ExHAC Reference Manual Version 2.0 IEC Standard: IEC 60079-10-1 Ed. 3.0





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Welcome to the ExHAC Users Guide

Thank you for purchasing the ExHAC Application software for performing a classification design in accordance with IEC 60079-10-1 standard for the classification of areas where an explosive gas atmosphere may exist.

The following sections in this User Guide will help guide you through the configuration process for performing a classification design using the ExHAC software. There are multiple parameters that must be configured for a valid assessment. Many of these parameters require the application of engineering judgement to ensure an analysis is performed in a proper way. We highly recommend that you complete the ExHAC Hazardous Area Classification training course prior to using the Software. The course provides you with the necessary insight into how an analysis is performed using the ExHAC software and the IEC standard. The training course also provides several application examples that will further assist you in performing an analysis.

Home Page



The ExHAC Home page is where you start your analysis.

ALL	icome An General	
*	Profile	*
¥r	Project	*
Q _O	FMA	*
+	SOR Info	*
+	Enclosure	*
+	HAC	*

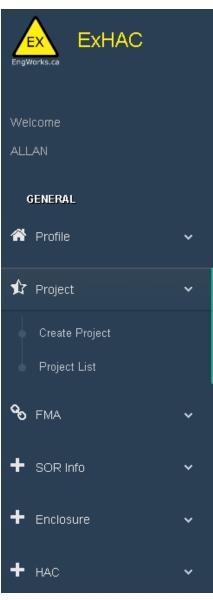
Profile	Permits you to change passwords to the
	application
Project	Allows you to configure project
	information
FMA	Allows you to perform a Flammable
	Mixture Analysis
SOR Info	Allow you to configure a Source of
	Release
Enclosure	Allows you to configure an Enclosure
	surrounding a source of release
HAC	Allows you to select the Project, FMA,
	SOR and Enclosure for analysis

Profile Page

		0	
		≡	
EngWorks.ca			
			Change Password
GENERAL			
希 Profile	~		
Change Password		Email :	abozek@engworks.ca
🏚 Project	~	User Name :	ALLAN
S FMA		Old Password :	
+ SOR Info		Password :	۴
		Confirm Password :	
+ Enclosure			
+ нас			
			Submit

The profile page permits you to change the password assigned to the application based on the email address provided. It is recommended that you change the default password here when you use the application for the first time.

Project



Every HAC analysis must be tied to a project which defines the high-level project parameters. You may store multiple projects in your project database.

Project	Allows you to configure project
	information
Create Project	Create a project for inclusion in the
	Project database
Project List	Select a project from the Project
	Database

Create Project

To create a project entry for inclusion in your project database, enter the project information as indicated. Press **SUBMIT** to store the project in your project database.

	Create Project
User Project Number*:	ExHAC Example 7
Project Name*:	Forced Ventilated Enclosure Application
Altitude(m)*:	100.0
Min Ambient Temperature(°C)*:	0.00
Max Ambient Temperature(°C)*:	40.00
Location*:	Process Building
User Project Description:	Example of a forced ventilated enclosure application
	Submit Cancel

User Project Number	The project number or code is a unique identifier that you
	can use to manage your projects.
Project Name	The project name as you describe it.
Altitude	Enter the project altitude if known. Enter 0 if unknown.
	ExHAC compensates for effects of atmospheric pressure in
	release calculations using this parameter.
Min. Ambient Temperature	Enter the expected minimum ambient temperature of the
	application.
Max. Ambient Temperature	Enter the expected maximum ambient temperature of the
	application.
Location	Enter the project location.
User Project Description	Enter any additional information that helps with
	documenting the assessment.

Project List

Your projects will appear in the Project List database once you create a project. You may edit the project parameters using the **EDIT** Function or delete a project using the **DELETE** function.

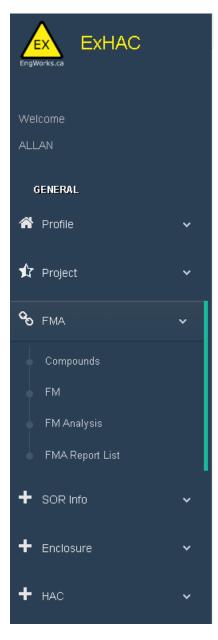
Note that if a HAC analysis is connected to a project, you cannot delete the project until the HAC analysis is deleted.

Project List search function will search all cells in the project database to allow you to find a specific project if you know the specific parameters you are looking for.

ro _.	ject List	arch							
#	User Project Number	Project Name	Altitude(m)	Min Ambient Temperature(°C)	Max Ambient Temperature(°C)	Location	Create DateTime		
1	ExHAC Example 1	Fuel Gas Manifold	1000	-40	40	Refinery	2023-07-17 10:59:59	Edit	Delete
2	ExHAC Example 2	Propane Tank	500	-40	40	Propane Filling Station	2023-08-01 14:56:18	Edit	Delete
3	ExHAC Example 3	Gasoline Pump	500	-20	40	Gasoline storage facility	2023-08-01 15:00:00	Edit	Delete
4	ExHAC Example 4	Benzene Pump	200	-10	32	Petrochemical Plant	2023-08-01 15:13:44	Edit	Delete
5	ExHAC Example 5	Hydrogen Compressor	450	-15	40	Refinery	2023-08-01 15:16:03	Edit	Delete
6	EXHAC Example 6	Crude Dehydration Vessel	10	-15	40	Oil Battery	2023-08-01 15:19:04	Edit	Delete
7	ExHAC Example 7	Forced Ventilated Enclosure Application	100	0	40	Process Building	2023-08-02 12:32:27	Edit	Delete
8	ExHAC Example 8	Naturally Ventilated Process Building	300	-32	40	Process Building in Oil Battery	2023-08-02 12:38:17	Edit	Delete

FMA – Flammable Mixture Analysis

The flammable mixture analysis tab is a powerful tool to help you assess the properties of flammable compounds. It will handle both pure flammable compounds and compound mixtures consisting of more than one flammable compound. To perform a HAC analysis, you will have to configure your flammable compound mixture within the FMA module.



