experience. User-Centered Design, Inc. (UCD) was contracted to conduct an expert review of a new design for TOXMAP, followed by a usability evaluation.

The expert review was conducted in November 2010. Based on the recommendations, changes were made to the new design. The usability evaluation was then conducted in July 2011. This report covers the findings from the usability evaluation.

The primary objectives of the usability evaluation were to assess users' understanding of the new TOXMAP design and their ability to use the various features easily. A total of fifteen (15) individuals participated in this evaluation, representing four concerned citizens and eleven professionals (toxicologists, researchers, and public health professionals). Eight in-lab tests were conducted on July 21, 2011, and seven tests were conducted remotely July 22-27, 2011.

Overall, participants liked the visual displays, interactivity, and responsiveness of the map. In addition, they liked the content and were impressed by the large amount of information provided. Participants who were familiar with the previous TOXMAP or other GIS sites had an easy time using the map while the learning curve for new users was fairly steep.

Key findings include:

- Participants seemed to jump right into using the site and skipped over the welcome screen that explained what features were available.
- The presentation of the Search Results table was confusing to all participants.
- The display of Map Contents and Search Results in two panels (one on the left, one on the right), with both visible simultaneously, was confusing to many participants.
- Various labels (e.g., Quick Search, Demographics) were either misleading or not descriptive enough for participants to understand easily.
- Most users felt a tutorial, or some kind of orientation to the tool, was needed for new users.

Some of the issues can be addressed through fairly minor alterations, while others will require more extensive changes to the design. The presentation of the Search Results seems to be the most critical issue related to users interpreting the map information correctly.

INTRODUCTION

The National Library of Medicine's (NLM) Division of Specialized Information Services (SIS) is redesigning TOXMAP (http://toxmap.nlm.nih.gov, a Geographic Information System (GIS). TOXMAP uses United States maps and allows users to visually explore information from the Environmental Protection Agency (EPA) regarding the Toxic Release Inventory (TRI) and Superfund Programs. The goal of the new design is to provide a more interactive map and a more "user-friendly" experience. User-Centered Design, Inc. (UCD) was contracted to conduct an expert review of a new design for TOXMAP and a usability evaluation which followed the review.

The expert review was conducted in November 2010. Based on the recommendations, changes were made to the new design. Some of the key changes include:

- Changes to the welcome screen to inform users of the available features.
- Docking the Map Contents and Search Results panels on the sides of the screen; this design replaced floating boxes which held the information.
- When the map is opened, having the expanded TOXMAP data layers shown by default.
- Changes to the formatting of the various pop-up boxes (Search, Demographics, Chemical Information) to improve usability.

After modifications to the site, the usability evaluation was conducted in July 2011 with participants representing the various audiences of the site: toxicologists/researchers, public health professionals, and environmentally concerned citizens. The rest of this report covers the findings from the usability evaluation.

Full Product Description

TOXMAP is a Geographic Information System (GIS) that uses United States maps to allow visual exploration of mapped information from the Environmental Protection Agency (EPA): the Toxics Release Inventory (TRI) and the Superfund Programs. TRI sites are locations where a significant amount of toxic chemicals are released. Superfund sites are locations that have been designated as abandoned hazardous waste sites.

TOXMAP is a customized Flash application based on GIS software developed by ESRI. It allows users to find TRI and Superfund sites both by browsing the map and searching for facilities that release specific chemicals. Users can either enter an address or coordinates to zoom to a specific location on the map, or they can manipulate the map manually with the map controls or a mouse. In addition, users can look up information about specific chemicals as well as specific facilities. This information comes from other NLM sites, as well as cdc.gov and other external sites. Finally, users can overlay the map with various, county-based US Census and Mortality data.

EQUIPMENT AND TEST DESIGN

Test Objectives and Research Questions

The primary objectives of the usability test were to assess users' understanding of the new TOXMAP design and their ability to use the various features easily.

Research questions included:

- How easily can users get started using the site?
- Do users understand what features TOXMAP offers?
- How easily can users interpret the results of a Search or Browse?
- Can users navigate/manipulate the map easily?
- How intuitive are the interactions for the various features?
- How easy or difficult is the learning curve?

Participants

A total of fifteen (15) individuals participated in this evaluation, representing:

- Concerned citizens, four (4)
- Various professionals associated with materials provided on TOXMAP: toxicologists, researchers, and public health professionals, eleven (11)

Most participants were either intermediate or advanced computer/Internet users. They represented a mix of ages, genders, and education. All but one was a college graduate and most had advanced degrees.

Test Facility

Eight in-lab tests were conducted at EurekaFacts in Rockville, MD on July 21, 2011, and seven tests were conducted remotely July 22-27, 2011. For the in-lab sessions, the participants and test administrator were co-located in a test room, while observers were located in a separate room where they could hear the session and view both the participant's screen and a video feed of the participant's face. During remote testing sessions, participants communicated with the facilitator either by phone or through computer-supported audio. A screen-sharing conferencing tool allowed the facilitator and observers to follow participants' mouse movements and interactions with the website. Recordings of all sessions were made and provided to SIS staff. Sessions lasted approximately one hour.

Method

A user-based evaluation that combined exploratory and task-based protocols was selected for this test. (The facilitator's guides can be found in Appendix A of this report.)

Participants were first invited to freely explore the site – to go to whichever areas were of interest. Previous TOXMAP users and experienced GIS users explored more fully than those without as much experience. Participants were then given tasks to find materials and do activities that were typical of what users might want to do on the site. Various aspects of the interface were discussed with participants upon completion of tasks. To conclude the session, the facilitator asked participants about what they thought of the learning curve and any additional over-arching thoughts or comments. Participants were given a stipend as a thank you gift.

Limitations of Research

The results of the research presented below are qualitative in nature. In other words, the small number of participants included in this research, as well as the method of recruitment, precludes statistical analysis of the results. The findings and recommendations provided by the research team are an interpretation of participant behaviors and comments, as well as industry standards and best practices. The results and recommendations are provided as input for decision-making.

FINDINGS AND RECOMMENDATIONS

Welcome Screen

Format

When participants launched TOXMAP they were greeted with a welcome screen (see Figure 1). The purpose of the welcome screen is to provide users with some quick background on what TOXMAP is and what can be done with it. In testing, participants seemed to ignore the welcome screen text and go straight to the "Enter Site" button. Participants apparently wanted to delve into using the site and thought that they could figure it out as they went. While this was not as much of a problem for experienced GIS users and those already familiar with TOXMAP, it left the others fairly lost as to what they should do once they entered the site.

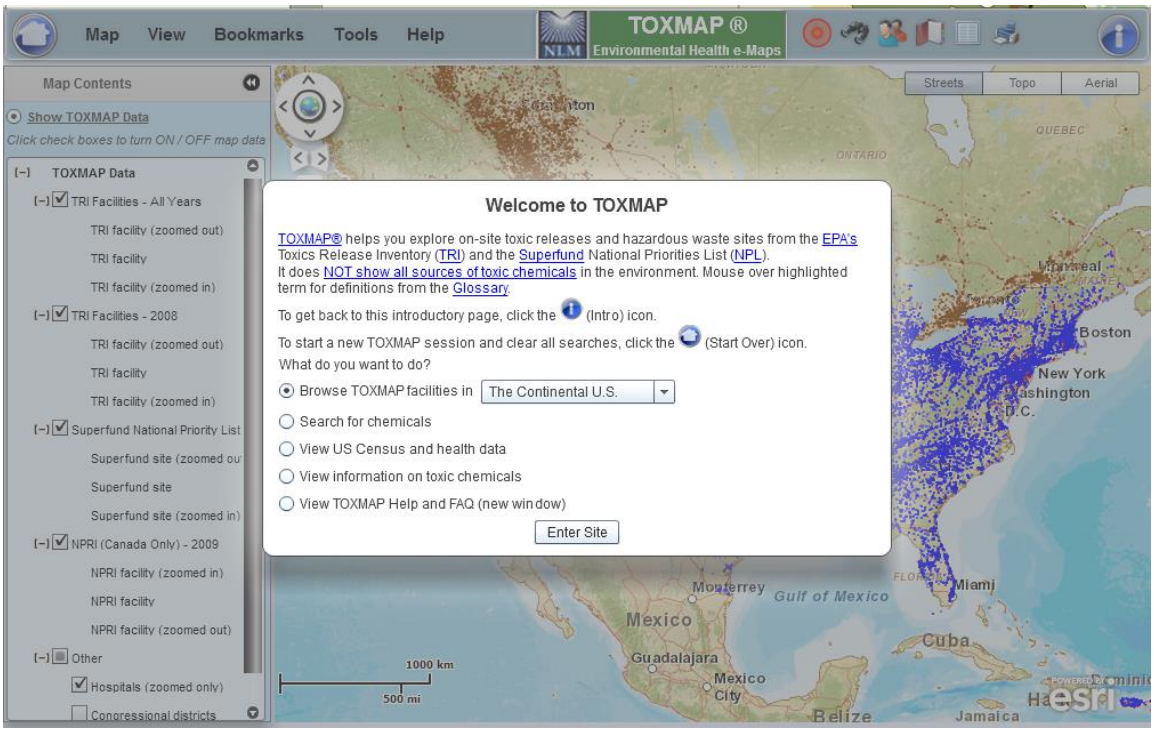

Figure 1: Welcome screen.

As designed, the welcome screen encourages users to skim over it. Though the text is short, it is dense. There are radio buttons to allow users to make a choice as to what to do; however, because there is a default selection, users are not required to make a choice and can therefore ignore the options. Finally, the label "Enter Site" is a strong call to action. The user's goal is to enter the site and the button tells them they can do this without paying attention to anything else.

Recommendation: Consider reformatting the welcome screen to encourage users to read it, as shown in Figure 2. The following changes were made to support this goal:

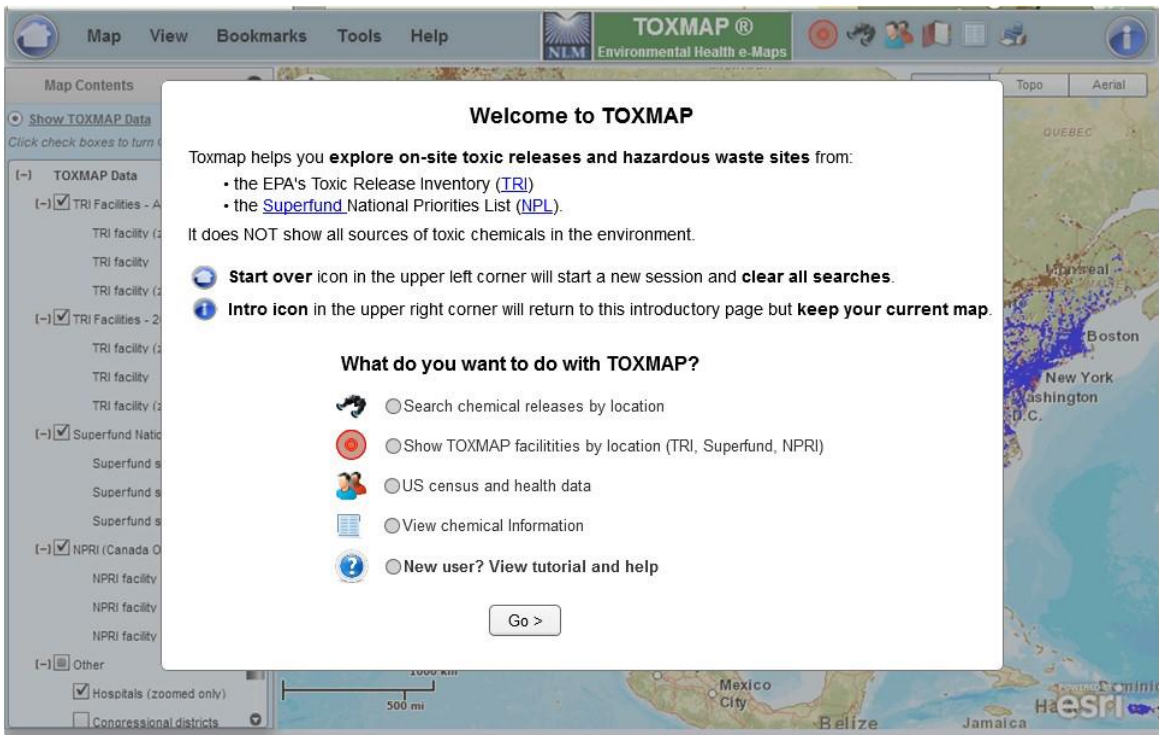

Figure 2: Mockup of alternative welcome screen.

- The welcome screen box is larger (700 x 500px) to indicate its importance and allow for more whitespace (which aids in readability).
- Key words are bolded to assist users in scanning the text.
- The two types of facilities (TRI and Superfund) are bulleted to draw attention to them.
- The information about the "Start over" and "Intro" icons are reformatted for ease of reading. The icons are aligned on the left, with icon name and key function bolded.
- The "What do you want to do with TOXMAP" question is formatted as a header for the options below it, centered so as to make it more prominent.
- Icons for each of the radio button options are included to help associate each function with the icons that are used in the site.
- The ability to browse TOXMAP facilities by either Continental U.S. or City/State/Zip has been changed to "show TOXMAP facilities by location." As recommended later in this report, the ability to decide between Continental U.S. or City/State/Zip could be moved to the "Find Address" feature. This allows the welcome screen to use the "Find Address" icon, which is parallel with the other options.
- An option to view a tutorial and help is included. It is bolded to both draw attention to it and set it apart from the other options, which are features of TOXMAP.

