CHEMICAL RISK ASSESSMENT

It’s Not the Hazard. It’s the Risk

Your Speakers

Jerome Marinkovic

Director of Product Research & Development, Chemwatch

Jerome is the Director of Product Research & Development at Chemwatch with over 6 years experience in the chemicals management marketplace.
His professional experience in chemical risk assessment includes development and deployment of the Chemwatch control banding risk assessment and approval system.

Jerome has advised many companies and government departments on chemical risk management with a particular focus on risk analysis issues and techniques.
Jerome holds a B Sc degree in Marine Biology and a Graduate Certificate in Software Project Management.

Claude Neri

Head of Compliance and Research Department, Chemwatch

Claude Neri is the Head of Compliance and Research Department at Chemwatch with over 17 years experience in the chemicals management marketplace.

His professional experience as a Chemical Database Project Technical Manager and Chemical Safety Projects Manager includes the successful management of a wide variety of projects such as chemical database web applications, molecular modeling and QSAR techniques. Claude holds BS degrees in Environmental Management of Hazardous Materials and Mathematics and a MS in Analytical Chemistry.

Chemwatch

We are:

- An international company, headquartered in Australia, with offices throughout Europe, the US and Asia-pacific
- A large employer of science graduate and postgraduates (including chemists, toxicologists and OHS specialists) and IT specialists (over 250 world-wide)
- A successful company with over 25 years of service to the chemicals safety community
- Thousands of clients globally, including hospitals, research institutes, and government departments.

What is Risk Assessment?

It certainly isn't Risk Analysis

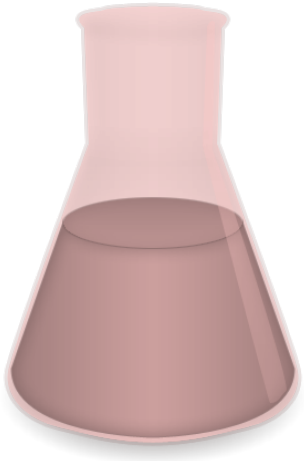
Risk Assessment	Risk Analysis
Central scientific **component of risk analysis**	Facilitates consistent and science-based **decision-making.**

Control Banding Approach

In a nutshell

Control Banding minimises Subjective decision making by following a Scientific method for Assessing Risks associated with the use of Chemicals.
Products used at a workplace often contain chemicals which, if not handled correctly, can cause harm.

HEALTH HAZARD + EXPOSURE POTENTIAL → GENERIC RISK ASSESSMENT → CONTROL APPROACH



CONTROL BANDING:

Action-oriented qualitative risk assessment

Simplified process for controlling exposure

Systemised selection of primary prevention

Large focus on "**User Friendliness**"

Origins of Control Banding

Scientific Community addressing Workplace challenges

"Banding Chemical Risk" was first mentioned in 1970's

Further developed in the late 1980's by OHS experts in the pharmaceutical industry…

Adoption:
Starts in 1990's and quickly expands to become the most used Chemical Risk Assessment methodology, worldwide

It is estimated that CB strategies are used to prevent work-related illness and injury for **2.5 billion workers**

This exponential growth continues through the adoption of Control Banding in emerging nations.

China is endorsing CB as the preferred method of assessing Chemical Risks. Chemwatch supports this as an official Partner of the Chinese Government (NRCC, CIRS & CNCIC)

European Government Agencies actively promote the use of CB in developing Countries; This initiative has been supported by Chemwatch (BAuA, GIZ)

ILO Control Banding

Scientific Community addressing Workplace challenges

ILO Workplace Chemicals Control Tool Kit (CCTK)

- Designed for small and medium Enterprises (SME)
- Particular focus on developing countries
- Eliminates “expertise” as a factor

Over 20 years experts have been contributing to the evolution of Control Banding;

These include:

- Occupational hygienists assembled by IOHA
- Specialists from UK, USA, Germany, Australia, South Africa and Asia.

COSHH Essentials refined Control Banding further:

- UK Health and Safety Executive (HSE)
- Facilitates business compliance with the regulations
- Eliminates “expertise” as a factor

International Labour Organization

HSE Health and Safety Executive

IOHA International Occupational Hygiene Association Recognized Certification Board

baua Bundesanstalt für Arbeitsschutz und Arbeitsmedizin

ILO *- INTERNATIONAL LABOUR ORGANISATION*
COSHH *- CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH*
IOHA *- INTERNATIONAL OCCUPATIONAL HYGIENE ASSOCIATION*
BAUA *- FEDERAL INSTITUTE FOR OCCUPATIONAL SAFETY & HEALTH*

Further adoption of Control Banding

Adoption growing exponentially

Many Governments around the world have regulated the use of the Control Banding Approach:

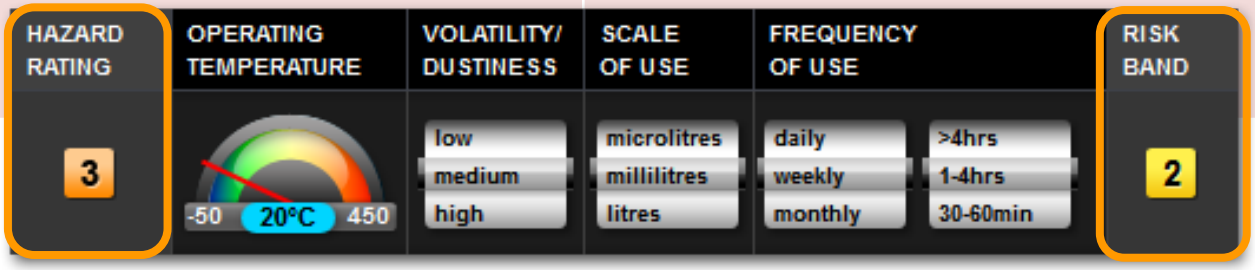
- International Programme on Chemical Safety (IPCS):
  - International Labour Organization (ILO)
  - World Health Association (WHO)
  - United Nations Environment Programme (UNEP)
  - International Chemical Control Toolkit (CCTK)
- UK COSHH Essentials
- Korean CB Toolkit
- Germany (BAuA) / Expo-Tool (EMKG)
- Belgium (REGETOX project)
- Netherlands (Stoffenmanager)
- Norway (KjemiRisk)

