Summary of the Results of the MCAS/MCLS Consequences:

	Scenario:	Causes:	Failure Frequency PerYear:	N0. Case:	Fatality X-Cord (m)	Fatality Y-Cord (Half width) (m)	Injury X-Cord (m)	Injury Y-Cord (Half width) (m)	Cumulative FAR Fatality Per 10^8 hours of Exposure	% FAR Contribution to Total	Probable Absolute Fatality Number for 45 / Hectare Population density	SIL/LOP
Reference No.:	**Ethyl mercaptan**			**Scenario:**	**Dispersion**							
*	6. Drums on site over heating by external source-Puff D	Drums integrity failure	5.144E-07	1	396.35	28.90	2478.47	146.2	0.0000508	1.546037	0.63987	1
*	1. Drums on site Pool 1 min rapid evaporation under D	Drums integrity failure	5.144E-07	1	113.66	7.41	435.21	25.39	0.0001225	3.727680	0.11344	2
*	4. Drums on site Hole in vessel liquid spill spread pool evaporation D	Weld failure	6.710E-07	1	23.24	2.06	295.45	18.01	0.0000189	0.573986	0.00076	2
Reference No.:	**Ethyl mercaptan**			**Scenario:**	**Fire**							
*	2. Drums on site unloading manifold failure liquid spill free spread pool Fire	Drums integrity failure	5.144E-07	3	69.67	69.67	120.67	120.67	0.0016076	48.908972	2.85928	2
*	4. Drums on site over heating by external source-Fire Ball	Drums integrity failure	5.144E-07	2	34.25	34.25	61.75	61.75	0.0009891	30.092032	0.63774	2
*	1. Drums on site or drum catastrophic failure liquid spill free spread pool Fire	Drums integrity failure	5.144E-07	1	10.01	10.01	18.01	18.01	0.0004966	15.108280	0.05470	NA
Reference No.:	**LNG**			**Scenario:**	**Fire**							
*	1. CLG Liquid Main Pipe rupture Cryogenic Liquid Pool Fire	Guillotine rupture of pipe	4.708E-10	1	1035.47	1035.47	1793.97	1793.97	0.0000005	0.014913	631.23601	1

Summary of the Results of the MCAS/MCLS Consequences:

	Scenario:	Causes:	Failure Frequency PerYear:	N0. Case:	Fatality X-Cord (m)	Fatality Y-Cord (Half width) (m)	Injury X-Cord (m)	Injury Y-Cord (Half width) (m)	Cumulative FAR Fatality Per 10^8 hours of Exposure	% FAR Contribution to Total	Probable Absolute Fatality Number for 45 / Hectare Population density	SIL/LOP
*	4. CLG Main Liquid Pipe Rupture flash puff Immediate Edge Ignition leading to Fire Ball	Guillotine rupture of pipe	4.708E-10	1	78.76	78.76	137.26	137.26	0.0000005	0.014738	3.60917	NA
*	4. CLG Gas Pipe Rupture Flash fire	Guillotine rupture of pipe	4.708E-10	1	29.51	29.51	54.01	54.01	0.0000004	0.013363	0.45941	NA
		TOTAL	**2.523E-66**	**12**					**0.00328689**	**100.000**	**639.610**	

Note: The above Probable Absolute Fatality Numbers (PAFN) are computed by total distances of all concentrations in dispersion, all IHR-values in Fire and all PSI values in Explosion and some Probable Absolute fatality Values appear although in actual there may not be any fatality at all. The actual fatality and Injuries are computed using only the fatality and Injury zones in Dispersion, Fire and explosion. Hence a small difference in fatality Numbers though both methods are standard methods of computation. FAR is for 40 Years of work life Exposure in an industry. The chance of all the scenarios occurring simultaneously giving an FAR of 0.003287 has chance = product of all chances of scenarios which comes to 2.523E-66. Note there can be only one MCLS/MCAS at any time.