Compounds	Allows you to create a compound in the
	FM compound database or search for a
	preconfigured compound in the ExHAC
	compound database.
FM	Allow the creation of a flammable
	mixture for analysis.
FM Analysis	Permits you to select a configured
	flammable mixture for analysis and
	create a report summarizing the
	analysis.
FMA Report	Allows you to retrieve a Flammable
List	Mixture Analysis report.

Compounds Management

Generic Compounds

ExHAC incorporates a compound database to help you configure your flammable mixture. The database incorporates both flammable materials based on IEC 80079-20-1 and some commonly found non-flammable compounds that may influence the properties of a flammable mixture.

		anageme												
us	stom Comp	ounds					Searc	ch				Create New	Custom C	Compou
No.	Compound Name	MW[kg/kmol]	MESG[mm]	MIC Ratio	LFL[%]	UFL[%]	Flashpoint[°C]] Boiling Point[°C]	AIT[°C]	Cp [kJ / kg K]	Pvap @20 °C [kPa]	Custom Compound Type		
1	Turpentine	136	1		0.8	6	35	154	253	1.72	0.67	Flammable	Edit	Delete
	neric Comp	ounds ^{MW[kg/kmo]}] MESG[m	m] MIC	C Ratio	LFL[%]	UFL[%] Flas	shpoint["C] Boil	Ing Point[°C]	earch	Ср [кЈ / кg К]	Pvap @20 °C [kPa]	Compoun	d Type
] MESG[m	m] MIC	C Ratio	LFL[%]	UFL[%] Flas	hpoint(°C) Boli -195	ing Point[°C]	_	Ср [kJ / kg k] 1.04	Pvap @20 °C [kPa] 3396	Compoun Inert	d Type
ier No. 1	Compound Name	MW[kg/kmol] MESG[m	m] MIG	C Ratio	LFL[%]	UFL[%] Flas		ing Point[°C]	_				d Type

To search for a preconfigured compound, enter the compound name in the Generic Compound search bar and the relevant matches will appear along with their relevant area classification material parameters.

Generic Compounds												
No.	Compound Name	MW[kg/kmol]	MESG[mm]	MIC Ratio	LFL[%]	UFL[%]	Flashpoint[°C]	Boiling Point[°C]	AIT[°C]	Cp [kJ / kg K]	Pvap @20 °C [kPa]	Compound Type
1	N2	28.014						-195.8		1.04	3395	Inert
2	H2O	18.015						99.98		4.18	2.34	Inert
3	CO2	44.01						-78.5		0.85	5729	Inert
4	Methanol	32.042	0.92	0.82	6	36	9	64.7	440	2.5	13	Flammable
5	со	28.01	0.84		10.9	74	-191	-191.5	607	1.04	3494	Flammable
6	H2S	34.081	0.83		4	45.5	-82.4	-60.3	260	1.01	1781	Flammable
7	Diesel No 2	170.335	0.94		0.6	6.5	52	175	254	2.21	0.055	Flammable

Custom Compounds

If a predefined compound does not exist in the generic compound database, or, if the preconfigured compound does not match the compound in your application, you can create a custom compound by pressing the CREATE NEW CUSTOM COMPOUND button.

Compounds Management			
Custom Compounds	Search	Create New	Custom Compound

Enter the new custom compound information into the form and press **Submit**.

	Create New Custom Compound	
Compound Name*	Turpentine	
Custom Compound Type*	Flammable	
Molar Mass (kg/kmol)*	136.000	
Boiling Point["C]"	154.00	
MESG[mm]*	1.00	
MIC Ratio		
LF L[%]*	0.80	
UFL[%]*	6.00	
Pvap @20 ℃ [kPa]*	0.670	
Flashpoint[°C]*	35.00	
Cp [kJ / kg K]*	1.72	
AIT[°C]*	253.00	
Г	Submit Cancel	
	Sushin Carber	

Note that to save the new custom compound you must enter all the information listed except for the MIC ratio. The new custom compound will appear in the custom compound section of the Compounds Management database.

om	pounds N	/lanageme	ent											
Cus	tom Com	pounds					Search	1				Create New C	Custom C	Compou
No.	Compound Name	MW[kg/kmol]	MESG[mm]	MIC Ratio	LFL[%]	UFL[%]	Flashpoint[°C]	Boiling Point[°C]	AIT[°C]	Cp [kJ / kg K]	Pvap @20 °C [kPa]	Custom Compound Type		
	Turpentine	136	4		0.8	6	35	154	253	1.72	0.67	Flammable	Edit	Delete

Flammable Mixtures

Once you have determined that all the compounds needed to configure your flammable mixture, you are required to add your flammable mixture to the flammable mixture database in the ExHAC FM tab. There are two sections to the FM database. **Custom Flammable Mixtures** are mixtures that you create. **Generic Flammable Mixtures** are preconfigured flammable mixtures included with the ExHAC application.

Flam	nmable Mixtures		
	Add	New Flammabl	e Mixtures
Cust	om Flammable Mixtures		
No.	Mixture Name		
1	Methanol	Edit	Delete
2	Pentane	Edit	Delete
з	Natural Gas	Edit	Delete

To create a custom flammable mixture, press the **ADD NEW FLAMMABLE MIXTURES** button. Enter the name of the flammable mixture you wish to analyze.

