



HazRAE

Chem/Bio/WMD Decision Support

The Most Advanced Third Generation
Mobile Chem/Bio/Rad Response System Available



User's Guide

www.raesystems.com

P/N 055-4002-000 Rev. C

HazRAE User's Guide

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Refer to important safety information throughout this guide for more warnings and precautions for this product.

NOTE: This is a Class B digital device, pursuant to Part 15 of the FCC Rules. Refer to the User's Guide on the Companion CD for Class B information.

Safety & Operational Information

Consult the documentation that accompanied your iPAQ Pocket PC for more detailed descriptions of safety notices, as well as product functions, care, and support.

Consult the accompanying HazRAE in-depth documentation for more detailed information on HazRAE's features and operation.

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Manual Conventions



Throughout this manual, several conventions are used to call attention to certain aspects and functionality of the system. When you see the icon at the left, it indicates something of particular interest.



Throughout this manual, there are certain things that are important to note or keep in mind. These items are noted by the use of the icon at the left.



The stylized arrow icon at the left is used to call out a capability that relies on HazRAE's integrated reachback capabilities. A particular function/feature that relies on reachback capability may not be available if not supported by your device, or if you are running stand-alone without any wired/wireless network connectivity.

Welcome

Congratulations on your purchase of HazRAE. You have joined the growing group of experienced and dedicated professionals that recognize the need for the best hazardous material incident response and investigative tools available.

We hope this software meets your expectations, and that HazRAE's unique, patent pending capabilities provides you with the answers you need in situations ranging from traditional hazardous materials incident response situations, to terrorism response. If you have any questions, comments or suggestions, please contact us either by email at info@raesystems.com or by phone. Also, check our web site for systems for emergency response and other handheld applications at www.raesystems.com.

If you have specific needs, please feel free to contact us for further information.

About HazRAE

HazRAE is the most advanced hazardous materials incident response / CBRNE investigative tool available. HazRAE has the tools you need for use in traditional incident response situations. More importantly, for terrorism response situations, only HazRAE's unique patent pending capabilities allows you to identify unknown hazardous materials using only physically observable characteristics or observed medical signs and symptoms, along with other unique investigative and forensic capabilities. The software has been designed to be easy to use and rapidly mastered. Only HazRAE provides train-once/deploy-anywhere capabilities, as it can run on most Pocket PC handhelds and Microsoft Windows laptop or desktop computers, with full capabilities.

System Requirements

To use HazRAE on your handheld device, you will need:

Pocket PC (including HP iPAQ)

- A Microsoft Windows Mobile/Pocket PC 2003, 2002, 2000, HPC211 HX2400, or PPC211 device based on an ARM, MIPS or SH3 processor
- Approximately 12 MB of main memory free

To use HazRAE on a PC, you will need:

Windows Computer

- Windows XP, 2000, NT, 98, ME with at least 12 MB free disk space

Support

If you have a problem with your iPAQ (for example, it won't turn on, the display doesn't work properly or appears damaged, etc.): contact Hewlett-Packard's technical support at <http://www.hp.com/support> or 1-800-652-6672.

If you have a problem with your HazRAE application: If the iPAQ starts up but there is a problem with HazRAE Chem/Bio/WMD Decision Support Application software, refer to the FAQ at <http://www.raesystems.com/hazrae>. If you don't find a solution to your software problem there, or if you do not have Internet access, contact RAE Systems Technical Support at 888-723-4800.

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IMPORTANT! REGISTER BEFORE YOU START!

Your HazRAE software can run 15 times before you register. However, you should register it as soon as possible to avoid possible disruption. If you have Internet access, go to <http://www.raesystems.com/hazrae> and follow the instructions for getting your system's unique Application License Code. (Note: For iPAQ Pocket PC, you will need both your iPAQ's serial number and RAE Systems serial number for this. You can find them on the box your iPAQ Pocket PC came in, and the RAE Systems serial number is on the back of your iPAQ. The iPAQ Pocket PC's serial number is also inside its battery compartment—remove the battery and you will see the serial number printed inside the case.) If you do not have Internet access or email, call RAE Systems Customer Service at 408-952-8200. If you register online, your Application License Code will be emailed to you within 24 hours.

Once you have your HazRAE Application License Code, write it below (along with other serial numbers) for future reference:

RAE Systems Serial Number (on CD or back of PDA): _____

iPAQ Pocket PC Serial Number (if running on an iPAQ): _____

HazRAE Application License Code: _____

Install your Application License Code by starting HazRAE and following these steps:

iPAQ Pocket PC

1. Install your Owner Information. Follow this path to access the Owner Information:

Start ► Settings ► Owner Information

Insert your information and then tap or click the circled X in the upper right corner.

2. Tap Start ► HazRAE and then tap/click Register in the menu that appears.
3. Use your stylus to tap in the Application License Code.
4. Tap OK.

HazRAE now has your Application License Code and is running.

Windows PC

1. Start HazRAE by double-clicking the HazRAE icon on your desktop (or by following the path Start ► Programs ► HazRAE).
2. Pull down the HazRAE tab, and from the menu select Options ► Register.
3. Type the Application License Code into the field.
4. Click OK.

HazRAE now has your Application License Code and is running.

Using HazRAE

HazRAE is available for both PC running Windows and iPAQ Pocket PC. Throughout this manual, you will see an instruction to “tap” a selection. With the iPAQ Pocket PC, this means to use the stylus and tap the appropriate location. On a PC, it means to use the left button on the mouse to click.

Starting HazRAE On A PC

Double-click the HazRAE icon on your desktop (or go to Start ► Programs ► Hazrae) in order to start HazRAE. It takes a few seconds to initialize, and then it is ready to use.

Starting HazRAE on An iPAQ Pocket PC

Turn on your iPAQ Pocket PC by pressing the Power button. Then:

1. Tap START with your stylus to bring up the Programs menu.
2. Tap PROGRAMS.
3. Tap HAZRAE. The HazRAE Chem/Bio/WMD Decision Support Application starts in approximately five seconds.

Inputting Text On A PC

Simply use the mouse to locate text boxes, and then type in the text using your computer's keyboard.

Inputting Text On An iPAQ Pocket PC

There are three ways to input text into the field:

- Keyboard
- Block Recognizer
- Letter Recognizer

The most reliable and accurate way is using the stylus to tap the “keys” of the “keyboard,” where you must intentionally select each character from what looks like a standard typewriter-style (QWERTY) keyboard. When you tap a letter on the keyboard graphic, it appears in the text input field.

To add a space (to separate adjacent words), tap the wide, unmarked space bar at the bottom. To get numbers, tap the key marked 123, and then tap the appropriate number(s). Note that symbols, such as parentheses and percentage are included here, as well. To exit numbers/symbols and return to alphabetic characters, tap the 123 key again.

Block Recognizer and Letter Recognizer are alternatives to using the “keyboard.” They allow you to write with the stylus, and HazRAE interprets letters and numbers. Note that Block Recognizer and Letter Recognizer require a special technique (demonstrated in the

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Help section, indicated by the “?”), and using them may introduce more errors than using the keyboard. For optimum accuracy, RAE Systems recommends using the “keyboard.”

There are two ways to erase the text in the input field:

1. Tap with the stylus after the last character and then repeatedly tap the large backspace key on the keyboard (upper right corner) to remove characters one at a time.
2. Touch the stylus at either end of the string of characters and drag to the other end. This highlights all the text. Now use the stylus to tap the backspace key on the keyboard (upper right corner) to remove all the selected characters at once.

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Operation Tabs

When you start HazRAE, you see a tab labeled HazRAE with five more tabs arranged in a row below it. These guide you to all of HazRAE's functions.

Here's a brief description of the tabs and their underlying functions:

Tabs

Tab	Description
Search	Enter material name, Guide, UNNA (United Nations and North American hazardous chemicals identification number), or CAS (Chemical Abstract Service Number) to search.
Discovery	Search for suspect chemicals via three menus, for color, texture, and odor.
S&S	Search by Signs & Symptoms via eight menus.
Mix	Determine possible reactions when two or more substances are mixed.
Rad	Comprehensive radioactive isotope information.
Blast	Explosion-related information, including IED (improvised explosive device), IND (improvised nuclear device), and detonator identification. Includes threat-ring distance calculators for IED and IND, as well as means to determine the type of detonator found.

HazRAE Menu Options

Option	Description
Placards	Placard Identification shows a list of standard hazardous materials placards. Use this screen to quickly scroll through the list of standard hazardous material placards to locate the observed placard, and view the associated guide for any selected placard.
Road/Rail ID	Information for identifying types of trucks and railroad cars.
Container ID	Information for identifying types of shipping containers, as well as port of departure, registry, and other data.
NFPA 704 Aid	National Fire Protection Association identification that uses a diamond shape with red, yellow, blue, and white quadrants and numbers that tell the risk level ratings ranging from 4 (highest) to 0 (lowest)

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UK/EU Codes	International response codes used throughout most of the world. They provide a concise indication of the type of hazard you're dealing with (HIN), a recommendation on the type of response for the initial phases of the incident (EAC), and a concise suggestion of the type of protective clothing (APP), along with the type of packing the material may be in (PG).
Conversions	Convert various types of radioisotope measurements.
Glossary	Alphabetized glossary of chemical and related terms.
Register	You only use this when you need to register software that is running in Trial mode or Demo mode.
About	This tells you the current HazRAE software version and related details

Edit	Description
Copy	Copies any of the response information that you're looking at onto the system's clipboard, where you can then paste it into an email, reporting tools, Microsoft Word, etc.
CPC on-hand	Chemical Protective Clothing list that can be edited to only include the types of chemical protective clothing that's immediately available.
Logging setup	Sets up a log file to create a comprehensive audit trail of actions taken and user directives specified.

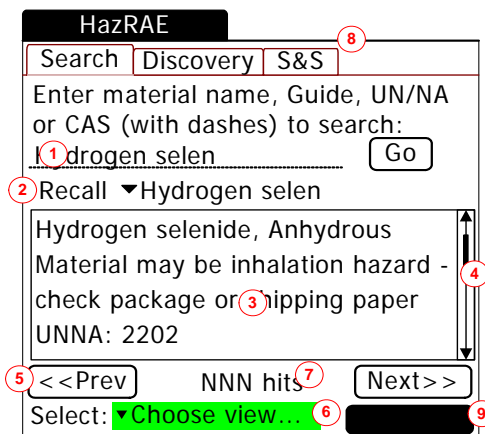
Preplans	Description
Save	Save a preplan that includes data to be viewed in CPC on hand.
Load	Load a preplan into HazRAE from memory.
Clear recall	Clear Recall allows you to completely clear the current list of recall bookmark entries.
Agent refs	Retrieve agent-specific information for the current material.
Local refs	Retrieve generic reference documents that you have created.

Search Tab

When you launch HazRAE, it always starts with the Search tab selected. A screen shot of the Search tab is shown below, with a brief explanation of the various parts of the display. Note that your display may look slightly different, depending on whether you are using HazRAE on Pocket PC or a desktop/laptop computer, as HazRAE's user interface style adapts to the user interface guidelines of the device on which it is running.

Circle Explanation Overview

- 1 Smart input processor
- 2 Search history bookmarks
- 3 Search results overview pane
- 4 Scrollbars (as needed) to scroll through overview results.
- 5 Intelligent navigation buttons
- 6 1-Tap Pop Up action menu
- 7 Hit counter indicating number of materials matched the criteria you specified in #1, above
- 8 Navigation tabs, to navigate to other parts of HazRAE
- 9 Precursor identifier



More details on the parts of the screen above are discussed below.


Smart Input Processor

This is where you can enter a portion of a material's name (including radioactive isotope names), a guide number, a UN number, a CAS NUMBER, or a material's tradename/synonym. When you tap the **Go** button, HazRAE will recognize what you're asking for, and take one of the following actions:

- If you enter in a material name, or a start of one, or an infectious agent name, and tap **Go**, HazRAE will check if it can find a match on the material's name, displaying the results in the search results overview pane (area 3, above). If the material name you entered was a tradename or synonym, HazRAE will automatically check for trade names, and display the first match in the overview pane. For biological agents, you can also enter the infectious agent name, the biological agent's official name, or common name.
- If you enter a valid guide number, and tap **Go**, HazRAE will take you to the appropriate ERG guide page (refer to the Guide Pages section for details of the guide pages). You can also enter something like "123,1," tap **Go**, and HazRAE will pull up guide 123, section 1 (Health).
- If you enter a UN Number, HazRAE will search for the associated material(s), and show you the first matching material in the search results overview pane. In area 7, the number of materials that matched the UN Number specified will be displayed.

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- If you enter a Chemical Abstract Service Number (CAS NUMBER), HazRAE will validate that the CAS NUMBER entered is valid and display all matching materials for the CAS NUMBER entered. In area 7, the number of materials that matched the CAS NUMBER specified will be displayed.



In the case that you've specified a material name that wasn't found in the system, there are a couple of things to try. Double check the specified spelling, try an alternate spelling, or specify just the first few characters of the agent's name. Next, if this doesn't help, instead of trying the agent's name, try its CAS NUMBER or UN Number (if known). Alternately, if an agent is not found within HazRAE, notice in the lower right corner of the screen, the "WebCheck" button appears. Tapping WebCheck tells HazRAE to try finding the material specified using HazRAE's reachback capability to retrieve the appropriate information from an external repository of 180,000+ material safety data sheets (or RTECS[®] toxicity sheets, depending on what was specified). Remember that MSDS's have not been peer reviewed, and should be used only after corroborating the information contained in these sheets with other recommended courses of action. The reachback results, if any, will appear in a separate window within your web browser, where you'll be able to review resulting matches as appropriate. You may also save these results into the appropriate G3AgentRefs or G3LocalRefs folders, which will make this information available for future reference from within HazRAE. If HazRAE finds these saved documents in the G3AgentRefs folder, it will automatically let you open and view these cached documents, without actually requiring any internet connectivity. See the section titled Accessing Local Reference Materials for detailed information on how to save this information and make it available from within the system.

Integrated Trade Name Check

HazRAE automatically checks for matching material synonyms and trade names when performing material searches. For example, entering "Vikane," finds Sulfuryl Fluoride, and display an overview of it in the overview pane, along with the reminder "Syn: Vikane," indicating that Vikane is a trade name for Sulfuryl Fluoride.

Bookmarks Recall

For each successful search that you perform (whether it is for a material, a guide, a UN Number or CAS number for which you subsequently review any of the material's available information via the 1-Tap Pop Up menu), HazRAE remembers the most recent 15 searches, ready to recall from this pop-up menu. This lets you quickly refer to previously accessed materials, guides, etc.

HazRAE remembers your search history, even if you quit and restart the system. Also, while browsing through materials, HazRAE bookmarks any of these materials for which you access more than just the overview information, by selecting any of the material's details available via the 1-Tap Pop Up menu.

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Search Results Overview Pane

The search results overview pane (area #3, above), displays an overview of a given material. This overview provides basic information about the material, depending on the type of material:

- **Chemical agents:** The overview includes the material's UN Number, CAS NUMBER, certain toxicity and hazard information, dependent upon the specific material. When available, the overview will also display the HIN, EAC, APP code and UN Hazard associated with the material. The HIN (Hazard Information Number or Code) is displayed on some intermodal containers, and is used South America, Europe and Asia. The EAC and APP codes are used in the UK and European Union and signify certain classes of protective clothing, and emergency actions that should be considered when dealing with an incident involving the specified material. Refer to the UK/ED Codes section of this manual for more information.
- **Biological agents:** The overview includes the agent's name, its UN Number, the name of the infectious agent, and the infective dose of the agent.
- **Radioactive isotopes:** The isotope name, its short name, CAS NUMBER (if available), atomic#, atomic weight, atomic mass, half life, specific activity and types of radiation associated with this isotope (e.g., Alpha, Beta, Gamma or Neutron – extremely useful to know when determining which types of detectors may be useful to detect the presence of the given isotope).

Intelligent Navigation

The and buttons, seen in area #5, are context sensitive. This means that:

- If the last search you did was by material name, these buttons will take you to the next/previous material found in the system (materials are stored alphabetically).
- If the last search you did was by UN Number, these buttons will take you to the next/previous material found with the same UN Number.
- If the last search you did was by CAS NUMBER, these buttons will take you to the next/previous material found with the same CAS NUMBER.
- If the last search you did was by synonym/tradename, then the next/previous buttons will take you to the alphabetically next/previous synonym/tradename.

The intelligence behind these navigation buttons is built-in, reducing the clutter and complexity of the user interface required to quickly get the answers you're looking for.

Instant Access to All Integrated Data via 1-Tap Pop Up (Choose view...)

Once you've selected the material you're interested in, tapping on the Choose View pop-up menu () will display a list of options that will take you to the appropriate view for this particular material. Not all options are applicable to each material, and only the applicable options for the selected material will appear in this pop-up menu. The complete set of options available is shown at the right. The specific capabilities offered by the various options noted in the table are discussed in more detail in the following sections of this user guide. This pop-up menu is highlighted in a bright

View Guide
Isolation Distances
Hazard Overview
Reactive Groups
Material Profile
Precursors
Protective Clothing
Respirators
EMS-Signs/Symptoms
EMS-First Aid

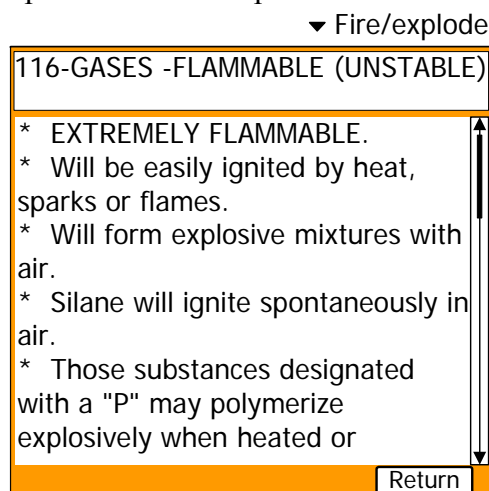
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green, as a visual-cue to let you know that agent-specific response information is available from this pop-up menu.

View Guide

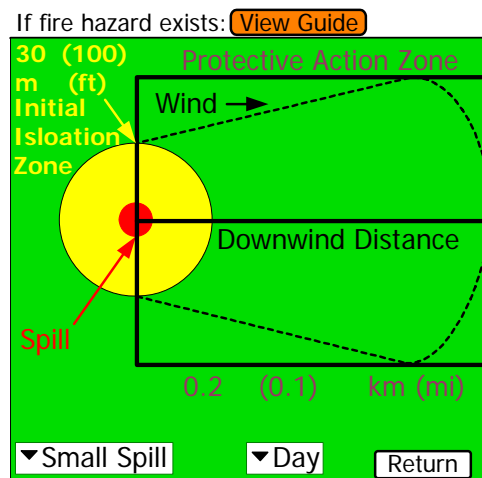
The guide pages are taken directly from the U.S. Department of Transportation's Emergency Response Guide reference. The ERG-2004 is designed to be used by a first responder to determine the appropriate level of action during the first 30 minutes after a transportation accident involving hazardous materials. Although knowledgeable in the field of law enforcement and public protection, a first responder is usually not an expert in the transport or handling of hazardous materials. Thus, the ERG is a compact source of essential information to use as a basis for making reasonable decisions, often under difficult conditions. The guide pages in HazRAE maintain the look and feel of the original ERG's

"Orange" pages, as is shown from the screenshot at the right. On the top right corner of the display is a popup menu that contains each of the sections of the selected guide. This pop-up menu lets you quickly select and navigate to the appropriate section of the guide. The upper rectangular area displayed at the right lists the number and name of the guide you are looking at, and the lower section displays the appropriate ERG guide pages. Tapping the **Return** button will return you to whichever screen you came from. If there is more text than can fit in the lower area, a scrollbar will appear, allowing you to scroll up or down through the guide.



Isolation Distances

Many materials in HazRAE have a specific Initial Isolation Zone and Protective Action Zone that have been calculated for them, depending on the size of the spill, and whether or not the spill has occurred during day or night time hours. Argonne National Laboratory provides the official values used in the calculation of the Initial Isolation Zone and Protective Action Zones used by the ERG, and HazRAE. HazRAE presents this information in an easy to understand graphical display, allowing a user to easily select the size of the spill, and the time of day of the spill, and immediately see the impact on the



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recommended size of the Initial Isolation Zone and the Protective Action Zone. HazRAE's isolation display is shown in the screenshot above.

In the screenshot, the spill is noted as the red circle. The Initial Isolation Zone is noted as the yellow circle around the spill. Distances are displayed in both meters and feet, or kilometers (km) and miles (mi) as appropriate. Initial Isolation Zone distances are displayed in yellow, and the Protective Action Zone distances are displayed in a dark purple. Simply tapping on the two pop-up menus will let you change the size of the spill (small or large), or change the time of day of the spill (day or night). The isolation and protective action zone values displayed will dynamically update based on what you specify.



The displayed distances are recommendations that an emergency responder or incident commander should evaluate prior to use based on the situation at the scene. **IF THERE IS A FIRE, or IF A FIRE IS INVOLVED**, you should go directly to the appropriate guide page, which you can get to by clicking on the "View Guide" button at the top of the screen.



Modeling for worst-case scenarios in the event of terrorism or sabotage indicates it may be appropriate to apply a factor of 1.5 or 2.0 to the values displayed, in those instances where sabotage or terrorism is suspected.

Hazard Overview

The Hazard Overview screen contains an overview of the hazards associated with the selected material. The hazard overview screen is shown at the right. The four different sections of this screen are described below:

- First is displayed the material name, any name variant (like certain inhalation or reactive hazards), shipping hazard, and water hazard information. The size of this field may grow in size based on the device that HazRAE is installed on.
- Next is the IDLH value associated with this specific material (may not be available or applicable for all materials). IDLH values are integrated from NIOSH, NIH and EPA data sources.
- After the IDLH value is the Air/Water reactive warning and levels of concern overview. This provides specific results of what happens when this compound mixes with air or water. May not be available for all materials. This field may grow in size based on the device that HazRAE is installed on. In addition, if available, this field will display the following hazard properties for the selected material: LOC, ERPG1, ERPG2, ERPG3, TEEL1, TEEL2, TEEL3, TLV-STEL and TLV-TWA. Note that LOC, as used in this field is the concentration of the chemical, is in grams per cubic meter, above which there may be serious, irreversible health effects as a result of a single exposure for a relatively short period of time, as described in Technical Guidance for Hazards Analysis (USEPA, FEMA, and USDOT 1987).
- Next are the material's Special Hazards (if any). Each material can have up to five special hazard warnings indicated for it. They will be listed in this area. These values come from EPA recommendations for the selected material.
- Note that depending on the selected material, the AEGs (including odor thresholds, where available), MEGs, MEG/CWA or RTECs options may be visible under the More... pop-up menu. Selecting any of the choice under the More... pop-up menu will display the appropriate exposure guidelines, as described in the following sections.

ISOBUTYL ISOCYANATE		↑
Material is water reactive (when spilled in water)		↓
IDLH: 5,000 mg/m3 [Unch]		
A pyrophoric material is capable of spontaneous ignition when exposed		↑
Special Hazards		
- Highly Flammable		
- Strong Oxidizing Agent		
- Air-Reactive		
- Peroxidizable Compound		
- Water-Reactive		
▼ More...		Return

The broad array of health hazard information and levels of concern (including odor thresholds) embedded in HazRAE, makes it the most comprehensive mobile chemical agent risk assessment tool (CARAT[®]) available today.

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Acute Exposure Guideline Levels (AEGLs)

When an incident occurs near a population center, responders are responsible for identifying appropriate level of concern that will protect the general public from exposure.

Public exposure guidelines are meant to protect all segments of the population, including the very young and the very old, pregnant women, and hypersensitive individuals. AEGLs, if available for a given material, is one choice available to use as the level of concern. Personal judgment and experience should always be used both for selecting the appropriate levels of concern and for planning a response based on the selected information.

The AEGL guidelines define three tiers of AEGLs as follows:

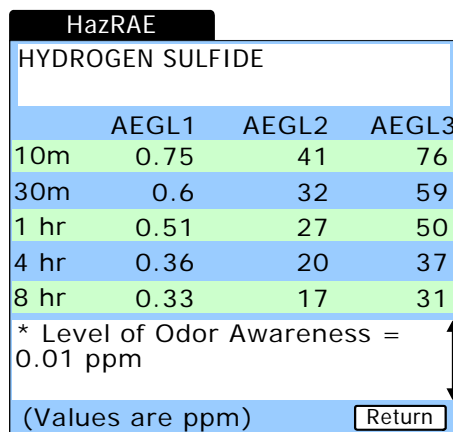
AEGL-1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL-2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Each of the three levels of AEGLs, AEGL1, AEGL2, and AEGL3, are developed for each of five exposure periods: 10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours. HazRAE includes the most up-to-date published AEGL values (proposed, interim and final) available as of July 2004. A screenshot of HazRAE's AEGL display is shown at the right.

When available, odor thresholds and other advisories relevant for the displayed material will also be displayed. Armed with this AEGL information, the MEG guidelines (covered later), and the previous level of concern information already mentioned, HazRAE gives responders instant access to the most comprehensive chemical agent risk assessment tool (CARAT[®]) available today.



The screenshot shows a software interface for HazRAE. At the top, it says 'HazRAE' in a black box. Below that, 'HYDROGEN SULFIDE' is displayed in a white box with a blue border. A table follows with columns for exposure periods and three AEGL levels. The table has alternating light green and light blue rows. Below the table, there is a note about odor awareness and a 'Return' button.

	AEGL1	AEGL2	AEGL3
10m	0.75	41	76
30m	0.6	32	59
1 hr	0.51	27	50
4 hr	0.36	20	37
8 hr	0.33	17	31


* Level of Odor Awareness = 0.01 ppm

(Values are ppm)

Military Exposure Guidelines (MEGs)

HazRAE provides military exposure guidelines (MEGs) for chemicals in air, water, and soil for use during the planning and operational phases of military deployments. MEGs can be used to characterize the level of health and mission risks associated with identified or anticipated exposures to chemicals in the deployment environment.