- There is no default radio button selected. This ensures that the user must look through the options to decide which one to select. This will encourage first time users to read through the list, while not being too much of a hindrance for returning users who will quickly be able to select which one they want.
- The "Enter Site" button is relabeled as "Go >." Now the button must be read in context with the radio buttons as it does not imply as much on its own. It is also more strongly visually connected with the radio buttons as it is centered beneath them.

Browsing by Continental U.S. vs. City/State/Zip

As mentioned previously, changing the welcome screen option from browsing the map by Continental U.S. or City/State/Zip to browsing by "location" simplifies the welcome screen and allows the use of the "Find Address" icon. However, users still need the ability to view the map both ways.

Recommendation: In "Quick Search," the state menu defaults to "Continental US," followed by the list of states. Consider treating the state menu within "Find Address" (see Figure 3) like the state menu within "Quick Search" (see Figure 4). Users expect to see all 50 states in a list labeled "State." Though continental US is not a state, it is related to it. By listing it as the default, users will notice it even if they did not expect it. Additionally, this will give a consistent interface to the two places where users can specify locations.

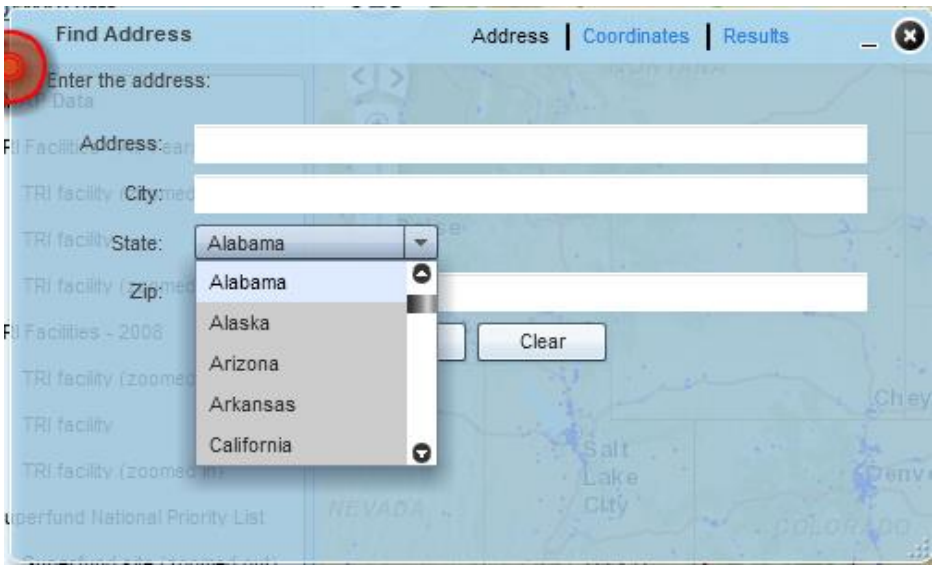

Figure 3: State menu within "Find Address."

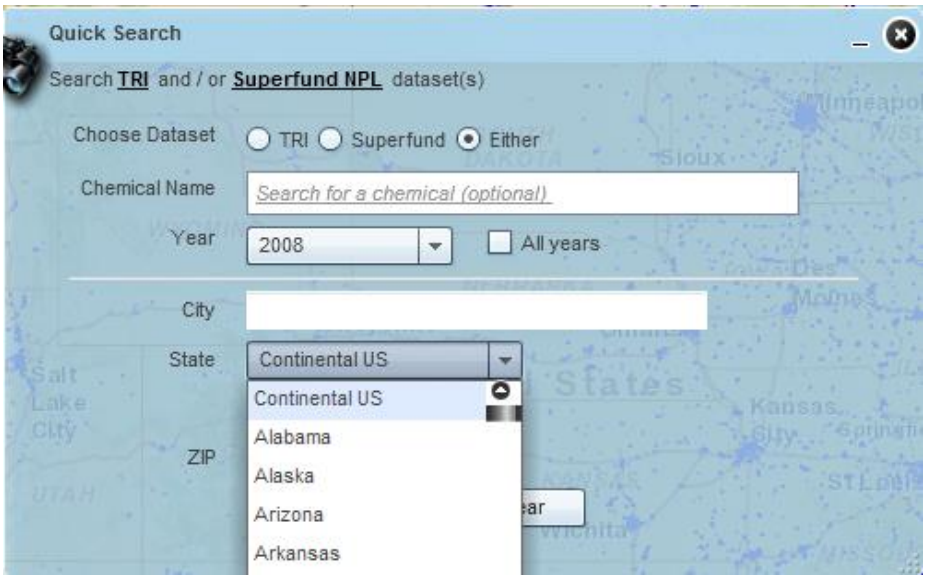

Figure 4: State menu within "Quick Search."

Menus vs. Icons

There were two ways to access the various functions within TOXMAP: a set of menus on the left side of the top bar, and a set of icons on the right side (see Figure 5). The "Tools" menu provided the same functionality as was provided in the icons on the right. Additionally, the "Bookmarks" menu was represented as an icon as well. The "Map," "View," and "Help" menus did not have equivalent icons. Participants often explored the text menus first, and not the icons. This is likely due to the fact that text is more explanatory than an icon and states explicitly what it is, which is more helpful for first time users. However, several participants said that after they became familiar with the tool, the icons would definitely be useful.

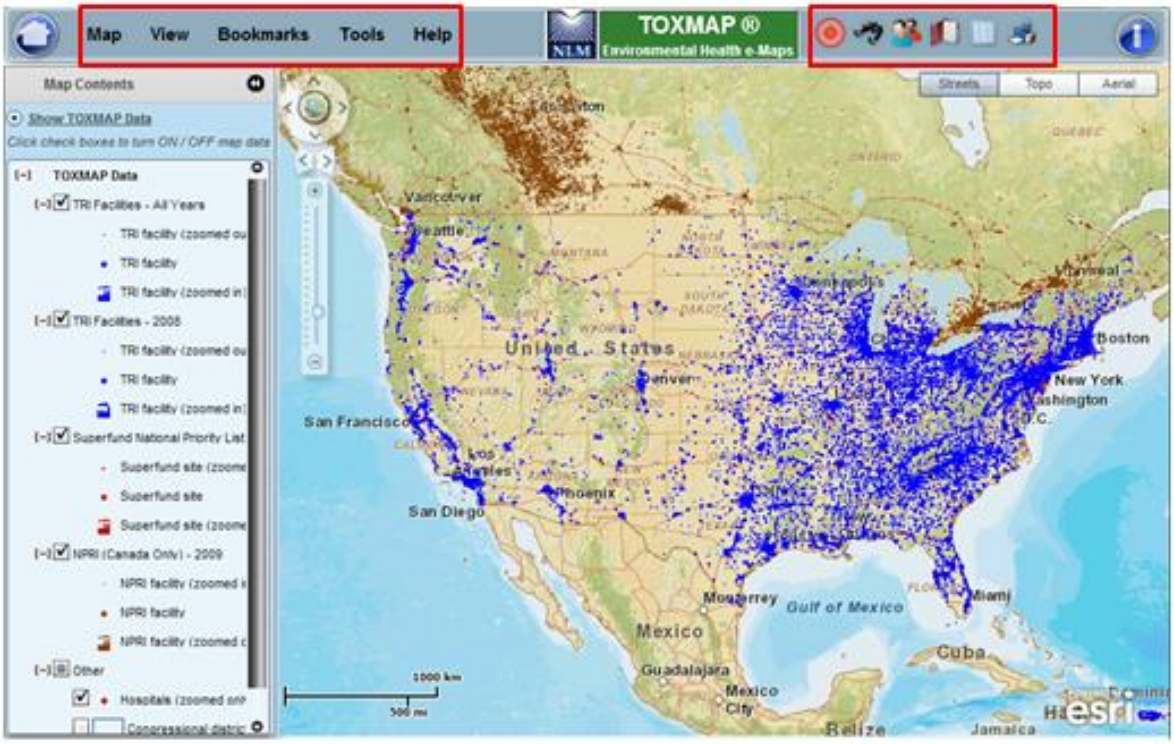

Figure 5: Menus and icons (highlighted) to access the main functionality of TOXMAP.

Recommendation: Two ways to access the same features seems redundant. Since both text and icons are helpful to users, consider removing the text menus and creating a single set of labeled icons for the primary functionality, as shown in Figure 6. "Help" is not shown as an icon since the various help content is currently located in several different spots, requiring a drop down menu to access each one. However, if all help and tutorial information is consolidated into a single location, consider also making the help menu a labeled icon. This would better coincide with the help/tutorial icon on the welcome screen.

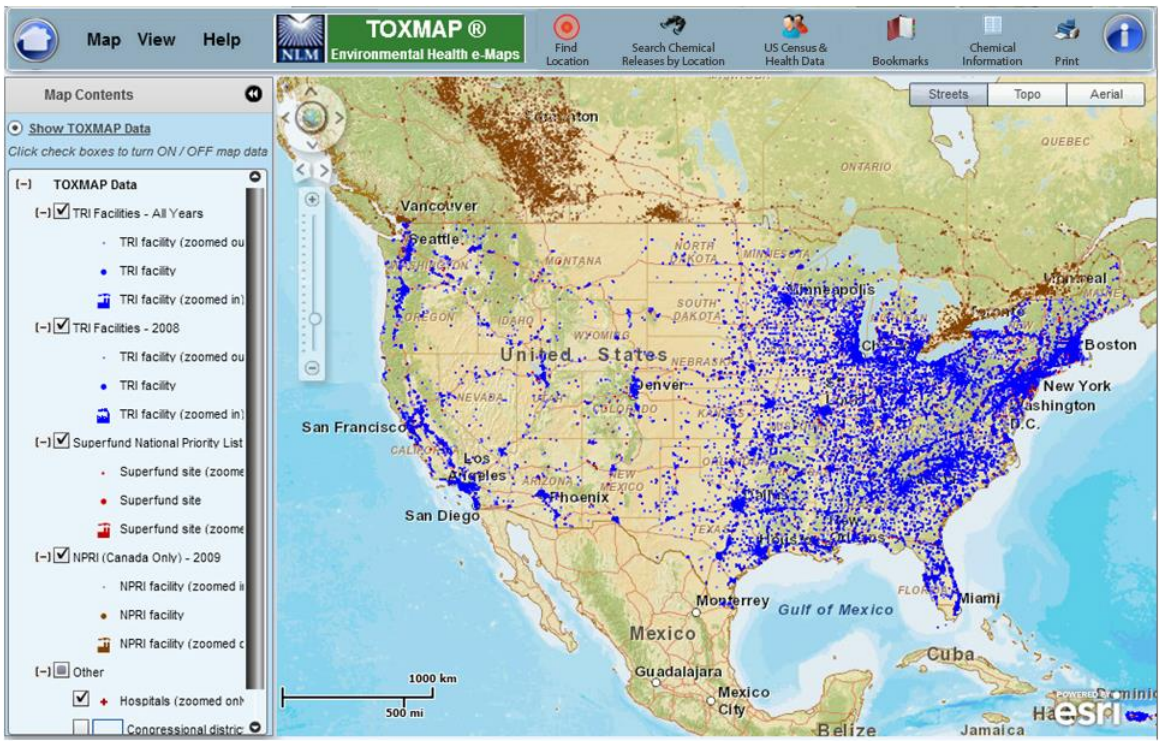

Figure 6: Mockup of labeled icons.

Labels

Quick Search Label

In several tasks, participants were asked to look for release information regarding a particular chemical (e.g., copper releases in eastern Nevada). However, participants often did not think to use "Quick Search." Often they tried "Chemical Information" first. A few participants still did not try "Quick Search," even when they could not find the information anywhere else. This is likely because the label "Quick Search" does not imply the type of search it provides – a search by chemical or location – while "Chemical Information" is clearly about chemicals (and therefore possibly has information about chemical releases).

Recommendation: Consider relabeling "Quick Search" as "Search Chemical Releases by Location." It is not required that the user enter a chemical, in which case they are searching for all facilities. However, if the user simply wants to locate facilities, regardless of the chemicals it releases, they can do so via the TOXMAP Data panel. Since the unique aspect of "Quick Search" is the ability to specify a chemical, adding the word "chemical" to the label may help users better identify it. Additionally, the other important aspect of "Quick Search" is the ability to specify a location to zoom to. If the user specifies neither a chemical nor a location, they are essentially searching for all chemicals in all locations, and therefore the label is still technically correct.

Demographics Label

Participants were asked to locate cancer mortality data, which could be done through the "Demographics" feature. However, most participants did not think mortality data would be included in demographics, and therefore they often did not find it.

Recommendation: Consider relabeling "Demographics" as "US Census & Health Data."