Chemwatch serves more than 500 large universities across the globe. Most of these organizations use Control Banding as their preferred method of Chemical Risk Assessment.

Hazard ≠ Risk

Very different “beasts”

Hazard	Risk
A hazard is any **source** of potential damage, harm or adverse health effects on something or someone. For example: • exposure to benzene introduces the hazard of an adverse health effect such as leukemia • electrical work introduces the hazard of electrocution or shock. • Welding introduces the hazard of exposure to welding fumes. Hazards can include objects in the workplace, such as machinery or dangerous chemicals.	Risk is the chance or probability that a person will be harmed or experience adverse health effects **if exposed to a hazard.** Factors that influence the degree of risk include: • how much a person is exposed to a hazard • how the person is exposed (e.g., inhalation, skin contact, ingestion, etc.) • how severe are the effects under the specific conditions of exposure. Risk assessment **starts** with Hazard Identification and aims to determine appropriate ways to eliminate and/or control the Hazard.



It’s not the Hazard

It’s the Risk

The terms **Hazard and Risk** are often used interchangeably but these simple examples explain the difference between the two.

Water Spill

- Wet floor presents a slipping **Hazard**!
- A physical barrier would minimise the **Risk**
- However, the floor is still wet, and the **Hazard** remains

Potassium dichromate in breathalyzers

- Potassium Dichromate is a **Hazardous** chemical
- The chemical is Controlled (properly covered and sealed in a device)
- **Using** it in a breathalyzer does not impose significant **Risk**

Flour in a bakery

- Many people consider flour to be **Non-hazardous**
- Inhalation exposure to flour over a long period of time may result in **diseases** like rhinitis, dermatitis or even asthma.
- There is significant **Risk**, even though flour is **non-hazardous**

First things first

The Overview

Chemical Specific
SDS / Label

SEVERITY
Hazard Identification
Hazard Grouping

Task Specific
Scenarios

PROBABILITY
Scale of Use
Airborne Potential
Frequency Of Use

RISK CALCULATION

CONTROLS

Stage 1: SEVERITY

Hazard Identification and Grouping

Eliminating "subjective views"

- Hazard classification is available from the SDS and/or product label.
- Pre-defined Hazard Grouping is used to assign a "Band" to the Chemical
- This ensures that any 2 or more assessors will arrive to the same outcome

Six Hazard Groups are identified:

- Group **A to E** determine the severity associated with the potential **inhalation** of the Product / Substance
- The sixth group, **group S** determines the Severity of the Hazard associated with Skin and/or Eye contact

Hazard Group	Type	Concentration range	Units	R-phrases	H-statements
A	Dust	>1 to 10	mg/m³	R36, R38 and all R-numbers not otherwise listed	H303, H304, H305, H313, H315, H316, H318, H319, H320, H333, H336 and all H-numbers not otherwise listed
	Vapour	>50 to 500	ppm		
B	Dust	>0.1 to 1	mg/m³	R20/21/22 and R68/20/21/22	H302, H312, H332, H371
	Vapour	>5 to 50	ppm		
C	Dust	>0.01 to 0.1	mg/m³	R23/24/25, R34, R35, R37, R39/23/24/25, R41, R43, R48/20/21/22, R68/23/24/25	H301, H311, H314, H317, H318, H331, H335, H370, H373
	Vapour	>0.5 to 5	ppm		
D	Dust	<0.01	mg/m³	R26/27/28, R39/26/27/28, R40, R48/23/24/25, R60, R61, R62, R63, R64	H300, H310, H330, H351, H360, H361, H362, H372
	Vapour	<0.5	ppm		
E	Dust	-	mg/m³	R42, R45, R46, R49, R68	H334, H340, H341, H350
	Vapour	-	ppm		

SEVERITY	EXTREME	HIGH	MOD	LOW	MIN
EXTREME	EXTREME +	EXTREME +	EXTREME	HIGH	HIGH
HIGH	EXTREME	EXTREME	EXTREME	MOD	MOD
MOD	EXTREME	HIGH	MOD	MOD	LOW
LOW	HIGH	MOD	LOW	LOW	MIN
MIN	LOW	LOW	LOW	MIN	MIN

Stage 1: SEVERITY

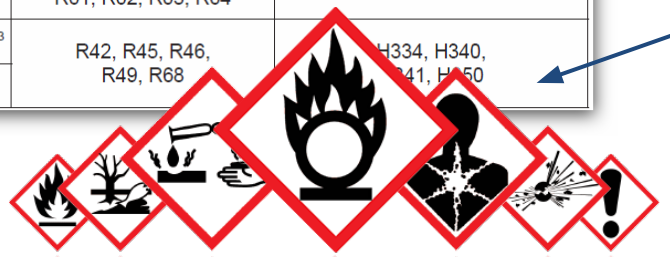
Hazard Classification as the basis of Risk Assessment

Prior to the global adoption of GHS, Risk Codes and/or values such as Exposure Limits were used to determine the appropriate Hazard Group.