With HazRAE, trained personnel such as preventive medicine officers, environmental staff officers, industrial hygienists, health risk assessors, or other medically trained personnel, can quickly characterize risks from chemical exposures over a broad range of materials. The


US Army Center for Health Promotion and Preventive Medicine is responsible for the publication of MEGs, and the data found in HazRAE is the latest released data, revised as of January 2004. A screenshot of one of the two MEG displays in HazRAE is shown at the right. The Hazard Overview Screen (described previously), will display a button () for any material that has associated MEG information. Military Exposure Guidelines for chemical warfare agents is described in the following section. Users of MEG data in HazRAE should be familiar with the Army's Chemical Exposure Guidelines for Deployed Military Personnel prior to interpreting the MEG data found in HazRAE.

HazRAE			
HYDROGEN SELENIDE			
Air MEGs (mg/m3)			
	Sev.	Sig.	Min.
1-hr	840	100	67
	8-hr	1-14 day	1-year
	0.98	0.98	N/A
Water MEGs (mg/L)			
	<7 Day	7-14 Day	1-year
5L/Day	0.14	0.05	0.02
15L/Day	0.7	0.14	0.007
Soil MEGs (mg/Kg): 47			
Last change: Jan-04 <input type="button" value="Return"/>			

Background on MEGs

MEGs are concentrations of chemicals in air, water, and soil that can be used to assist in assessing the significance of field exposures to chemical hazards during or planning for military deployments. Specifically, a MEG is a chemical concentration, which represents an estimate of the level above which certain types of health effects may begin to occur in individuals within the exposed population after a continuous, single exposure of specified duration. The severity of the health effects and percentage of the exposed population demonstrating health effects will increase as concentrations increase above the MEG limits. MEGs are not designed for determining casualty estimates but are instead are preventive measures guidelines.

MEGs for Chemical Warfare Agents (MEG/CWAs)

For chemical warfare agents, Air-MEGs are provided for temporary and short-term exposure scenarios of 10 minutes, 1 hour, 8 hours, and 24 hours. The Hazard Overview Screen (described previously), will display a button () for any material that has associated MEG/CWA information. The MEG/CWA screen is shown at right.

HazRAE			
SARIN (WHEN USED AS A WEAPON)			
Air MEGs (mg/m3)			
	Min.	Sig.	Severe
10m	0.0069	0.087	0.38
1hr	0.0028	0.035	0.13
8hr	0.001	0.013	0.051
24hr	0.0003	0.004	0.02
Last change: Jan-04 <input type="button" value="Return"/>			

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Definition of Health Effects for Air/Water MEGs

The tables below list a summary of the health and performance impacts associated with air and water exposure. For additional information or guidance, refer to the US Army Center for Health Promotion and Preventive Medicine.

Definitions Of Health Effects Associated With Air-MEGs

Exposure Duration	Health Effects and Performance Degradation
1 hour (Severe)	The airborne concentration above which continuous exposure for 1 hour could begin to produce life-threatening or lethal effects in a small portion of individuals. Increasing concentrations and/or duration of exposure will increase incidence of lethality and severity of non-lethal severe effects.
1 hour (Significant)	The airborne concentration above which continuous exposure for 1 hour could begin to produce irreversible, permanent, or serious health effects that may result in performance degradation and incapacitate in a small portion of individuals. Increasing concentrations and/or duration of exposure will increase incidence and severity of effects.
1 hour (Minimal)	The airborne concentration above which continuous exposure for 1 hour could begin to produce mild, non-disabling, transient, reversible effects, if any. Such effects should not impair performance. Increasing concentration and/or duration could result in performance degradation, especially for tasks requiring specific mental/visual acuity or physical dexterity/strength.
8 hours and 24 hours	The airborne concentration above which continuous exposure for 8 or 24 hours could begin to produce mild, non-disabling, transient, reversible effects, if any. Such effects should not impair performance. Increasing concentration and/or duration could result in performance degradation, especially for tasks requiring specific mental/visual acuity or physical dexterity/strength.
14 days	The airborne concentration for a continuous exposure for up to 14 days (24 hours/day) that should not impair performance and is considered protective against significant, non-cancer effects. Increasing concentration and/or duration could result in performance degradation or increase the potential for inducing delayed/permanent disease (e.g., kidney disease or cancer).
1 year	The airborne concentration for a continuous exposure up to 1 year (365 days, 24 hours/day) that is considered protective against health effects including chronic disease and increased risk to cancer (i.e., cancer risk greater than 1×10^{-4}). No performance degradation or long-term health consequences are expected with exposure at or below this level. Increasing concentration and/or duration could increase the potential for delayed/permanent disease (e.g., kidney disease or cancer).

Definitions Of Health Effects Associated With Water-MEGs

Exposure Duration	Health Effects and Performance Degradation
5 days 5 or 15 L/day	The drinking water concentration for a continuous daily consumption of either 5 L/day or 15 L/day for up to 5 days that should not impair performance and is considered protective against significant non-cancer effects. Increasing concentration and/or duration could result in performance degradation, need for medical intervention, or increase the potential for delayed/permanent disease (e.g., kidney disease or cancer).
14 days 5 or 15 L/day	The drinking water concentration for a continuous daily consumption of either 5 L/day or 15 L/day for up to 14 days that should not impair performance and is considered protective against significant non-cancer effects. Increasing concentration and/or duration could result in performance degradation, need for medical intervention, or increase the potential for delayed/permanent disease (e.g.,

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	kidney disease or cancer).
1 year 5 or 15 L/day	The drinking water concentration for a continuous daily consumption of either 5 L/day or 15 L/day for up to 1 year that should not impair performance and is considered protective against health effects including chronic disease and increased risk to cancer (i.e., cancer risk greater than 1×10^{-4}). Increasing concentration and/or duration could increase the potential for delayed/permanent disease (e.g., kidney disease or cancer).

Definitions Of Health Effects Associated With Soil-MEGs

Exposure Duration	Health Effects and Performance Degradation
1 year	The soil concentration for continuous, daily exposure (from ingestion, dermal absorption, and inhalation) for up to 1 year (365 days) that should not impair performance and is considered protective against any health effects including chronic disease and increased risk to cancer (i.e., cancer risk greater than 1×10^{-4}). Increasing concentration and/or duration could increase the potential for delayed/permanent disease (e.g., kidney disease or cancer).

Registry of Toxic Effects of Chemical Substances (RTECS)



For those materials in the system where there is an RTECS# available, HazRAE provides access to RTECS data, either locally or via reachback access to this data, for any materials within the system for which an RTECS# is available. When the RTECS option is available and selected, the appropriate RTECS information for the current chemical agent will display within your default web browser.

Background on RTECS

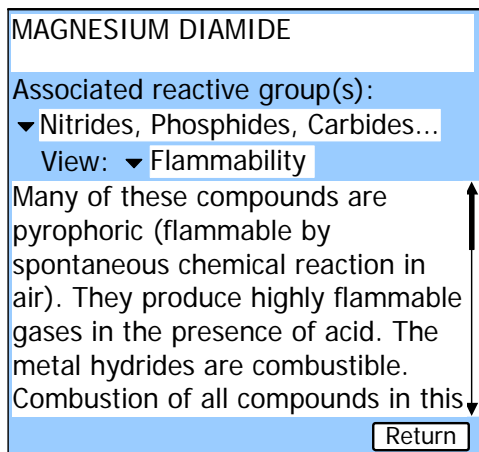
RTECS is a definitive toxicological database with supplemental information pertinent to both the chemical industry and the occupational safety and health community. This technical data is needed to assess workers' exposures to chemicals, particularly to lesser-known-and-used chemical substances. OSHA has designated RTECS as a primary source for toxicity data for Material Safety Data Sheets in its Hazard Communications Rule. In recent years RTECS has grown to include more than 160,000 chemicals. The toxicological data are organized into six fields: primary irritation, mutagenic effects, reproductive effects, tumorigenic effects, acute toxicity and multiple dose toxicity. Each data line includes the citation to its bibliographic source. RTECS provides a host of reference data including, but not limited to: CAS Numbers, OSHA PELs, ACGIH TLVs, NIOSH RELs, Carcinogenic assessments, Beilstein Reference Numbers, and Bioassay results from the National Toxicology Program.

On December 18, 2001, CDC's Technology Transfer Office, on behalf of NIOSH, successfully completed negotiating a Public Health System Trademark Licensing Agreement for RTECS. This non-exclusive licensing agreement provides for the transfer and continued development of the RTECS Database and its Trademark to MDL Information Systems, Inc. ("MDL"), a wholly owned subsidiary of Elsevier Science, Inc. Under this agreement, MDL will be responsible for updating, licensing, and marketing and distributing RTECS.

Reactive Groups

Most materials are associated with specific reactive groups. The Reactive Groups screen lets you navigate through the various reactive group attributes that this material is associated with. A screenshot of the reactive groups screen is shown at the right. The reactive groups screen is broken down into the following four components:

- **Material name:** At the top of the screen, the selected material's name is displayed for quick reference.
- **The reactive group(s) pop-up menu** lists which reactive group(s) this particular material belongs to. When using a HazCat test kit to confirm the existence of a suspected agent, knowing the agent's reactive group(s) can significantly expedite your HazCat test results, by indicating (based on the agent's reactive group) which HazCat group test you should start with. If the results are positive, you'll have saved quite a bit of time over traditional HazCat operations, as instead of having to run through a battery of HazCat tests, you'll know which group test to start with in advance, which should then positively confirm that the material does or does not belong to the indicated reactivity group.
- **Each reactive group has specific attributes**, as defined by the View: pop-up menu. Materials/compounds in each group have information organized in 5 categories that you can choose to view: Flammability, Reactivity, Toxicity, Other characteristics and Examples of the materials that are part of this group. You can view any of this information by tapping on the View pop-up menu, and selecting the desired category.
- **Characteristics of the selected attribute** for the group to which the selected material belongs are displayed in the lower text box. Note that some materials belong to more than one group. If a material belongs to more than one group, the Associated reactive group(s) pop-up menu will be enabled. This will let you choose between the groups that the selected material is associated.



Note: The reactive group provides general information for all materials that belong to this group. The Specific characteristics (flammability, toxicity, etc.) of a specific material may differ from these group attributes. Use this information for general guidance, when more specific information is not available. If available, use the information on the Hazard Overview and Chemical Profile screens for the specific hazards associated with this chemical.



Material Profile

As a quick reference, HazRAE contains supporting chemical profile data on many of the materials stored in the system. A snapshot of the chemical profile screen is shown at the right. There are three parts to this display, as described below:

- The upper section includes a general description of the material. It also includes things like physical attributes, flash point, and other attributes unique to the selected material.
- The center section of the display shows a more detailed material profile, describing the material, specific reactions, its composition, and other information. If available for the displayed material, the following fields will also be present: Auto Ignition, Boiling Point and Flash Point. Some materials have ignition, flash and boiling point temperatures that vary over a temperature range (e.g., 131 to 135 degrees). Where this range is insignificant, from an emergency response perspective, only the lower, more conservative, temperature is displayed. If the range is great (e.g., 200 to 400 degrees), the range will be displayed. The flash point values will also indicate how the flash point temperature was measured, using either the open cup method, abbreviated (oc) in the system, close cup, abbreviated (cc), or unspecified. Lower Explosive Limit, Upper Explosive Limit, Melting Point, Specific Gravity, Vapor Density, Vapor Pressure, Ionization energy (sometimes referred to as ionization potential), and RAE Systems correction factors for their 9.8eV, 10.6eV and 11.7eV photoionization detectors (PIDs) are also available. The correction factor fields are labeled RAE 9.8CF, RAE10.6CF and RAE11.7CF. Refer to your RAE Systems PID user manual or application notes to learn how to use these correction factors. Correction factors with a “+” sign after them indicate confirmed values. Others are preliminary and may be subject to change.
- The last element on this screen is the chemical formula for the selected material.

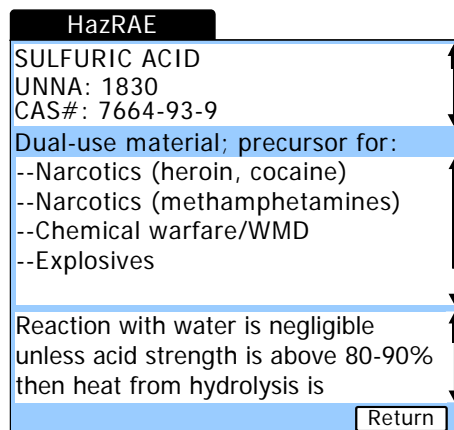
General description/Profile:	
A white to reddish colored solid in the form of crystalline rods. Used as an antiseptic and in organic	↑ ↓
Salts, basic, such as SODIUM PHENOLATE, are generally soluble in water. The resulting solutions contain moderate concentrations of hydroxide ions and have pH's	↑ ↓
Chemical Formula:	
C6H6O.Na	
Return	



Precursor Identifier

Access to the precursor identifier screen is available via the 1-Tap Pop Up at the bottom of the Search, Discovery and S&S tab. The Search tab will also display and highlight a precursor button as appropriate. The **Precursor** button is only visible if the displayed material is a known dual-use material that is or may be a precursor associated with one or more of the following categories:

- Narcotics (heroin, cocaine)
- Narcotics (methamphetamines)
- Explosives/improvised explosive devices (IEDs)
- Chemical warfare/WMD agents.



Tapping on the **Precursor** button (when visible on the Search Tab for the displayed material) or selecting Precursors from the 1-Tap Pop Up menu takes you to the selected material's associated set of precursors. Note that a given material may be a precursor for more than one of the above listed categories, and if so, each category that it belongs to will be listed. It is important to remember that many of these dual-use materials have many legitimate industrial and agricultural uses, so when assessing intended use, discretion must be paid to the context in which the material was found.

Remember that while the precursor button is only visible on the Search Tab, if a material has known precursors associated with it, you can always access these by selecting the Precursors option from the 1-Tap Pop Up menu visible at the bottom of the Search, Discovery, or S&S tab.

Protective Clothing

HazRAE has specific chemical protective clothing recommendations available for many materials and trade names. This information covers specific clothing recommendations (suit fabric, gloves, boots and face shields) for most major types of protective clothing (neoprene, natural rubber etc). Once a material has been identified (via the Search, Discovery or S&S tab), the protective clothing information (if available) for the selected substance is directly accessible via the system's 1-Tap Pop Up menu (▼ Choose view...).

At the right is a screenshot of the Protective Clothing screen. At the top of the screen is a check box that you can select that will filter out any protective clothing that is currently not on-hand in your inventory. What you have in inventory can be set tapping on the HazRAE menu, and selecting Edit/CPC on-hand. From the dialog box that will appear, you can quickly select the protective clothing that you have on hand. Toggling this check box on/off will switch between displaying all protective clothing, and only the clothing available on-hand.

HazRAE	
Show only on-hand CPC:	<input checked="" type="checkbox"/>
Fabric:	▼ Tychem® Responder®
	At least 8 hours
Gloves:	▼ Neop/Butyl
	Less than 1 hour
Boots:	▼ Polyurethane+PVC
	1 - 3 hours (limited data)
Faceshield:	▼ FEP Teflon
	At least 3 hours
Matrix B:	▼ N/A
	N/A
<input type="button" value="Return"/>	

The ordering of the protective clothing that is displayed in the pop-up menus is determined by the breakthrough time for the particular material as specified for the currently selected material. Selecting a different type of protective clothing material will update the breakthrough time as appropriate. The protective clothing with the longest breakthrough time is always displayed first, with other protective clothing with shorter break through times displayed lower down the list of pop-up options. The following disclaimer from the EPA applies to all compounds with protective clothing listed in the MATRIX B field: "These protective clothing recommendations are based on experimental data for another chemical with similar chemical properties and structure. Because material recommendations for chemicals in the same classification will generally, but not always, be appropriate, use caution when following these recommendations. Extra safety margins should be used with the estimated protection time(s)."

The permeation times for the DuPont materials (Tychem® 7500, Tychem® BR & LV, Tychem® CPF 1, Tychem® CPF 2, Tychem® CPF 3, Tychem® CPF 4, Tychem® F, Tychem® QC, Tychem® Reflector®, Tychem® Responder®, Tychem® SL, Tychem® TK) are used by permission, and are taken from the January, 2003 Chemical Protective Clothing Permeation Data, and includes the following DuPont cautions and warnings:

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This information is based upon technical data that DuPont believes to be reliable. It is subject to revision as additional knowledge and experience are gained. DuPont makes no guarantee of results and assumes no obligation or liability in connection with this information.

It is the user's responsibility to determine the level of toxicity and the proper personal protective equipment needed. The information set forth herein reflects laboratory performance of fabrics, not complete garments, under controlled conditions. It is intended for informational use by persons having technical skill for evaluation under their specific end-use conditions at their own discretion and risk.

Anyone intending to use this information should first verify that the garment selected is suitable for the intended use. In many cases, seams and closures have shorter breakthrough times and higher permeation rates than the fabric. Please contact the garment manufacturer for specific data. If fabric becomes torn, abraded or punctured, end user should discontinue use of garment to avoid potential exposure to chemical.

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This information is not intended as a license to operate under or a recommendation to infringe any patent or technical information of DuPont or others covering any material or its use.

In the normalization process of DuPont permeation times, fabrics whose breakthrough times were listed as less than thirty minutes have been omitted from the system.

Protective Clothing Display Name Abbreviations

The names of the chemical protective clothing materials in HazRAE may sometimes be abbreviated. The table below can be used as a reference from the HazRAE displayed name, and the full protective clothing name:

HazRAE Display Name	Full Name
AL PE	Aluminized Polyethylene
AL PET	Aluminized Polyethylene Terephthalate
AL PET/PVC	Aluminized Polyethylene Terephthalate/Polyvinyl Chloride
Barricade®	Plastic Laminate (Dupont Company)
Blue Max®	Plastic Laminate (MSA Company)
BUTYL	Butyl Rubber
BUTYL/NEOP	Butyl Rubber/Chloroprene Rubber
CELLULOSE ACETATE	Same
Checkmate®	Plastic Laminate (Lakeland Company)
Chemrel®	Plastic Laminate (Chemron Company)
Chemrel® Max	Plastic Laminate (Chemron Company)
ChemTuff®	Plastic Laminate (Chemron Company)
CHLOROBUTYL	Chlorobutyl Rubber
CPE	Chlorinated Polyethylene
CR 39	Same
EVAC	Ethylene Vinyl Acetate
FEP TEFLON	Fluorinated Ethylene Propylene
FEP/PTFE	Fluorinated Ethylene Propylene/Polytetrafluoroethylene

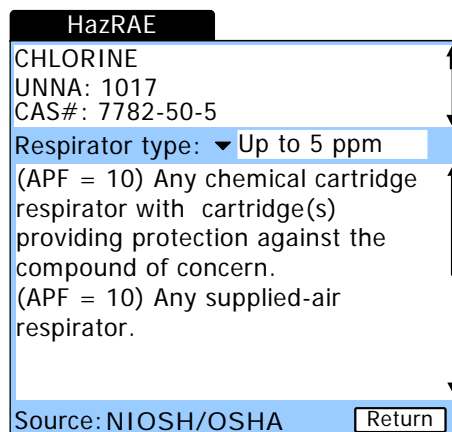
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HazRAE Display Name	Full Name
Hypalon®	Same
Interceptor®	Plastic Laminate (Lakeland Company)
NAT RUB+NEOP	Natural Rubber + Chloroprene Rubber
NAT RUB+NEOP+NBR	Natural Rubber + Chloroprene Rubber + Nitrile-Butadiene Rubber
Natural Rubber	Same
NEOP	Chloroprene Rubber
NEOP/BUTYL	Chloroprene Rubber/Butyl Rubber
NEOP/NAT RUB	Chloroprene Rubber/Natural Rubber
NEOP+PVC	Chloroprene Rubber + Polyvinyl Chloride
NIT+POLYURETHANE+PVC	NIT+POLYURETHANE+PVC
NITRILE	Nitrile Rubber
NITRILE/Natural Rubber	Nitrile Rubber/Natural Rubber
NITRILE+PVC	Nitrile Rubber + Polyvinyl Chloride
NONWOVEN FABRIC	Same
PE	Polyethylene
PE/EVAL/PE	Polyethylene/Ethylene Vinyl Alcohol/Polyethylene
PET	Polyethylene Terephthalate
POLYURETHANE	Polyurethane Rubber
POLYURETHANE+PVC	Polyurethane Rubber + Polyvinyl Chloride
PTFE Teflon®	Polytetrafluoroethylene Teflon
PVAC	Polyvinyl Acetate
PVAL	Polyvinyl Alcohol
PVC	Polyvinyl Chloride
Silver Shield®	Same
Tychem® 7500	Same
Tychem® BR & LV	Same
Tychem® CPF 1	Same
Tychem® CPF 2	Same
Tychem® CPF 3	Plastic Laminate (Kappler Company)
Tychem® CPF 4	Same
Tychem® F	Same
Tychem® QC	Same
Tychem® Reflector®	Same
Tychem® Responder®	Plastic Laminate (Life-Guard Company)
Tychem® SL	Same
Tychem® TK	Same
TYVEK® Saranex® 23-P	Polyethylene/Polyvinylidene Chloride/Polyethylene/Tyvek
Viton®	Fluoroelastomer
Viton®/Butyl	Fluoroelastomer/Butyl Rubber
Viton®/Chlorobutyl	Fluoroelastomer/Chlorobutyl Rubber
Viton®/Neoprene	Fluoroelastomer/Chloroprene Rubber

Respirator Recommendations

HazRAE includes integrated access to respirator recommendations for a broad range of materials. From the 1-tap pop-up menu, select Respirators to view respirator recommendations for the currently selected material. Respirator recommendations have been integrated from the latest issue of the NIOSH Pocket Guide to Chemical Hazards available, released November 11, 2001, latest printing February 2004.

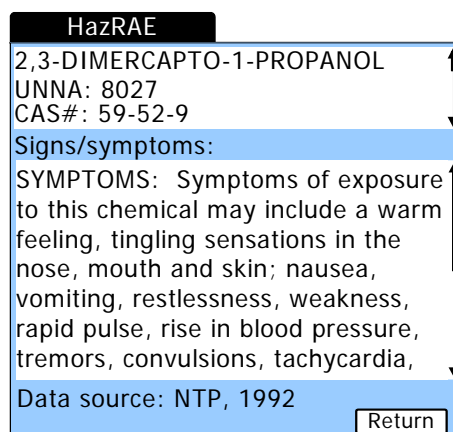
A screenshot of the respirator screen is displayed at the right. The pop-up menu in the middle of the display contains various substance concentration levels. Making a selection from the Respirator type pop-up menu for a given concentration level (or Emergency, Escape or At or above NIOSH), will display the suitable classes of respirators, with their assigned protection factors (APFs), that are acceptable for use under the stated conditions. Of course, more protective respirators may be worn. Emergency or planned entry into unknown concentrations or entry into IDLH conditions are followed by the classes of respirators acceptable for these conditions. The "Escape:" option, when selected, will indicate respirator types that are to be used only for escape purposes.



The bottom left corner of the screen indicates whether the NIOSH, OSHA or other exposure limit (US military exposure limits are used for chemical agent limits) used on which to base the respirator recommendations. The more protective limit between the NIOSH REL or the OSHA PEL is always used. NIOSH/OSHA indicates that the limits are equivalent.

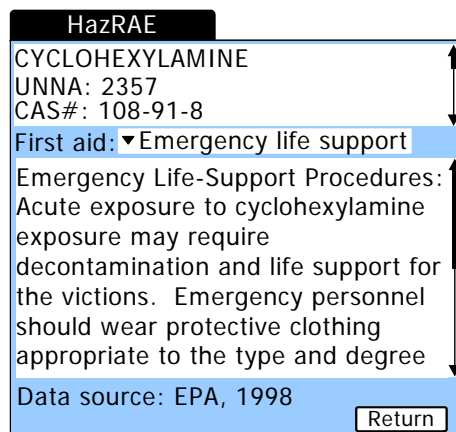
EMS-Signs/Symptoms

The EMS-Signs/Symptoms view displays the material's complete name, along with the signs and symptoms that are associated with the material, and the data source, and date of publication, for the source of the information. A screenshot of the EMS-Signs/Symptoms screen is shown at the right. To return from this view, just click on the Return button, found on the lower right corner of the screen.



EMS-First Aid

The EMS-First Aid view displays first aid and emergency life support procedures for use in response to exposure to the specified material. First aid response procedures are broken down into sections. The sections possible are: Warnings, Emergency life support, Eyes/skin, Ingestion, Inhalation, Aspiration, Notes, Stabilization, Decontamination, Treatment and Other. Not all materials will have all sections, and some materials may have a section listed more than once in the pop-up menu, as in the case of eyes/skin. This may occur when there are different procedures available for treatment of eyes vs. skin, or perhaps multiple sets of notes or warning associated with the material. The data source for the government approved first aid information is displayed below the first aid procedures, along with the date of publication.



The screenshot shows a window titled "HazRAE" with the following content:

- CYCLOHEXYLAMINE
- UNNA: 2357
- CAS#: 108-91-8
- First aid: ▼Emergency life support
- Emergency Life-Support Procedures:
Acute exposure to cyclohexylamine exposure may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree
- Data source: EPA, 1998
- Return button



First aid information contained in the system is intended as an educational aid for use by certified emergency medical practitioners. Any specific treatments or procedures should only be performed by or under the supervision of competent certified emergency medical practitioners, based on their evaluation and interpretation of a patient's condition and attendant circumstances, indications or contraindications.

Discovery Tab

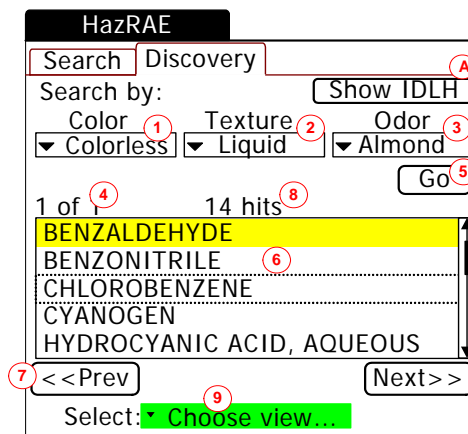
In incident response scenarios where traditional identifiers regarding the materials in use are known, HazRAE's Search tab provides the tools an emergency responder needs to quickly transition from observation to action. However, in those cases where traditional identifiers are not known, such as terrorism response, only HazRAE, with its patent pending technology, can help instantly identify suspect materials, using only your observation skills to note the physically observable material attributes encountered on-scene. This follows the NFPA 472 guidance, that any responder, even at the awareness level of certification, is supposed to be able to use on-scene clues to help them size up the situation. HazRAE puts this into practice.

