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Tox Town: An Internet Introduction to Environmental Health and Toxic Chemicals

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Comment on This Field Report

Abstract
Can a web site present environmental health information to the general public in a fun and compelling manner? This was the goal of the National Library of Medicine's Specialized Information Services when it designed Tox Town. By its nature, chemical data is complex and not often perceived by the general public as relevant to their daily lives. However, many common hazardous materials (e.g., asbestos, carbon monoxide, lead, radon) can have profound health effects if encountered in the everyday environment. Enhanced with lively graphics, sound effects, and animation, Tox Town adds interest to learning about connections between chemicals, the environment, and the public's health. This field reports describes the features of Tox Town and discusses how it is being used by educators, students, and the general public.

Keywords: environmental education, toxic chemicals, educational Websites

Introduction

People are exposed to environmental hazards every day and are often unaware of the potential risks to their health from the built and natural environments. **Tox Town**® is an interactive Web site about commonly encountered toxic substances, the environment, and health. Enhanced with lively graphics, sound effects, and animation, Tox Town adds interest to learning about connections between chemicals, the environment, and the public's health. It brings to life the everyday locations where one might encounter mercury, lead, cleaning products, radon, solvents, and other potential hazards. Visitors can take a virtual stroll through a town, city, or U.S.-Mexico border neighborhood and click on locations like a school, hospital, construction site, factory, or farm for non-technical information on hazards. Tox Town also illustrates a wide range of environmental health issues, including smog, drinking water pollution, asbestos in schools, on-the-job safety, pesticides, and many more. Tox Town's target audience is high school students and educators, college and graduate students, and other interested adults.

Background

Tox Town is a project of the Specialized Information Services Division of the National Library of Medicine and was launched in October, 2002. The National Library of Medicine, the worlds' largest library of the health sciences, is in Bethesda, Maryland, and is part of the National Institutes of Health, an agency of the U.S. Department of Health and Human Services. Its **Web site** has become a popular destination for doctors, scientists, and consumers who seek health and biomedical information tailored to their interests. Appendix 1 summarizes many of the NLM Internet resources of interest for environmental health, toxicology, and consumer health.

There were two motivations for developing a consumer-level resource on environmental health. First, in the 1990s, NLM expanded from its traditional audience of health professionals and researchers to include health consumers, and consequently developed many new resources for non-professional audiences. Second, the TOXNET collection of extensive toxicology, chemical, and environmental health databases, typically used by toxicologists, chemists and researchers, is often perceived as inherently complex and of limited appeal to a general audience. Tox Town was created to bridge the gap between these complex resources and the interested public. It answers the information needs of interested citizens, while attempting to motivate the general public and students to learn more about environmental health and toxicology.

Marti Szczur, Deputy Associate Director of the Specialized Information Services Division, decided to experiment with using a graphical interface to create an environmental health resource that would be compelling to a general audience. This was a radical departure from the Library's usual text-dense bibliographic indexes and full-text databases. Tox Town began as a pilot to present information in a new way.

Features

Tox Town greets visitors with a picture of "Hometown, USA". Users can explore Tox Town by selecting neighborhoods, location links, or chemical links. They can click all around the city, town, or U.S.-Mexico border (Figures 2, 3, 4) to find answers to their questions about environmental hazards. Each neighborhood illustrates environmental health hazards and toxic chemicals that might be found there. Within a neighborhood, users can click on a Location link or Chemical link for additional information about a particular environmental health concern. For example, in the city scene, a user can click on the brownfield location to open a list of links that includes a page on "What are brownfields?" and other selected resources written at an introductory level (Figure 5). Additionally, a user with questions about a local river could click on the town's river and choose information on drinking water, parasitic diseases, chemicals in water, and other information provided by a variety of federal agencies. Some concerns are repeated in every scene, such as cleanliness of drinking water, but others are unique to a setting, such as brownfields in the city. To see all the environmental health concerns included in Tox Town, users can access the Site Map or browse through each neighborhood. Table 1 lists just some of the 100-plus potential hazardscovered in Tox Town.