Displaying Panels on the Screen

Default View

When the user enters the site with the default "browse" option selected (as many participants did), the screen shows the map with the "TOXMAP Data" panel visible (see Figure 7). Some participants were more willing to explore than others, but for those who were not, they saw the "TOXMAP Data" panel and assumed that was all they could do with the map. The browse feature allows users to view different types of facilities, and clicking on the facilities brought up release information, among other things. This seemed to satisfy users who did not know what features to expect.

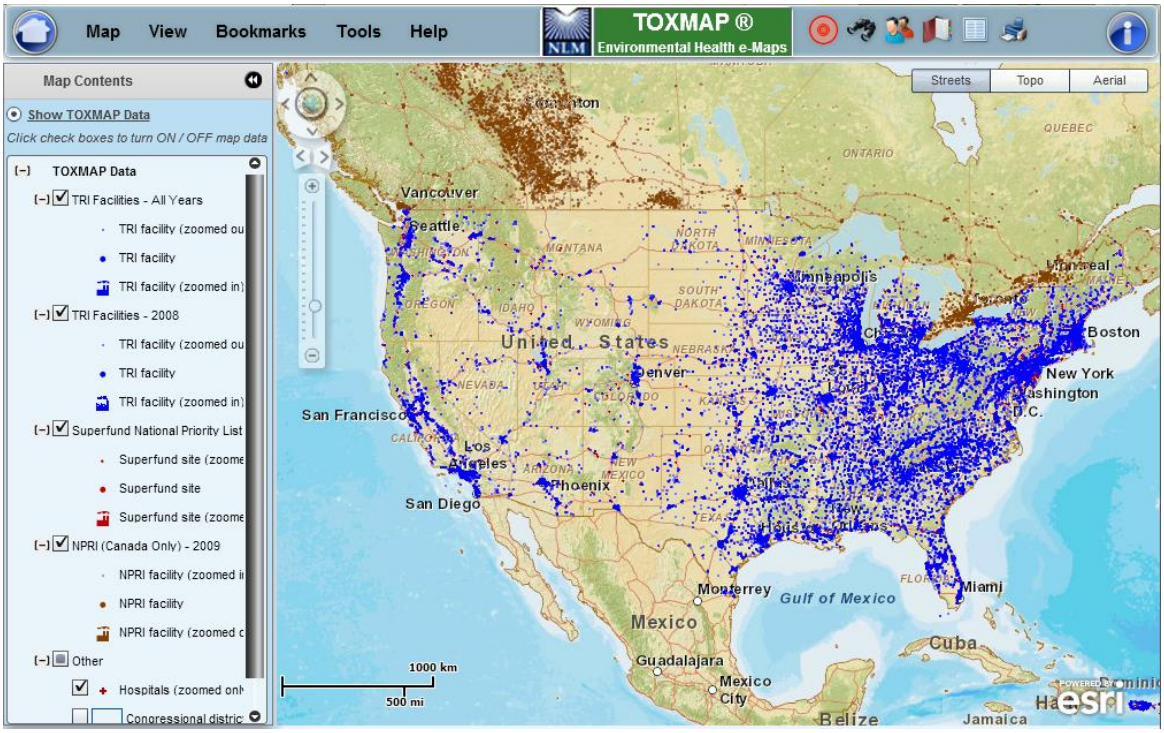

Figure 7: Browse TOXMAP facilities in Continental US.

Recommendation: Consider always displaying the screen with both the "Show Quick Search" and "Show TOXMAP Data" radio buttons visible so users immediately realize that there are more options for viewing data than just the "TOXMAP Data" panel (see Figure 8). When the user has not run a search, the default search results could be shown as the equivalent of the

TOXMAP Data by searching all facilities, all years, with no specific chemical selected. Additionally, consider changing the labels of the two radio buttons to be more explicit and better match the labels used on the welcome screen and icons (e.g., “Show Chemical Releases” and “Show TOXMAP Facilities”).

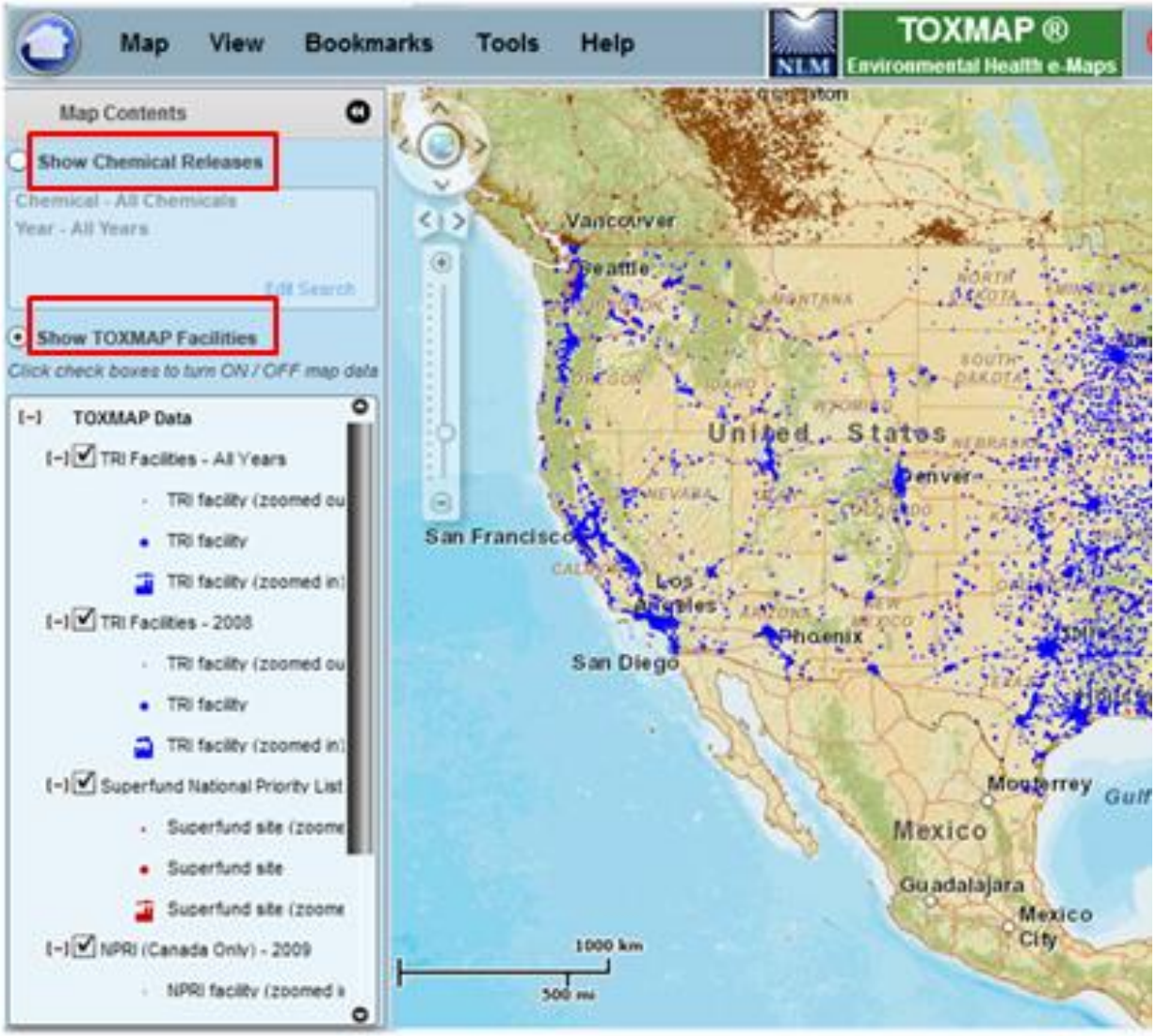

Figure 8: Panel with radio buttons for both Quick Search and TOXMAP Data (highlighted).

Two Panels at Once

Once participants started exploring the site and discovered Quick Search, a new “Search Results” panel appeared on the right side of the screen (see Figure 9). This resulted in one active panel (Search Results) and one inactive panel (TOXMAP Data), with the ability to switch between the two data sets embedded in the left panel as radio buttons.

Figure 9: Quick Search results panel on right.

Many participants did not realize that the data sets in each of the two panels were unrelated – that they could use one or the other, but not both. They also failed to locate where they could switch from one to the other. Since both panels were displayed, they wanted to interact with them both. Participants would often try to uncheck the facility types in TOXMAP Data as they were viewing Search Results.

Recommendation: Consider combining both panels into a single panel, on either the left or right side of the screen, with the ability to collapse/hide the content that is not applicable to the user's current task. For example, Figure 10 shows what the panel might look like when the user is viewing Search Results. Figure 11 shows what the panel might look like when the user is browsing TOXMAP facilities. Since they are separate activities, the user can never see both the Search Results and the TOXMAP Data at the same time. This focuses the user's attention on their current task, rather than requiring them to split their attention.

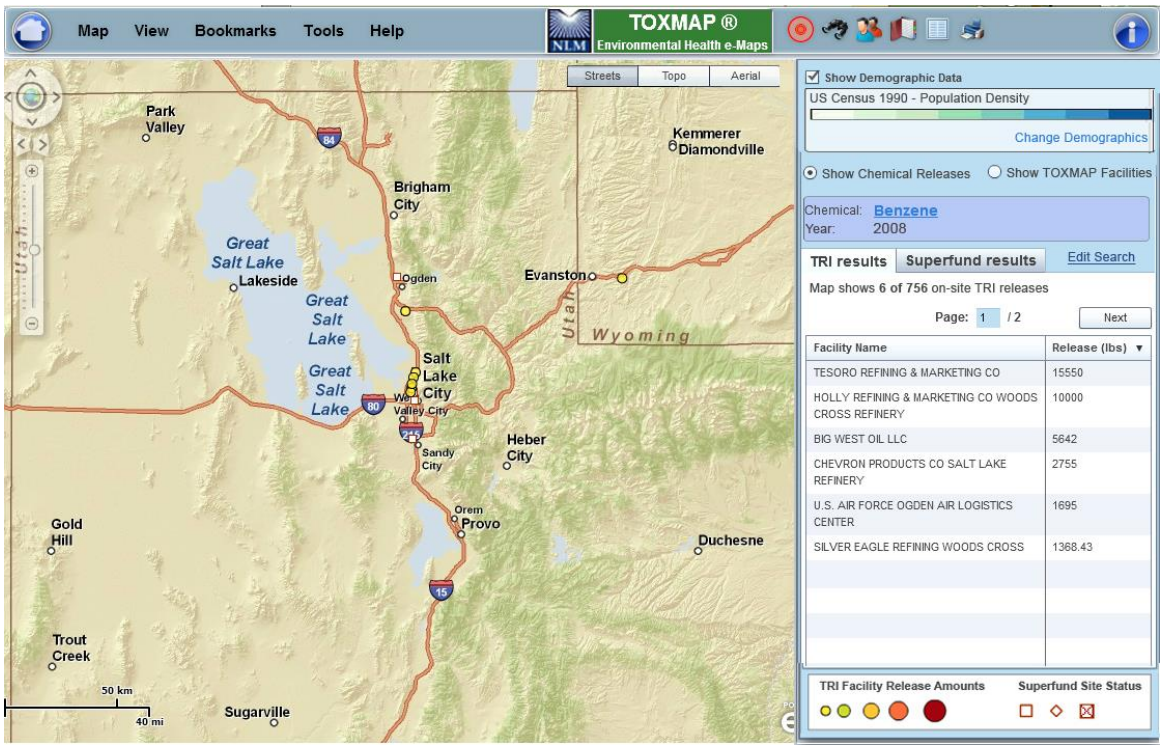

Figure 10: Mockup of combined panel, showing Search Results.

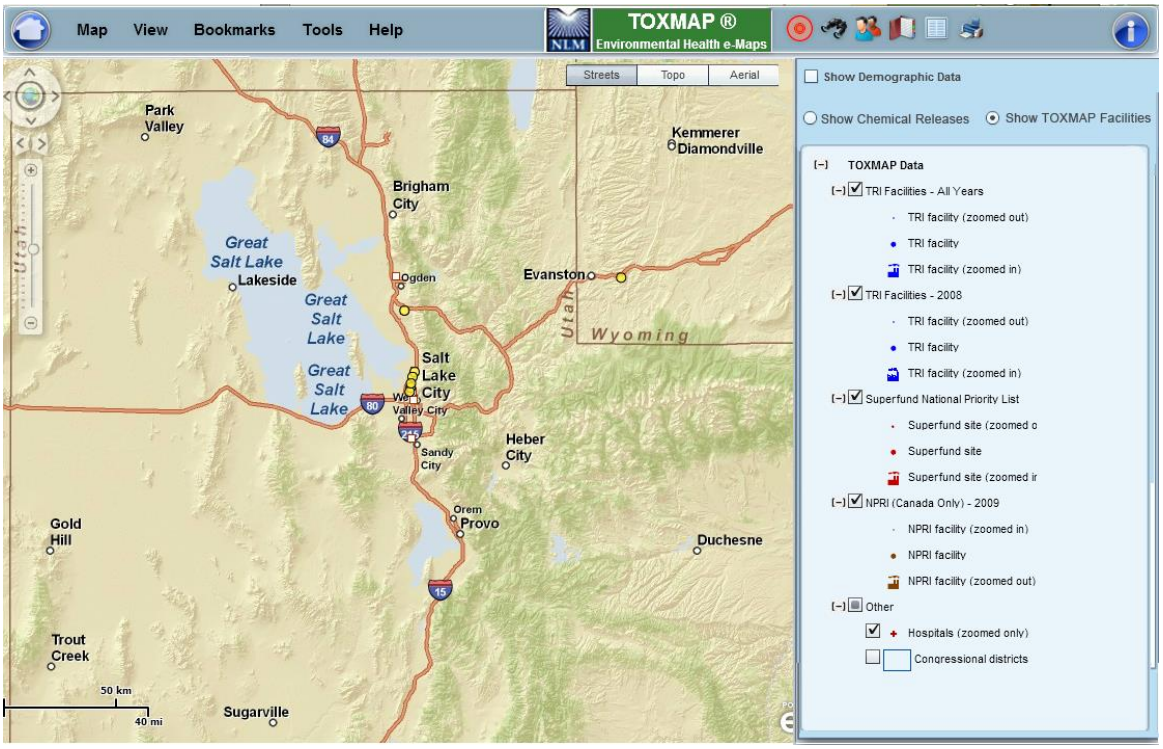

Figure 11: Mockup of combined panel, showing TOXMAP Data.