Summary of the Results of the MCAS/MCLS Consequences distances

Reference No.: **Ethyl mercaptan** **Scenario:** **Dispersion**

	UEL:	LEL:	TEEL3/IDLH:	TEEL2:	TEEL1:	TEEL0:
* 6. Drums on site over heating by external source-Puff D	100000	28000	500	10	10	5
Distances in meter---------->	52.26	84.81	396.35	1872.61	1872.61	2478.47
* 4. Drums on site Hole in vessel liquid spill spread pool evaporation D	45000	28000	500	10	7	5
Distances in meter---------->	2.58	3.32	23.24	198.03	243.38	295.45
* 1. Drums on site Pool 1 min rapid evaporation under D	120	100	50	10	10	5
Distances in meter---------->	66.96	74.93	113.66	289.85	289.85	435.21

Reference No.: **Ethyl mercaptan** **Scenario:** **Fire**

	Maximum IHR at height of simulation (kW/m2)	IHR (KW/m2) for First Isopleth :	IHR (KW/m2) for Second Isopleth :	IHR (KW/m2) forThird Isopleth :	IHR (KW/m2) for Fourth Isopleth :	IHR (KW/m2) for Fifth Isopleth :
* 4. Drums on site over heating by external source-Fire Ball	66.71	37.5	25	12.5	4	1.6
Distances in meter---------->	1	34.25	42.75	61.75	110.75	175.75
* 2. Drums on site unloading manifold failure liquid spill free spread pool Fire	553.8	37.5	25	12.5	4	1.6
Distances in meter---------->	1	69.67	85.17	120.67	213.67	337.67
* 1. Drums on site or drum catastrophic failure liquid spill free spread pool Fire	162.87	37.5	25	12.5	4	1.6
Distances in meter---------->	1	10.01	12.51	18.01	31.51	50.01

Reference No.: **LNG** **Scenario:** **Fire**

	Maximum IHR at height of simulation (kW/m2)	IHR (KW/m2) for First Isopleth :	IHR (KW/m2) for Second Isopleth :	IHR (KW/m2) forThird Isopleth :	IHR (KW/m2) for Fourth Isopleth :	IHR (KW/m2) for Fifth Isopleth :
* 4. CLG Main Liquid Pipe Rupture flash puff Immediate Edge Ignition leading to Fire Ball	558.23	37.5	25	12.5	4	1.6
Distances in meter---------->	1	78.76	96.76	137.26	243.26	385.26
* 4. CLG Gas Pipe Rupture Flash fire	50.67	37.5	25	12.5	4	1.6
Distances in meter---------->	1	29.51	37.01	54.01	97.51	155.51

Summary of the Results of the MCAS/MCLS Consequences distances

	Maximum IHR at height of simulation (kW/m2)	IHR (KW/m2) for First Isopleth :	IHR (KW/m2) for Second Isopleth :	IHR (KW/m2) forThird Isopleth :	IHR (KW/m2) for Fourth Isopleth :	IHR (KW/m2) for Fifth Isopleth :
* 1. CLG Liquid Main Pipe rupture Cryogenic Liquid Pool Fire	1478.62	37.5	25	12.5	4	1.6
	Distances in meter---------->					
	1	1035.47	1268.47	1793.97	3171.47	5014.47

HAMS-GPS : Risk Assessment Simulations (FN Curve- Cumulative Frequency)