Table 1. Environmental Health Concerns included in Tox Town

Air Pollution	Medical Waste
Airplanes and Airports	Medicines
Alternative Fuels	Molds
Animal Diseases and Human Health	Monkeypox Virus Infections
Asthma Triggers	Motor Vehicle Safety
Beaches	Nail Salons
Bites and Stings	Noise
Brownfields	Nursing Home Environmental Health
Camping Safety	Occupational Health
Campus Environmental Health	Occupational Health for Healthcare
Cell Phones	Workers
Child Safety	Office Buildings
Construction	Outdoor Air
Cosmetics	Over-the-Counter Medicines
Cruise Ships	Parasitic Diseases
Dengue	Pest Control
Dental Offices and Labs	Pets
Dietary Supplements	Pfiesteria Infections
Drinking Water	Pharmacies
Drowning	Plague
Dry Cleaning	Playground Safety
Drug and Medical Device Safety	Poison Ivy, Oak and Sumac
Electromagnetic Fields	Poisoning
Ergonomics	Power Lines
Eye Injuries	Rabies
Factories	Radiation Exposure
Fire Safety	Recreation Safety

Farm Safety
Food Contamination and Poisoning
Food Safety
Fuel Economy
Groundwater
Hair Salons
Hantavirus Infections
Heat Illness
Herbal Medicine
Home Remodeling
Homes
Hospital Environmental Health
Household Poisons
Household Products Database
Hypothermia
Indoor Air Pollution
Industry
Insect Bites and Stings
Integrated Pest Management
Latex Allergy
Lyme Disease
Malaria

Rats
Rural Health
Salmonella Infections
Secondhand Smoke
Septic Systems
School Buses
School Health
Sick Building Syndrome
Sports Safety
Sun Exposure
Swimming
Tick Bites
Toluene
Traveler's Health
Vehicles
Vitamins and Minerals
Water Safety (Recreational)
Watersheds
West Nile Virus
Workplace Safety
Zoonose

Figure 1.   **National Library of Medicine main web site (http://www.nlm.nih.gov/)**
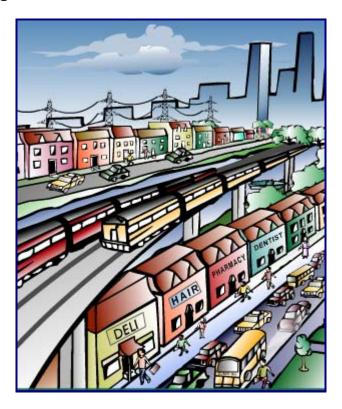
Figure 2. City neighborhood
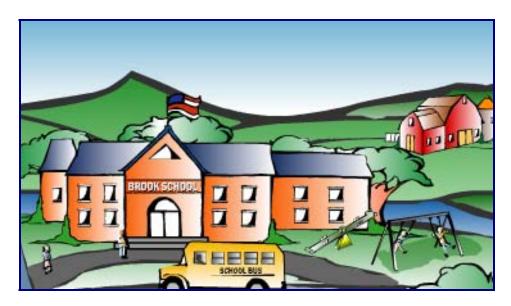

Figure 3. Town scene

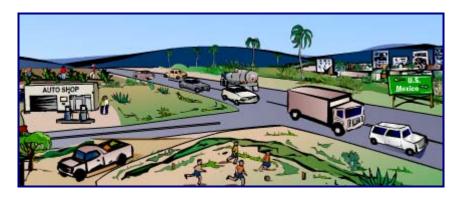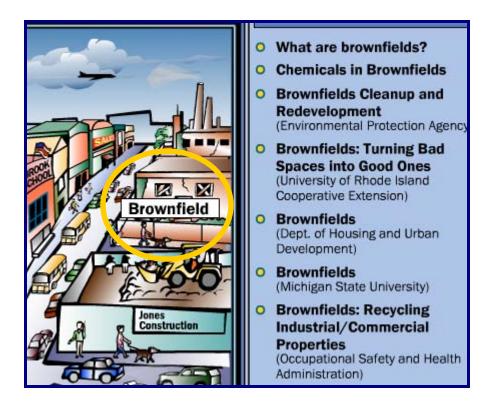**Figure 4. U.S.-Mexico border landscape**

Figure 5. About brownfields

In addition to environmental health topics, Tox Town also introduces 16 toxic chemicals (Table 2) one might encounter in everyday life, in everyday places. Each neighborhood has a list of chemicals that users can click on to see where a particular chemical, such as mercury, might be found. Chemicals are described in non-technical language, for example: "What is mercury?"; "How might I be exposed?" and "How can mercury affect my health?". These descriptions are supplemented with Internet links about each chemical and its possible impact on human health. A high school student writing a paper about the health effects of

lead, for example, could choose the "Lead" button to find out what lead and lead poisoning are, and how to prevent it in children (Figure 6).

