

## ChemPro100 Libraries (Dual-SCCell CP100V2) 9.2.3

### What is a Library?

The ChemPro100 uses fuzzy logic to compare what the device is seeing in its sample to saved "patterns" that result from the device being tested with the actual chemicals using both laboratory and real world exposure test scenarios. This laboratory and real world test data is used to create a detection library.

### Why Use Libraries?

While the ChemPro100 can detect a wide variety of Chemical Warfare Agents (CWAs) and Toxic Industrial Chemicals (TICs) if all of these chemicals were to be put in one list it could lead to an unsatisfactory number of false alarms. Therefore, chemicals of interest are put into lists ("Libraries") that are use specific. For example, clues (physical, biological, etc.) at the scene will lead responders to draw conclusions about the type of threat and then the responder can choose the correct library. If the responder reinterprets the on-scene clues the selected library in the ChemPro100 can be changed "on-the-fly."

### Understanding the Following Charts

The ChemPro100 is a classifier, not an identifier. Its pattern recognition software will alarm for groups of chemicals but not identify a particular chemical. For example, when a ChemPro100 is presented with GB, it will display "Nerve" and the gasmask icon along with a bar graph of relative concentration. But the ChemPro100 will not identify the GB as either "GB" or "Sarin." In the case of the nerve agents, the response protocol is the same for all of the agents so the "Nerve" alarm is appropriate. Blister requires a different

response protocol so it is found in another "classification."







1. Detected compound class
2. Agent relative concentration
3. Agent related icon
4. Alarm acknowledged/Mute button
5. Blinking status LEDs

### The ChemPro100 Provides Broad Chemical Protection

Unlike other CWA detectors, the ChemPro100 will alert operators that there is a chemical threat present that doesn't match a pattern, but still could present a threat to the operator. This "Chemical Hazard/ Chemical Detected" alarm provides a degree of protection that competitive products cannot provide.

## CWA (Chemical Warfare Agent)-9.2.3

### Alarm indications and agent coverage

Alarm indication		Library specified agents	Low Alarm mg/m <sup>3</sup>	Library unspecified agents/cases
Text	Icon			
Nerve		GA, GB, GD, GF VX	0.1 0.1	Nerve precursors
Blister		HD L	2 2	Vesicant precursor
Chemical Hazard		-	-	Unknown chemical in potentially hazardous concentrations
Blood		AC, CK	20	-

#### Library purpose:




This library is designed for use in military or first responder environments when circumstances indicate that a CWA attack has taken place or could potentially take place.

#### Library meanings:

- **Nerve:** The ChemPro100 will display “Nerve” and the gasmask icon to indicate that operators should “mask-up” because there is a nerve agent such as Tabun (GA), Sarin (GB), Soman (GD), Cyclo-Sarin (GF), VX or some nerve agent precursors in the air being sampled by the ChemPro100.
- **Blister:** The ChemPro100 will display “Blister” and the gasmask icon to indicate that operators should “mask-up” because there is a blister agents such as Sulfur mustard (HD), Lewisite (L) or some vesicant precursors in the air being sampled by the ChemPro100.
- **Blood:** The ChemPro100 will display “Blood” and the gasmask icon to indicate that operators should “mask-up” because there is a blood agent such as Hydrogen cyanide (AC) or Cyanogen chloride (CK) in the air being sampled by the ChemPro100.
- **Chemical Hazard:** The ChemPro100 will display “Chemical Hazard” and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100 do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## TIC (Toxic Industrial Chemicals) -9.2.3

### Alarm indications and agent coverage

Alarm indication		Library specified agents	Low ppm <sup>(1)</sup>	Library unspecified agents/cases
Text	Icon			
Acid		Hydrogen Chloride (HCl) Hydrogen Fluoride (HF) Nitric Acid (HNO <sub>3</sub> )	50 <sup>(2)</sup> 30 <sup>(2)</sup> 25 <sup>(2)</sup>	Acetic Acid
Toxic		Ammonia (NH <sub>3</sub> ) Carbon disulfide (CS <sub>2</sub> ) Hydrogen sulfide H <sub>2</sub> S) Chlorine Cyanogen chloride (CK) Hydrogen Cyanide (AC) Arsine (AsH <sub>3</sub> ) Ethylene oxide (ETOX) Phosphorous trichloride (PH <sub>3</sub> )	300 500 100 50 <sup>(2)</sup> 50 18 3 100 25	Acrylonitrile
Chemical Hazard		-	-	Unknown chemical in potentially hazardous concentrations

**Notes:**

(1): Low = Alarm limit (IDLH-level). Note: Alarm may occur also below this concentration limit.

