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।। श्री श्याम देवाय नमः ।।

Mob. : 9314961278
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9351790310

Krishnum Dyes & Intermediate Pvt. Ltd.

Factory : Untwaliya (Churu)

Office : Opp. Narbada Bhawan, Mochiwada, CHURU-331001 (Raj.)

Ref. No. ..... **Date**: 01.02.2021

Ref. No.:

To

The Director, (Industry III), IA Division,
Ministry of Environment, Forest & Climate Change,
Indira ParyawaranBhawan, JorBagh Road,
New Delhi - 110 003

Subject- For obtaining Environmental Clearance for Proposed Dyes & intermediates Manufacturing Project of 150MT/Month (Crude) [{Disperse Azo Dyes (All colours)-100 MT/Month, Coumarin Dyes (All colours)-25MT/Month &Methine Dyes (All colours) - 25MT/Month}] atKhasara no. 670/521 of Revenue Village-Untwalia, Tehsil & District- Churu (Rajasthan) by M/s. Krishnum Dyes & Intermediate Pvt. Ltd.- **Reg. Submission of Additional Details Sought by Expert Appraisal Committee (Industry-2 Sector).**

Ref:1. **1. MoEFCC File No.: IA-J-11011/134/2018-IA-II(I);**
2. MoEFCC Proposal No.: IA/RJ/IND2/74141/2018;
3. Agenda Item No. 19.5, 19th Meeting of the Expert Appraisal Committee (Industry-2 Sector);

Sir,

With reference to the aforesaid subject and the above cited reference; we would like to bring in to your kind notice that the technical presentation was held in front of Expert Appraisal Committee (Industry-2 Sector) on 11.05.2020. Queries were raised during the EAC(Industry-2 Sector) meeting and thereafter, an ADS was generated on portal on date 26.05.2020.

In view of the foregoing, we are herewith submitting the ADS Reply for your kind consideration and would like to request your good self to kindly consider our project for further processing.

Thanking you with Regards,

For M/s. Krishnum Dyes & Intermediate Pvt. Ltd.

Krishnum Dyes & Intermediate Pvt. Ltd. Authorised Signatory

Mahesh Kumar Prajapat
(Director & Authorized Signatory)
Encl: As above

ADS

(Additional Details Sought)

Reply

For

Proposed Dyes & Intermediates Manufacturing Project
Capacity - 150 MT/Month (Crude)
[{Disperse Azo Dyes (All colours) - 100 MT/Month,
Coumarin Dyes (All colours) - 25 MT/Month &
Methine Dyes (All colours) - 25 MT/Month}]

At

Khasara no. 670/521 of Revenue Village - Untwalia, Tehsil & District - Churu (Rajasthan)

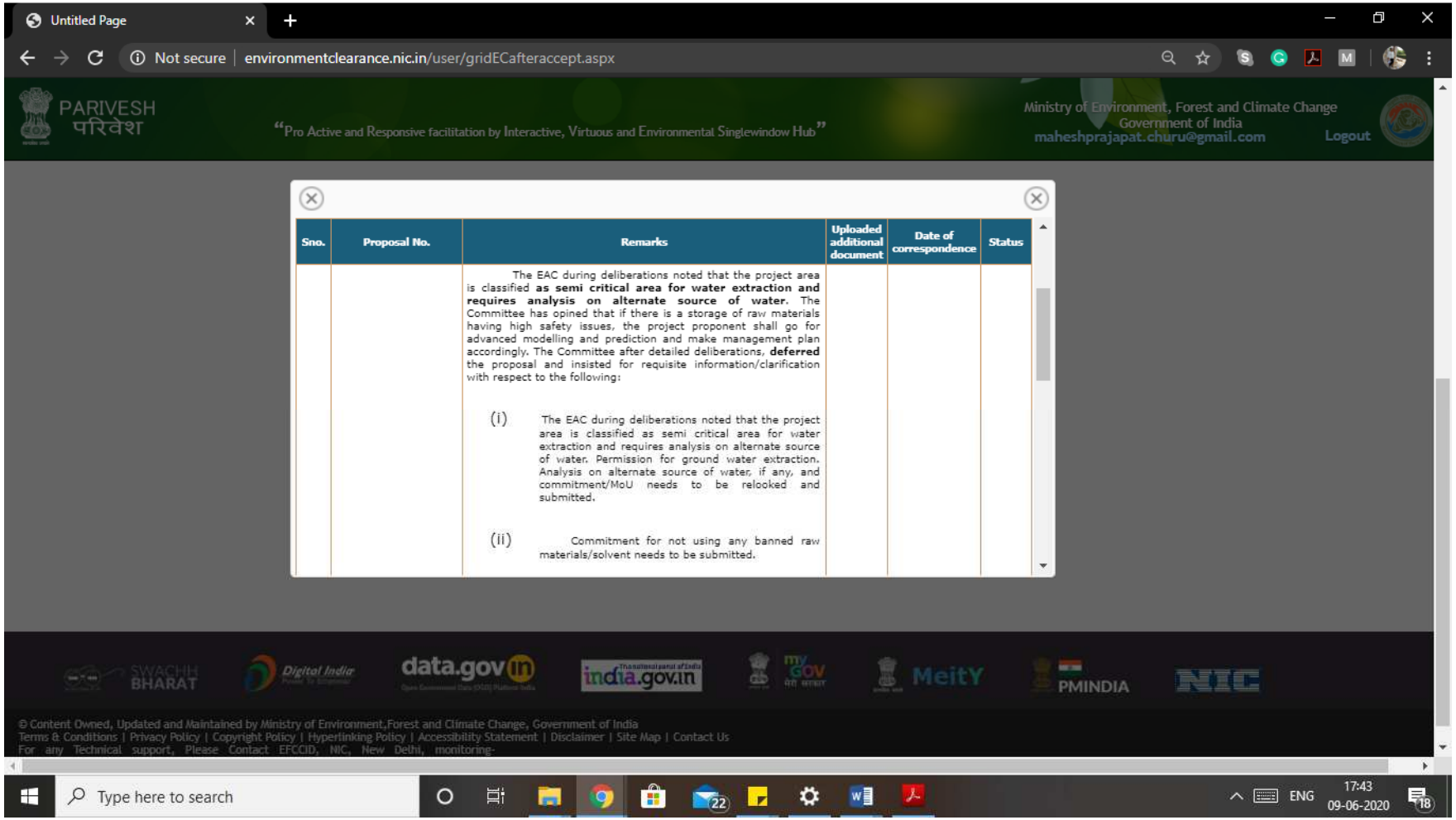
Project Proponent

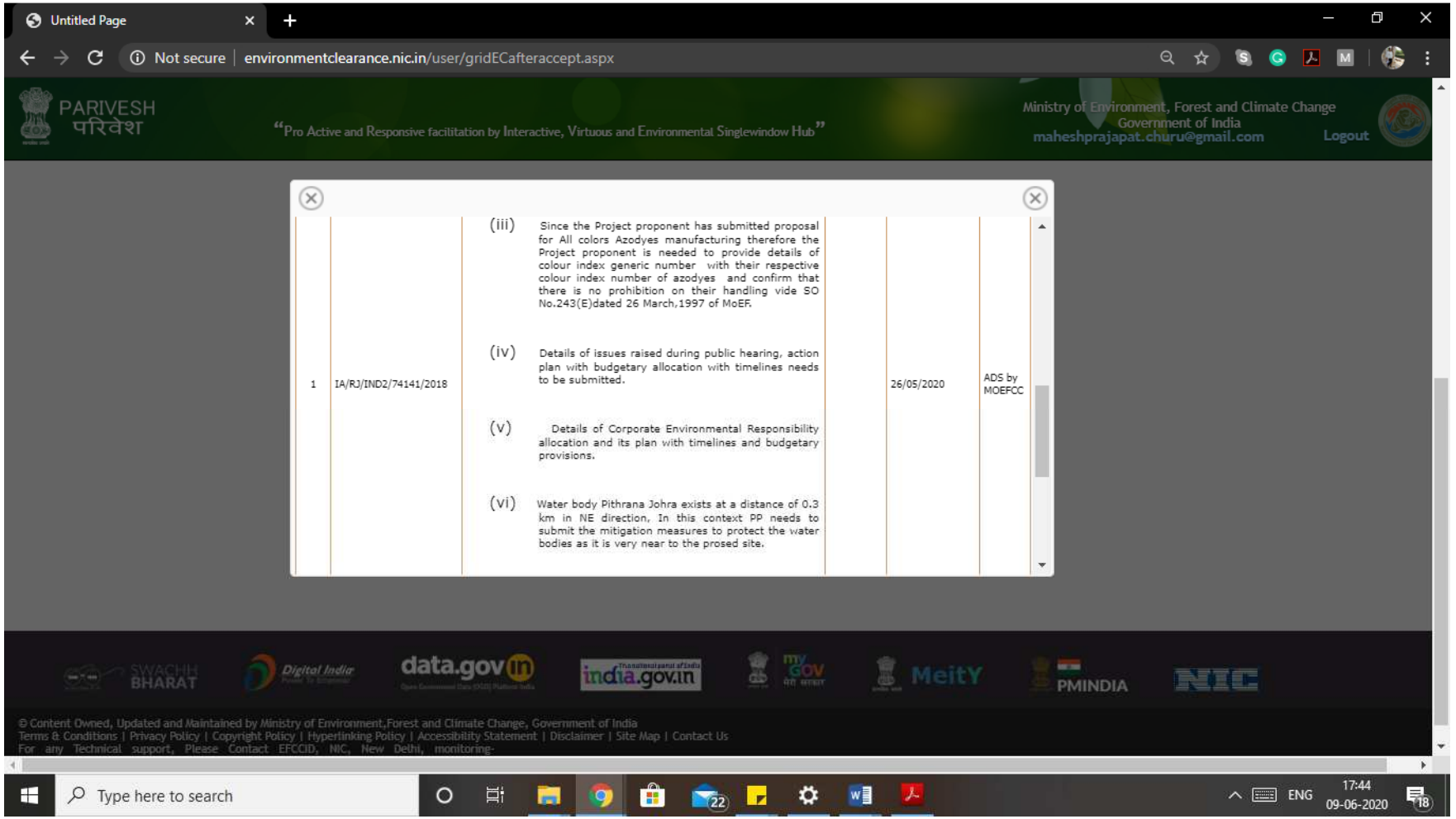
M/s. Krishnum Dyes and Intermediate Pvt. Ltd.

Address: Opposite Narbada Bhavan
Churu – 331001 (Rajasthan)
Phone No. - +91-900111
Email – maheshprajapat.churu@gmail.com

Content List

Additional Details Sought

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(iii) Since the Project proponent has submitted proposal for All colors Azodyes manufacturing therefore the Project proponent is needed to provide details of colour index generic number with their respective colour index number of azodyes and confirm that there is no prohibition on their handling vide SO No.243(E)dated 26 March,1997 of MoEF.
(iv) Details of issues raised during public hearing, action plan with budgetary allocation with timelines needs to be submitted.
(v) Details of Corporate Environmental Responsibility allocation and its plan with timelines and budgetary provisions.
(vi) Water body Pithrana Johra exists at a distance of 0.3 km in NE direction, In this context PP needs to submit the mitigation measures to protect the water bodies as it is very near to the prosed site.
1 IA/RJ/IND2/74141/2018 26/05/2020 ADS by MOEFCC
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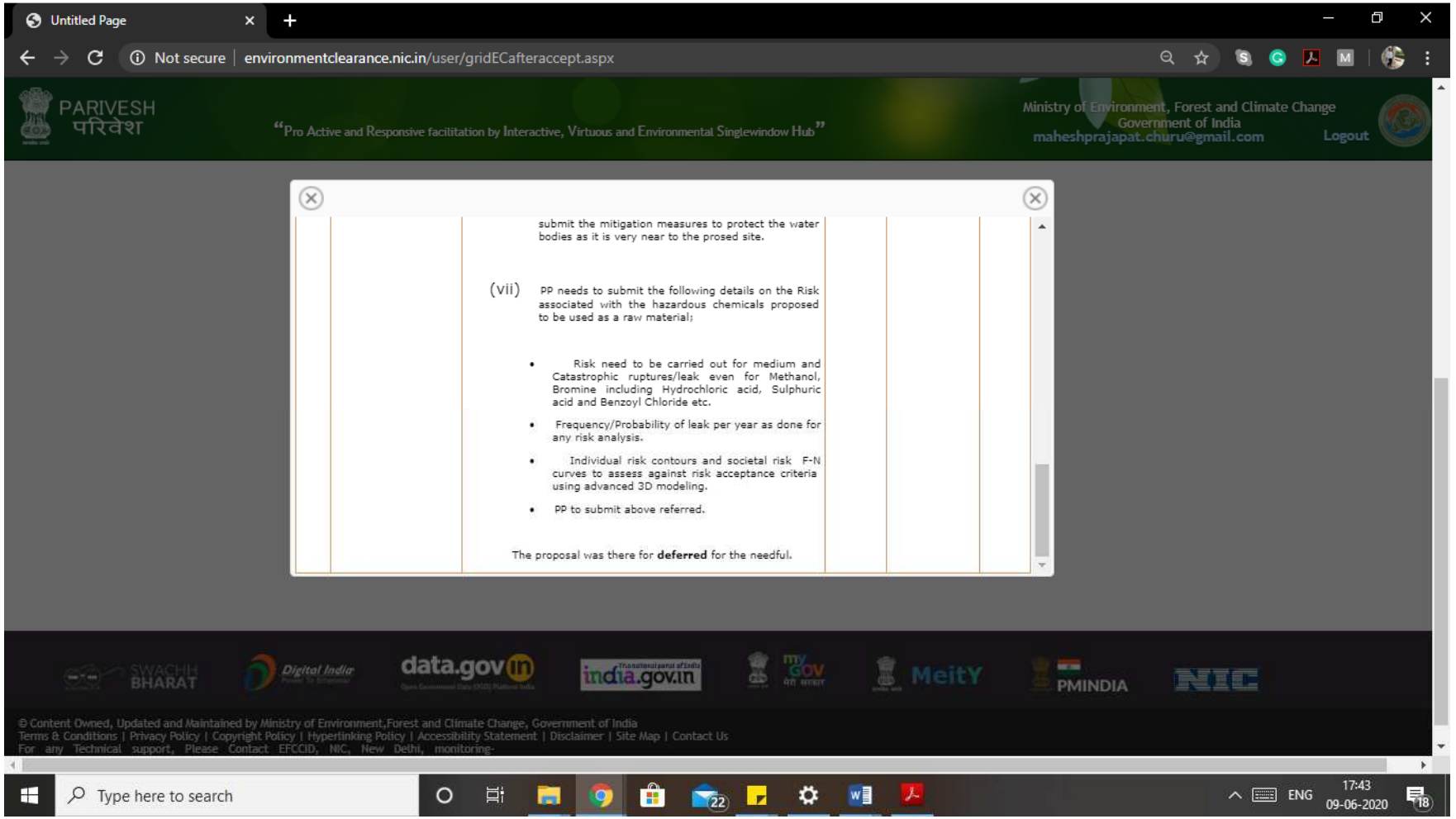
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submit the mitigation measures to protect the water bodies as it is very near to the prosed site.
(vii) PP needs to submit the following details on the Risk associated with the hazardous chemicals proposed to be used as a raw material;
Risk need to be carried out for medium and Catastrophic ruptures/leak even for Methanol, Bromine including Hydrochloric acid, Sulphuric acid and Benzoyl Chloride etc.
Frequency/Probability of leak per year as done for any risk analysis.
Individual risk contours and societal risk F-N curves to assess against risk acceptance criteria using advanced 3D modeling.
PP to submit above referred.
The proposal was there for deferred for the needful.
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Reply of Additional Details Sought

S. No.	Additional Details Sought	Reply
i.	The EAC deliberations noted that the project area is classified as semi-critical area for water extraction and requires analysis on alternate source of water. Permission for ground water extraction. Analysis on alternate source of water, if any, and commitment/MoU needs to be relooked and submitted.	The total water requirement for the proposed Project has been estimated as 117.8 KLD; out of which 34.8 KLD will be freshwater, 61 KLD will be recycled water and 22 KLD will be in form of Ice. It has been proposed to source the Fresh water from ground water or other outside sources/local suppliers. The application (vide No. 21-4/12530/RJ/IND/2018) was submitted to CGWA for withdrawal of ground water (34.8 KLD) which has been approved from CGWA on 09th January, 2021 and NOC for withdrawal of groundwater has been issued vide NOC No. CGWA/NOC/IND/ORIG/2021/10549 by CGWA which is valid up to 08.01.2024. Copy of the same has been enclosed as ***Annexure-1(a).*** Other than the above, permission for providing 34.8 KLD of water for the project as alternative emergent demand (on payment basis) has also been obtained from Executive Engineer, PHED, Division Churu vide letter no. 525 dated 25.06.2020. The copy of the permission has been enclosed as ***Annexure-1(b).*** The company has proposed various rainwater harvesting measures and details regarding the same have been enclosed as ***Annexure-1(c).***
ii.	Commitment for not using any banned raw materials/solvent needs to be submitted.	Commitment for not using any banned raw materials/solvent as well as not producing or handling of banned Azodyes as per the MOEFCC Notification vide S.O. No. 243(E) dated 26 March, 1997 published proposing imposition of Prohibition On The Handling Of Azodyes, has been enclosed as ***Annexure-2.***
iii.	Since the Project proponent has submitted proposal for All colors Azodyes manufacturing therefore the Project proponent is needed to provide details of colour index generic number with their respective colour index number of azodyes and confirm that there is no prohibition on their handling vide SO No. 243(E) dated 26 March,1997 of MoEF.	Details of the Colour Index Generic Number (CIGN) with their respective Colour Index Constitution Number (CICN) and CAS Numbers have been enclosed as ***Annexure-3.*** Commitment for not producing or handling any banned Azodyes as per the MOEFCC Notification vide S.O. No. 243(E) dated 26 March, 1997 published proposing imposition of Prohibition On The Handling Of Azodyes, has been enclosed as ***Annexure-2.***
iv.	Details of issues raised during public hearing, action plan with budgetary	Time bound action plan for implementation of the commitments raised during Public Hearing along with budgetary allocation has

S. No.	Additional Details Sought	Reply
	allocation with timelines needs to be submitted.	been prepared and incorporated in the Final EIA/EMP Report in Chapter 7, Section 7.2.4, Page No. 137-138. Copy of the same has been enclosed herewith as ***Annexure-4*** for your ready reference.
v.	Details of Corporate Environmental Responsibility allocation and its plan with timelines and budgetary provisions.	As per OM of MoEFCC dated 30.09.2020, the company has proposed to spend Rs. 40.50 Lacs for implementation of commitments made during Public Hearing. Detailed Public Hearing action plan along with time bound and money bound budget allocation has been enclosed herewith as ***Annexure 4.***
vi.	Water body Pithrana Johra exists at a distance of 0.3km in NE direction, In this context PP needs to submit the mitigation measures to protect the water bodies as it is very near to the proposed site.	There is one water body name as Pithrana Johra (~0.3 Km in NE direction) falls within the study area of the project site. The proposed project will be a Zero Liquid Discharge Unit and there will be no change in the drainage and Topography of the buffer zone. Therefore, no adverse impact on the said water body is envisaged due to the proposed project. However, the company has proposed to rejuvenate Pithrana Johra by constructing 2 number of recharge shafts in the Pond. The same will facilitate the ground water recharge of 11846.75 cum/annum.Detailed Rain water harvesting plan has been enclosed herewith as ***Annexure-1(c).***
vii.	PP needs to submit the following details on the Risk associated with the hazardous chemicals proposed to be used as a raw material; • Risk need to be carried out for medium and Catastrophic ruptures/leak even for Methanol, Bromine including Hydrochloric acid, Sulphuric acid and Benzoyl Chloride etc. • Frequency/Probability of leak per year as done as done for any risk analysis. • Individual risk contours and societal risk F-N curves to assess against risk acceptable criteria using advanced 3D modeling. • PP to submit above referred.	Detailed Risk Assessment Modelling has been carried out for the project. Copy of the Report is enclosed herewith as ***Annexure 5.***

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LIST OF ANNEXURES

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भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल प्राधिकरण
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Authority

(भूजल निकासी हेतु अनापत्ति प्रमाण पत्र)
NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

Project Name:	Krishnum Dyes And Intermediate Private Limited		
Project Address:	Khasra No- 670/521, Village- Untwaliya, Tehsil And District Churu		
Village:	Untwaliya	Block:	Churu
District:	Churu	State:	Rajasthan
Pin Code:			
Communication Address:	Khasra No- 670/521, Village- Untwaliya, Tehsil And District Churu, Churu, Churu, Rajasthan - 331021		
Address of CGWB Regional Office :	Central Ground Water Board Western Region, 6-a, Jhalana Doongri, Jaipur, Rajasthan - 302004		

1.	**NOC No.:**	CGWA/NOC/IND/ORIG/2021/10549			
2.	Application No.:	21-4/12530/RJ/IND/2018	3.	Category: (GWRE 2017)	Semi Critical
4.	Project Status:	New Project	5.	NOC Type:	New
6.	**Valid from:**	09/01/2021	7.	**Valid up to:**	08/01/2024

8. Ground Water Abstraction Permitted:

Fresh Water		Saline Water		Dewatering		Total	
m³/day	m³/year	m³/day	m³/year	m³/day	m³/year	m³/day	m³/year
34.80	10440.00						

9. Details of ground water abstraction /Dewatering structures

	Total Existing No.:0						**Total Proposed No.:1**					
	DW	DCB	BW	TW	MP	MPu	DW	DCB	BW	TW	MP	MPu
Abstraction Structure*	0	0	0	0	0	0	0	0	1	0	0	0

*DW- Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; MP-Mine Pit;MPu-Mine Pumps

10.	Ground Water Abstraction/Restoration Charges paid (Rs.):	62640.00

11.	Number of Piezometers(Observation wells) to be constructed/ monitored & Monitoring mechanism.	No. of Piezometers	Monitoring Mechanism		
			Manual	DWLR**	DWLR With Telemetry
	**DWLR - Digital Water Level Recorder	1	1	0	0

(Compliance Conditions given overleaf)

This is an auto generated document & need not to be signed.

Validity of this NOC shall be subject to compliance of the following conditions:

Mandatory conditions:

1) Installation of digital water flow meter (conforming to BIS/ IS standards) having telemetry system in the abstraction structure(s) shall be mandatory for all users seeking No Objection Certificate and intimation regarding their installation shall be communicated to the CGWA within 30 days of grant of No Objection Certificate through the web-portal.

2) Proponents shall mandatorily get water flow meter calibrated from an authorized agency once in a year.

3) Construction of purpose-built observation wells (piezometers) for ground water level monitoring shall be mandatory as per Section 14 of Guidelines . Water level data shall be made available to CGWA through web portal. Detailed guidelines for construction of piezometers are given in Annexure-II.

4) Proponents shall monitor quality of ground water from the abstraction structure(s) once in a year. Water samples from bore wells/ tube wells / dug wells shall be collected during April/May every year and analysed in NABL accredited laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. Water quality data shall be made available to CGWA through the web portal.

5) In case of mining projects, additional key wells shall be established in consultation with the Regional Director, CGWB for ground water level monitoring four (4) times a year (January, May, August and November) in core as well as buffer zones of the mine.

6) In case of mining project the firm shall submit water quality report of mine discharge/ seepage from Govt. approved/ NABL accredited lab.

7) The firm shall report compliance of the NOC conditions online in the website (www.cgwa-noc.gov.in) within one year from the date of issue of this NOC.

8) The firm shall submit the water audit report in case of water requirement is in excess of 100 m3/day through certified auditors within three months of completion of the same to CGWA.

9) Application for renewal can be submitted online from 90 days before the expiry of NOC. Ground water withdrawal, if any, after expiry of NOC shall be illegal & liable for legal action as per provisions of Environment (Protection) Act, 1986.

10) This NOC is subject to prevailing Central/State Government rules/laws/norms or Court orders related to construction of tube well/ground water abstraction structure / recharge or conservation structure/discharge of effluents or any such matter as applicable.

General conditions:

11) No additional ground water abstraction and/or de-watering structures shall be constructed for this purpose without prior approval of the Central Ground Water Authority (CGWA).

12) The proponent shall seek prior permission from CGWA for any increase in quantum of groundwater abstraction (more than that permitted in NOC for specific period).

13) Proponents shall install roof top rain water harvesting in the premise as per the existing building bye laws in the premise.

14) The project proponent shall take all necessary measures to prevent contamination of ground water in the premises failing which the firm shall be responsible for any consequences arising thereupon.

15) In case of industries that are likely to contaminate the ground water, no recharge measures shall be taken up by the firm inside the plant premises. The runoff generated from the rooftop shall be stored and put to beneficial use by the firm.

16) Wherever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.

17) Wherever the NOC is for abstraction of saline water and the existing wells (s) is /are yielding fresh water, the same shall be sealed and new tubewell(s) tapping saline water zone shall be constructed within 3 months of the issuance of NOC. The firm shall also ensure safe disposal of saline residue, if any.

18) Unexpected variations in inflow of ground water into the mine pit, if any, shall be reported to the concerned Regional Director, Central Ground Water Board.

19) In case of violation of any NOC conditions, the applicant shall be liable to pay the penalties as per Section 16 of Guidelines.

20) This NOC does not absolve the proponents of their obligation / requirement to obtain other statutory and administrative clearances from appropriate authorities.

21) The issue of this NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and take decisions independently of the NOC.

22) In case of change of ownership, new owner of the industry will have to apply for incorporation of necessary changes in the No Objection Certificate with documentary proof within 60 days of taking over possession of the premises.

23) This NOC is being issued without any prejudice to the directions of the Hon'ble NGT/court orders in cases related to ground water or any other related matters.

(Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent.)

Executive Engineer PHED Division Churu

Sr. No. 525

Date : 25/06/2020

To,
M/s Krishnum Dyes & Intermediate Pvt. Ltd.
Revenue Village- Untwalia
Teh. & Distt. Churu (Raj)

Sub : Reg Permission for Providing 34.8 KLD Water for your Project As alternative emergent demand.

Ref : Your Letter Dated 17.06.2020

With Reference to subject sited matter and your letter for providing 34.8 KLD water for your project. We Hereby Accept your request to provide 34.8 KLD water at AAPNI YOJANA Churu As alternative emergent demand on Payment Basis. For which tanker should be arranged by you at your own cost.

(Ram Kumar)
Executive Engineer,
PHED, Div Churu

अधिशासी अभियन्ता
जन स्वा० अभि० विभाग
खण्ड-चूरू D.D.O. कोड-9250

Annexure 1 (C)

RAIN WATER HARVESTING PLAN

M/s. Krishnum Dyes & Intermediate Pvt. Ltd has proposed to implement rainwater harvesting structures by diverting the runoff that is generated from roof sheds, Roads and green belt areas for recharge into ground water system. Implementation of recharge mechanism shall ensure that balance between the discharges vis-à-vis recharge relations of the aquifer system and improve in the ground water quality. The normal annual rain fall for the said area has been taken as 377.9 mm or 0.38 m. The annual rainfall taken for runoff calculation is 414 mm. Based on the site plan and land use pattern on the plot.

It is proposed to construct rain water harvesting structures considering a total land area 10,000 sqm (Including Road area 2389 sqm, Paved area 3118 sqm, Green area 3300 sqm and Open area 1193 sqm). These structures are expected to recharge ground water by an estimated volume of 1844.75 cum per year under normal rainfall conditions.

Rainwater harvesting will be carried out by following methods.

1. Roof top rainwater harvesting by recharge pits/tube wells
2. Runoff rainwater harvesting from grounds in the proposed industrial unit

A. Roof Top Rainwater Harvesting

The plant premises have different buildings with RCC and V shaped roof. Drain pipes has been proposed to collect water from flat RCC roof. These drain pipes are further connected with main rainwater collection pipes, provided with collection chambers. In case of V shaped roof, rainwater is collected through gutters attached at the end of the roof and these gutters are connected to rainwater pipes. From such roof catchments, almost 80-90% runoff water can be collected.

Average rooftop rainwater runoff available = A x Rf x AvRc

Where,

A = Roof top area = 2389 Sq.m

Rf = Rainfall = 414 mm (average annual rainfall)

AvRc= Average run-off coefficient= 0.80

Average rainwater runoff available = 2389x 0.414 x 0.80

= 791.23 Cum ---------- (A)

The rainwater runoff collected from roof top surfaces can be directly used for recharging the groundwater through subsurface recharge pits/filter pits.

B. Augmentation of surface run off through road, cemented floor and paved area

In the plant area, there are approach roads for office, various operating sections, workshop, canteen etc. The plant area also has parking and other cemented floor portion. Slope of these

cemented area and roads need to be maintained in such a way that the available runoff should move towards the proposed open drains and this water shall be taken to the recharge ponds/pits. Total road and paved area is coming about 3118Sq.m. Taking 60% as runoff coefficient for paved area, the availability of water has been worked out as under

Average rainwater runoff available from paved area = A x Rf x AvRc

Where,

A = Total Paved area = 3118Sq.m.

Rf = Rainfall = 414 mm (average annual rainfall)

Average rainwater runoff available = 3118x 0.414 x 0.60

= 774.51 Cum---------- (B)

C. Augmentation of surface run-off from Green Belt Area

The plant area comprises about 10,000 Sq.m (About 33% of total plant area) of land which is proposed to be developed as green belt area/plantation. For green area having slope less than 10 percent, runoff coefficient is generally taken as 15%. Availability of water from green belt area is calculated as:

Average rainwater runoff available from green area= A x Rf x AvRc

Where,

A = Total green area = 3300 Sq.m.

Rf = Rainfall = 414 mm (average annual rainfall)

Average rainwater runoff available = 3300 x 0.414 x 0.15

= 204.93 Cum ---------- (C)

D. Rain Water harvesting from Open Land

The project consists about 1193 Sq.m. area as open area to be reserved. Taking 15% as the runoff coefficient for open area, average runoff available has been calculated as under:

Catchment area =1193Sq.m.

Runoff coefficient = 0.15

Available Runoff = 1193 x 0.414 x 0.15

= 74.08 Cum---------- (D)

Expected Rainwater Recharge from all the above structures/areas

= (A) + (B) + (C) + (D)

= 791.23 + 774.51 + 204.93 + 74.08

= 1844.75 Cum

The computation of runoff for each unit has been worked out and the details are tabulated below:-

Table: 1

Estimation of the Runoff from the industry premises

S. No.	Land use type	Area (m^2)	Co-efficient of runoff	Annual Rainfall (m)	Quantity of Runoff (m^3)/annum
1	Roof area (building)	2389	0.80	0.414	791.23
2	Paved area (road & others)	3118	0.60	0.414	774.51
3	Green area	3300	0.15	0.414	204.93
4	Open Area	1193	0.15	0.414	74.08
	Total	**10,000**			**1844.75**

From the above computation, it is suggested that a total annual quantum of 1844.75 cum of rain water can be fruitfully harvested by constructing suitable recharge structures – **recharge pits with injection well system.**

The total water requirement of the plant will be 34.8 cum/day or 11484 cum/annum as per 330 plant working days. Project site is located in Block- Churu, District- Churu which is coming under Semi Critical zone as per CGWB categorization. As per CGWB guidelines, to withdraw groundwater for plant activities, rainwater harvesting/artificial groundwater recharge criteria are mandatory (100%) for industries falling in Semi Critical zone. However, to augment groundwater resources and to fulfill the recharge criteria, industry shall implement groundwater recharge measures in the nearby areas artificially in the village ponds.

RAINWATER HARVESTING OUTSIDE THE PLANT AREA

Artificial Groundwater Recharge outside Plant Premises

M/s. Krishnum Dyes & Intermediate Pvt. Ltd has proposed to rejuvenate one number of large existing village pond PithranaJohra located outside the plant premises in Untwalia, villageat a distance of 0.3km in NE direction which would accommodate and recharge surface runoff from surrounding areas during monsoon season.

Details for the same have been given below:

Table 2

Summarization of Proposed Pond for Rainwater Harvesting

S. No.	Particulars	Details
1	Recharge Structure	Pond
2	Area	0.2025ha
3	Distance	300m

4	Direction	NE Direction

After rejuvenating the village pond, the monsoon runoff water from the catchment of the ponds shall be collected in the pond for groundwater recharge. A certain quantity of impounded water shall be naturally infiltrated down / percolated and join the sub-surface aquifer. Remaining quantity/run-off available after natural percolation from bed of pond may further recharged by recharge shafts/injection well in the storage area which shall ensure further increase in total recharge or additional recharge.