Search

TRI and Superfund Tabs

When the user performed a search and chose to show both TRI and Superfund sites, the Search Results were shown in two tabs (see Figure 12). Participants often did not notice the two tabs. For those who weren't familiar with the difference between TRI and Superfund sites, it was even more confusing. When the option to show both types of sites is selected, the map always displays both TRI and Superfund sites. However, the table only shows results (and therefore the legend) for only one type of site at a time. This can be confusing since there is no visible legend for some of the icons on the map.

Figure 12: TRI and Superfund tabs (highlighted) in Search Results.

Recommendation: Consider reformatting the search results to make the tabs visually more apparent and have both legends (TRI and Superfund) combined into one, when viewing both TRI and Superfund sites (see Figure 13).

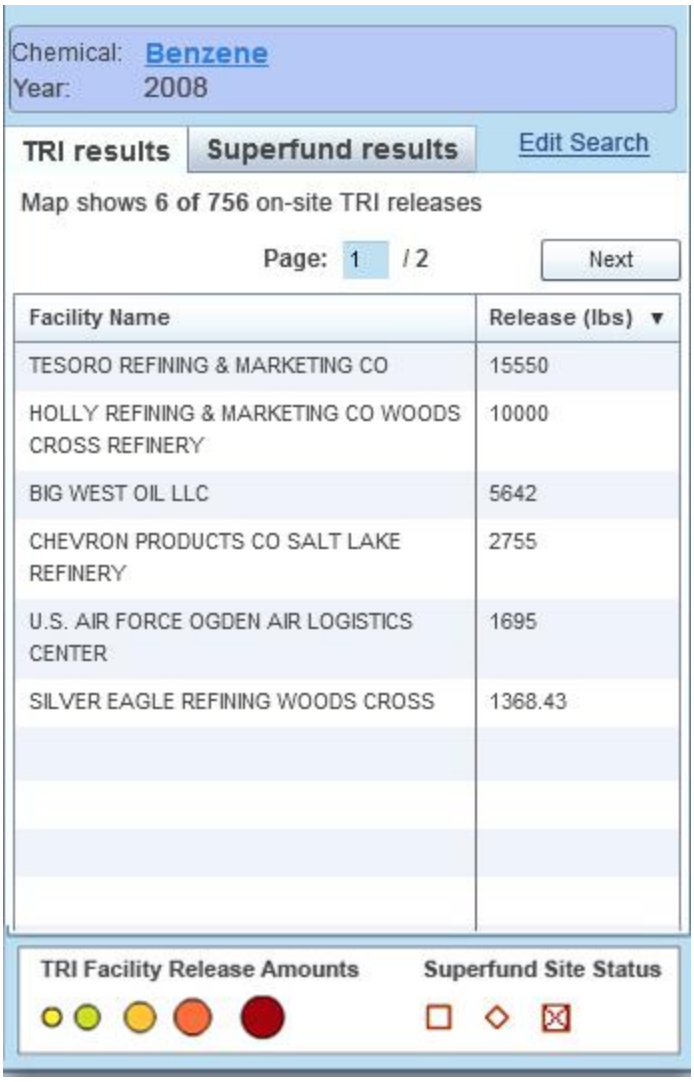

Figure 13: Mockup of Search Results.

In Figure 13, since the chemical name and year apply to both TRI and Superfund sites, that information has been pulled out above the tabs. The tabs are then visually connected to the white box below it that displays the results. The legend, which now applies to both tabs, is visually separated from the tabs and is in its own box. Additionally, the legend labels are explicit in what they refer to and tie into the tab labels (i.e., "TRI Facility Release Amounts" and "Superfund Site Status").

Understanding the Table of Results for the Quick Search

The Quick Search table of results was displayed with a row allotted for every facility across the country that matched the chemical named in the search. Those rows are ordered by release amount (high to low) and are paginated; 500 rows are allotted per page. However, only the facilities located in the visible part of the map are displayed in the table. The result of this situation is that many empty placeholder rows and usually only a few facilities show up on any page. Thus, the user who has searched for a chemical might have to move through

many pages, each of which shows none or only a few facilities in order to see all facilities within the visible map area. Participants, not unexpectedly, did not understand this and were therefore quite confused by the table and often did not see all the applicable results.

The situation was further complicated when participants moved the map. Moving the map caused changes to the contents of the Table of Results and resulted in confusion—especially if the map was moved inadvertently. Participants did not realize that the map position was determining exactly what they were seeing in the Table.

Recommendation: Ideally, the table of results would include only what is visible on the map, ordered by release amount. However, it is understood that this may not be possible while still maintaining the responsiveness of the map. If that is the case, consider adding a link to an explanation of how the table works (e.g., "How to use this table"). A text link is preferable to a help icon, as it can explicitly state what information it will provide, and help icons are often ignored. However, note that even with a text link it is likely some users will ignore it.

In the explanation, consider including the following information (perhaps with visual aids):

- Results are ordered by release amount country-wide, with 500 results per page.
- The empty rows indicate facilities outside the visible area of the map.
- The rows with data indicate facilities inside the visible map area.
- Facilities inside the visible map area may have small releases and therefore may be located on later pages.
- If the user chooses to search for both TRI and Superfund sites, the results are in different tabs.
- Upon doing a search, the Search Results panel appears, possibly overlaying a portion of the map that was previously visible. Therefore, the map may need to be adjusted to find facilities of interest.

Search Parameters

Several tasks required participants to locate chemical releases in a particular area. When participants selected a state, they expected the Search to *limit* the results to only those within that state. Instead, results from the surrounding states that were visible on the map were shown (see Figure 14). Participants did not realize that entering a location in Quick Search zooms the map to the specified location, but does not limit the Search Results to the specified area.

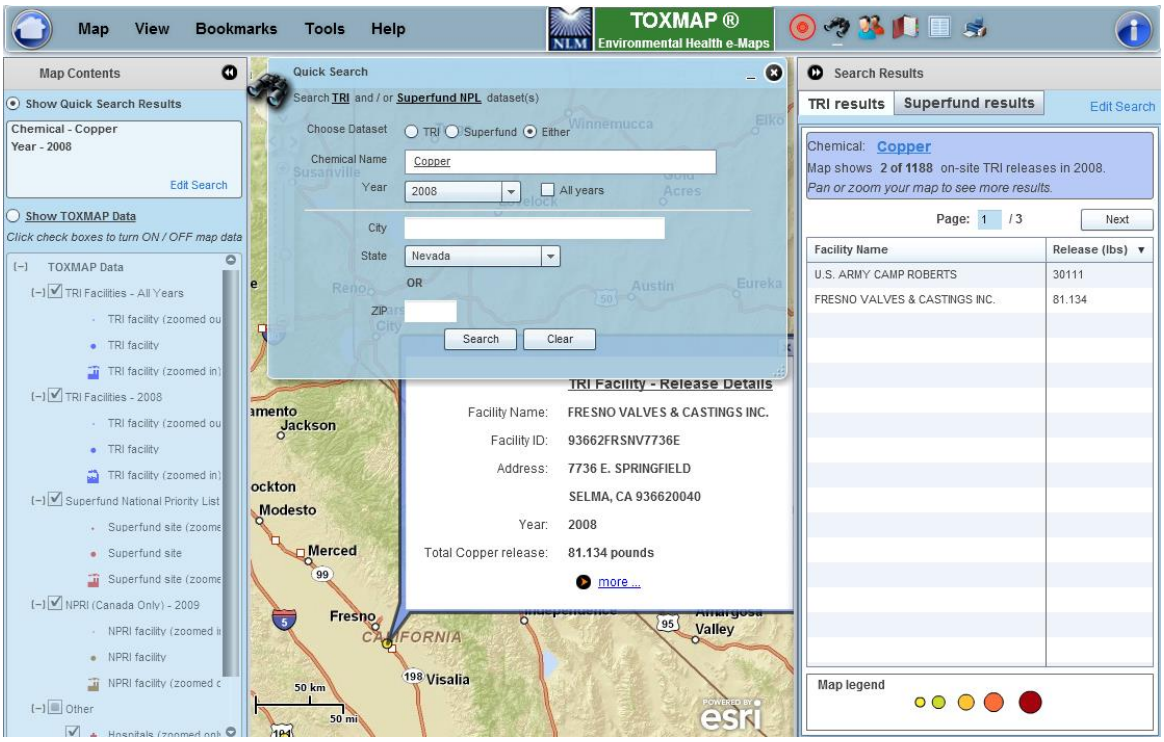

Figure 14: Search results when Nevada was specified as the state.

Recommendation: Consider adding a label to the Quick Search box that says "Zoom map to:" above the location fields. Additionally, consider adding a checkbox next to the state menu that would allow users to limit the results only to the currently selected state.

Clear

The Quick Search box has a "Clear" button that clears all the fields in the box. When participants wanted to change their search criteria, however, they never used the clear button. Instead, they just changed the criteria. It's also possible that some users may think the "Clear" button will clear the Search Results, rather than the form fields.

Recommendation: Consider removing the clear button.

Closing Facility Pop-Ups

The facility pop-up boxes would often open in such a way that the close button was not accessible (see Figure 15). Participants often tried clicking outside the box, dragging the box, or clicking on another facility in an effort to close the box.

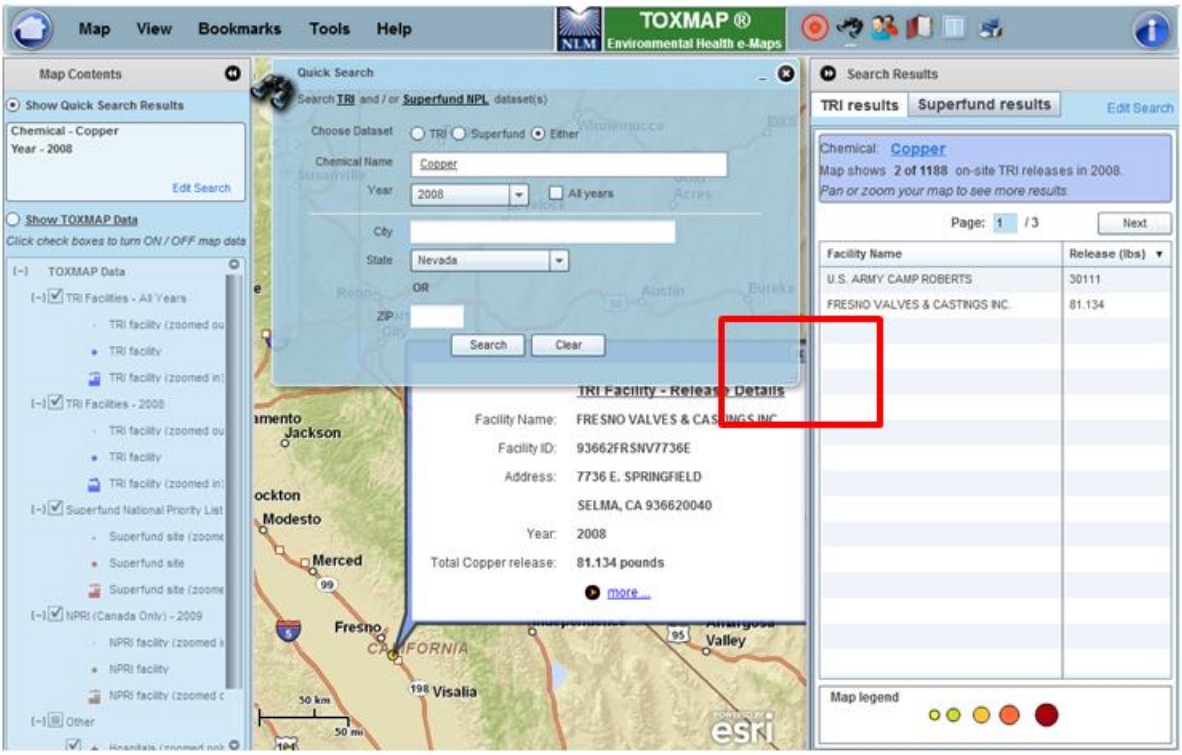

Figure 15: Inaccessible close button (highlighted) on a facility pop-up box.