In the latest Model, Hazard Codes have been mapped directly to Hazard Groups.

Hazard Group	Type	Concentration range	Units	R-phrases	H-statements
A	Dust	>1 to 10	mg/m³	R36, R38 and all R-numbers not otherwise listed	H303, H304, H305, H313, H315, H316, H318, H319, H320, H333, H336 and all H-numbers not otherwise listed
	Vapour	>50 to 500	ppm		
B	Dust	>0.1 to 1	mg/m³	R20/21/22 and R68/20/21/22	H302, H312, H332, H371
	Vapour	>5 to 50	ppm		
C	Dust	>0.01 to 0.1	mg/m³	R23/24/25, R34, R35, R37, R39/23/24/25, R41, R43, R48/20/21/22, R68/23/24/25	H301, H311, H314, H317, H331, H335, H370, H373
	Vapour	>0.5 to 5	ppm		
D	Dust	<0.01	mg/m³	R26/27/28, R39/26/27/28, R40, R48/23/24/25, R60, R61, R62, R63, R64	H300, H310, H330, H351, H360, H361, H362, H372
	Vapour	<0.5	ppm		
E	Dust	-	mg/m³	R42, R45, R46, R49, R68	H334, H340, [illegible]
	Vapour	-	ppm		

(M)SDS
Hazard Classification



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Stage 2: PROBABILITY

Step 1: Scale Of Use

Scale of use is determined by the **quantity** of the chemical handled in any particular Risk Assessment scenario.

The higher the scale of use, the higher the likelihood of Exposure.

Quantity	Solid		Liquid	
	Weight	Typically received in	Volume	Typically received in
Small	Grams	Packets or bottles	Millilitres	Bottles
Medium	Kilograms	Kegs or drums	Litres	Drums
Large	Tonnes	Bulk	Cubic metres	Bulk

Stage 2: PROBABILITY

Step 2: Ability to become airborne

Products/Chemicals will either be in a solid or liquid state. Gases are handled as highly volatile liquids.
This step is important to assess the likelihood of the chemical becoming airborne.

For SOLIDS

DUSTINESS

LOW - Pellet like solids that don't break up. Little or no "dust" is seen during use e.g. PVC pellets, waxed flakes

MEDIUM - crystalline, granular solids. When used, dust is seen, but settles out quickly. Dust is left on surfaces after use e.g. soap powder.

HIGH - fine, light powders. When used, dust clouds can be seen to form and remain in the air for several minutes e. g. cement, carbon black, chalk dust.

For LIQUIDS

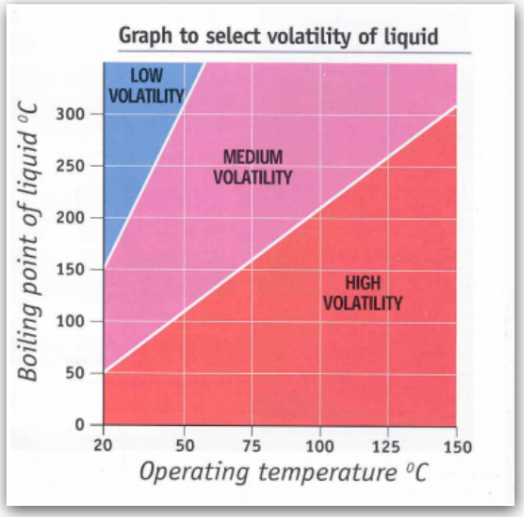
VOLATILITY

LOW - (>150 °C BP)
Evaporates slowly at room temperature;

MEDIUM (50-150 °C BP)
Medium evaporation rate at room temperature.

HIGH - (<50 °C BP)
Evaporates quickly at room temperature. Chemical can be smelled immediately. Exposure is imminent without sufficient controls

BP* - Boiling Point

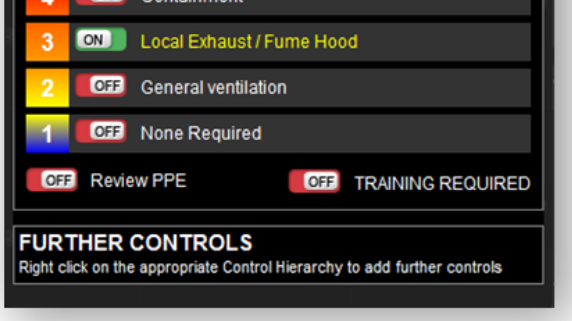


Stage 3: Risk Calculation

Enter the (Risk) Matrix

A risk assessment is not about creating huge amounts of paperwork, but rather about identifying sensible measures to control the risks in your workplace.