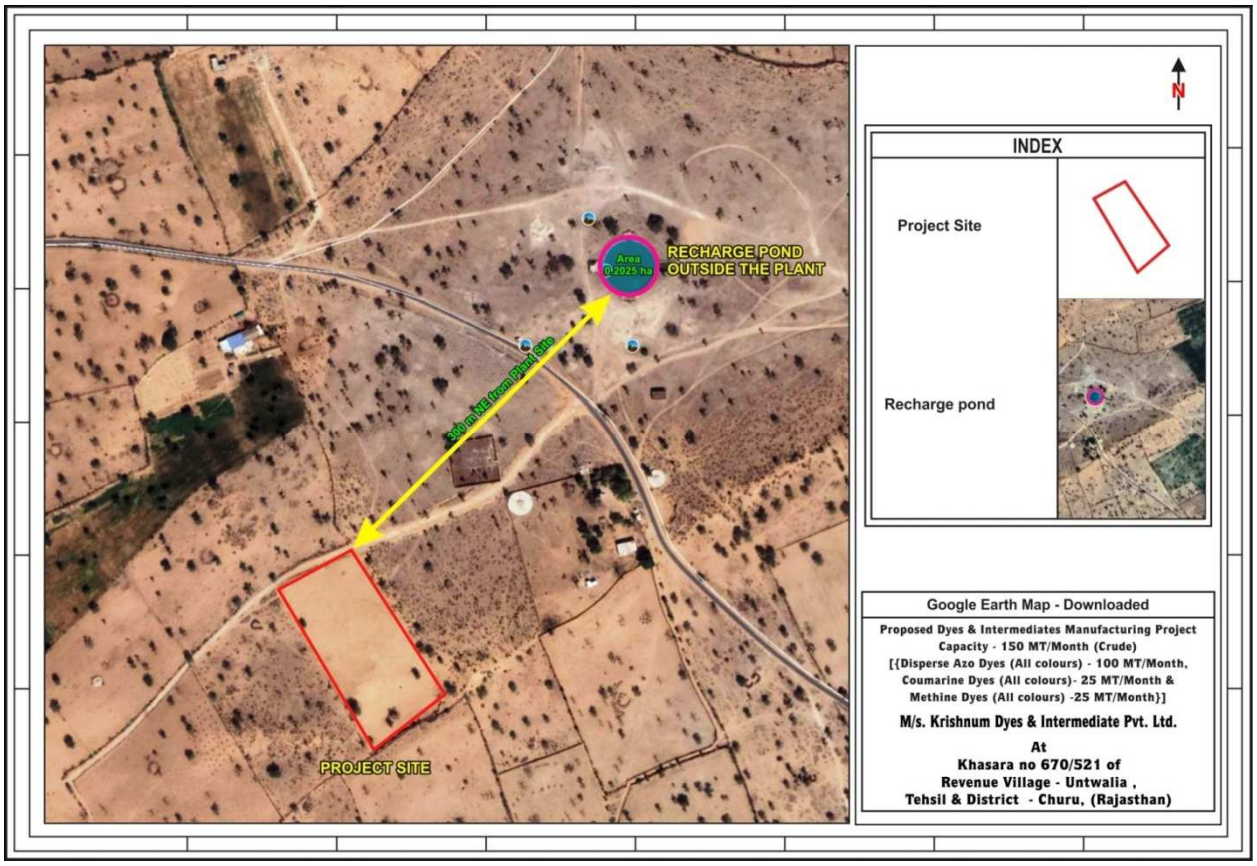


Fig 1: Proposed Rainwater Harvesting Pond located outside the Plant

A total of 2 number of recharge shafts are proposed to be constructed in the Pond. A bore of 8 inches diameter dug to a depth of 30-40 m below ground level (Bed of Pond). 10 mm aggregate is filled up to a height of about 2 m from below. A 6 inches perforated pipe is inserted and top of the pipe is kept higher than the ground level about 2 m. The upper portion of PVC pipe can be used in future for back washing. 10 mm gravel is filled in the bore well. A well type concrete structure is constructed around the shaft above the bed of pond to maintain at least 1.0 to 1.5 m of dead storage. This well type structure is filled with filter media (layers of coarse aggregates, fine aggregates and top as sand). A desilting chamber may be provided before entry into the well so

that the water entering the well, loose considerable amount of silt and therefore avoiding frequent clogging. Schematic diagramof proposed recharge shaft is shown in **Figure 2 .**

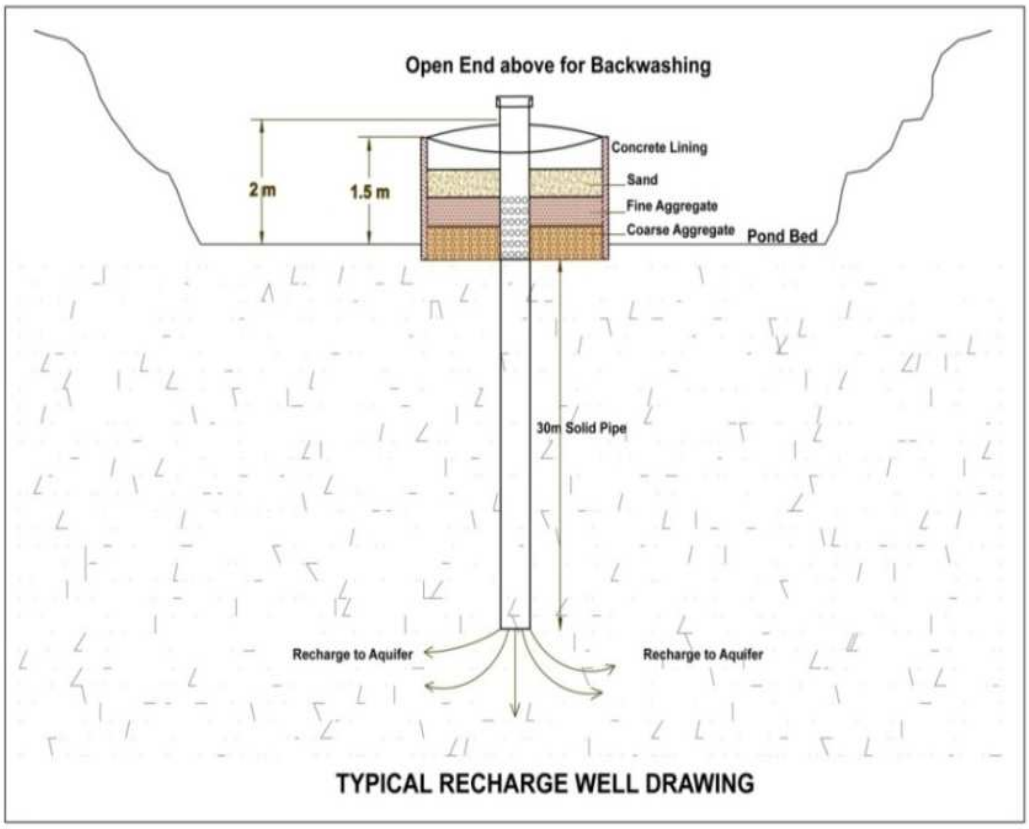


Fig 2 : Design of Recharge Shaft

Table 3

Details of Proposed Recharge Ponds outside Industrial Unit

S.No	Particulars	Details
1	Recharge Structure	Pond
2	Area	0.2025 ha
3	Latitude	28°14'43.77"
4	Longitude	75°00'19.67"
5	Rainfall	414 mm
6	Pond Spread Area	2025 m^2
7	Depth	3 m
8	Storage Capacity	6075 m^3

Table 4

Summarization of Artificial Groundwater Recharge outside Industrial Unit

S. No.	Pond Name	Storage Capacity (Cum) (A)	Fillings per Season (B)	Water Available for Recharge (Cum) (A * B)	Total Expected Recharge (65% i.e. Natural percolation + By Recharge Shaft) (Cum/annum)
1.	Pond-1	2025	3	18225	11846.75

Table 5

SUMMARIZATION OF RAINWATER HARVESTING PLAN

Total Fresh Water Requirement for Proposed Project	34.8 KLD or **11484 Cum/annum** (330 working days)
Source of Water Withdrawal for Project Activities	Groundwater
RWH Potential/Artificial Recharge Criteria	100% recharge (Semi Critical Zone) (CGWA Guidelines)
Rainwater Harvesting Quantum - Proposed Storage inside Industrial Premises	
Industrial Premises	**1844.75cum/annum**
Rainwater Harvesting Quantum outside Industrial Premises	
Rejuvenate Village Pond	**11846.75 cum/annum**
Total Rainwater Harvesting Potential (I + II)	***13691 cum/annum***
RWH Potential/Artificial Recharge Developed	***119%***

-=-=-=-

GSTIN: 08AAFCK8448Q1ZM

॥ श्री श्याम देवाय नमः ॥

Mob. : 9314961278
9001118289
9351790310

Krishnum Dyes & Intermediate Pvt. Ltd.

Factory : Untwaliya (Churu)

Office : Opp. Narbada Bhawan, Mochiwada, CHURU-331001 (Raj.)

Ref. No. .....

UNDERTAKING

Date 01/02/2021

I, **Mahesh Kumar Prajapat (Managing Director & Authorized Signatory) of** M/s. Krishnum Dyes & Intermediate Pvt. Ltd. give this undertaking to the effect that the company will neither be using any banned raw materials/solvent nor will produce or handle any banned Azodyes as per the MOEFCC Notification vide S.O. No. 243 (E) dated 26th March, 1997 published proposing imposition of Prohibition On The Handling Of Azodyes, in the project "Proposed Dyes & Intermediates Manufacturing Project of 150 MT/Month (Crude) [{Disperse Azo Dyes (All colours) - 100 MT/Month, Coumarine Dyes (All colours) - 25 MT/Month & Methine Dyes (All colours) - 25 MT/Month}] at Khasara no. 670/521 of Revenue Village - Untwalia, Tehsil & District - Churu (Rajasthan)".

Date: 01.02.2021

Place: CHURU (Rajasthan)

For & behalf of M/s. Krishnum Dyes & Intermediate Pvt. Ltd.

Krishnum Dyes & Intermediate Pvt. Ltd. Authorised Signatory

Mahesh Kumar Prajapat
(Director & Authorized Signatory)

Annexure 3

List of Products with Colour Index Generic Name, Colour Index Number, CAS Number and Production Capacities

S. NO.	PRODUCT NAME	Colour Index Generic Name	Colour Index Number	CAS Number	CAPACITY (MT/MONTH)
A. DISPERSE DYES					**100**
A1. HCl Based Disperse Dyes					
1.	Yellow 79	C.I. Solvent Yellow 79	551200	12237-31-9	
2.	Yellow SGL	C. I. DISPERSE YELLOW - 126	-	61968-70-5	
3.	Yellow 114	C.I. Disperse Yellow 114	128455	61968-66-9	
4.	Yellow 34	C.I. Pigment Yellow 34	77603	1344-37-2	
5.	Yellow 119	C.I. Pigment Yellow 119	77496	68187-51-9	
6.	Yellow 68	C.I. Disperse Yellow 68	21005	12223-89-1	
7.	Red 278	C.I. Disperse Red 278	113386	68248-10-2	
8.	Yellow M7G	C.I. Disperse Yellow M7G	-	-	
9.	Yellow 247	C.I. Disperse Yellow 247	-	-	
10.	Yellow 248	C.I. Disperse Yellow 248	-	-	
11.	Yellow 249	C.I. Disperse Yellow 249	-	-	
12.	Yellow 235	C.I. Disperse Yellow 247	-	177570-98-9	
13.	Orange 25 (Orange RL)	C.I. Disperse Orange 25	11227	31482-56-1	
14.	Red 74	C.I. Acid Red 74	13355	61703-11-5	
15.	Black 296	-	-	-	
16.	Black 1	C.I. Acid Black 1	20470	6054-48-4	
17.	Orange 288	C.I. Disperse Orange 288		3769-57-1	
18.	Orange 25	C.I. Disperse Orange 25	11227	31482-56-1	
19.	Red 54 (Scarlet RR)	C.I. Disperse Red 54	11131	12217-86-6	
20.	Yellow 221	C.I. Pigment Yellow 221	-	-	
21.	Orange 44 (Orange 3R 150)	C.I. Direct Orange 44	40251	2610-05-1	
A2. NSA Based Disperse Dyes					
22.	Navy Blue 79.1	C.I. Disperse Blue 79:1	11344	3618-72-2	
23.	Navy Blue 79.2	C.I. Disperse Blue 79:2	11345	3618-72-3	
24.	Navy Blue 183	C.I. Disperse Blue 183	11078	2309-94-6	
25.	Navy Blue 183.1	C.I. Disperse Blue 183.1	-	2537-62-4	
26.	Blue 291	C.I. Disperse Blue 291	113395	56548-64-2	
27.	Blue 4R	Basic blue 8	42563	66557-45-7	
28.	Blue 6GEF	-	-	-	
29.	Blue 4RB	-	61205	-	
30.	Blue 4GEF	-	-	-	
31.	Red BS (R152)	C. I. Disperse Red 152	111905	78564-86-0	
32.	Scarlet GS (R153)	C.I. Direct Red 153	28210	78564-87-1	

S. NO.	PRODUCT NAME	Colour Index Generic Name	Colour Index Number	CAS Number	CAPACITY (MT/MONTH)
33.	Red -XF2R			-	
34.	Red 311	C.I. Disperse Red 311	-	77907-28-9	
35.	Yellow Brown XF (YBXF)	-	-	-	
36.	Brown XF (BrXF)	-	-	-	
37.	Navy XF2R	-	-	-	
38.	Navy XF2G	-	-	-	
39.	Brown 378	-	-	-	
40.	Brown 165	C.I. Direct Brown 165	22045	6486-32-4	
41.	Brown 165.1	-	-	-	
42.	Orange 61	C.I. Acid Orange 61	19320	12270-45-0	
43.	Orange 30	C.I. Disperse Orange 30	-	12223-23-3	
44.	Scarlet 3R C. I. Red 50	C. I. Acid Red 50	45220	12223-35-7	
45.	Scarlet 3R C. I. Red 54	C. I. Disperse Red 54	11131	12217-86-6	
46.	Blue 373	C.I. Disperse Blue 373	-	51868-46-3	
47.	Red 202	C.I. Pigment Red 202	73907	61931-39-3	
A3. Solution based Disperse Dyes					
48.	Blue GSL - CI Blue 165	C.I. Disperse Blue 165	11077	41642-51-7	
49.	Blue DBR - CI Blue 366	C.I. Disperse Blue 366	-	84870-65-5	
50.	Red F3BS - CI Red 343	C.I. Disperse Red 343	-	99035-78-6	
51.	Red F3BST - CI Red 343.1	C.I. Disperse Red 343.1	-	-	
52.	Red F3BST - CI Red 343.2	C.I. Disperse Red 343.2	-	-	
53.	Blue WW2GS - CI Blue 378	C.I. Disperse Blue 378	-	885474-76-0	
54.	Blue GRL - CI Blue 165.1	C.I. Disperse Blue 165:1	113357	86836-00-2	
B. COUMARIN DYES					**25**
55.	Fluorescent Yellow 8GF - CI Disperse 82	C.I. Disperse Yellow 82	551200	12239-58-6	
56.	Fluorescent Yellow 10GF - CI Disperse 184	C.I. Disperse Yellow 184	551640	71838-87-4	
57.	Fluorescent Yellow 10GN - CI Disperse 232/184.1	C.I. Disperse Yellow 232/184.1	-	35773-43-4	
C. METHINE DYES					**25**
58.	Brilliant Blue SR - CI Disperse Blue 354	C.I. Disperse Blue 354	48480	104137-27-1	

There is no prohibition on handling of the above dyes vide SO No. 243(E) dated 26 March, 1997 of MoEF.

Annexure 4

Public Hearing Action Plan and Summary of Budget Allocation Implementation of Commitments based on Public Hearing

1. Public Hearing Action Plan

S. No.	Issues / Points / Opinions of Local Public	Name of the Person	Reply/Clarification by the Project Proponent	Action Plan along with Budgetary Allocation
1.	The proposed project was welcomed and stated that it would help in the pace of **development in the nearby villages**. Appreciating the efforts of the Project Proponent in the financial help provided by them for the development of schools in nearby areas.	Kalyan Singh, Village Untwalia	KDIPL will carry out various activities for development of the nearby area. Major thrust area identified for the same are Education, Health and Sanitation, Infrastructure Development, Water Conservation and Agro-based Livelihood.	A budget of Rs. 40.5 lakhs has been earmarked for implementation of commitments based on Public Hearing in next 3 years.
			The education infrastructure of the nearby area will be further strengthened by need & priority based distribution of furniture in schools in adjoining areas & villages in consultation with Education Officials and Repair work of buildings & furniture as per requirement and suggestions of Anganwadi centers & heads of the school under Education Developmental activities.	Budget earmarked: Rs. 3.0 lakhs to be spent in next 3 years
2.	The Project Proponent were appreciated for their lead for industrialization on behalf of the people in nearby areas and suggested them to give preference to the locals for the **employment opportunities** that would be generated. Also advised to adopt proper mitigation measures for pollution for protection of local environment.	**Harlala Saran, District Head**	About 100 direct and 150 indirect employment opportunities likely are to be generated due to the proposed project Other than this, training programs will be organized to improve Agro based livelihood and assistance for testing of soil samples along with the suggestion for crops and fertilizers input as per soil quality will be made available.	Locals will be preferred for providing employment as per eligibility criteria. Rs. 13 Lakhs have been earmarked for Agro based Livelihood developmental activities.
			Adequate pollution control and mitigation measures will be adopted to meet the notified environmental standards viz. installation of alkali scrubbers for controlling HCl bearing and H_2SO_4 bearing fumes, multi cyclones to control PM emission, three stage ETP followed by RO and MEE for waste water treatment and 100% recycling of treated water etc.	Cost for Environmental Protection Measures: ✓ Capital Cost: Rs. 1.5 Crore ✓ Recurring Cost: Rs. 35 Lac/annum.

S. No.	Issues / Points / Opinions of Local Public	Name of the Person	Reply/Clarification by the Project Proponent	Action Plan along with Budgetary Allocation
3.	Appreciated the efforts for the proposed project which could be beneficial for the **development of the nearby areas** and help in increasing the **employment opportunities** for the people staying in nearby areas. Enquired about proposed dyes and their uses.	**Kishan, Village Ratnanagar**	About 100 direct and 150 indirect employment opportunities likely are to be generated due to the proposed project Other than this, training programs will be organized to improve Agro based livelihood and assistance for testing of soil samples along with the suggestion for crops and fertilizers input as per soil quality will be made available.	Locals will be preferred for providing employment as per eligibility criteria. Rs. 13 Lakhs have been earmarked for Agro based Livelihood developmental activities.
			Proposed dyes are basically used for dying and printing of the textile/ fabric.	-
4.	Enquired about the waste water treatment method to be implemented for no discharge outside. Also, suggested for **regular health check-up of the workers**.	**Ram Soni, Village Bisau**	Process effluent will be treated in Tertiary level Effluent Treatment Plant having capacity of 100KLD followed by three stage R.O. and permeate of R.O. shall be reused in process. Rejects of R.O. plant shall be sent to MEE. The condensate water from MEE will be recycled. The salt from MEE will be sent to TSDF. No water will be discharged outside the plant premises.	Cost for Environmental Protection Measures: ✓ Capital Cost: Rs. 1.5 Crore ✓ Recurring Cost: Rs. 35 Lac/annum.
			Pre-placement and periodical medical check-up of the workers will be carried out as per prevailing norms.	Budget earmarked for Occupational and Safety Hazards: Rs. 29 lakhs/annum

2. Summary of Proposed Budget Allocation for Implementation of Commitments based on Public Hearing

As per OM dated 30th September, 2020, an amount of Rs. 40.5 Lakhs has been earmarked for implementation of the commitments made during Public Hearing.

Detailed activity wise action plan has been given as under with budget allocation and time line:

Proposed Budget Allocation for Implementation of Commitment based during Public Hearing

S. No.	Activity	Expenditure			
		1st Year	2nd Year	3rd Year	Total
A.	**Village Development Activities**				
1.	Construction of toilets with water storage facility in Government School: a. Construction of 2 toilets in Untwaliya village at Government Secondary School, Untwaliya and 2	0.8 {Activity 1 (a)}	0.8 {Activity 1 (b)}	0.8 {Activity 1 (c)}	**2.4**

S. No.	Activity	Expenditure			
		1st Year	2nd Year	3rd Year	Total
	public toilets. b. Construction of 2 toilets in Ramsar village at Government Secondary School and 2 public toilets. c. Construction of 2 toilets in Churu village and Government Secondary School Dhani D.S. Pura Untwaliya, Ramsara, Churu and 2 public toilets. (~ Rs. 20,000 per toilet)				
2.	Installation of solar street lights on village approach roads of a. Ramsara, b. Untwaliya, and c. Khasoli villages in consultation with Panchayat (~ 60 solar light in each village @ Rs. 3,333/per unit including installation cost).	2 {Activity 2 (a)}	2 {Activity 2 (a)}	2 {Activity 2 (a)}	**6**
3.	Installation of RO plant, Water ATM Room & water Tanki in Untwalia and Ramsara Villages a. Installation of RO Plant (800 ltr/hrs) (Rs. 3.0 lacs/-) b. Construction of Water ATM Room of 20 m2 size (Rs. 3.0 lacs /-) c. Construction of Water Tanki (Rs. 0.5 Lacs /-) d. O and M of the RO Plant for 03 Years (Rs. 025/year)	13 {Activity 3 (a, b, c)}	0.05 {Activity 3 (d)}	0.05 {Activity 3 (d)}	13.1
4.	Two Roof Top Rain water harvesting structures in each Govt. Schools at a. Government Secondary School, Untwaliya; b. Government Secondary School, Ramasar and c. Government Senior Secondary School Dhani D.S. Pura (~ 50,000 per rain water harvesting structure)	1 {Activity 4 (a)}	1 {Activity 4 (b)}	1 {Activity 4 (c)}	**3**
Sub Total		**16.8**	**3.85**	**3.85**	**24.5**
B.	**School/Educational Development Activities**				
5.	Need and priority based distribution of furniture (Desk and chair) in a. Government Secondary School, Untwaliya; b. Government Secondary School, Ramasar and c. Government Senior Secondary School Dhani D.S. Pura, Churu in consultation with Education Officials (Rs. 3000 @ one pair of desk and chair)	1 {Activity 5 (a)}	1 {Activity 5 (b)}	1 {Activity 5 (c)}	**3.0**
Sub Total		**1**	**1**	**1**	**3**
C.	**Agro-based Development**				
6.	Vocational training and skill development program Rs. 10000/- per student for motor winding, cooler and TB repairing, household item making, tailoring, embroidery, computer coaching, bag making, spices preparation etc. and construction of skill development centre at villages Churu, Untwaliya (~ 70 students).	2.5	2.5	2	**7**
7.	Awareness Camps for Local Farmers: organic farming, new agricultural technic, soil quality, promotion of vegetable / cash crop farming and horticulture. Total 8	2	2	2	**6**

S. No.	Activity	Expenditure			
		1st Year	2nd Year	3rd Year	Total
	{Ramsara, Untwaliya, Dhani Pannesingh, Khasoli, Hunatpura, Thailasar, Dhani Doongarsinghpura, Lalpura (SD Sujangarh)} number of villages will be covered covering total beneficiaries about 200 farmers.				
Sub Total		**4.5**	**4.5**	**4**	**13**
Total		**22.3**	**9.35**	**8.85**	**40.5**

***** *The activities given in the above table are excluding the Pollution control and mitigation measures, which are included in EMP cost [Capital Cost: Rs. 150 Lacs & Annual Recurring cost: Rs. 35 Lacs/annum].*

****** *The activities given in the above table are excluding the funds allocated for Occupational and Safety Hazards which is Rs. 29 Lacs per annum.*

*****

M/s Krishnum Dyes & Intermediate Pvt Ltd

Risk Assessment study

Address:- Khasara no. 670/521 of Revenue Village – Untwalia, Tehsil & District – Churu Rajasthan, India.

TABLE OF CONTENT

Executive Summery

The work described in this report is the results of concerning the consequence analysis of possible accidental releases of various flammable and Toxic chemicals at their Churu Plant.

These QRA studies were conducted using consequence modelling tools that provide the consequence predictions based on simple analytical methods and typically fail to incorporate effects of obstructions and congestions present at the site. The effects can be significant in the physics that governs the development of vapour clouds as well as in resultant overpressures from explosion of such vapour clouds. These can result in significantly different overpressures in consequence analysis if the presence of obstructions and congestion are significant at the site.

Based on level of hazards present, the report focus on the accidental release the chemicals having flammable and toxic property. After review of the plot plans, it was decided by that for the chemical release, the consequence results from simple analytical methods of analysis for Churu site.

The following accidental worst-case scenarios of the chemicals are considered for this study:

1. Dispersion of outlet pipeline from underground Methanol tank rupture (10 MT) rapid and slow & steady pool evaporation.
2. Dispersion of Oleum 23% (20 KL) rapid and slow & steady pool evaporation.
3. Dispersion of Sulphuric acid (20 KL) rapid and slow & steady pool evaporation.
4. Dispersion of Hydrochloric acid (10 KL) rapid and slow & steady pool evaporation.
5. Dispersion of benzoyl Chloride (200 ltr) rapid and slow & steady pool evaporation.
6. Dispersion of Bromine (3 Kg bottle) rapid and slow & steady pool evaporation.
7. Fn curve – Cumulative Frequency

The study focuses on:

I. Basis for Chemical Dispersion Modelling
II. Dispersion model development and validation
III. Review of consequences from each accidental scenario
IV. Possible mitigations measures to avoid the scenario to be happen.

The results (Analysis and Interpretation) are explained in the report.

The summary of consequence analysis is presented below:

Table 01: Summary of conclusion for prevailing wind condition from NE to SW

Case No.	Chemical	Type of Hazard	Height of Release (mtr)	Gas Dispersion from leak location Horizontal Distance(mtr)
1	Methanol	Flammable	1	3.5mtr
2	Oleum 23%	Toxic	1	23.50mtr
3	Sulphuric acid	Toxic	1	16.50mtr
4	Hydrochloric acid	Toxic	1	34.50mtr
5	Benzoyl Chloride	Toxic	1	3.50mtr
6	Bromine	Toxic	1	3.50mtr

It is concluded that safety of the plant, process and product (chemicals) will be accomplished post implementation of the recommendations raised in this report. The impact due to leakages if any will be restricted well within the boundary of the Plant.

The present plant, is utilise the improved method, which is delivered through QRA software. This report presents an overview of a practical application the QRA study. It describes the process involved in creating the QRA model, the improved modelling, the range of information that can be generated from the software and how this information can provide input to key decisions and engage the range of non-specialist stakeholders.

Objectives

The main objectives of this Risk Assessment (RA) study are :

- Identification of vulnerable units with resources to hazard indices,
- Generation of release scenarios for escape of toxic/flammable chemicals from facilities along the Plant,
- Estimation of damage distances for the accidental release based on different scenarios,
- Estimation of probability of occurrence of hazardous event through event tree analysis,
- Modelling of chemical dispersion from buried pipeline due to leak and its dependency on various parameters,
- Suggestion of risk mitigation measures for storage facilities at plant

- Determine damage due to major hazards having damage potential to life & property and provide a scientific basis to assess safety level of the plant.

The principle objective of this study was to identify major risks in the manufacture of specialty fine chemicals and storage of hazardous chemical at site and to evaluate on-site & off-site consequences of identified hazard scenarios. Pointers are then given for effective mitigation of hazards in terms of suggestions for effective disaster management, suggesting minimum preventive and protective measures & change of practices to ensure safety.

Another area of simplicity in QRAs is the estimate of immediate fatality rates for fire scenarios. They are often informed by external consequence modelling which the analyst needs to interpret and turn into a set of input data, but there are few tools which model fires accounting for the specifics of the platform such as congestion and confinement.

Finally, whilst traditional QRAs might carry out time dependent release rate calculations, this is not normally transferred to the calculation of fatalities during the mustering phase following a hydrocarbon release.

Project Scope

The scope of the present report is to carry out risk assessment for the Plant. Standard industry practices are considered while carrying out risk assessment study. M/s QMS India Limited were requested to perform a consequence analysis to assess the consequence of the accidental scenarios on M/s Krishnum Dyes & Intermediate Pvt Ltd, Khasara no. 670/521 of Revenue Village – Untwalia, Tehsil & District – Churu Rajasthan, India.

Modelling was conducted using the software tool considering the IDLH values for toxicity, LFL and UFL values for flammability, Inventory, molecular weight and their leak locations are the main parameters to select the accident scenarios.

Based on the issued assumption and input data provided by the Client, following toxic and flammable release scenarios are decided to be modelled using 3D CFD technology for detailed dispersion analysis.

Sr.No.	Chemical	Hazard	Type of Failure Possible	Leak Size Hole Diameter	Chain of events
1	Methanol	Flammable	leakage from storage tank	Full bore rupture	Liquid Release → Pool Evaporation→ **Flammable Dispersion of Toluene Vapour**
2	Oleum 23%	Flammable	leakage from storage tank	Full bore rupture	Liquid Release → Pool Evaporation→ **Flammable Dispersion of Oleum**
3	Sulphuric acid	Toxic	leakage from storage tank	Full bore rupture	Liquid Release → Pool Evaporation→ Toxic **Dispersion of Sulphuric Acid**
4	Hydrochloric acid	Toxic	leakage from storage tank	Full bore rupture	Liquid Release → Pool Evaporation→ Toxic **Dispersion of Hydrochloric Acid**
5	benzoyl Chloride	Toxic	leakage from transfer pipeline of 40 mm	Full bore rupture	Liquid Release → Pool Evaporation→ Toxic **Dispersion of Benzoyl Chloride**
6	Bromine	Toxic	leakage from Chlorine tonner	16 mm	**Toxic Dispersion of Chlorine gas**

Project Objective:-

Any scenario in the process safety is an unplanned event or incident sequence that results in a loss event and its associated impacts, including the success or failure of safeguards involved in the incident sequence.

Consequence is a result of specific event. For qualitative evaluation, the consequences are the effects following from the initiating cause by taking the description from the lost event impacts. In the context of quantitative risk analysis, it refers to the physical effects of the loss event usually involving a fire, explosion or release of toxic or corrosive material.

Similarly, consequence analysis is the analysis of the expected effects of incident outcome cases, independent of frequency or probability. Selecting a scenario and carrying out the consequence analysis of the selected scenario is the primary objective of this study.

The secondary objective of the study is to provide recommendations by suggesting device, system or action that would likely interrupt the chain of events following an initiating cause or that would mitigate loss event impacts. For the secondary objective to meet, it is necessary for the analyst, who is carrying the consequence analysis, to understand the hazards - the risks – and the existing safeguards (preventive, protective and mitigative), already in place.

These safeguards are depicted from the documents provided by the client to us. Examination of the documents and the analysis of the expected effects of the incident outcome will help in finding the missing gap in layers of protection. Providing the suggested extra layer will strengthen to interrupt the chain of events that would either help in preventing the scenario (unplanned event) or additionally help in mitigating loss event impact.

Properties of Scenario Chemical (Raw Materials):-

S.N.	Name of Chemical	Properties							NFPA		
		State	Boiling Point (°C)	Melting Point/ Freezing point (°C)	Flash Point (°C)	LELUEL (%)	IDLH (ppm)	TLV (ppm)	Odour Threshold (ppm)	H	F	R
1	Methanol	Liquid	**64.44**	**-97.77**	**11.11**	**6-36.5**	**6000**	**200**	**8.9**	**1**	**3**	**0**
2	Oleum 23%	Liquid	**340**	**14**	--	--	**3**	**0.2**	--	**3**	**0**	**0**
3	Sulphuric acid	Liquid	**330**	**-1.1**	--	--	**15**	**1**	--	**3**	**2**	**0**
4	Hydrochloric acid	Liquid	**50.5**	**-25**	--	--	**50**	**2**	**0.77**	**3**	**1**	**0**
5	benzoyl Chloride	Liquid	**198**	**-1**	**72**	**1.1**	**10**	**1**	**0.041**	**3**	**2**	**0**
6	Bromine	Liquid	**58.8**	**7.2**	**58.8**	--	**3**	**0.2**	**0.05**	**3**	**0**	**0**

Chemical Storage Facility

Details of Storage facility of chemicals is shown in following table

S.No	Chemical	Storage Capacity	Above Ground/ Underground	Storage Temp. (°C)	Operating Pressure (Bar)
1	Methanol	10 KL	Underground	Ambient	1
2	Hydrochloric Acid	10 KL	Above Ground	Ambient	1
3	Sulphuric Acid	20 KL	Above Ground	Ambient	1
4	Oleum 23%	20 KL	Above Ground	Ambient	1
5	Benzoyl Chloride	200 lt	In Barrel	Ambient	-
6	Bromine	3Kg	In Bottle	Ambient	-

Chapter – 2 Company Details

Krishnum dyes & Intermediate Pvt. Ltd have a very strong and experienced after sales service which are also known as Technical Service Department which guides customer to obtain better results from our products. Market for disperse dyes is growing @ 10% per annum, and there are only two major producers in the Industry. Their continuous technological research and product development and superior after sales services will ensure increase in market share and eventually better net sales realization. Strong presence in the value added product. Wide range of product to meet customized need. Long standing relationships with leading consumer Industries.

M/s. Krishnum Dyes & Intermediate Pvt. Ltd. is planning to set up a Proposed Dyes & Intermediates manufacturing project of 150 MT/Month [{Disperse Azo Dyes (All colours) - 100 MT/Month, Coumarine Dyes (All colours)- 25 MT/Month & Methine Dyes (All colours) - 25 MT/Month}], at Khasara no 670/521 of Revenue Village - Untwalia, Tehsil & District - Churu, (Rajasthan).

2.1 Project Site:

The company M/s Krishnum Dyes & Intermediate Pvt Ltd is located at Latitude 28°24'18.40"N to 28°24'34.40"N and longitude 75°00'2.94"E to 75°00'3.98"E in Khasara no. 670/521 of Revenue Village – Untwalia, Tehsil & District – Churu Rajasthan, India.

2.2 Process:

Disperse dyes are traditionally non-ionic chemicals with sparing solubility in water which, consequently, are able to retain comparatively better substantivity for hydrophobic fibres, such as polyester, nylon and acetate. For the sake of efficient diffusion into textiles, the particles of disperse dye should be as fine as possible comprising low molecular weight molecules in the range of 400 – 600. It is essential for disperse dyes to be able to withstand various dyeing conditions, pH and temperature, resulting in negligible changes in shade and fastness.

Disperse dyes are often substituted azo, anthraquinone or diphenylamine compounds which are non-ionic and contain no water solubilising groups. The dye particles are thus held in dispersion by the surface-active agent and the dyes

themselves are called disperse dyes. They are marketed in the form of either an easily dispersible powder or a concentrated aqueous dispersion and are now the main class of dye for certain synthetic fibres

Diazotization: Taken stirrable water in small HDPE Tank charged PCONA (para choro Ortho Nitro Aniline), charged HCl (31 %) stirring- cooling O °C by ice addition of NaNO2 solution C.R S.T positive prepare diazo.

Coupling: In HDPE tank taken stirrable water and charged soda ash heated to 70 °C and charged HMQ (n methyl 4 hydroxy quinoline) stirring cooling and received diazo from small wooden vet adjusted pH -7 to 8 by soda – heated to 90 °C cooling filtration washing- sand milling -spray drying and packing.

Azo disperse dyes Azo dyes are defined as compounds containing at least one azo group attached to sp^2- hybridized carbon atoms, such as benzene, naphthalene, thiazole and thiophene. Under normal conditions, azo dyes exist in the more stable planar tras-form so that the carbon nitrogen bond angle is approximately 120 (Gordon & Gregory, 1983).

Azo dyes are by far the most important class and account for more than 50% of the total commercialized disperse dyes in the world. There are several reasons why azo dyes have dominated the markets and have replaced many of the conventional anthraquinone dyes. In principal, the azo group is an inherently intense chromophore in terms of the tinctorial strength, when compared with the comparatively weak anthraquinone chromogen, normally 2 or 3 times stronger in tinctorial strength. By virtue of their simplicity and the ease of manufacture, unlike the other types of dyestuffs such as anthraquinone and styryl, the cost of manufacturing azo dyes is comparatively lower than the expensive anthraquinone dyes.