Relying on these observable attributes, HazRAE can find matching materials from its database in under 3 seconds on a low-end Palm device, and almost instantaneously on more powerful handhelds and desktop computers. HazRAE contains unique attributes that describe the materials in its database and provides a unique "signature" of each material. These signatures (and special modifiers, described below), are used to find unique matches with the physical characteristics observed on-scene with materials in the database.

A screenshot of the Discovery tab is shown below at the right. An overview of the various parts of the screen are listed below, followed with a more detailed explanation for each part of the display.

Circle Explanation Overview

- | | |
|---|---|
| 1 | Color attribute selector |
| 2 | Texture attribute selector |
| 3 | Odor attribute selector |
| 4 | Results page count |
| 5 | Go button |
| 6 | Discovery results pane |
| 7 | Previous/Next page navigation buttons |
| 8 | Hit counter indicating total number of materials that matched your criteria. |
| 9 | 1-Tap Pop Up has Material-specific substance information. |
| A | Only visible when >1 and <11 hits found, shows/hides available IDLH values for the returned materials. Useful for making a quick assessment of which of the returned materials has the lowest IDLH value. |



Color Attribute Selector

Use this pop-up list to choose any of the available colors to describe the observed color of the material. This pop-up menu stays open so you can easily select more than one color attribute. To hide this pop-up menu, tap anywhere outside of the pop-up menu. Tapping on "-N/A-" will deselect any selected colors or special modifiers. For instance, if you choose the attributes brown and green, and then tap , HazRAE will return a list of

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materials that are brown or green in an uncontrolled environment. The color attribute selector also supports four special modifiers (dark, light, pale, bright). These modifiers tell HazRAE that in addition to the colors you specified, the material must also contain the selected modifier. For instance, selecting a color of brown and tapping , Discovery will return many matching materials, while selecting light and brown will return a much smaller set of materials. Note that if you select any of the special modifiers by themselves, without specifying any color(s), and then tap , the modifier will be treated like any of the other colors. So, for instance, selecting only the “Light” special modifier will return all light-colored materials.

Texture Attribute Selector

Use this pop-up list to choose any of the available textures to describe the physical attributes of the material (e.g., liquid, powder, gas, etc.). The basic functionality of the texture pop-up menu is the same as the color attribute pop-up menu, described above. The list of textures also includes certain physical attribute modifiers that are useful in many situations, such as heavier than water, lighter than water, heavier than air and lighter than air. If you select any of the texture attribute special modifiers by themselves, and then tap , like with colors, the special modifier will be treated like another texture, and all materials that match will be returned. So, for instance, only specifying Lighter than Air will return all materials whose gases or fumes are lighter than air.

To find all materials whose gases or fumes are lighter than air, just select the Lighter than Air special modifier. Special modifiers associated with textures are displayed in the table at the right.

Water insoluble
Water soluble
Waxy
Oily
Heavier than air
Lighter than air
Heavier than water
Lighter than water

Odor Attribute Selector



Use this pop-up list to choose any of the available odors observed or reported from the scene of an incident. Remember that if you can smell the odor associated with a material, that you are exposing yourself to the material, which may be deadly in the case of chemical weapons. Odor information is best collected from informants (in the case of investigations), victims or others fleeing the scene of an incident. The basic functionality of the odor pop-up menu is the same as the color and texture attribute pop-up menus, described above.

Results Page Count

The results page count indicates the number of pages of results that matched the attribute search you specified. HazRAE returns the first 50 matching results from your attribute search, and displays the results in the results pane (discussed below). If more than 50 matching materials were found, they'll be divided into pages of 50. Use the and buttons to go to the next/previous page of 50 results.

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Search Button

Use the button to search for those materials that match the attributes you specified in the color, texture and odor pop-up menus. Matching materials (if any) will be displayed in the discovery results pane. Note that if you specify more than one color, HazRAE will return all materials that match any of the color attributes you specify (including the restrictions imposed by the special modifiers, as previously described in the Color attribute selector section of this guide). If you specified several colors and several textures, HazRAE will return all materials that match any of the colors you specified *and* match any of the textures you specify. Likewise, if you specify one or more odors, HazRAE will return *all* materials that match *any* of the odors you specified, *and any* of the textures, *and any* of the colors you specified.

Discovery Results Pane

If the color, texture, odor and special attribute modifiers you specified matched material(s) in the database, their names will be displayed in the discovery results pane. You can scroll through this list of materials. Tap on any material, and then tap on the material specific pop-up menu (described below), to view the specific information related to the selected material.

Previous/Next Page Navigation Buttons

If the color, texture, odor and special attribute modifiers you specified matched more than 50 materials, the and buttons will move a page (50 materials) at a time through your search results. Notice that as you change pages, the page number changes to reflect which page of results you are currently looking at.

Hit Count Indicator

The hit counter indicator displays the total number of “hits,” or materials that matched the attributes that you specified. The number of attributes you specify in your search can limit, or expand, the number of matching materials found.

Instantly Access All Data via 1-Tap Pop Up

Once you've selected the material you're interested in, tapping on the Choose View pop-up menu () will display a list of options that will take you to the appropriate view for this particular material. Only the applicable options for the selected material will appear in this pop-up menu. The options available from this pop-up menu are described in the View Guides, Isolation Distances, Hazard Overview, Reactive Groups, EMS-Signs/Symptoms, EMS-First Aid and Chemical Profile sections of this manual. This pop-up menu is highlighted in a bright green, as a visual-cue to let you know that agent-specific response information is available from this pop-up menu.

Show IDLH Button

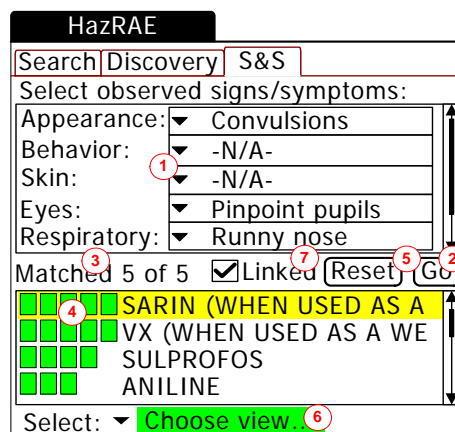
The button is a useful decision aid that quickly displays the IDLH value (if available) associated with the returned list of hits, when >1 and <11 suspect matches were found. This can be toggled on and off.

Signs and Symptoms (S&S) Tab

HazRAE has signs and symptoms, and first aid information available for most materials and trade names integrated in its database. Use the Search Tab to identify a compound by name, UN number or CAS number or Discovery to help identify an unknown material based on observed physical properties, and the S&S tab to help identify unknown chemical agents/materials by signs and symptoms that they cause. Once a material has been identified, the response information relevant for the substance is directly accessible via the system's 1-Tap Pop Up menu

(). The View Guides, Isolation Distances, Hazard Overview, Reactive Groups and Chemical Profile views are described elsewhere in this document. The EMS-Signs/Symptoms, and EMS-First Aid views are described in the sections below.

HazRAE is also unique in that it helps you to identify unknown hazardous compounds based on medical signs and symptoms observed in someone who has been exposed to a hazardous chemical. It does this by matching the observed signs and symptoms that you've specified, with the materials in its database, and returns the top 25 best matching materials. A screenshot of the S&S Tab is shown at the right. An overview of the various parts of the screen is listed below, followed with a more detailed explanation for each part of the S&S display.



Circle Explanation Overview

- 1 Signs/symptoms categories and pop-up menus.
- 2 The Go button matches materials with the specified signs and symptoms.
- 3 Number of user specified symptoms the selected (highlighted in yellow) material actually matched, out of the total number of symptoms the user specified.
- 4 The results list displays a graphical view of the rank of each matching material. Best matching materials will always be located at the top of the list.
- 5 The Reset button resets all the categories and lets you quickly start over.
- 6 1-Tap Pop Up menu to access data relevant to the currently selected (highlighted in yellow) hazardous compound.
- 7 Links signs and symptoms search results with previous discovery results (if available). If no prior discovery results are available, this option won't be visible.



All of the symptom and first aid data found in HazRAE comes from published, government approved data sources, such as the National Institute of Health, the EPA, etc.

Symptom Categories

Use the signs and symptoms categories to select the signs and symptoms observed. There are eight categories, similar to those defined by the Defense Protective Service's NBC Agent categories, only expanded to contain more than 120 distinct indicators to choose from to more accurately reflect the wide range of materials in the HazRAE database. Depending on the device on which you are running the system, there may be a scroll bar to the right of the categories, to let you scroll the list up or down in order to view all eight categories. The pop-up menus are similar to the pop-up menus on the Discovery tab, in that when you tap on them, they pop-up, and stay up, to more easily allow you to select multiple indicators. Close the pop-up menu by clicking anywhere outside of it. To disable all the indicators in a given category, select "-N/A-."

Go Button

Use the button to return the top 25 compounds whose signs and symptoms best match those you've selected. You can also add additional indicators to those already selected, and tap the button to return the top 25 matches based on the revised list of indicators.

Link Checkbox

The link checkbox, (only visible if prior results are available on the Discovery Tab), if checked, will factor in matching results from a prior Discovery Search with the current S&S results. This may change the ranking of your results, giving a higher rank to an agent that matches the observed signs and symptoms, *and* the physical properties that you've specified. When used appropriately, this is a very powerful capability.

To link prior discovery results in with the ranked results of an S&S search, check the Linked checkbox. Any S&S results (or future results) will not only be ranked to include the top 25 agents that best match the signs and symptoms you've described, but also match the physical properties you've specified. Materials that match both the physical properties specified in a prior discovery search, and have ranked in the top 25 matching materials (based on signs and symptoms), will get re-ranked, and get subsequently sorted higher on the list of most probable agents. To link a prior discovery search with S&S, tap the linked checkbox, Linked. When reviewing the results of a S&S search, you may notice that when you tap on some of the resulting agent names displayed in the results listbox, that the Linked appears highlighted yellow. Agents that match both the prior discovery search and the S&S search, will be ranked higher in the list of matching agents, and the checkbox will appear like this: **Linked**.

Match Results

Area five of the screen, as circled in the above illustration, displays for the material highlighted in the list box of results, how many of the indicators you specified this material actually matched, along with the total number of indicators you specified.

Top 25 Best Matching Materials

This list box (as indicated in circled area 4, in the above screenshot), contains the best matching materials. The best matching materials (those that best matched the indicators you specified) will always be at the top of the list, and those with the lowest scores will be at the bottom. To the left of the material name is a graphical segment display to give you a quick feel for how well a given material matched the indicators you specified. To see the actual score, tap on the material to highlight it. The actual score, which is defined as the number of indicators for the selected material that matched those you specified in the signs/symptoms categories, will be displayed in red-circled area 4. It's always a good idea to confirm scores, as the graphic indicators can only resolve differences in scores of 20% or more. Also, if the Linked checkbox is visible and checked, then you've also factored in a previous discovery search in with the current search, and materials that matched both the signs and symptoms and physical properties you specified will get ranked higher than other comparable non-matching agents. See the Linked section (above) for more information.

Reset Button

Use the button to reset all the signs and symptoms across all eight categories, to start a completely new search.

Instant Access to All Data via 1-Tap Pop Up

Once you've selected the material you're interested in, tapping on the Choose View pop-up menu () will display a list of options that will take you to the appropriate view for this particular material. The applicable options for the selected material will appear in this pop-up menu. Options available from this pop-up menu are described in the View Guides, Isolation Distances, Hazard Overview, Reactive Groups, EMS-Signs/Symptoms, EMS-First Aid and Chemical Profile sections of this guide. The sections below explain specifics for the EMS-Signs/Symptoms and EMS-First Aid views. This pop-up menu is highlighted in a bright green, as a visual-cue to let you know that agent-specific response information is available from this pop-up menu.

Signs and Symptoms Category Quick Reference

The table below lists the indicators present in each category supported by the system. Signs/symptoms within a category appear in alphabetical order:

Category	Indicators	Category	Indicators
Appearance	Convulsions Cramps Difficulty standing Dizziness Drooling Drowsiness Facial swelling	Respiratory	Bleeding Bronchial inflammation Bronchial secretion Chest tightness/pain Choking Cough Coughing up blood

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Category	Indicators	Category	Indicators
	Fainting Fatigue Impaired reflexes Loss of appetite Muscle pain Muscular stiffness Numbness Pallor Paralysis Photophobia Ringing in the ears Staggering Stupor Twitching/tremors Unconsciousness/coma Weak/tingling arms/legs		Deep breathing Difficulty breathing Dry mouth Fluid in lungs Frothing of the mouth Hoarseness Inflamed gums Irritation/burns Noisy breathing Pink frothy sputum Rapid breathing Respiratory arrest Runny nose Sneezing
Behavior	Agitation Apprehension Confusion Delirium Difficulty speaking Hallucinations Hyperactivity Lack of concentration Talkative	Cardiovascular	Abnormal heart beat Cardiac depression Cardiac dilatation Headache Heart failure Hypertension Hypotension Light-headedness Rapid heart beat Slow pulse Weak pulse
Skin	Bleeding rashes Blisters Bluish skin/lips Burns Flushed Frostbite Green stained skin Inflamed skin Irritation Itching skin Sensitivity Spontaneous bleeding Stinging Yellowed skin	Digestive System	Almond odor urine/vomitus Belching Black stools Blistering Bloody diarrhea Bloody stools Bloody urine Bloody vomitus Burning pain Coffee-ground vomit Constipation Defecate/urinate involuntarily Difficulty urinating Excessive urination Garlic breath Gastro. burning/irritation Green stained tongue Loss of feeling in lips/tongue Metallic taste Nausea/vomiting Painful diarrhea Painful urination Red/green/brown urine Salivation Thirst Watery diarrhea

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Category	Indicators	Category	Indicators
Eyes	Bleeding Blindness Blurred vision Burning pain Changes in color vision Cloudiness Dilated pupils Dimness of vision Drooping eyelids Eyelid swelling Irritate/burn Loss of coordination Necrosis Pinpoint pupils Protruding eyeballs Spasms/winking Tearing Unreactive pupils	Temperature	Chills Cold extremities Cold sweat Fever Sweating

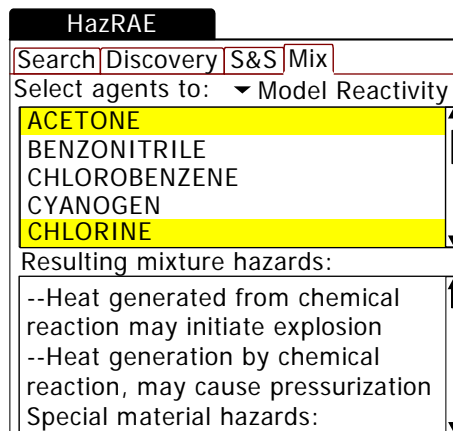
Note that for use by the widest audience, specialized medical terms have been replaced with more common terms. For instance, under the Eyes category, tearing is used in place of the more technical term lacrimation. Also, each term in each category actually represents a table of synonyms. In the same example of tearing, behind the scenes, this one term actually takes into account such things as lacrimation, watering eyes, causes tears, watery eyes and teary eyes, etc.

Mixtures (Mix) Tab

HazRAE has advanced forensics and investigative and response planning capabilities to virtually “mix” a broad range of materials and model their resulting reactivity, along with the ability to “mix” a broad range of precursors to model potential precursor outcomes. Both capabilities are described in more detail below.

Mixing Materials to Model Reactivity

You can select any two materials from the list box of available materials displayed in the upper half of the screen, as seen in the above



screenshot. The materials in this list come from materials that have been book marked, e.g., materials that you have already researched while using the Search Tab. Refer to the Search Tab’s search history bookmarks section of this manual for more information on how bookmarks are automatically created for you. To select a material, simply tap on the material’s name. As soon as two materials are selected, HazRAE will model the material’s reactivity, and display the expected reactivity results on the bottom half of the display, along with other special material hazards associated with the selected materials. Selecting a third material will de-select the first selected material, select the new material, and then model this new reaction. Likewise, you can click and drag in the list box to select any adjacent materials to mix them together and model their reactivity.

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Background on Mixtures

In 1980, the Hazardous Materials Management Section of the California Department of Health Services prepared a manual for the EPA, titled "A Method for Determining Hazardous Waste Compatibility." Subsequently, NOAA expanded upon this work in numerous ways, and submitted it for peer review. The end results are the models that HazRAE uses to predict reactivity between materials.

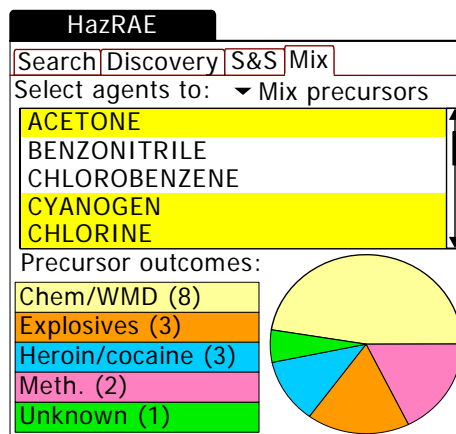
Known Limitations

- One chemical can catalyze (speed up) the reaction between other chemicals. For example, nickel carbonyl catalyzes many polymerization reactions and other kinds of synthetic organic reactions. HazRAE cannot predict when a reaction between two chemicals could be speeded up by another chemical.
- To view "air" or "water" reactivity of a material, use the Hazard Overview screen, as it indicates air/water reactivity (along with other hazards) associated with a given material. It is always advisable to review, in addition to any resulting mixture reactions, the material's Hazard Overview screen in addition to the Special Material Hazards associated with the resulting mixture.

Mixing Precursors to Model Probable Outcomes

Mixing precursors is similar to looking into your kitchen pantry to review what you have on hand, and then imagining what you could possibly make for dinner. Similarly, when mixing precursors, HazRAE allows you to select any number of materials from the available list, and then combine them to indicate the likelihood of the materials being used to produce a given outcome.

To mix precursors and model their outcomes, instead of reactivity, select the Mix precursors option from the pop-up menu visible on the top half of the display, as shown in the screenshot at the right. Note that while most materials have legitimate industrial or agricultural applications, HazRAE contains precursor information on potential nefarious uses of a material. Also, many materials (like acetone) are dual-use precursor materials useful for a number of outcomes like explosives, narcotics, etc. The numbers displayed in parenthesis next to each precursor outcome indicates the total score the precursor outcome received by mixing all the selected materials together. In the case of acetone, it would contribute one point each to the outcomes of Explosives, Heroin/cocaine and Meth, as it is a known precursor for each of the mentioned outcomes. If a selected material is not a known precursor, the category Unknown will receive one point. The visible pie chart, which updates dynamically as materials are added or removed from the list of selected precursors, provides a quick picture of relative probability of each precursor outcome.



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Remember that you need to use on-scene situational awareness to help validate whether the dual-use precursor outcomes are consistent with your environmental settings – e.g., finding chlorine in a water treatment plant makes sense.

Viewing outcome ingredients

You can view the agents that went in to producing a given precursor outcome's score by tapping on its label. For instance, in the above screenshot, tapping on the Unknown (1) label in green, would pop-up a dialog box displaying the one agent that has an unknown precursor outcome, while tapping on Explosives (3) would pop-up a dialog box displaying the three ingredients associated with the explosive precursor outcome.

Radioactive Isotopes

HazRAE contains comprehensive radioactive isotope information, critical for use in training, simulating or responding to a range of incidents involving radiation – from incidents involving transportation accidents to dealing with terrorist use of radiological materials – dirty bombs and improvised nuclear devices. Additionally, HazRAE has the advanced ability to identify unknown radioactive isotopes based on their unique emission signatures, when used (by advanced response teams) with specialized equipment such as gamma ray spectrometers.

Using the Search Tab, a known/desired isotope can be selected by just entering its name (e.g., Uranium-232) its short name (U-232), or CAS NUMBER (if one has been assigned). The overview of the isotope selected will display:

- Isotope name: The full name of the selected isotope (e.g., Uranium-232)
- Short name: The short name of the selected isotope (e.g., U-232)
- CAS NUMBER: Only displayed if available for the selected isotope
- Atomic# Atomic number of the selected isotope
- Atomic weight Standard atomic weight of the selected isotope
- Atomic mass Atomic mass of the selected isotope
- Half life Half life of the selected isotope (in Minutes, Days or Years)
- Specific activity Specific activity (in both curies and becquerel per gram)
- Radiation types Types of radiation associated with this isotope (e.g., Alpha, Beta, Gamma or Neutron – extremely useful to know when determining which types of detectors may be useful to detect the presence of the given isotope).

Guide

The Department of Energy, Transportation Emergency Preparedness Program recommends the use of ERG Guide 163 as the guideline for First Response Organizations actions and information if the situation is a known radiological event, but no other information is available about the material. Reassess the situation and take appropriate action to protect response personnel, victims, equipment, the public, and property (if

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necessary) based on any new information. HazRAE follows these recommendations, except for those isotopes that are spontaneously fissile; in which case the recommendation provided is Guide 165.

Hazard Overview

HazRAE provides critical information regarding the exposure limits to radioactive isotopes. This information is useful in various response scenarios involved with radiation incidents. The hazard overview screen for radioactive isotopes is shown at the right. For the selected isotope, HazRAE provides the maximum public exposure limits and the maximum occupational exposure limits. The limits may be viewed for various retention classifications, such as day or week. All values are given in both curies and becquerels, which are measures of the radioactive decay rate of an isotope. The source for this exposure data is the United States Nuclear Regulatory Commission (NRC).

HazRAE	
Ac-224	Max. Public Limits
Air Conc:	5.0E-11 $\mu\text{Ci/ml}$ = 1.9E-6 Bq/ml
Water Conc:	3.0E-5 $\mu\text{Ci/ml}$ = 1.1E+0 Bq/ml
	Max. Occupational Limits
Ing.	2.0E+3 μCi = 7.4E+7 Bq LLI wall
ALI:	2.0E+3 μCi = 7.4E+7 Bq
Inh.	3.0E+1 μCi = 1.1E+6 Bq Bone surf.
ALI:	4.0E+1 μCi = 1.5E+6 Bq
Inh.	1.0E-8 $\mu\text{Ci/ml}$ = 3.7E-4 Bq/ml
DAC:	
Retention:	<input type="text" value="Days"/> <input type="button" value="Return"/>

Maximum Public Limits

Public exposure limits are provided for Air Concentration and Water Concentration. Member of the public means any individual except when that individual is receiving an occupational dose. Airborne radioactive material means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases. Waterborne radioactive material means radioactive material dispersed in the water in various forms. Units of concentration are in microcuries per milliliter, and the equivalent value in becquerels per milliliter.

Maximum Occupational Limits

Occupational dose means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources. Occupational dose does not include doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released, from voluntary participation in medical research programs, or as a member of the public.

Occupational exposure limits are provided for Ingestion ALI, Inhalation ALI, and Inhalation DAC. Limit values may be provided for specific organs and/or stochastic exposure. Stochastic means health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Non-stochastic effects can be related directly to the dose equivalent. Retention values may be selected for multiple exposure classes (days, weeks, etc.), plus notations. Units are in microcuries and the equivalent value in Becquerels.

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Annual Limit on Intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue.

Derived Air Concentration (DAC) means the concentration of a given radionuclide in air, which if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate of 1.2 cubic meters of air per hour), results in an intake of one ALI.

The retention class is a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as Days, Weeks, or Years, which applies to a range of clearance half-times: for class days of less than 10 days, for class weeks from 10 to 100 days, and for class years of greater than 100 days.

Exposure Guideline Recommendations

The Preparedness Directorate of the Department of Homeland Security (DHS) is issuing guidance entitled “Application of Protective Action Guides for Radiological Dispersal Devices (RDD) and Improvised Nuclear Device (IND) Incidents” for Federal agencies, and as appropriate, State and local governments, emergency responders, and the general public who may find it useful in planning and responding to an RDD or IND incident. The guidance recommends “protective action guides” (PAGs) to support decisions about actions that may need to be taken to protect the public when responding to or recovering from an RDD or IND incident. This draft guidance was initially published for public comment in the Federal Register, January 3, 2006. A copy of the complete document can be found here: <http://ogcms.energy.gov/documents/71fr174.pdf>.

The PAGs for RDD and IND incidents are generally based on the following sources: the PAGs developed by EPA in coordination with other Federal agencies through the Protective Action Guide Subcommittee of the Federal Radiological Preparedness Coordinating Committee; guidance developed by the FDA for food and food products and the distribution of potassium iodide; and OSHA regulations. In order to use this guide, there may be a need to compare the PAG to the results of a risk assessment or dose projection. It should be emphasized that, in general, when making radiation dose projections, realistic assumptions should be used so the final results are representative of actual conditions. The following table provides a summary of the key actions and suggested PAGs for an RDD or IND incident.

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Phase	Protective action	Protective action guide	Reference
Early	Limit Emergency Worker Exposure.	5 rem (or greater under exceptional circumstances) ¹ .	EPA PAG Manual.
	Sheltering of Public	1 to 5 rems projected dose ²	EPA PAG Manual.
	Evacuation of Public	1 to 5 rems projected dose ³	EPA PAG Manual.
	Administration of Prophylactic Drugs.	For potassium iodide, FDA Guidance dose values ^{4,5} .	FDA Guidance ⁶ .
Intermediate	Limit Worker Exposure	5 rem/yr	See Appendix 1.
	Relocation of General Public	2 rems, projected dose first year Subsequent years: 500 mrem/yr projected dose.	EPA PAG Manual.
	Food Interdiction	500 mrem/yr projected dose	FDA Guidance ⁷ .
Late	Drinking Water Interdiction	500 mrem/yr dose	EPA guidance in development.
	Final Cleanup Actions	Late phase PAG based on optimization.	