Recommendation: Consider adding a "Close" link to the bottom of the box as an alternative way to close it. This will increase the chances that either the close button or the close link is accessible at all times.

Demographics

Instructions for Demographics

The Demographics box has a line of instructions and a note at the top (see Figure 16). The first line says three things in one sentence: that the user needs to click an item for it to show up on the map (which seemed pretty obvious to participants), that it shows county-level data, and that only one layer can be shown at a time. The information about only one layer being visible at a time was added part of the way through testing after several participants asked whether or not they could view multiple demographics at once. Finally, there is a note that explains that a co-occurrence of a substance and particular health problem does not necessarily imply one caused the other. This note applies only to the mortality data, but is visible across all tabs.

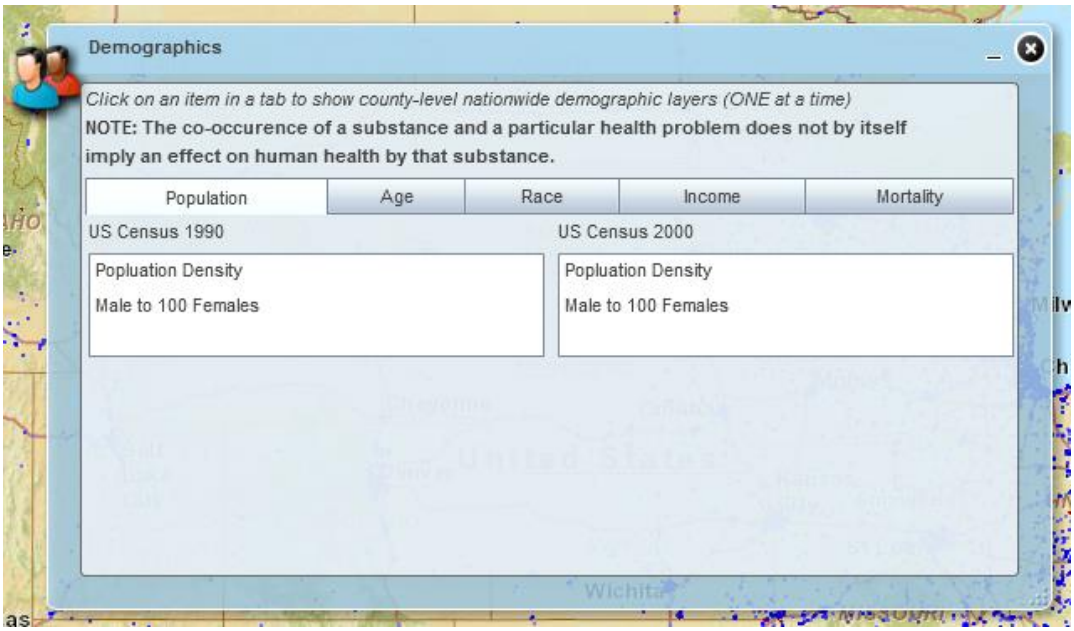

Figure 16: Demographics box.

When participants were zoomed in closely and they added a demographic layer, the background often only showed a single color (see Figure 17) and participants did not realize what happened despite the information about county level data. They had to be prompted to zoom out to see more data.

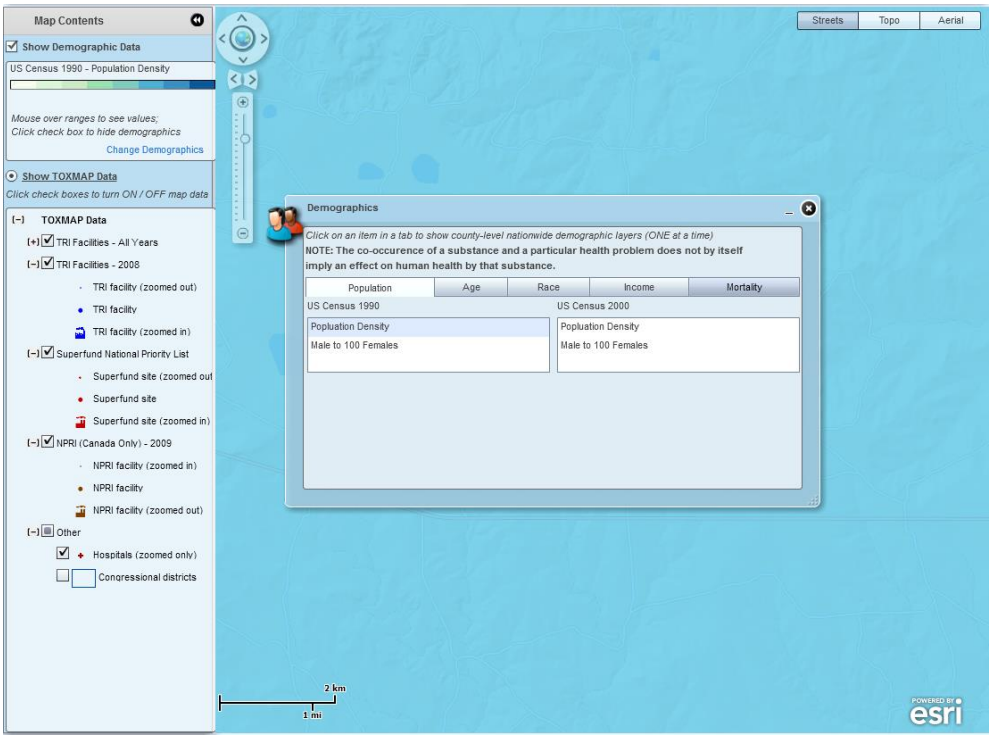

Figure 17: Demographic layer can be only one color when user is zoomed in.

Recommendation: Consider un-italicizing the instructions and bulleting the two main points: that only one layer is visible at a time, and that the data is at the county-level and therefore the user may need to zoom out to make sense of the data (see Figure 18). Additionally, since the note about co-occurrence applies only to the mortality tab, consider showing it only on that tab (see Figure 19) and on any relevant tabs that may be added in the future.

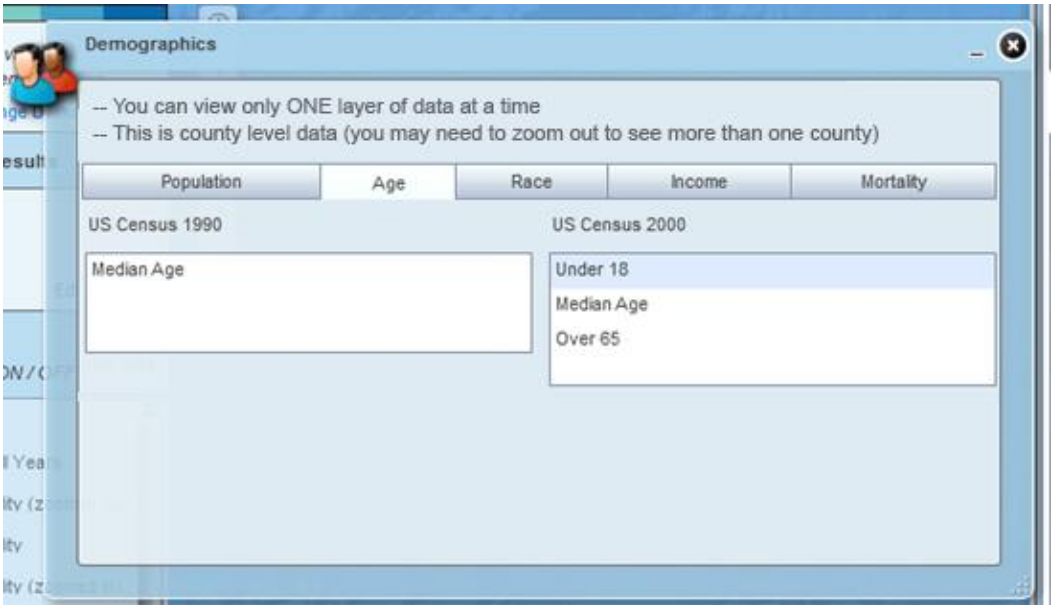

Figure 18: Mockup of demographics instructions.

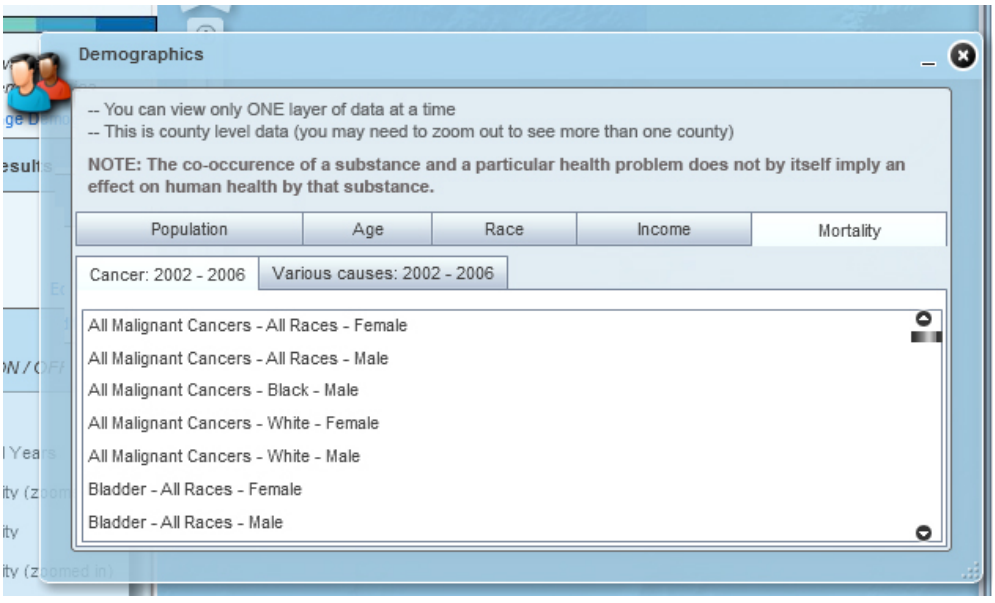

Figure 19: Mockup of mortality tab.

Explanation of Mortality Categories

Due to the nature of the mortality data, the mortality options within demographics are divided up by female and male (see Figure 20). It is not possible to view combined cancer data for everyone, regardless of sex. However, this is a task that users might commonly want to do. One participant, who was interested in the data, said she would keep exploring the site for a way to get combined data. If it was impossible to do so, she wanted it to explicitly tell her that so she would not waste time.

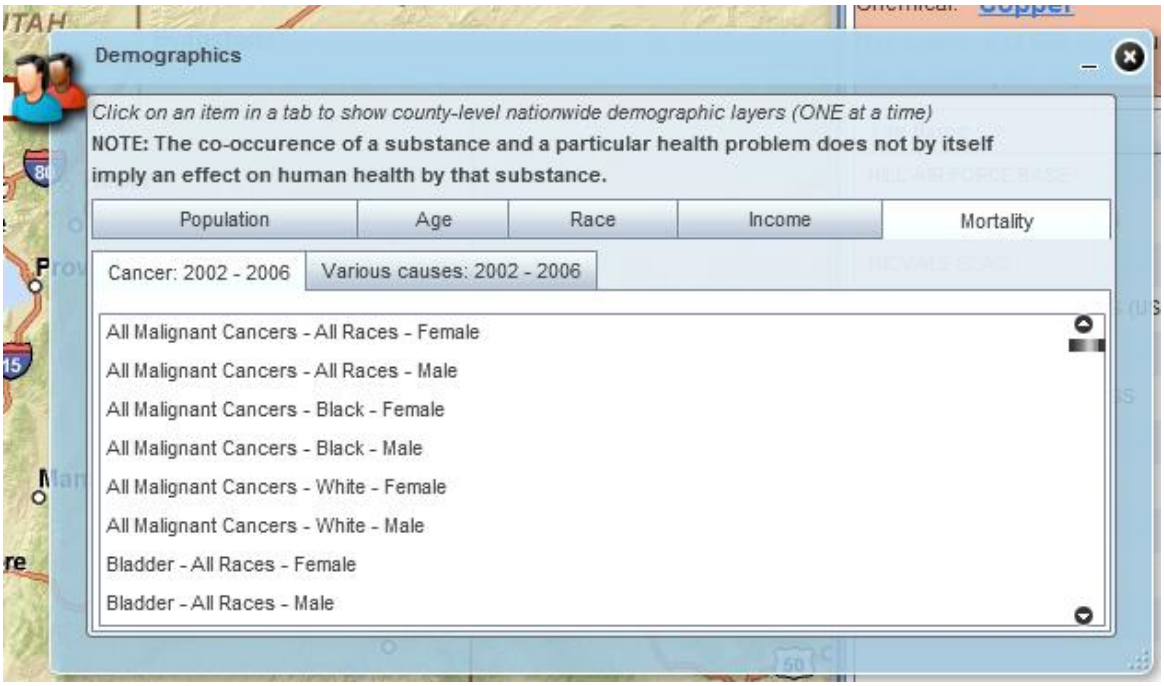

Figure 20: Mortality options within Demographics.

Recommendation: Consider including a link to either a section of the help pages or a pop-up/roll over message that explains why it is not possible to view male and female data together.