Azo dyes cover a whole gamut of colours, from yellow to blue-green hues, by varying the intermediates especially when heterocyclic diazo components are coupled to aminobenzene couplers substituted with powerful electron donating groups, giving bright blue-green colours. Although some deficiencies of azo dyes are not easily overcome, such as duller shades, lower fastness to light and breakdown

into carcinogenic amines derived from the cleavage of the azo linkage, and have somewhat restricted their extensive usage against anthraquinone dyes, the cost effectiveness undoubtedly compensates for the drawbacks mentioned above

Coumarin Synthesis The Pschorr coumarin synthesis involves the reaction of phenols with ββ-keto esters in the presence of a condensing agent. The history of coumarin's synthesis began in the mid of 19th century by W.H. Perkin in his famous first synthesis of a vegetable perfume.

Coumarin is prepared by treating the sodium salt of ortho-hydroxybenzqaldehyde with acetic anhydride. It involves other methods which has been developed by Pechmann Claisen, Knoevenagal, Reformatsky and Wittig for the synthesis of pyrone-ring moieties in coumarins.

Methine dyes - Methine dyes with longer chains are obtained by reaction with malonaldehyde, glutaconaldehyde, or their derivatives. ... Diazamethine dyes are prepared from heterocyclic azo dyes that are obtained by diazotizing heterocyclic amines and coupling with aromatic or heterocyclic coupling components.

2.3 Dispersion modelling

Release of Chemicals is very common in accident situation. Such hazardous chemicals are release in the environment in case failure of storage tank, pipe network, valve failure or complete failure of vessel. It is very complex to estimate dispersion manner of such complex situation.

Dispersion modelling technique is used in this study to estimate the concentration and time profile of release hazardous chemical. In most cases, release chemical forms a vapor cloud, Explosion and travel in the down ward wind direction. So it is very important to account for the weather condition in such study along with the other following factor.

a. Density of the air compared to air
b. The rate of release
c. Orientation of release
d. Weather stability
e. Wind speed and direction

These gases can react with air and water which has significant effect in calculations in dispersion modelling. The level of effects on people of such material depends on concentration and time of exposure. It is very difficult to estimate the size of cloud and accurate concentration with time. To avoid such problems, it is good to assume certain constants. For safety reasons, the assumption is always based on the worst condition scenario.

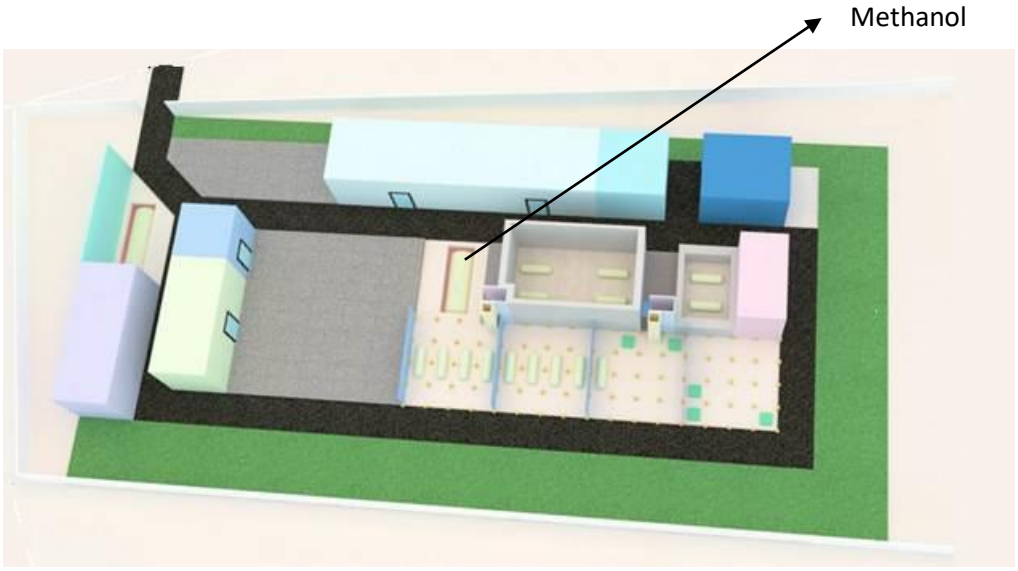
The Consequence analysis study is carried out for the storage tank, pipelines such as Methanol is stored in underground storage tank where the impacts are negligible and Hydrochloric Acid, Sulphuric Acid, Oleum 23%, Benzoyl Chloride, Bromine etc are stored in aboveground storage tank where the impacts is calculated through dispersion modelling and risk contours maps are generated are per the standard data available.

Methanol Hazards

Methanol can cause an immediate risk of fire or explosion and burns with a clean clear flame that is almost invisible in daylight. Concentrations of greater than 25% of

Methanol in water can be ignited. Methanol releases vapors at ambient temperatures, when mixed with air this substance can burn in the open- atmosphere or explode. Vapors generated from methanol are heavier than air, it may have tendency to travel at the ground level and may reach the point of ignition and leads to flash back. Accumulations of these vapors generated from Methanol in confined spaces such as buildings may explode, if ignited. Methanol storage containers rupture violently, if exposed to fire or excessive heat for sufficient time duration. Estimated Heat Radiation Levels due to Methanol Tank Accidental Fires is given in Table. Heat Radiation Contours due to Accidental Fire of Methanol Tank and Individual risk contours for Methanol is given in Figure. The Methanol storage tank pipeline details are as follows: -

S.No	Pipe No./Name	Storage Tank Capacity	Leak rate (Kg/s)	Operating Temperature (^oC)	Operating Pressure (Kg/cm^2)	Prevailing Wind Direction & Speed [m/s]
1	Methanol	10KL	1.1	Ambient	Ambient	NE-SW 3

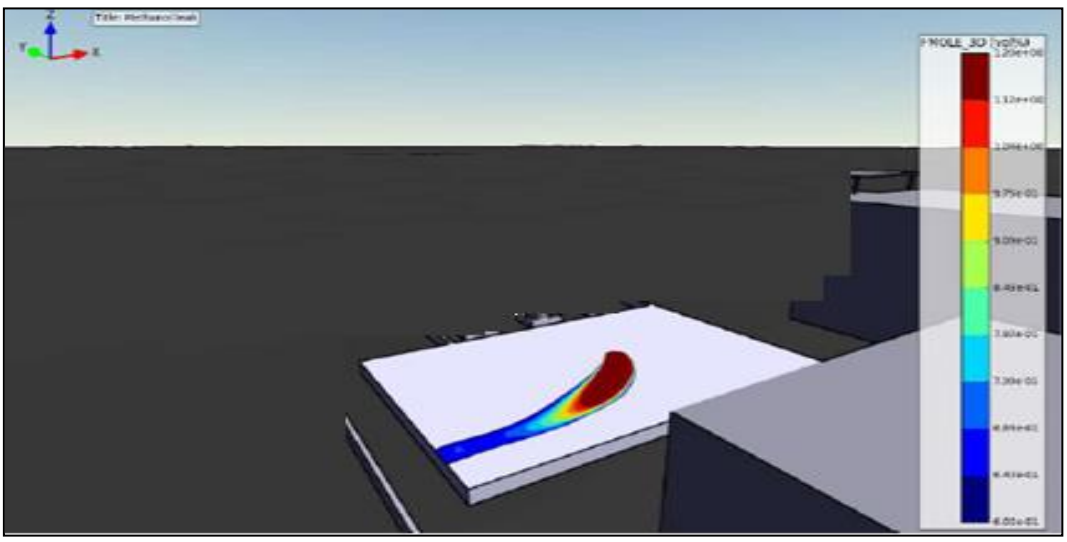


Plot description Methanol Dispersion

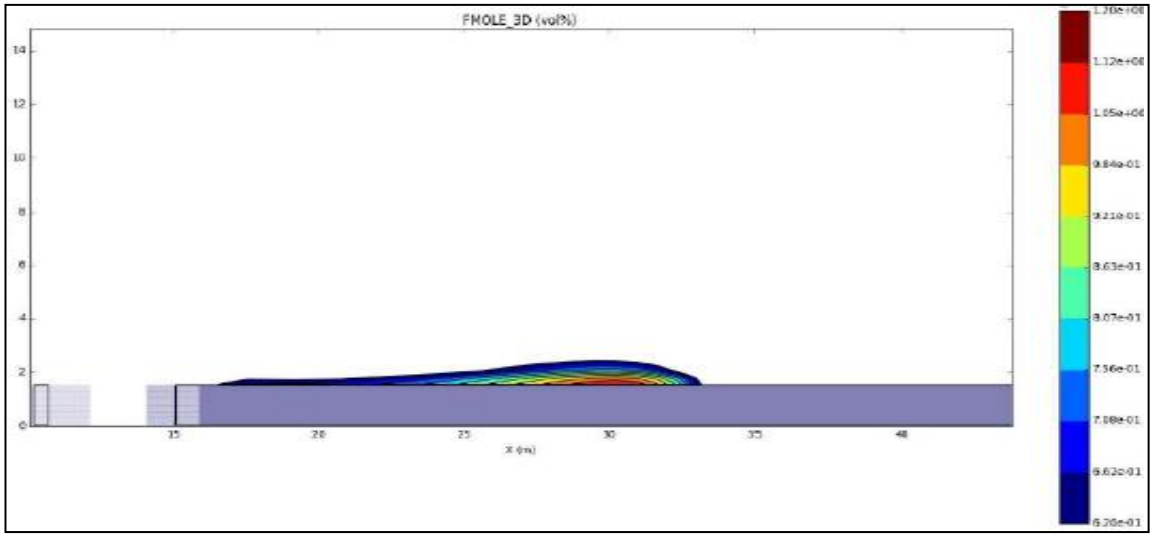
Simulated data are collected and presented in 2D cut plane plots and 3D volume plots. 2D cut plane plots show the variable value for every grid cell (in the selected 2D plane) at selected times and 3D volume plots show the boundaries of the concentration for the specified value. 2D cut plane plots have been used to illustrate the flammable gas concentration at various time instances on vertical and horizontal planes. 3D volume plots have been used to show the propagation of the concentrated cloud with wind at various time instances.

The accidental leak from transfer pipeline connecting underground tank of Methanol inventory was considered for the simulations. Simulations were performed to capture the Methanol dispersion, its mixing with air and further dilution for the prevailing wind condition which is NE to SW.

The Simulations were performed to capture the dispersion of the Methanol, its mixing with air and dilution and then cloud movement based on the prevailing wind condition. The resulting cloud was simulated for 10 Min after the leak. The leak started at 1.5 min of simulation time. The Methanol cloud is stabilized at 6.3 Min after the leak is started for the flammable gas concentrations (10% LFL). The maximum distance covered by cloud at 6 Min sec is shown in below Figure which is indise the plant boundries.



The concentrations were scaled between 0.6 – 1.2 vol % which is 10 to 20% LFL of Methanol. In below Figure, the Blue colour represent the 10% flammable concentration contour. The flammable gas cloud stays within the plant boundary and spread up-to wall of plant towards south west direction.



Chemical Modelling

Methanol

Distance table and effect of chemicals Concentration

Scenario	Causes	Failure Frequency Per Year	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 30/Hectare Population density
Tank rupture 1 min rapid Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	1	5.34	0.61	8	0.6	0.0691488	32.789635	0.00260
Tank rupture slow and steady Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	1	5.11	0.53	8	0.95	0.0363110	17.218285	0.00114

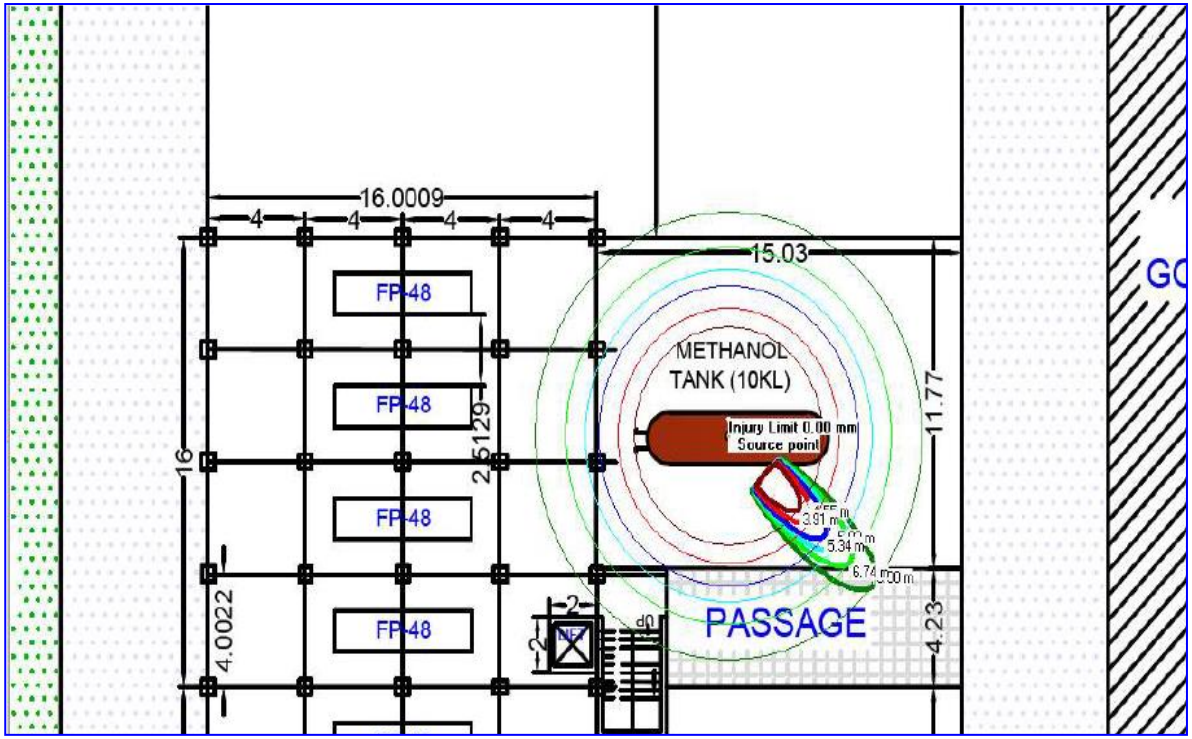
Estimated distance

S.No	Description	Event	Impact Criteria PPM	Distance of Max. ISOPleth from source	Time (Sec)	ISOPleth Angle	Isopleth Area (Ha)
1	Methanol storage	Dispersion of Vapor cloud	100	3.50	0.98	6.36	0.00012
2		Tank rupture slow and steady Pool evaporation	90	3.50	1.10	9.09	0.00021

Probability Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc. (ppm) along X-axis	Dose (mg)	Absolute	
							Fatality No.	Injury No.
2.1	0	0	0.53	<0.001	320.71	0	0	0
4.9	0	0	1.23	<0.001	64.88	0	0	0

Scenario-1 Methanol Tank rupture 1 min rapid Pool Evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Methanol Tank UG 10KL
Name of Chemical : Methanol
Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.37
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 222.33
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 5.31
MGC Distance (m) : 14.00
Explosion mass (lbm) : Mass = 0
Time for stabilization concentration zones of dispersion (Secs) 2.00

*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 1	100	2.00	3.91	0.98	1.91	0.78	3.50	6.36	0.00012
Conc. 2	75	2.00	4.55	1.14	2.55	0.29	4.50	1.85	0.00006
Conc. 3	55	2.00	5.34	1.34	3.34	1.22	5.50	6.33	0.00032
Conc. 4	45	2.00	5.93	1.48	3.93	0.97	5.50	5.04	0.00030
Conc. 5	35	2.00	6.74	1.69	4.74	0.79	6.50	3.48	0.00029
Conc. 6	25	2.00	8.00	2.00	6.00	1.20	7.50	4.57	0.00057

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

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Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -5.06 +1(Ln(Conc 1.98 x Time)

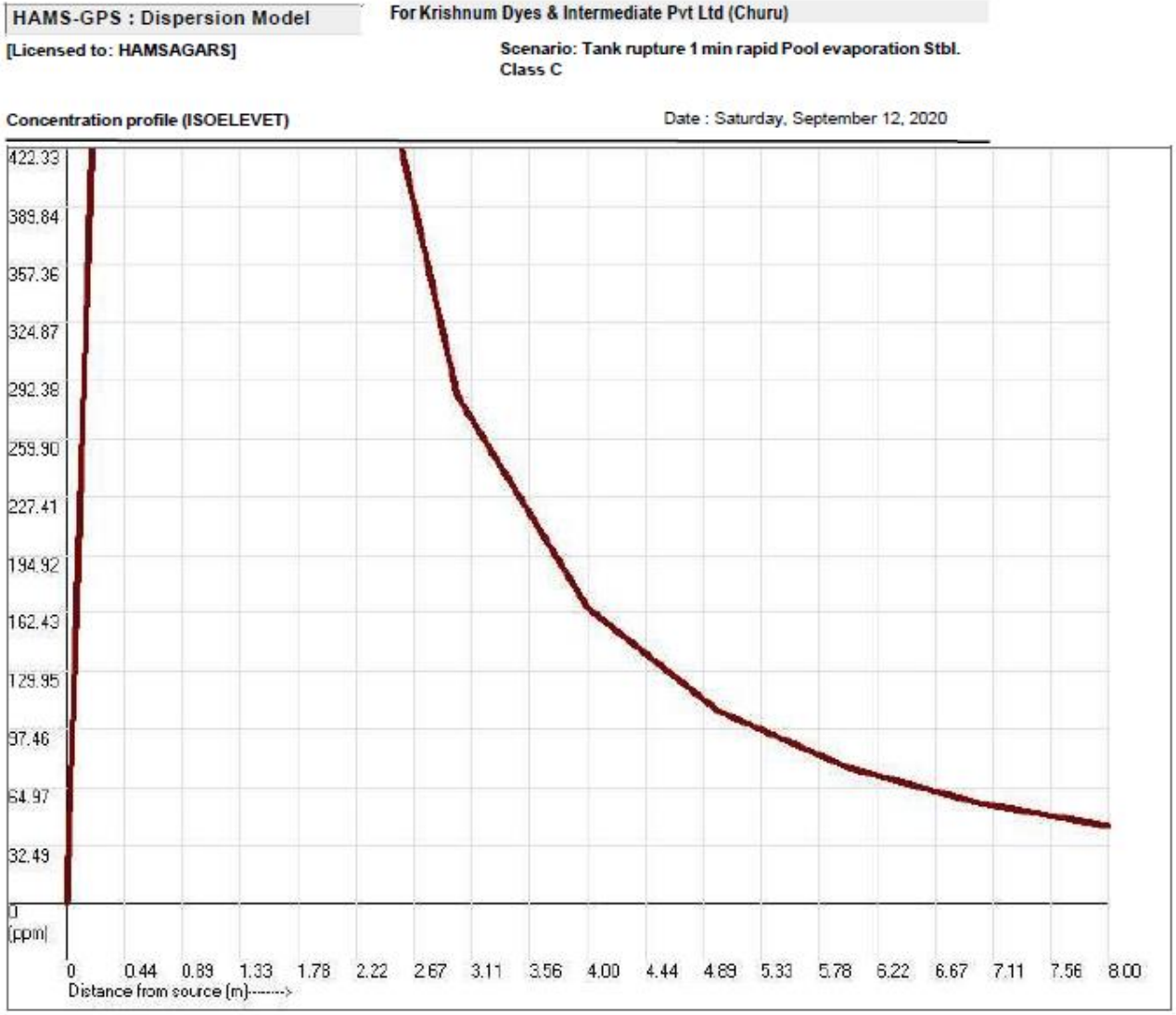
T = time 30 min of exposure

Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	320.71	0	0	0
2.5	0	0	0.63	<0.001	231.71	0	0	0
2.9	0	0	0.73	<0.001	175.48	0	0	0
3.3	0	0	0.83	<0.001	137.6	0	0	0
3.7	0	0	0.93	<0.001	110.84	0	0	0
4.1	0	0	1.03	<0.001	91.21	0	0	0
4.5	0	0	1.13	<0.001	76.37	0	0	0
4.9	0	0	1.23	<0.001	64.88	0	0	0
5.3	0	0	1.33	<0.001	55.79	0	0	0
5.7	0	0	1.43	<0.001	48.48	0	0	0
6.1	0	0	1.53	<0.001	42.51	0	0	0
6.5	0	0	1.63	<0.001	37.57	0	0	0
6.9	0	0	1.73	<0.001	33.43	0	0	0
7.3	0	0	1.83	<0.001	29.93	0	0	0
7.7	0	0	1.93	<0.001	26.95	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
422.33
389.84
357.36
324.87
292.38
259.90
227.41
194.92
162.43
129.95
97.46
64.97
32.49
0
(ppm)
0 0.44 0.89 1.33 1.78 2.22 2.67 3.11 3.56 4.00 4.44 4.89 5.33 5.78 6.22 6.67 7.11 7.56 8.00
Distance from source (m)------>

HAMS-GPS : Dispersion Model
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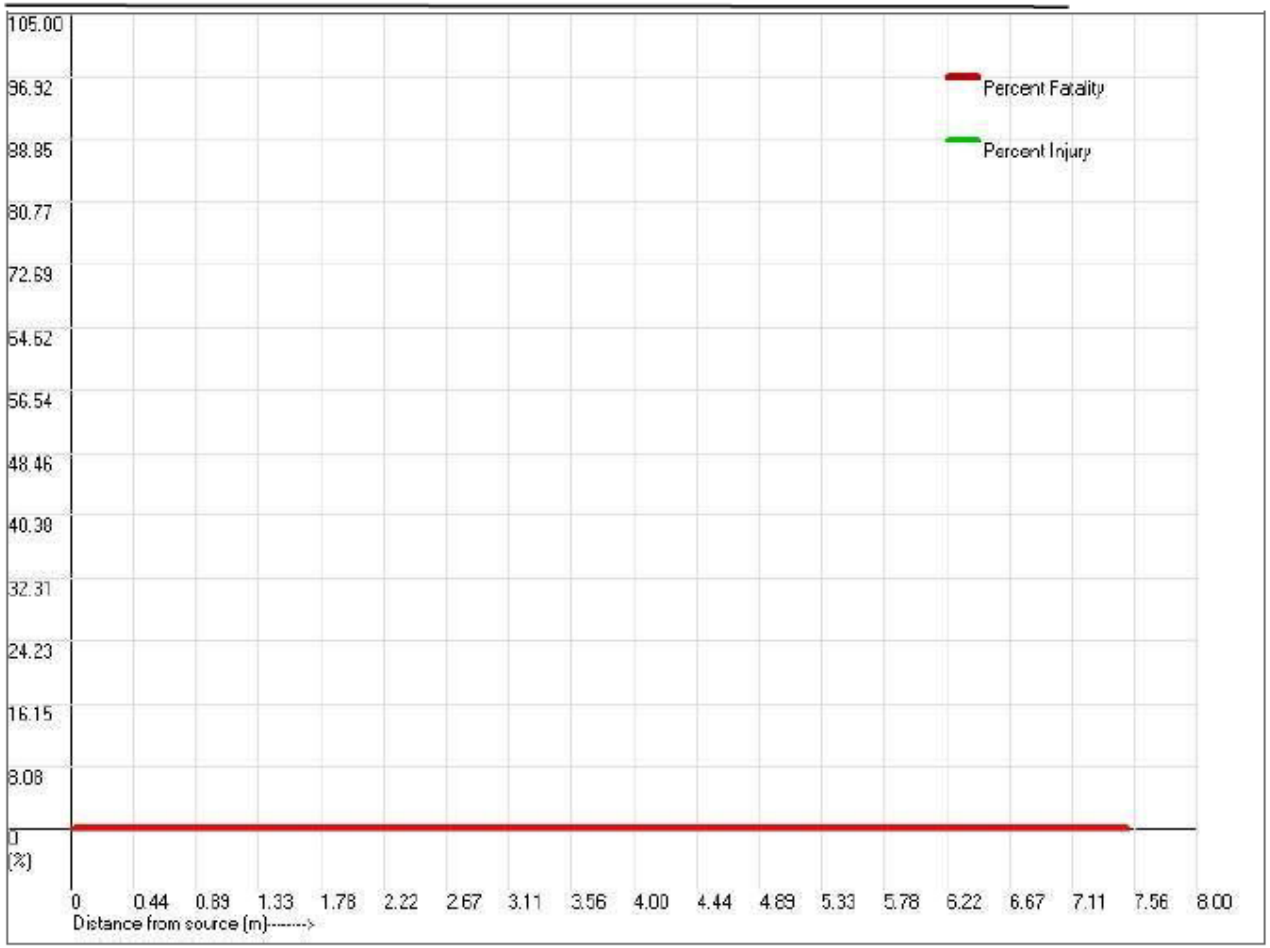
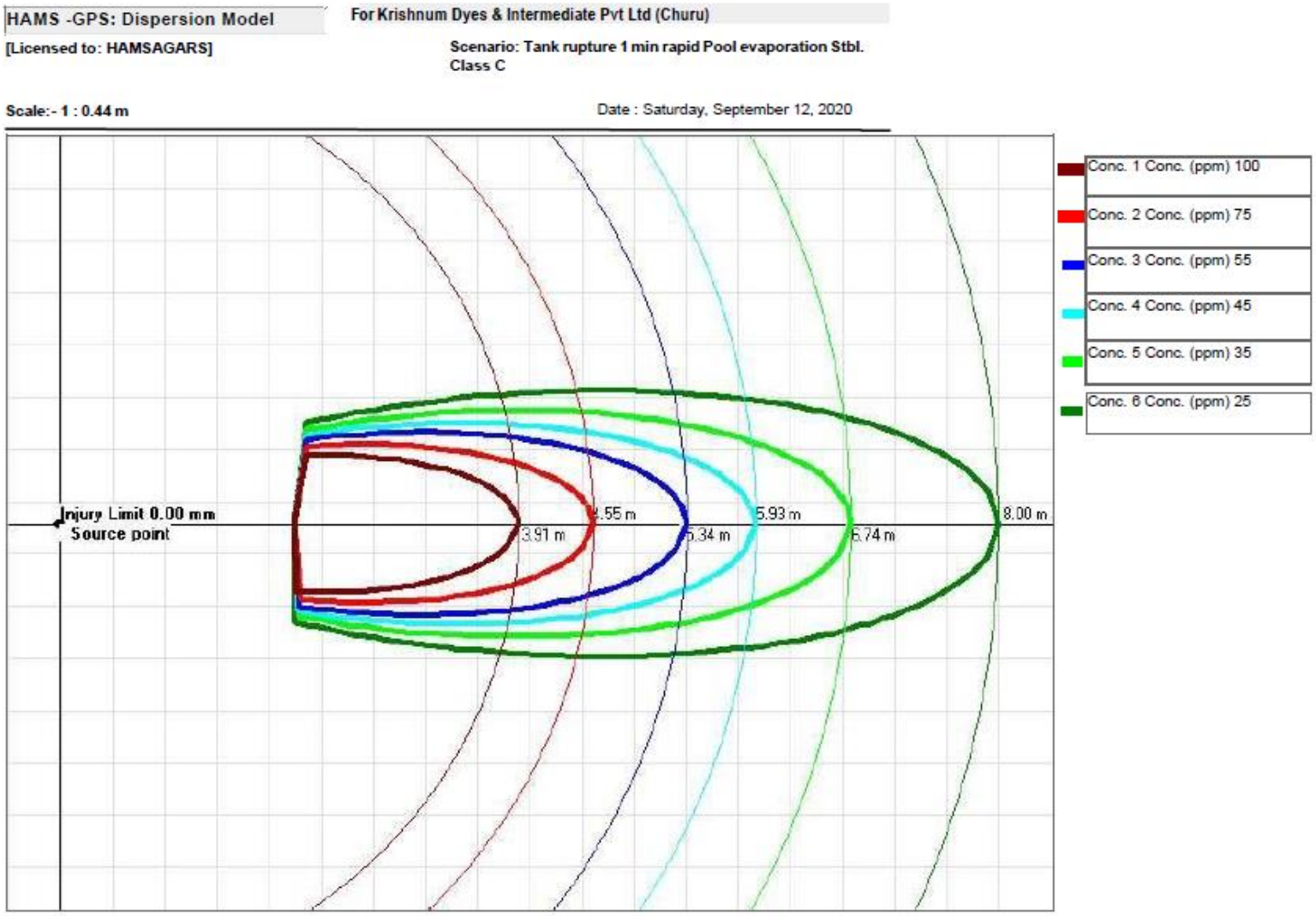
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

Scenario: Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Scale:- 1 : 0.44 m
Date : Saturday, September 12, 2020
Conc. 1 Conc. (ppm) 100
Conc. 2 Conc. (ppm) 75
Conc. 3 Conc. (ppm) 55
Conc. 4 Conc. (ppm) 45
Conc. 5 Conc. (ppm) 35
Conc. 6 Conc. (ppm) 25
Injury Limit 0.00 mm
Source point
3.91 m
4.55 m
5.34 m
5.93 m
6.74 m
8.00 m

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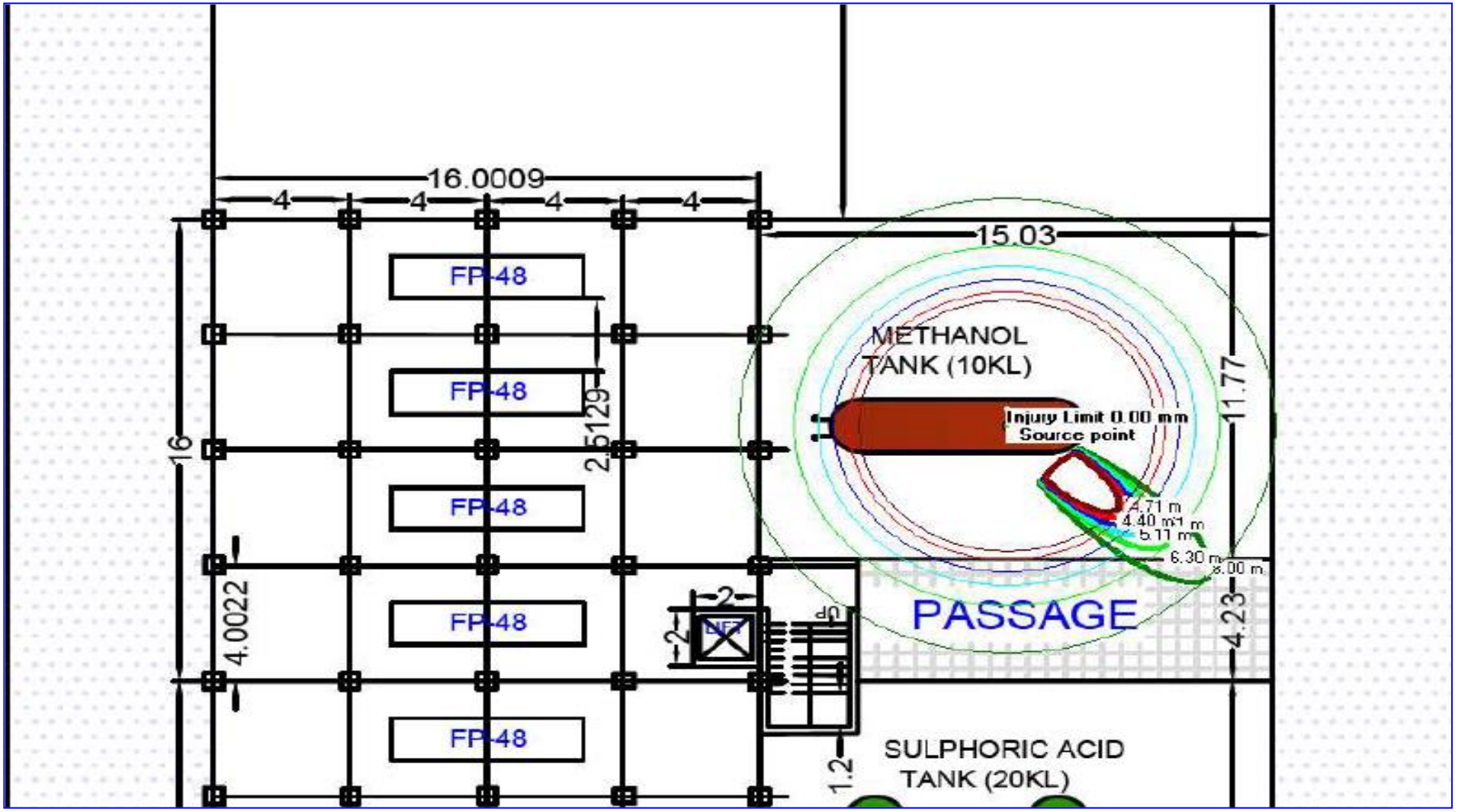
Scenario-2 Methanol Tank rupture slow and steady Pool Evaporation



HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Methanol Tank UG 10KL
Name of Chemical : Methanol
Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.37
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 222.33
MGC (ppm) : 5.31
Explosion mass (lbm) : Mass = 0
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC Distance (m) : 14.00
Time for stabilization concentration zones of dispersion (Secs) 2.00

*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 1	80	2.00	4.40	1.10	2.40	1.12	3.50	9.09	0.00021
Conc. 2	70	2.00	4.71	1.18	2.71	1.28	3.50	10.36	0.00027
Conc. 3	60	2.00	5.11	1.28	3.11	1.05	4.50	6.65	0.00026
Conc. 4	50	2.00	5.61	1.40	3.61	1.39	4.50	8.78	0.00039
Conc. 5	40	2.00	6.30	1.58	4.30	1.31	5.50	6.79	0.00044
30Conc. 6	25	2.00	8.00	2.00	6.00	1.90	6.50	8.31	0.00090

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

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[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit(y) -10.12 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -5.06 +1(Ln(Conc 1.98 x Time)