¹ In cases when radiation control options are not available or, due to the magnitude of the incident, are not sufficient, doses above 5 rems may be unavoidable. For further discussion see Appendix 1.
² Should normally begin at 1 rem; however, sheltering may begin at lower levels if advantageous.
³ Should normally begin at 1 rem.
⁴ Provides protection from radioactive iodine only.
⁵ For other information on medical prophylactics and treatment please refer to <http://www.fda.gov/cder/drugprepare/default.htm> or <http://www.bt.cdc.gov/radiation/index.asp> or <http://www.orau.gov/reacts>.
⁶ "Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies," December 2001, Center Drug Evaluation and Research, FDA, HHS (<http://www.fda.gov/cder/guidance/5386fml.htm>).
⁷ "Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies," August 13, 1998, Office of Health and Industry Programs, Center for Devices and Radiological Health, FDA, HHS (<http://www.fda.gov/cdhr/dmgrp/84.html>).

In cases when radiation control options are not available, during the early phases of an incident, doses above 5 rems may be unavoidable, and incident commanders may need to consider raising the property and lifesaving response worker guidelines in order to prevent further loss of life and massive spread of destruction (see the table below for additional guidance).

The EPA Federal Guidance for emergency-worker exposure is contained in a Federal Guidance report titled "Manual of Protective Action Guides and Protective Actions For Nuclear Incidents," which was issued in 1992. The report's guidance is that workers can receive up to 10 rem to protect valuable property; and up to 25 rem for saving a life. It also states that greater than 25 rem can be received for life saving if the responders volunteer, are non-pregnant adults, and are fully aware of the risks involved. These emergency doses for a once-in-a-lifetime exposure are not added to occupational dose.

The National Council on Radiation Protection and Measurements (NCRP), which is a scientific non-profit organization chartered by Congress to develop recommendations for radiation protection standards, issued its latest recommendations in 1993, which is later than the EPA emergency guidance. The NCRP recommendation for emergency occupational exposure is that exposures that do not involve life saving be limited to occupational dose limits. However, for life saving the dose may approach 50 rem provided the workers understand the risks from this amount of exposure. They also state that the use of volunteers is desirable and that older workers with low lifetime exposure should be chosen, whenever possible.

Annual Radiation Dose Limits	Agency
Radiation Worker - 5 rem	(NRC, "occupationally" exposed)
General Public - 100 mrem	(NRC, member of the public)
General Public - 25 mrem	(NRC, D&D all pathways)
General Public - 10 mrem	(EPA, air pathway)
General Public - 4 mrem	(EPA, drinking water pathway)

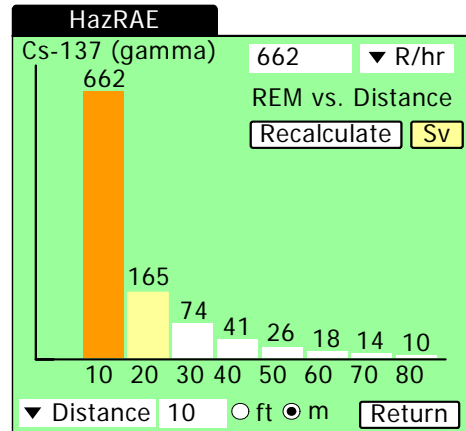
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Isolation Distance

The isolation distance for radiological response consists of four screens: distance, fallout, dose, and half-life. Each displays a bar graph with levels over distance/time/half-life for the selected isotope. Responders can input values specific to the situation, such as readings from detectors, distance from the source of the radiation, time since the event, grams of the material, and half-life selection. Default values are provided by the database.

Distance

The distance screen for radiological response displays the isotope short name, a gamma radiation user input in rems (or sieverts) per hour, the decay levels over distance, and a button to bring up a tool to convert rems to sieverts (or sieverts to rems).



To illustrate the use of this screen it is helpful to consider a response situation. While en route to the scene the responder can bring up the HazRAE isolation distance screen for the radiological isotope. If the radiation type is unknown the HazRAE Rad tab may be used in conjunction with the appropriate survey equipment to identify the isotope(s). The isolation distance screen will populate the graph with a rem/hour value for that isotope, which is an estimate of gamma emissions at close range. If survey equipment measures a different value (most likely something less than the given max, due to time/distance/attenuating factors) simply enter that number with the rem (or sievert) per hour unit selection, then tap the recalculate button. The screen updates the graph of rems (or sieverts) over distance. To convert rems to sieverts select the **Sv** button. The unit conversion tool window pops up with the first rem level and the appropriate conversion. To convert a value other than the default enter that number into the unit converter, then select the calculate button.

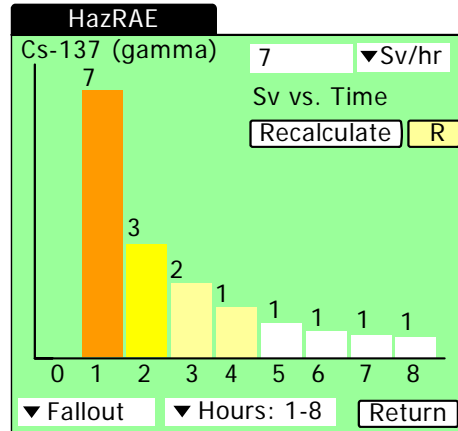
The levels in the graph decrease with the inverse-square of the distance; doubling your distance from the point source decreases the exposure by a factor of four. In the data entry box at the bottom of the screen input your estimated distance from the source, select feet or meters using the appropriate radio button, and press the recalculate button. The horizontal axis of the graph may be used to determine appropriate back-off distance from the gamma radiation. Note that the graph bars are color-coded with respect to the Rad ranges in the EMS Signs-and-Symptoms screen. The ranges and corresponding colors are explained in the table below.

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EMS Signs-and-Symptoms Rad Range	Graph Bar Color
> 3000	Black
3000 - 801	Red
800 - 601	Orange
600 - 201	Bright Yellow
200 - 101	Pale Yellow
100 - 0	White

Fallout

The fallout screen for radiological response displays the isotope short name, a gamma radiation user input in rems (or sieverts) per hour, the fallout decay levels over time, and a button to bring up a tool to convert rems to sieverts (or sieverts to rems).



To illustrate the use of this screen it is helpful to consider a response situation. While en route to the scene the responder can bring up the HazRAE isolation fallout screen for the radiological isotope. If the radiation type is unknown the

HazRAE Rad tab may be used in conjunction with the appropriate survey equipment to identify the isotope(s). The isolation fallout screen will populate the graph with rem/hour value for that isotope, which is an estimate of gamma emissions at close range. If survey equipment measures a different value (most likely something less than the given max, due to time/distance/attenuating factors) simply enter that number with the rem (or sievert) per hour unit selection, then tap the recalculate button. The screen updates the graph of rems (or sieverts) over time. To convert rems to sieverts, select the **Sv** button. The unit conversion tool window pops up with the first rem level and the appropriate conversion. To convert a value other than the default enter that number into the unit converter, then select the calculate button.

At the bottom of the screen is a selection menu with different time ranges: Hours 1-8, Hours 8-16, Hours 16-24, and Days 1-8. The decay rate is displayed graphically by the bars, with the rem levels (roughly equivalent to rad levels for gamma radiation) displayed numerically above each bar. The horizontal axis of the graph may be used to determine an appropriate standoff time from the gamma radiation. Note that the graph bars are color-coded with respect to the rad ranges in the EMS Signs-and-Symptoms screen. The ranges and corresponding colors are in the table above.

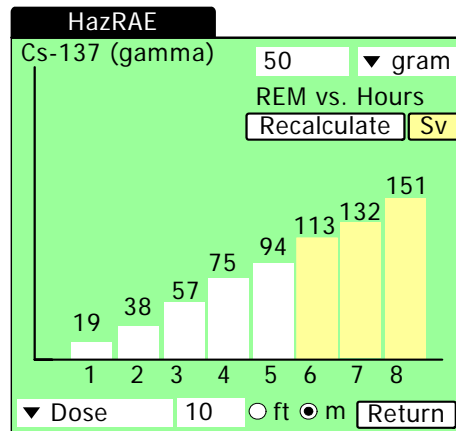
The basis for these calculations was published by Oak Ridge National Labs, and follows the rule-of-sevens, which states that for every seven-fold increase in time following a fission detonation (starting after 1 hour) the radiation intensity decreases by a factor of 10 (~10% after 7 hours). This rule is accurate to 25% for the first two weeks.

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Dose

The dose screen for radiological response displays the isotope short name, a user input box for the amount of radioactive material in grams, a graphical display of the estimated linear increase in total gamma dose for each hour as a function of the distance from the source, and a button to bring up the unit conversion tool to convert rems to sieverts.

To illustrate the use of this screen it is helpful to consider a response situation. While en route to the scene the responder can bring up the HazRAE isolation dose screen for the radiological isotope. If the radiation type is unknown the HazRAE Rad tab may be used in conjunction with the appropriate survey equipment to identify the isotope(s). The isolation dose screen will populate the graph using a default value of 1 gram of the selected isotope. If a different value is known simply enter that number, then tap the recalculate button. The screen updates the levels for the number of grams specified. To convert rems to sieverts, select the **Sv** button. The unit conversion tool window pops up with the first rem level and the appropriate conversion. To convert a value other than the default enter that number into the unit converter, then select the calculate button.



The levels in the graph increase linearly over each hour of time, and vary with the square of the distance from a point source. In the data entry box at the bottom of the screen input your estimated distance from the source in feet or meters (by selecting the appropriate radio button) and select the recalculate button. The values in the graph may be used to estimate accumulated gamma dose after each hour of exposure at the given distance. The graph bars are color-coded with respect to the radiation ranges in the EMS Signs-and-Symptoms screen. The ranges and corresponding colors are explained in the table above.

Note that when using the distance, fallout, and dose screens the input units (see upper right corner of the screen) may be in grams, rems/hour (rem/hr), or sieverts/hour (Sv/hr). The gram selection is based on dose estimation calculations from this dose screen. If gamma radiation detection equipment is available actual readings may be entered in rems or sieverts and the selection of the appropriate units pulldown menu.



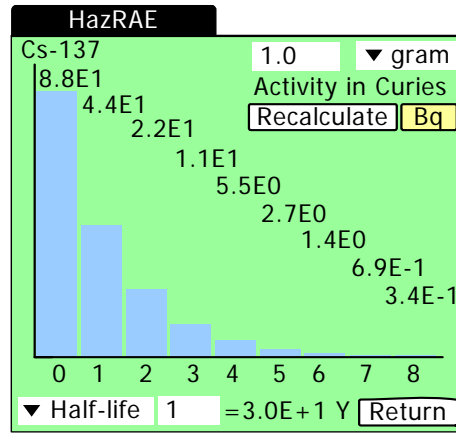
IMPORTANT: The dose values are estimates, and should not be considered as a replacement for dosimeters! The actual total dose is a function of alpha, beta, gamma, and neutron rays. This dose screen only considers gamma radiation, and HazRAE contains the most energetically significant gamma emissions. The travel of radiation is also a function of atmospheric conditions (air density, particulates, humidity, etc.), and local on-scene parameters, which is why a personal dosimeter is a more accurate measurement tool. The rem/hr pulldown in the upper right corner of the screen should be used when actual rem readings are available instead of using this dose estimation tool.

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Information regarding shielding against various types of ionizing radiation can be found in Appendix D of this manual.

Half-life

The half-life screen for radiological response displays the isotope short name, a user input box for the amount of radioactive material in grams, a graphical display of the decrease in activity over half-life, the activity levels in curies for the specific number of grams, and a button to bring up the unit conversion tool to convert curies to becquerels.



To illustrate the use of this screen it is helpful to consider a response situation. While en route to the scene the responder can bring up the HazRAE isolation half-life screen for the radiological isotope. If the radiation type is unknown the HazRAE Rad tab may be used in conjunction with the appropriate survey equipment to identify the isotope(s). The isolation half-life screen will populate the graph using a default value of 1 gram of the selected isotope. If a different value is known simply enter that number, then select the recalculate button. The screen updates the Curie levels for the number of grams specified. To convert curies to becquerels select the button. The unit conversion tool window pops up with the curie level for 0 half-lives and the appropriate conversion. To convert a value other than the default enter that number into the unit converter, then select the calculate button.

The units pull down in the upper right corner of the screen defaults to grams, and the graph depicts activity. Conversely, if the activity is known the number of grams may be calculated. Select the activity units in curies or becquerels, enter the activity value from survey readings, then select the Recalculate button. The graph will depict the estimated number grams based on current readings, and what would remain after the displayed number of half-lives.

At the bottom of the screen is a half-life calculator. Enter a half-life number, then select the button. The result is the time it takes for the isotope's activity to decay to the corresponding level in the graph.

Material Profile

HazRAE provides a wealth of critical information surrounding the properties of radioactive isotopes. This information is useful in various response scenarios involved with radiation incidents. The material profile screen for radioactive isotopes is shown at the left. For the selected isotope, HazRAE provides common industrial uses of the isotope, along with the activity range typical of the given industrial application (if known). The system also displays radiation emissions associated with the selected isotope. This may be any combination of alpha, beta or gamma radiation. Radiation energy is listed (in MeV – million electronvolts) along with the probability of occurrence (%) for the emission (for alpha and beta emissions only). Radiation energy is sorted and displayed from strongest to weakest emission energies for alpha and beta emissions. Gamma emissions are generally listed in order of abundance, reflecting what is most likely to be observed in the field under short sampling periods.

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Also note that for response purposes, HazRAE does not display radiation emissions of isotopes whose half lives are less than 10 minutes, as it is extremely unlikely that these isotopes would be present in sufficient quantities/time to be meaningful in any response scenario. On occasion, the results in the emissions field may display “Alpha/Beta/Gammas are below baseline or only EC/IT occur.” The baseline is defined as the 10-minute half-life, or whose occurrence is less than one percent. If the above message is displayed, note that EC stands for electron capture, and IT stands for isomeric transition.

The lower third of the above screen is dedicated to display the decay chain transitions and decay products (sometimes referred to as daughter isotopes) associated with the selected isotope. This information is useful, among other things, for survey, response, and waste management purposes. An isotope will transition through various states, generally releasing energy of various forms until a stable isotope is produced. Isotope transitions occur generally via alpha (a), beta (B-, 2B-, etc.), electron capture (EC), or spontaneous fission (SF). These transitions lead to a new isotope (which itself may decay), a stable isotope (the end of a decay chain) or perhaps an unknown isotope state. HazRAE uses the convention of “>” to indicate a decay energy emission or a decay daughter product. Within the system, an isotope at the end of its decay chain is considered to be stable when its half-life is greater than 500,000,000 years.

The International Atomic Energy Agency (IAEA) assigns risks associated with radiation sources and their radioactive isotopes based on the type of sealed source and its specific activity, which HazRAE displays at the bottom of the screen. Radiation sources, utilizing radioactive materials, are used throughout the world for a wide variety of peaceful purposes, in industry, medicine, research and education; they are also used for various

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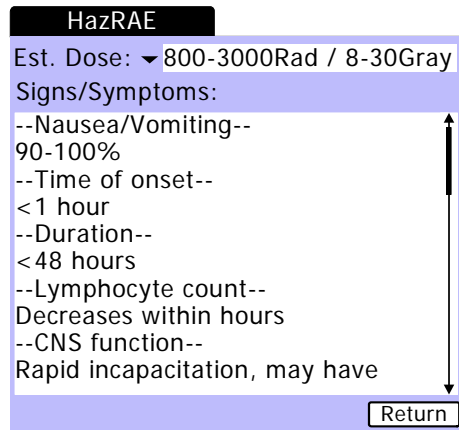
military purposes. Many are in the form of sealed sources with the radioactive materials firmly contained or bound within a suitable capsule or housing. The risks posed by these sources and materials vary, depending on such factors as the radionuclide used, the physical and chemical form, and the specific activity. Unless breached or leaking, sealed sources present a risk from external radiation exposure only. However, breached or leaking sealed sources, as well as unsealed radioactive materials, may lead to contamination of the environment and the intake of radioactive materials into the human body. Isotopes are grouped into five categories. The full definitions of the categories (as displayed in the above screenshot) assigned by the IAEA are as follows:

Category	Short Definition	Full Definition
1	Personally extremely dangerous	This amount of radioactive material would be likely to cause permanent injury to a person who handled it, or were otherwise in contact with it, for more than a few minutes. It would probably be fatal to be close to this amount of unshielded material for a period of a few minutes to an hour. If dispersed by a fire or explosion, could possibly permanently injure or be life threatening to persons in the immediate vicinity. There would be little or no risk of immediate health effects to persons beyond a few hundred meters away, but contaminated areas would need to be cleaned up in accordance with international standards. For large sources the area to be cleaned up could be a square kilometer or more. It would be highly unlikely to contaminate a public water supply to dangerous levels, even if the radioactive material were highly soluble in water.
2	Personally very dangerous	This amount of radioactive material could cause permanent injury to a person who handled it, or were otherwise in contact with it, for a short time (minutes to hours). It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of hours to days. If dispersed by a fire or explosion, could possibly permanently injure or be life threatening to persons in the immediate vicinity. There would be little or no risk of immediate health effects to persons beyond a hundred meters or so away, but contaminated areas would need to be cleaned up in accordance with international standards. The size of the area to be cleaned up would depend on many factors but would probably not exceed a square kilometer. It would be virtually impossible for a Category 2 source to contaminate a public water supply to dangerous levels, even if the radioactive material were highly soluble in water.
3	Personally dangerous	This amount of radioactive material could cause permanent injury to a person who handled it, or were otherwise in contact with it, for some hours. It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks. If dispersed by a fire or explosion, could possibly permanently injure or be life threatening to persons in the immediate vicinity. There would be little or no risk of immediate health effects to persons beyond a few meters away, but contaminated areas would need to be cleaned up in accordance with international standards. The size of the area to be cleaned up would depend on many factors, but would probably not exceed a small fraction of a square kilometer.
4	Unlikely to be dangerous	It is very unlikely that anyone would be permanently injured by this amount of radioactive material. This amount of unshielded radioactive material could possibly - temporarily injure someone who handled it or were otherwise in contact with it, or who were close to it for a period of many weeks. If dispersed by a fire or explosion, could not permanently injure persons.
5	Not dangerous	No one could be permanently injured by this amount of radioactive material. If dispersed by a fire or explosion, could not permanently injure persons.

HazRAE may display a range for the IAEA assigned risk factor when there are multiple industrial uses for a given isotope, and whose specific activities vary such that the assigned risk depends on the specific activity of the isotope encountered.

EMS-Signs and Symptoms for Radioactive Isotopes

HazRAE includes signs and symptoms of exposure to ionizing radiation. Additionally, if you have a dosimeter, or other personal dosimetry device, HazRAE can help you recognize signs and symptoms associated with a range of dosimetry readings. Signs and symptoms associated with exposure to ionizing radiation vary according to the amount of exposure received.



A screenshot of the signs and systems screen for radiation exposure is displayed at the right.

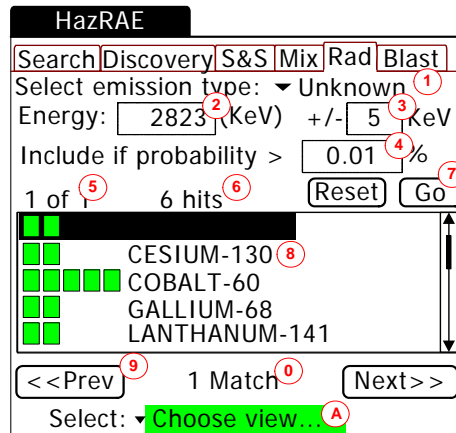
Symptoms of exposure are further broken (as is shown at the right) into the following categories: Nausea/Vomiting, Time of onset, Duration, Lymphocyte count, CNS function, Latent phase duration, Manifest symptoms, Manifest time of onset, Manifest critical period, Manifest organ system, Hospitalization duration and expected mortality rate.

EMS-First Aid for Radioactive Isotopes

HazRAE includes first aid recommendations for exposure to ionizing radiation. This includes isotope specific treatment information and general first aid response guidance for Stabilization, Decontamination, Ingestion and Treatment recommendations. Access to this information is available under the Choose View... 1-Tap Pop-Up menu. The information is displayed on the first aid screen, previously discussed. Refer to the EMS-First Aid section of this manual for more information.

Rad Tab (Isotope Identification)

HazRAE includes advanced capabilities to identify a broad range of unknown isotopes based on their emission energies, as detected by survey equipment such as gamma ray spectrometers, spectrum analyzers, etc. (there are numerous companies that make this type of equipment, Canberra, Ortec and Thermo Electron Corporation are three examples). For all the isotopes found in HazRAE (nearly 700), the system contains the unique emission energy signatures associated with these isotopes.



These energy readings, as measured in the field with the appropriate survey equipment, in conjunction with the use of HazRAE's isotope identification capabilities as described below, allows for the identification of isotopes

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associated with the measured readings, along with correlating the identified isotopes with typical industrial uses and activity levels of the correlated isotopes, and critical response information needed to make informed response decisions. An overview of the various parts of the above screen is described below, followed with a more detailed explanation for each part of the Rad display.

Circle Explanation Overview

- 1 Type of energy emission (if known). Options are Unknown, Alpha, Beta, Gamma-abund, and Gamma-max.
- 2 Emission energy (as measured by your equipment), in KeV.
- 3 Energy tolerance, in KeV. Optimum setting depends on a number of factors, including your equipment's accuracy and resolution.
- 4 When emission types are known, for either Alpha or Beta emissions, allows you to specify a minimum probability of occurrence threshold.
- 5 Current, and total number of pages of identified isotopes.
- 6 Total number of identified isotopes
- 7 Starts a search, or resets cumulative search results.
- 8 Identified isotopes, and relative fit with cumulative query specifications
- 9 Navigation buttons lets you page forward or back through the returned results.
- 0 Indicates the number of query results the selected isotope matches.
- A 1-tap pop-up menu for navigating directly to response information

Selecting Emission Type

HazRAE allows you to limit your search for an isotope to just those isotopes with a given type of radiation emissions, either Alpha, Beta, Gamma-abund, Gamma-max, or unknown. The ability to specify emission type is useful when your equipment only supports detection of specified types of radiation, or you can selectively apply filters for specific emission types or in the instances when you want to limit your search to a suspected type of radiation. When trying to identify unknown isotopes in a relatively short sample period, it may be useful to use the Gamma-abund filter. This filter limits the search to the most abundant gamma emissions related to a given isotope, which may be different than the maximum gamma energy emission associated with an isotope. Thus, while the Gamma-max may uniquely identify an isotope, due to the nature of your survey gear, properties of the isotope itself, or time constraints on-site given to sample emissions, limiting a search to Gamma-abund may actually be a good choice, the circumstances surrounding its use will depend largely on the capabilities of your survey gear, and circumstances unique to the specific incident environment. In general, HazRAE considers gamma emissions representing an abundance of at least 10% as significant, and includes these energies in its identification algorithms. When in doubt, use the Unknown filter, which will search across all emission types for matching isotopes.

A given isotope may emit gamma rays at various emission energies, depending on a number of factors, during its decay. In addition to Gamma-abund, HazRAE allows you to limit gamma searches based on average or maximum gamma emission energies. The rationale for these two options is dictated by the capabilities of your survey equipment,

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and how you have it configured. The paragraph below explains some of these options and complications associated with isotope identification:

To measure gamma emissions with a gamma spectrometer, a spectrum analyzer with the proper front end, or other survey equipment, there are several ways the device could be used. To catch maximum emission energies, it is most likely that someone would use a spectrum analyzer's "Peak Hold" feature to capture maximum energy emissions. A similar function is performed by a multi-channel analyzer, that like a multi-channel receiver, simultaneously detects energy readings in a range of narrow channels. An issue complicating the identification process is to remember that if an isotope has a half life of say 20 days, there is no predicting when exactly decay emissions will take place, just that at the end of the 20 day period, 50% of the original amount of the isotope will have decayed to something else. During this decay period, some quantity of the isotope may be in various phases of its decay chain, and these resulting daughter isotopes will have their own radiation emission signatures, again complicating the identification process.

Selecting Emission Energy Tolerance

In addition to specifying a measured emission energy reading, HazRAE allows you to specify a tolerance. Identified isotopes must have emission signatures that fall within the tolerance of the emission energy that you specify. The system will set suggested tolerances, but actual tolerances will depend on a range of factors including the accuracy and resolution of your detection equipment.

Selecting Probability of Occurrence

When identifying alpha- or beta-emitting isotopes, HazRAE allows you to limit your search for emission energies that exceed a specified probability of occurrence, if known. This option is not available when identifying isotopes of unknown emission types.

Tapping Reset or Go

The **Go** button will attempt to identify isotopes based on the parameters you've specified. HazRAE allows you to run multiple searches, selecting differing parameters based on survey equipment measurements. The system will integrate matching search results, displaying them in the list box above (see Circle 8 of the Rad Screen). Pressing the **Reset** button will reset the results of any prior isotope identification searches, allowing you to start over. Tapping on an isotope displayed in the list box will highlight, and display the cumulative number of times it matched the parameters specified in the preceding emission queries. Also note that even if you only do one query of an unknown emission type, some isotopes may have more than one match, as the isotope may have multiple emission energies of varying types that all fall within the bounds of the specified query. After performing several searches based on readings taken from your survey equipment, HazRAE will provide percentage ranks (the green bars) and numerical scores for identified isotopes. Identified isotopes with higher scores are more likely to indicate the actual isotope(s) involved.

Instant Access to All Data via 1-Tap Pop Up

Once you've selected the isotope you're interested in, tapping on the Choose View pop-up menu (**Choose view...**) will display a list of options that will take you to the appropriate view for this particular isotope. The applicable options for the selected isotope will

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appear in this pop-up menu. Options available from this pop-up menu are described in the View Guides, Isolation Distances, Hazard Overview, EMS-Signs/Symptoms, EMS-First Aid and Material Profile sections of this manual. This pop-up menu is highlighted in a bright green, as a visual-cue to let you know that agent-specific response information is available from this pop-up menu.