Flammable Mixture Man	agement	
Flammable Mixture		
Mixture Number:	FM20240006	
Mixture Name:	Heavy Crude Oil	

Next step is configuring the flammable mixture using the compounds listed in the compounds database. Enter the mole% values in the table provided. ExHAC handles all heavy end hydrocarbons as C11+ and it will estimate the vapour pressure of the mixture using C11 as basis. This will provide a conservative value for vapour pressure. If a more accurate estimate of the crude heavy ends is required, you may enter the boiling fractions as a custom compound tab. Be sure that the mole% adds up to 100% before pressing SAVE.

Flar	mmabl	e Mixture											
Mixture Number:			FM20240006	FM20240006									
Mixture	Mixture Name: Heavy Crude Oil												
Ger	Generic Compounds												
No.	Mole %	Compound Name	Compound Type	MW[kg/kmol]	MESG[mm]	MIC Ratio	LFL[%]	UFL[%]	Flashpoint[°C]	Boiling Point[°C]	AIT[°C]	Cp [kJ / kg K]	Pvap @20 °C [kPa]
1	38.00	C11+	Flammable	156.308	1.05		0.6	6.5	62	195.9	206	2.18	0.037
2	15.00	n-Decane	Flammable	142.282	1.05		0.7	5.6	46	174.1	210	2.17	0.128
3	14.00	n-Nonane	Flammable	128.255	0.94		0.7	5.6	30	150.8	205	2.19	0.421
4	12.00	n-Octane	Flammable	114.229	0.94		0.8	6.5	13	125.6	206	2.21	1.39
5	10.00	n-Heptane	Flammable	100.202	0.91	0.88	0.85	6.7	-7	98.4	204	2.22	4.72
6	5.00	n-Hexane	Flammable	86.175	0.93	0.88	1	8.9	-22	68.7	225	2.23	16.2
7	4.00	n-Pentane	Flammable	72.149	0.93	0.97	1.1	8.7	-40	36.1	243	2.29	56.6
8	2.00	n-Butane	Flammable	58.122	0.98	0.94	1.4	9.3	-60	-0.5	372	1.71	208

Upon success, the "FM successfully Created" message will appear, and the flammable mixture will appear in the Custom Flammable Mixtures Database.

lam	imable Mixtures		
	Add	New Flammal	ole Mixtur
Cust	om Flammable Mixtures		
N-	Mixture Name		
1	Heavy Crude Oil	Edit	Delete
1 2		Edit Edit	
1	Heavy Crude Oil		Delete Delete Delete
1 2 3	Heavy Crude Oil Pentane	Edit	Delete Delete
1	Heary Crude Oil Pentane Crude Oil	Edit	Delete

To edit the composition of a custom flammable mixture, press the **Edit** tab for mixture of concern and you can edit the composition of the mixture. You may also delete a custom flammable mixture from the database provided it has not been used in an FM Analysis.

FM Analysis Management

Next step is to perform an analysis of the custom flammable mixture that you have created. To do so, Press the ADD NEW FMA button in the FM analysis tab.

FM A	Analysis Management			_		
	Search			L	Add	New FMA
No.	Mixture Name	Create Date	Edit Date			
1	Propane	2023-11-23 14:42:40	2023-11-23 14:42:40	Edit	Create Report	Delete
2	Benzene	2023-11-27 12:03:10	2023-11-27 12:03:10	Edit	Create Report	Delete
з	Hydrogen	2023-11-28 09:34:16	2023-11-28 09:41:36	Edit	Create Report	Delete
4	Crude Oil	2023-11-28 12:40:21	2023-11-28 12:40:37	Edit	Create Report	Delete
5	Pentane	2023-11-28 15:17:55	2023-11-28 15:17:55	Edit	Create Report	Delete

The CREATE New FM Analysis will appear. Select the new flammable mixture by clicking on the select function corresponding to the mixture you want to analyze. A search function is also available to help locate the mixture to be analyzed.

Create New FM Analysis										
vailable	Flammable Mixt	ures								
		Search Cancel								
	Mixture Name	Mixture Type								
Select	Propane	Custom								
Select	Benzene	Custom								
Select	Hydrogen	Custom								
Select	Crude Oil	Custom								
Select	Pentane	Custom								
Select	Heavy Crude Oil	Custom								
Select	Natural gas	Generic								
Select	Gasoline	Generic								

Once you have selected the flammable mixture, the composition will appear as well as the START ANALYSIS button.

Cre	eate N	ew FM Analys	sis								
Ava	ailable Fla	ammable Mixtures									
	Search Cancel Start Analysis										
		Mixture Name	Mixture Type								
s	Select	Propane	Custom								
s	Select	Benzene	Custom								
s	Select	Hydrogen	Custom								
s	Select	Crude Oil	Custom								
s	Select	Pentane	Custom								
s	Select	Heavy Crude Oil	Custom								
s	Select	Natural gas	Generic								
s	Select	Gasoline	Generic								

eric Compounds											
Compound Name	Mole %	MW[kg/kmol]	MESG[mm]	MIC Ratio	LFL[%]	UFL[%]	Flashpoint[°C]	Boiling Point[°C]	AIT[°C]	Cp [kJ / kg K]	Pvap @20 °C [kPa]
C11+	38.00	156.308	1.05		0.6	6.5	62	195.9	206	2.18	0.037
n-Decane	15.00	142.282	1.05		0.7	5.6	46	174.1	210	2.17	0.128
n-Nonane	14.00	128.255	0.94		0.7	5.6	30	150.8	205	2.19	0.421
n-Octane	12.00	114.229	0.94		0.8	6.5	13	125.6	206	2.21	1.39
n-Heptane	10.00	100.202	0.91	0.88	0.85	6.7	-7	98.4	204	2.22	4.72
n-Hexane	5.00	86.175	0.93	0.88	1	8.9	-22	68.7	225	2.23	16.2
n-Pentane	4.00	72.149	0.93	0.97	1.1	8.7	-40	36.1	243	2.29	56.6
n-Butane	2.00	58.122	0.98	0.94	1.4	9.3	-60	-0.5	372	1.71	208

Press START ANALYSIS and the results will be displayed.