T= time 30 min of exposure

Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	320.71	0	0	0
2.5	0	0	0.63	<0.001	231.71	0	0	0
2.9	0	0	0.73	<0.001	175.48	0	0	0
3.3	0	0	0.83	<0.001	137.6	0	0	0
3.7	0	0	0.93	<0.001	110.84	0	0	0
4.1	0	0	1.03	<0.001	91.21	0	0	0
4.5	0	0	1.13	<0.001	76.37	0	0	0
4.9	0	0	1.23	<0.001	64.88	0	0	0
5.3	0	0	1.33	<0.001	55.79	0	0	0
5.7	0	0	1.43	<0.001	48.48	0	0	0
6.1	0	0	1.53	<0.001	42.51	0	0	0
6.5	0	0	1.63	<0.001	37.57	0	0	0
6.9	0	0	1.73	<0.001	33.43	0	0	0
7.3	0	0	1.83	<0.001	29.93	0	0	0
7.7	0	0	1.93	<0.001	26.95	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
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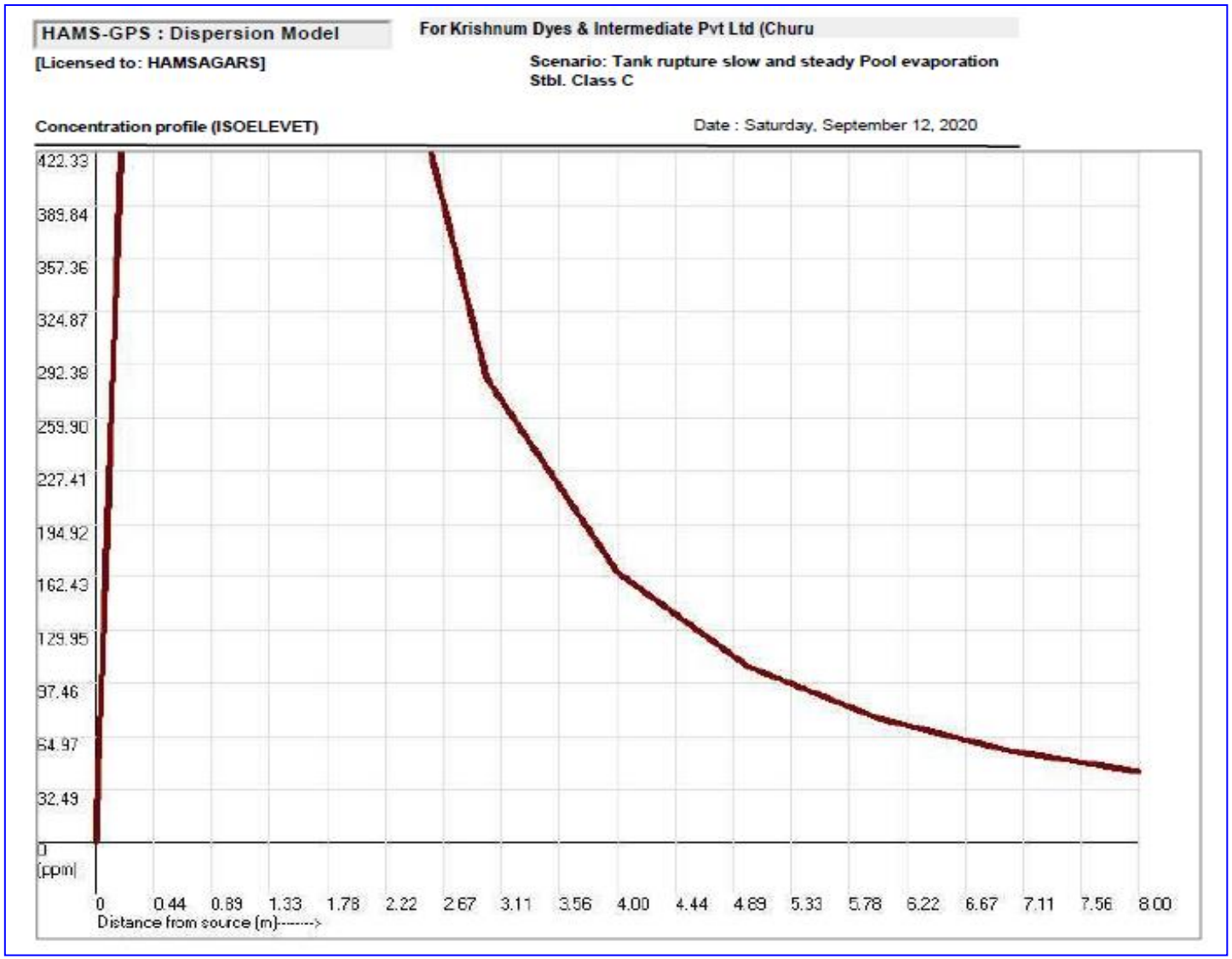

HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu
[Licensed to: HAMSAGARS]
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
422.33
389.84
357.36
324.87
292.38
259.90
227.41
194.92
162.43
129.95
97.46
64.97
32.49
0
(ppm)
0 0.44 0.89 1.33 1.78 2.22 2.67 3.11 3.56 4.00 4.44 4.89 5.33 5.78 6.22 6.67 7.11 7.56 8.00
Distance from source (m)------>

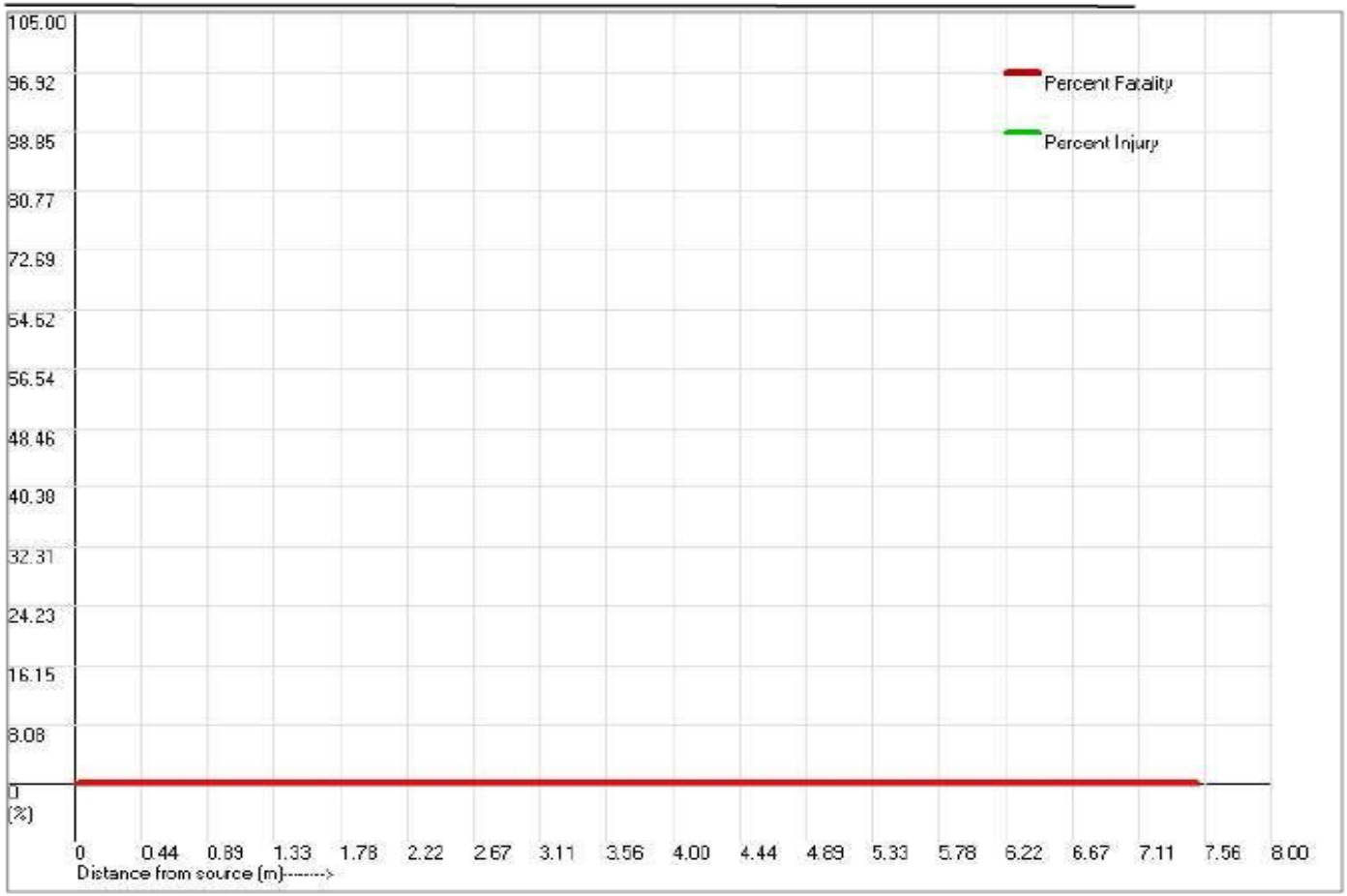
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

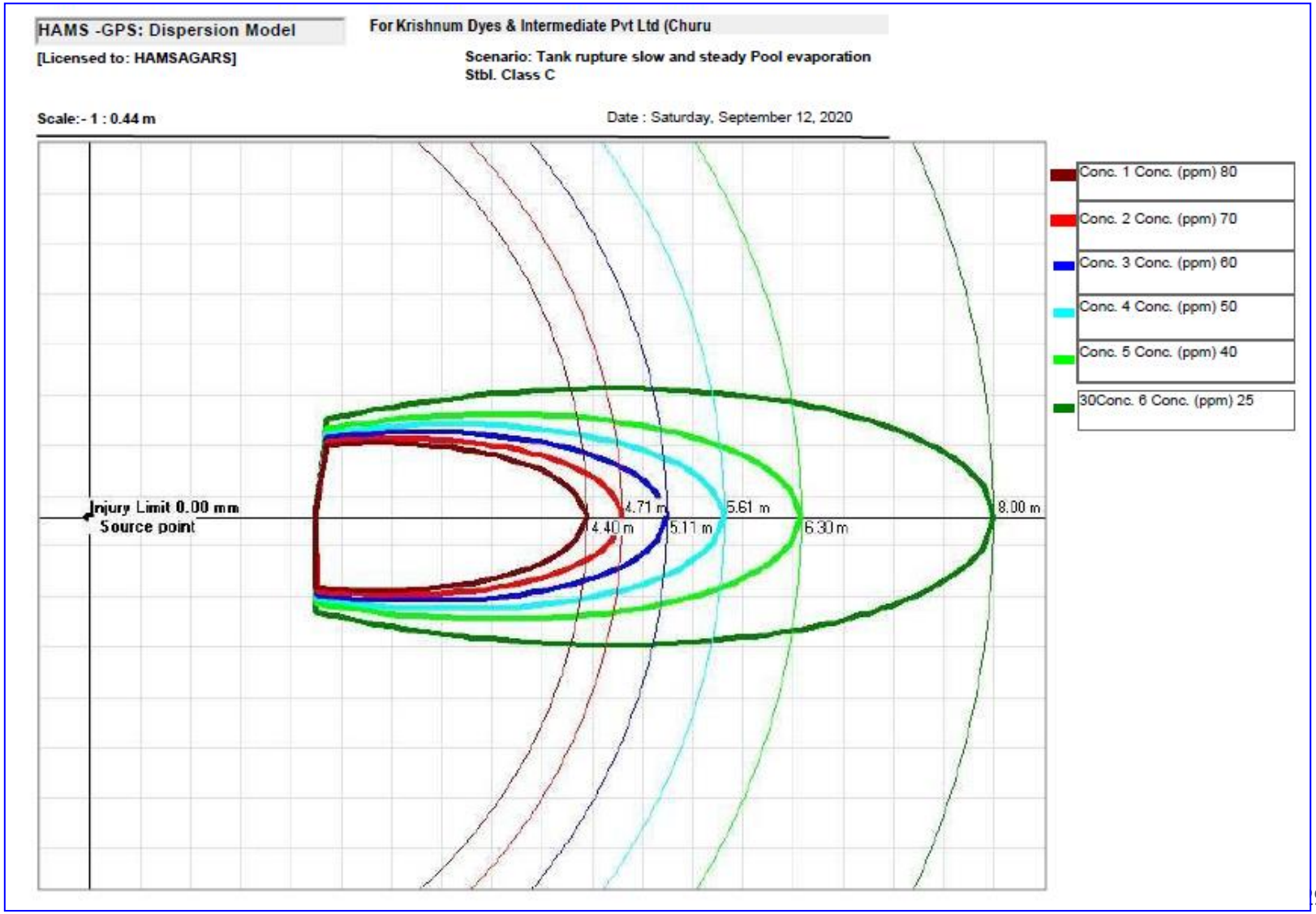
For Krishnum Dyes & Intermediate Pvt Ltd (Churu

Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C

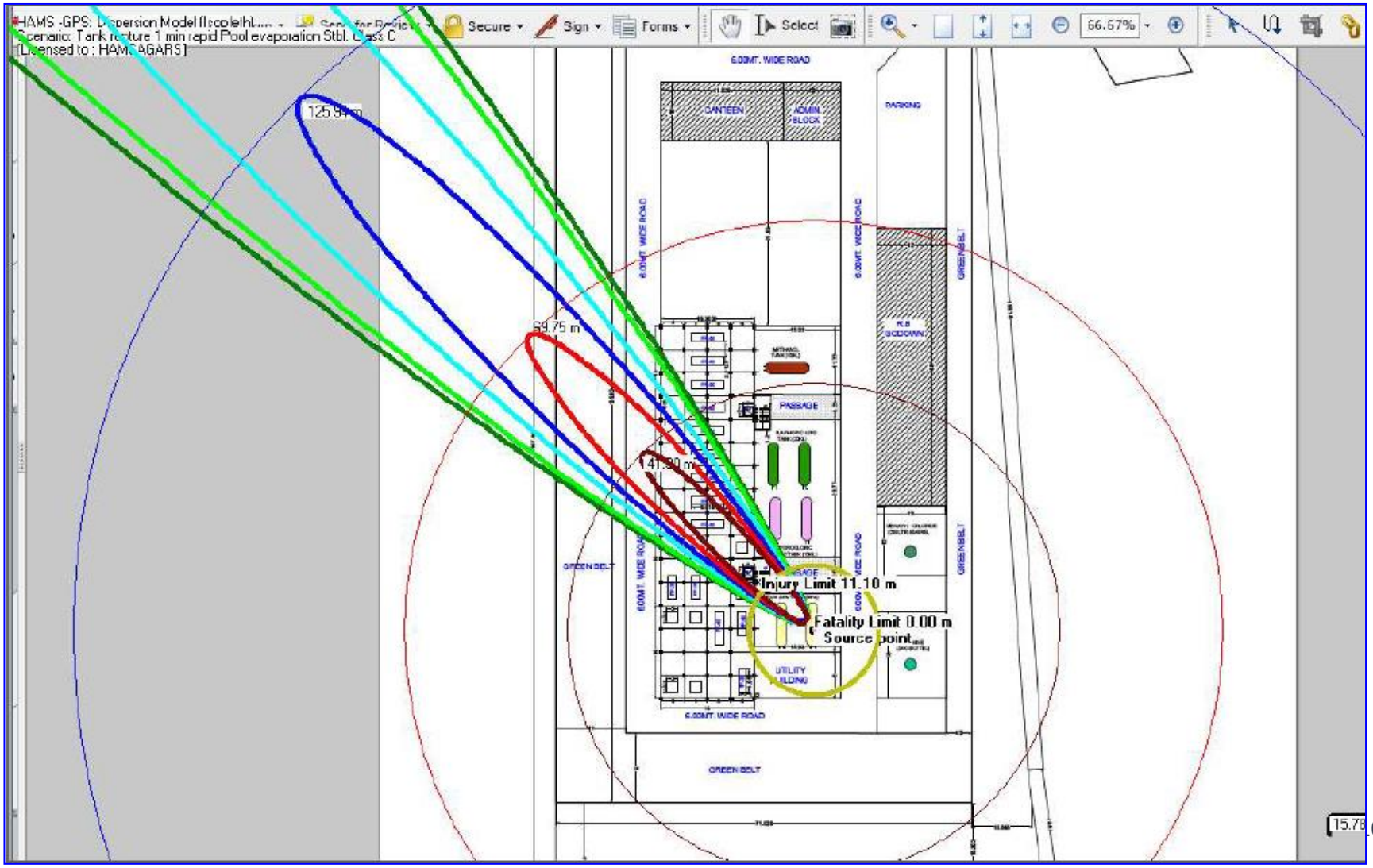
Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 0.44 m
Date : Saturday, September 12, 2020
Conc. 1 Conc. (ppm) 80
Conc. 2 Conc. (ppm) 70
Conc. 3 Conc. (ppm) 60
Conc. 4 Conc. (ppm) 50
Conc. 5 Conc. (ppm) 40
30Conc. 6 Conc. (ppm) 25
Injury Limit 0.00 mm
Source point
4.40 m
4.71 m
5.11 m
5.61 m
6.30 m
8.00 m

Scenario-3 Oleum 23% Tank rupture 1 min rapid Pool evaporation



Oleum 23%

Distance table and effect of chemicals Concentration

Scenario	Causes	Failure Frequency Per Year	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 30/Hectare Population density
Tank rupture 1 min rapid Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	2	125.94	8.21	946.59	49.93	0.0044672	2.118316	0.02670
Tank rupture slow and steady Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	2	37.78	2.71	272.79	16.74	0.0045691	2.166627	0.00270

Estimated distance

S.No	Description	Event	Impact Criteria PPM	Distance of Max. ISOPleth from source	Time (Sec)	ISOPleth Angle	Isopleth Area (Ha)
1	Oleum 23%	Dispersion of Vapor cloud	50	23.50	10.48	7.12	0.018
2		Tank rupture slow and steady Pool evaporation	50	8.50	3.22	7.51	0.002

Probability Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc. (ppm) along X-axis	Dose (mg)	Absolute	
							Fatality No.	Injury No.
2.1	0	71.61	0.53	<0.001	11838.19	1.59	0	15.038
22.1	0	0	5.53	0.004	136.35	0.0184	0	0

HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Oleum 23% Tank 20KL
Name of Chemical : Oleum 23%
Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : D
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 7.12
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 8293.01
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 120.23
MGC Distance (m) : 19.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 3.95

*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	50	2.00	41.90	10.48	39.90	5.87	23.50	7.12	0.018
Conc. 1	20	2.00	69.75	17.45	67.75	9.99	42.50	6.70	0.053
TEEL3/IDLH:	7.48	2.00	125.94	31.50	123.94	16.41	74.50	6.28	0.160
TEEL2:	2.49	2.00	238.87	59.75	236.87	29.66	138.50	6.11	0.552
TEEL1:	0.5	2.00	618.01	154.58	616.01	68.47	345.50	5.66	3.313
TEEL0:	0.25	2.00	946.59	236.76	944.59	99.65	541.50	5.26	7.393

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -5.06 +1(Ln(Conc 1.98 x Time)

T= time 30 min of exposure

Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	71.61	0.53	<0.001	11838.19	1.5951	0.000	15.038
4.6	0	31.22	1.15	<0.001	2833.28	0.3818	0.000	0.000
7.1	0	10.39	1.78	0.002	1255.24	0.1691	0.000	0.062
9.6	0	0	2.40	0.002	703.06	0.0947	0.000	0.000
12.1	0	0	3.03	0.003	446.42	0.0602	0.000	0.000
14.6	0	0	3.65	0.003	306.74	0.0413	0.000	0.000
17.1	0	0	4.28	0.003	223.12	0.0301	0.000	0.000
19.6	0	0	4.90	0.004	170.46	0.023	0.000	0.000
22.1	0	0	5.53	0.004	136.35	0.0184	0.000	0.000
24.6	0	0	6.15	0.005	113.51	0.0153	0.000	0.000
27.1	0	0	6.78	0.005	97.41	0.0131	0.000	0.000
29.6	0	0	7.40	0.005	85.34	0.0115	0.000	0.000
32.1	0	0	8.03	0.006	75.73	0.0102	0.000	0.000
34.6	0	0	8.65	0.006	67.73	0.0091	0.000	0.000
37.1	0	0	9.28	0.006	60.87	0.0082	0.000	0.000
39.6	0	0	9.90	0.007	54.88	0.0074	0.000	0.000
42.1	0	0	10.53	0.007	49.6	0.0067	0.000	0.000
44.6	0	0	11.16	0.007	44.92	0.0061	0.000	0.000
47.1	0	0	11.78	0.008	40.75	0.0055	0.000	0.000
49.6	0	0	12.41	0.008	37.05	0.005	0.000	0.000

HAMS-GPS : Dispersion Model

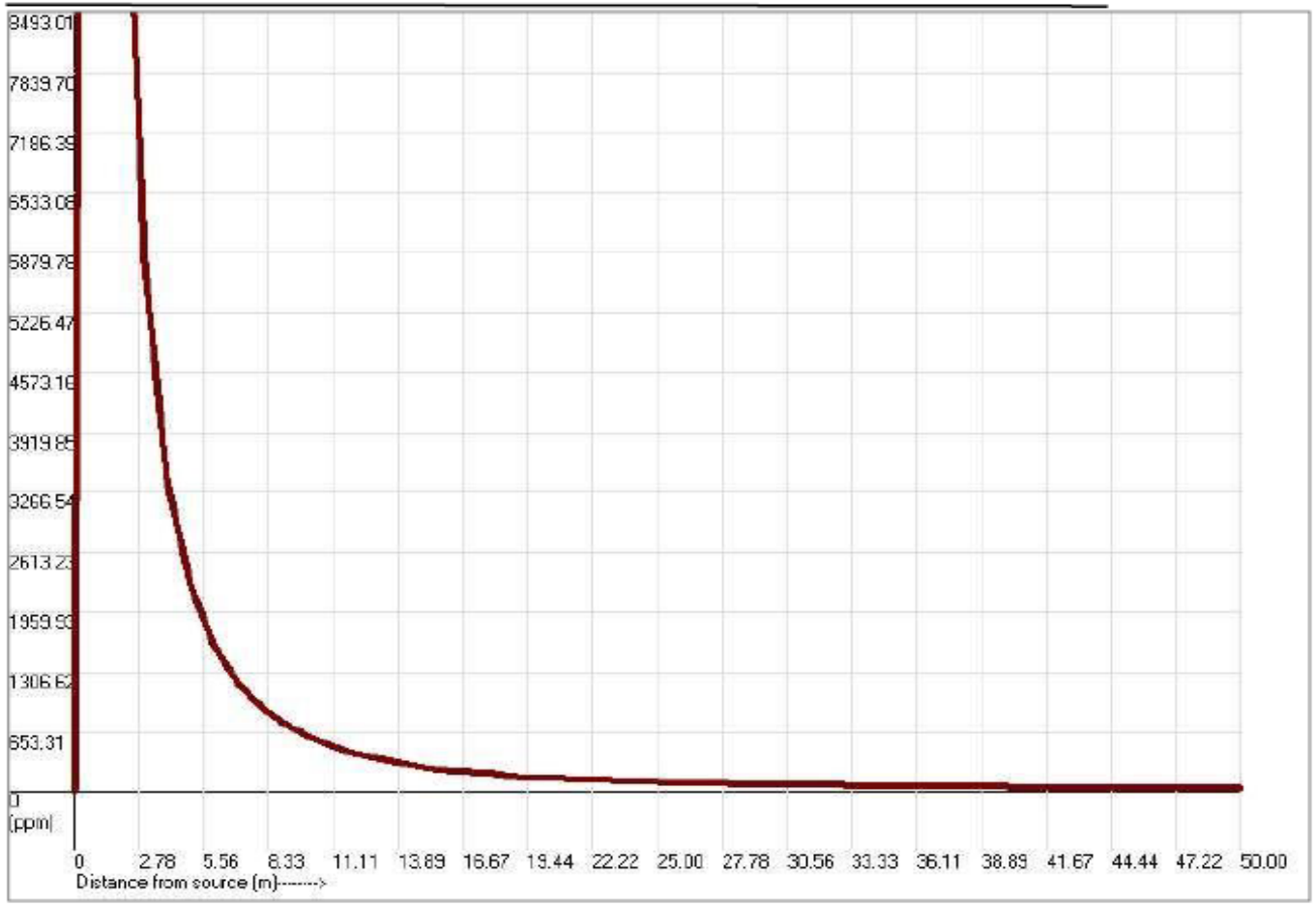
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to: HAMSAGARS]

Scenario: Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Concentration profile (ISOELEVET)

Date : Saturday, September 12, 2020



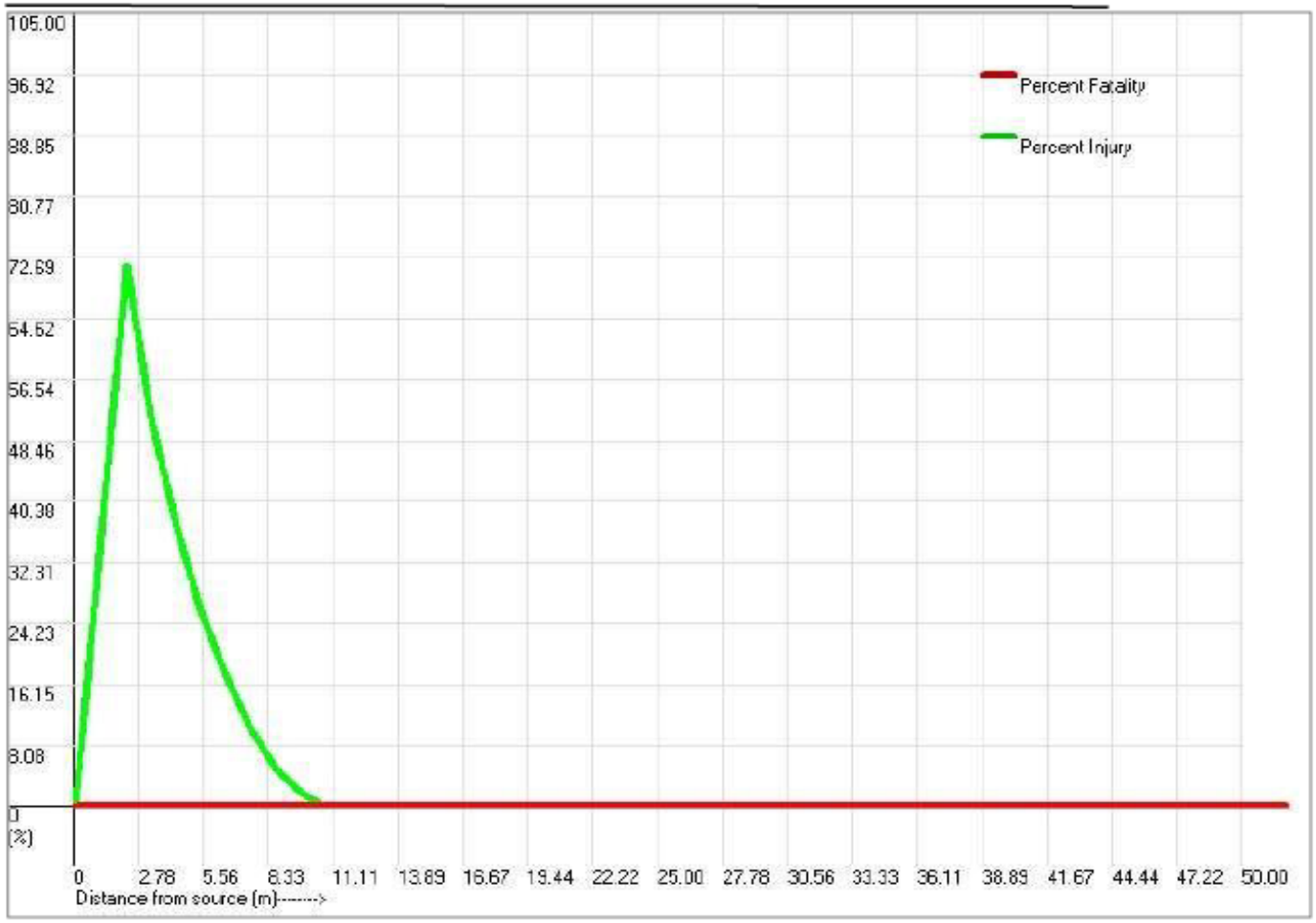
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

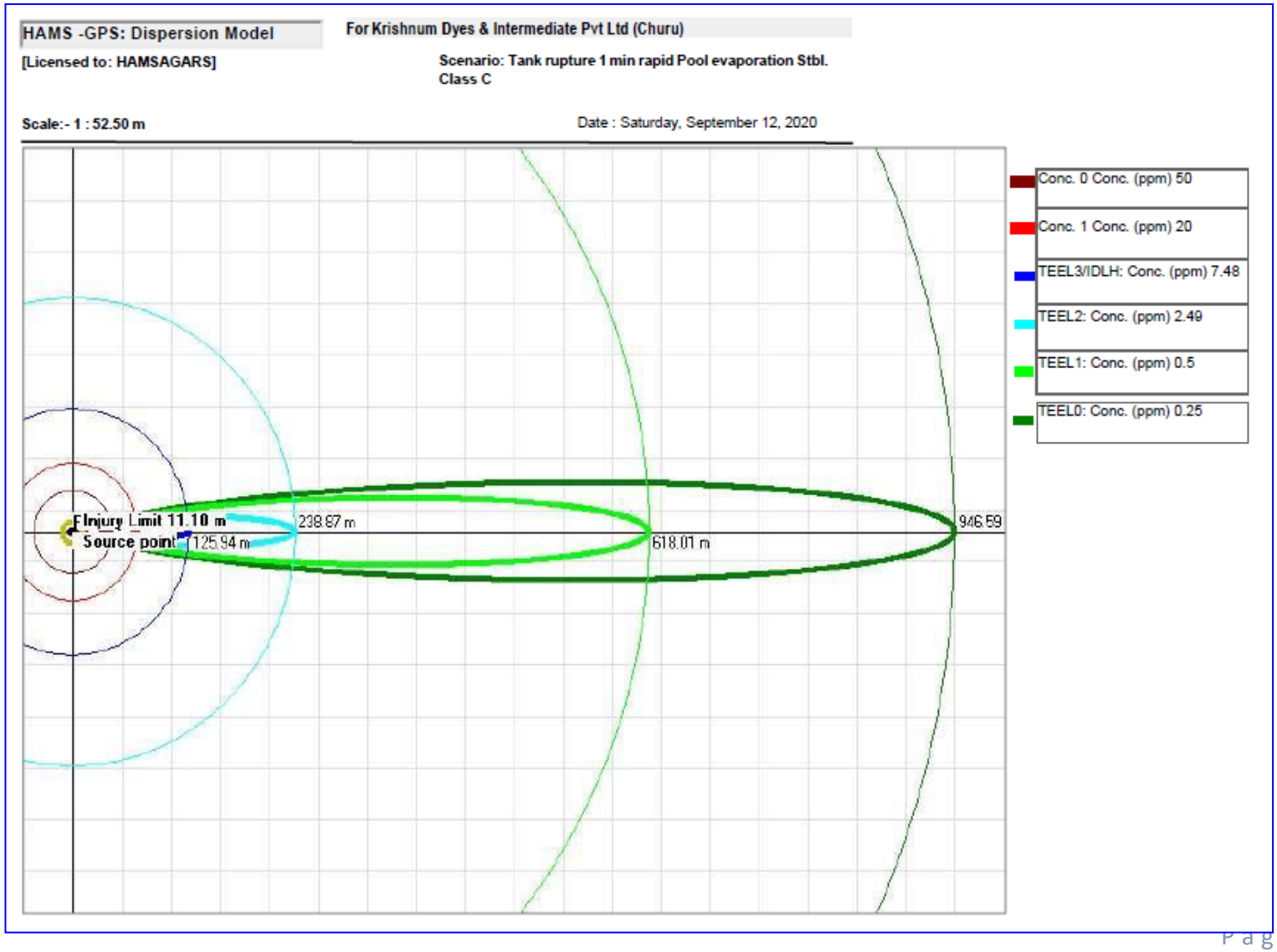
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

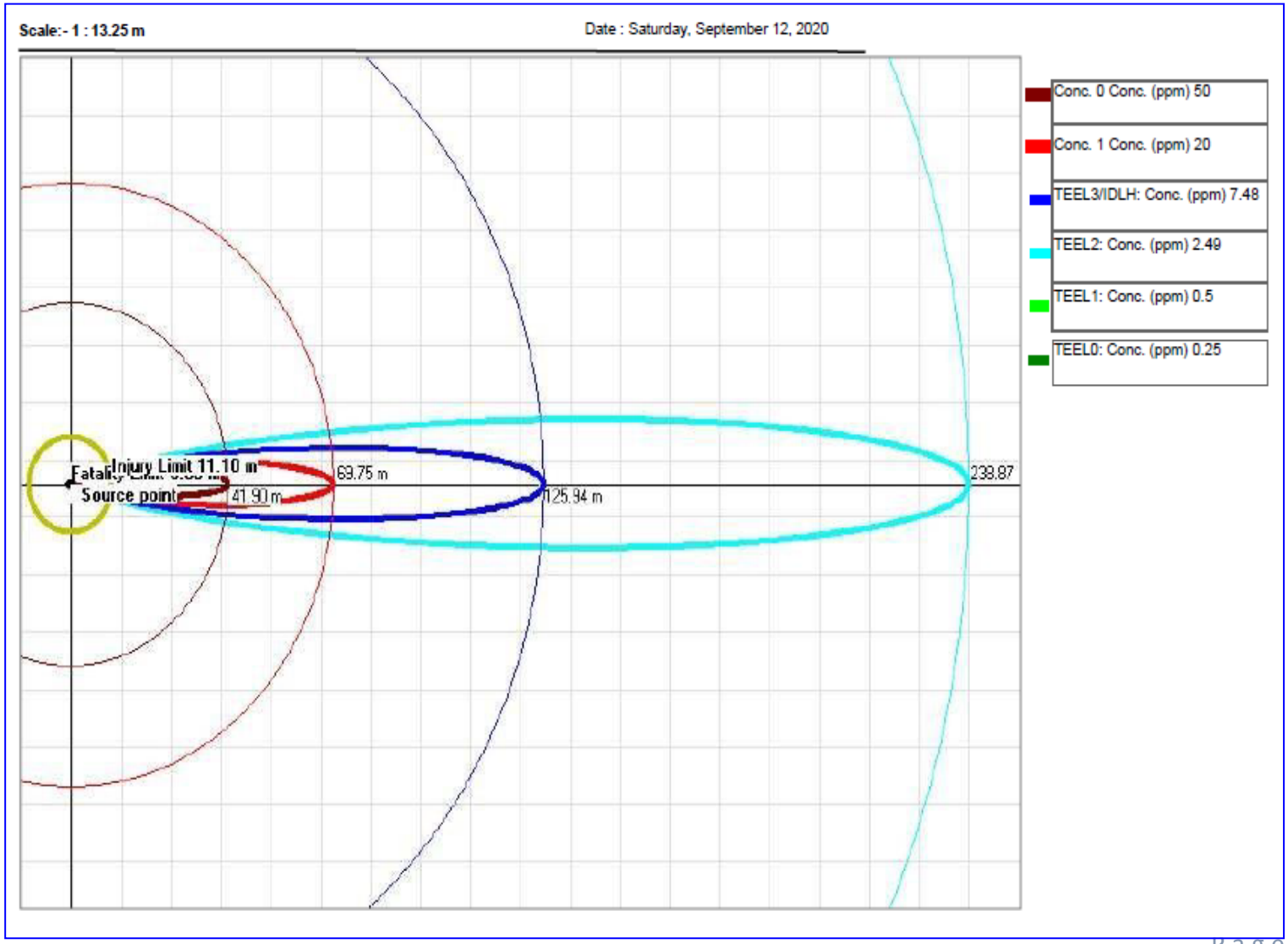
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Fatality and Injury profile