Table 2. Tox Town's 16 chemicals and chemical groups

Arsenic	Ozone
Asbestos	Particulate Matter
Benzene	Pesticides
Carbon Monoxide	Phthalates
Chromium	Radon
Lead	Sulfur Dioxide
Mercury	Toluene
Nitrogen Oxides	Volatile Organic Compounds

Figure 6.   Lead in a home might be found in paint on the sills or in the drinking water from the kitchen sink
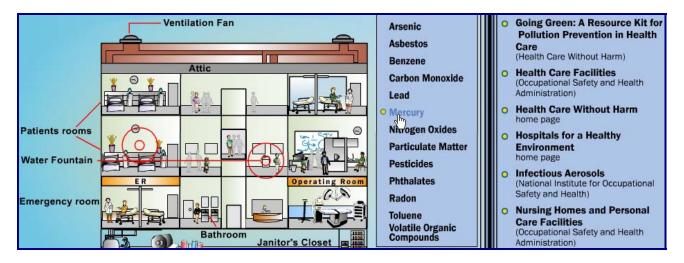

Chemicals included in Tox Town meet the following criteria:

- Toxic (or perceived as such by the general public)
- Commonly encountered in the United States
- Known or expected to impact human health
- Of interest to federal agencies that regulate, research, or advise on a chemical's health effects (e.g., the Environmental Protection Agency (EPA) or the Agency for Toxic Substances and Disease Registry (ATSDR)

Tox Town offers many special features including a text version, a Spanish version, site maps, graphics, color, sounds, and animation. Some buildings display an interior view that provides "inside" information on where chemicals might be found

(Figure 7). Tox Town's special effects require Macromedia Flash, which can be downloaded quickly and at no cost from the Macromedia Web site. The **text version** is a complete mirror of all the text and links from the graphical version. It was developed to conform to the Americans with Disabilities Act standards because the Flash-based graphic version of Tox Town is not readable using current screen-reading software for the visually impaired. The **Spanish version** includes materials already available in Spanish from other Web sites, but is not a complete mirror of the English-language version.

Figure 7. Inside a Hospital

Information on chemical and environmental concerns is from the TOXNET and MedlinePlus resources of the National Library of Medicine (NLM), as well as other authoritative sources. Selection guidelines (based on MedlinePlus) are used in evaluating links to Web pages. The chemical descriptions (for example, "What is arsenic?") were written for Tox Town based on TOXNET and other resources and were reviewed by NLM toxicology staff.

Today

Interest in Tox Town is growing. In its first year there were about 90,000 visits, and in the second year there were 200,000 visits. Visits during the third year are projected at more than 250,000. The numbers suggest that people with an interest in environmental health are discovering this Web site.

 Tox Town is included in the National Library of Medicine's extensive training and conference exhibit program that brings information on NLM resources to thousands of users a year. NLM has paid special attention to promoting Tox Town as an information source for organizations concerned with environmental justice and health disparities. Numerous environmental newsletters have published stories on Tox Town and several press announcements have resulted in stories in newspapers. Tox Town posters were recently sent to 5,500 public libraries for their bulletin boards. Several modest contracts have been awarded to organizations interested in promoting community use of NLM environmental health and other resources.

In November 2004, about 50 individuals and organizations that had expressed interest in Tox Town were asked for their feedback on how they've used it. Their answers included:

- Community health fairs, using a laptop connected to Tox Town to demonstrate environmental health concerns
- Home schooling enrichment
- Classroom enrichment
- Teaching environmental health assessment skills to nurses
- Resource for a state Environmental Justice Commission
- Listed as a resource link on EPA and many state and local government Web sites
- Demos for teachers and librarians at professional meetings
- Ready reference, especially for chemical information
- Place to refer inquirers who want to know more about environmental health issues
- Advanced Placement Environmental Science courses in high schools

Tomorrow

Tox Town continues to evolve with input from users and from more formal evaluations. Two focus groups in 2002 provided important early feedback that guided Tox Town's initial development. Ongoing feedback comes from NLM participation in many environmental health forums including the federal Tox-to-Consumer Interagency Working Group, as well as from email and personal contacts. In developing the U.S.-Mexico border scene, NLM relied heavily on guidance from health, environmental and library professionals who practice in Texas, New Mexico, Arizona and California and are best acquainted with border issues. Because the Border Neighborhood is the newest (March 2005) addition to Tox Town, it will be the next focus for feedback and promotion efforts.