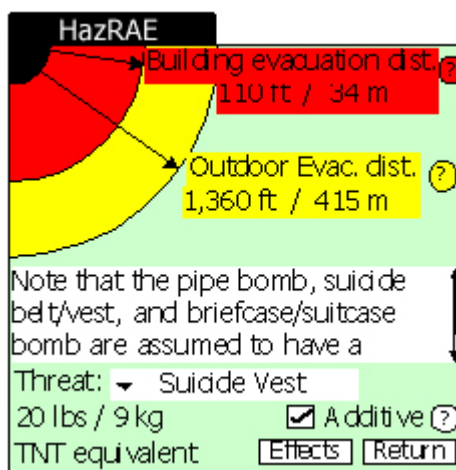
Due to the nature of isotope emissions, decay products, background emissions, etc., identification of isotopes requires training, skills and assets that may not be available to all response organizations. In these situations, joint training exercises with the appropriate response agencies/teams is a good way to practice using HazRAE's isotope identification capabilities. If you'd like to discuss more advanced isotope identification correlation capabilities, please contact us.

Blast Tab


The blast tab contains working aids related to explosive detonations, both conventional and non-conventional improvised nuclear devices. Some of the capabilities available via this tab assume specialized bomb technician/forensics training, while some of the capability is valuable to a broad range of responders – like the ability to calculate safe standoff distances for a broad range of simple or complex IED threats, as explained in the following sections.

IED Standoff/Improvised Explosive Devices

HazRAE includes a fast and easy to use danger and threat ring calculator for estimating standoff distances for more than 160 Improvised Explosive Devices (IEDs) and other explosives. The information, data and standoff distance calculations displayed by the IED Standoff screen were integrated from various government sources using standard Hopkinson-Cranz cube root scaling as required, with integrated RAE Systems proprietary down-range correction factors based on actual controlled detonations, in addition to data from the National Guard, the Department of Defense, and the Bureau of Alcohol Tobacco and Firearms (ATF), among other sources. Additionally, if you are running HazMapper's real-time GPS based mapping system along with HazRAE, the IED threat rings displayed in HazRAE will automatically be transferred to HazMapper, and displayed on HazMapper's real-time GPS maps, greatly increasing situational and geographical awareness – critical for planning modes of ingress/egress, overlaying site specific information like high-risk facilities, etc.



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From the Blast Tab, the IED Standoff screen as seen above is selected by choosing IED Standoff from the available list of options, and tapping the  button.

The IEDs listed in the Threat pop-up menu (as seen above) are arranged in alphabetical order. Once you select the appropriate IED, the display updates to provide information regarding:

Building Evacuation Distance – Displayed in feet and meters, governed by the ability of an un-reinforced building to withstand severe damage or collapse.

Outdoor Evacuation Distance - Displayed in feet and meters, governed by the greater of fragment throw distance or glass breakage/falling glass hazard distance. These distances can be reduced for personnel wearing ballistic protection. Note that the pipe bomb, suicide belt/vest, and briefcase/suitcase bomb are assumed to have a fragmentation characteristic that requires greater standoff distances than an equal amount of explosives in a vehicle.

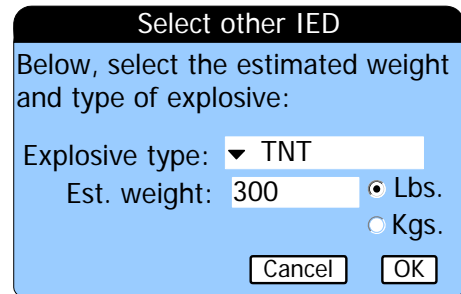
Explosives Mass (TNT equivalent) - Displayed in pounds and kilograms or gallons/liters (as appropriate), governed by the greater of fragment throw distance or glass breakage/falling glass hazard distance. These distances can be reduced for personnel wearing ballistic protection. Note that the pipe bomb, suicide belt/vest, and briefcase/suitcase bomb and other smaller contained IEDs are assumed to have a fragmentation characteristic that requires greater standoff distances than an equal amount of explosives in a vehicle.

Fireball Diameter (for LPG/Butane/Propane) - Assumes efficient mixing of the flammable gas with ambient air.

Safe Distance (for LPG/Butane/Propane) - Determined by U.S. firefighting practices wherein safe distances are approximately 4 times the flame height. Note that an LPG tank filled with high explosives would require a significantly greater standoff distance than if it were filled with LPG.

On-Scene IED calculations

In addition to having integrated access to the most comprehensive set of stand off distances for known improvised explosive devices, HazRAE also includes the capability to calculate standoff and evacuation distances based on on-scene conditions for over 130 types of explosives. This is extremely useful in situations that the suspected IED is not one of those available from the existing set of known IEDs in the pop-up Threat menu. In this situation, select the “User Specified...” option from the pop-up menu. A dialog box will appear (as seen at the right), allowing you to select the suspected type, and estimated weight of the device. With this information, HazRAE will calculate



Select other IED

Below, select the estimated weight and type of explosive:

Explosive type:

Est. weight: Lbs. Kgs.

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standoff and evacuation distances based on these parameters. Note that the default type of explosive selected is TNT, but if the type of explosive employed is known, you can specify it, and HazRAE will base its calculations upon the type of explosive selected (say C-4 or RDX instead of TNT). When specifying the weight of the suspected device, you can also select between pounds and kilograms, and the system will perform the necessary conversions.

Calculating standoff for complex IEDs/combined yield devices

HazRAE understands that some IED threats may consist of mixed loads composed of multiple types of explosives with varying explosive yields. In these scenarios, HazRAE allows you to combine the various IED components (say a suicide bomber wearing a suicide vest who is also pushing a trash bin loaded with explosives, or say 10 lbs of C4 with 20 kg of TNT, etc.). Notice the “Additive” checkbox on the lower right part of the IED display. By selecting this checkbox, the currently selected explosive and any additional IEDs selected will get added to an overall explosive load, and HazRAE will calculate the building and outdoor evacuation distances based off this combined explosive load. An unlimited number of explosives can be combined into a mixed load IED. To review all the component explosives that comprise this combined explosive load, tap on the question mark button that appears when the “Additive” check box is selected. A pop-up window will appear letting you review the various components that comprise the overall explosive load. De-select the Additive checkbox will turn off this capability, and display standoff distance based only on the currently selected explosive. Note that you can't combine LPG gas tank/cylinder explosions of liquefied gas with other combined load mixtures. If you try to do this, the system will only display the fireball radius and safe evacuation distance for the selected LPG threat, and will automatically de-select the additive check box. Also note that if the detonation times of the components of a combined explosive that you've modeled vary, the resulting explosive will be a proportional, and not additive charge. In this case, HazRAE assumes the worst case (being additive), and the guidance provided will be for the worst case scenario.

Improvised explosive devices and terrorism



The world of terrorism encompasses more than just traditional explosives cobbled together to deliver an explosive charge. There are many industrial chemicals, that when accidentally or intentionally mixed together, will result in powerful explosions, some that will also release toxic gases (chlorine, phosgene, phosphine, etc.) Keep in mind that these industrial chemicals are generally easier to come by than any of the traditional explosives found under the “Other...” pop-up menu option of the IED Standoff screen, and do not contain any taggant. Nor will the purchase of these industrial chemicals raise nearly the attention of someone trying to buy C4, TNT, Semtex, etc. The good news is that HazRAE has the ability to mix chemicals and model their reactions, indicating whether or not explosive reactions will take place, whether toxic gases will result, along with a range of other hazardous chemical reactions associated with the resulting mixture. If a toxic gas is emitted, HazRAE also contains exposure limits, health hazards, respirator and protective clothing recommendations, first aid procedures and much more, all instantly available for agents within the system.

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Also, HazRAE, as previously discussed in the Mixtures Tab chapter of this manual, can mix any number of chemical agents together to model the most probable dual use outcomes, including explosives. The above capabilities, when used together, make HazRAE the most comprehensive IED decision support system available today, providing capabilities, guidance and response information otherwise unavailable to bomb squads or other response teams.



When dealing with suspected IED scenarios, be particularly cautious and alert for secondary devices, routes of ingress/egress and refrain from using non-intrinsically safe electronics from within at least several hundred meters of the suspected device.

Blast Effects Consequences

Humans, buildings and other structures respond to varying levels of overpressure caused by the detonation of high explosives in different manners. While overpressure decreases with distance from the point of detonation, terrain, and other structures may distort the effects of a blast's overpressure wave at a given distance. Overall, there are generally accepted overpressure ranges, within which a given set of blast effect consequences are expected to occur. Knowing these consequences, and their distance from a given sized detonation, is useful in planning access and barrier controls, along with devising physical access mitigation strategies.

While different reference sources may list specific values that vary from other sources, generally accepted consequence ranges are listed below. For the IED that you've currently modeled or selected, HazRAE will calculate and display a range of blast effects consequences, and the ranges (in feet and meters) from the blast that one could expect to see the impact of the specified consequence.

Over Pressure Range	Blast Effect Consequences
0.1 to 0.2	Possible breakage of windows under stress; very loud noise.
0.5 to 2.0	Minor damage to frame houses, windows shatter, plaster cracked; personnel knocked down
1.0 to 2.0	Failure of wooden siding, corrugated steel panel joints fail
2.0 to 3.0	Un-reinforced concrete, cinder block walls fail.
2.9 to 4.5	Oil storage tanks ruptured, self-framed steel panel buildings collapse. Possible lethality from flying glass and other projectiles.
4.5 to 7.3	Utility poles snap, serious damage to buildings with structural steel framework. Loaded rail cars overturn
10+	Destruction of most buildings, eardrum/lung damage and threshold fatalities

To review the available blast effects consequence guidance are varying distances from the specified device, press the **Effects** button on the IED Standoff display. A dialog box will pop-up, summarizing expected blast effect consequences from the point of detonation outward.

HazRAE User's Guide

Calculating Breaching Standoff

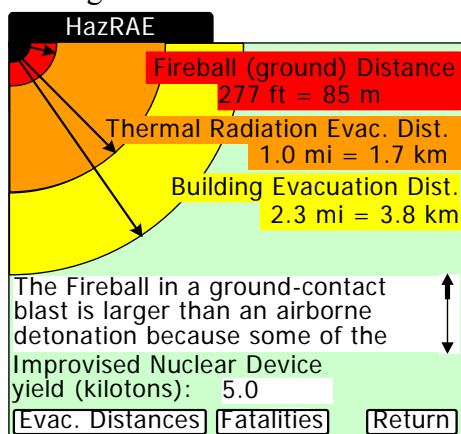
You can specify specific explosive charge weights (using the other... option from the Threats pop-up menu) for the selected explosive down to 0.006 of a pound (2.72 grams / ~42 grains). Note that HazRAE's calculations factor in a fragmentation component on smaller sized blasts, so the values you see as a result of using the IED Standoff calculations for estimating breaching standoff may be slightly greater than what may initially be expected.

Improvised Nuclear Devices

HazRAE includes a fast and easy to use threat ring calculator for estimating standoff distances for Improvised Nuclear Devices (INDs). The calculations displayed by the IND Standoff screen are based on the Rankine-Hugoniot scaling laws as used in "The Effects of Nuclear Weapons" (3rd Edition).

From the Blast Tab, the IND Standoff screen as seen at the right is selected by choosing IND Standoff from the available list of options, and tapping the **Go** button.

By entering a yield value in kilotons and then tapping **Evac.Distances**, the display updates to provide information regarding: fireball distance radius, thermal radiation evacuation distance, and building evacuation distance. The term kiloton refers to the release of 10^{12} calories of explosive energy.



Fireball Distance - Displayed in feet and meters, the Fireball in a ground-contact blast is larger than an airborne detonation because some of the energy is reflected back up from the surface. If the altitude at the point of burst is greater than 75% of the displayed fireball distance there is no fireball at ground level.

Thermal Radiation Evacuation Distance - Displayed in miles and kilometers, the outdoor evacuation distance is a function of Thermal Radiation from a blast at the optimum altitude. Thermal radiation is non-ionizing electromagnetic radiation which has a significant heating effect. Air is virtually transparent to thermal radiation. For the given radius the thermal radiation intensity is sufficient to cause 2nd-degree burns.

Ionizing radiation is electromagnetic radiation of sufficient energy to ionize atoms. This type of radiation is extremely dangerous, but it is also strongly absorbed by air, unlike thermal radiation. Since the ionizing radiation distance is less significant than the thermal radiation distance it is not shown on this display. Refer to the Isolation Distance screens for stand-off distances related to ionization.

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Building Evacuation Distance - Displayed in miles and kilometers, the Building evacuation distance is a function of the Air Blast at the optimum altitude. At 1 PSI overpressure it is sufficient to shatter windows.

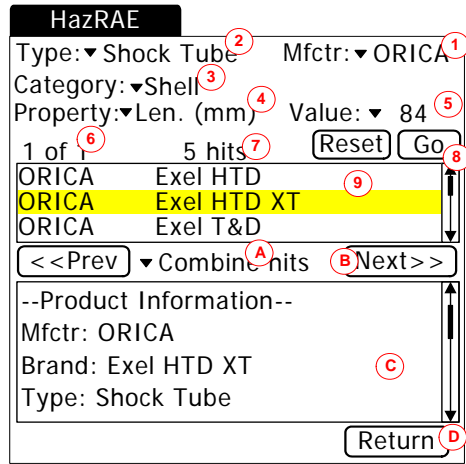
Fatalities Estimate - By inputting a yield value in kilotons and then selecting the Fatalities button, a dialog box will pop-up. Within the displayed distance, all people may be considered fatalities within hours of the blast. By selecting a metropolitan area from the pull down menu, the number of casualties is estimated based on population density for the specified metropolitan area.

Direct Fatalities
5.0 kilotons yield
Distance: 0.8 mi = 1.2 km
City: ▼ New York
Fatalities: 8,002

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Detonator ID

HazRAE contains powerful detonator identification capabilities for over 300 brands of commercial and military detonators, encompassing a range of over 7,000 detonators. Based on the physical clues associated with a detonator (type of wire, insulator color, case materials, etc.), these clues can be used to help identify the specific detonator involved in a given incident. From the Blast Tab, the Detonator ID screen as seen at the right is selected by choosing Detonator ID from the available list of options, and tapping the **Go** button.



Detonator ID is an advanced capability that is of primary use by EOD/Bomb technicians and other specially qualified personnel. If you don't have explosive/bomb handling certifications, the detonator identification capabilities should be left to properly trained and qualified professionals.

A brief explanation of the various parts of the Detonator ID display is given below, with more details following in the subsequent sections.

Circle	Explanation Overview
1	Manufacturer filter pop-up menu
2	Detonator type selector pop-up menu
3	Category selector pop-up menu to choose the category of properties applicable for the type of detonator selected (see #2).
4	Property selector pop-up menu to choose the property for the selected category (see #3) of the specified type of detonator (see #2).
5	The value you wish to specify for the appropriate property is specified here.
6	Number of pages of matching detonators. A page is defined as containing up to 50 detonators.
7	Displays the total number of detonators that matched the criteria you specified in 1, 2, 3 & 4; above.
8	The "GO" button executes a search based on the above specified criteria. The "Reset" button resets all search results.
9	Displays an overview list of detonators that match your specified search criteria.
A	Advanced search capability allows combining or refining multiple search results for more complex queries.
B	Next/Previous buttons will page through the matching detonator results, when more than one pages worth of detonators were found, as indicated in #6, above.
C	Displays the full set of properties and attributes associated with the detonator selected in #9, above.
D	Returns to the main menu.

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Detonator Selection Criteria

To find those detonators that match the physical detonator clues available, use the Type, Manufacturer, Category, Property and Value pop-up menus to specify the physical clues/evidence available. The interplay between various parameters you specify, and search results, are described below.

Type pop-up menu

Use the Type pop-up menu to select between the various types of detonators. The types include Electric, Electronic, Non-electric and shock-tube detonators. Changing detonator types will reset any previous search results and Manufacturer, Category and Property value selections.

Manufacturer pop-up menu

If a specific detonator manufacturer is known or suspected, it can be specified here. Only detonators that match the specified manufacturer will be returned when performing a search. This effectively filters out detonators that don't match the specified manufacturer. Leave this as "Unknown" will include all manufacturers that match the rest of the search criteria. Available manufacturers include:

African Explo. (AEL)	Dyno Nobel	IDL
ATLAS	Dyno Nobel-TEC	IRECO
Austin	Ensign-Bickford	Military detonators
Davey Bickford	ETI	ORICA
Davey Fire	Famesa	Owen Oil Tools
Delta Caps Canada	GOEX Inter.	PETRO-EXPLO
Detonics	Hercules	RISI
Dupont	Hercules/ETI	
DYNAMWELL	ICI	

Category pop-up menu

For a given Type of detonator (as described above), various categories of properties can be specified for which you may have properties that you'd like to specify when querying for matching detonators. The categories of properties that are available for a given type of detonator are described in the table below.

Electric	Electronic	Non-electric	Shock Tube
Shells, Tag/Shunts, Wire Specifications	Shells, Wire Specifications	Shells	Shells, Tube Delay

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Property pop-up menu

For each of the categories specified above, various properties for the given category can be specified. The properties available for each category for a given type of detonator are described below.

	Electric	Electronic	Non-electric	Shock Tube
Shells	Shell length, Shell diameter, Case material, Crimp style, Plug style, Plug color, rings	Shell length, Shell diameter, Case material, Crimp style, Plug style, Plug color, rings	Shell length, Shell diameter, Case material	Shell length, Shell diameter, Case material
Tag/Shunts	Wire Color 1, Wire Color 2, Shunt Style, Delay time, Delay number	N/A	N/A	N/A
Wire specs	Wire color 1, Wire Color 2, conductor material, orientation, delay, AWG, Wire Length	Wire color 1, Wire Color 2, conductor material, orientation, delay, AWG, Wire Length	N/A	N/A
Tube Delay	N/A	N/A	N/A	Delay time, Delay number, Tube color, Connector block color, Tube length

Combine/Refine pop-up menu

HazRAE allows you to combine multiple search results using varying criteria in arbitrarily complex ways, to better address real-world “what-if” types of questions. Selecting Combine from this pop-up menu combines multiple search results together, generally resulting in a larger set of matching detonators. For instance, to find all the electric detonators that have two shell rings or a red leg wire, you would select Combine Hits to find these results. To find all electric detonators with two shell rings and a red leg wire, you could first search for shells with two rings and then change this pop-up to Refine, change the category to Wire specs, and then search for leg wire 1=Red. The table below outlines a few more examples.

Example queries and expected results for Electric Detonators

Detonator Category	Property Settings	Combine/Refine Settings	Expected Results
Wire specs	Wire color 1=Red Wire color 2=Yellow	Combine	All electric detonators that have Red wire color 1 AND Yellow wire color 2
Wire specs Shells	Wire color 1=Red Wire color 2=Yellow Rings	Combine Refine	All electric detonators that have Red wire color 1 AND Yellow wire color 2 AND have 2 shell rings

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By using HazRAE's advanced detonator selection criteria to specify among various types, categories and properties of detonators, and selectively using Combine/Refine its possible to quickly and accurately differentiate between many different detonators. Your selection criteria can include any/all of the attributes listed within a given property group. All the properties you specify within property group must match for a given detonator for the system to consider it a match. Changing categories clears any property values specified from within a different category. Also note that the system allows you to perform sequential queries based on the same or differing property or category settings, as long as they are all within the same type of detonators. This effectively allows you to combined search results in ways not otherwise possible.



For instance, you could structure a search to return all electric detonators whose leg wires are red and blue or blue and red. To do this, first set up property values so that the electric detonator of interest has Wire color 1 of red and Wire color 2 of blue. Next, perform another search whose Wire color 1 is blue and Wire color 2 is red. This effectively returns all electric detonators whose leg wires are red and blue or blue and red. Remember that for a search to be successful, a detonator must match all the property values that you specify when performing a search. Property values that are not set and left as "Unknown" are ignored while searching. To clear out and reset all detonator search results and settings, tap the reset button.

To view the details associated with any detonator that meets your search criteria, just tap on its overview information in the returned list of matching detonators. In the text box in the lower portion of the screen, the system will display a full report containing all the known properties of the selected detonator. Remember that while looking at matching detonators, you can always copy/paste the detonator's details into another application, such as your word processing program, email, BATS, etc., to share your findings with others.

We'd like to thank the U.S. Bureau of Alcohol, Tobacco and Firearms' (ATF) Western Region for their patience and assistance regarding suggestions for the development of the Detonator ID capabilities within HazRAE. ATF is in no way responsible for any issues or omissions with the detonator ID, as implemented within HazRAE, but they should receive credit for sharing valuable insights, which made this capability possible.

Biological Agents

Biological agents are not accessed through a separate tab, but are instead accessed in HazRAE by typing in their name (for example, anthrax). The system has comprehensive data for over 160 agents integrated in its embedded database – almost five times more agents than any other handheld or mobile system. In the system, biological agents can be identified by proper name, infectious agent, or common name. Additionally, you can browse all toxins in the system by doing a search on UN/NA number 3172, while doing a search on UN/NA 2814 lets you browse through all the infectious agents.

There is no standard definition of a biological agent. The definition used here follows the definition in Frederick R. Sidell and David R. Franz, “Overview: Defense Against the Effects of Chemical and Biological Warfare Agents,” pp. 4-5, in Frederick R. Sidell, et al., *Medical Aspects of Chemical and Biological Warfare* (Washington, D.C.: Office of the Surgeon General, Department of the Army, 1997): “Biological agents are either replicating agents (bacteria or viruses) or non-replicating materials (toxins or physiologically active proteins or peptides) that can be produced by living organisms. Some of the non-replicating biological agents can also be produced through either chemical synthesis, solid-phase protein synthesis, or recombinant expression methods.”

The Department of Defense defines a biological agent as “a microorganism that causes disease in personnel, plants, or animals or causes the deterioration of materiel.” It separately defines a toxic agent as “a poison formed as a specific secretion product in the metabolism of a vegetable or animal organism as distinguished from inorganic poisons. Such poisons can also be manufactured by synthetic processes.” See Joint Publication 1-02, DOD Dictionary of Military and Associated Terms, as found at <http://www.dtic.mil/doctrine/jel/doddict/>.

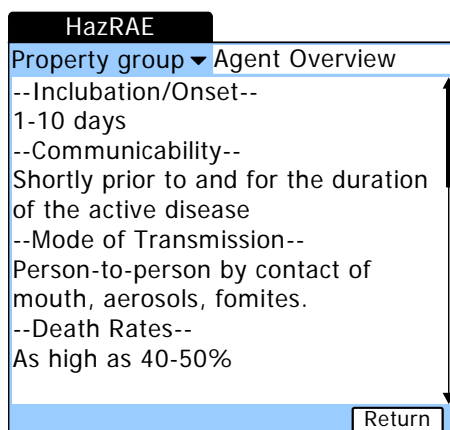
HazRAE follows the above definitions when referring to biological agents, and extends this by integrating biological agents that may not be effective warfare agents, but may be very effective terrorism agents (e.g., SARS).

Because most of the data associated with biological agents has been seamlessly integrated with the existing HazRAE screens, only three biological agent-specific screens have been added to the system, and they are described below. They are accessed under the pull-down menu on the lower left side labeled “Select” and which has a default value of “Choose View.”

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Hazard Overview

The Hazard Overview screen for biological agents is different than the screen displayed for chemical agents, to adequately present an overview of the associated agent's hazards. A screenshot of the hazard overview screen for biological agents is shown at the right. The screen contains up to 14 fields, categorized into groups of related fields. You can navigate from group to group by selecting the desired group from the Property group pop-up menu, as seen in the upper right portion of the screen.



The groups available, and their associated property fields are highlighted below:

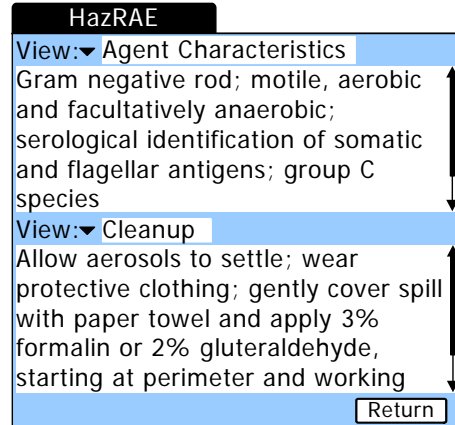
Hazard Overview Property Group	Associated Fields
Agent Overview	Incubation/Onset time Communicability Mode of Transmission Death Rates
Dissemination/Range	Reservoir Zoonosis Vector Range
Susceptibilities	Drugs Disinfectants Inactivation Survival outside host
Surveillance	Surveillance Epidemiology

Note: Not all fields are available for all biological agents, and they are not displayed when they are unavailable. The system remembers the last group you were viewing, so if you leave the Hazard Overview screen and then come back to it, the display will be just as you left it, ideal for quickly confirming any required values.

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Material Profile

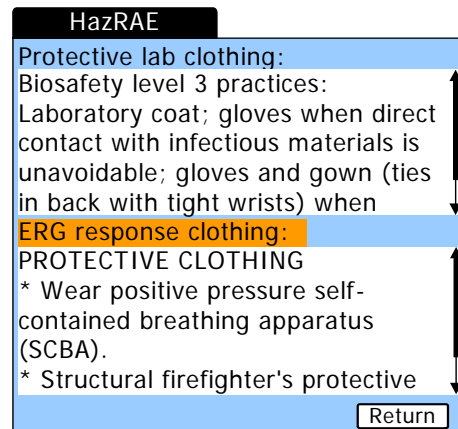
The Material Profile screen for biological agents is different than the screen displayed for chemical agents, due to the distinct differences between biological and chemical agents. The biological material profile screen is shown at the right. The upper part of the screen contains a pop-up menu that lets you select between viewing the agent's physical characteristics, and the agents pathogenicity (if this data is available). Use the upper pop-up menu to switch between the two views.



The lower part of the display contains a pop-up menu that allows you to select between viewing the cleanup decontamination/disposal procedures for the selected agent. Use the lower pop-up menu to switch between the two views.