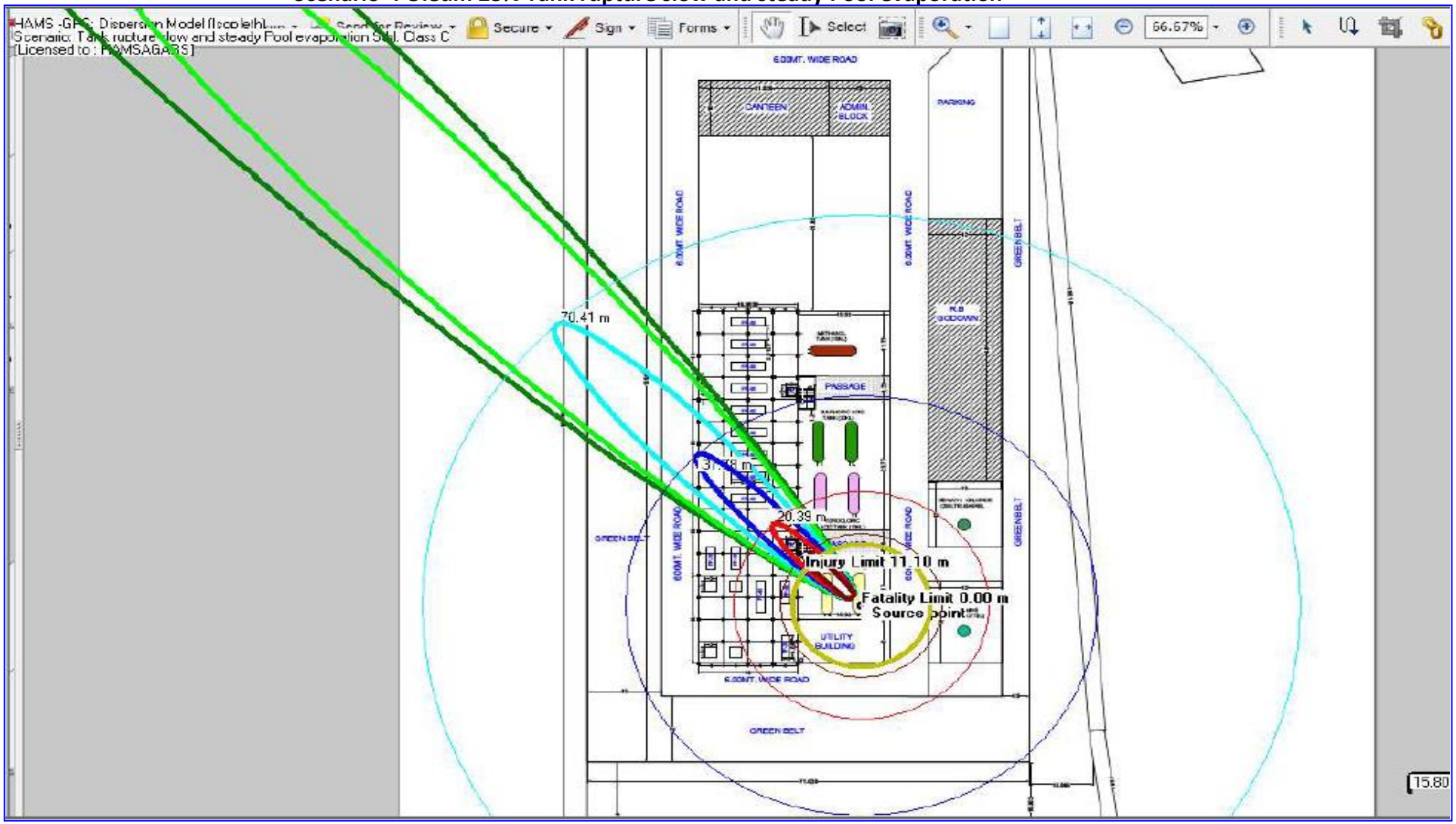
Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Scale:- 1 : 52.50 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 50
Conc. 1 Conc. (ppm) 20
TEEL3/IDLH: Conc. (ppm) 7.48
TEEL2: Conc. (ppm) 2.49
TEEL1: Conc. (ppm) 0.5
TEEL0: Conc. (ppm) 0.25
Injury Limit 11.10 m
Source point
125.94 m
238.87 m
618.01 m
946.59


Scale:- 1 : 13.25 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 50
Conc. 1 Conc. (ppm) 20
TEEL3/IDLH: Conc. (ppm) 7.48
TEEL2: Conc. (ppm) 2.49
TEEL1: Conc. (ppm) 0.5
TEEL0: Conc. (ppm) 0.25
Injury Limit 11.10 m
69.75 m
239.87
Source point
41.90 m
125.94 m

Scenario-4 Oleum 23% Tank rupture slow and steady Pool evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Oleum 23% Tank 20KL
Name of Chemical : Oleum 23%
Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : D
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.9
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 1048.27
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 15.20
MGC Distance (m) : 19.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 1.14
*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	50	2.00	12.86	3.22	10.86	2.24	8.50	7.51	0.002
Conc. 1	20	2.00	20.39	5.10	18.39	3.47	12.50	7.90	0.005
TEEL3/IDLH:	7.48	2.00	37.78	9.45	35.78	5.41	20.50	7.52	0.015
TEEL2:	2.49	2.00	70.41	17.61	68.41	10.07	42.50	6.76	0.054
TEEL1:	0.5	2.00	182.73	45.70	180.73	23.20	106.50	6.22	0.329
TEEL0:	0.25	2.00	272.79	68.23	270.79	33.48	158.50	6.03	0.712

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -5.06 +1(Ln(Conc 1.98 x Time)

T = time 30 min of exposure

Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	0.006	1496.4	0.0198	0.000	0.000
15.74	0	0	3.94	0.016	33.32	0.0004	0.000	0.000
29.38	0	0	7.35	0.022	10.91	0.0001	0.000	0.000
43.02	0	0	10.76	0.028	6.04	0.0001	0.000	0.000
56.66	0	0	14.17	0.032	3.62	0	0.000	0.000
70.3	0	0	17.58	0.036	2.5	0	0.000	0.000
83.94	0	0	21.00	0.040	1.87	0	0.000	0.000
97.58	0	0	24.41	0.042	1.45	0	0.000	0.000
111.22	0	0	27.82	0.044	1.17	0	0.000	0.000
124.86	0	0	31.23	0.046	0.96	0	0.000	0.000
138.5	0	0	34.64	0.047	0.8	0	0.000	0.000
152.14	0	0	38.05	0.047	0.68	0	0.000	0.000
165.78	0	0	41.46	0.047	0.59	0	0.000	0.000
179.42	0	0	44.88	0.046	0.52	0	0.000	0.000
193.06	0	0	48.29	0.044	0.45	0	0.000	0.000
206.7	0	0	51.70	0.042	0.4	0	0.000	0.000
220.34	0	0	55.11	0.038	0.36	0	0.000	0.000
233.98	0	0	58.52	0.034	0.33	0	0.000	0.000
247.62	0	0	61.93	0.027	0.3	0	0.000	0.000
261.26	0	0	65.35	0.016	0.27	0	0.000	0.000

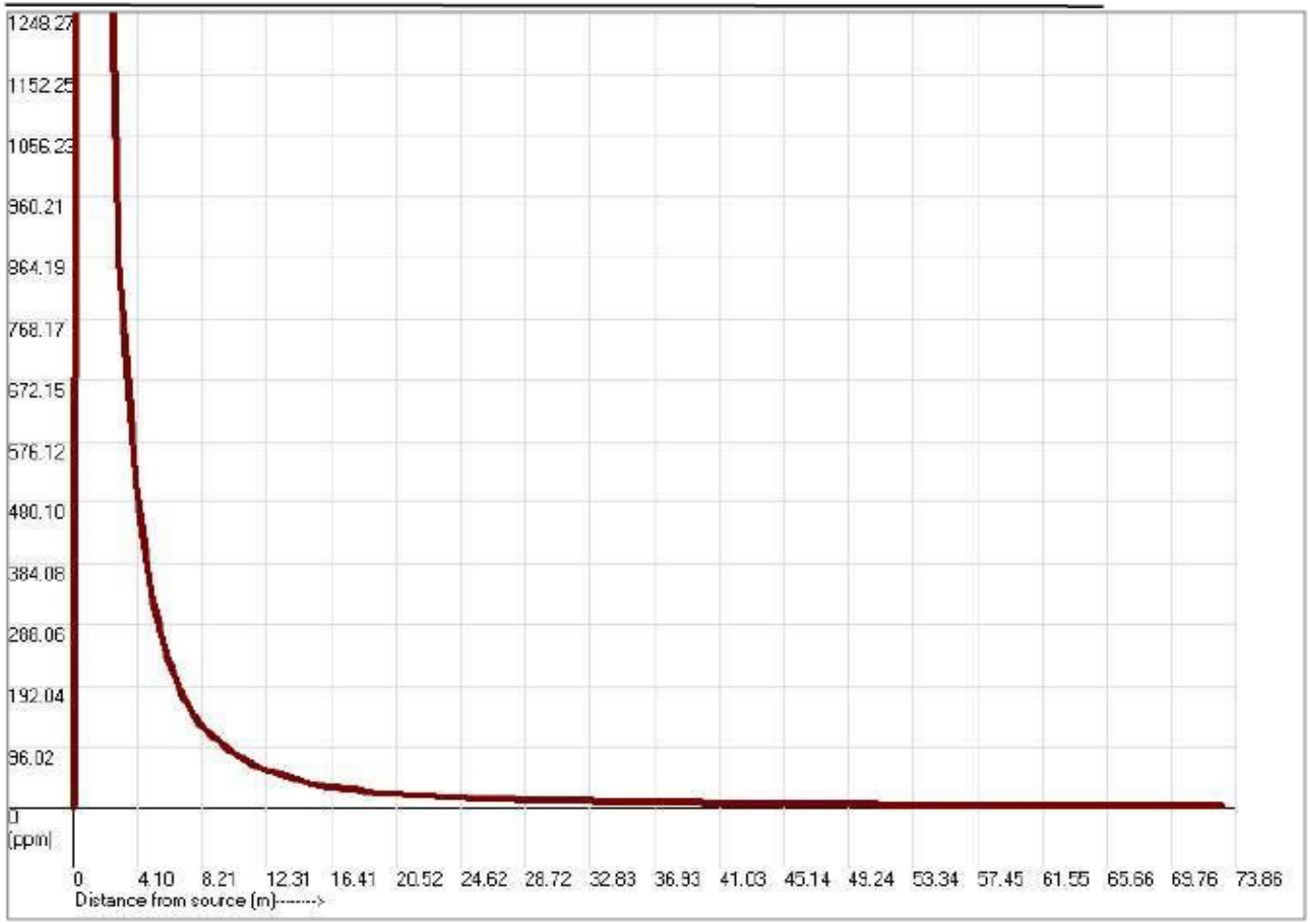
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C

Concentration profile (ISOELEVET)

Date : Saturday, September 12, 2020



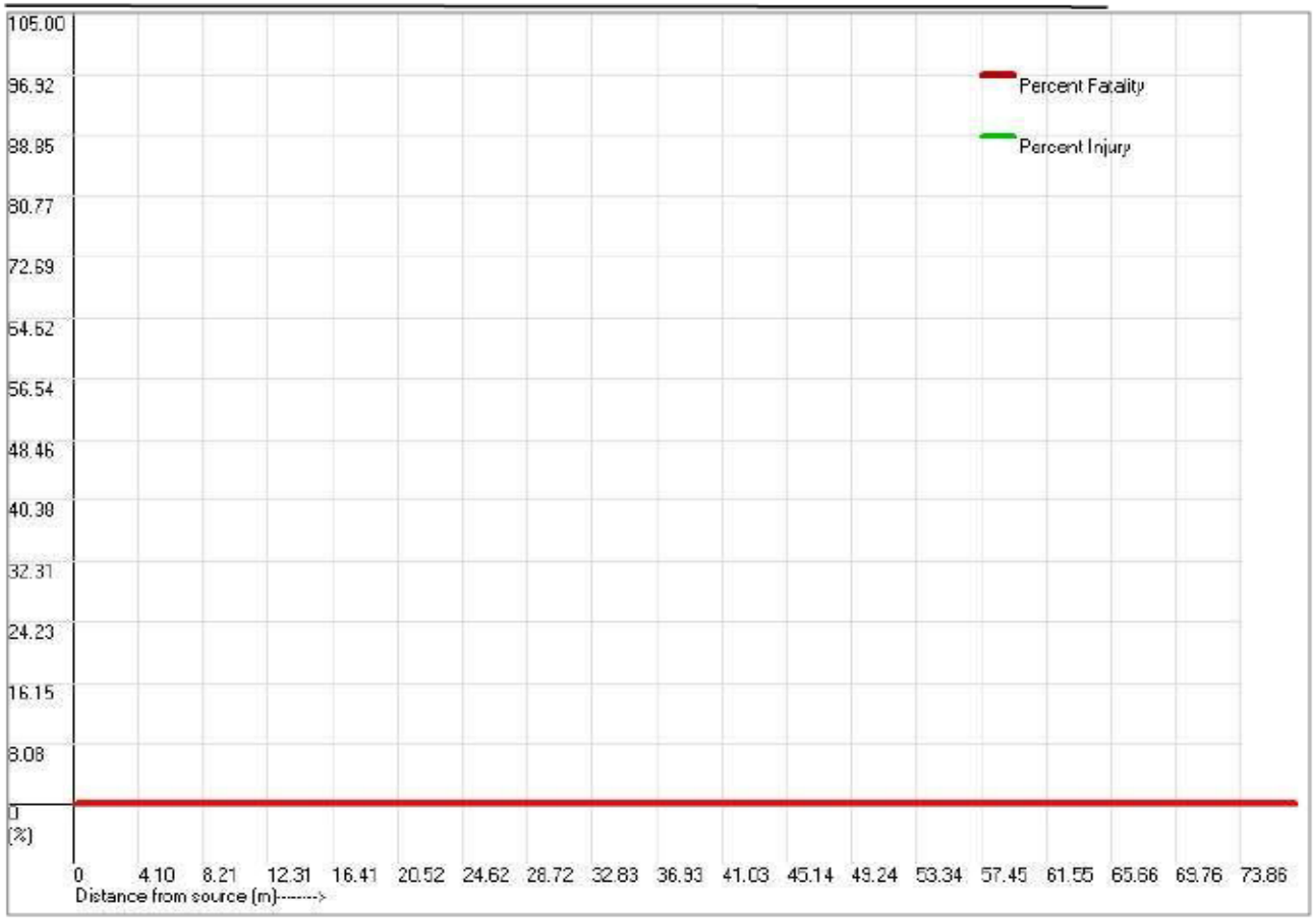
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

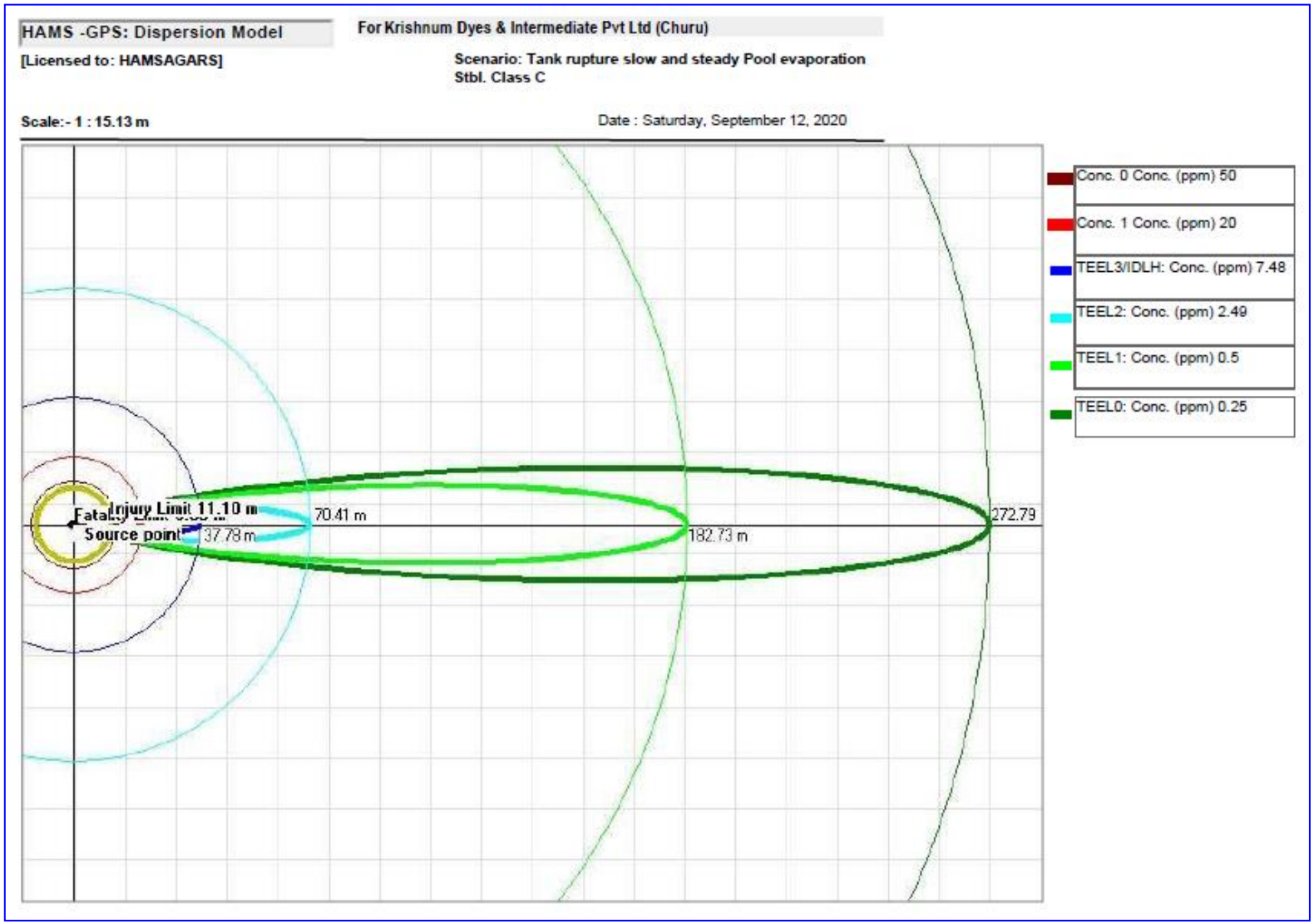
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

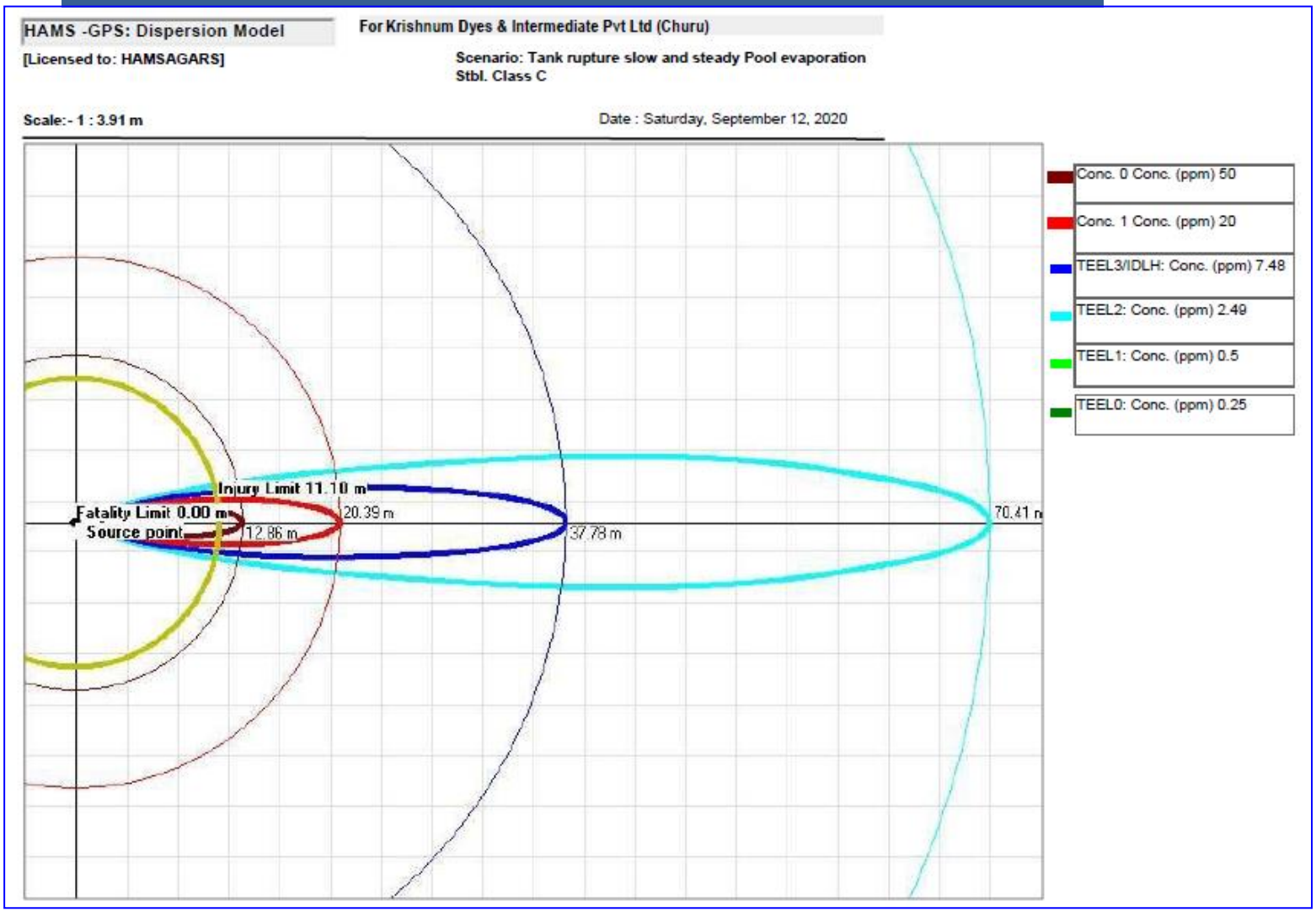
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C

Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 15.13 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 50
Conc. 1 Conc. (ppm) 20
TEEL3/IDLH: Conc. (ppm) 7.48
TEEL2: Conc. (ppm) 2.49
TEEL1: Conc. (ppm) 0.5
TEEL0: Conc. (ppm) 0.25
Injury Limit 11.10 m
70.41 m
37.78 m
182.73 m
272.79


HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 3.91 m
Date : Saturday, September 12, 2020
Injury Limit 11.10 m
Fatality Limit 0.00 m
Source point
12.86 m
20.39 m
37.78 m
70.41 m
Conc. 0 Conc. (ppm) 50
Conc. 1 Conc. (ppm) 20
TEEL3/IDLH: Conc. (ppm) 7.48
TEEL2: Conc. (ppm) 2.49
TEEL1: Conc. (ppm) 0.5
TEEL0: Conc. (ppm) 0.25

Sulphuric Acid

Distance table and effect of chemicals Concentration

Scenario	Causes	Failure Frequency Per Year	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 30/Hectare Population density
Tank rupture 1 min rapid Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	2	78.44	8.87	520.53	46.67	0.0058366	2.767670	0.02348
Tank rupture slow and steady Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	2	4.08	0.46	25.34	2.91	0.0051868	2.459547	0.00006

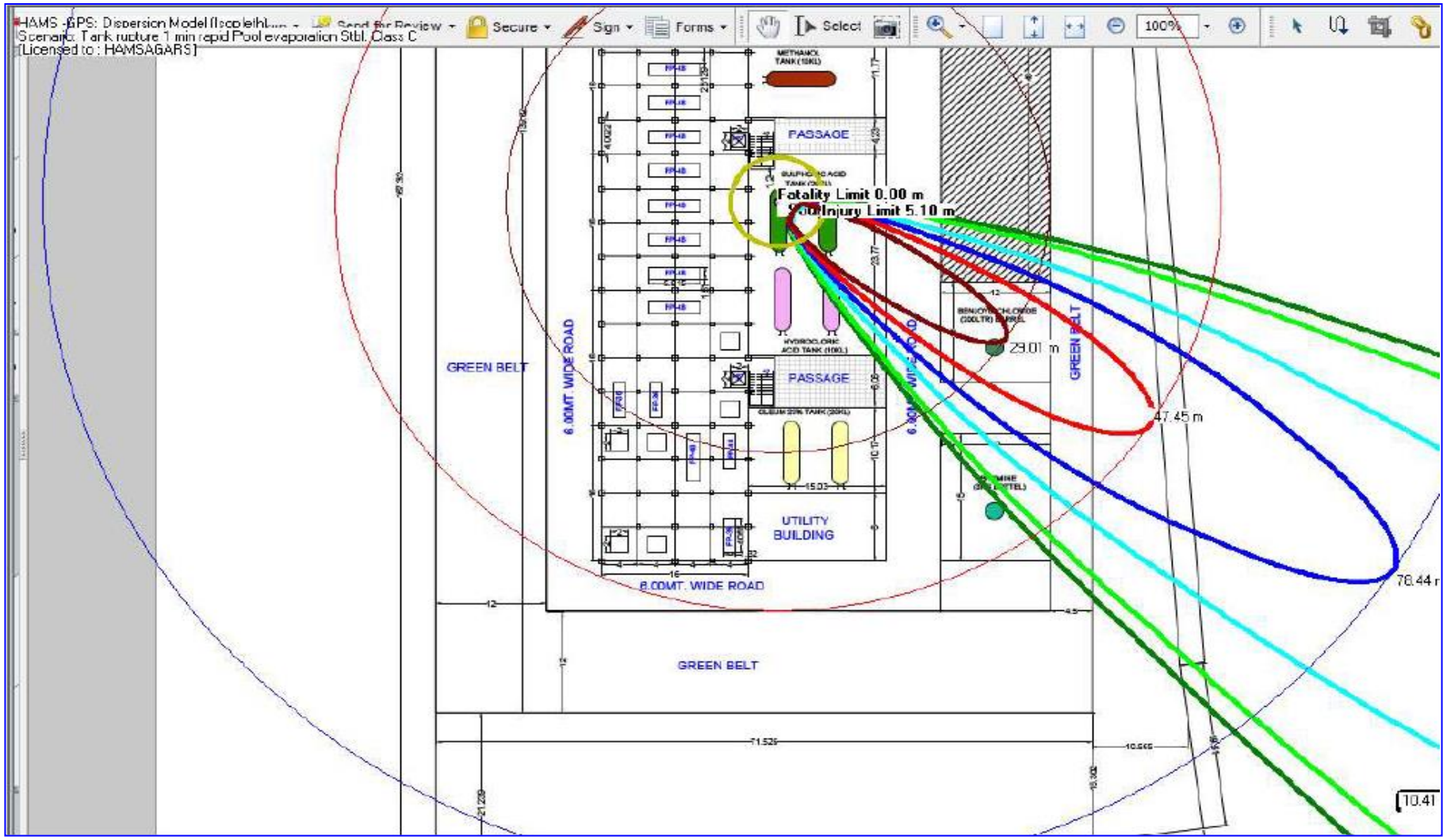
Estimated distance

S.No	Description	Event	Impact Criteria PPM	Distance of Max. ISOPleth from source	Time (Sec)	ISOPleth Angle	Isopleth Area (Ha)
1	Sulphuric Acid	Dispersion of Vapor cloud	50	16.50	7.26	11.02	0.014
2		Tank rupture slow and steady Pool evaporation	10	3.50	0.88	8.13	0.00012

Probability Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc. (ppm) along X-axis	Dose (mg)	Absolute	
							Fatality No.	Injury No.
2.1	0	20.51	0.53	<0.001	6405.56	0.81	0	2.030
22.1	0	0	5.53	0.006	75.31	0.0096	0	0

Scenario-5 Sulphuric Acid Tank rupture 1 min rapid Pool Evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Sulphuric Acid Tank 20KL
Name of Chemical : Sulphuric Acid
Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 7.39
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 4440.59
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 106.12
MGC Distance (m) : 14.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 2.17
*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	50	2.00	29.01	7.26	27.01	6.43	16.50	11.02	0.014
Conc. 1	20	2.00	47.45	11.87	45.45	10.92	30.50	10.15	0.039
TEEL3/IDLH:	7.48	2.00	78.44	19.62	76.44	17.73	45.50	11.02	0.106
TEEL2:	2.49	2.00	145.53	36.40	143.53	29.43	84.50	9.88	0.332
TEEL1:	0.5	2.00	354.74	88.73	352.74	66.05	204.50	9.17	1.830
TEEL0:	0.25	2.00	520.53	130.20	518.53	93.34	299.50	8.86	3.801

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module | For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -6.07 +1(Ln(Conc 1.98 x Time)

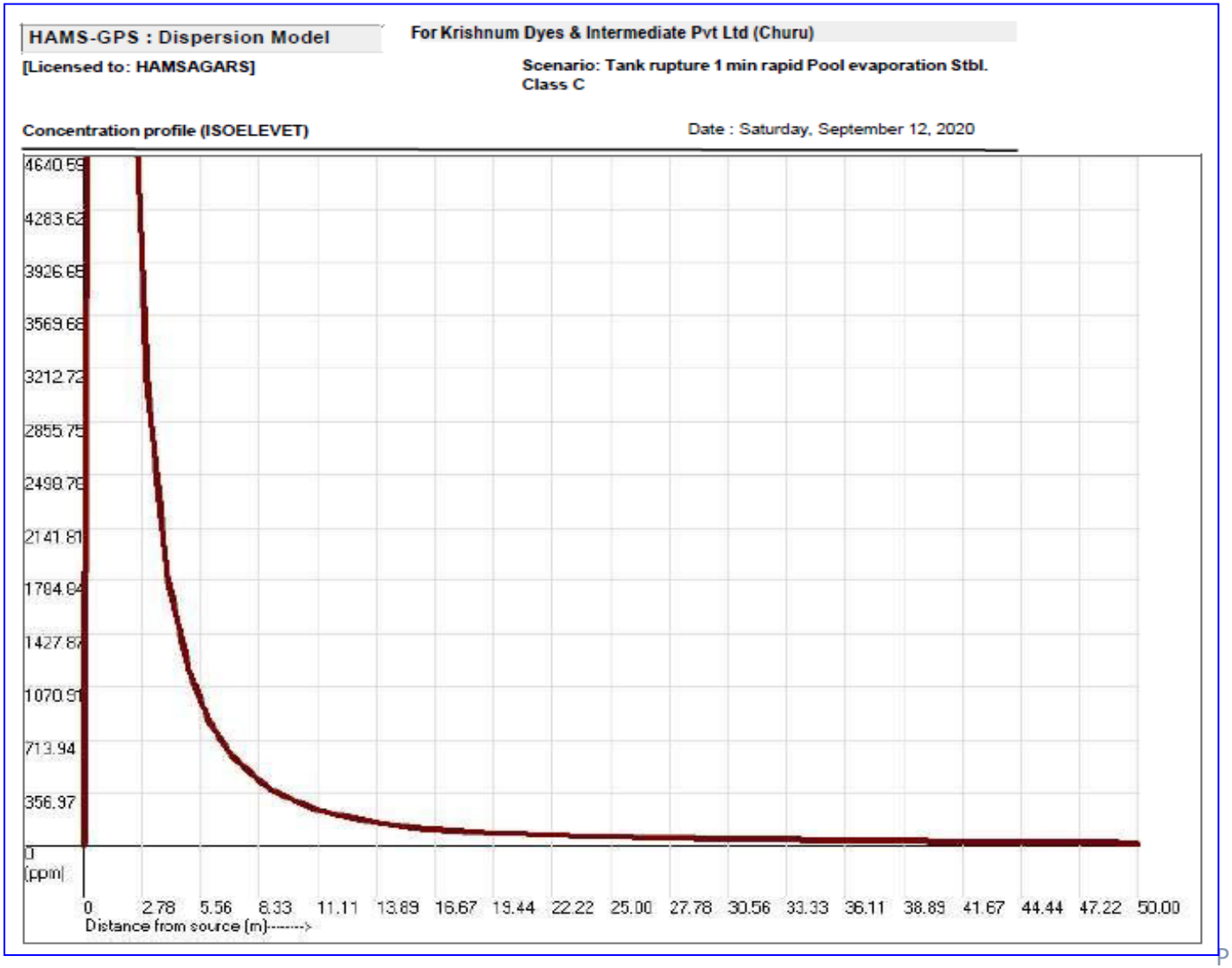
T= time 30 min of exposure

Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	20.51	0.53	<0.001	6405.56	0.8123	0.000	2.030
4.6	0	0	1.15	0.001	1462.61	0.1855	0.000	0.000
7.1	0	0	1.78	0.002	631.33	0.0801	0.000	0.000
9.6	0	0	2.40	0.003	347.28	0.044	0.000	0.000
12.1	0	0	3.03	0.004	217.86	0.0276	0.000	0.000
14.6	0	0	3.65	0.004	150.24	0.0191	0.000	0.000
17.1	0	0	4.28	0.005	112.63	0.0143	0.000	0.000
19.6	0	0	4.90	0.005	90.19	0.0114	0.000	0.000
22.1	0	0	5.53	0.006	75.31	0.0096	0.000	0.000
24.6	0	0	6.15	0.007	64.34	0.0082	0.000	0.000
27.1	0	0	6.78	0.007	55.62	0.0071	0.000	0.000
29.6	0	0	7.40	0.008	48.39	0.0061	0.000	0.000
32.1	0	0	8.03	0.008	42.29	0.0054	0.000	0.000
34.6	0	0	8.65	0.009	37.1	0.0047	0.000	0.000
37.1	0	0	9.28	0.009	32.65	0.0041	0.000	0.000
39.6	0	0	9.90	0.010	28.84	0.0037	0.000	0.000
42.1	0	0	10.53	0.010	25.57	0.0032	0.000	0.000
44.6	0	0	11.16	0.010	22.75	0.0029	0.000	0.000
47.1	0	0	11.78	0.011	20.31	0.0026	0.000	0.000
49.6	0	0	12.41	0.011	18.2	0.0023	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
4640.59
4283.62
3926.65
3569.68
3212.72
2855.75
2499.78
2141.81
1784.84
1427.87
1070.91
713.94
356.97
0
(ppm)
0
2.78
5.56
8.33
11.11
13.89
16.67
19.44
22.22
25.00
27.78
30.56
33.33
36.11
38.89
41.67
44.44
47.22
50.00
Distance from source (m)------>