Feedback shows that users would most like to see:

- More chemicals
- More geographic scenes
- Clearly defined reading level and target audience
- Ready-made curriculum for teachers to use with Tox Town
- Games and game-like features
- Information on local chemical releases and local problems
- Guidance on actions users can take to address environmental health concerns

In response, Tox Town is adding 20 additional chemicals (Table 3) and will be developing additional neighborhoods such as a farm scene (Figure 8) and a U.S. southwest desert scene. NLM is also building relationships with science teachers to evaluate Tox Town from the perspective of its usefulness in curricula. A feature that will allow users to search for local information by ZIP code is also under consideration. Content could also be expanded to include links to "Action!"

resources that describe steps users can take to improve environmental health in their communities.[1]

Table 3. Tox Town's 20 chemicals and chemical groups upcoming in 2005

Acetone	Gasoline and gasoline additives
Ammonia	Methanol
Carbon dioxide	Perchlorate
Chlorine	Perchloroethylene
Chlorofluorocarbons (CFCs)	Persistant organic pollutants (POPs)
Diesel fuel and exhaust	Polychlorinated biphenyls (PCBs)
Dioxin	Polycyclic aromatic hydrocarbons (PAHs)
Ethylene glycol	Polyvinyl chloride (PVC)
Ethylene oxide	Selenium
Formaldehyde	Solvents

Figure 8. Farm scene

Conclusion

Tox Town compiles a unique range of environmental health and toxic chemical information, presented in an easy-to-use graphic format. Whether concerned about the built or natural environment, users can find introductory materials on many issues of interest to architects and planners, including the use of environmental design to maximize the health of children and youth. Tox Town can also be used to introduce youth and community members to environmental health concepts and raise awareness of and demand for quality community planning and building design that can enhance health.

Endnote

1. Comments or questions on Tox Town may be sent to **tehip@teh.nlm.nih.gov**.

Cynthia Love is an information specialist in the Specialized Information Services (SIS) Division of the National Library of Medicine (NLM). She has been the project lead of Tox Town (the "mayor" of Tox Town) since its conception in 2001. Cindy started at NLM as an Associate Fellow prior to joining the staff of the NLM Library Operations Division as a reference librarian.

Marti Szczur is the Deputy Associate Director of the Specialized Information Services (SIS) Division at the National Library of Medicine (NLM). SIS has a comprehensive portfolio of useful environmental health information products which includes Tox Town. Marti has been active in developing environmental health information resources oriented towards the general public. Prior to coming to NLM in 2000, she worked over 25 years for NASA working in the information system and technology domain.

Mary Higgins is an artist and designer/ developer of high-end computer animations and multimedia applications. She recently formed a new design and technology company, and is an adjunct faculty member at George Mason University. Previously, she was the Art Director for Activ8Designs. Mary has been the artist and application designer/developer of Tox Town since the web site's beginning.

Erinn Aspinall has over eight years of library-related experience, including six years in health sciences libraries. Erinn is currently in her second year of the post-graduate National Library of Medicine's (NLM) Associate Fellowship Program, and working at the University of New Mexico Health Sciences Library and Informatics Center (HSLIC.) In September 2005, she will become the Distance Services Librarian at HSILC. During her first year as an Associate Fellow, Erinn developed the U.S.-Mexico border scene in Tox Town. Prior to her NLM experience, she worked for the Public Health Information Services & Access (PHISA) at the University of Michigan.

Appendix 1

National Library of Medicine Internet Resources in Environmental Health, Toxicology, Consumer Health, and Medicine

Tox Town
(**http://toxtown.nlm.nih.gov**)

Household Products Database: Chemical ingredients in household products and manufacturer-issued safety information
(**http://householdproducts.nlm.nih.gov**)

Haz-Map: Occupational health information on the connection between work exposures and disease
(**http://hazmap.nlm.nih.gov**)

MedlinePlus: Health and drug information for consumers
(**http://medlineplus.gov**)

TOXNET: Databases on toxic chemicals and environmental health
(**http://toxnet.nlm.nih.gov**)

MEDLINE/PubMed: Index to biomedical journals
(**http://pubmed.gov**)

National Library of Medicine main Web site
(**http://www.nlm.nih.gov**)

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