Create New FM A	Analysis							
Available Flammable Mix	xtures		Flammable Mixdure Number	FM20240006				
			Flammable Mixture Name	Heavy Crude Oil				
	Search	Cancel	Flammable Mixture Analysis Number	FA20240006 130.78				
	Start Analysis	s Save Analysis	Molar Mass[kg/kmol]					
			Relative Density Gas/Air	4.516				
Mixture Name		Mixture Type	Polytropic Index Of Expansion-y	1.03				
Select Propane		Custom	Flash Point(°C)	27.6				
Select Benzene		Custom	AIT Calculation Method	Mole Percentage Based	Override AIT Minimum 🗸			
Select Hydrogen		Custom	Auto Ignition Temperature[*C]	204	Ocerride			
Select Crude Oil		Custom	Boiling Point[*C]	151.4				
Select Pentane		Custom	Vapor Pressure @20*C[kPa]	7.965				
Select Heavy Crude Di	II	Custom	LFL[vol %]	0.71%				
Select Natural gas		Generic	UFL[vol %]	6.41%				
Select Gasoline		Generio	LFL[kp/m3]	0.038				
			UFL[kg/m3]	0.349				
			Group	IIA	Override Select 🗸			
			Temperature Code	ТЗ	L			

Within the results, you have the option to select the AIT calculation method and/or override the Auto Ignition temperature and the group classification based on your own engineering judgement. To change the AIT Calculation method, choose a selection from the drop-down menu. To manually override the Auto Ignition Temperature, select "User Defined" from the drop-down menu and enter the value you desire.

Create N	lew FM Analysis								
Available F	lammable Mixtures		Flammable Mixbure Number	FM20240006					
			Flammable Mixture Name	Heavy Crude Oil FA20240006 130.78					
	Search	Cancel	Flammable Mixture Analysis Number						
	Start Analys	is Save Analysis	Molar Mass[rg/kmol]						
			Relative Density Gas/Air	4.516					
	Mixture Name	Mixture Type	Polytropic Index Of Expansion-#	1.03					
Select	Propane	Custom	Flash Point("C)	27.6					
Select	Benzene	Custom	AIT Calculation Method	Mole Percentage Based	Override	Mole Weight Average	~		
Select	Hydrogen	Custom	Auto Ignition Temperature[*C]	204	Override				
Select	Crude Dil	Custom	Boiling Point(*C)	151.4					
Select	Pentane	Custom	Vapor Pressure @20*C[kPa]	7.965					
Select	Heavy Crude Oil	Custom	LFL(vol %)	0.71%					
Select	Natural gas	Generio	UFL[vol %]	6.41%					
Select	Gasoline	Generio	LFL[kg/m3]	0.038					
			UFL[kg/m3]	0.349					
			Ōroup	IIA	Override	Select	~		
			Temperature Code	ТЗ					

Be sure to enter "Start Analysis" to update your analysis and enter "Save Analysis" to save any changes to your analysis. This will store your results for later use in an HAC analysis.

FMA Report List

To view the results of your FM Analysis in an IEC format, you must create a report in the FM Analysis menu. Click on **CREATE REPORT** to view your analysis.

FM A	Analysis Management					
	Search				Add I	New FMA
No.	Mixture Name	Create Date	Edit Date			
1	Propane	2023-11-23 14:42:40	2023-11-23 14:42:40	Edit	Create Report	Delete
2	Benzene	2023-11-27 12:03:10	2023-11-27 12:03:10	Edit	Create Report	Delete
3	Hydrogen	2023-11-28 09:34:16	2023-11-28 09:41:36	Edit	Create Report	Delete
4	Crude Oil	2023-11-28 12:40:21	2023-11-28 12:40:37	Edit	Create Report	Delete
5	Pentane	2023-11-28 15:17:55	2023-11-28 15:17:55	Edit	Create Report	Delete
6	Heavy Crude Oil	2024-02-19 10:14:48	2024-02-19 10:21:54	Edit	Create Report	Delete

If the report is satisfactory, Click on **SAVE REPORT** and the results will be saved in your Saved Report database for later retrieval if needed. To download a report in in an Excel or PDF format, Click on the desired option as shown.

Flamma	ble Mixture Composition													
Doc #	FD20230004-240201													
FM Name	Crude OI													
	Compound Name	Mole %	Molar mass (kg/kmol)	MESG (mm)	MIC ratio	LFL (vol %)	UFL (vol %)	Pvap @ 20°C (kPa)	Flash point (°C)	Boiling point (°C)	Cp (kJ/kg K)	AIT (°C		
	Ethane	0.03	30.07	0.91	0.82	2.40	15.50	3766.00	-135.00	-88.60	1.74	515.00		
	Propane	0.43	44.10	0.92	0.82	1.70	10.90	837.00	-104.00	-42.10	1.67	445.00		
	n-Butane	3.78	58.12	0.98	0.94	1.40	9.30	208.00	-60.00	-0.50	1.71	372.00		
	n-Pentane	17.03	72.15	0.93	0.97	1.10	8.70	56.60	-40.00	36.10	2.29	243.00		
	n-Hexane	11.84	86.18	0.93	0.88	1.00	8.90	16.20	-22.00	68.70	2.23	225.00		
	n-Heptane	13.29	100.20	0.91	0.88	0.85	6.70	4.72	-7.00	98.40	2.22	204.00		
	n-Octane	13.75	114.23	0.94		0.80	6.50	1.39	13.00	125.60	2.21	206.00		
	n-Nonane	8.05	128.26	0.94		0.70	5.60	0.42	30.00	150.80	2.19	205.00		
	n-Decane	6.13	142.28	1.05		0.70	5.60	0.13	46.00	174.10	2.17	210.00		
	C11+	25.67	166.31	1.05		0.60	6.60	0.04	62.00	195.90	2.18	206.00		