Protective Clothing

In order to adequately reflect the unique attributes of biological agents, the Protective Clothing screen for biological agents is different from the screen displayed for chemical agents. This screen displays both recommendations for protective clothing when working with the selected agent in a controlled, laboratory-type setting and when responding to incidents involving the selected agent in an uncontrolled environment/first responder type of environment. The first responder clothing recommendations are taken directly from the appropriate guide pages of the ERG. The lab protective clothing field also indicates the appropriate level of bio-safety practices that should be followed when working with the selected biological agent/toxin.

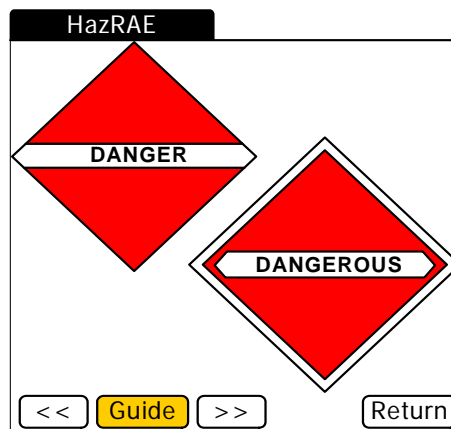


Signs and Symptoms / First Aid

Signs and symptoms and first aid is available for biological agents in a similar fashion via the existing EMS-Signs/Symptoms and EMS-First Aid screens previously discussed. Refer to those sections for more information on their use.

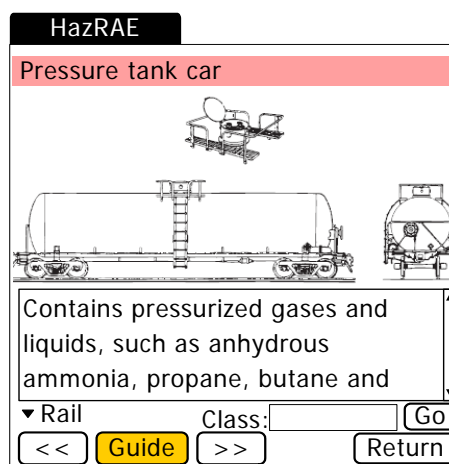
Placard Identification

Use the Placard Identification screen to quickly scroll through the list of standard hazardous material placards to locate the observed placard, and then view its associated guide. Access the placard identifier by tapping on the HazRAE menu bar, and selecting “Placard Identifier” from the selection of choices that appear under the Options menu. This handy quick reference tool is particularly useful for responders who may not be completely familiar with the meaning or response guide of a given placard. A placard screen is shown here. From the placard screen, tapping on the Guide button takes you directly to the ERG2004 guide page (Orange Section) for the selected placard. Use the << and >> buttons to navigate through the available placards.



Road/Rail Identification

Use the Road/Rail ID screen to quickly scroll through the list of available road/rail car silhouettes to identify the type of road/rail carrier involved in an incident. Access the placard identifier by tapping on “HazRAE” in the upper left corner of the display. A menu bar will appear. Tap on the “Options” menu, if it is not already highlighted. Choose “Road/Rail ID” from the selection of choices that appear under the Options menu. This quick reference tool is particularly useful for responders who may not be completely familiar with the nuances of the road/rail carriers involved at an incident scene, and the types of commodities that they typically carry. A screenshot of the Road/Rail ID screen is shown at the right. Tank cars/carriers that are commonly transported under high pressure will display their short name, on the top of the screen, highlighted in light-red, as a reminder to responders that these tanks pose additional dangers (e.g., BLEVE and others), and extra precautions should be used in response situations.



Tapping on the Guide button will take you directly to the recommended ERG guide page (Orange Section) for the selected silhouette. Use the << and >> buttons to navigate through the available silhouettes. You can also use the Road/Rail pop-up to quickly jump to from either section of road or rail silhouettes. When browsing rail cars, the screen will also display an editable field called Class. Specifying a part of the stenciling observed on the side of a rail car (e.g., DOT 105A 500W, AAR-203W, etc.), and then tapping the Go button will return appropriate information regarding the specified type of rail car, and the typical commodities carried by the observed car. When specifying a class, the rail car

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displayed is only illustrative, and may not ideally reflect the exact rail car you've specified.

As a general rule of thumb, non-pressurized tank cars represent approximately 75% of the tank car rail fleet. Approximately 23% are pressurized tank cars, with the remaining falling into specialized cars, such as cryogenic tank cars.



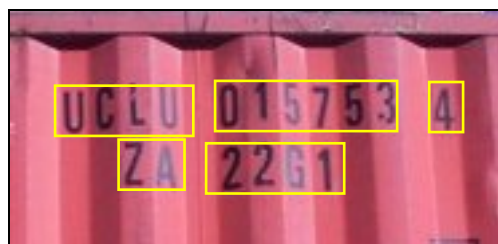
Note: The recommended guides should be considered as last resort if the product(s) involved in an incident cannot be identified by any other means.

Container Identification

With HazRAE, you have the ability to quickly and easily identify a range of information and threats concerning intermodal containers. Intermodal containers contain codes and markings on their sides and ends that if decoded correctly, and be used to provide varying degrees of situational awareness regarding a given container. The Official Intermodal Equipment Register contains data on containers owned by the major international ocean carriers, leasing companies, and North American Railroads. Likewise, Bureau International des Containers, France, maintains a similar owner registry list of containers. HazRAE uses these and other registries as the basis for its ability to identify owner registry information for over 9,800 owner codes (sometimes referred to as prefix codes). The United Nations maintains a registry of port codes and locations for over 45,000 types of port facilities world-wide. HazRAE maintains a subset of these, and can decode principal maritime ports of embarkation/debarkation for over 2,800 facilities worldwide.

Example Codes and Markings

Containers have stencilled on their sides and ends a variety of codes and markings, which HazRAE can quickly decode, validate and display their meanings. As an example, the photo at right shows typical stenciling found on the side of a sample container. The ends of the container typically contain similar, and perhaps additional, codes of interest that can be decoded, providing additional on-scene situational awareness. In the photo, from upper left to lower right, several of the codes that the system can decode are highlighted.



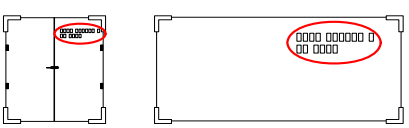
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The table below describes these and the other container codes that the system can decode:

Code Name	Description
Owner/Prefix code (e.g., UCLU)	Consists of four capital letters. The fourth is generally a "U." These codes should be registered with the Bureau International des Containers (BIC), but often are not. The owner code indicates the type of entity that owns the container (e.g., shipper, leaser, trucking company or other), the name of the entity, and, optionally, its country of origin.
Serial number	Consists of six numerals. The container owner assigns these numbers.
Check digit	The check digit provides a means of validating the accuracy of the owner/prefix code and serial number. HazRAE can determine whether a given check digit is valid, or if not present, what the prescribed check digit should be.
Country code of container registration	This optional code (the first two character box on the left, in the second row of the above photo) contains the ISO-3166 country code. While many containers may still contain these stenciled country codes, starting in 1996, these codes have been dropped from many new containers.
Size and type codes	HazRAE decodes the new size and type codes that were put into use in the beginning of 1996. This code consists of four alphanumeric characters. The first character encodes the container's length, the second character encodes the height and the width of the container. The third and fourth character indicate the type of container, and can be a group designation or a detailed type code designation, providing general or specific hazard warnings.
Country/Port code	Although it is not displayed in the photo, HazRAE can also decode the country and port of embarkation/debarkation, which can sometimes be found on a container or its associated paperwork. This is typically two upper-case alphabetic characters followed by another three alphabetic characters, like "PK KCT."

Access the Container ID screen by tapping on "HazRAE" in the upper left corner of the display. A menu bar appears. Tap on the "Options" menu, if it is not already highlighted. Choose "Container ID" from the selection of choices that appear under the Options menu. This quick reference tool is particularly useful for responders that may not be completely familiar with the types of information provided by stencilling on the side of a container, as detailed above. The Container ID screen is shown at the right. This contains an illustration of a typical container, highlighting in red where the codes that are typically stenciled on a container can be found. Below this are three edit boxes. Each edit box can contain several codes, all of which HazRAE can decode and display in the text box at the bottom of the screen. Type in the codes that are available in the appropriate text edit box, and tap "Go" to decode the information, or tap "Clear" to clear any entries or decoded information and start over.

HazRAE



Shipper code/serial:

Country and/or type code:

ISO country/port code:

HTAU = Hussain Trading Agencies
 Length: 20' (6.07m)
 HeightxWidth: 4' 3" (1.3m)x8' (1.5m)
 Class: T6 = Dangerous liquids,

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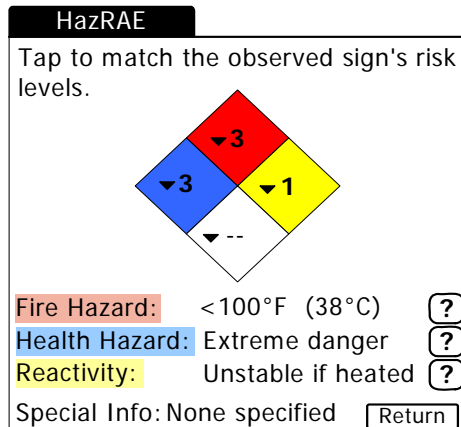
The table below describes which codes can be entered into which edit box. Not all codes are required, nor will they be necessarily available in all situations.

Edit box name	What can be specified
Shipper code/serial	Owner/prefix code (required if anything is entered in this edit box), optionally followed by serial number and an optional check digit. If the check digit is specified, HazRAE will validate it against the specified owner/prefix and serial number. If no check digit is specified, and a serial number is provided, HazRAE will indicate what the correct check digit should be.
Country and/or type code	Indicates (when available), the container's country of registration, and type code. The type code indicates the physical dimensions, and often the construction characteristics and physical hazards associated with the container. There are a total of 65 possible type / hazard codes, and HazRAE can decode them all.
ISO country/port code	This code (when available), indicates the country and port of embarkation/debarkation, which can sometimes be found on a container or its associated paperwork. This is typically 2 upper case alphabetic characters followed by another 3 alphabetic characters, like "PK KCT," as illustrated in the above screenshot.

Lastly, as a general rule, high-density/heavy goods are normally loaded in shorter containers. Low-density goods (examples: paper towels, plastics, etc.) are normally loaded in larger containers. So, when both are loaded, a smaller container normally weighs more than a larger container.

NFPA 704 Hazard Classification Aide

The marking system designed by the National Fire Protection Association identifies hazard characteristics of materials at terminal and industrial sites. It uses a diamond divided into four quadrants, with each quadrant representing a different characteristic, as explained below. The risk level ratings, ranging from four (highest risk) to zero (minimum risk), are based upon protective equipment normally used by firefighters.




You can access the NFPA 704 working aide by tapping on “HazRAE” in the upper left corner of the display. A menu bar will appear. Tap on the “Options” menu if it is not already selected, and choose “NFPA 704 aid” from the selection of choices that appear under the Options menu. When viewing a material that has a known NFPA 704 rating, HazRAE will pre-load the values for the given material. This allows you to see the NFPA 704 symbol associated with the material, and decode its meaning. When on scene at a fixed facility that is displaying the NFPA 704 symbol, you can also interactively configure the symbol above to match the one displayed on the facility, to determine the fire, health, and reactivity risks of the materials contained within the facility. The NFPA 704 screen is shown at the right, and its functionality is described in the sections below.

Health Hazards (Blue)


Health hazards in firefighting generally result from a single exposure, which may vary from a few seconds up to an hour. Only hazards arising out of an inherent property of the material are considered. It should be noted, however, that the physical exertion demanded in firefighting or other emergency conditions tends to intensify the effects of any exposure. Tapping on the down arrow or number in the blue diamond will let you select the health hazard number that matches the placard observed on scene. A short description of the health hazard is displayed to the right of the Health Hazard label, on the lower portion of the display. More details regarding the associated health hazards are available by tapping the button, to the right of the Health Hazard label.

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Flammability (Red)

Susceptibility to burning is the basis for assigning risk levels within this category. The method of attacking the fire is influenced by the material's susceptibility factor. Tapping on the down arrow or number in the red diamond will let you select the flammability hazard number that matches the placard observed on scene. A short description of the flammability hazard is displayed to the right of the Fire Hazard label, on the lower portion of the display. More details regarding the associated flammability hazards are available by tapping the  button, to the right of the Fire Hazard label.

Reactivity (Yellow)

The assignment of degrees in the reactivity category is based upon the susceptibility of materials to release energy either by themselves or in combination with water. Fire exposure is one of the factors considered, along with conditions of shock and pressure. Tapping on the down arrow or number in the yellow diamond will let you select the reactivity hazard number that matches the placard observed on scene. A short description of the reactivity hazard is displayed to the right of the Reactivity label, on the lower portion of the display. More details regarding the associated reactivity hazards are available by tapping the  button, to the right of the Reactivity label.

Special Information (White)

The quadrant includes information on specific characteristics of the material (e.g., reactivity with water, radioactivity, tendency to oxidize etc). Tapping on the down arrow or number in the white diamond will let you select the special information code (if present) that matches the placard observed on scene. A short description of the special information hazard is displayed to the right of the Special Info label, on the lower portion of the display.

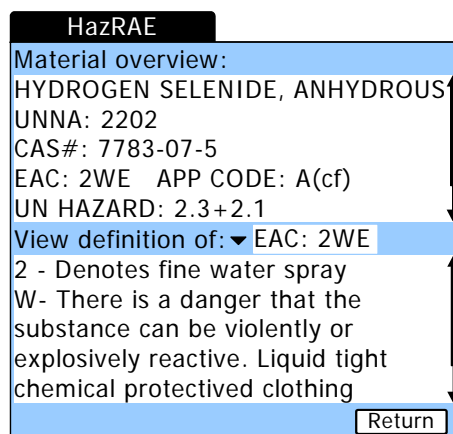
International Operations

HazRAE has easy-to-use built-in features and capabilities for international operations. Units of measure (weights, distances, temperatures, etc.) are displayed in both metric and imperial units of measure. Materials and trade names are available in English, Spanish, French, Italian, Dutch and German. Trade names used in Europe, in addition to U.S. trade names, are also integrated in HazRAE. Additionally, emergency codes used in the UK and Europe are available for most materials in the system. Specifically, the following information is available for international operations:

Fields available	Definition
HIN	Hazard identification codes, referred to as “Hazard Identification Numbers” under European and some South American regulations, may be found in the top half of an orange panel on some intermodal bulk containers in or destined for the U.S., and are ubiquitous in Europe.
EAC	Emergency Action Code.
APP code	Additional Personal Protection code defines additional protective clothing and personal protective apparatus recommendations for response involved with the given material.
UN Hazard class	The hazard class of dangerous goods is indicated either by its class (or division) number or name. The hazard class or division number must appear on the shipping document after each shipping name.
Packing Group	Packing group codes range from I to III. Packing group (PG) I represents substances presenting a high danger. PG II represents substances presenting a medium danger. PG III represents substances presenting a relatively low danger.

If a material has any of these fields associated with it, it will be displayed on the bottom part of the display on the Search Tab, along with the rest of the material's overview information. The information is also displayed (as appropriate) on the Hazard Overview Screen.

As an aid to responders, HazRAE can also decode these fields, and display their meanings. To decode this information, when a material is displayed that contains this information, select the UK/EU Codes menu choice available in the Options drop down menu, visible by tapping on “HazRAE” in the upper left corner of the window. Note this menu item is disabled if there is no UK/EU Code information available for the current material.



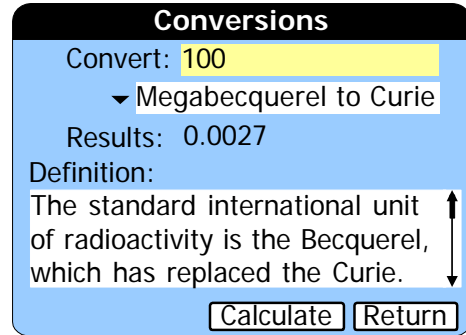
After selecting UK/EU Codes from the Options menu, a screen similar to the screenshot at the right should be visible. The upper half of the screen contains an overview, including the UK/EU codes, of the currently selected material. The bottom half of the screen contains a pop-up menu that lets you select the given code associated with the material, and display its full definition. The options available in the “View definition” pop-up menu seen at the right will vary based on the given material. These options may include decoding the material's EAC, APP or HIN code. Tap on the pop-up menu, and select the given code to display its full definition in the lower half of the screen.



Note: Some materials can be PG I, II and/or III. In these instances, the system will display all of the relevant packing groups associated with the given material. It is the user's responsibility based on the specific situation, to determine which appropriate packing group is actually on-scene, and the EAC displayed will reflect the most dangerous packing group.

Unit Conversion Calculator

HazRAE has easy an easy to use unit conversion calculator built-in. The unit conversions calculator can be selected by tapping on the “HazRAE” in the upper left corner of the display. A menu bar will appear. Tap on the “Options” menu, if it is not already selected. In the dropdown menu of choices under the Option menu that appears, select Conversions. The dialog box displayed above will appear on the screen.



To use the calculator, specify the quantity that you want to convert by tapping in the yellow highlighted edit field, and entering the desired quantity. Next, choose the conversion that you'd like HazRAE to perform for you from the pop-up menu. Notice that when changing from one type of conversion to another, the system also conveniently displays a brief definition of the meaning of the unit of measure that is being converted. Tap on the **Calculate** button to have the system calculate and display the results. Tap the return button when you're finished. If you need the results of your conversion in another application, select the Paste option in the desired application, and your results should appear.

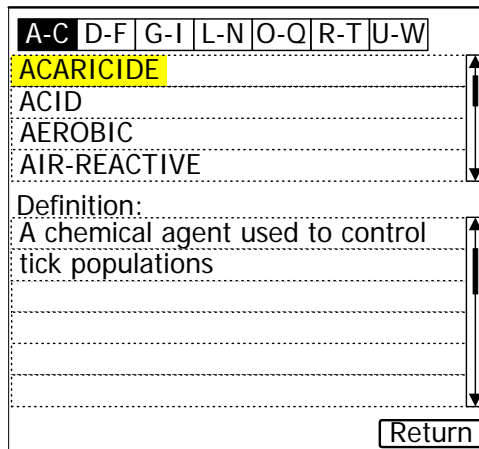
The system supports conversions between the following units of measure:

Becquerel to curie	Sievert to rem	Kilograms to pounds
MegaBecquerel to curie	Sievert to milliRem	Ounces to grams
GigaBecquerel to curie	Sievert to microRem	Grams to ounces
TeraBecquerel to curie	Rem to sievert	Pounds to grains
Curies to becquerel	Rem to milliSievert	Grains to pounds
DPM to curie	Rem to microSievert	Grains to grams
DPM to becquerel	Millimeters to inches	Grams to grains
DPS to curie	Centimeters to inches	Ounces to grains
Gray to rad	Inches to millimeters	Grains to ounces
Gray to milliRad	Inches to centimeters	Gallons to liters
Gray to microRad	Meters to feet	Liters to gallons
Rad to gray	Feet to meters	Ounces to milliliters
Rad to centiGray	Kilometers to miles	Milliliters to ounces
Rad to milliGray	Miles to kilometers	Fahrenheit to celsius
Rad to microGray	Pounds to kilograms	Celsius to fahrenheit

Interactive Glossary

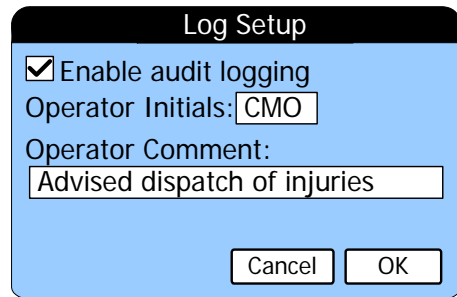
HazRAE includes an extensive reference of common terms and acronyms frequently found associated with hazardous materials. You may find these terms on bills of lading, package labeling, material safety data sheets, etc. You can access the Glossary screen directly from any screen within HazRAE by tapping on "HazRAE" in the upper left corner of the display. A menu bar will appear. Tap on the "Options" menu, if it is not already highlighted. Choose "Glossary" from the selection of choices that appear under the Options menu. On the Glossary screen, (seen at the right) tapping on any term will display its

definition in the lower definition text box. Tapping on the letter tabs above the terms will take you directly to the terms that start with the associated letter. You can tap on the index tabs more than once to jump to the next alphabetical set of terms represented by the tab. For instance, tapping on **A-C** once will highlight this tab (as shown in the screenshot), and take you to the terms that start with "A." Tapping it again will take you to the terms that start with "B." Tapping it a third time will take you to the terms that start with "C." Tapping it again will return you to the terms that start with "A." Tapping on the **Return** button will return you to whatever screen you came from.



Comprehensive Accountability

HazRAE has the most comprehensive accountability capabilities of any mobile decision aid. Accountability provides a precise and comprehensive audit trail of actions taken, and user directives specified (such as search parameters, etc.) while using the system. The intent is that for evidentiary, training, incident reporting, time billing or other purposes, the system records adequate time-tagged information such that an entire incident could be accurately re-created at a later time simply by sequentially reviewing the contents of the audit file. Selecting the Edit/Logging setup menu in HazRAE configures auditing. The Edit/Logging setup can be found by tapping on "HazRAE" in the upper left corner of the display. A menu bar will appear. Tap on the "Edit" menu if it is not already selected, and then tap "Logging setup." Selecting this option brings up the audit log setup dialog box, as illustrated at the right. In HazRAE there are 3 classes of auditable event entries that the system records: system events, user auditing events needed to recreate actions taken by the user, and events that are initiated by the user. Specific details regarding each event can be found in the Accountability Event Specifications section later in this manual. Below is an explanation of what you'll typically find in a HazRAE audit log file. If the device that you're running HazRAE on supports logging, you'll be able to turn logging on or off, along with setting the operator's initials, and making any arbitrary comments that should get added to the audit file.



In the example log file listed above, we have the log file created for 2001, September 11th (20010911), along with the location of where the file was created (/G3Logs). Next, we see HazRAE version information written to the log file. The current user at the time was "CMO." Subsequent to this, the operator entered a comment regarding on-scene observations, and then did a material search for Hydrogen Sulfide. Next, the operator reviewed several sections of ERG guide 117. We also see that the operator reviewed the Hazard Overview screen, and then went to the S&S tab, and searched for two signs and symptoms under the Respiratory category (pop-up items 17

```

13:31:38      --Log file created /G3Logs/G3-20010911.txt--
13:29:28      HazRAE Version 7.0R
13:29:28      RAE Systems · (C)2003-2004 · All Rights
Reserved
13:29:28      Core Data V5.0
13:29:28      Trade names V5.0
13:29:28      Extended Data V5.0
13:29:28      Property Data V5.0
13:29:28      Device/username:      NEST Lead-1
13:29:28      Health V5.0
13:29:28      --Log opened--
13:29:28      Current user:         CMO
13:30:15      Op comment:           Arrived on-scene.
13:30:22      Material name:       HYDROGEN SULFIDE
13:30:26      Guide: 117 Sec: Health
13:30:32      Guide: 117 Sec: Fire/explode
13:31:00      Op comment:           No initial fire risk
13:31:06      Hazard Overview      HYDROGEN SULFIDE
13:31:13      S&S tab
13:31:26      Respiratory          17,16
13:31:26      S&S search           19 matches
13:31:31      Protective Clothing  AMMONIA, ANHYDROUS
13:31:38      Material Profile     AMMONIA, ANHYDROUS
13:31:40      --Log closed--
15:30:39      --Log opened--
15:30:39      Current user:         CMO
15:39:43      UNNA found:          3355
17:03:33      Isolation Screen     INSECTICIDE GAS,
POISONOUS, FLAMMABLE, N.O.S.
    
```

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and 16). This search resulted in returning 19 materials that could cause matching symptoms. The operator then reviewed protective clothing recommendations for anhydrous ammonia, and reviewed its material profile. Next we see that the log was closed, the application was quit at 13:31:40, but then relaunched at 15:30:39, when the user did a UN Number search for UN Number 3355, and then reviewed the isolation screen for this material. The time format (12/24-hour clock) will comply with the system settings on your device.

The log file is compatible with any email/messaging application you may have on your computer or handheld, and can easily be attached to email/instant messages and transmitted to other users (refer to your system's email software for more information).



Note that if HazRAE attempts to update the current log file while it is open for exclusive use by another application, HazRAE won't be able to update the current log.

Operationally, the best practice is to close the current audit log file when finished reviewing it, or create a copy of it under a different name. Use the copy if you anticipate needing to review the log while simultaneously using HazRAE during an incident.

Accountability Event Specifications

In HazRAE there are 3 classes of auditable event entries that the system records: system events, user auditing events needed to recreate actions taken by the user, and events that are initiated by the user. Each type of event is discussed below. A single line in the audit log consists of up to three fields (tab separated). These fields are the timestamp, the event name/type, followed by any relevant parameters. Having each field separated by a tab character makes it very easy to integrate the accountability log with other applications, such as word processors, spreadsheets, external databases, ICS forms, etc.