SEVERITY	EXTREME	HIGH	MOD	LOW	MIN
EXTREME	EXTREME +	EXTREME +	EXTREME	HIGH	HIGH
HIGH	EXTREME	EXTREME	EXTREME	MOD	MOD
MOD	EXTREME	HIGH	MOD	MOD	LOW
LOW	HIGH	MOD	LOW	LOW	MIN
MIN	LOW	LOW	LOW	MIN	MIN



Stage 4: Control Approach

Selection of Control Approach

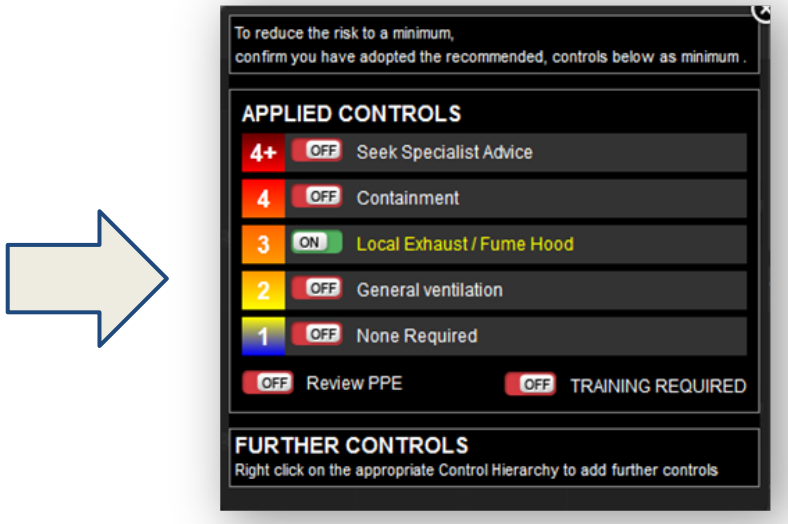
The Control Approach is determined by the chemical group and the “Scenario” selected during previous stages of the process.

Pre-defined table allows the assessor to find the appropriate (Minimum) control approach for any assessment.

Hazard group A				
Small	1	1	1	1
Medium	1	1	1	2
Large	1	1	2	2
Hazard group B				
Small	1	1	1	1
Medium	1	2	2	2
Large	1	2	3	3
Hazard group C				
Small	1	2	1	2
Medium	2	3	3	3
Large	2	4	4	4

Example control banding approach for exposures to chemicals by inhalation

Target Range of Exposure Concentration	Hazard group	Control
>1 to 10 mg/m³ dust >50 to 500 ppm vapor	Skin and eye irritants	Use good industrial hygiene practice and general ventilation.
>0.1 to 1 mg/m³ dust >5 to 50 ppm vapor	Harmful on single exposure	Use local exhaust ventilation.
>0.01 to 0.1 mg/m³ dust >0.5 to 5 ppm vapor	Severely irritating and corrosive	Enclose the process.
<0.01 mg/m³ dust <0.5 ppm vapor	Very toxic on single exposure, reproductive hazard, sensitizer*	Seek expert advice.



Stage 4: Control Approach

Task-specific control guidance sheet(s)

For each control approach there is a general Control Document which sets out the principles of the control approach.

In addition a set of dedicated guidance sheets for common activities or processes are available. These may address:

- Inhalation
- Skin
- Environment
- Safety
- General Maintenance
- Checklists

Task description	Task control sheet
Control Approach 1	
General principles	100
Sack, bottle and drum storage	101
Bulk storage	102
Removing waste from air cleaning unit	103

Addressing Frequency

And why it matters

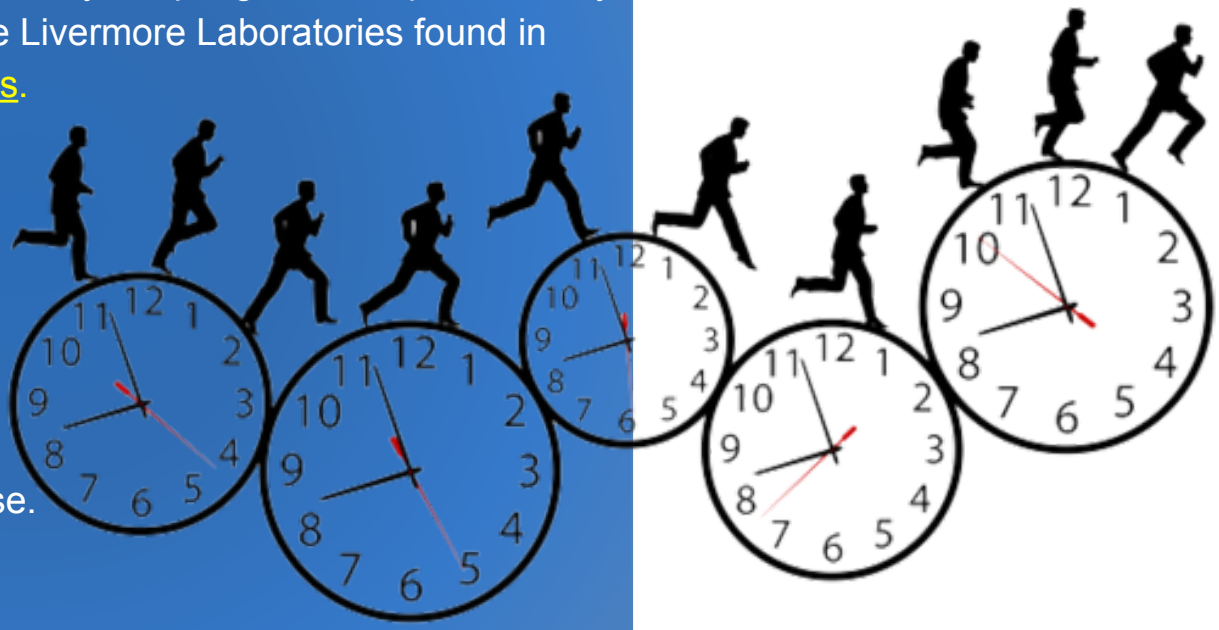
ILO model does not take into account Frequency of Use

The ILO model is based on a 40-hour work-week.