Mouse-Over Legend

The demographics legend had an instruction telling the user to "mouse over ranges to see values" (see Figure 21). Some participants did not notice the message, and others thought it meant to mouse over the map itself. In addition, requiring the user to mouse over the legend to view the values meant that the user either has to remember the ranges (requiring memory resources) or mouse over it every time they want to reference it (requiring extra time and action).

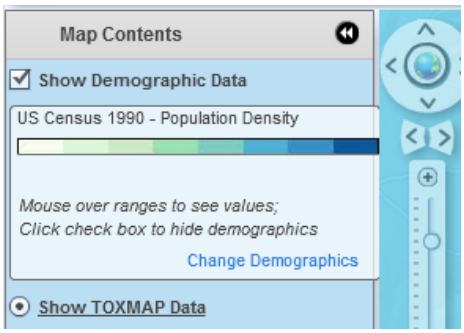

Figure 21: Demographics legend.

Recommendation: Consider displaying the legend vertically with the color block on the left and the range it represents written to the right of it. If space is an issue, consider displaying it in two columns.

Legend Scales

Each demographic has a different scale (e.g., age, dollars, percentage), but the scale is not always indicated in the legend roll-overs (see Figure 22). For example, race is defined with percentages, but population, age, income, and mortality are not defined with their respective scales.

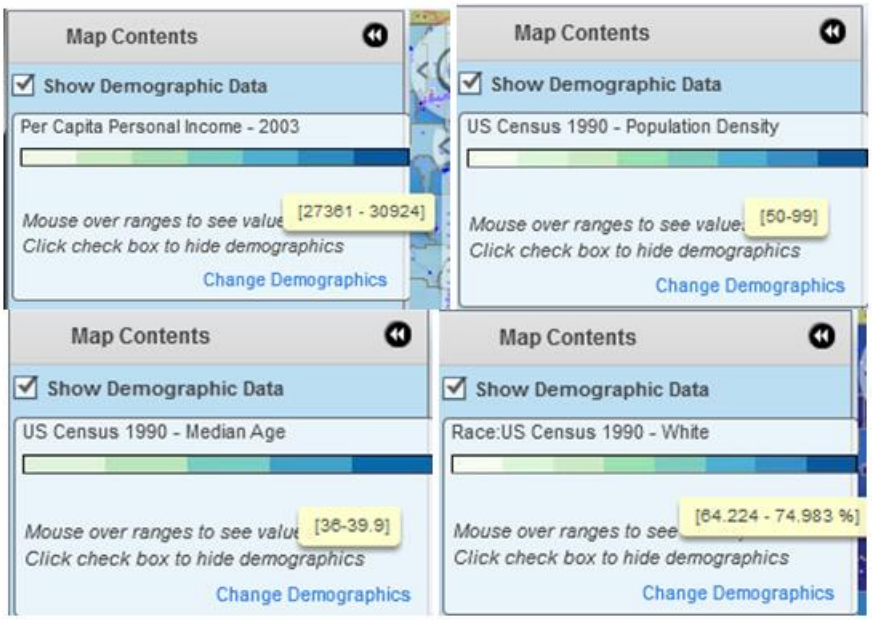

Figure 22: Examples of legend values.

Recommendation: Consider listing the scale for each demographic type (e.g., years old, $, %, people).

Removing the Demographic Layer

Some participants had difficulty figuring out how to remove the demographic layer; this is accomplished by un-checking the "Show Demographic Data" checkbox in the left panel. Participants often re-opened the demographic pop-up box thinking they could remove it there. When that didn't work, some participants eventually noticed the checkbox.

Recommendation: Consider adding a "Clear" button to the demographics box which would clear the demographic data from the map. This would provide an additional way to clear the layer (keep the checkbox in the left panel as a method). However, if this is done, note that it would behave differently than the current "Clear" button in Quick Search which could be confusing. As noted above, presently the "Clear" button in Quick Search only clears the box used for selecting criteria. Therefore the button in Quick Search would either need to behave consistently with the button in Demographics, or be removed.

Chemical Information

The Chemical Information box contains a scrolling list of all chemicals (see Figure 23). Participants sometimes had difficulty scrolling to the right chemical in the list (i.e., they would accidentally scroll past it several times). The shorter the height of a scroll box, the more difficult it becomes to use effectively. In addition, some participants said they would have preferred searching for chemicals in the list.

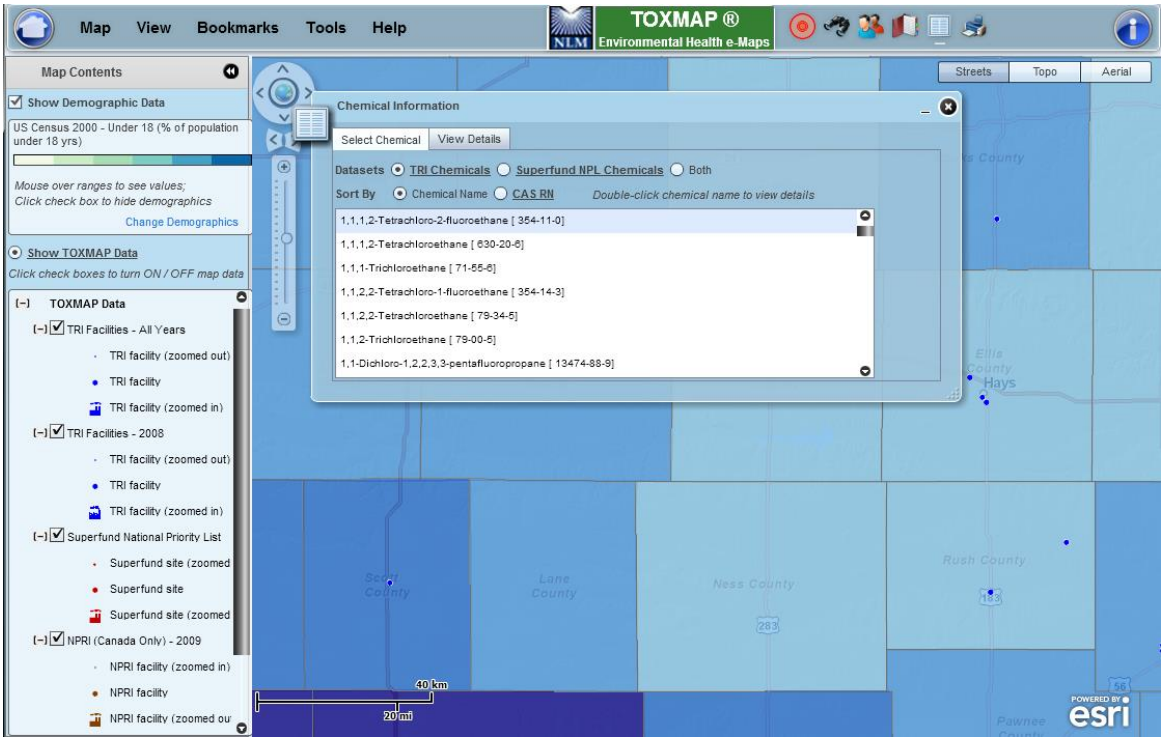

Figure 23: Chemical Information box.

Recommendation: Consider adding a lookup box above the full list of chemicals that would narrow the full list down as the user types – similar to what is done in Quick Search (see Figure 24).

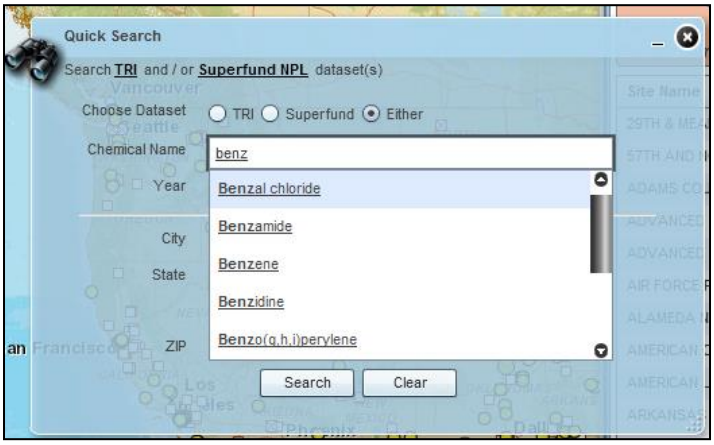

Figure 24: Quick Search with lookup box for chemical name.

Miscellaneous

Hospital Icons

The hospital icon is a red cross, which looks similar to the red dot used for Superfund sites when the map is zoomed out. Some participants mistook the hospital for a Superfund site.

Recommendation: Consider using a different color or icon for the hospitals.

Commas in Numbers

Some participants had a difficult time reading the numbers for pounds released in the Quick Search results table due to the lack of commas.

Recommendation: Consider adding commas to all relevant numbers throughout the site.

Opening Minimized Icon Boxes

Each of the main icon boxes provides the ability to minimize it. When minimized, the box slides closed and the icon remains overlaying the map (see Figure 25). Clicking on the minimized icon will re-open the box, as will selecting the tool from the Tool menu. However, clicking on the icon in the icon bar, which is what most participants tried to do, does not re-open it.

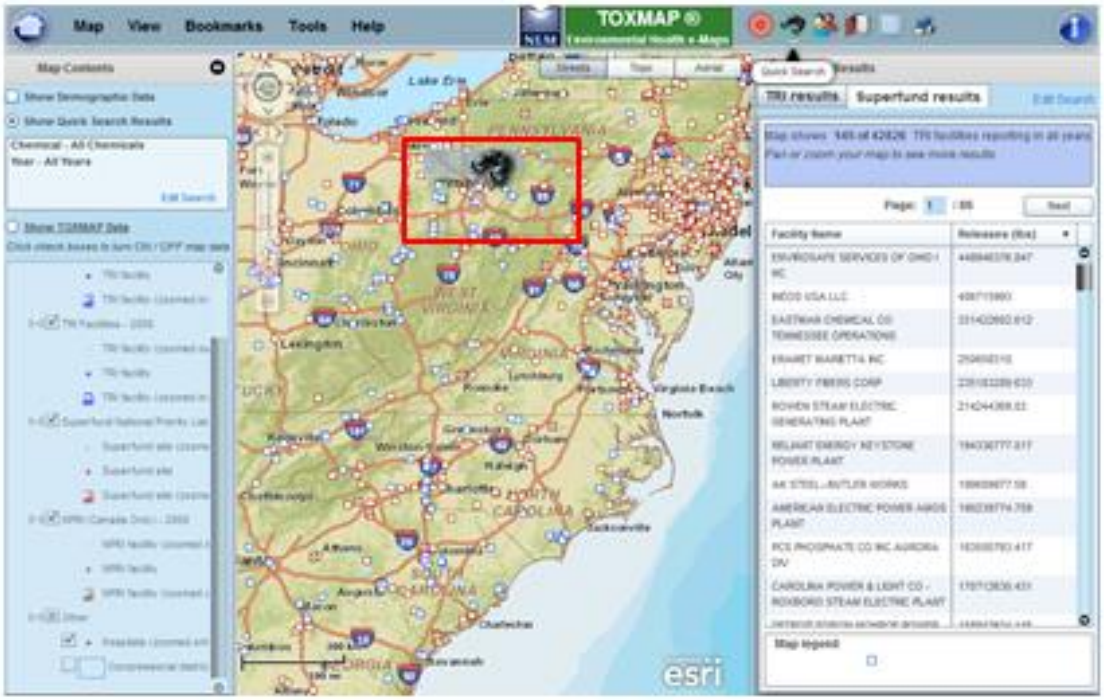

Figure 25: Icon (highlighted) for minimized Quick Search box.

Recommendation: Consider expanding the minimized box when the icon in the icon bar is clicked.

Print

Participants had different expectations for what the print function would print. Some participants thought it would only print the map, some thought it would only print the table, and some thought it would print both.

Recommendation: Consider allowing users to choose what they want to print (table, map, or both). If that is not possible, tell the users in a print dialog or preview page what will be printed so they know what to expect. Whatever is printed should probably not include the surrounding map interface (e.g., menu/tool bars, open icon boxes, etc).

Collapsing the Side Panels

Each of the side panels (i.e., Map Contents and Search Results) can be collapsed by clicking on a double arrow icon (see Figure 26). Several participants clicked the arrows on the Search Results panel when looking for a way to edit the search. Arrows are typically used to indicate that the user will be taken elsewhere (e.g., new page, new window, etc.), whereas a minus sign (-) typically means something will collapse (e.g., as is done in the TOXMAP Data list of checkboxes).

Figure 26: Double arrow icon (highlighted) that collapses the side panel.

Recommendation: If collapsible panels are used, consider using a different icon, such as a minus sign. However, if the minus is used, when the panel is collapsed the icon would need to change to a plus sign (which indicates expand).

Underlining the Title on the TRI Facility Box

On websites, underlined text is typically used to indicate a link. The title of the facility pop-up boxes, "TRI Facility – Release Details," is underlined (see Figure 27), causing at least one participant to click on it, expecting it to go to more information.