(2): Valid in < 16 g (H<sub>2</sub>O)/m<sup>3</sup>.

See following paragraphs for other general limitations and conditions in detail.

### Library purpose:




This library is designed to help classify potentially unknown toxic chemical environments.

### Library meanings

- **Acid:** The ChemPro100 will display "Acid" and the acid icon to indicate that operators may be exposed to Hydrogen Chloride (HCl), Hydrogen Fluoride (HF) and Nitric Acid (HNO<sub>3</sub>) or possibly another acid at IDLH levels (Immediate Danger for Life and Health). Concentrations of Acetic Acid may also trigger this alarm. The alarm indication 'Chemical Hazard' may occur in high acid concentrations.
- **Toxic:** The ChemPro100 will display "Toxic" and the skull & crossbones icon to indicate that operators may be exposed to Ammonia (NH<sub>3</sub>), Carbon disulfide (CS<sub>2</sub>), Hydrogen sulfide (H<sub>2</sub>S), Hydrogen cyanide (AC), Cyanogen Chloride (CK), Ethylene Oxide (ETOX), Arsine (AsH<sub>3</sub>), Chlorine (Cl<sub>2</sub>) and Phosphorous trichloride (PH<sub>3</sub>) at IDLH levels. Concentrations of Acrylonitrile may also trigger this alarm. Alarm indication 'Chemical Hazard' appears often preceding or following 'Toxic' alarm.
- **Chemical Hazard:** The ChemPro100 will display "Chemical Hazard" and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100 do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## Precursor-9.2.3

### Alarm indications and agent coverage

Alarm indication		Library specified agents	Low <sup>(1)</sup> mg/m <sup>3</sup>	Library unspecified agents/cases
Text	Icon			
Nerve precursor		Dimethyl methyl phosphonate	0.5	CWA nerve agents
		Di methyl phosphite	0.5	
		Methyl phosphonic dichloride	0.2	
		Pinacolyl alcohol	150	
Vesicant precursor		Thiodiglycol	0.1	
Chemical Hazard		-	-	Unknown chemical in potentially hazardous concentrations

Note: (1): Low = Alarm limit. Note: Alarm may occur also below this concentration limit.

### Library purpose:


This library is designed to help CWA counter proliferation officials and law enforcement officials to identify the precursors typically used to produce nerve agents and vesicants.

### Library meanings

- **Nerve precursor:** The ChemPro100 will display “Nerve Precursor” and the skull & crossbones icon to indicate that operators may be exposed to Dimethyl methyl phosphonate (DMMP), Dimethyl phosphite, Methyl phosphonic dichloride and Pinacolyl alcohol. Concentrations of nerve agents such as GA, GB, GD, GF and VX may also trigger this alarm. Alarm indication ‘Chemical Hazard’ may occur in high nerve precursor concentrations.
- **Vesicant precursor:** The ChemPro100 will display “Nerve Precursor” and the skull & crossbones icon to indicate that operators may be exposed to Thiodiglycol. Alarm indication ‘Chemical Hazard’ may also occur.
- **Chemical Hazard:** The ChemPro100 will display “Chemical Hazard” and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100 do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## First Responder-9.2.3

### Alarm indications and agent coverage

Alarm indication		Library Specified Agents	Alarm Limit <sup>(1)</sup> ppm
Text	Icon		
Toxic		Ethylene Oxide	100
		Acrylonitrile	100
		Hydrogen Sulfide	10
		Arsine	5
		Ammonia	300
		Phosphorous Trichloride	25
		Carbon Disulfide	500
		Allyl Alcohol	40
		Hydrogen Cyanide	50
		Cyanogen Chloride	50
		G type Nerve	0.2 mg/m3
		HD type Blister	5 mg/m3
Chemical Detected	-	Any measurable agent	Unknown chemical in potentially hazardous concentrations

**Note:** (1): Operation in cold (< 5 °C) and hot environments (>35 °C) may lead to increased alarm limits. Operation in conditions where background air is slightly contaminated can also lead to increased alarm limits.