Chemwatch has addressed this issue by adopting a model produced by a team of scientists from Lawrence Livermore Laboratories found in Control Banding for Nano-materials.

Short duration / frequency of use can produce a lower risk rating for some chemicals.

Conversely, hazardous materials with highest severity will not be affected with a low frequency of use.



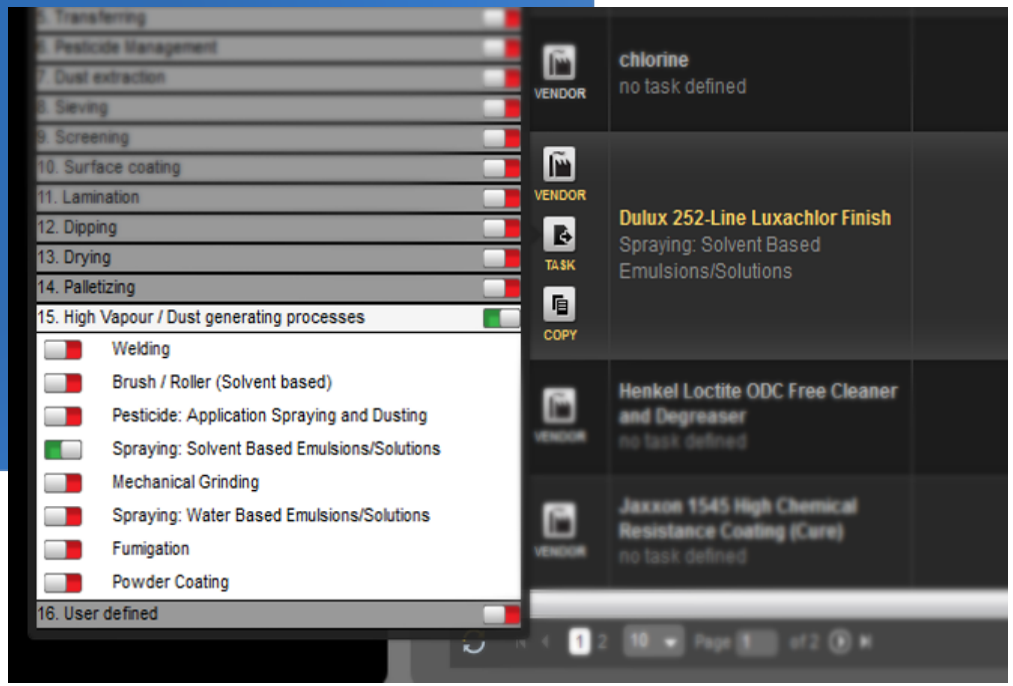
Do Tasks Matter?

It's not a Yes/No answer...

"Task" is in most cases irrelevant to the Risk Assessment outcome and serves a largely administrative purpose. Certain Tasks, however, imply certain Controls are needed.

High vapour or dust generating processes require higher level controls. Chemwatch has recognised this and we suggest pre-selection of appropriate Control Measures, where appropriate.

Spraying or Welding are some examples.



Job is a Series of Tasks

Grouping Risk Assessments together

Chemicals used by an organization can be grouped into “Folders” representing:

- **Locations**
- **Jobs**

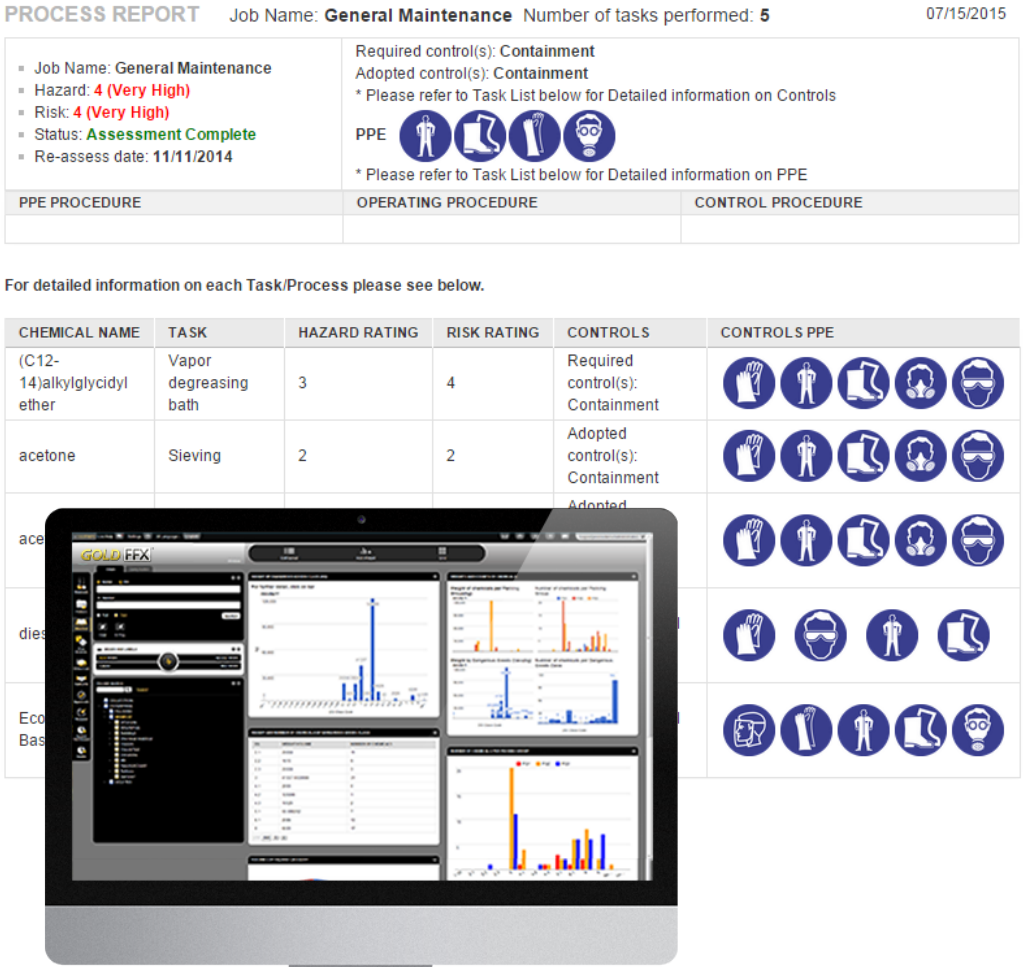
It is important to see the “View of Above”; all Hazards and Risks associated with each Chemical in a single view.