For MyCo

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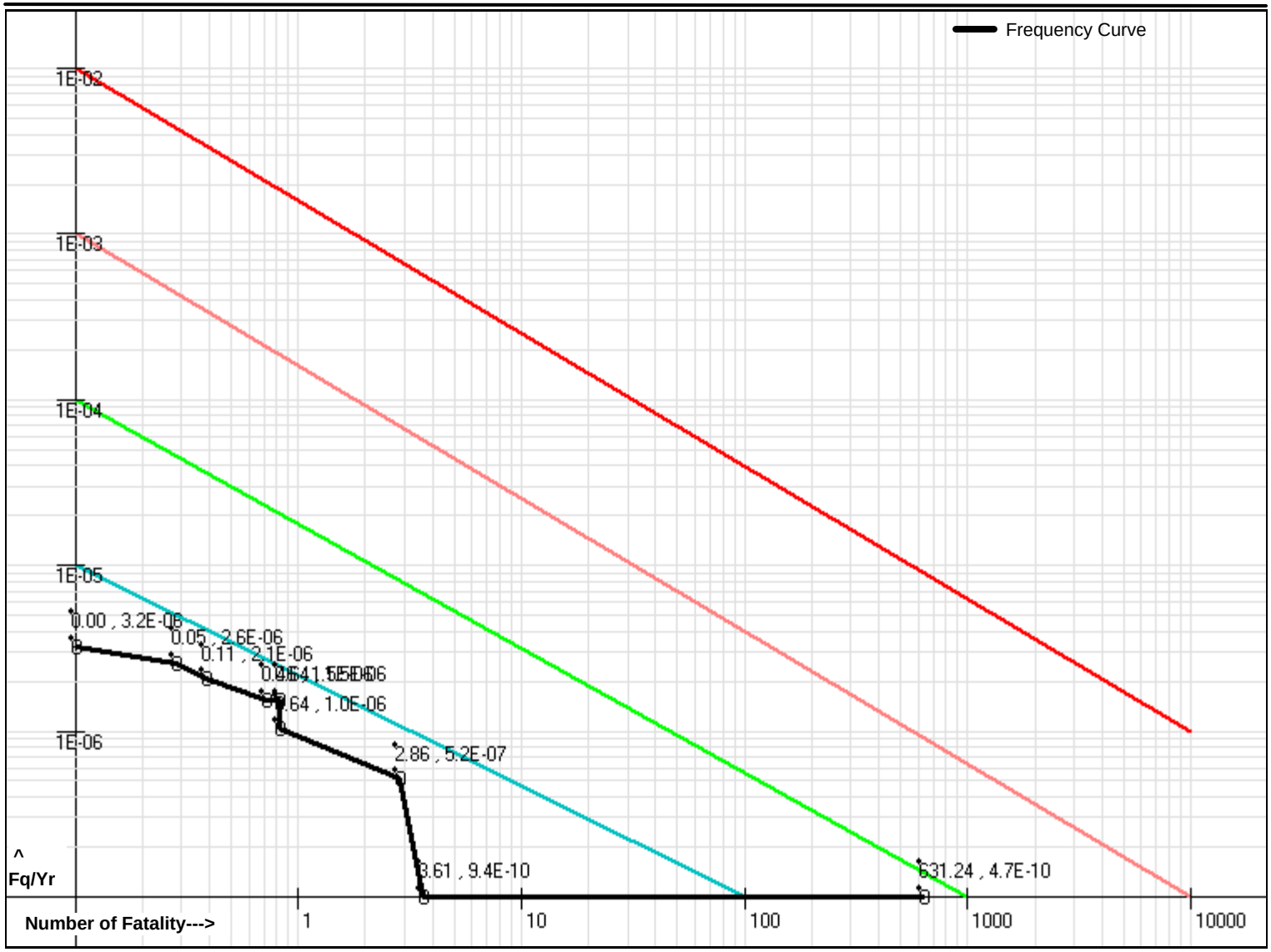
Date : Wednesday, May 18, 2016

Scale: Log Scale



If Fn-Curve lies above RED line : INTORABLE RISK REGION

If Fn-Curve lies between RED and Orange line : UNJUSTIFIABLE RISK REGION

If Fn-Curve lies between Orange and Green line : ACCEPTABLE RISK REGION

If Fn-Curve lies between Green and Blue line : NEGLIGIBLE RISK REGIO

Fn-Curve

NOTE: Absolute/Number of Fatality fatality is based on population density of 45 per hectare. The number exposed in each scenario depends on product of vulnerability area in hectare for each scenario and population density.

