Technically Speaking

A look at the New PEAC-WMD from a chemist's view

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PEAC TOOL UPGRADES

Aristatek has upgraded the PEAC tool, adding new chemicals and features. Adding improvements to the PEAC tool is a constant on-going process; periodically these upgrades are offered to the public. Let us take a few minutes and look at the improvements provided in the latest upgrade.

More Chemicals

The upgrade will contain many more chemicals. These include many chemicals used in industry as well as more chemical warfare agents, bio-toxins, and pesticides. More information has been added for the chemicals already in the PEAC data base. Many reference sources including those on the Internet were consulted when constructing this data base.

Pesticides

Pesticides are different from most other chemical listings in that they are intentionally dispersed in the environment. They are used to kill or repel insect pests, birds, rodents, weeds, nematodes, or fungus. Most commonly they are used in the growing or storage of food crops, but they may also be used to kill or repel insect vectors (flies, mosquitoes, fleas) which might spread disease, prevention of wood rot in buildings, and other uses. Pesticides are available in many formulations that consist of one or more active ingredient plus various inert ingredients. The inert ingredients are additives whose purpose is to aid in dispersal or application to the environment or keep the pesticide from sticking during storage. The active ingredient might be, for example, a white powder, but the inert ingredients may include water and a surfactant to enable the pesticide to be dispersed on the vegetation as a spray or an aerosol. Sometimes flammable materials such as xylene are added to the pesticide to aid in application. Formulations may be dusts, granules, baits, emulsified in liquids, water-soluble concentrates even though the active ingredient is in a very different form.

There are roughly 1,000+ different active ingredients and perhaps 90,000+ formulations. About 30 to 50 new active ingredients are developed each year. In the United States, pesticide application is regulated by the Environmental Protection Agency. The more toxic or potentially environmentally harmful pesticides are classified as Restricted Use Pesticides, meaning, they can only be purchased and used by certified applicators and used under controlled conditions. General Use Pesticides are less toxic (to people and the environment) and can be purchased and used by anyone. States may impose additional restrictions. Some pesticides are considered too harmful and have been withdrawn, at least in the United States. The Department of Transportation shipping numbers for a particular active ingredient vary depending upon whether the formulation is shipped as a compressed gas (dispersed as an aerosol), a solid, a liquid with a flash point below 23°C, a liquid with a flash point between 23 and 61°C, or a liquid with a flash point above 61°C.

Pesticide information in the PEAC tool is organized according to the active ingredient. Various brand names of formulations containing the active ingredient are listed with each active ingredient, but no attempt is made to list the composition of each formulation. Instead the PEAC tool describes the physical form of the pure active ingredient, the chemical formula, melting point, vapor pressure, density, flash point if applicable, water solubility (in milligrams per liter), and boiling point if applicable. The PEAC tool lists only general information on formulations; for example, the active ingredient may be a white crystalline powder but it comes in dusts, liquid concentrates, aerosols, or as a bait without going into details, and depending upon the formulation, may be shipped under several different UN/NA numbers. The PEAC tool also states whether the active ingredient is classified as "general use" or "restricted use". Information on the lethal dose or lethal concentration to test animals (usually a rat or rabbit) is provide if the active ingredient is ingested, inhaled, or applied to the skin. This gives a good idea on the pesticide toxicity.

The PEAC tool provides information on what the pesticide is used for. Some pesticides are very specific such as killing mosquitoes without harming birds, fish, aquatic invertebrates, or other insects. Others are broad spectrum.

Also provided in the PEAC tool are symptoms of exposure and effects on target organs, including long term effects such as cancer. Most of this information comes from laboratory tests on test animals (mostly rats, mice, rabbits, and dogs), but some come from prison volunteers who have agreed to ingest small amounts of the pesticide daily over a specified period of time.

Also provided in the PEAC tool is information on the fate of the pesticide in the environment. Some pesticides are rapidly broken down and do not persist for more than a few days. Others may last for years and even build up in the food chain.

The major reference sources consulted in putting together the information in the PEAC tool were

1. National Library of Medicine Hazardous Substances Data Base at
http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

2. EPA Pesticide Data Base at
http://www.epa.gov/pesticides/science/models_db.htm#databases

3. Extoxnet Info Base including Pesticide Information Profiles at
http://ace.ace.orst.edu/info/extoxnet/

4. U.S. Dept. of Agriculture Pesticide Fact Sheets at
http://www.infoventures.com/e-hlth/pestcide/pest-fac.html

Bio-toxins

A separate category has been added to the PEAC tool that enables the user to display biotoxins from which a selection can be made. Examples of biotoxins in the PEAC tool include

Abrin
Aflatoxin (B1,B2,G1,G2,M1,M2)
Batrachotoxin

Botulinum toxin
Brevetoxin (A,B,C)
Cicutoxin
Ciguatoxin (CTX-1,2,3)
Digitoxin
Maitotoxin
Nivalenol
Ricin
Saxitoxin
Shiga toxin
Staphylococcal enterotoxin B
T-2 Toxin
Tetrodotoxin

Diseases

More diseases which can be potentially be spread by terrorist activities have been added. Information on pathogen viability outside the host (as in dust, soils, animal or human secretions) and on sterilization has been added.