A Job is defined as a series of Tasks

A Job is always defined by Organization

Risks associated with a Job are not necessarily the same as the Risks associated with the Task.

<u>The Task with the worst possible outcome defines the overall “Job” rating.</u>



PROCESS REPORT Job Name: **General Maintenance** Number of tasks performed: **5** 07/15/2015

- Job Name: **General Maintenance**
- Hazard: **4 (Very High)**
- Risk: **4 (Very High)**
- Status: **Assessment Complete**
- Re-assess date: **11/11/2014**

Required control(s): **Containment**
Adopted control(s): **Containment**
* Please refer to Task List below for Detailed information on Controls
PPE
* Please refer to Task List below for Detailed information on PPE

PPE PROCEDURE	OPERATING PROCEDURE	CONTROL PROCEDURE

For detailed information on each Task/Process please see below.

CHEMICAL NAME	TASK	HAZARD RATING	RISK RATING	CONTROLS	CONTROLS PPE
(C12-14)alkylglycidyl ether	Vapor degreasing bath	3	4	Required control(s): Containment	
acetone	Sieving	2	2	Adopted control(s): Containment	
ace				Adopted	
dies					
Eco Bas					

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Control Banding & Dangerous Goods

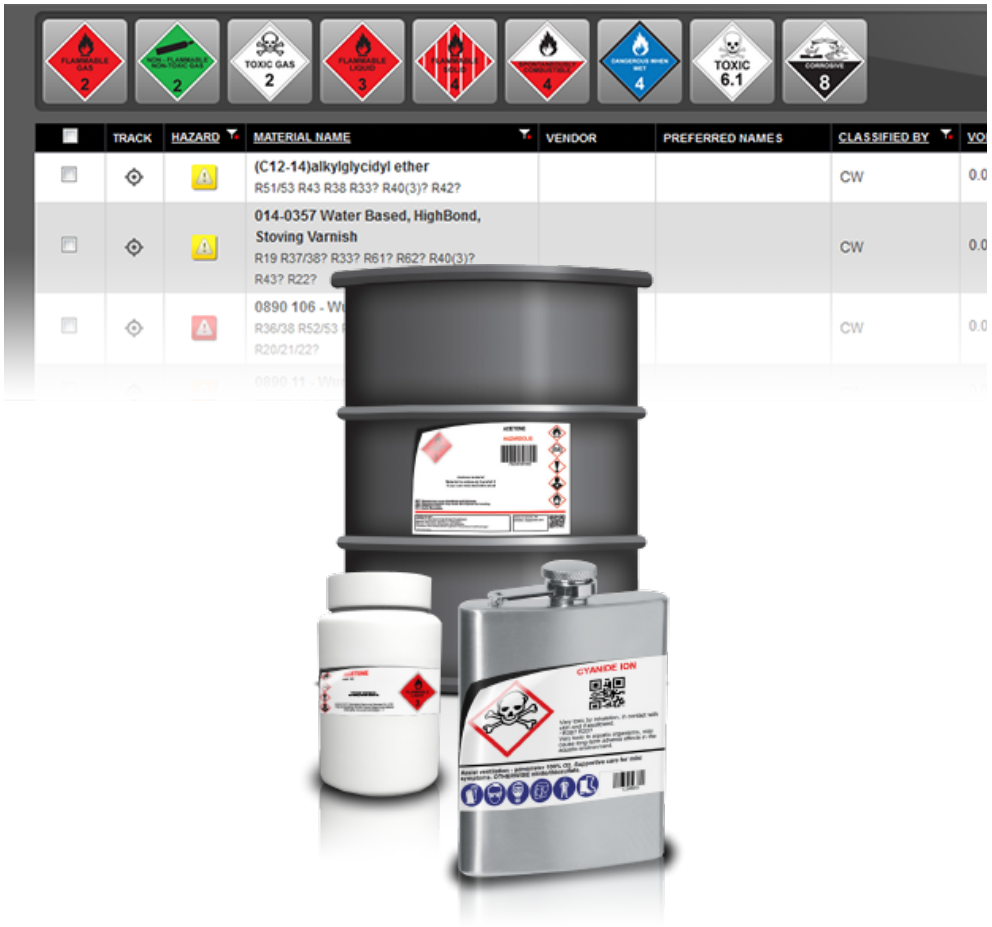
Dangerous Goods Risk Assessment

In addition to **Health Risks** the "Control Banding" approach can also be applied to **Physical Risk Assessment**.