HAMS-GPS : Risk Assessment Simulations (Frq. Vs. Dist Curve- Cumulative Frequency) **For MyCo**

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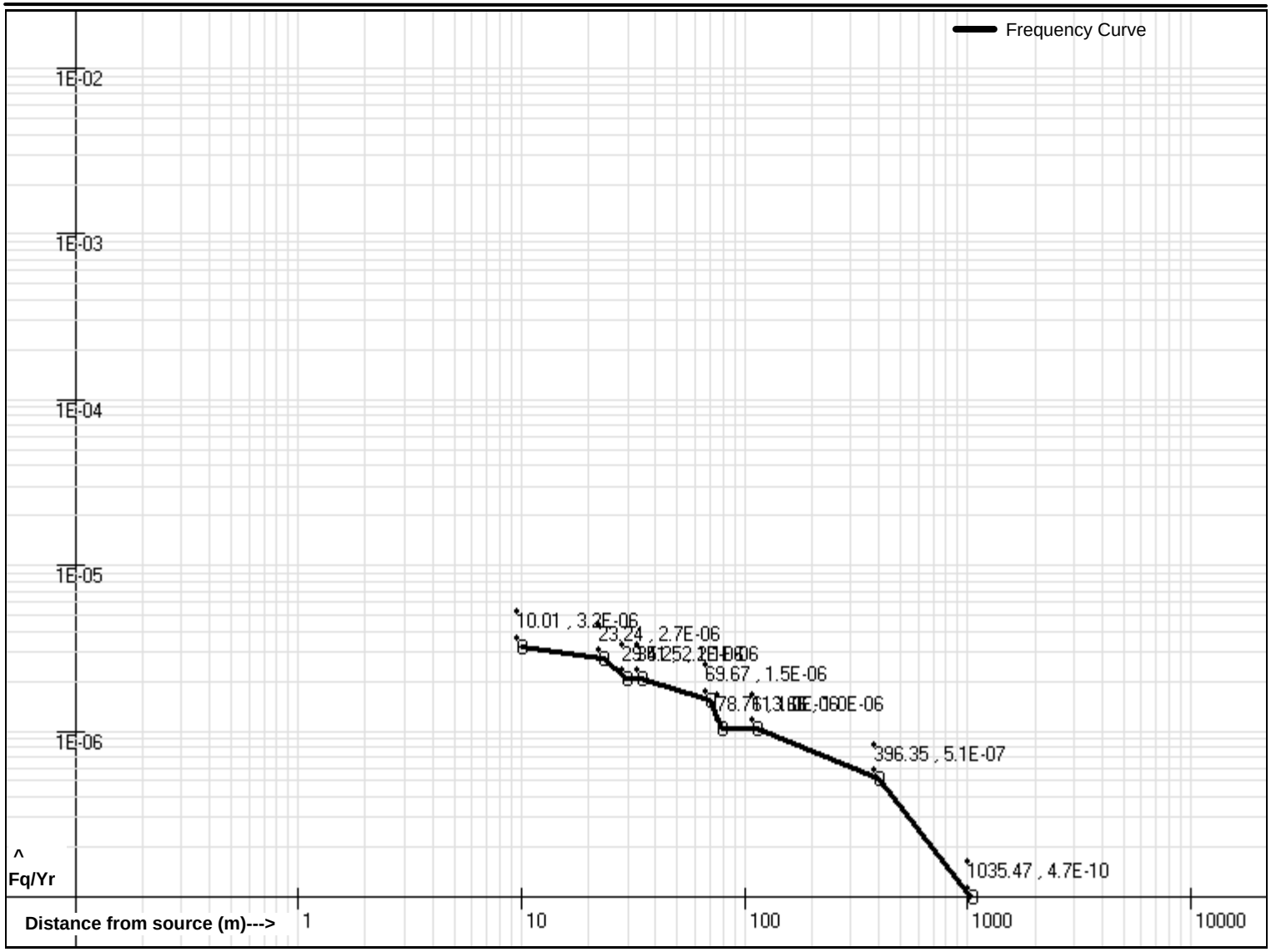
Date : Wednesday, May 18, 2016