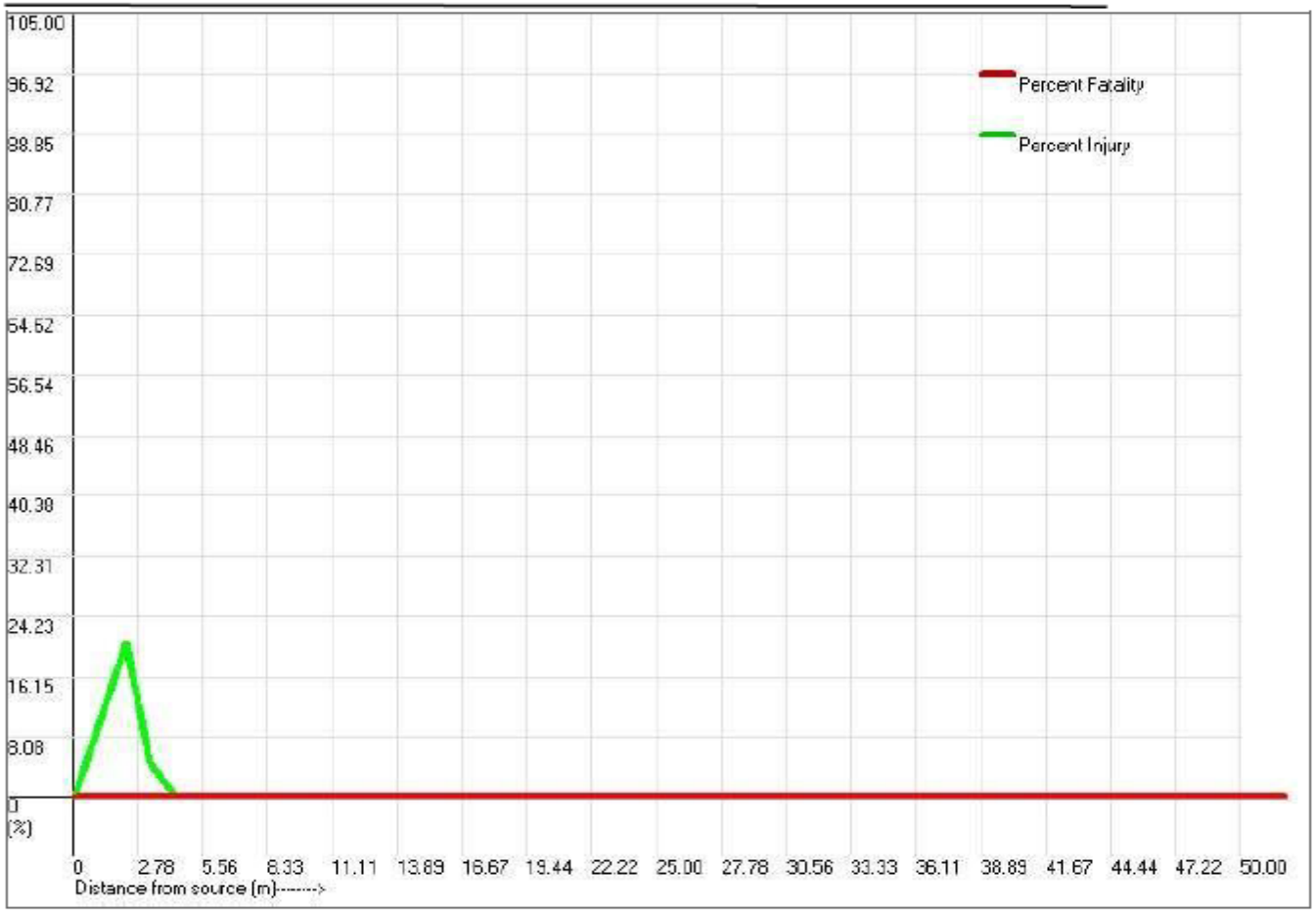
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

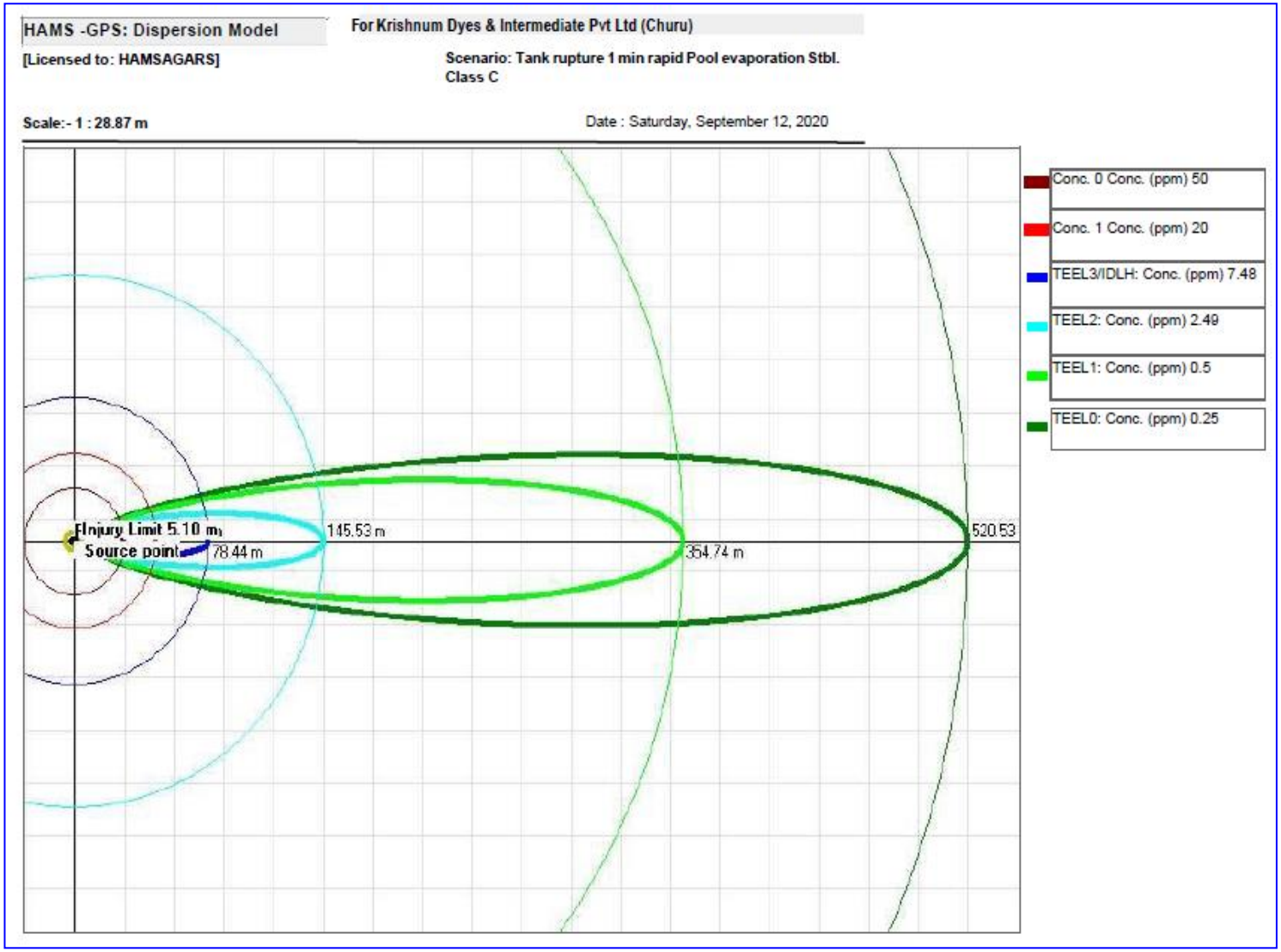
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

Scenario: Tank rupture 1 min rapid Pool evaporation Stbl. Class C

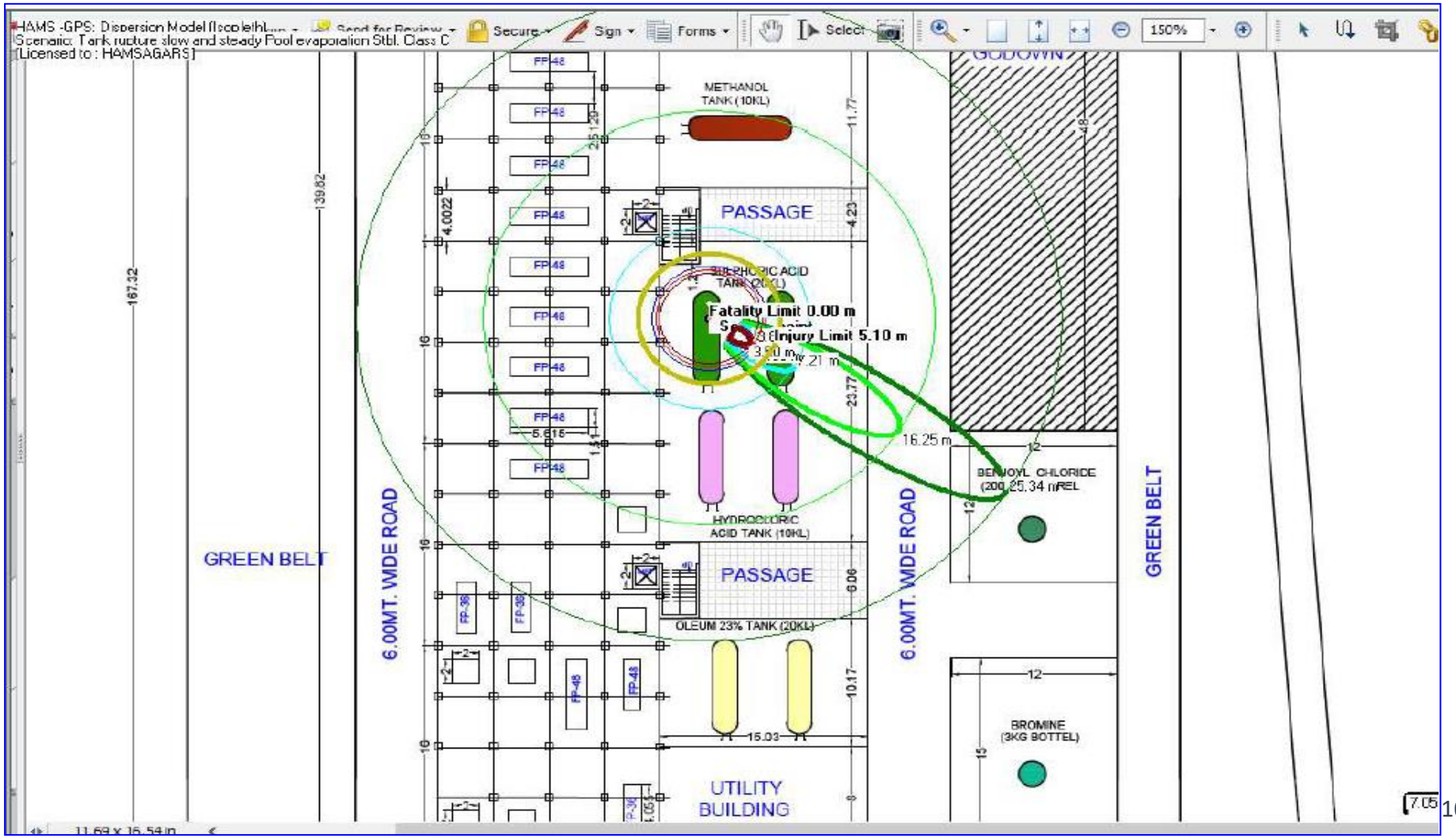
Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Scale:- 1 : 28.87 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 50
Conc. 1 Conc. (ppm) 20
TEEL3/IDLH: Conc. (ppm) 7.48
TEEL2: Conc. (ppm) 2.49
TEEL1: Conc. (ppm) 0.5
TEEL0: Conc. (ppm) 0.25
Injury Limit 5.10 m
Source point
78.44 m
145.53 m
354.74 m
520.53

Scenario-6 Sulphuric Tank rupture slow and steady Pool Evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Sulphuric Acid Tank 20KL
Name of Chemical : Sulphuric Acid
Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.03
Percent Humidity (%) : 10.00

Results

Max Isopleth conc (ppm) : 18.03
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 0.43
MGC Distance (m) : 14.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 6.34
*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	10	2.00	3.50	0.88	1.50	1.00	3.50	8.13	0.00012
Conc. 1	8.5	2.00	3.82	0.96	1.82	0.68	3.50	5.55	0.00010
TEEL3/IDLH:	7.48	2.00	4.08	1.02	2.08	0.92	3.50	7.49	0.00015
TEEL2:	2.49	2.00	7.21	1.80	5.21	1.85	5.50	9.55	0.00076
TEEL1:	0.5	2.00	16.25	4.06	14.25	4.24	10.50	11.41	0.005
TEEL0:	0.25	2.00	25.34	6.34	23.34	5.82	14.50	11.35	0.011

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module | For Krishnum Dyes & Intermediate Pvt Ltd (Churu

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10 +1(Ln(Conc ^{2} x Time)

Injury Probit (y): -6 +1(Ln(Conc ^{2} x Time)

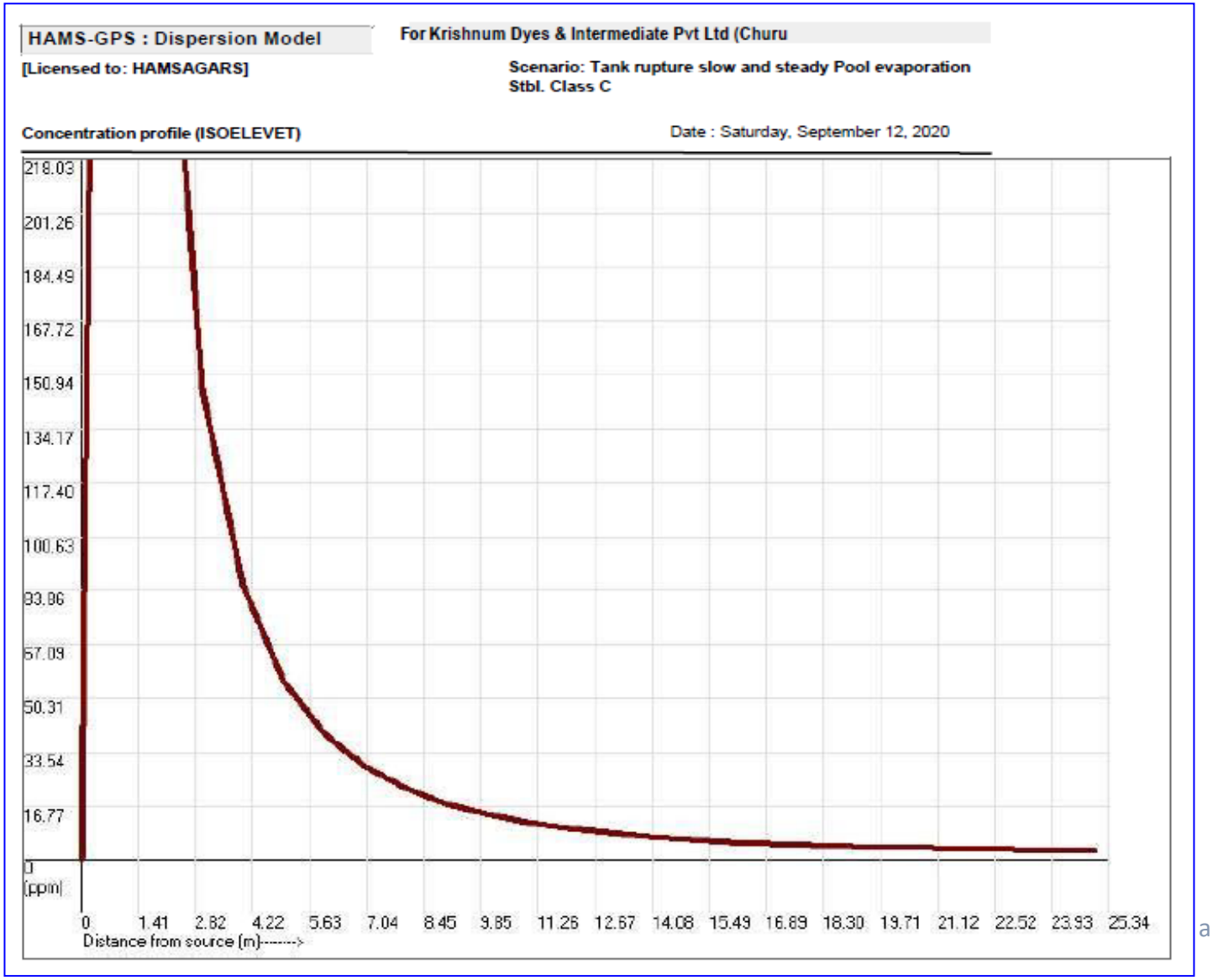
T= time 30 min of exposure

Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	26	0	0	0
3.37	0	0	0.84	<0.001	10.72	0	0	0
4.64	0	0	1.16	<0.001	5.84	0	0	0
5.91	0	0	1.48	<0.001	3.66	0	0	0
7.18	0	0	1.80	<0.001	2.51	0	0	0
8.45	0	0	2.11	<0.001	1.82	0	0	0
9.72	0	0	2.43	0.001	1.38	0	0.000	0.000
10.99	0	0	2.75	0.001	1.07	0	0.000	0.000
12.26	0	0	3.07	0.001	0.86	0	0.000	0.000
13.53	0	0	3.38	0.001	0.71	0	0.000	0.000
14.8	0	0	3.70	0.001	0.59	0	0.000	0.000
16.07	0	0	4.02	0.001	0.51	0	0.000	0.000
17.34	0	0	4.34	0.001	0.45	0	0.000	0.000
18.61	0	0	4.65	0.001	0.4	0	0.000	0.000
19.88	0	0	4.97	0.001	0.36	0	0.000	0.000
21.15	0	0	5.29	0.001	0.33	0	0.000	0.000
22.42	0	0	5.61	<0.001	0.3	0	0	0
23.69	0	0	5.93	<0.001	0.28	0	0	0
24.96	0	0	6.24	<0.001	0.26	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000


HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
218.03
201.26
184.49
167.72
150.94
134.17
117.40
100.63
83.86
67.09
50.31
33.54
16.77
0
(ppm)
0 1.41 2.82 4.22 5.63 7.04 8.45 9.85 11.26 12.67 14.08 15.49 16.89 18.30 19.71 21.12 22.52 23.93 25.34
Distance from source (m)------>

HAMS-GPS : Dispersion Model
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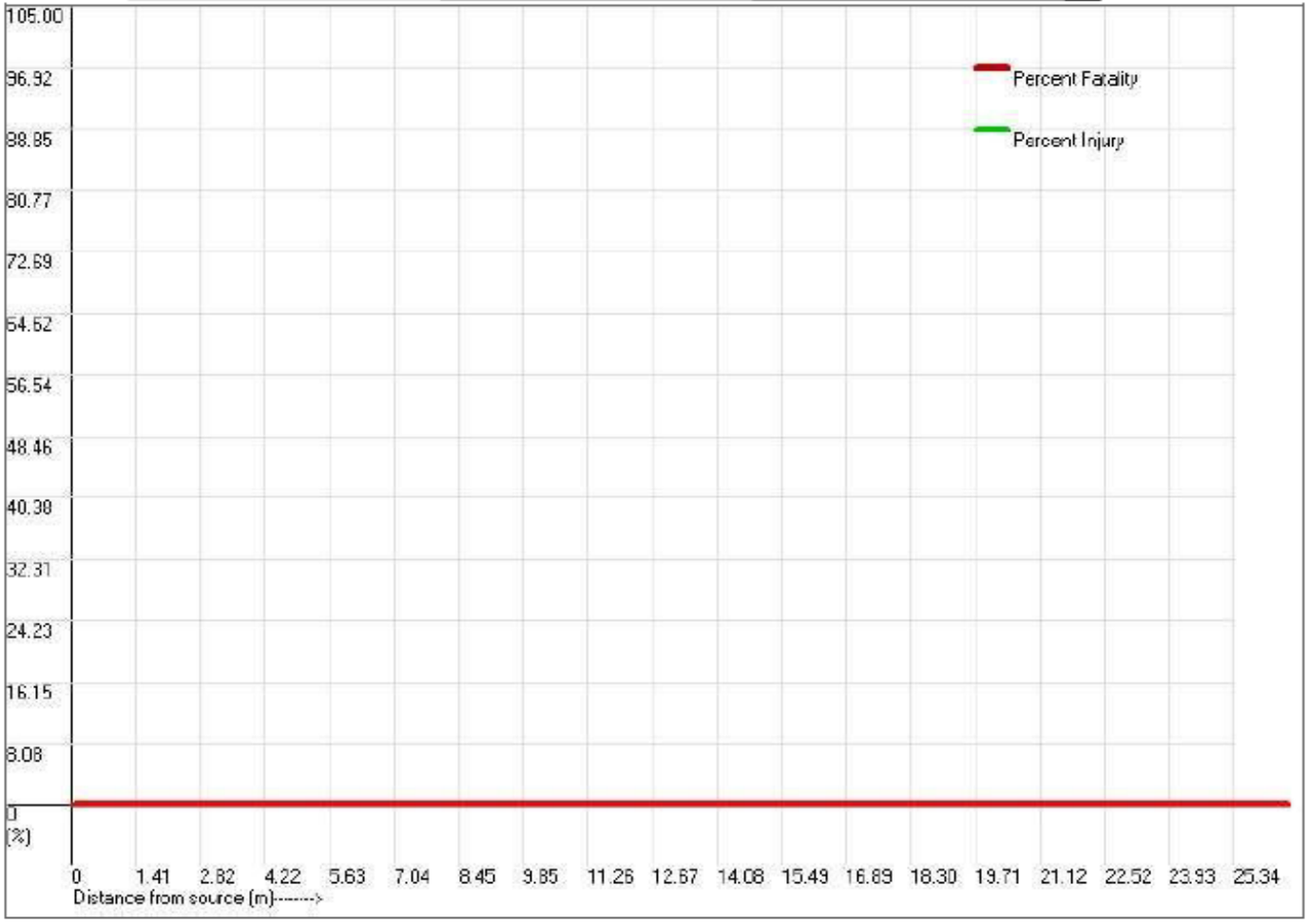
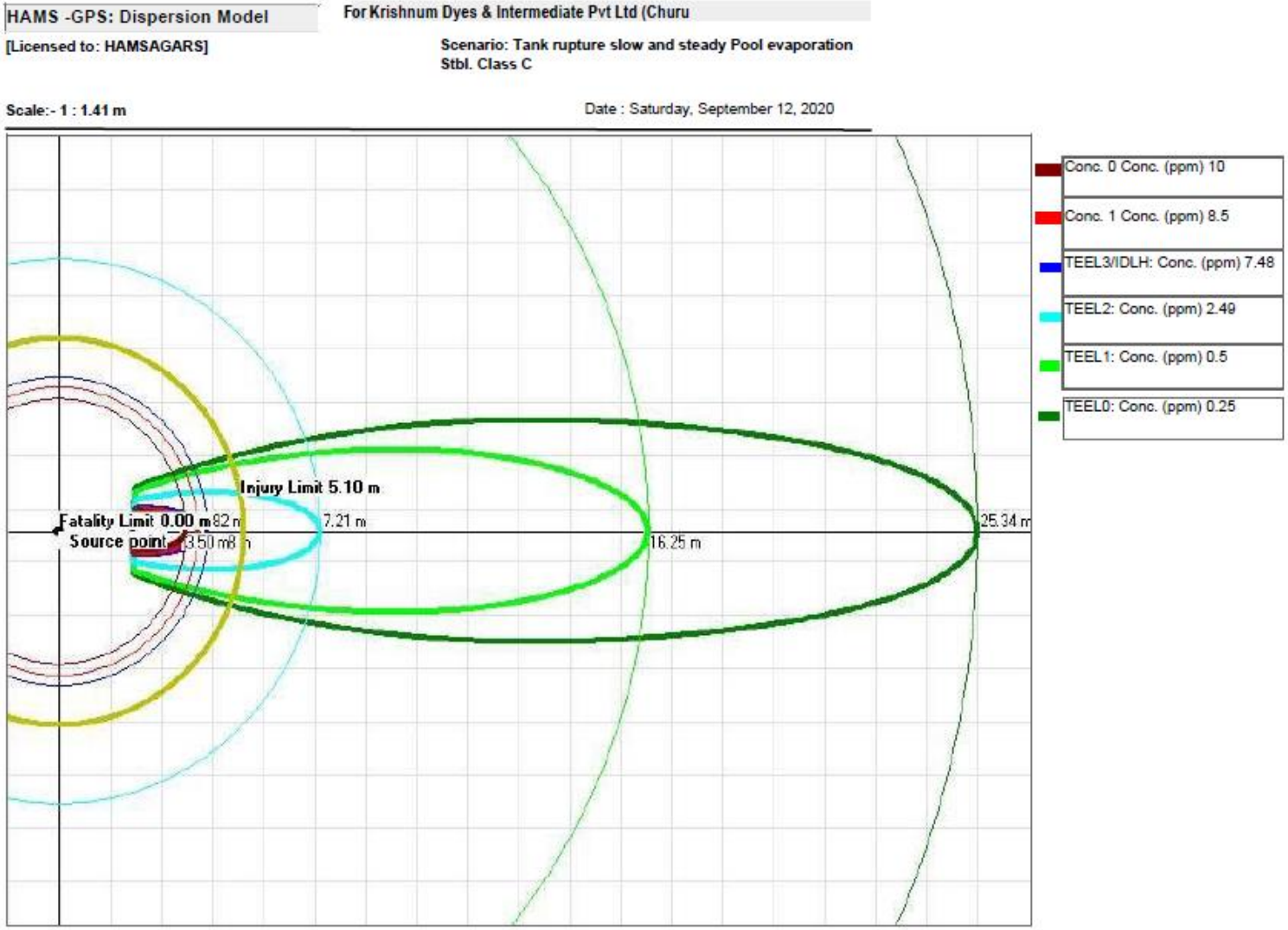
For Krishnum Dyes & Intermediate Pvt Ltd (Churu

Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C

Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 1.41 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 10
Conc. 1 Conc. (ppm) 8.5
TEEL3/IDLH: Conc. (ppm) 7.48
TEEL2: Conc. (ppm) 2.49
TEEL1: Conc. (ppm) 0.5
TEEL0: Conc. (ppm) 0.25
Injury Limit 5.10 m
Fatality Limit 0.00 m
Source point
7.21 m
16.25 m
25.34 m

Hydrochloric Acid

Distance table and effect of chemicals Concentration

Scenario	Causes	Failure Frequency Per Year	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 30/Hectare Population density
Tank rupture 1 min rapid Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	2	93.29	10.12	1755.21	139.49	0.0007857	0.372568	0.00429
Tank rupture slow and steady Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	2	59.37	7.06	1129.22	93.76	0.0008068	0.382571	0.00195

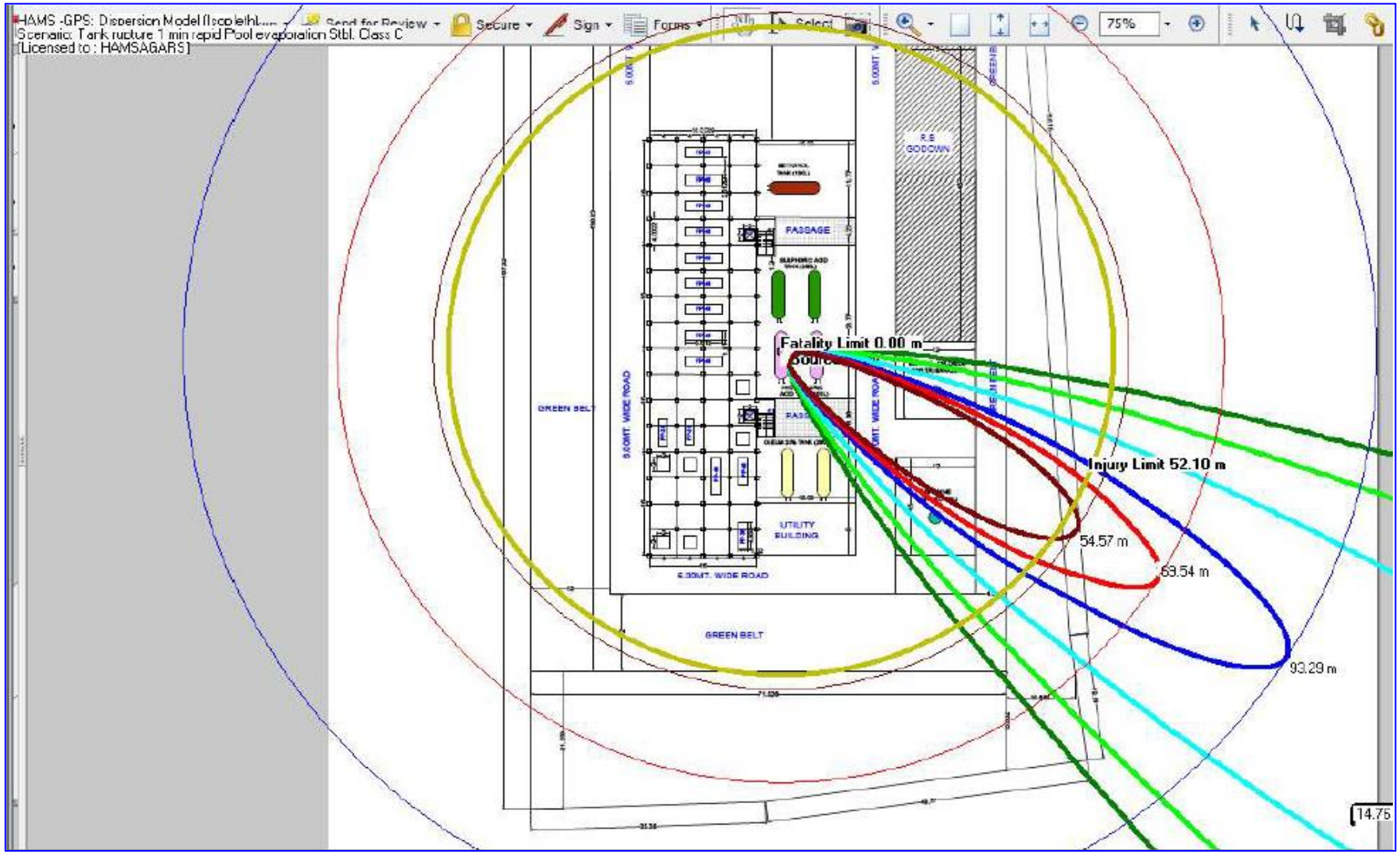
Estimated distance

S.No	Description	Event	Impact Criteria PPM	Distance of Max. ISOPleth from source	Time (Sec)	ISOPleth Angle	Isopleth Area (Ha)
1	Hydrochloric Acid	Dispersion of Vapor cloud	400	34.50	13.65	10.55	0.053
2		Tank rupture slow and steady Pool evaporation	400	23.50	9.25	9.81	0.022

Probability Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc. (ppm) along X-axis	Dose (mg)	Absolute	
							Fatality No.	Injury No.
2.1	0	100	0.53	<0.001	173357.41	66.46	0	106.500
23.1	0	4.52	5.78	0.010	859.52	0.1451	0	0.136

Scenario-7 Hydrochloric acid Tank rupture 1 min rapid Pool Evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Hydrochloric Acid Tank 10KL
Name of Chemical : Hydrochloric Acid
Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 200
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 120178.30
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 2871.91
MGC Distance (m) : 14.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 7.32
*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	400	2.00	54.57	13.65	52.57	12.85	34.50	10.55	0.053
Conc. 1	250	2.00	69.54	17.39	67.54	16.13	41.50	11.00	0.086
TEEL3/IDLH:	149	2.00	93.29	23.33	91.29	20.24	50.50	11.33	0.145
TEEL2:	32.8	2.00	217.19	54.32	215.19	42.37	125.50	9.58	0.716
TEEL1:	4.5	2.00	652.18	163.12	650.18	114.38	375.50	8.66	5.841
TEEL0:	0.75	2.00	1755.51	439.09	1753.51	278.97	1008.50	7.87	38.420

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc $^{1.98}$ x Time)

Injury Probit (y): -5.06 +1(Ln(Conc $^{1.98}$ x Time)