Dangerous Goods (DG) Risk Assessment is based on the the **Physical hazard** ratings that can be calculated based on DG Classification:

- UN DG
- IATA
- IMDG
- DOT
- TDG
- ADG
- etc.

Chemwatch has applied the Control Banding Model to Dangerous Goods.



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Control Banding & Dangerous Goods

Digging Deeper

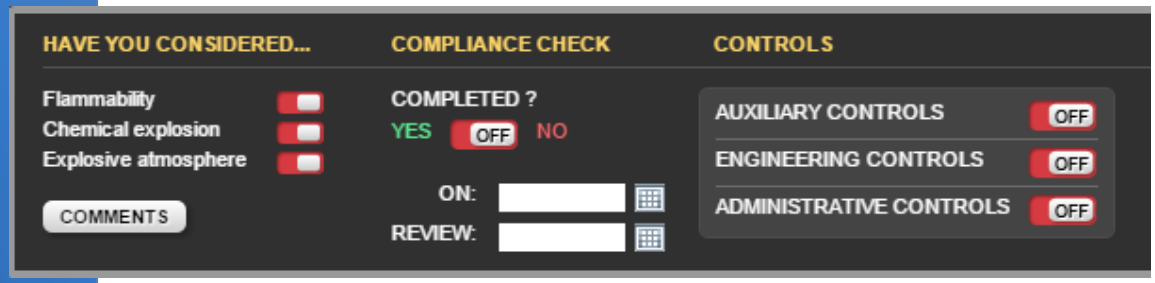
Dangerous Goods properties can also be assigned to each Risk Assessment:

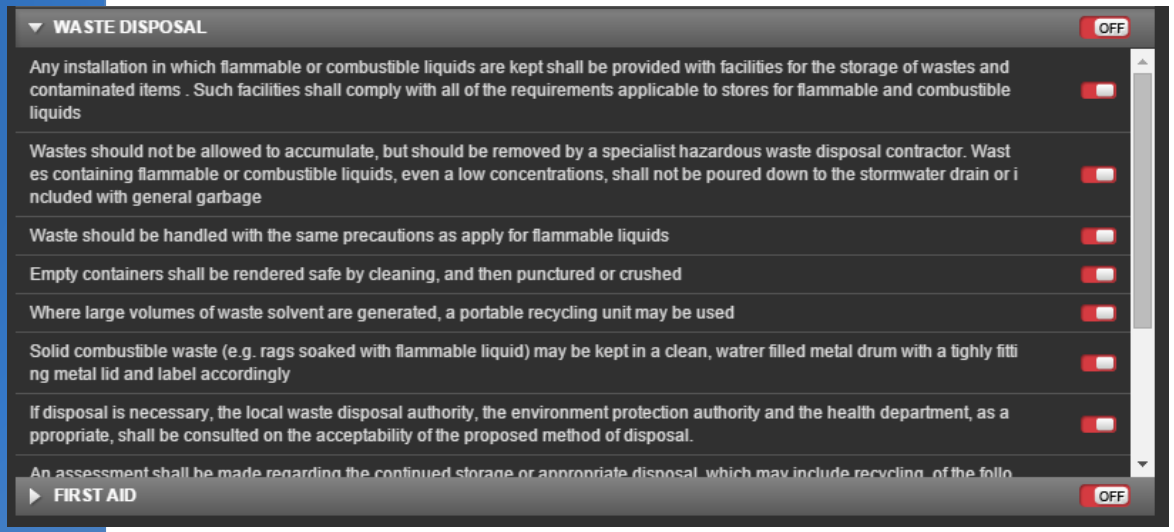
- Flammability
- Chemical Explosion
- Explosive Atmosphere
- Corrosivity
- Chemical Instability
- etc.

Dangerous Goods Classification is geared towards Physical Hazards.

Use of Checklists assists in addressing various types of Controls:

- Engineering Controls
- Administrative Controls
- Auxiliary Controls





Environmental Control Banding

Environmental Risk Assessment

Control Banding methodology can be applied on Environmental Risk Assessment.

GHS Classification takes into account Environmental Hazards, and can be used as the basis of SEVERITY calculation.

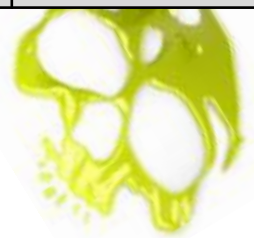
The Control Banding Risk Assessment methodology can be applied on the Risk Calculation.

Release “scale” and “frequency” parameters form the PROBABILITY component.

Risk Band is calculated using a 5x5 Risk Matrix.

Control Approaches target the potential release to “Air”, “Water” or “Land”.

SEVERITY	H - Code	H - Phrase
Very high	H400	Very toxic to aquatic life with acute toxic effects
	H410	Very toxic to aquatic life with long lasting effects
	H401	Toxic to aquatic life with acute toxic effects
High	H411	Toxic to aquatic life with long lasting effects
Medium	H402	Harmful to aquatic life with acute toxic effects
	H412	Harmful to aquatic life with long lasting effects
	H413	May cause long lasting harmful effects to aquatic life



Risk Report as the Communication Tool

Clear, concise, and to the point

Report is designed for the worker in a workplace,
It has to:

- be **clear** (easy to understand)
- be **concise** (1 page)
- outline **everything** of potential impact

Expertise **should not** be required to understand the content of the report.

This may be addressed through the use of:

- Color coding
- Icons / images
- Simplified / short phrases

Chemwatch has gathered this valuable feedback from the workplace over 20 years.

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Risk Assessments in Approvals

Key Criteria

Every organization will have their own view of what forms KEY APPROVAL CRITERIA for a new chemical.