Scale: Log Scale



Frq. Vs.Dist Curve

HAMS-GPS : Risk Assessment Simulations (ALARP) **For MyCo**

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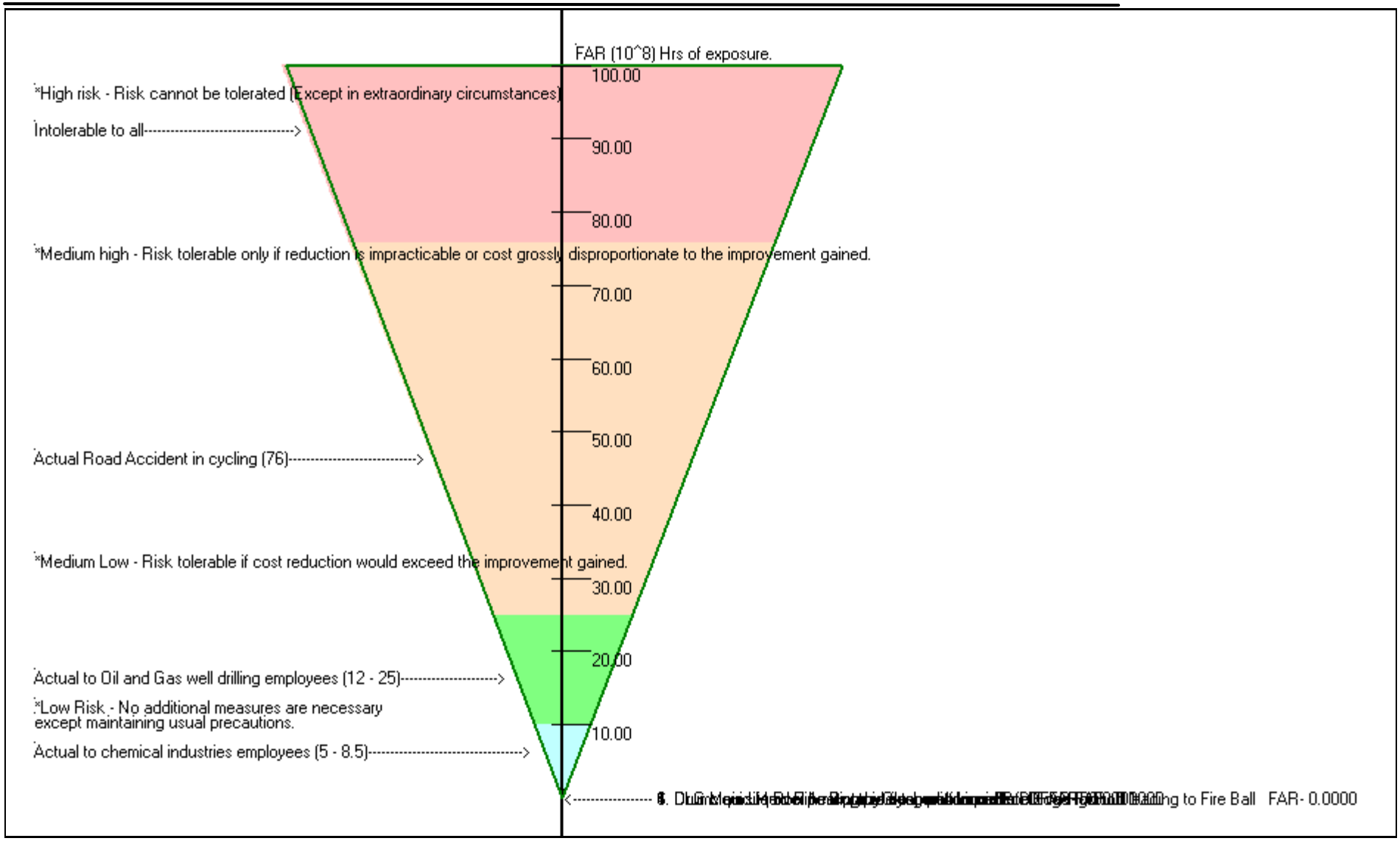
Date : Wednesday, May 18, 2016