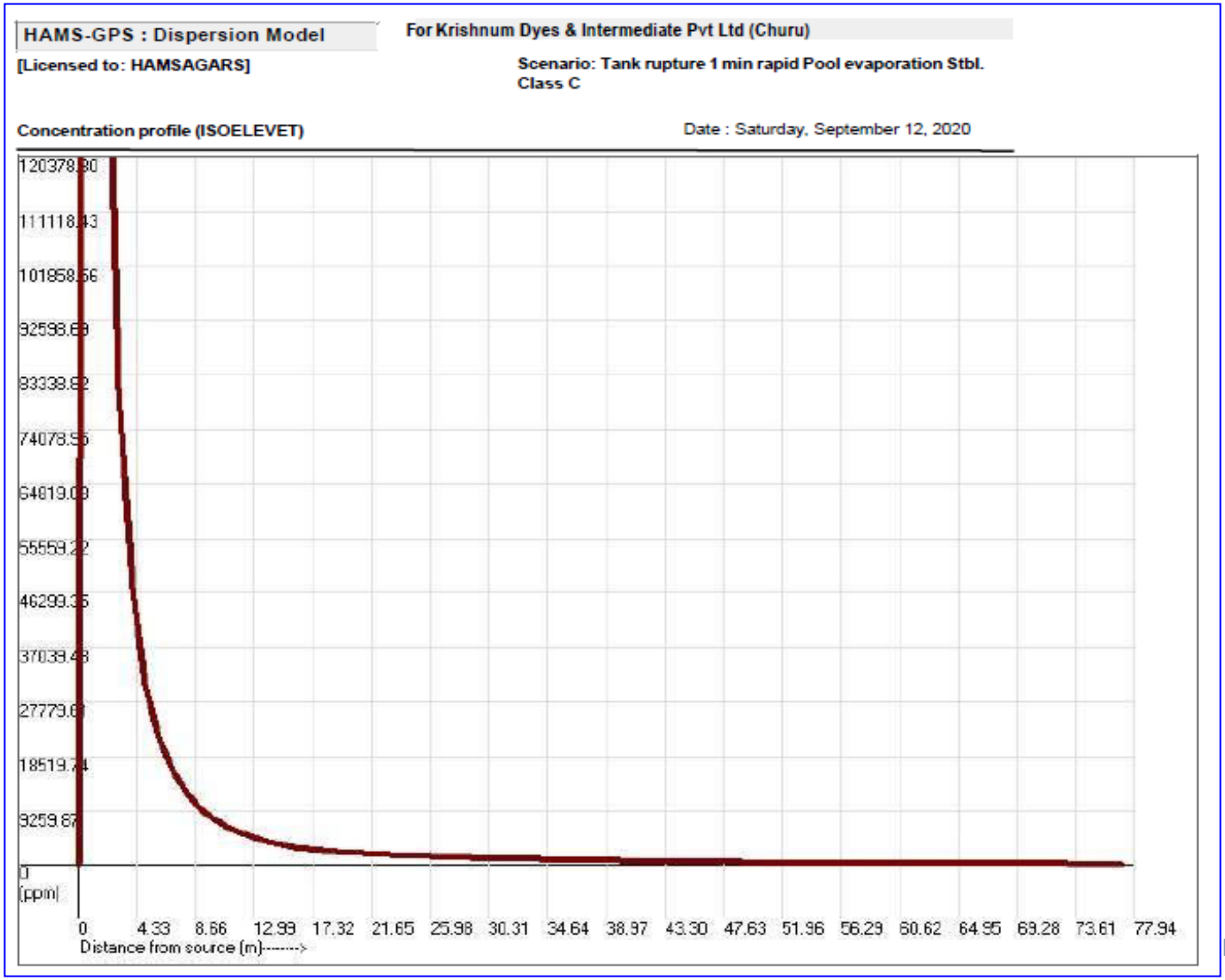
T= time 30 min of exposure

Scenario : Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	100	0.53	0.001	173357.41	66.4524	0.000	106.500
7.1	0	100	1.78	0.006	17086.1	6.5495	0.000	1.800
12.1	0	100	3.03	0.009	5896.19	2.2602	0.000	2.700
17.1	0	68.47	4.28	0.012	3048.07	1.1684	0.000	2.465
22.1	0	49.6	5.53	0.015	2038.2	0.7813	0.000	2.232
27.1	0	35.92	6.78	0.018	1505.2	0.577	0.000	1.940
32.1	0	24.26	8.03	0.020	1144.56	0.4387	0.000	1.456
37.1	0	14.33	9.28	0.023	883.66	0.3387	0.000	0.989
42.1	0	6.55	10.53	0.025	691.94	0.2652	0.000	0.491
47.1	0	1.53	11.78	0.027	549.64	0.2107	0.000	0.124
52.1	0	0	13.03	0.029	442.77	0.1697	0.000	0.000
57.1	0	0	14.28	0.031	361.44	0.1386	0.000	0.000
62.1	0	0	15.53	0.033	304.45	0.1167	0.000	0.000
67.1	0	0	16.78	0.035	266.08	0.102	0.000	0.000
72.1	0	0	18.03	0.037	234.67	0.09	0.000	0.000
77.1	0	0	19.28	0.039	208.62	0.08	0.000	0.000
82.1	0	0	20.53	0.041	186.77	0.0716	0.000	0.000
87.1	0	0	21.79	0.043	168.25	0.0645	0.000	0.000
92.1	0	0	23.04	0.045	152.42	0.0584	0.000	0.000
97.1	0	0	24.29	0.046	138.78	0.0532	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
120378.80
111118.43
101858.06
92598.68
83338.82
74078.95
64819.09
55559.22
46299.35
37039.48
27779.61
18519.74
9259.87
0
(ppm)
0
4.33
8.66
12.99
17.32
21.65
25.98
30.31
34.64
38.97
43.30
47.63
51.96
56.29
60.62
64.95
69.28
73.61
77.94
Distance from source (m)------>

HAMS-GPS : Dispersion Model

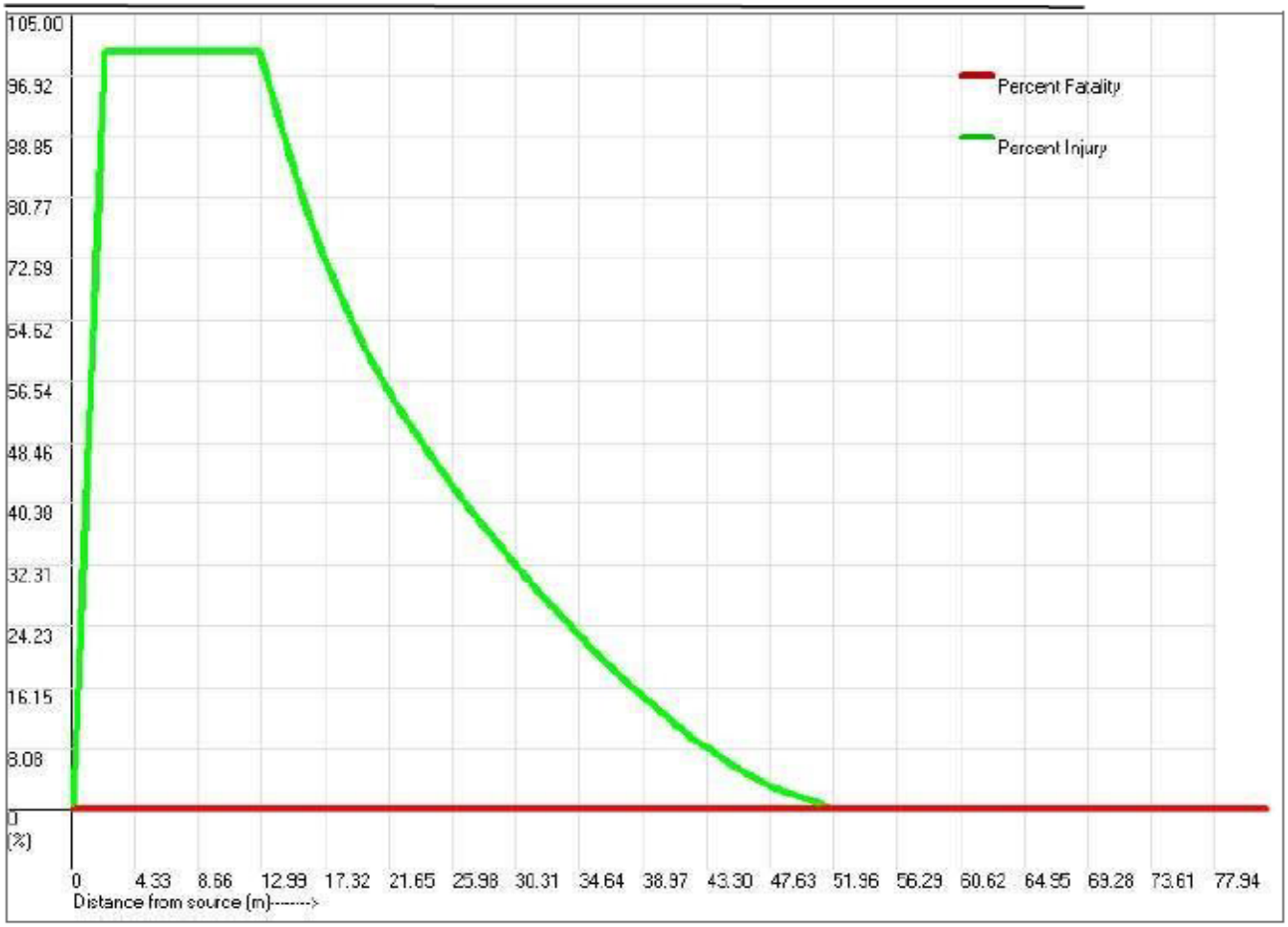
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

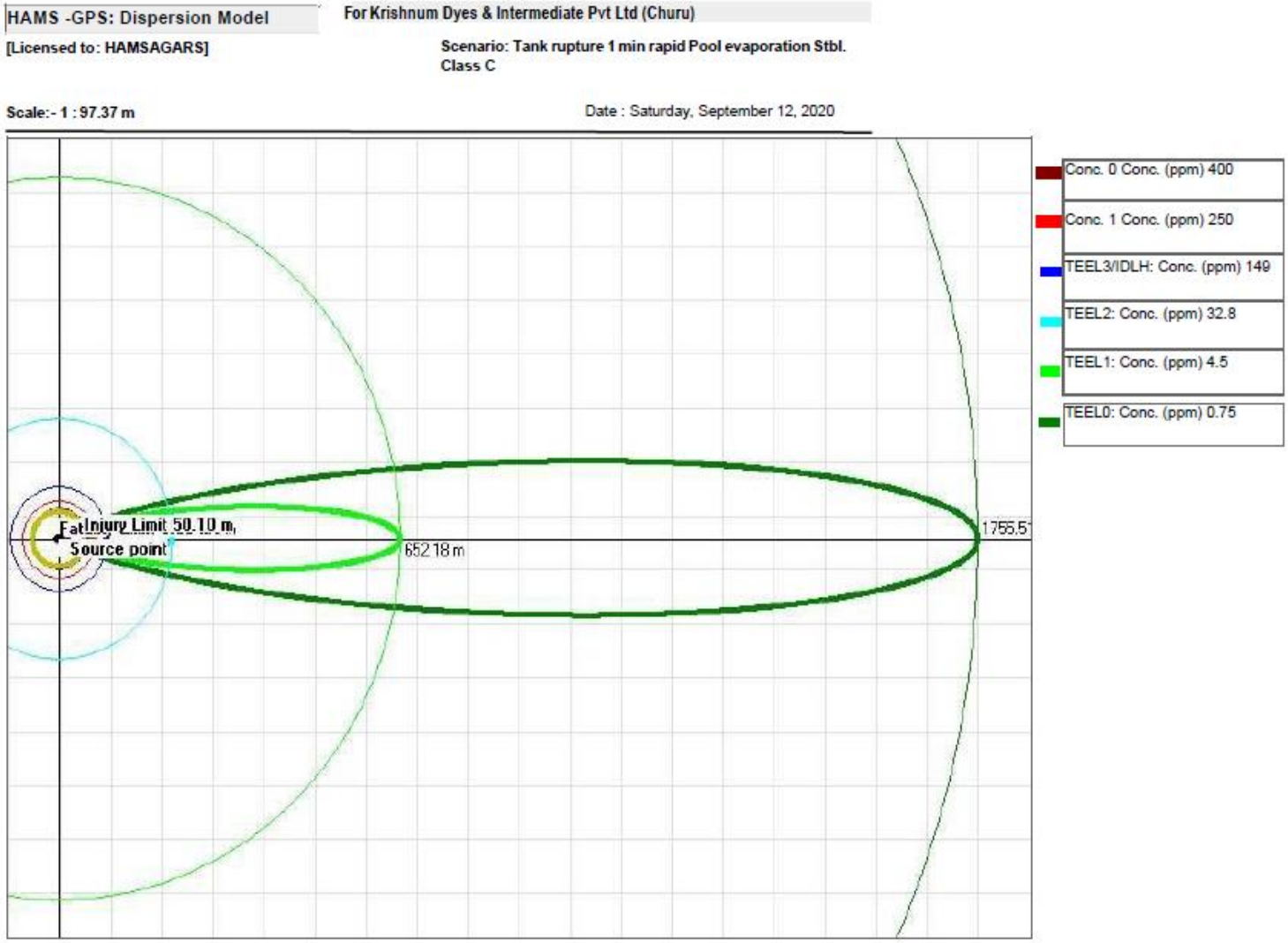
[Licensed to: HAMSAGARS]

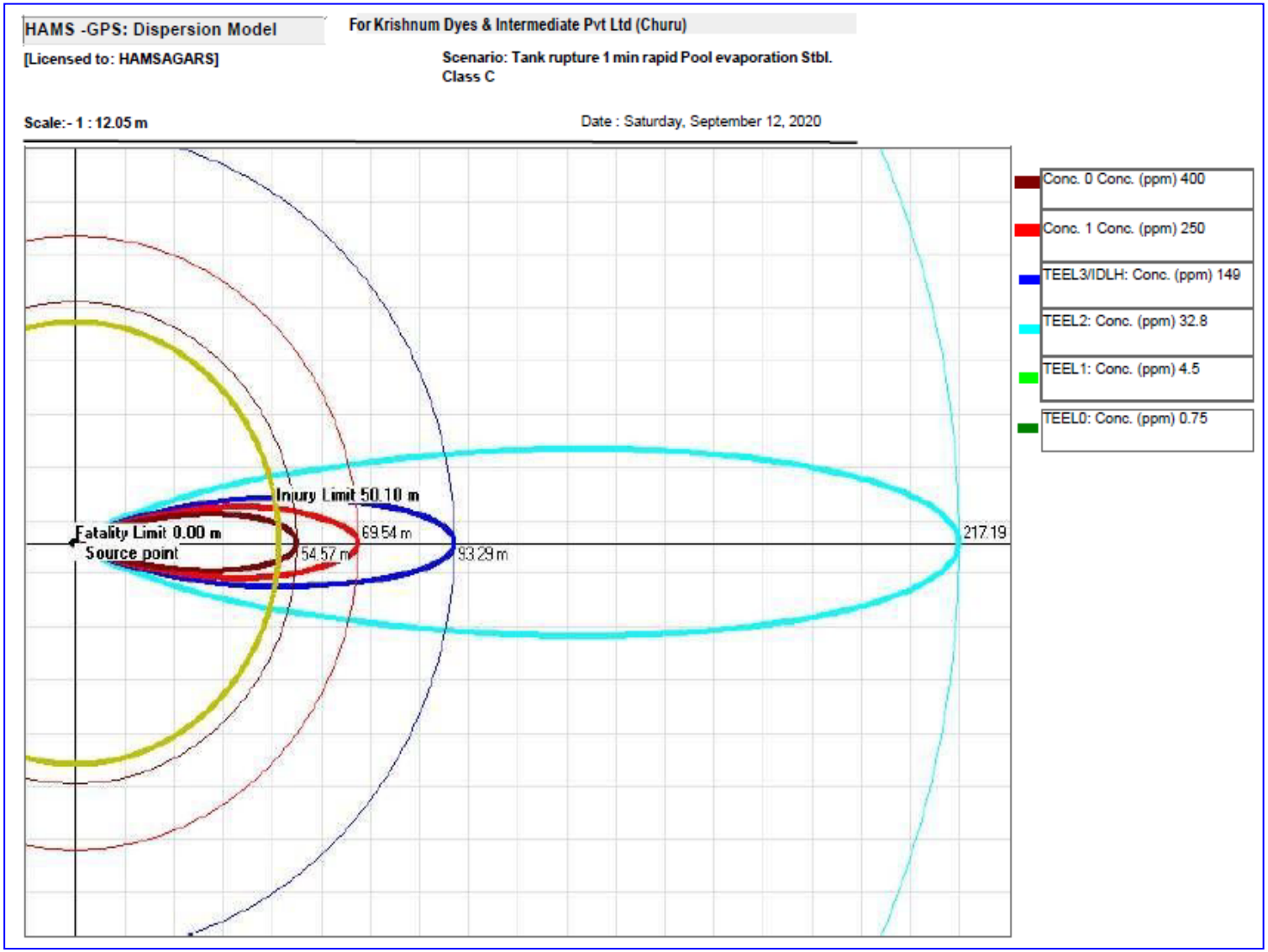
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl. Class C

Fatality and Injury profile

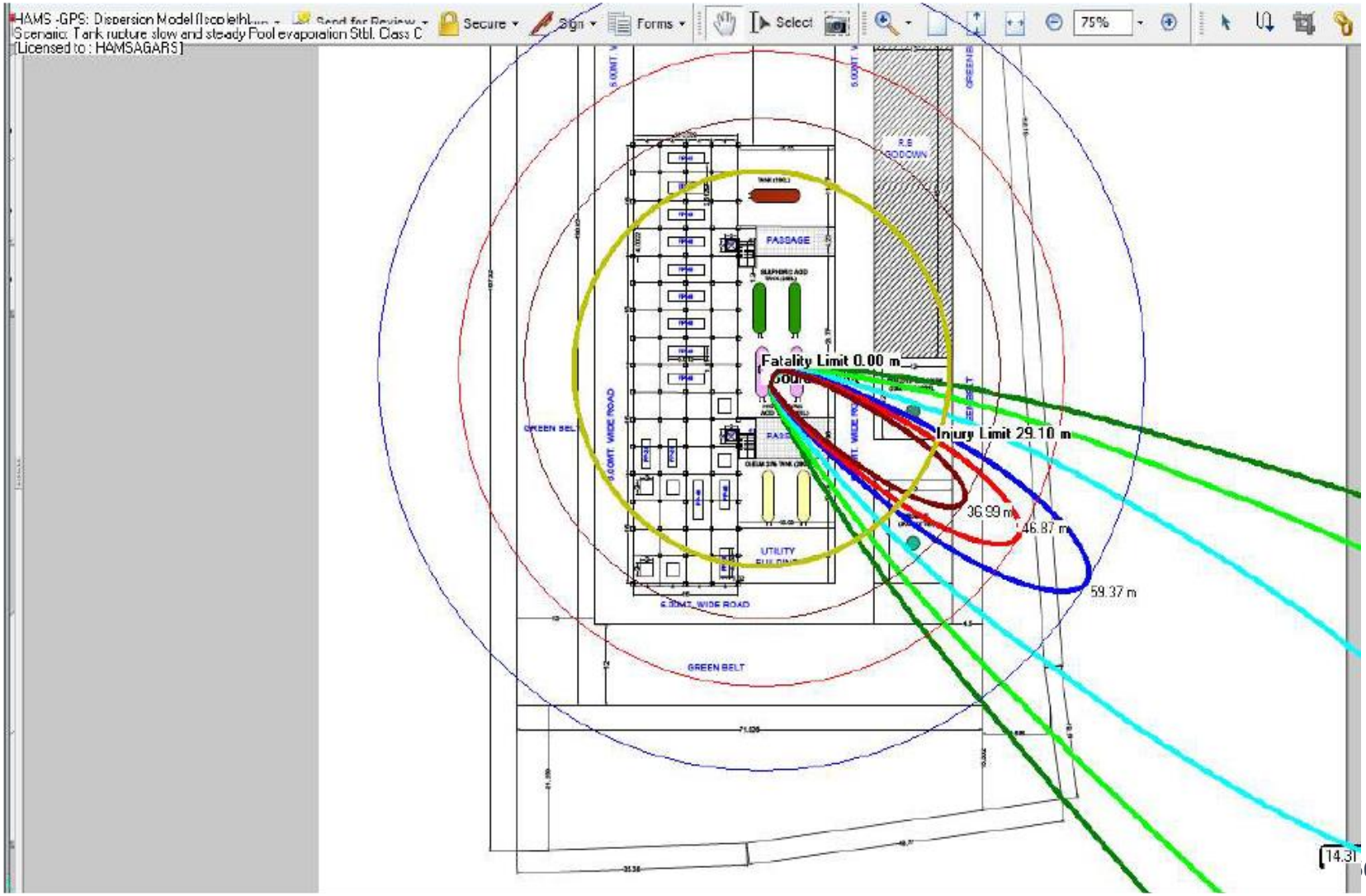
Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Scale:- 1 : 97.37 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 400
Conc. 1 Conc. (ppm) 250
TEEL3/IDLH: Conc. (ppm) 149
TEEL2: Conc. (ppm) 32.8
TEEL1: Conc. (ppm) 4.5
TEEL0: Conc. (ppm) 0.75
Fatal Injury Limit 50.10 m
Source point
652.18 m
1755.5


HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture 1 min rapid Pool evaporation Stbl.
Class C
Scale:- 1 : 12.05 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 400
Conc. 1 Conc. (ppm) 250
TEEL3/IDLH: Conc. (ppm) 149
TEEL2: Conc. (ppm) 32.8
TEEL1: Conc. (ppm) 4.5
TEEL0: Conc. (ppm) 0.75
Injury Limit 50.10 m
Fatality Limit 0.00 m
Source point
69.54 m
54.57 m
93.29 m
217.19

Scenario-8 Hydrochloric acid Tank Rupture slow and Steady Pool Evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Hydrochloric Acid Tank 10KL
Name of Chemical : Hydrochloric Acid
Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 90
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 54080.23
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 1292.36
MGC Distance (m) : 14.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 4.71

*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	400	2.00	36.99	9.25	34.99	8.13	23.50	9.81	0.022
Conc. 1	250	2.00	46.87	11.72	44.87	10.75	30.50	9.99	0.038
TEEL3/IDLH:	149	2.00	59.37	14.85	57.37	14.12	37.50	10.66	0.064
TEEL2:	32.8	2.00	139.29	34.84	137.29	28.27	81.50	9.84	0.305
TEEL1:	4.5	2.00	419.37	104.89	417.37	76.82	241.50	9.04	2.518
TEEL0:	0.75	2.00	1129.22	282.44	1127.22	187.52	648.50	8.23	16.601

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc $^{1.98}$ x Time)

Injury Probit (y): -5.06 +1(Ln(Conc $^{1.98}$ x Time)

T= time 30 min of exposure

Scenario : Tank rupture slow and steady Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	100	0.53	<0.001	78010.83	13.1718	0.000	46.200
5.1	0	88.72	1.28	0.002	14614.21	2.4676	0.000	0.532
8.1	0	60.03	2.03	0.004	5931.32	1.0015	0.000	0.720
11.1	0	40.06	2.78	0.005	3157.96	0.5332	0.000	0.601
14.1	0	25.47	3.53	0.006	1957.08	0.3304	0.000	0.458
17.1	0	15.4	4.28	0.007	1371.63	0.2316	0.000	0.323
20.1	0	8.85	5.03	0.009	1056.7	0.1784	0.000	0.239
23.1	0	4.52	5.78	0.010	859.52	0.1451	0.000	0.136
26.1	0	1.69	6.53	0.011	717.28	0.1211	0.000	0.056
29.1	0	0	7.28	0.012	605.75	0.1023	0.000	0.000
32.1	0	0	8.03	0.012	515.05	0.087	0.000	0.000
35.1	0	0	8.78	0.013	440.26	0.0743	0.000	0.000
38.1	0	0	9.53	0.014	378.23	0.0639	0.000	0.000
41.1	0	0	10.28	0.015	326.61	0.0551	0.000	0.000
44.1	0	0	11.03	0.016	283.49	0.0479	0.000	0.000
47.1	0	0	11.78	0.017	247.34	0.0418	0.000	0.000
50.1	0	0	12.53	0.018	216.89	0.0366	0.000	0.000
53.1	0	0	13.28	0.018	191.13	0.0323	0.000	0.000
56.1	0	0	14.03	0.019	169.22	0.0286	0.000	0.000
59.1	0	0	14.78	0.020	150.49	0.0254	0.000	0.000

HAMS-GPS : Dispersion Model

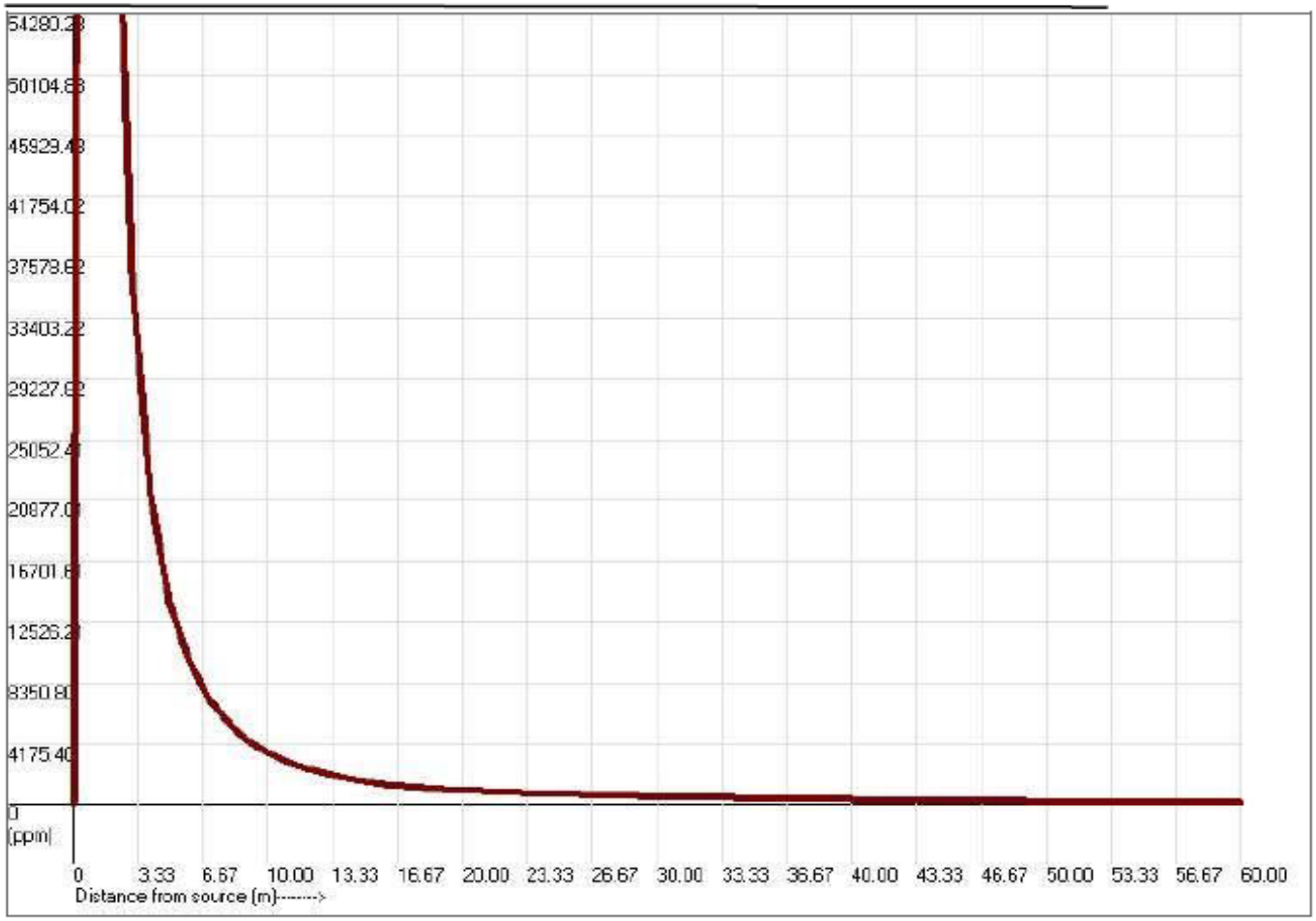
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to: HAMSAGARS]

Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C

Concentration profile (ISOELEVET)

Date : Saturday, September 12, 2020



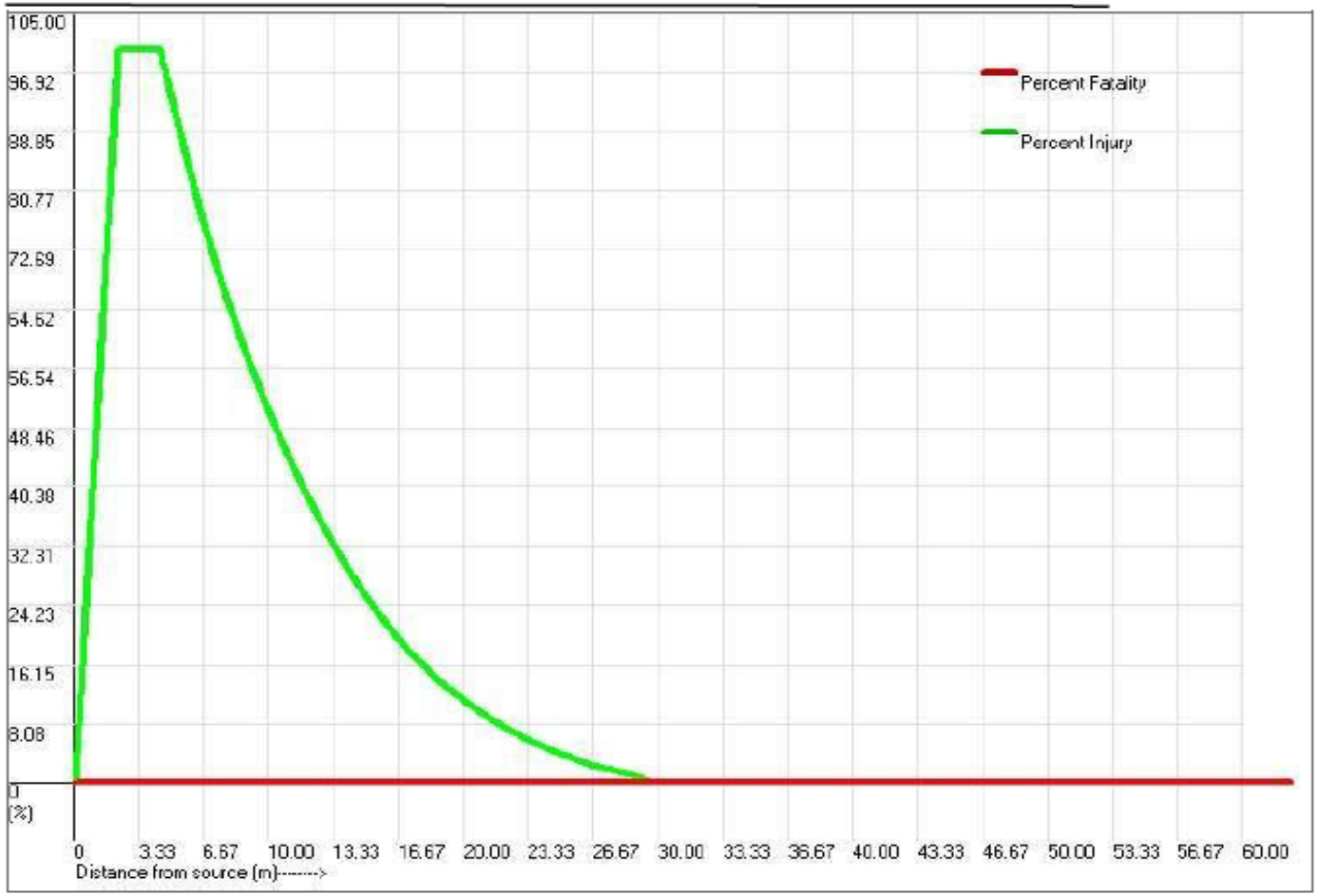
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

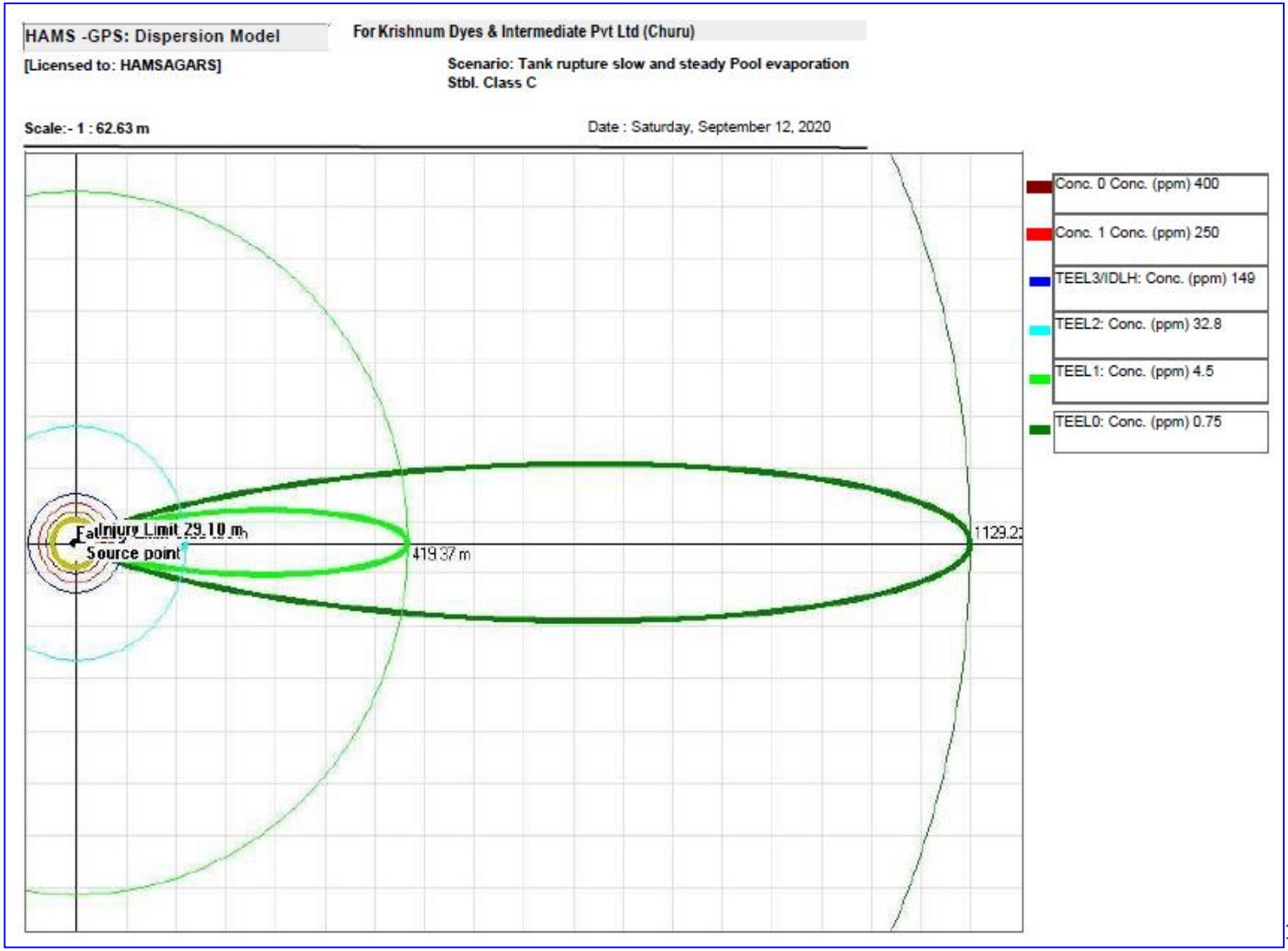
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