This Criteria may include:

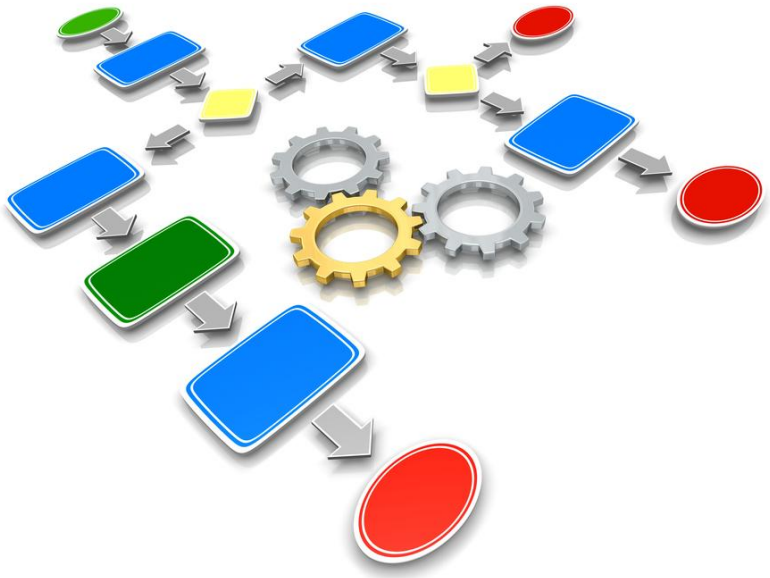
- Regulatory Review
- SDS review
- Environmental Review
- Internal procedural approvals

The above criteria, typically, forms a **strategic** perspective. The Risk Assessment, however, will "**place the chemical in the workplace**" and apply a detailed scenario for evaluation.

Approval workflow often involves multiple stakeholders; several may treat the Risk Assessment as key criteria.

Chemwatch will run a Webinar dedicated to Approvals in September.

@PPROVALS

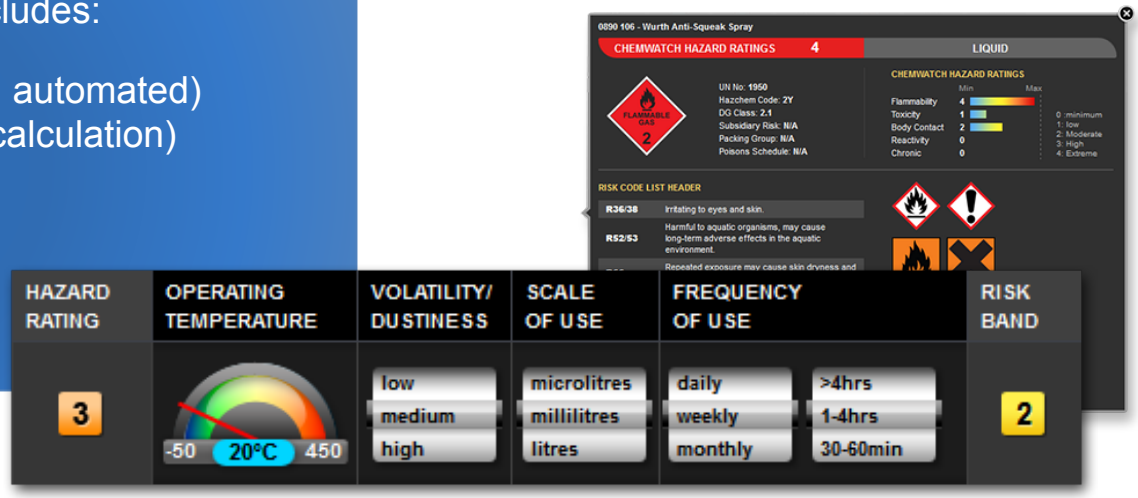


Why Technology Matters

Consistency, Accuracy and Speed!

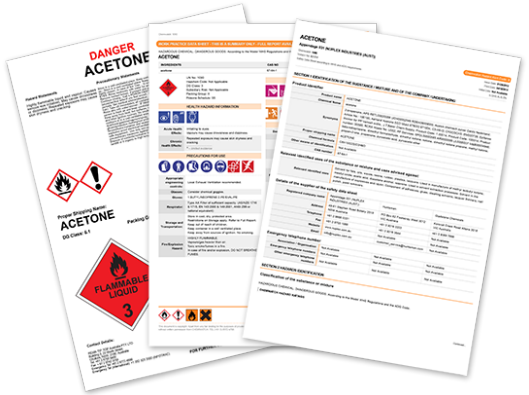
Software solutions simplify the Risk Assessment Process; The input required is minimal, and includes:

- **Hazard classification** (SDS/Label, automated)
- **Volatility or dustiness** (selection/calculation)
- **Scale Of Use**
- **Frequency Of Use**



The Software produces the:

- Control Band / Risk Level
- Control approach(es)
- Advice on controlling Risks
- Written guidance and documentation
- Risk Report



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Natural Progression

Mobile and Cloud Technology as an Advantage

Health and Safety management, as well as other operational activities are increasingly performed using mobile technologies.

Performing Risk Assessments on the factory floor gives users the ability to bring the administrative process i**nto the workplace**.

Immediate benefits are:

- Geo-tagging ability
- Management of tasks
- Risk assessments, live, from the floor
- Integration with other systems
- Access to documents from mobile devices

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www.chemwatch.net

http://www.chemwatch.net/products/cobra-coshhpliant