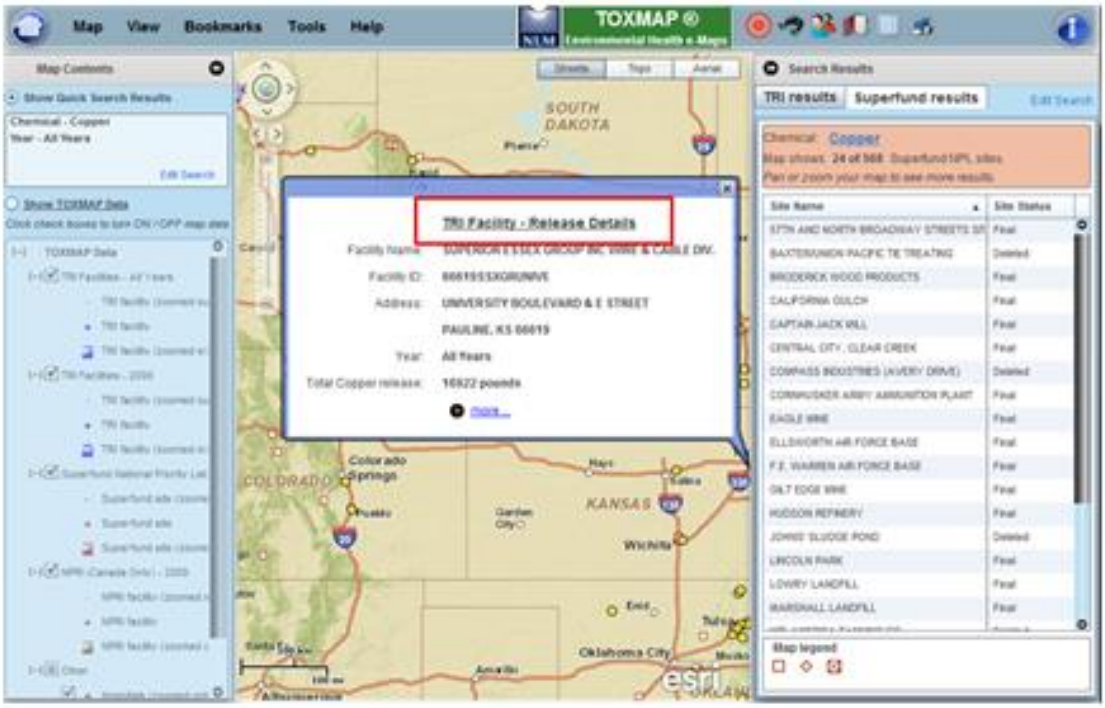

Figure 27: Facility pop-up box title (highlighted).

Recommendation: Consider removing the underline from the title.

Pop-Up Blocker

Several participants had an active pop-up blocker running. When the browser message was activated that asked if they wanted to allow pop-ups, they chose to allow them. However, doing so restarted the entire session, causing them to lose any progress they had made with TOMAP (positioning the map, obtaining Search Results, etc).

Recommendation: Since it is not possible to control how the pop-up blocker works, consider telling users before they enter the site (either on the welcome screen or on a page that launches the tool) that they should allow pop-ups (with a link explaining how to do so).

Why 2008 Data?

Some participants wondered why the TOXMAP data checkboxes gave the option of showing facilities in 2008, along with "all years" (see Figure 28). They did not realize that the 2008 year data was the most recent available since such data has not been checked and vetted for use in the map until about 1-2 years after it is collected.

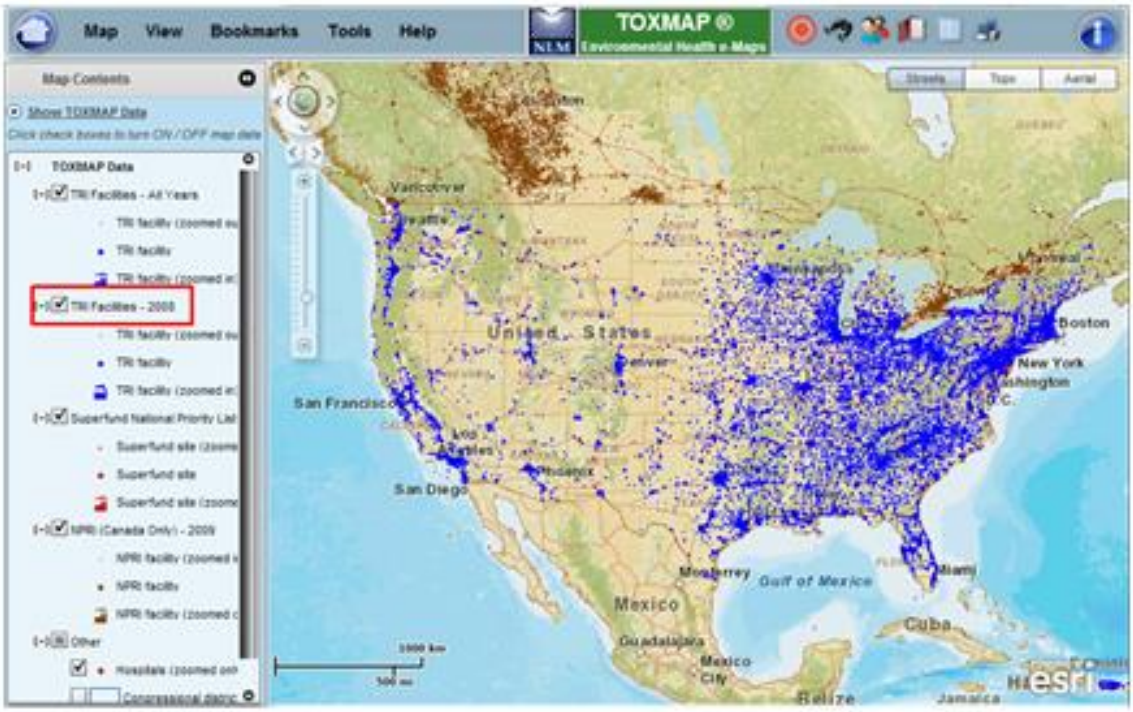

Figure 28: TRI Facilities label for only the most recent data (highlighted) in TOXMAP Data panel.

Recommendation: Consider adding "(latest year)" to the TOXMAP Data labels that list specific years (e.g., "TRI Facilities – 2008 (latest year)").

Suggestions for New Features

Participants had several suggestions for additional features, including:

- Adding street names on the aerial view of the map.
- Ability to search for multiple chemicals at once.
- Including EPA monitoring sites.
- A persistent search box (though if suggested changes are made, this may alleviate the need for that).
- Ability to export Quick Search Results and map (not just print).

Information from the Participants

Evaluation of the Learning Curve

At the end of the session, participants were asked what they thought of the learning curve for TOXMAP (i.e., easy or hard). There were four participants who had previous experience with TOXMAP or similar GIS sites. These participants felt the learning curve was fairly easy. The remaining participants were closely divided, saying the site was hard or moderately hard to use. As is typical with usability tests, participants seemed to have more trouble actually

using the site than their evaluations reflected. However, the overall impression seemed to be that once a person became familiar with the site it would be easier to use and understand.

Need for Additional Information

Most participants felt that information for a first time user (such as a tutorial) would be helpful.

Recommendation: Consider using the following topics –appropriate at the time of the usability test, but which may need modifications by the time the site is released—in the tutorial:

- How to get back to Welcome/Intro screen.
- How to switch between Quick Search and TOXMAP Data.
- How to determine what TOXMAP Data the user is seeing and how to turn layers off.
- How to determine what the user searched for in Quick Search, and how to edit the search.
- How to use the Quick Search results table.
- How to turn on/off Demographics.
- How to open/close/minimize icon windows.
- How to open, use, and return from external sites linked to from Chemical Information.
- How to collapse/expand side panels.
- How to use all features (use examples).
- Information addressed in this report that has not been mentioned above (e.g., "only one demographic layer at a time") when decisions have been made about changes.

In addition, it is recommended that information be provided for users of the previous TOXMAP; it should highlight areas of possible confusion: those capabilities that have changed or those capabilities that have not yet been included in the new version.

CONCLUSION

Overall, participants liked the visuals, interactivity, and responsiveness of the map. In addition, they liked the content and amount of information provided. Participants who were familiar with the previous TOXMAP or other GIS sites had an easier time using it, while the learning curve for other users was fairly steep.

Some of the issues discussed can be addressed through fairly minor updates, while others will require more extensive changes to the design. The presentation of the Search Results seems to be the most critical issue to help users interpret the map correctly, and the situation will probably require the most amount of work to resolve. Changing the design from a two-panel display to a consolidated single panel will likely have the largest positive effect on users' ability to discover and understand the various features.

This concludes UCD's effort on this usability evaluation project of TOXMAP for the National Library of Medicine's Division of Specialized Information Services.

APPENDIX A: FACILITATOR'S GUIDES

Facilitator's Guide for Usability Testing

TOXMAP with Concerned Citizens

July 2011

Submitted to:

Colette Hochstein

National Institutes of Health

National Library of Medicine

Specialized Information Services

TOXMAP

hochstec@mail.nlm.nih.gov

Submitted by:

User-Centered Design, Inc.

20548 Deerwatch Place

Ashburn, VA 20147

(703) 729-2370

www.user-centereddesign.com

[Note: The purpose of this document is to guide the moderator. The questions and tasks contained herein may not be asked as written. The facilitator often draws on participant comments and the natural flow of the testing process to determine the flow of the session. While the facilitator will try to follow the order of the guide, many times tasks will come up ahead of time or in different order. The facilitator may allow the order of the tasks to change in order to let the process flow naturally.]

Pre-Test

[Administer the informed consent]

Introduction

Thank you for agreeing to participate in this study. Do you have any questions for me before we get started?

There are a few things I'd like you to keep in mind while we work. The first is, this is not an evaluation of you or your knowledge. This is an evaluation of the design you will be working with today. I will be trying to evaluate the design through your eyes. I'll give you some things I'd like you to try to do and then see if you have any difficulty accomplishing them. Mostly I will just watch you work but I'm also here to answer any questions if I need to although I may let you keep working on your own before I answer you. At times, I may ask you some direct questions, but this is not to test you but to see if the website is giving you the answer that it is supposed to. In other words, I am testing the website, not you. So you can't make any mistakes.

The second thing I would like you to keep in mind is that I didn't design what you will be working with today so you can't hurt my feelings. I want you to feel free to praise or criticize the design as you see fit. If there are areas of concern or things you don't like, feel free to talk about them. That way, we might figure out a way to make the website better. And I want you to know that the website is not finished. The creator is still working on it so we may run into some not quite perfect parts.

Finally, I'd like you to know that I have a colleague with us today taking notes for me. There [may be/are] other people who are observing today as well. Don't worry about them. You and I will work on this together and they'll just watch.

[To verify that we know actual information about the participants (and their background) and to get them comfortable with talking in this strange situation, we'll have them talk about subjects that they are comfortable with. Participants will be [concerned citizens or professionals, e.g., toxicologists, researchers, or public health professionals]

[Concerned citizens] Before we actually get started, I'd like to know a little bit about your background.

- What sort of work do you do?
- We are told that you are interested in the impact of toxic chemicals on the environment and the climate. How did you come into this interest?
- Have you joined any groups or done anything special to further your knowledge about these issues?
- Have you ever searched for geographic based information about hazardous chemicals or threats to the environment? Tell me about it.

- Have you ever used the TOXMAP website? [If yes] When was the last time you used the site? How frequently do you use the site? How do you usually work on the site? (Search all? Other?)

Exploration

We are going to be working with a website called TOXMAP. It is a new design of a current website.

[Note: Within each group (concerned citizens and professionals), the regular site and the diamond site will be used alternately. In the questions at the end of testing, we will address the other design with each participant. For "experienced" participants who see the diamond site in testing, it will be interesting to note if they notice the diamonds used for the TRI sites.]

[For those who have experience with the current design, say "you will notice both similarities and differences between this and the current website. Not all of the functionality of the current site has been included here yet. Feel free to tell us about any capabilities that you miss."] So, first, I'd like you to look at the website that we will be testing today.

- Please describe your first impressions.

Then I'd like to have you just explore the site and see what you can do here. [Note especially participants' first exploration. When they seem to have finished the first exploration, discuss what they've done and then say.]

Why did you choose to explore this first? Is there something especially interesting to you about this.

Now I'd like for us to go back to the introductory screen and have you tell me about it. [If participant initially stops on the introductory screen these questions can be asked right away. Otherwise, come back after the first exploration so the questions are not too disruptive of the initial experience.]

- Tell me about the "Welcome to TOXMAP" screen. How would you typically use an introductory screen like this? Is what you've done today typical?

- Did you notice the options? How did you decide which option to chose when you just entered the site today? What do you think the options mean?

- Why was that option your first choice?

Then let's have you get on with your exploration. [See the response to these items.]

- The TOXMAP Map Contents display (see how they approach it),

- The Icons (for features) or the Words (note which they explore first, see if they seem to recognize the redundancy between the two),

- The map (how they approach it)

- Note if they explore the Tools, Help, Bookmark.