Date : Wednesday, May 18, 2016

HAMS-GPS : RBI (Risk Based Investigation) Matrix

For MyCo

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Chance levels ---------->

Severity levels ---------->

						Total	%
	0	0	0	0	0	0	0.00
	0	0	2	0	0	2	22.22
	0	1	1	0	0	2	22.22
	0	0	1	0	1	2	22.22
	3	0	0	0	0	3	33.33
Total	3	1	4	0	1	9	
%	33.33	11.11	44.44	0.00	11.11		100

Risk Levels	Total	%
HIGH	0	0.00
MEDIUM HIGH	3	33.33
MEDIUM	2	22.22
Low	1	11.11
SAFE	3	33.33
Total	9	100

Applications of RBI-Risk Matrix: Following are the applications of an RBI-Risk matrix

1. As an indicator of the risk level of the installation,
2. To establish risk mitigation measures and evaluate their effects
3. To compare units and processes on the basis of risk,
4. To develop trends of risk development of a unit over time and during its life cycle.

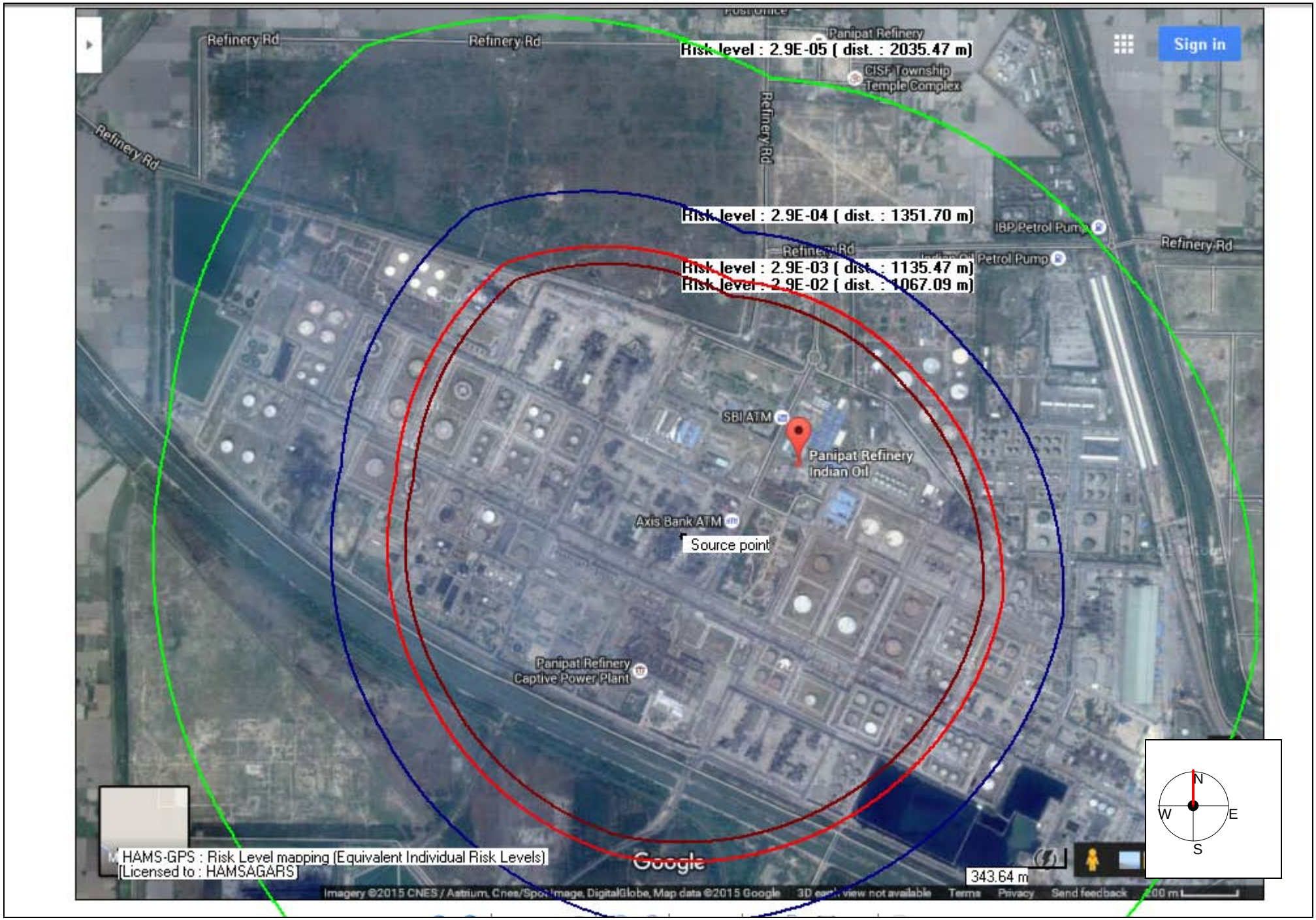
Number of Risk (Damage-Consequence) level areas