System Events

System events are entries that the system automatically makes into the log file independent of a user's actions. Examples are events such as start of application, stop of application, the version of HazRAE in use, etc. A list of all the system-generated events are described below:

System Event	Event Definition
--Log file created /G3Logs/G3-20060331.txt--	Header information. First entry in any log file, records the log's file name, and location. The file name is composed of the year, month and date for when the log file was created. If a log file for the given day doesn't exist, one will be created. If a log file for the day already exists, new events will be posted to this file. See Open/close log events below for more information.
HazRAE Version nnn	Header information. Each time HazRAE creates a log file, it automatically make an entry recording the version of the system in use. "nnn" will be the actual version of your system.
RAE Systems · (C)2003-2006 · All Rights Reserved	Header information. Copyright information is always inserted at the start of every new audit file.
NEST Lead-1	Device or username of the machine running the system. Useful when integrating and comparing logs from multiple units that may be involved in the same incident.
Core Data Vnnn*	Header information. Version data for the various system components

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System Event	Event Definition
	are always inserted at the start of every new audit file.
Trade names Vnnn*	Header information. Version data for the various system components are always inserted at the start of every new audit file.
Extended Data Vnnn*	Header information. Version data for the various system components are always inserted at the start of every new audit file.
Property Data Vnnn*	Header information. Version data for the various system components are always inserted at the start of every new audit file.
Health Vnnn*	Header information. Version data for the various system components are always inserted at the start of every new audit file.
Property Data Vnnn*	Header information. Version data for the various system components are always inserted at the start of every new audit file.
--Log opened--	Every time the system is launched, an audit log entry is created denoting this fact. Note that while one audit file may contain more than one incident, it is easy to differentiate these incidents by time, and also by open/close log entries.
--Log closed--	Every time the system is exited, if logging is enabled, a Closed log entry get made. Entries between an Opened and Closed log entry define everything that took place from when the application was launched, until it was exited.
--Log enabled--	If auditing is disabled, and the user enables auditing, a Log enabled entry will get written to the audit file.
--Log disabled--	If auditing is enabled, and the user disables auditing, a Log disabled entry will be written to the audit file.
Current User:	On startup, records the initials of the last operator that used the system.

* The value displayed in-lieu of “nnn” is dictated by the version of your system.

Note that all entries in an audit file are made in chronological order. The only exception to this rule is the very first line of the event log, whose timestamp will reflect the actual time that the audit log was written to storage memory or disk. One entire HazRAE session will be bound between the “—Log opened—” and “—Log closed—” entries. HazRAE will automatically create its log files as needed. A new log file will be created each day, if logging has been enabled. If the user deletes a needed log file, HazRAE will create a new log file with the same name, containing the latest accountability log entries in this new file.

User Events

User auditing events automatically timestamp and record actions taken by a user while using the system, creating a precise transcript that can be used to provide an accurate “replay” of actions taken in the system. The auditable events are listed below:

User Auditing Event	Event Definition
<Category>	Lists the name of each signs/symptoms category specified by the user. For each specified signs and symptoms category, selected items within this category will be listed.
AEGL Screen	User viewed the AEGL screen for the currently selected agent.
Bio agent:	Matching bio-agent search was made. Name of matching bio agent is also recorded in the log.
CAS# found:	Matching CAS# search was made. CAS# searched is also recorded in the log.
Color	Attributes and modifiers selected from the Discovery Color category is recorded in the log.
Combined matches:	Total number of matching isotopes found during previous Isotope Identification request.

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User Auditing Event	Event Definition
Discovery Search	Discovery search was made. Number of matching materials is also recorded in the log.
Discovery tab	Discovery tab was selected.
Edit CPC on-hand	Edit CPC on-hand dialog box was viewed.
Firstaid Screen	EMS-Firstaid screen for the currently selected material was viewed. Selected material name is also recorded in the log.
Glossary tab	Glossary tab was selected.
Guide: <nnn>	Guide <nnn> was viewed. Section <sss> was also viewed.
Hazard Overview	Hazard Overview screen for the currently selected material was viewed. Selected material name is also recorded in the log.
IED Screen	IED screen was viewed.
IND Screen	IND screen was viewed.
Isolation Screen	Isolation screen for currently selected material was viewed. Selected material name is also recorded in the log.
Isotope Search	An isotope identification request was made. Entry will contain emission filter type (if any), bandwidth tolerance (in KeV), and specified probability (if applicable).
Load preplan	User specified to load a pre-plan. Entry will specify the name of the pre-plan loaded, along with operator initials.
Material name:	Matching material name search was made. Name of matching material is also recorded in the log.
Material Profile	Material Profile screen for the currently selected material was viewed. Selected material name is also recorded in the log.
MEG Screen	Military Exposure Guidelines screen was selected.
MEG/CWA Screen	Military Exposure Guidelines/Chemical Warfare Agents screen was selected.
Mixtures Tab	Mixtures tab was selected.
New User:	Entry will also contain the operator initials of the newly specified operator.
NFPA 704 screen	NFPA 704 screen was viewed.
Odor	Attributes and modifiers selected from the Discovery Odor category is recorded in the log.
Placard screen	Placard screen was viewed.
Precursor Screen	Precursor screen for the specified material was viewed.
Print Screen	User request to print currently displayed screen [Windows only].
Protective Clothing	Protective Clothing screen for the currently selected material was viewed. Selected material name is also recorded in the log.
Rad Tab	Radioactive Isotope Identification tab was selected.
Reactive Groups	Reactive Groups screen for the currently selected material was viewed. Selected material name is also recorded in the log.
S&S search	Signs and symptoms search took place. Also records the number of matching materials
S&S tab	Signs and Symptoms tab was selected.
Save preplan	User saved current configuration into a pre-plan. Entry will contain the name of the pre-plan.
Search by	Isotope search was performed. Entry will contain the parameters used in the search.
Search tab	Search tab was selected.
Show IDLH/Hide IDLH	User selected to view/hide IDLH values of returned materials.
Symptoms Screen	EMS-Symptoms screen for currently selected material was viewed. Selected material name is also recorded in the log.
Texture	Attributes and modifiers selected from the Discovery Texture category is recorded in the log.

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User Auditing Event	Event Definition
Trade name:	Matching trade name search match was found. Name of trade name match is also recorded in the log.
UK/EU Definitions Screen	User viewed the UK/EU Definitions screen.
Unit Conversions	User activated the unit conversion calculator.
UNNA found:	Matching UNNA search was made. UNNA number is also recorded in the log.

Operator Initiated Events

Operator initiated events are actions that a user can take to directly impact the state of the audit file. These events are discussed below:

Operator Auditing Event	Event Definition
New User :	A new user, with the initials/ID as specified in the audit log is now using the system.
Op comment :	Operator specified comments entered into the log file.

Device Constraints

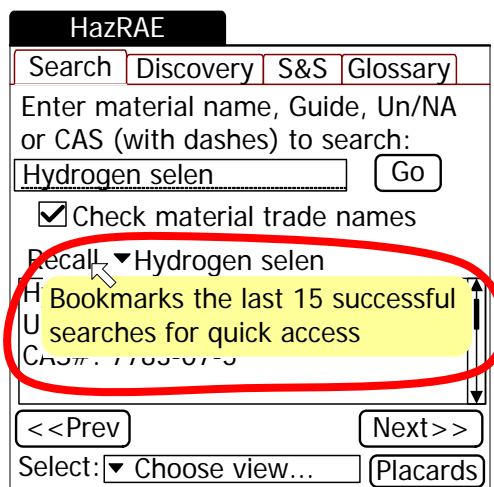
With exception for the minor limitations mentioned below, HazRAE is unique in that it is the only system available that provides the user full capabilities (and train-once, deploy anywhere capability) on all supported devices.

Auditing is only available for devices that have the required input/output capabilities. Also, on some devices, auditing is only enabled if an external storage card is available for use. Depending on your device, this may be an SD memory card, compact flash memory card, memory stick, etc. The card needs to be available for read/write use by the system. The memory card that HazRAE is delivered on is also suitable for audit log storage purposes. If a suitable memory card or other storage device is not available, the warning message "Memory Card needed for logging" will appear in the log setup dialog box. Closing the Log Setup dialog box, inserting a suitable memory card, and opening the dialog box again should enable audit logging.

Log files are written into the directory G3Logs, found either on the memory card of your device or in the root of your device (under MyDevice) or the root of your hard drive.

Context-Sensitive Online Help

HazRAE has been designed to be the easiest to learn and easiest to use emergency response system available. Most people feel comfortable using the system within 15 minutes. Plus, with HazRAE, once you're familiar with using the system on one platform (a Pocket PC handheld, for instance), you'll feel right at home using the system on any other platform supported by the system, as while the system's user interface takes on the look and feel similar to that of the host system, the software itself is identical on all supported platforms. Thus, with HazRAE, you truly have a train once, deploy anywhere solution.



On many screens throughout the system, there may be certain unavoidable technical terms that are used. In these situations, the system supports online context-sensitive help to clarify the meaning or specific functions of the system. To access available online help, tap and hold on top of any a display label on any of the screens that has context-sensitive help. At the right is the Search screen tab. This screen shot was taken with the cursor depressed on top of the recall label (which does have online help). Tapping and holding on top of any label that supports online help will bring up a brief context sensitive explanation of whatever you tapped on. Similar to other computer systems, the explanation will stay on screen for several seconds, and then automatically disappear. To make the context sensitive help re-appear, just tap on the display label again.

Managing Preplans

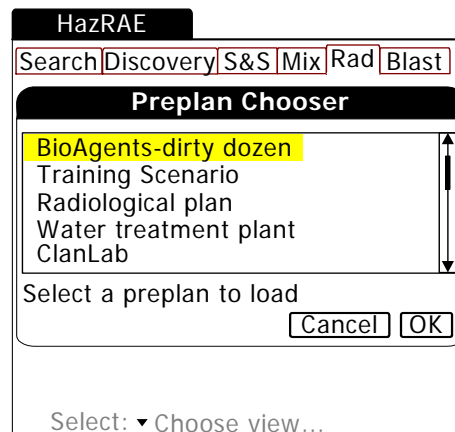
HazRAE has allows you to create libraries of preplans for later use as needed. Preplans are useful for creating various training scenarios, or creating specific plans to be used for given contingency response scenarios. Preplans are quick and easy to create, and can also be shared between other HazRAE users on any other platform. Within HazRAE, a preplan consists of a pre-selected list of agents, and chemical protective clothing recommendations that you may want to pre-configure the system with for quick reference or use at a later point in time.

Save Preplan

To create and save a preplan, you first research the desired agents, and retrieve any response information regarding the selected agent, so that the system will add it to the recall list. The agents that are currently available in the recall list will be saved as part of your preplan.

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Next, configure your chemical protective clothing inventory as appropriate. Once you have set up the protective clothing and recall list configuration as desired, tap on “HazRAE” in the upper left corner of the display. From the menu bar that appears, select the Preplans menu, and choose the Save option. When prompted, give the preplan the desired name. Once you have saved a preplan, you can share it with other HazRAE users by transmitting the plan to other users via Bluetooth, I/R, instant messaging or email. HazRAE preplans are interoperable on all HazRAE platforms.



Load Preplan

To load a preplan, tap on “HazRAE,” shown in the upper right corner of the window. In the dropdown menu of choices that appear, select Preplans. Under the Preplans menu, choose Load, and a dialog box similar to the screenshot at the right will appear, allowing you to specify the preplan that you'd like to load. Tap on the desired preplan to highlight it, and then tap the button to load the plan, or cancel to not load the plan. Once you load the plan, your recall list and protective clothing configuration are automatically updated to reflect the settings stored in the preplan. If you have received a preplan from another HazRAE user, you must copy it into the HazRAE folder on your computer/device for the system to automatically find the plan the next time you choose to load a preplan. Note that on PalmOS-based devices, you can store the preplan anywhere in main memory and the system will find it.

Clear Recall

Clear Recall allows you to completely clear the current list of recall bookmark entries. This is useful if you want to create a preplan that only contains the specific set of agents that you specify, and nothing more. Note that once you clear the recall list, you cannot undo this action. Also note that you cannot save an “empty,” and that if the recall bookmark list is empty, then no preplan can be saved.

Accessing Local Reference Materials

While HazRAE has been designed to be the most comprehensive mobile HazMat/CBRNE decision support system available, there are still situations where user developed reference materials, forms, checklists or other organization specific reference aids such as incident maps and overlays or response information unique to a specific agent, may be available for use.

It is easy to add the above types of information to HazRAE, whether its reference aids or other materials unique to a specific agent, or general information that would be handy to directly access from within HazRAE. To access either agent specific reference materials, or reference materials that should be available regardless of a specific agent, there are two menu items available: Agent Refs and Local Refs, found under the Preplans menu. Access the Preplans menu by tapping on “HazRAE” in the upper left corner of the display. A menu bar will appear. Tap on the “Preplans” menu, if it is not already highlighted, as shown at the right, and the menu options will be displayed. The relevant choices are Agent Refs and Local Refs. Both options are described below.



Agent Specific Reference Documents

Use the “Agent Refs” menu option to retrieve agent-specific information for the current material. For instance, your organization may have unique guidance on containment, decontamination, reference materials or cleanup procedures for a specific agent that is not found in HazRAE. This information can be easily made available for use from HazRAE, available whenever you access the specific agent. As an example, we’ll assume that there are chlorine-specific standard operating procedures and other reference materials that you’d like to have available whenever chlorine is accessed from HazRAE. To access an agent-specific reference document, use the following two steps.

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Step One

First the reference documents must be in a file format that HazRAE understands. HazRAE supports the following file types, depending on the platform that HazRAE is running on:

File Type	Supported HazRAE Platform
Adobe Acrobat	Windows, PocketPC/CE
Text files	Windows, PocketPC/CE
HTML files	Windows, PocketPC/CE
Microsoft Word files	Windows, PocketPC/CE
Microsoft Excel files	Windows, PocketPC/CE
Microsoft PowerPoint files	Windows
Graphics/photos/maps (GIF, JPG, PNG, BMP)	Windows, PocketPC/CE
HazMapper™ incident maps and views	Windows, PocketPC/CE

Also, to view documents in any of the above supported file types, the associated application, or application document viewer must be available on your device/computer. Adobe makes Acrobat viewers available for all HazRAE support platforms, and can be obtained for free directly from www.adobe.com. Microsoft makes Word, Excel and PowerPoint viewers available for specific versions of Microsoft-based operating systems. If you don't have the full Microsoft application installed on your computer/device, you may check at www.support.microsoft.com to see if a viewer is available.

Step Two

In the root level of your device/computer, you'll find a directory folder named "G3AgentRefs." HazRAE creates this directory folder automatically for you if one doesn't exist, or you can create one yourself. Agent specific documents need to be stored in this folder, and must conform to a simple naming convention: First, the file name must be one of the above mentioned file types, and the document name must match the first nine alphabetic characters of the agent's name (chem, bio, rad or explosive/IED) that the reference document should be linked to. While viewing an agent in HazRAE, if you try to access agent-specific references materials for this agent when none have been created, HazRAE will pop-up a dialog box, advising what the file name prefix for this agent needs to be. Also note that if the agent name is less than nine characters, the start of the reference document name must match the complete agent name, and it is best to avoid spaces in file names, as some systems have problems with spaces in file names. For example, given specific shelter-in-place recommendations (stored as an MS-Word document) for a chlorine release, to make this information available whenever chlorine is accessed in HazRAE, you could name the file "Chlorine-shelter.doc," and drop it into the G3AgentRefs directory (found at the root of your device, or at the root level, also known as C:\G3AgentRefs of your computer). Or, if you have specific exposure guidelines that your organization follows that you'd like to make available, (lets assume this guidance is in Adobe Acrobat format), the file could be named "Chlorine-exposure.pdf" and dropped in the G3AgentRefs folder. When you try to access agent-specific reference materials for a specific agent, what happens after selecting "Agent refs" from the Preplan menu (the

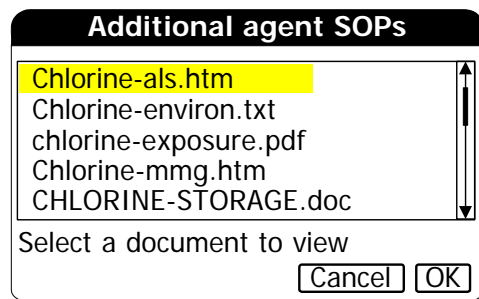


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menubar will appear whenever you tap on “HazRAE,” in the upper left corner of the display) depends on:

Number of Agent-Specific Documents	Resulting Action
No agent specific reference documents available for the selected agent.	HazRAE will display a dialog box indicating the file name prefix that should be used to make agent-specific reference documents available from within the system.
Only one agent-specific reference document exists for the selected agent.	HazRAE will automatically open the document and display it for your review.
More than one agent-specific reference document exists for the selected agent.	HazRAE will open a dialog box, allowing you to choose the desired agent specific reference document that should be opened.

An example of a scenario where multiple chlorine specific reference documents are available (note that capitalization in file names is ignored) is shown at the right. To view any of the available agent specific reference documents, tap on the selected file name to highlight it, then tap the OK button. To cancel out of this dialog box without doing anything, just tap the Cancel button.



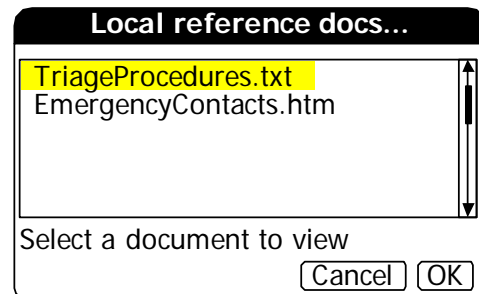
You may add an unlimited number of agent-specific reference documents to the system by simply storing them in the “G3AgentRefs” directory folder. If this directory folder does not exist, HazRAE will create it automatically for you. To remove an existing agent specific reference document, just delete it from the “G3AgentRefs” directory folder using your computer/device’s file browser/explorer.

Reference Documents Available at Any Time

Use the “Local Refs” menu option to retrieve generic reference documents that you’ve created that should be available from within HazRAE. Examples of reference document that you may want to make locally available from within HazRAE are an emergency contact telephone list, NIMS-compliant ICS forms, or a PARS checklist. To access these local reference materials from within HazRAE, use the following steps:

Step One


Store the desired reference documents in the “G3LocalRefs” directory folder found at the root level of your device, or computer. The supported file types are listed in the previous Agent Refs section. Store the file onto your computer/device in the G3LocalRefs directory folder (one will automatically be created for you from within HazRAE if it doesn’t exist in the device’s root folder).



Step Two

Make sure to store the desired file into the directory folder G3LocalRefs. When the Local

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Refs menu is next selected, a dialog similar to the one at the right will be displayed. Select the desired file type, then tap the  button. The selected reference document will be automatically opened for you. If no documents are available, HazRAE will pop-up a dialog advising you of such, and reminding you where you need to store these locally accessible documents.

Reachback Capabilities

HazRAE includes advanced reachback capabilities, that allows the system to wirelessly reach back to national databases or operation centers to retrieve additional information or guidance that may not otherwise be available to a user at an incident scene. For the reachback capabilities to work, your device (handheld device or computer) must have Internet connectivity. HazRAE uses this connectivity to make advanced queries to various governmental databases to retrieve additional information, as appropriate, for the agent that is currently being reviewed within HazRAE. First aid information is an example. While HazRAE has comprehensive BLS (Basic Life Support) for most agents, and ALS (Advanced Life Support) for some agents, Reachback makes available even more advanced information, along with the latest guidance and recommendations available for the selected agent. The only limitation is that your device running HazRAE must have Internet network access (wired or wireless) to retrieve this advanced information. In addition, your device must support the required networking protocols. If it does, then on the bottom right corner of the screens listed below, on supported devices, you'll notice the reachback button. Tapping this button will retrieve additional information for the current agent from authoritative remote databases such as those housed at the U.S. National Institute of Health, the National Library of Medicine, and the National Institute of Standards and Technology. The areas of the system that provide reachback capabilities are listed below:



Reachback-enabled screens	Type of information
First Aid Screens (Bio, Rad, Chem agents)	Additional advanced life support information.
Hazard Overview Screens (Bio, Chem agents)	Additional health/occupational hazard information
Physical Properties Screen (Chem agents)	Additional physical properties for chemical agents

Advanced users may have specialized authoritative reachback destination databases that they'd like to access. HazRAE can be configured to access custom reachback destinations, contact RAE Systems for details on this.

Another strategy to follow is to use the reachback capabilities built into HazRAE in conjunction with the local reference, and agent specific documents capability that HazRAE supports. For instance, in an office type setting, you may have good connectivity, and may access a range of reachback resources when assembling a pre-plan. Saving these reachback documents into the appropriate agent-specific or local reference folders, with the appropriate names (see the "Accessing Local Reference Materials" section of this guide for more information), will allow access to these documents locally from within the system for those contingencies when no wireless network communications are available.



Tips and Tricks

Be Thorough When Using Search by Name

When searching for a material by name, it's a good policy to use the next/previous buttons to check for a similar material, to make sure that you have the specific material you're interested in. For instance, if you search for "ammonia," you'll want to use the next/previous button to select which of the following ammonia compounds you're really interested in:

AMMONIA (CONC 20% OR GREATER)
AMMONIA SOLUTION (ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S.)
AMMONIA SOLUTION, WITH MORE THAN 50% AMMONIA
AMMONIA SOLUTIONS (CONTAINING MORE THAN 35% BUT NOT MORE THAN 50% AMMONIA)
AMMONIA, ANHYDROUS
AMMONIA, ANHYDROUS, LIQUEFIED
AMMONIA, SOLUTION, WITH MORE THAN 10% BUT NOT MORE THAN 35% AMMONIA
AMMONIA, SOLUTION, WITH MORE THAN 35% BUT NOT MORE THAN 50% AMMONIA
AMMONIA, ZINC CHLORIDE, ZINC SULFATE, (ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.)

Making Deductions Using Discovery

Given a choice, when approaching an incident involving an unknown gas, is it generally safer to approach uphill or downhill from the incident? Using Discovery, you can deduce a potential answer to this question (and others, too). Search for how many materials are heavier than air, and note how many matching materials are found. Now, change the search to only find materials that are lighter than air. Note that there are almost 20 times the number of hazardous materials that are heavier than air compared to hazardous materials that are lighter than air.

Multiple Routes to the Same Chemical

There are many chemicals whose properties may vary, depending on a number of factors. HazRAE has the flexibility and intelligence built in to handle many of these situations. Lets look at sulfur as an example. It has an odor similar to rotten eggs, and is commonly found as a powder, a solid or as crystals with a yellow or pale yellow color. Using any combination of the above attributes, Discovery will always return sulfur. Specifying a color of yellow, and an odor of rotten eggs will return 5 matches. Specifying a color of pale yellow and an odor of rotten eggs will only match sulfur. Specifying no color, but either crystals, powder or solid, under the texture pop-up, will all result in matching sulfur.

First Responder Clues for Detecting Hazardous Materials Presence

When responding to hazardous materials/terrorism incidents there are a number of clues available to the first responder to aid in determining the presence of hazardous materials. Below is a list of some of the available clues, and the areas that HazRAE supports your positive identification of the material, consistent with recommendations of NFPA 472.

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Given this clue	Use this area in HazRAE
Occupancy and/or location	NFPA 704 Symbols
Markings and colors	Placard Identifier
Placards and labels	Search Tab/Placard screen
Shipping papers	Search Tab
Senses / Observable indicators	Discovery Tab
Victims with signs/symptoms	S&S Tab

Printing Data from HazRAE

Depending on which platform you are running HazRAE (Pocket PC, laptop computer, or desktop PC), you may have different options available. On some platforms, you can print the data of any HazRAE display. If HazRAE supports printing from your platform, under the Options menu (found by tapping on “HazRAE” in the upper left corner of the application’s window), you’ll see “Print Screen,” which allows you to print data directly from the system.

In addition, a capability that works on all platforms is the ability to copy data from any of HazRAE’s data screens (e.g., Guide Screen, Material Profile screen, etc.) by using the Edit/Copy option. You can find the Edit menu by tapping on HazRAE at the top of the screen. The Copy option is under the Edit menu. Once you have copied the data, you can paste it into other applications. So, for instance, you could copy the data from the Hazard Overview screen, and paste it into your word processor to print it as part of an after action report, or paste it into an email program or instant messenger to notify someone as part of an ongoing incident response.

Support FAQ

The following is a list of frequently asked HazRAE questions.

Using HazRAE on a Pocket PC in the Mil-Spec Case causes Erratic Cursor Control.

Symptoms of this include tapping on the screen without anything happening, tapping on a control and another control responds, or when the virtual keyboard is displayed, “ghost” key presses are observed. For proper use from within the Mil-Spec case, you need to calibrate your handheld’s screen for optimal performance within the enclosure.

If you are running HazRAE on a Pocket PC-based device, follow the steps below to calibrate the screen. Under the Start menu, choose Settings. Then, tap on the System tab. You should see an icon called “Screen.” Tap on it to launch. From its window, you should see a button called “Align Screen.” Follow the procedure it describes to align the screen (while it is in the Mil-Spec case). Once it completes this alignment successfully, it should operate much better for you.

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I'm trying to virtually mix agents, but don't see them in the Mixture Tab.

HazRAE allows you to mix any agents that are found in your recall list of bookmarks. The system automatically makes an entry in the recall list for any agent that you've researched by accessing any of its related response information while on the Search Tab (e.g., you've done anything more than reviewed the agent's overview, while on the Search Tab). Once the system has automatically added an agent to your recall list, it will be available for mixing or modeling precursor outcomes from the Mixture Tab.

What military standards does HazRAE adhere to?

HazRAE is fully DoD Common Operating Environment/Joint Technical Architecture (DOD COE/JTA) compliant, and is the only mobile HAZMAT, Chem/Bio/WMD response system that is compliant with this standard. Additionally, HazRAE is the only commercial HAZMAT, Chem/Bio/WMD decision support system that can be deployed in any environment that supports HPAC 4.0 or later.

Thank you for using HazRAE—the only third-generation hazardous material response system available. Feel free to contact us if you have problems, suggestions or would like to check for software updates at: <http://www.raesystems.com>.