#### Library purpose:




This library combines the CWA 9.2.3 library with the TIC 9.2.3 library and is useful for applications where the user needs to provide protection from both CWA and TIC threats.

#### Library meanings

- **Toxic:** The ChemPro100 will display "Toxic" and the skull & crossbones icon to indicate that operators may be exposed to Toxic Industrial Compounds like Ethylene Oxide (ETOX), Acrylonitrile, Arsine (AsH<sub>3</sub>), Hydrogen Sulfide (H<sub>2</sub>S), Ammonia (NH<sub>3</sub>), Phosphorous Trichloride (PCl<sub>3</sub>), Carbon Disulfide (CS<sub>2</sub>), Allyl Alcohol, Hydrogen Cyanide (AC) and Cyanogen Chloride (CK) as well as Chemical Warfare Agents like G-type Nerve agents and HD-Blister agent.
- **Chemical Detected:** The ChemPro100 will display "Chemical Detected" to tell operators that while the chemical(s) being sampled by the ChemPro100 do not match the alarm patterns in this library, an unknown chemical is present at such a level that they could represent a hazard to the user. The "Chemical Detected" alarm often precedes and follows Toxic alarm indication. Indication may occur also due to several other compounds.

## VOC (Volatile Organic Compounds)-9.2.3

### Alarm indications and agent coverage

Alarm indication		Library specified agents	Low <sup>(1)</sup> ppm	Library unspecified agents/cases
Text	Icon			
Flammable		Acetone Ethanol Methanol n-Hexane Isopropanol Diethyl ether Ethyl acetate Methyl methacrylate	100 2000 500 600 400 400 400 100	Solvents and fuel vapours
Organic acid		Acetic acid	50	-
Chemical Hazard		-	-	Unknown chemical in potentially hazardous concentrations

Note: (1): Low = Alarm limit. Note: Alarm may occur also below this concentration limit.

### Library purpose:






This library is designed to help classify potentially unknown toxic chemical environments.

### Library meanings

- Flammable:** The ChemPro100 will display “Flammable” and the flame icon to indicate that operators may be exposed to VOCs such as Acetone, Ethanol, Methanol, n-Hexane, Isopropanol, Diethyl ether, Ethyl acetate and Methyl methacrylate at IDLH levels. Concentrations of other solvents and fuel vapors may also trigger this alarm. Alarm indication ‘Chemical Hazard’ may occur in high concentration and humidity.
- Acid:** The ChemPro100 will display “Acid” and the acid icon to indicate that operators may be exposed to Acetic Acid at IDLH levels (Immediate Danger for Life and Health). The alarm indication ‘Chemical Hazard’ may occur in high acid concentrations.
- Chemical Hazard:** The ChemPro100 will display “Chemical Hazard” and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100 do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## H.T.C 9.2.3

### Alarm indications and semi-quantitative concentration limit:

Alarm Indication		Library specified Agents	Alarm Limit <sup>(1)</sup>	Library unspecified agents/causes
Text	Icon			
TDI		Toluene di-isocyanate	0.04-0.06 pm	Alkanes and diesel vapor in low concentration.
Acetonitrile		Acetonitrile	30-100 ppm	
Inorganic acid		Hydrogen Chloride Hydrogen Fluoride	5-10 ppm 2-5ppm(RH<40) >>5ppm(RH>40)	
Toxic		Toxic	Not specified	G type nerve agents, Lewisite, inorganic acids in high concentration possible.
VOC		VOC	Not specified	Alcohols, alkanes, ketones, fuel and solvent vapors.

Note: (1): Low = Alarm level. Alarm may occur also below this concentration limit.