Radioactive Isotopes

The number of radioactive isotopes in the PEAC tool has been expanded from about 130 to 200. The radioactive decay products are also listed. The most prominent gamma radiation energy levels and intensities are listed.

NIOSH Pocket Guide

The information provided in the NIOSH Pocket Guide has been used in earlier PEAC editions, but in the upcoming release, the user has the option of displaying the entire NIOSH Pocket Guide entry for the selected chemical on the PEAC screen.

The Emergency Response Guidebook (ERG)

The information provided in the 2000 Emergency Response Guidebook has been used in current PEAC release, but in the upcoming updates, the user has the option of displaying the 2004 Emergency Response Guidebook entry for the chemical selected on the PEAC screen. The DOT 2004 Emergency Response Guidebook edition was released in late 2004, which will soon be added to the PEAC tool.

Reactions of Chemicals When Mixed

A new feature added to the PEAC tool is the ability of the user to select two or more chemicals in the database. A discussion is displayed of possible reactions (e.g. explosive mixtures, dangerous gases given off, etc.) if the chemicals are mixed together. This could happen if there are spills involving several chemicals that may mix because of the accident. The methodology used in the PEAC tool is the same as used by the U.S. Environmental Protection Agency and National Oceanic Atmospheric Administration in their Chemical Reactivity Worksheet.

Ability for User To Input Mass or Mass Flow Rate as an Option

The earlier PEAC editions asked the user for a container or tank size or a hole size in case of a leak from a tank or pipe. In some situations, the user may know the net contents of the container in kilograms or pounds but not know the tank dimensions. Also, the release rate in kilograms per second may be known (approximately) but the hole size may known less precisely. The new edition of the PEAC tool will provide the user the option of specifying the mass or mass release rate directly when computing protective action distances. Also, the newer PEAC edition will have the ability to model very small release rates. The old features are still available in the new PEAC edition, but these options should prove useful in some situations.

Word Search Engine

A word search engine is added to the upcoming PEAC tool that may help in locating information. For example, a person might type in the word "vomit" and "green" and all PEAC entries where these words are used under description or symptoms appear on the screen. This is not intended to be a method of identifying chemicals. Descriptions of chemicals and symptoms of exposure are subjective. Also, many chemicals become discolored or may polymerize on storage. A purified chemical may be a white powder, but the technical grade might be a yellow, viscous liquid, or there may be a solution of the chemical in water. Also, many chemicals such as pesticides and chemical warfare agents may contain additives to aid in their dispersal, which results in a very different chemical appearance. The chemical warfare agent VX in pure form is an oily liquid which is difficult to disperse in the air, but a terrorist organization might use the same technology using additives available for pesticides resulting in a VX fine dust.

Chemical Exposure Guidelines for Deployed Military Personnel.

Aristatek has had requests to incorporate the Levels of Concern for toxic chemicals that may potentially be encountered by military personnel. These include several chemical warfare agents. This information is in the document,

USACHPPM Technical Guide 230, January 2002, Appendix C. Chemical Exposure Guidelines for Deployed Military Personnel.

The Levels of Concern are reported in units of concentration of chemical in the air (ppm or mg/m^3) and arranged in categories of "minimal health risk, "significant health risk", and "severe health risk". The Levels of Concern are reported for different exposure times: 1 hour, 8 hours, 14 days, and 1 year. Only the air concentrations are reported in the PEAC tool, but the manual also gives concentrations in drinking water. The manual also gives symptoms of exposure, target organ information, and odor detection limits. About 110 toxic chemicals with Levels of Concern from this reference source are listed in the PEAC tool.

Mass Causality Exposure Symptom Matrix

An exposure symptom matrix was developed by the Pentagon's Defense Protective Service and referred to as the NBC Indicator Matrix for exposure to toxic materials that could potentially be released by a terrorist. The user checks the presence of symptoms, observations and other indicators (listed in order that such indicators are most likely to be noticed) that may be present for each of the agents/materials included, and the PEAC tool directs the user to categories of toxic agent/material which are most likely to display these symptoms. The agents/materials are organized into categories, e.g. nerve agents, blood agents, choking, blister, irritants, etc.

Additional CPC entries

The index of CPC entries has been expanded based on access to additional manufacturers of CPC specification sheets.

ATSDR Medical Management Guidelines

The ATSDR (Agency for Toxic Substances and Disease Registry) has developed medical management guidelines for a series of toxic substances. These guidelines are now available for display for specific toxic substances in the PEAC database.

Incorporation of User Defined Text Files

Users sometimes have additional information either for a specific chemical or of a general nature they want to be able to access via the PEAC tool. A new PEAC-tool option will allow the user to create and update text files to be displayed on the PEAC tool.

Glossary

A glossary is added to the upcoming PEAC tool for technical terms and acronyms.