Dot	c#	F02023000-240201												
FM	Name	Crude Oil												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Flammable substance					Volatility •		LFL/ UFL		Ex Chracteristics			
	Name	Composition	Molar mass (kg/kmol)	Relative density gas/ air	Polytropic index of Adiabatic Expansion (y)	Flash point (°C)	lgnition temp. Þ (°C)	Boiling point (°C)	Vapour pressure at 20 ℃ (kPa)	vol (%)	(kg/m3)	Equipment group. ^b	Temp. class	Any other relevant information or remain
1	Crude	0.03%Ethane.0.43%Propane.3.78%n- Butane.17.03%n-Pentane.11.84%n- Hexane.13.29%n-Heptane.13.75%n-	113.39	3.91	1.035	4.60	204.00	118.20	20.745	0.79	0.037	All	73	
	Oil	Octane 8.05%n-Nonane 5.13%n- Decane 25.67%C11+	113.35	0.01	1000	4.00	204.00	110.20	20.745	6.98	0.329	11A 13	13	
a	Normally	r the value of vapour pressure is given, but i	n the absence of t	hat hailing point ca	n ha ward:									

FMA Report List

The FMA Report List provides an overview of your saved FM Analysis. To view a stored report, click on **VIEW REPORT** and your saved report will be displayed. You can then download a report in an Excel or PDF format as before.

FM A	Analysis Report List				
	Search				
No.	Mixture Name	Report Created By	Create DateTime		
1	Pentane	ALLAN	2023-09-04 12:22:17	View Report	Delete
2	Methanol	ALLAN	2023-09-04 12:22:57	View Report	Delete
з	Crude Oil	ALLAN	2023-09-04 12:23:15	View Report	Delete
4	Propane	ALLAN	2023-09-04 12:24:43	View Report	Delete
5	Benzene	ALLAN	2023-09-04 12:26:17	View Report	Delete
6	Hydrogen	ALLAN	2023-09-04 12:28:01	View Report	Delete
7	Crude Condensate	ALLAN	2023-09-04 12:29:17	View Report	Delete
8	Heavy Crude Oil	ALLAN	2024-02-19 10:43:06	View Report	Delete

Should you desire to delete an FM Analysis from your database, click on DELETE and the FM Analysis will be removed.

SOR Info

The SOR Info tab in the ExHAC main menu is where you configure a Source of Release.

Welcome	
ALLAN	
GENERAL	
希 Profile	~
🏠 Project	~
S FMA	~
♣ SOR Info	~
Create SOR	
SOR List	
➡ Enclosure	*
🕈 нас	~

Create SOR	Allows you to create a Source of Release in the SOR List Database
SOR List	Displays a list of all SOR's you have created

Create SOR

To create an SOR for analysis, enter the data as presented on the screen. Drop down menus are provided when selecting the SOR Type and the Grade of Release. The SOR type will change the diagram displayed to indicate the release behavior. Note that all fields must be entered to Submit an SOR.

For a Gas or Vapour Release, the stream temperature and pressure will factor into the release scenario. The Grade of Release will influence the Zone classification. The ambient temperature will influence the gas density in a gas or vapour release and the evaporation rate of a liquified gas or pool release.

Enter **Submit** when you have entered the required information. A "SOR Successfully Created" message will appear.

	Create SOR
SOR Name*:	Propane Release
SOR Type*:	Liquefied Gas Release 🗸
	SR SOR successfully Created
Stream Temperature(°C)*:	20.00
Stream Pressure(KPag)*:	1200.000
Grade Of Release*:	Secondary
Ambient Temperature(°C)*:	20.00
	Submit Cancel

The SOR will then appear in the SOR List.

SOR List

The SOR list displays all SORs successfully configured. A search function can be used to locate an SOR in the list.

You may edit an SOR by clicking on the edit button. You may also delete an SOR provided it has not been used in an HAC Analysis.

	Search						
#	SOR Name	Туре	Grade Of Release	Ambient Temperature(°C)	Create DateTime		
1	Condensate Release	Liquid Pool Release	Secondary	20	2023-05-29 15:11:19	Edit	Delete
2	Natural Gas Manifold Release	Gas or Vapor Release	Secondary	20	2023-07-17 12:32:27	Edit	Delete
3	Pentane Pool Release	Liquid Pool Release	Secondary	20	2023-07-17 15:36:12	Edit	Delete
4	Propane Release	Liquefied Gas Release	Secondary	20	2023-08-03 11:37:30	Edit	Delete

Enclosure

The Enclosure tab in the ExHAC main menu is where you configure an Enclosure surrounding a Source of Release. It is not necessary to configure an enclosure for an HAC analysis. If no enclosure is configured, ExHAC assumes that it is an open-air, "Non-Enclosed" application.

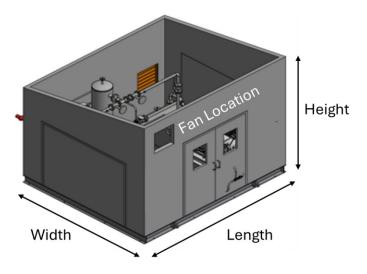
Welcome	
ALLAN	
GENERAL	
希 Profile	~
🏠 Project	~
S FMA	~
✤ SOR Info	~
+ Enclosure	~
Create Enclosure	
Enclosure List	
🕈 НАС	~

Create	Allows you to create an enclosure
Enclosure	surrounding a Source of Release.
Enclosure List	Displays a list of all Enclosures you
	have created

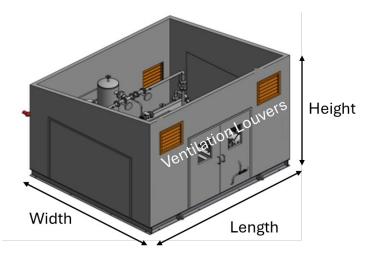
Create Enclosure

To configure an enclosure, enter the information required to complete the form. When configuring the length and width dimensions for the enclosure, pay attention to the direction of the airflow anticipated through the enclosure. The location of the forced ventilated fans or natural ventilation louvers define the "length" side of the building.