For those **without TOXMAP experience**, if they are having trouble exploring…

1. What do you see that shows you what you can do directly with the map?

2. There are special capabilities that you can use with this map. What do you see?

For those with **previous experience** on TOXMAP, if they don't mention these items probe on…

1. Can you find all the features that you would typically use?

2. Organization of the page (Do you see how the functions are presented?)

3. Did anything confuse you when you first started using TOXMAP? (what areas, do you see how that area is handled here?)]

Tasks

Now I'm going to ask you to do some specific tasks. In these tasks we'd like you to Put yourself into these situations and try to find the related information/maps/etc. that the task implies that you should find. Feel free to ask any questions that come to mind as you work but I might not answer right away to see if the design lets you find the answer on your own. Also, if it feels comfortable, tell me what's happening. I'm more interested in seeing if you can accomplish this task on your own. I'll stop you and ask questions if I think I need to. I also like you to tell me when you think you are done with the task in case it's not obvious.

1. You are the parent of a toddler and you hear a news story about the potential health effects of exposure to lead compounds. You know there is an EPA designated toxics release site near your home in Sparrows Point, Maryland that has reported releasing lead compounds.

   Can you find the site in TOXMAP? How many pounds were released in 2008?
   How can you use TOXMAP to learn more about how lead compounds can affect human health?

2. You then wonder what other chemicals are considered to be reportable to the EPA Superfund.

   Where can you find a list of Superfund chemicals in TOXMAP?

3. You have become fed up with city life and you want to move back home to eastern Nevada. However, some friends of yours express concern about the toxic releases generated from copper and other mining activities in the state. They have heard there are some locations that produce in excess of 8,000 pounds of copper in 2008.

   Can you find such a facility in TOXMAP? To which environmental medium was the copper released?

   Be prepared to tell them it is NOT copper compounds. (TO LAND) ROBINSON NEVADA MINING CO**TRI** Facility ID: 89319BHPCP7MILE 7 MILES W. OF ELY ON HWY. 50 RUTH, NV 89319 released Copper 8205 lbs.

4. You've just read a newspaper article on the health effects of styrene (a clear, colorless liquid derived from petroleum and natural gas by-products; used in making plastic materials used in thousands of strong, flexible, and lightweight products). You now wonder if any of the waste sites near your second home in Front Royal, VA, contain styrene.

   Can you find some information about this in TOXMAP? What do you find?

   To solve: Use quick search, search Superfund for styrene, then zoom into the Front Royal VA area, find AVTEX FIBERS, INC.EPA ID Number: VAD070358684BOX 1169 KENDRICK LN, FRONT ROYAL, VA 22630

5. You then become curious regarding whether there are any TRI sites that released styrene in 2008 near your home in Front Royal, VA, and about the portion of that area's population that was under 18 years. You explore both of these with TOXMAP.

   Do you find any TRI sites? What portion of the population was under 18 years in 2000?

6. You also become interested in the income ranges in this area. You also explore this with TOXMAP.

   What are the income ranges this area?

   Addresses "Was it clear how to overlay the demographic layers?" Be sure they use 2000 Census.

7. Remove (turn off) the income range layer.
   You now decide to take a look at a map of styrene releases for the entire lower 48 states for 2005.

   How can you do this?

Post Test Interview Questions

Great, now I'd like to ask you a few questions.

1. What was the best or most satisfying part of this website?

2. In general, were your TOXMAP results presented clearly so that you felt you knew what you were looking at on the map? Why do you say that?

3. What part of the website do you think initially confused or frustrated you the most? [If not obvious from testing] How did you figure it out?

4. Was there any wording or any labels that weren't clear to you?

5. There are two versions of the new site. I'm going to show you a map that you probably saw if you had been using the other version.

   - Do you see the difference from what you used?

- Here is the map in your version. Which of these would you prefer to use?

6. Did you remember the icons in the upper corners? Do you remember what they mean? Were they helpful?

7. Let's talk about the icons in the upper right (not the corner one). Did they make sense to you?

8. Tell me about the box called Map Contents. Did it make sense to you? Did you have to work with it to figure out how it operated?

9. We didn't have you use the Print option in the test. What would you think would be printed if you used it?

10. [If not covered within the test] Let's talk about your experience with [as appropriate] the Quick Search, Demographics, Chemical Information, and Bookmarks. Did you see/use the Mouse-over tips?

11. Tell me about the map controls (those moving NSEW and closer and further away). Were they overall helpful or confusing?

12. Most websites have a learning curve associated with them. You [have used| haven't used] the current TOXMAP very much, right?

    - So, how hard or easy was it for you to learn this website?

    - Do you think that others with your experience will have about the same experience as yours?

13. What are the things you liked most about the way the website looks and works?

14. What things did you like least about the way the website looks and works?

15. Are there any changes you would recommend to improve the site's usability, usefulness and appeal?

Wrap up

OK, we're done. Are there any questions you would like to ask me about the website or about today's experience that I did not ask you about?

[Statement about stipend and payment if in-person testing.}

Thanks again for your participation.

Facilitator's Guide for Usability Testing

TOXMAP with Professionals

July 2011

Submitted to:

Colette Hochstein

National Institutes of Health

National Library of Medicine

Specialized Information Services

TOXMAP

hochstec@mail.nlm.nih.gov

Submitted by:

User-Centered Design, Inc.

20548 Deerwatch Place

Ashburn, VA 20147

(703) 729-2370

www.user-centereddesign.com

[Note: The purpose of this document is to guide the moderator. The questions and tasks contained herein may not be asked as written. The facilitator often draws on participant comments and the natural flow of the testing process to determine the flow of the session. While the facilitator will try to follow the order of the guide, many times tasks will come up ahead of time or in different order. The facilitator may allow the order of the tasks to change in order to let the process flow naturally.]

Pre-Test

[Administer the informed consent]

Introduction

Thank you for agreeing to participate in this study. Do you have any questions for me before we get started?

There are a few things I'd like you to keep in mind while we work. The first is, this is not an evaluation of you or your knowledge. This is an evaluation of the design you will be working with today. I will be trying to evaluate the design through your eyes. I'll give you some things I'd like you to try to do and then see if you have any difficulty accomplishing them. Mostly I will just watch you work but I'm also here to answer any questions if I need to although I may let you keep working on your own before I answer you. At times, I may ask you some direct questions, but this is not to test you but to see if the website is giving you the answer that it is supposed to. In other words, I am testing the website, not you. So <u>you</u> can't make any mistakes.

The second thing I would like you to keep in mind is that I didn't design what you will be working with today so you can't hurt my feelings. I want you to feel free to praise or criticize the design as you see fit. If there are areas of concern or things you don't like, feel free to talk about them. That way, we might figure out a way to make the website better. And I want you to know that the website is not finished. The creator is still working on it so we may run into some not quite perfect parts.

Finally, I'd like you to know that I have a colleague with us today taking notes for me. There [may be/are] other people who are observing today as well. Don't worry about them. You and I will work on this together and they'll just watch.

[To verify that we know actual information about the participants (and their background) and to get them comfortable with talking in this strange situation, we'll have them talk about subjects that they are comfortable with. Participants will be [concerned citizens or professionals, e.g., toxicologists, researchers, or public health professionals]

[Professionals] Before we actually get started, I'd like to know a little bit about your background.

- Where do you work?
- What sort of work do you do?
- In your work do you search for geographic based information about hazardous chemicals or threats to the environment? Tell me how that fits into your work.
- Have you ever used the TOXMAP website? [If yes] When was the last time you used the site? How frequently do you use the site? How do you usually work on the site? (Search all? Other?)

Exploration

We are going to be working with a website called TOXMAP. It is a new design of a current website.

[Note: Within each group (concerned citizens and professionals), the regular site and the diamond site will be used alternately. In the questions at the end of testing, we will address the other design with each participant. For "experienced" participants who see the diamond site in testing, it will be interesting to note if they notice the diamonds used for the TRI sites.]

[For those who have experience with the current design, say "you will notice both similarities and differences between this and the current website. Not all of the functionality of the current site has been included here yet. Feel free to tell us about any capabilities that you miss."] So, first, I'd like you to look at the website that we will be testing today.

- Please describe your first impressions.

Then I'd like to have you just explore the site and see what you can do here. [Note especially participants' first exploration. When they seem to have finished the first exploration, discuss what they've done and then say.]

Why did you choose to explore this first? Is there something especially interesting to you about this.

Now I'd like for us to go back to the introductory screen and have you tell me about it. [If participant initially stops on the introductory screen these questions can be asked right away. Otherwise, come back after the first exploration so the questions are not too disruptive of the initial experience.]

- Tell me about the "Welcome to TOXMAP" screen. How would you typically use an introductory screen like this? Is what you've done today typical?
- Did you notice the options? How did you decide which option to chose when you just entered the site today? What do you think the options mean?
- Why was that option your first choice?

Then let's have you get on with your exploration. [See the response to these items.]

- The TOXMAP Map Contents display (see how they approach it),
- The Icons (for features) or the Words (note which they explore first, see if they seem to recognize the redundancy between the two),
- The map (how they approach it)
- Note if they explore the Tools, Help, Bookmark.

For those **without TOXMAP experience**, if they are having trouble exploring…

3. What do you see that shows you what you can do directly with the map?
4. There are special capabilities that you can use with this map. What do you see?

For those with **previous experience** on TOXMAP, if they don't mention these items probe on…

4. Can you find all the features that you would typically use?

5. Organization of the page (Do you see how the functions are presented?)

6. Did anything confuse you when you first started using TOXMAP? (what areas, do you see how that area is handled here?)]

Tasks

Now I'm going to ask you to do some specific tasks. In these tasks we'd like you to Put yourself into these situations and try to find the related information/maps/etc. that the task implies that you should find. Feel free to ask any questions that come to mind as you work but I might not answer right away to see if the design lets you find the answer on your own. Also, if it feels comfortable, tell me what's happening. I'm more interested in seeing if you can accomplish this task on your own. I'll stop you and ask questions if I think I need to. I also like you to tell me when you think you are done with the task in case it's not obvious.

1. You have become fed up with city life and you want to move back home to eastern Nevada to work. However, some friends of yours express concern about the toxic releases generated from copper and other mining activities in the state. They have heard there are some locations that produce in excess of 8,000 pounds of copper in 2008.
2. Can you find such a facility in TOXMAP? To which environmental medium were the copper released?

   ROBINSON NEVADA MINING CO **TRI** Facility ID: 89319BHPCP7MILE 7 MILES W. OF ELY ON HWY. 50 RUTH, NV 89319 released Copper 8205 lbs.

3. You're studying chemical toxic releases in the Great Salt Lake area around the time of the 2002 Winter Olympics. How would you find out the number of TRI facilities that released more than 250,000 pounds of chemicals in the immediate Great Salt Lake area in 2002?

4. A colleague from Baltimore, MD is interested in hazardous waste sites (PENDING: and their proximity to hospitals). How can he/she find the number of Superfund NPL sites inside the Baltimore beltway? (PENDING: Are any of them near hospitals?)

5. What is the largest chlorine release in South Carolina in 2006? How does it compare to the largest Chlorine release nationwide?

6. You've heard that the ToxFAQs put out by the CDC have excellent information. Given your research interest in ammonia, use TOXMAP to see if the CDC has put out a ToxFAQ for ammonia.

7. You are studying Benzene exposure and its known links to cancer mortality. Understanding the care one must take in drawing conclusions from simple co-occurrence of a substance and a health problem, how could you use TOXMAP to demonstrate this link?

Post Test Interview Questions

Great, now I'd like to ask you a few questions.

1. What was the best or most satisfying part of this website?

2. In general, were your TOXMAP results presented clearly so that you felt you knew what you were looking at on the map? Why do you say that?

3. What part of the website do you think initially confused or frustrated you the most? [If not obvious from testing] How did you figure it out?

4. [For users of the current TOXMAP] Is there anything you would like to say in comparing this TOXMAP to the current TOXMAP that you haven't already covered? With the understanding that this version is not complete yet, when it is complete and has all the features—which edition would you use if both were available? Why?

5. There are two versions of the new site. I'm going to show you a map that you probably saw if you had been using the other version.

    - Do you see the difference from what you used?

    - Here is the map in your version. Which of these would you prefer to use?

6. Did you remember the icons in the upper corners? Do you remember what they mean? Were they helpful?

7. Let's talk about the icons in the upper right (not the corner one). Did they make sense to you?

8. Tell me about the box called Map Contents. Did it make sense to you? Did you have to work with it to figure out how it operated?

9. We didn't have you use the Print option in the test. What would you think would be printed if you used it?

10. [If not covered within the test] Let's talk about your experience with [as appropriate] the Quick Search, Demographics, Chemical Information, and Bookmarks. Did you see/use the Mouse-over tips?

11. Tell me about the map controls (those moving NSEW and closer and further away). Were they overall helpful or confusing?

12. Most websites have a learning curve associated with them. You [have used| haven't used] the current TOXMAP very much, right?

    - So, how hard or easy was it for you to learn this website?

    - Do you think that others with your experience will have about the same experience as yours?

13. What are the things you liked most about the way the website looks and works?

14. What things did you like least about the way the website looks and works?

15. Are there any changes you would recommend to improve the site's usability, usefulness and appeal?

Wrap up

OK, we're done. Are there any questions you would like to ask me about the website or about today's experience that I did not ask you about?

[Statement about stipend and payment if in-person testing.}

Thanks again for your participation.