RAE Systems World Headquarters

3775 N. First St.

San Jose, CA 95134-1708 USA

Phone: 408.952.8200

Fax: 408.952.8480

E-mail: customerserv@raesystems.com

Web Site: www.raesystems.com

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Appendices

Appendix A: HazRAE Data Sources

The table below documents various data sources used within HazRAE

# of Materials/ trade names	Data Source	Where Used
96,000+	EPA, EU Commission on Hazardous Substances	LEL, UEL, physical attributes, trade names
70,723	NOAA	Reactive materials, physical attributes, trade names
6,613	NOAA, EPA	Reactivity, Flammability, Toxicity, specific hazards
5,726	Chemical Abstract Service	CAS NUMBERS
3,408	DOT ERG 2004	Response SOP guides, isolation distances
5,432	NIH	Health, toxicological and ELSP information
4,800+	HSDB	HSDB is a National Library of database focused on the toxicology of potentially hazardous chemicals; used for reachback access to most currently published, peer reviewed exposure information.
2,000,000+	MSDS Repository	Integrated reach-back guidance to manufacturer's safety data sheets.
1,102	USCG CHRIS	Various material attributes / water reactivity
1,101	EPA, NIOSH, OASG ¹	IDLH values
2,519	DOE, CDC	TEEL, ERPG (Rev20)
949	NFPA, RIDS	Fire rating classifications. Note – where NFPA ratings between data sources differ, the most conservative value (from a safety perspective) is used.
677	NIOSH Pocket Guide	IDLH values, physical attributes, respirator recommendations
633	Argonne National Labs	Isolation Distances, Protective Action Zones
31,000+	NIOSH, EPA, DuPont	Protective clothing / breakthrough times
167	USAMRIID, WHO, CDC, HC & others	Biological warfare agents, bio-toxins, and bio terror agents
8,800+	DEA, FBI, ATF, EPA, United Nations & others	Precursors for explosives, chemical warfare, cocaine, heroin & methamphetamines
7,000+	ATF	Commercial/military detonators
9,800+	United Nations Code For Trade And Transport Locations	Coastal ports of embarkation/debarkation for intermodal containers
12,000+	RTECS	Toxic substances / RTECS registry pages
2,800+	Bureau International des Containers	Intermodal containers owner registration codes and country of origin
692	National Nuclear Data Center	Radioactive isotope overview (March, 2004 update)
692	U.S. Nuclear Regulatory Commission	Occupational exposure limits; general public exposure guidelines
	International Atomic Energy Commission	Sealed Sources and industrial uses/assigned risks of selected isotopes
	Department of Homeland Security RDD Working Group	Signs, symptoms and medical response information for radioactive isotopes

¹ OSHA/NIOSH Interim Guidance for TLV/IDLH values for Airborne Exposure Limits to Nerve Agents, Published April 1, 2005, in consultation with the OASG. These values are advisory and interim in nature; OSHA may update this guidance as additional information becomes available.

Other data sources referenced in HazRAE include:

- *The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals*, S. Budavari, Ed., Merck & Co., Inc., Rahway, NJ, 1996
- *Aldrich Handbook of Fine Chemicals and Laboratory Equipment*, 2000-2001 Aldrich-Sigma

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- *Bretherick's Handbook of Reactive Chemical Hazards*, 5th ed., Butterworth-Heinemann, Oxford, 1995.
- *Chemistry of Organic Compounds*, 2nd Ed., C. R. Noller, W. B. Saunders Company, 1958
- *Hazardous Chemicals Handbook*. Carson, P. A. and Mumford, C. J., Butterworth-Heinemann, Oxford, 1994.
- *ChemCheck Handbook*, STP Specialty Technical Publishers, Vancouver, Canada, 1994.
- *Chemical and Engineering News*, published weekly by the American Chemical Society
- Chemical Manufacturers Association Case Histories
- *Chemistry and Technology of Explosives*, Urbanski, T., London, MacMillan
- *Hazardous Materials Reference Book*, Davis, D. J. and Davis, J. A.. Van Nostrand Reinhold, New York, 1996.
- *Farm Chemicals Handbook, 1995*, Meister Publishing Company, Willoughby, OH
- *Fire and Explosion Risks*, von Schwartz, E., London, Griffin, 1918
- *The Condensed Chemical Dictionary*, 9th ed., G. G. Hawley, 1977
- *A Comprehensive Treatise on Inorganic Chemistry and Theoretical Chemistry*, First Edition and supplements, J. W. Mellor, Longmans Green & Co., London, and Wiley-Interscience, New York
- *Journal of Chemical Education*
- *Journal of Hazardous Materials*
- *Journal of Loss Prevention*
- *Journal of Organic Chemistry*, published by the American Chemical Society
- *Journal of Organometallic Chemistry*
- *Journal of the American Chemical Society*
- *Encyclopedia of Chemical Technology*, Kirk-Othmer, Wiley-Interscience, New York, 3rd ed., 1978 and 4th ed., 1992.
- Lancaster Catalog 2000-2001, Lancaster Synthesis Ltd.
- *Hazardous Chemicals Desk Reference*, 3rd ed., Lewis, R. J., Van Nostrand Reinhold, New York, 1993.
- National Fire Protection Association (NFPA)
- National Toxicity Program
- *Safety in the Chemical Laboratory*, Pieters, London, Academic Press, 2nd ed., 1957
- Underwriters Laboratory's Bulletin of Research
- United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry
- *Handbook of Chemistry and Physics*, 59th Ed., Weast, CRC Press, 1979

Appendix B: Comparative Lethality of Selected Toxins

AGENT	LD ₅₀ (µg/kg)	MOLECULAR WEIGHT
Botulinum toxin	0.001	150,000
Shiga toxin	0.002	55,000
Tetanus toxin	0.002	150,000
Diphtheria toxin	0.10	62,000
Ciguatoxin	0.40	1,000
C. perfringens toxins	0.1 - 5.0	35-40,000
Batrachotoxin	2.0	539
Ricin	3.0	64,000
Taipoxin	5.0	46,000
Tetrodotoxin	8.0	319
Saxitoxin	10.0 (Inhal 2.0)	299
VX	15.0	267
SEB (Rhesus/Aerosol)	27.0 (ED ₅₀ ~pg)	28,494
Anatoxin-A(s)	50.0	500
Microcystin	50.0	994
Soman (GD)	64.0	182
Sarin (GB)	100.0	140
Aconitine	100.0	647
T-2 Toxin	1,210.0	466

Source: USAMRIID's *MEDICAL MANAGEMENT OF BIOLOGICAL CASUALTIES HANDBOOK*, Fourth Edition, February 2001.

Appendix C: Ruggedized HazRAE Specifications

Military Specifications for HazRAE Case

If your HazRAE system was delivered in the deluxe ruggedized enclosure provided by RAE Systems (P/N 055-3000-000), it conforms to the specifications listed below:

MIL-STD-810F - Impact Resistant to Drop - PASSED

Resistance to impact by dropping according to Method 516.5, Procedure IV (Transit Drop) of MIL-STD-810F, "Department of Defense Test Method Standard for Environmental Engineering Considerations and Laboratory Tests."

"No damage, except for slight cosmetic damage such as small dents or scuff marks, was observed." –Hauser Laboratories of Boulder, Colorado

MIL-STD-810F - Water Resistance - PASSED

Water infiltration resistance according to the Immersion test described in MIL-STD-810F, Method 512.4.

"Cases were tested with a simulated PDA in place, no water leakage was observed in any of the cases tested." –Hauser Laboratories of Boulder, Colorado

SAE J575 (JUN92) - Dust Resistance - PASSED

Dust Resistance according to the test contained in SAE J575 (JUN92), a standard according to automotive lighting devices.

"No evidence of dust penetration into the interior of the case was observed." –Hauser Laboratories of Boulder, Colorado

***Testing performed by Hauser Laboratories, of Boulder, Colorado, on June 20 through July 1, 2002. Hauser Laboratories is a division of Microbac Laboratories, Inc.

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Appendix D: Ultra-Rugged Recon™ HazRAE Specifications

The Tripod Data Systems™ Recon™ delivers maximum performance and reliability in a lightweight and extremely rugged design that's easy to carry. The waterproof Recon weighs just 17 ounces, and it exceeds military specifications for drop, vibration and both high and low temperature operation. The HazRAE based Recon works wherever and whenever you need it. Recon based HazRAE systems conform to the following specifications:

Environment Operating Temperature	-22 to 140°F (-30 to 60°C)
Humidity	MIL-STD-810F, Method 507.4
Sand & Dust	IP67, MIL-STD-810F, Method 510.4, Procedures I and II
Water	IP67, sealed against accidental immersion (1m for 30 minutes) MIL-STD-810F, Method 512.4, Procedure I
Drop	MIL-STD-810F, Method 516.5, Procedure IV, 26 drops from 4 ft (1.22 m) onto plywood over concrete, 6 additional drops at -4°F (-20°C), 6 additional drops at 140°F (60°C)
Vibration	MIL-STD-810F, Method 514.5, Procedure I, Figures 17 and 18
Altitude	MIL-STD-810F, Method 500.4, Procedures I, II and III, 15,000 ft at 73°F (23°C)

Appendix E: Background on Radiation

Radiation surrounds us all the time, in the form of sunlight, radio waves, microwaves, cosmic rays and thermal rays from things like heat lamps. This type of radiation is mostly electromagnetic radiation, where the shorter the wavelength (higher frequency), the higher the energy of the photons. Most of this type of radiation that an individual is normally exposed to is harmless, either because the photon energy or intensity is too low.

Nuclear radiation is different in that:

- It consists of particles (alpha, beta, neutrons) as well as short wavelength emissions (gamma rays).
- It consists of energy levels that are generally high enough to ionize molecules, causing biological damage.

Because of its ability to ionize molecules, nuclear radiation is sometimes referred to as ionizing radiation. The damage caused to living cells by a radiation source depends on many factors, including the energy level of the source, the accumulated time of exposure, the distance between the source and the exposed cells, and any shielding used to block the source. The effects of exposure to a radioactive source follows observed properties that are particularly important for a responder to remember: the dose received from a given source is four times less at double the distance from the source, whether the radiation involved is alpha, beta, gamma or neutron radiation.

Shielding Against Nuclear Radiation

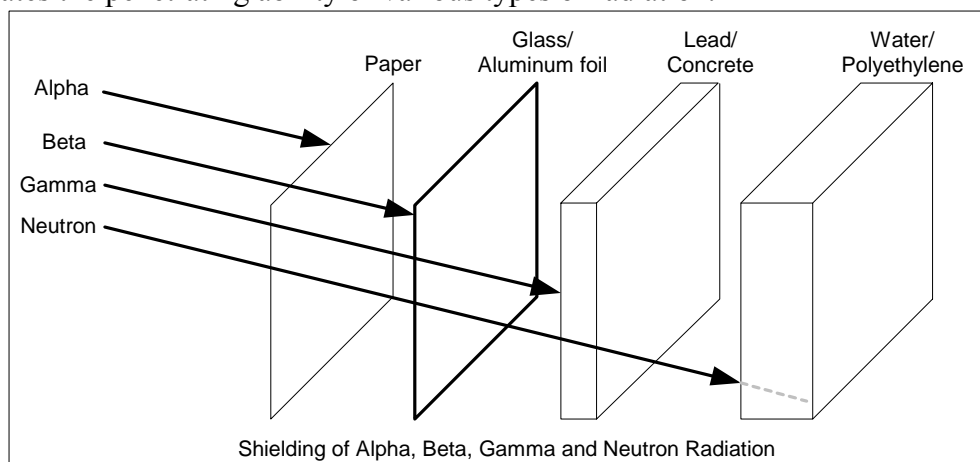
Because of their different ranges in air and material/tissue, different types of shielding materials are used to shield against alpha, beta, and gamma sources. Alpha particles are heavy charged particles (Helium molecules with two neutrons and two protons) with a very short range in air. They can be stopped with a sheet of paper or by the outer dead layer of the skin. An alpha particle of at least 7.5 MeV is needed to penetrate the nominal protective layer of the skin.

Beta particles can travel significant distances in air, but solid materials easily stop them. The range of beta particles in air is ~12 feet (3.6 meters) per MeV. For Co-60 with a beta MeV of 2.8 the range is ~34 feet (10 meters). Beta emitting sources should be shielded with low-density materials (for example plastics) to reduce un-intended x-rays as a by-product of their absorption by shielding materials. Low levels of beta radiation can be stopped completely by about a half inch of water, a smaller thickness of plastic, or less than one quarter of an inch of glass. Another common shielding material for beta sources is aluminum. Leather gloves can greatly reduce the beta radiation dose. A beta particle of at least 70 KeV is needed to penetrate the nominal protective layer of the skin.

Gamma and x-rays are shielded with denser materials, such as lead or steel. Lead, which is a very good absorber for gammas, is a poor shielding material against neutrons. Neutron shielding is very complicated because of the range of neutron energies commonly encountered and the dependence of neutron interactions on these energies and the shielding materials.

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As a general principle, neutrons are slowed and then absorbed. Because elastic scattering with a proton is the most efficient method to slow/moderate a neutron, hydrogen rich materials such as water, paraffin wax, and polyethylene are used. An illustration below illustrates the penetrating ability of various types of radiation.



The table below describes various shielding materials, their effectiveness for a given type of radiation, and some of the advantages and disadvantages of each material:

Shielding Material	Radiation	Shielding Advantages	Shielding Disadvantages
Iron	Gamma	Relatively cheap and available in many forms and thickness. It has reasonable density and good structural characteristics.	It activates in neutron fields and leaks intermediate-energy neutrons.
Lead	Gamma	It is cheap and easy to form with moderately high density.	It is a toxic metal with severe restrictions on disposal as a radioactive waste. Impurities may be activated by neutrons.
Tungsten	Gamma	It has the highest available density in a commonly available metal. It has good activation characteristics.	It is very expensive and difficult to form.
Water	Neutrons, gamma	It is cheap, transparent, with a high hydrogen density.	It can flow and leak out of container and evaporate. It would need 12 times the thickness of lead to have the same attenuation to gammas.
Paraffin	Neutrons, gamma	It is cheap and easily formed with good hydrogen density. It can have various additives, and has no neutron activation.	It is combustible and its final form is not rigid. The neutron capture by hydrogen produces a hard-to-shield gamma. Lots of thickness would be needed for gammas.
Polyethylene	Neutrons, gamma	It is easily shaped, machined. It has good hydrogen density. It does not activate and can be manufactured with selected additives.	It is semirigid and needs support for large sections. Lots of thickness would be needed for gamma rays.
Concrete	Neutrons, gamma	It is cheap, with good structural characteristics. Good choice when space is not a concern, has an acceptable hydrogen density for neutron shielding and it is stable at elevated temperatures.	It activates and large shields must be reinforced to avoid cracks. Shields can have voids.
Hydrogen	Neutrons	It is available in many materials and it is good for reducing energy of neutrons.	It produces high-energy gamma when capturing thermal neutrons.
Boron	Thermal neutron	It is easily added to many materials, and does not result in a radioactive product.	It is difficult to attain high concentrations when added to materials and it is expensive.
Lithium	Thermal neutron	The neutron absorbing process does not produce any gammas and lithium can be mixed with other materials.	Each absorbed neutron produces a lithium atom and it is expensive.

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Shielding Material	Radiation	Shielding Advantages	Shielding Disadvantages
Cadmium	Thermal neutron	It is a metal that is easily formed with sharp edges for beam definition. A thin piece can stop all thermal neutrons.	A toxic metal that produces a long-lived radioactive nuclide. Neutron capture produces high energy gammas that are difficult to shield.

Gamma Ray Dose Reductions for Various Building Types

Shielding characteristics of most structures for gamma radiation can be categorized based on whether they are “small” or “large.” Small structures are primarily single-family dwellings, and large structures include office, industrial, and commercial buildings. The typical attenuation factors given in the table below show the importance of the type of structure for protection from external gamma radiation. Sheltering in place (staying inside a structure with doors and windows closed and, generally, with exterior ventilation systems shut off) is a low-cost, low risk protective action that can provide protection with an efficiency ranging from almost 100% to zero, depending on the circumstances. The dose reduction factors shown in the table below are initial values prior to infiltration of contaminated air, and therefore apply only to short duration plume exposure.

Type of Structure	Effective dose rate reduction to short term external radiation
Wood frame house (first floor)	10%
Wood frame house (basement)	40%
Masonry house	40%
Large office or industrial building	80% or better

Appendix F: Backing Up & Reinstalling HazRAE

Backing Up & Re-Installing HazRAE On iPAQ Pocket PC

Using the SD card to restore HazRAE

Restoring from the SD Card merely reinstalls the HazRAE program. It does not restore any other data that may have been lost.

1. Charge the iPAQ's battery.
2. Turn on the iPAQ.
3. Follow the iPAQ's onscreen instructions to reset the unit.
4. Ensure the SD card is in the slot.
5. Tap the Date line at the top of the screen, and set the **Time** and **Date**.
6. Tap "Tap here to set owner information." Enter your owner information exactly the same way as when you registered to obtain your owner registration key. If you do not do this, you will only be allowed 15 trial usages.
7. **Start ► Programs ► File Explorer**.
8. Pull down the location menu to **My Device**.
9. Select the **SD Card** folder.
10. Tap on **InstallMe_1st**. Tap **OK**.
11. Tap on **InstallMe_2nd**. Tap **OK**.
12. Close the **File Explorer** by tapping on the circled **X** in upper right corner.

The **Programs** window should still be open. Otherwise, tap **Start ► Programs**.

13. Tap on the **HazRAE** icon.

Backing Up And Restoring HazRAE With iPAQ's Backup

The iPAQ has a non-volatile memory that stores information even if the battery is fully discharged. This allows you to back up HazRAE and everything else on your iPAQ.

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Begin by saving a backup:

1. Start ► Programs ► iPAQ Backup.

To back up once, simply tap **Backup Now**. This creates a backup file of everything on your iPAQ. This will take a couple of minutes.

When the backup is done, you'll see a message that says, "Operation Completed." Tap **OK**.

When a window pops up, prompting you to restart your iPAQ, tap **OK**. Your iPAQ's entire contents are backed up to the iPAQ File Store. The file is automatically named with a format that uses the word "backup" followed by a date consisting of the 4-digit year followed by a 2-digit month and 2-digit date (for example: backup_200508-01).

To set up a recurring (automatic) backup:

1. Tap Start ► Programs ► iPAQ Backup

2. Tap on **Options** at the lower left corner. Then select **Switch to Advanced Mode**.

The iPAQ will scan the file system. This will take a few seconds.

3. Tap **Options** ► **Scheduled Backup**

4. Check the box labeled **Enable Scheduled Backup**.

5. Select the backup frequency (daily or weekly).

For *daily* backups, set the time at which you would like your backup to occur.

For *weekly* backups, set the date and time at which you would like backups to start.

6. Check the box labeled **Restart Device When Complete**.

7. Tap **OK**.

8. Tap **Backup**.

If you see a window that says, "File exists - do you want to replace the existing backup file?" tap **Yes**.

9. Tap **Start** to begin the backup. The backup process takes a few minutes.

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10. When the backup is complete, you will see the message “Operation Complete.” Tap **OK**.

11. Next you will see the message “Operation Completed. Tap OK to start your device.” Tap **OK**. Now the iPAQ will automatically create a new backup file at the specified intervals.

Restoring Your HazRAE And Other Data From Backup

1. Turn on your iPAQ.
2. Click Start ► Programs ► iPAQ Backup

There are two modes of operation, Basic and Advanced. Both do the same thing, although you have to follow different instructions:

Basic Mode (Default)

1. Tap **Restore Now**.
2. It takes a few minutes. When it says Operation Completed, tap **OK**.
3. You'll see a message that says, “Tap OK to restart your device.” Tap **OK**.

Advanced Mode

1. Tap the **Restore** tab.
2. When you see “Select a backup file,” tap the “...” button.
3. Select the appropriate backup file.
4. Tap **Open**.
5. Tap **Restore...**
6. Tap **Start**. Restoring will take a few minutes.
7. When you see the message “Operation completed,” tap **OK**.
8. When you see the message “Tap OK To Restart Your Device,” tap **OK**. The iPAQ reverts.

Backing Up & Re-Installing HazRAE On A Windows PC

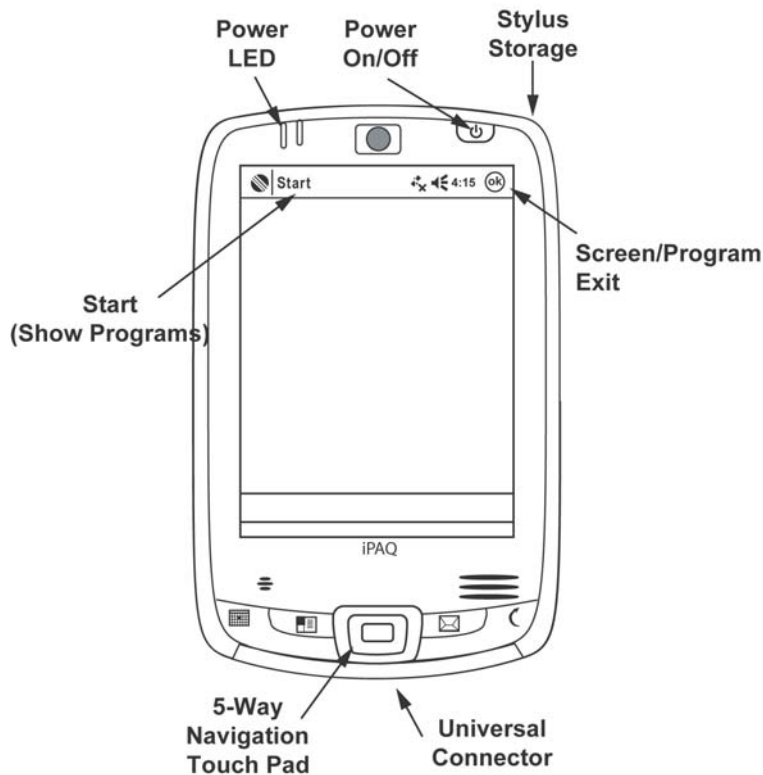
On a PC running Windows, your data should be automatically stored on the local hard drive. This includes log files and Preplanning data. To reinstall the program, insert the disc and double-click on HazRAE_Win32_Installer. Then follow the instructions for installation. **Note:** You will have to input your registration information again.

Appendix G: iPAQ-Specific Information

The following section covers charging, screen alignment, and other details that are specific to the iPAQ and do not apply to a laptop or desktop PC.

iPAQ Pocket PC Layout and HazRAE Functions

Operating HazRAE on the iPAQ Pocket PC requires knowing only a few of the iPAQ Pocket PC's features. Note the locations of the power on/off switch, power LED, stylus storage, and the points on the screen that are used to show programs (where you select HazRAE) and the OK button, where you Exit screens or programs. The iPAQ Pocket PC has other buttons and functions, but they do not apply to HazRAE. (For further information, refer to the documentation from HP that accompanies your iPAQ Pocket PC.)



Locations of switches, ports, and controls on the iPAQ Pocket PC.

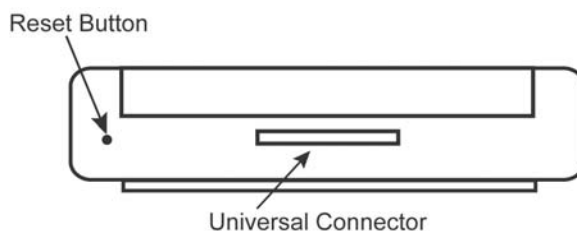
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Care of the iPAQ Pocket PC

- Always use the stylus to make selections. Other objects may damage the iPAQ Pocket PC display.
- Never clean the screen with water. Use cleaner designed for LCD displays.
- Keep the iPAQ Pocket PC in its case during travel.

Charging Your iPAQ Pocket PC

Before using your iPAQ Pocket PC to run the HazRAE Chem/Bio/WMD Decision Support Application, make sure its battery is fully charged. A full charge is usually completed in four hours. You can operate the iPAQ Pocket PC on its AC adapter and USB/Serial sync cable while the battery is charging or when the battery is fully charged. Connect the AC adapter to the USB/Serial sync cable and plug that into the iPAQ Pocket PC's Universal Connector, located on the bottom of the unit.



Bottom of iPAQ Pocket PC: Connect the USB/Serial sync cable and AC adapter to the Universal Connector port to charge the iPAQ Pocket PC's internal batteries.

NOTE: Plugging in the AC adapter turns on the HP iPAQ Pocket PC. If the unit does not turn on, lightly press the Reset button on the bottom of the unit with the tip of the iPAQ Pocket PC's stylus.

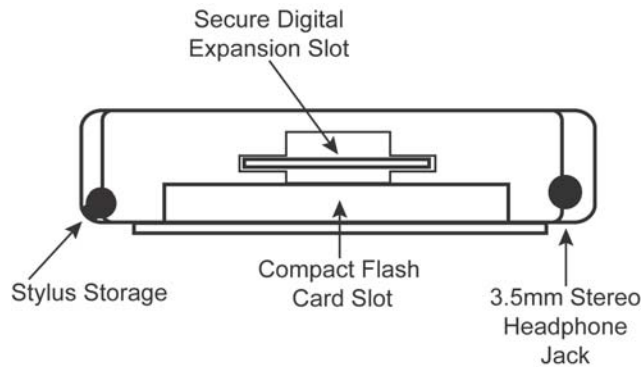
NOTE: Whenever you are not using your iPAQ Pocket PC, leave it on its charger so that its battery is always fully charged.

NOTE: You can charge the iPAQ Pocket PC's batteries without the AC adapter by connecting the USB/Serial sync cable to the iPAQ Pocket PC's Universal Connector and a USB port on a computer that is turned on.

Optional charging devices, including a desktop cradle and an auto adapter, are available from HP at <http://www.hp.com/go/iPAQ Pocket PCaccessories> or 1-888-291-7997.

Turning On Your iPAQ Pocket PC

Turn on your iPAQ Pocket PC by pressing the switch on the end of the device.



Make sure your iPAQ Pocket PC's battery is fully charged. If you are unsure of how much power remains in the internal batteries, check the battery settings by going to the Power section of the system settings:

Start ► Settings ► System ► Power

There are two bar graphs with corresponding numerical information that tells you how much battery power remains in the main battery and the backup battery.

Aligning The Screen For Accuracy

It is important to align your screen so that it accurately recognizes where you tap with the stylus. Alignment takes less than a minute. Align your screen by going to the Screen setting:

Start ► Settings ► System tab ► Screen

Tap "Align Screen" with your stylus and then tap your stylus on the five targets that appear in succession. Calibration is now complete. Tap OK to exit.

Note: You must realign your screen if:

- The HP iPAQ Pocket PC does not respond accurately to your taps.
- You perform a full reset of your HP iPAQ Pocket PC.

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RAE Systems, Inc.
World Headquarters
3775 N. First St.
San Jose, CA 95134-1708 USA
Phone: 408-952-8200
Fax: 408-952-8480
www.raesystems.com