For example, a forced ventilation enclosure with an extraction fan will define the "Length-Upwind" dimension.



In a naturally ventilated enclosure application, the "Length-Upwind" dimension will be defined by the location of the ventilation louvers.



If an enclosure is defined as "Naturally Ventilated", you will be prompted to enter an interior and exterior temperature. This will be used to define the "Stack Effect" ventilation velocity in the HACK analysis. The values selected should be a worst-case ambient temperature scenario expected where the inside

ambient temperature is a few degrees higher than the exterior ambient temperature. Refer to clause 7.2.2 of IEC 60079-10-1 standard for a discussion on this.

	Create Enclosure
Enclosure Name*:	Naturally Ventilated Enclosure
Length-Upwind(m) *:	11.500
Width(m) *:	5.000
Height(m) ^:	4.000
Volume(m3) *:	230.00
Naturally Ventilated*:	Yes 🗸
Exterior Ambient Temperature(°C)*:	28.00
Interior Ambient Temperature(°C)*:	31.00
Description:	Naturally Ventilated Process Building handling heavy crude
H	Submit Cancel

Press SUBMIT when you have entered all the required data.

Enclosure List

Once you have configured your enclosure, it will appear on the Enclosure list. You can edit or delete an enclosure from the list. Note that you cannot delete an enclosure if it has been used in a HAC analysis.

nclo	osure Lis [.] s	earch									
No.	Enclosure #	Enclosure Name	Length-Upwind(m)	Width(m)	Height(m)	Volume(m3)	Exterior Temp.(°C)	Interior Temp.(°C)	Naturally Ventilated		
1	E20230001	Pentane Pump Building	5	8	4	160	0	0	No	Edit	Delete
2	E20230002	Heat Exchanger Building	11.5	5	4	230	28	31	Yes	Edit	Delete
3	E20240003	Naturally Ventilated Enclosure	11.5	5	4	230	28	31	Yes	Edit	Delete

HAC

The HAC tab in the ExHAC main menu is where you configure a HAC analysis using the Project, FMA, SOR and Enclosure information you have entered.

EngWorks.ca ExHAC	
Welcome ALLAN	
GENERAL	
🆀 Profile	*
🏚 Project	*
S FMA	*
+ SOR Info	*
+ Enclosure	*
+ нас	~
Create HAC HAC Analysis List HAC Report List	

Create HAC	Allows you to create an HAC analysis
	using the data created in the FMA,
	SOR and Enclosure tabs
HAC Analysis	Displays a list of all HAC analysis you
List	have configured and saved. Allows
	you to edit and create a report
	output for a configured HAC analysis
HAC Report	Allows you to display and print out
LIst	the results of a HAC report

Create HAC

To create a HAC, you must first configure your analysis by selecting the Project, FMA, SOR and enclosure to use in your analysis. You can do this my clinking on the blue tabs adjacent the Site number, FMA number, SR number and the Enclosure number. Select the items you want to use in your analysis.

If your application does not incorporate an enclosure, there is no need to configure an enclosure. ExHAC will assume the release source is non-enclosed.

HAC Number*:	HC2024000015
Site Number*:	P20230001
Jser Project Number:	Example 1
roject Name:	Fuel Gas Manifold Application
¥titude (m):	1000
FMA Number*:	GA20210001
FM Name:	Natural gas
Relative Density Gas/Air:	0.579
SR Number*:	S20230001
SR Name:	Natural Gas Manifold Release
SR Type:	Gas or Vapor Release
Stream Temperature (°C):	50
Stream Pressure (kPag):	8000
Grade Of Release:	Secondary
Enclosure Number:	Non-Enclosed
Enclosure Name:	
Naturally Ventilated:	
Enclosure Length (up wind) (m); LB:	
Enclosure Width (m); WB:	
Enclosure Height (m3); HB:	
Enclosure Volume (m3); VB:	

Once you have configured your HAC, enter "Configure analysis".