Scenario	HIGH	MEDIUM HIGH	MEDIUM	LOW	SAFE	SIL/LOP
1. CLG Liquid Main Pipe rupture Cryogenic Liquid Pool Fire	0	0	1	0	0	1
1. Drums on site or drum catastrophic failure liquid spill free spread pool Fire	0	0	0	0	1	NA
1. Drums on site Pool 1 min rapid evaporation under D	0	1	0	0	0	2
2. Drums on site unloading manifold failure liquid spill free spread pool Fire	0	1	0	0	0	2
4. CLG Gas Pipe Rupture Flash fire	0	0	0	0	1	NA
4. CLG Main Liquid Pipe Rupture flash puff Immediate Edge Ignition leading to Fire Ball	0	0	0	0	1	NA
4. Drums on site Hole in vessel liquid spill spread pool evaporation D	0	1	0	0	0	2
4. Drums on site over heating by external source-Fire Ball	0	0	1	0	0	2
6. Drums on site over heating by external source-Puff D	0	0	0	1	0	1
TOTAL	0	3	2	1	3	

Applications of RBI-Risk Matrix: Following are the applications of an RBI-Risk matrix

1. As an indicator of the risk level of the installation.
2. To establish risk mitigation measures and evaluate their effects.
3. To compare units and processes on the basis of risk
4. To develop trends of risk development of a unit over time and during its life cycle.

SAFE	3	x 100 /	9	=	33.33 %
LOW	1	x 100 /	9	=	11.11 %
MEDIUM	2	x 100 /	9	=	22.22 %
MEDIUM HIGH	3	x 100 /	9	=	33.33 %
HIGH	0	x 100 /	9	=	0.00 %