### Library purpose:



The "Highly Toxic Chemical" library provides detection of TDI and Acetonitrile and some acids in the industrial environment.

### Library meanings

- **TDI:** The ChemPro100 will display "TDI" and the skull & crossbones icon to indicate that operators may be exposed to Toluene diisocyanate at approximately the US OSHA PEL (Permissible Exposure Limit).
- **Acetonitrile:** The ChemPro100 will display "Acetonitrile" and the skull & crossbones icon to indicate that operators may be exposed to Acetonitrile at NIOSH and OSHA REL/PEL levels.
- **Inorganic Acid:** The ChemPro100 will display "Inorganic Acid" and the acid icon to indicate that operators may be exposed to HCl and HF at approximately NIOSH and OSHA REL/PEL levels.
- **Toxic:** The ChemPro100 will display "Toxic" and the skull & crossbones icon to indicate that operators may be exposed to Toxic Industrial Compounds
- **VOC:** The ChemPro100 will display "VOC" and the flame icon to indicate that Volatile Organic Compounds are present.

## Clan Lab 1.2.0

### Alarm indications and semi-quantitative concentration limit:

Alarm indications				Chemical	Alarm limit
Text	Icon	Audio	Visible		
Chemical Detected			Red LEDs	Acetic acid	Detectable mostly at TWA level
				Acetone	
				Ammonia	
				Benzene	
				Ethers	
				Ethyl acetate	
				Ethyl alcohol	
				Gasoline	
				Hydrogen chloride	
				Isopropyl alcohol	
				Methyl amine	
				Phosphine	
				Phosphorus trichloride	
Toluene					

### Library purpose:



This library is designed to alert responders in clandestine methamphetamine labs (“clan lab”) that potentially toxic concentrations of chemicals typically present in clan labs may be present at levels that exceed TWA levels. This library is still considered a “prototype” library and while it can be made available, further field validation is sought.

### Library meanings

- **Chemical Detected:** The ChemPro100 will display “Chemical Detected” and the skull & crossbones icon to indicate that operators may be exposed to clan lab chemicals at levels that exceed TWA (Time Weighted Average) levels.

## Overhaul 1.2.0

### Alarm indications and semi-quantitative concentration limit:

Alarm indications				Chemical	Alarm limit
Text	Icon	Audio	Visible		
Mask Up			Red LEDs	Acrylonitrile	Detectable mostly at TWA level
				Ammonia	
				Benzene	
				Formaldehyde	
				Hydrogen chloride	
				Hydrogen cyanide	
				Hydrogen fluoride	
				Sulphur dioxide	
Toluene					

#### Library purpose:



“Overhaul” is the process whereby firefighters enter a structure that has burned but has been put out with the purpose of confirming that the fire is completely out and to potentially identify the source of the fire. There are many potentially toxic gases in this environment. This library is designed to warn firefighters that potentially toxic gases are present during the Overhaul process and that they should don their SCBA to protect themselves. This library is still considered a “prototype” library and while it can be made available, further field validation is sought.

#### Library meanings

- **Mask Up:** The ChemPro100 will display “Mask Up” and the gasmask icon to indicate that firefighters may be exposed to chemicals from the smoldering environment at levels that exceed TWA (Time Weighted Average) levels.

## Irritant 1.2.0

### Alarm indications and semi-quantitative concentration limit:

Alarm indications				Pepper sprays	Detectability after attack (h)
Text	Icon	Audio	Visible		
Irritant			Red LEDs	Juova Law Enforcement (2% oleoresin capsicum), USA	1
				Bodyguard Defence Pepper Spray (5% OC), USA	>24
				Sabre 5.0 Law Enforcement Unit (5% OC), USA	
				First Defence Red Pepper Spray MK-4, Germany	
				First Defence Red Pepper Gel MK-4, Germany	

Saturated vapor of capsaicin can also be detected.

### Library purpose:

This library is designed to help first responders identify the presence of irritant chemicals such as pepper spray. This library is still considered a “prototype” library and while it can be made available, further field validation is sought.

### Library meanings

- **Irritant:** The ChemPro100 will display “Irritant” and the X icon to indicate the presence of irritant compounds.