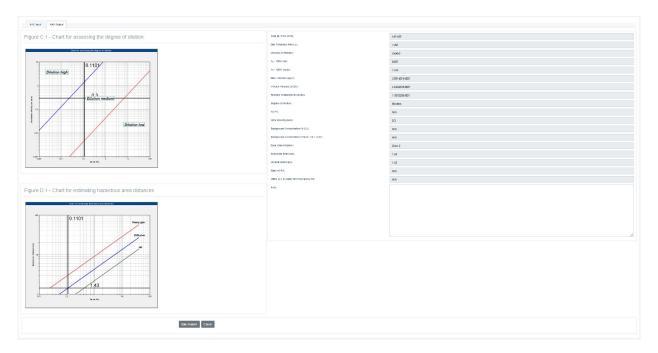
C Number	HC2024000015	Type of Release:	Diffusive	Override	
Number*:	P20230001	Wind Speed (m/s); Uw:	0.3	Override	
er Project Number:	Example 1	Pool Surface Area (m2):	N/A.	Override	
ect Name:	Fuel Gas Manifold Application	Wind Speed at Pool Surface (m/s):	N/A.	Override	
ude (m):	1000	Coefficient of Discharge:	0.75	Override	
Number*:	GA20210001	Hole Cross Section (mm2):	0.25	Override	
kame:	Natural gas	Saturated \dpour:	False	Overtide	
tive Densty Gas/Ar:	0.579	Stream Compressibility:	0.888	Overtide	
Vumber*:	S20230001	Stream Polytropic Factor; Fn:	0.75	Override	
ame:	Natural Gas Manifold Release	Availability of Ventilation:	Good		
ype:	Gas or Vapor Release	Ventilation Inefficiency; f:	N/A.	Override	
am Temperature (*C):	Gais or Vapor Release	Pressure Coefficient Characteristic; &Cp:	N/A.	Override	
am Pressure (kPag):	8000	Vent Discharge Characteristic; Cd:	N/A.	Override	
e Of Release:		Effective area of upuind opening (m2); A1:	N/A		
sure Number:	Secondary	Effective area of dounnind opening (m2); A2:	N/A		
	Non-Enclosed	Effective area of upper opening (m2); /42:	N/A		
osure Name:		Effective area of lower opening (m2); A1:	N/A		
rally Ventilated:		Vertical Distance of Bouyancy (m); Hb:	N/A.	Override	
orure Length (up uind) (m); LB:		Factor of combination effect; fo:	N/A	Override	
osure Width (m); WB:		Emergency Evacuation (m3/h):	N/A	ofm	
osure Height (m3); HB:		Forved Ventilation (m3/h):	N/A	ofm	
osure Volume (m3); VB:					

Once the configure analysis is complete, a series of parameters will appear on the right-hand side of the screen. ExHAC will provide a set of default parameters as a starting point for your analysis. You can enter your own parameters by entering new values in the override cells provided. Note that cells with a N/A value indicate the parameters are not required for the configured analysis.

For a HAC analysis involving an enclosure, you will be prompted to enter a ventilation rate for a forced ventilated design or define the size of louvers and other relevant parameters for a naturally ventilated design. Your analysis cannot proceed until the relevant parameters are defined.

SR Number*:	S20230007	Stream Polytropic Factor; Fn:	N/A	Override	
SR Name:	Pentane Pump Release	Availability of Ventilation:	Good		v
SR Type:	Liquid Pool Release	Ventilation Inefficiency; f.	2	Override	2
Stream Temperature (°C):	40	Pressure Coefficient Characteristic; ∆Cp:	N/A	Override	
		Vent Discharge Characteristic; Cd:	N/A	Override	
Stream Pressure (kPag):	450	Effective area of upwind opening (m2);	N/A		
Grade Of Release:	Secondary	A1:			
Enclosure Number:	E20230001	Effective area of downwind opening (m2); A2:	N/A		
Enclosure Name:	Pentane Pump Building	Effective area of upper opening (m2);	N/A		
Naturally Ventilated:	No	A2:			
Enclosure Length (up wind) (m); LB:	5	Effective area of lower opening (m2); A1:	N/A		
Enclosure Width (m); WB:	8	Vertical Distance of Bouyancy (m); Hb:	N/A	Override	
Enclosure Height (m3); HB:	4	Factor of combination effect; fc:	N/A	Override	
Enclosure Volume (m3); VB:	160	Emergency Evacuation (m3/h):		cfm	
		Forced Ventilation (m3/h):	1200	cfm	706.293
	Start Analysis Cancel				

To display the results of an analysis, click on the HAC Output tab.

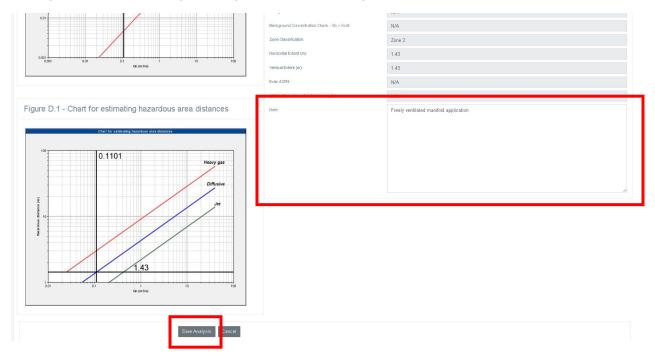


The HAC output tab will display your results in a tabular and graphical format. Figure C.1 will display the degree of dilution and Figure D.1 will display the classification extents based on the release characteristic calculated for the assessment.

To modify the input parameters for your analysis, click on the HAC Input tab to go back to the original input parameter configuration. You can then modify parameters as you see fit optimize your results.

You have the option to enter additional information related to your analysis in the "Notes" section of the output tab.

Once you are satisfied with your analysis, enter "Save Analysis" to save the results.



HAC Analysis List

Your HAC analysis will then appear in the HAC Analysis list. You can edit or create a report summarizing your results by pressing on the "HAC Analysis List" tab entering the "Edit" or "Create Report" function for your analysis.