Risk level : 2.9E-05 (dist. : 2035.47 m)
Risk level : 2.9E-04 (dist. : 1351.70 m)
Risk level : 2.9E-03 (dist. : 1135.47 m)
Risk level : 2.9E-02 (dist. : 1067.09 m)
Source point
Panipat Refinery
Indian Oil
SBI ATM
Axis Bank ATM
Panipat Refinery
Captive Power Plant
CISF Township
Temple Complex
IBP Petrol Pump
Refinery Rd
Sign in
HAMS-GPS : Risk Level mapping (Equivalent Individual Risk Levels)
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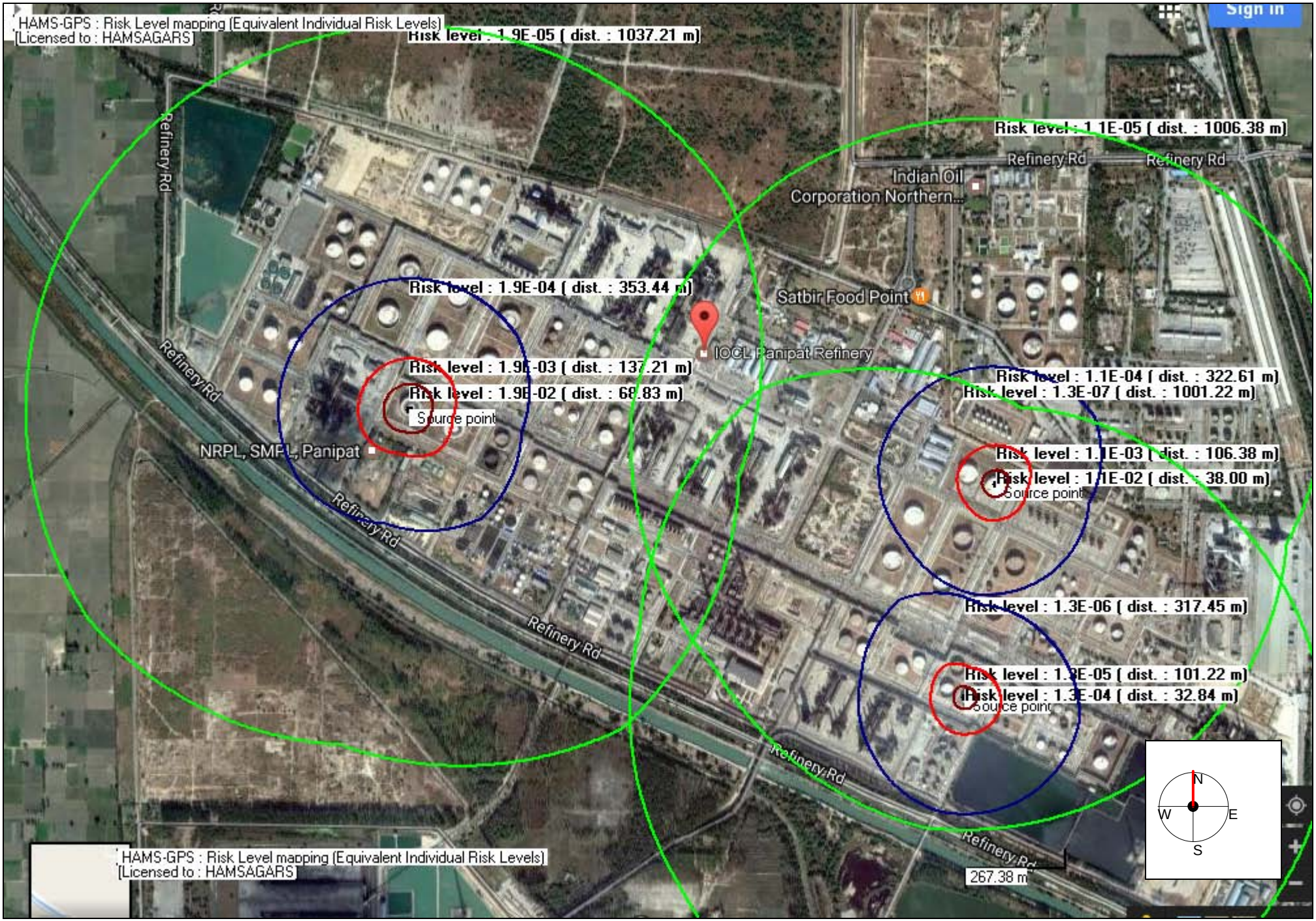
343.64 m
N
W
E
S


HAMS-GPS : Risk Level mapping (Equivalent Individual Risk Levels)
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Risk level : 1.9E-05 (dist. : 1037.21 m)
Risk level : 1.1E-05 (dist. : 1006.38 m)
Refinery Rd
Indian Oil Corporation Northern...
Satbir Food Point
IOCL Panipat Refinery
Risk level : 1.9E-04 (dist. : 353.44 m)
Risk level : 1.9E-03 (dist. : 137.21 m)
Risk level : 1.9E-02 (dist. : 68.83 m)
Source point
NRPL, SMPL, Panipat
Risk level : 1.1E-04 (dist. : 322.61 m)
Risk level : 1.3E-07 (dist. : 1001.22 m)
Risk level : 1.1E-03 (dist. : 106.38 m)
Risk level : 1.1E-02 (dist. : 38.00 m)
Source point
Risk level : 1.3E-06 (dist. : 317.45 m)
Risk level : 1.3E-05 (dist. : 101.22 m)
Risk level : 1.3E-04 (dist. : 32.84 m)
Source point
N
W
E
S
267.38 m
HAMS-GPS : Risk Level mapping (Equivalent Individual Risk Levels)
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