			Search							Add	New HA
ENERAL										_	
Project		No.	Project Name	Mixture Name	SOR Name	Enclosure Name	Create Date	Edit Date			
		1	Fuel Gas Manifold Application	Natural gas	Natural Gas Manifold Release	Non-Enclosed	2024-02-08 10:03:42	2024-02-08 11:39:12	Edit	Create Report	Delete
		2	Propane Tank Application	Propane	Propane Tank Valve Release	Non-Enclosed	2024-02-09 13:07:26	2024-02-14 13:25:27	Edit	Create Report	Delete
		3	Gasoline Pump Application	Gasoline	Gasoline Pump Release	Non-Enclosed	2024-02-12 08:36:17	2024-02-13 12:40:30	Edit	Create Report	Delete
		4	Benzene Pump Application	Benzene	Benzene Pump Application	Non-Enclosed	2024-02-13 12:15:38	2024-02-13 13:17:16	Edit	Create Report	Delete
Create HAC HAC Analysis List		5	Hydrogen Compressor Application	Hydrogen	Compressor Seal Release	Non-Enclosed	2024-02-13 13:54:45	2024-02-13 14:15:48	Edit	Create Report	Delete
HAC Report List		6	Crude Vessel Application	Crude Oil	Process Vessel Pool Release	Non-Enclosed	2024-02-14 09:57:05	2024-02-14 10:31:44	Edit	Create Report	Delete
		7	Forced Ventilated Enclosure Application	Pentane	Pentane Pump Release	Pentane Pump Building	2024-02-16 12:53:38	2024-02-16 14:34:11	Edit	Create Report	Delete
		8	Naturally Ventilated Process Building	Crude Oil	Crude Pump Release	Heat Exchanger Building	2024-02-17 09:05:49	2024-02-17 11:14:58	Edit	Create Report	Delete
		9	Fuel Gas Manifold Application	Natural gas	Natural Gas Manifold Release	Non-Enclosed	2024-02-19 12:24:06	2024-02-19 12:48:15	Edit	Create Report	elete

Clicking on the "Create Report" function will display a complete report of your analysis on the screen. All input parameters and output results will be summarized in a tabular and IEC format.

laz	zardous area classificatio	n — Information	Hazardous a	rea classification - Deta	ail
	Doc #	HD2024000015-240201	Doc #	HD2024000015-240201	
1	Site #	P20230001	Project	Example 1	Refinery classification update
	Project #	Example 1		P20230001	Refinery
	Project Name	Fuel Gas Manifold Application	FM Analysis	GA20210001	Natural gas
	Description	Refinery classification update	Source of release	S20230001	Natural Gas Manifold Release
	Location	Refinery	Enclosure	Non-Enclosed	
	Altitude (m)	1000.00			Input/Override
	Minimum Ambient Temp. (°C)	-20.00		Wind Speed at Pool Surface (m/s)	N/A
	Maximum Ambient Temp. (°C)	40.00		Pvap @ Tstrm (kPa)	4474.68
2	FM analysis	GA20210001		Description- Pool surface area (m2)	N/A
	FM Name	Natural gas		Coefficient of Discharge	0.75
3	Source of release	S20230001		Description- Hole cross section (mm2)	N/A
	Name	Natural Gas Manifold Release		Velocity of Release	choked
	Туре	Gas or Vapor Release	Source of Release	Stream Compressibility, Z	0.89
	Ambient Temperature (°C)	20.00		Stream Polytropic Factor; Fn	0.75

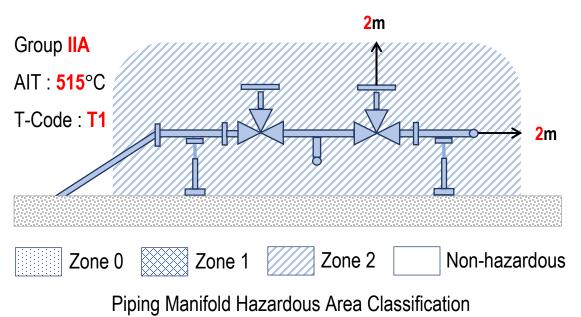
HAC Report List

You have the option to export the report as an Excel or pdf file. To save the report as a permanent record, enter "Save Report".

The saved report will appear in the HAC report list accessed from the "HAC Report List" tab. You can view and export a report in an Excel or PDF format.

ExHAC		≡ Н/	AC Report List									
Welcome			Sea	arch								
GENERAL		#	Report Doc #	Project Code	Project Name	Mixture Name	SOR Name	Enclosure Name	Created By	Created Date		
🏘 Profile	~	1	HD2024000001-240201	Example 1	Fuel Gas Manifold Application	Natural gas	Natural Gas Manifold Release	Non-Enclosed	ALLAN	2024-02-14 13:16:54	View Report	Delete
✿ Project	~	2	HD2024000006-240201	Example 2	Propane Tank Application	Propane	Propane Tank Valve Release	Non-Enclosed	ALLAN	2024-02-14 13:43:21	View Report	Delete
°⊗ FMA	~	3	HD2024000007-240201	Example 3	Gasoline Pump Application	Gasoline	Gasoline Pump Release	Non-Enclosed	ALLAN	2024-02-17 14:35:04	View Report	Delete
+ SOR Info	*	4	HD2024000008-240201	Example 4	Benzene Pump Application	Benzene	Benzene Pump Application	Non-Enclosed	ALLAN	2024-02-17 14:35:13	View Report	Delete
+ Enclosure + HAC	~ ~	5	HD2024000009-240201	Example 5	Hydrogen Compressor Application	Hydrogen	Compressor Seal Release	Non-Enclosed	ALLAN	2024-02-17 14:35:25	View Report	Delete
		6	HD2024000010-240201	Example 6	Crude Vessel Application	Crude Oil	Process Vessel Pool Release	Non-Enclosed	ALLAN	2024-02-17 14:35:37	View Report	Delete
HAC Report List		7	HD2024000011-240201	Example 7	Forced Ventilated Enclosure Application	Pentane	Pentane Pump Release	Pentane Pump Building	ALLAN	2024-02-17 14:35:53	View Report	Delete
		8	HD2024000013-240201	Example 8	Naturally Ventilated Process Building	Crude Oil	Crude Pump Release	Heat Exchanger Building	ALLAN	2024-02-17 14:38:07	View Report	Delete

Your analysis is now complete and fully documented! You can use the results to create a plot plan or cross-sectional diagram of your application indicating the degree and extent of your classification design.



For additional guidance on how to perform an hazardous area classification design assessment for a variety of applications, please see our application examples we have included in the ExHAC training course.