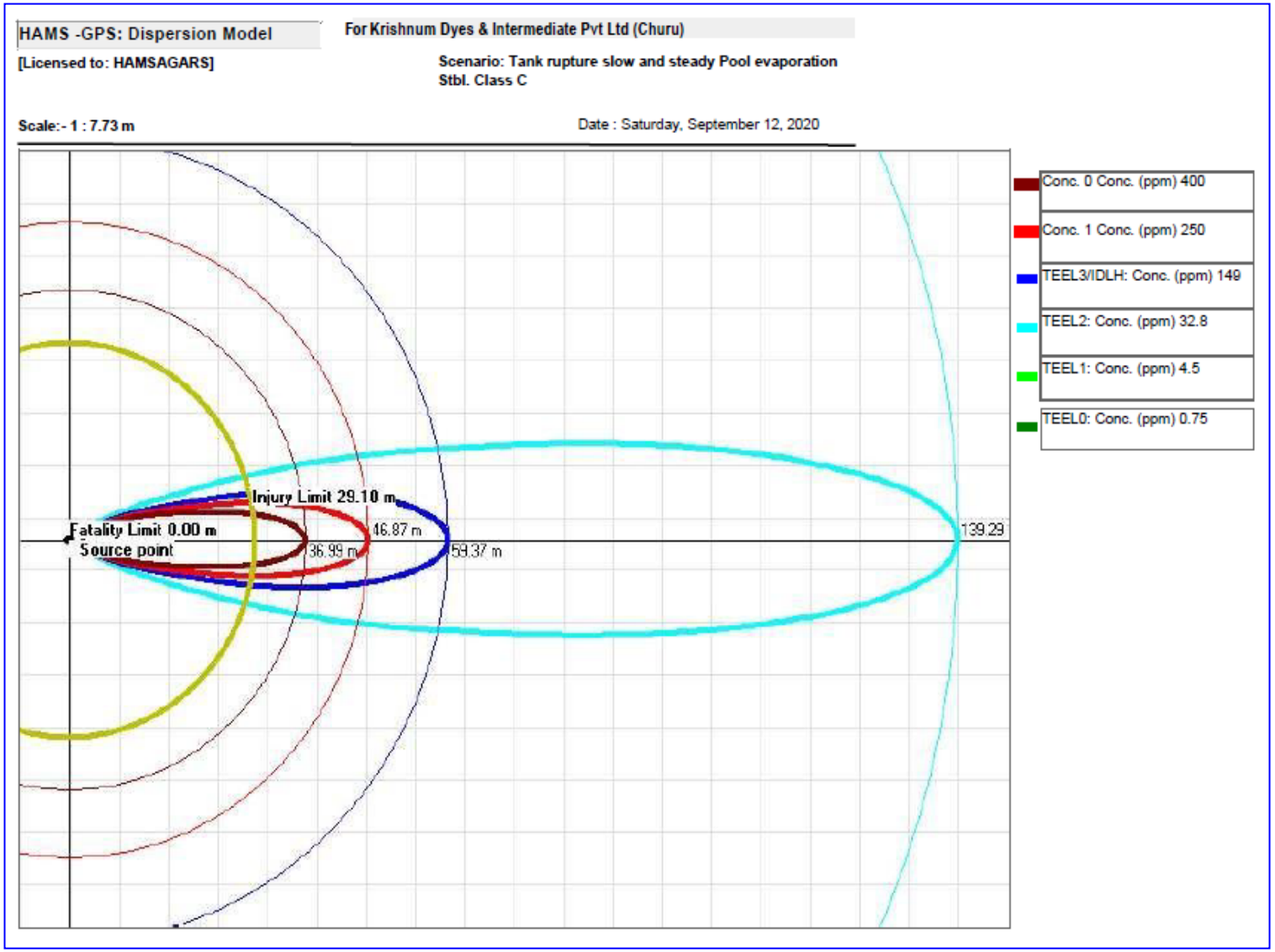
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C

Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 62.63 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 400
Conc. 1 Conc. (ppm) 250
TEEL3/IDLH: Conc. (ppm) 149
TEEL2: Conc. (ppm) 32.8
TEEL1: Conc. (ppm) 4.5
TEEL0: Conc. (ppm) 0.75
Fatality Limit 29.10 m
Source point
419.37 m
1129.2


HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Tank rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 7.73 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 400
Conc. 1 Conc. (ppm) 250
TEEL3/IDLH: Conc. (ppm) 149
TEEL2: Conc. (ppm) 32.8
TEEL1: Conc. (ppm) 4.5
TEEL0: Conc. (ppm) 0.75
Injury Limit 29.10 m
Fatality Limit 0.00 m
Source point
36.99 m
46.87 m
59.37 m
139.29

Benzoyl Chloride Barrel

Distance table and effect of chemicals Concentration

Scenario	Causes	Failure Frequency Per Year	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 30/Hectare Population density
Tank rupture 1 min rapid Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	1	4.36	0.55	6.56	0.75	0.0496637	23.549994	0.00138
Tank rupture slow and steady Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	1	4.31	0.54	8.16	1.12	0.0259488	12.304659	0.00070

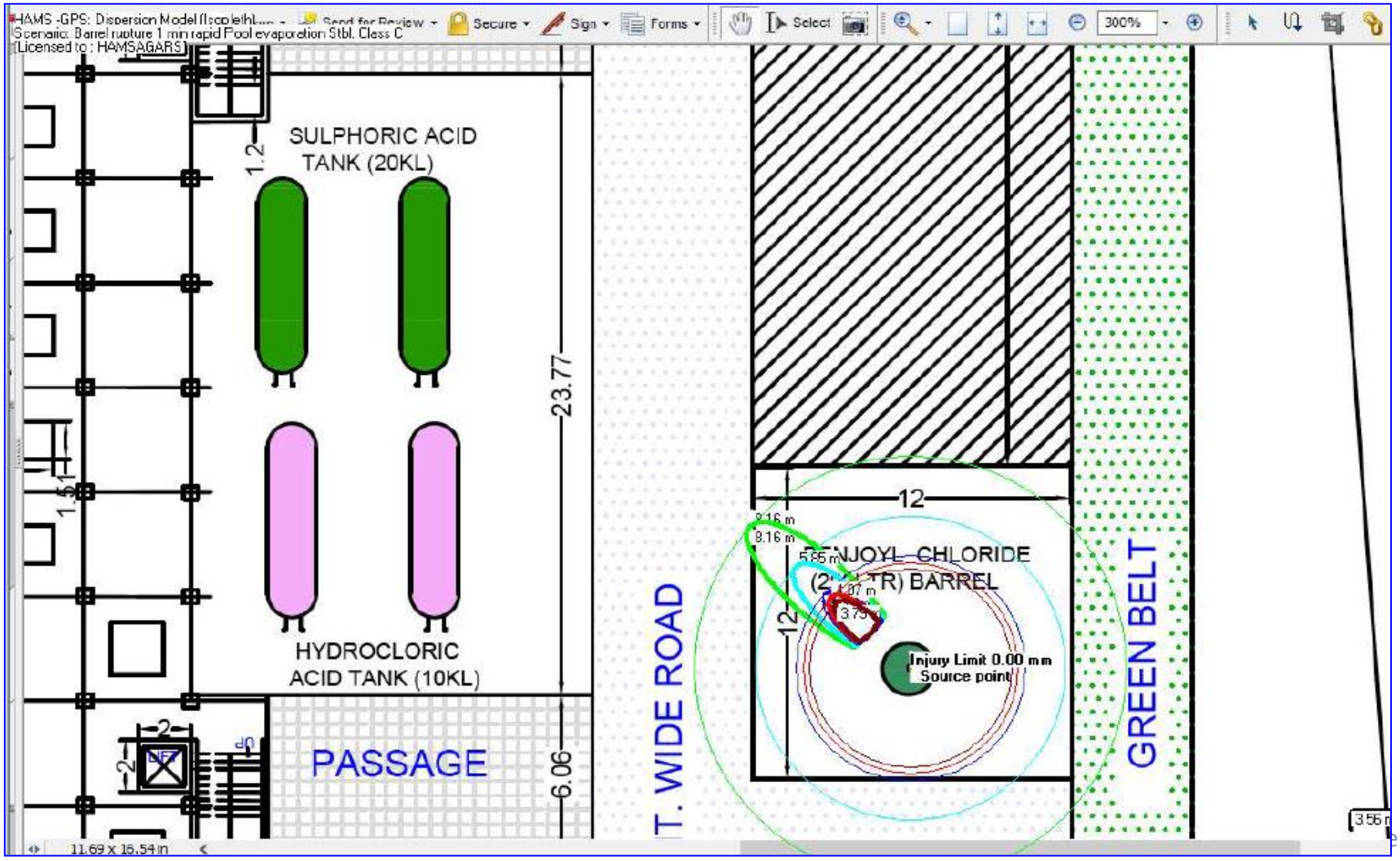
Estimated distance

S.No	Description	Event	Impact Criteria PPM	Distance of Max. ISOPleth from source	Time (Sec)	ISOPleth Angle	Isopleth Area (Ha)
1	Benzoyl Chloride Barrel	Dispersion of Vapor cloud	23	3.50	.95	5.30	0.00009
2		Tank rupture slow and steady Pool evaporation	2.5	3.50	1.02	7.41	0.00015

Probability Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc. (ppm) along X-axis	Dose (mg)	Absolute	
							Fatality No.	Injury No.
2.1	0	0	0.53	<0.001	69.34	0	0	0
6.61	0	0	1.65	0.010	7.86	0	0	0

Scenario-9 Benzoyl Chloride Barrel rupture 1 min rapid Pool Evaporation



HAMS-GPS : Dispersion Module — **For Krishnum Dyes & Intermediate Pvt Ltd (Churu)**

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Benzoyl Chloride Barrels 200 lt
Name of Chemical : benzoyl chloride
Scenario : Barrel rupture 1 min rapid Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.08
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 48.07
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 1.15
MGC Distance (m) : 14.00
Explosion mass (lbm) : Mass = 0
Time for stabilization concentration zones of dispersion (Secs) 2.04

*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 1	23	2.00	3.79	0.95	1.79	0.65	3.50	5.30	0.00009
Conc. 2	20	2.00	4.07	1.02	2.07	0.91	3.50	7.41	0.00015
Conc. 3	18	2.00	4.31	1.08	2.31	1.07	3.50	8.69	0.00019
Conc. 4	10	2.00	5.85	1.46	3.85	1.51	4.50	9.52	0.00046
TEEL1:	5.2	2.00	8.16	2.04	6.16	2.24	5.50	11.51	0.001
TEEL0:	5.2	2.00	8.16	2.04	6.16	2.24	5.50	11.51	0.001

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -5.06 +1(Ln(Conc 1.98 x Time)

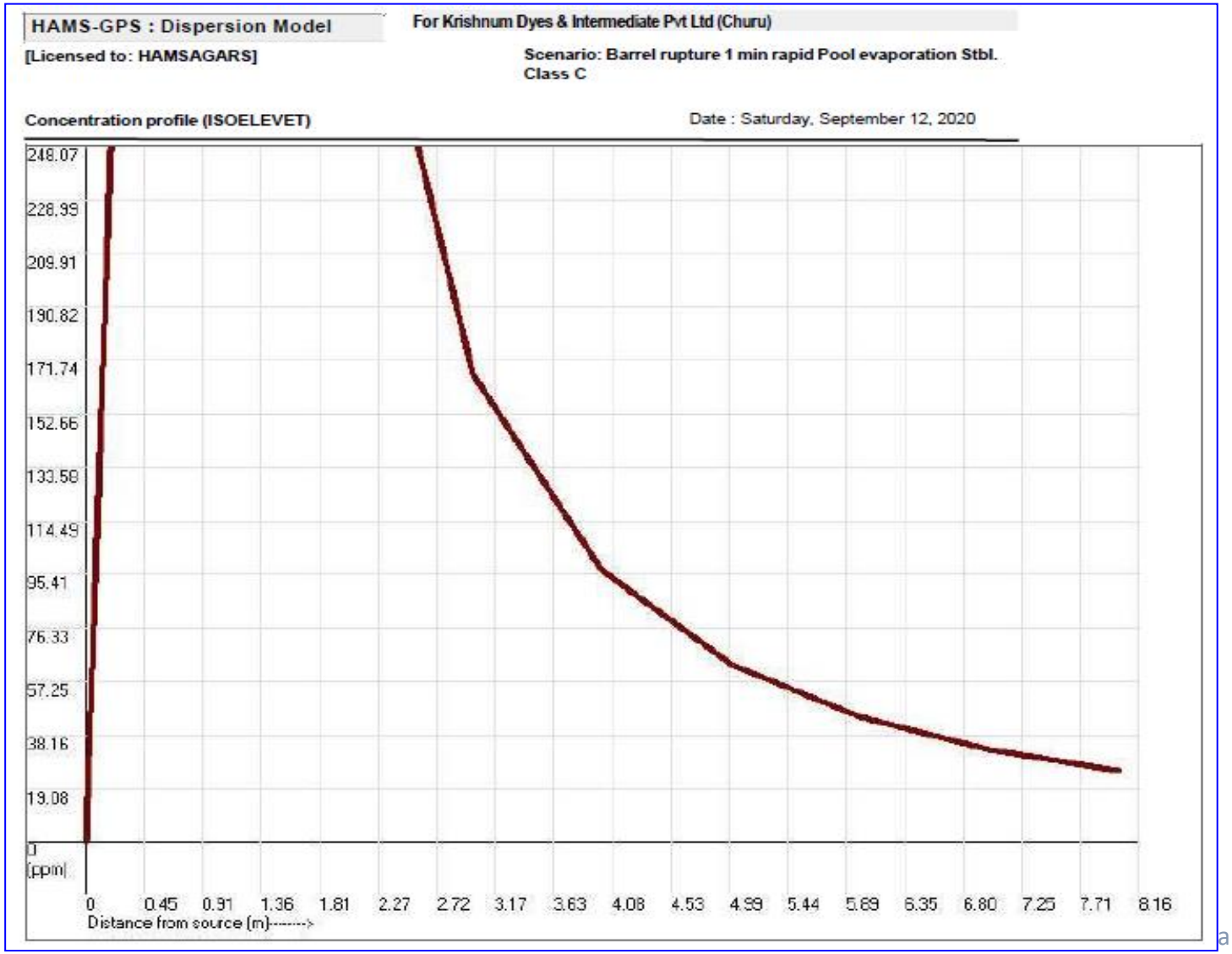
T= time 30 min of exposure

Scenario : Barrel rupture 1 min rapid Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	69.34	0	0	0
2.51	0	0	0.63	<0.001	49.73	0	0	0
2.92	0	0	0.73	<0.001	37.45	0	0	0
3.33	0	0	0.83	<0.001	29.25	0	0	0
3.74	0	0	0.94	<0.001	23.48	0	0	0
4.15	0	0	1.04	<0.001	19.27	0	0	0
4.56	0	0	1.14	<0.001	16.1	0	0	0
4.97	0	0	1.24	<0.001	13.65	0	0	0
5.38	0	0	1.35	<0.001	11.72	0	0	0
5.79	0	0	1.45	<0.001	10.17	0	0	0
6.2	0	0	1.55	<0.001	8.9	0	0	0
6.61	0	0	1.65	<0.001	7.86	0	0	0
7.02	0	0	1.76	<0.001	6.99	0	0	0
7.43	0	0	1.86	<0.001	6.25	0	0	0
7.84	0	0	1.96	<0.001	5.62	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Barrel rupture 1 min rapid Pool evaporation Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
248.07
228.99
209.91
190.82
171.74
152.66
133.58
114.49
95.41
76.33
57.25
38.16
19.08
0
(ppm)
0 0.45 0.91 1.36 1.81 2.27 2.72 3.17 3.63 4.08 4.53 4.99 5.44 5.89 6.35 6.80 7.25 7.71 8.16
Distance from source (m)------>

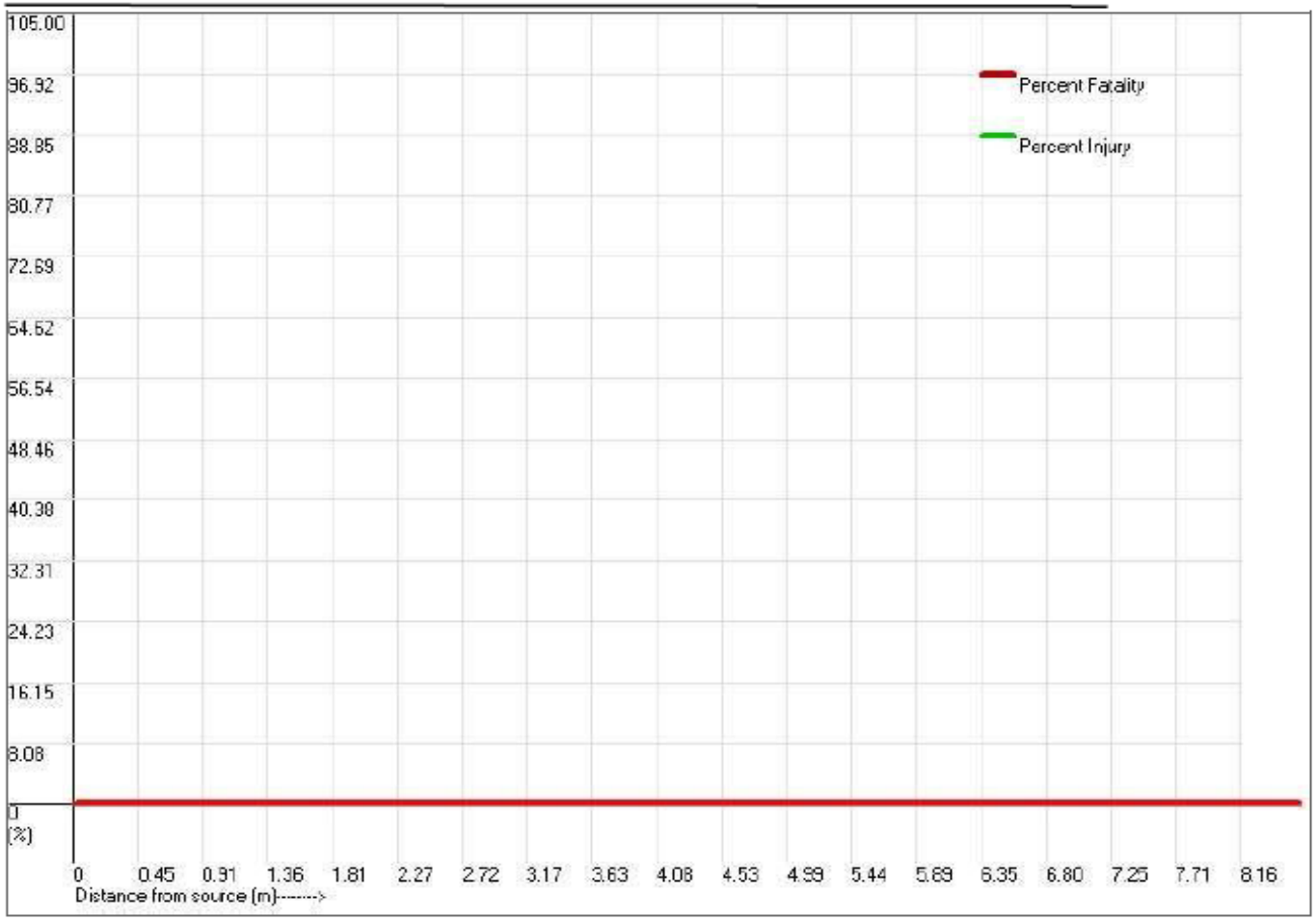
HAMS-GPS : Dispersion Model
[Licensed to: HAMSAGARS]

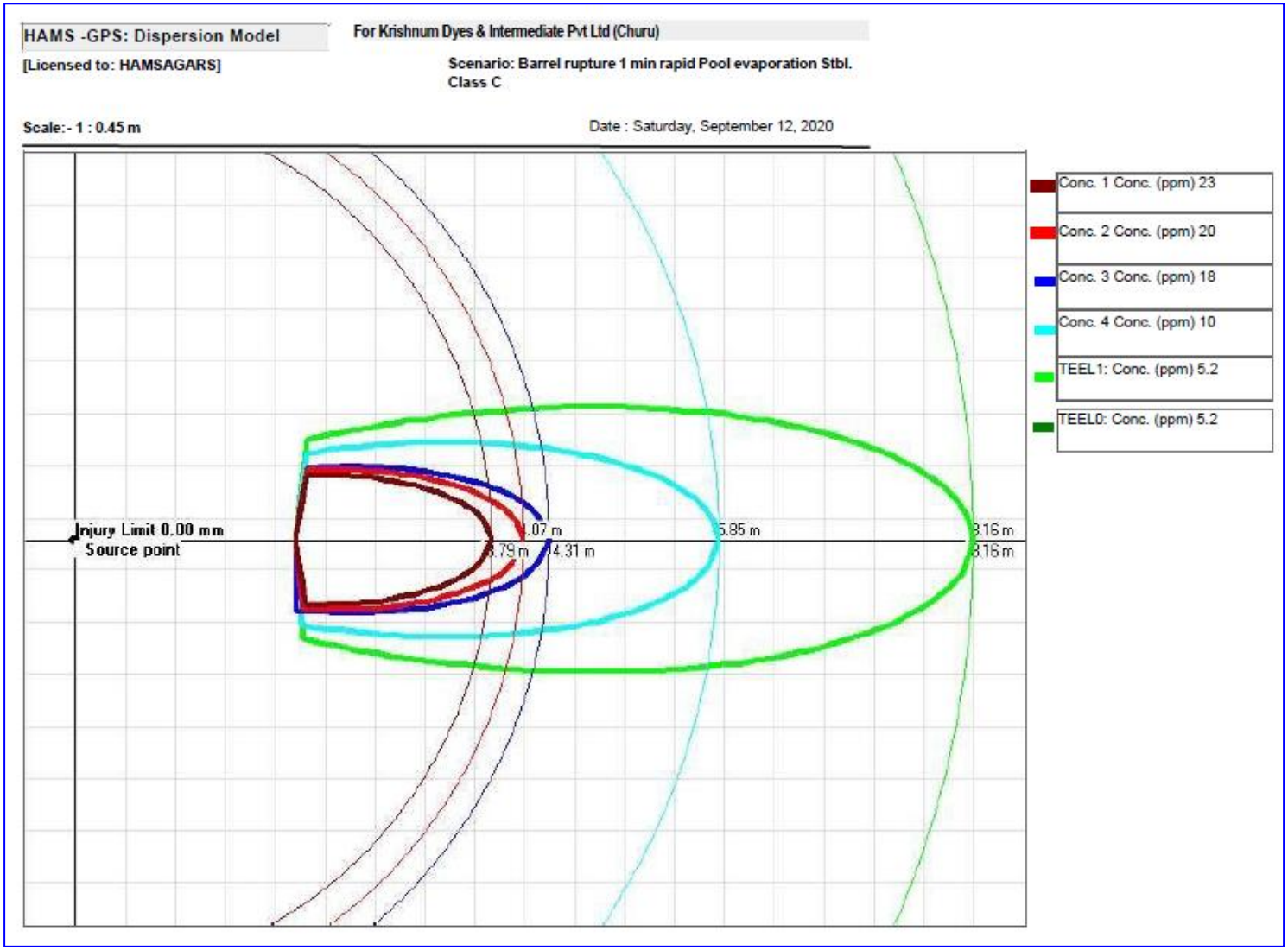
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

Scenario: Barrel rupture 1 min rapid Pool evaporation Stbl. Class C

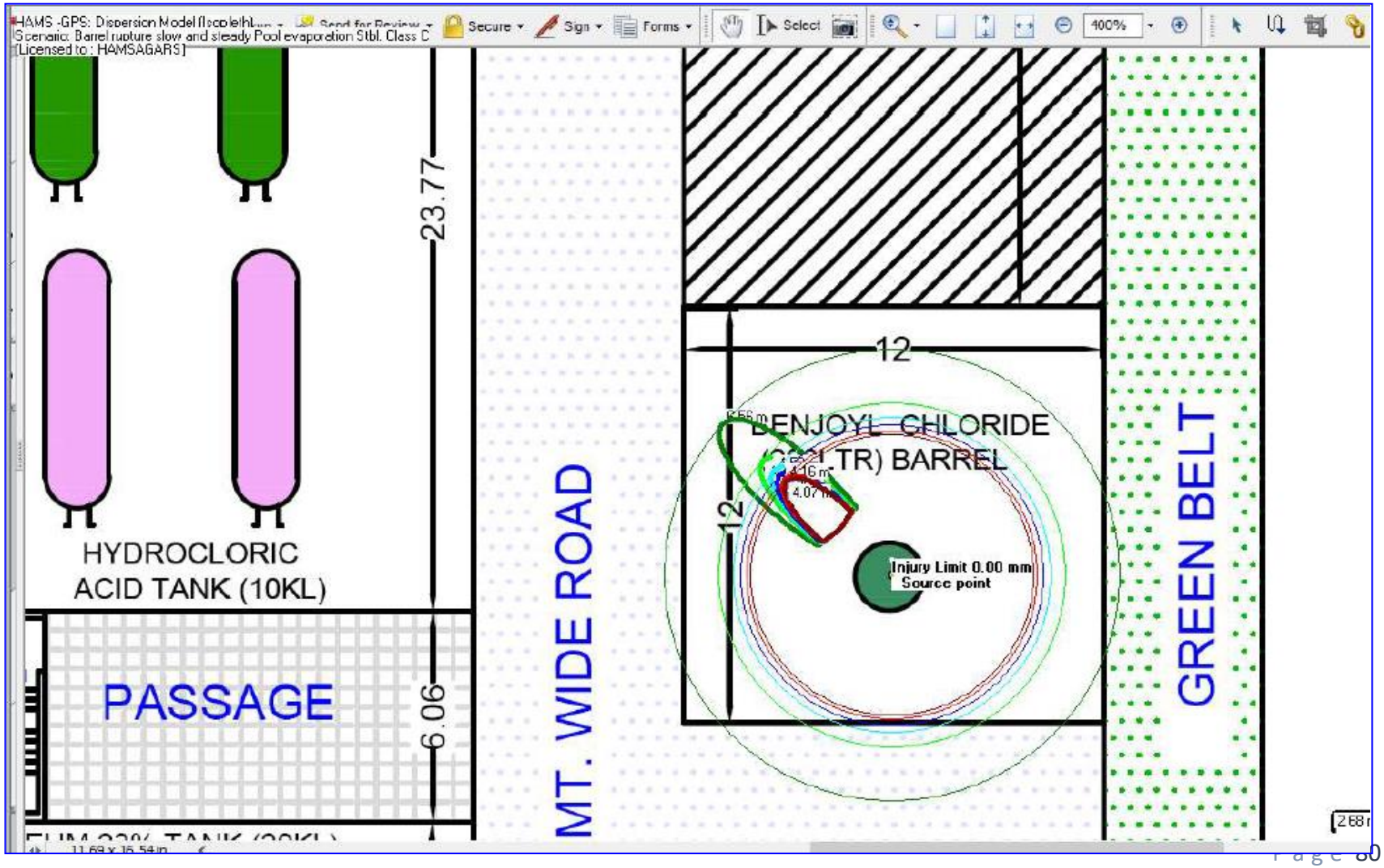
Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Barrel rupture 1 min rapid Pool evaporation Stbl. Class C
Scale:- 1 : 0.45 m
Date : Saturday, September 12, 2020
Conc. 1 Conc. (ppm) 23
Conc. 2 Conc. (ppm) 20
Conc. 3 Conc. (ppm) 18
Conc. 4 Conc. (ppm) 10
TEEL1: Conc. (ppm) 5.2
TEEL0: Conc. (ppm) 5.2
Injury Limit 0.00 mm
Source point
.07 m
3.79 m
4.31 m
5.85 m
8.16 m
8.16 m

Scenario-10 Benzoyl Chloride rupture slow and steady Pool Evaporation



HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Benzoyl Chloride Barrels 200 lt
Name of Chemical : benzoyl chloride
Scenario : Barrel rupture slow and steady Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.01
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm): 6.31
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 0.15
MGC Distance (m) : 14.00
Explosion mass (lbm) : Mass = 0
Time for stabilization concentration zones of dispersion (Secs) 1.64
*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 1	2.5	2.00	4.07	1.02	2.07	0.91	3.50	7.41	0.00015
Conc. 2	2.4	2.00	4.16	1.04	2.16	0.97	3.50	7.89	0.00016
Conc. 3	2.2	2.00	4.36	1.09	2.36	1.10	3.50	8.93	0.00020
Conc. 4	2	2.00	4.58	1.15	2.58	0.38	4.50	2.42	0.00008
Conc. 5	1.7	2.00	4.98	1.25	2.98	0.94	4.50	5.96	0.00022
Conc. 6	1	2.00	6.56	1.64	4.56	1.49	5.50	7.71	0.00053

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module

For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -10.12 +1(Ln(Conc $^{1.98}$ x Time)

Injury Probit (y): -5.06 +1(Ln(Conc $^{1.98}$ x Time)

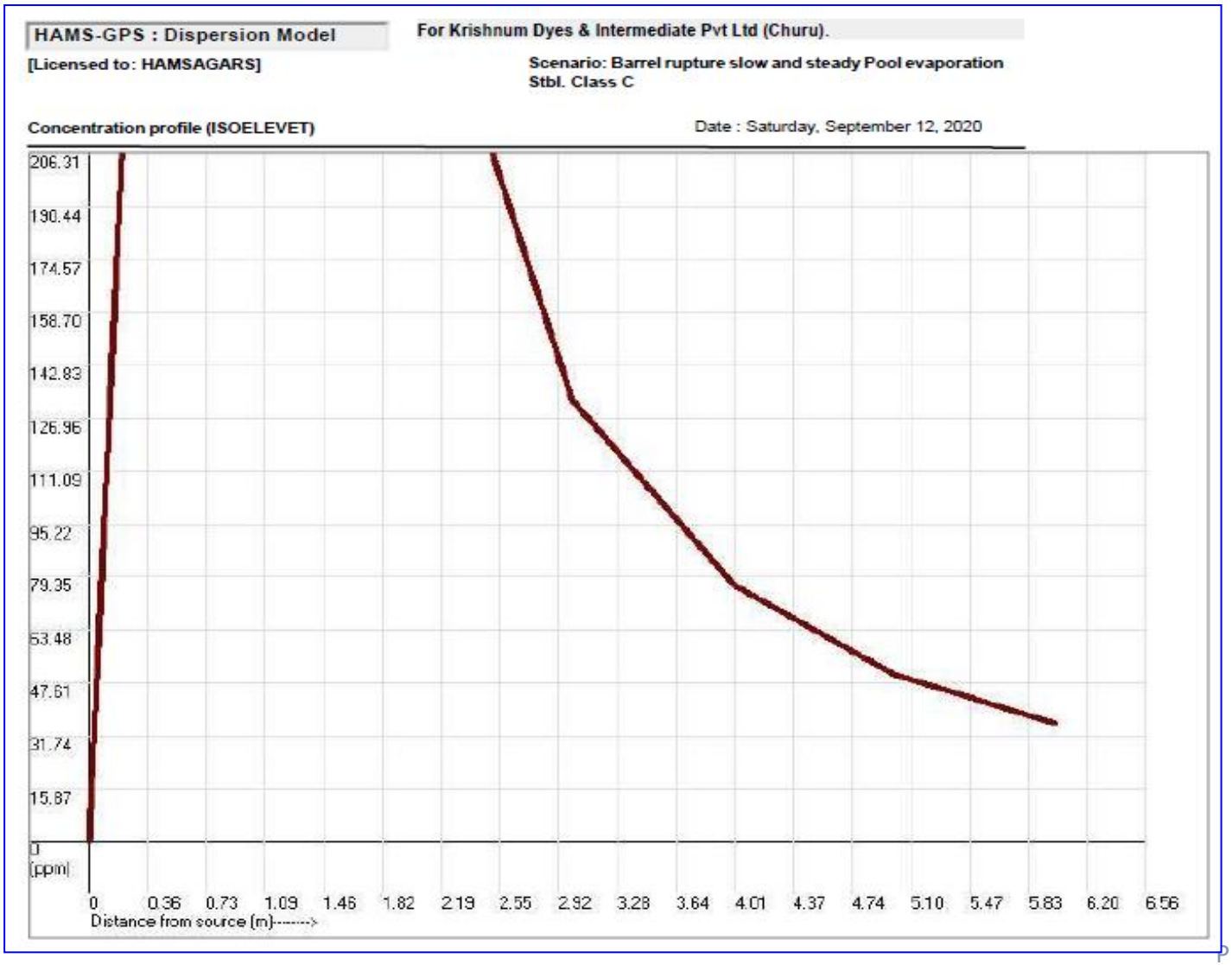
T= time 30 min of exposure

Scenario : Barrel rupture slow and steady Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	8.67	0	0	0
2.43	0	0	0.61	<0.001	6.6	0	0	0
2.75	0	0	0.69	<0.001	5.2	0	0	0
3.09	0	0	0.77	<0.001	4.21	0	0	0
3.42	0	0	0.86	<0.001	3.48	0	0	0
3.75	0	0	0.94	<0.001	2.92	0	0	0
4.08	0	0	1.02	<0.001	2.49	0	0	0
4.41	0	0	1.10	<0.001	2.15	0	0	0
4.74	0	0	1.19	<0.001	1.87	0	0	0
5.07	0	0	1.27	<0.001	1.64	0	0	0
5.4	0	0	1.35	<0.001	1.45	0	0	0
5.73	0	0	1.43	<0.001	1.3	0	0	0
6.06	0	0	1.52	<0.001	1.16	0	0	0
6.39	0	0	1.60	<0.001	1.05	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu).
[Licensed to: HAMSAGARS]
Scenario: Barrel rupture slow and steady Pool evaporation
Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
206.31
190.44
174.57
158.70
142.83
126.96
111.09
95.22
79.35
63.48
47.61
31.74
15.87
0
[ppm]
0
0.36
0.73
1.09
1.46
1.82
2.19
2.55
2.92
3.28
3.64
4.01
4.37
4.74
5.10
5.47
5.83
6.20
6.56
Distance from source (m)------>

HAMS-GPS : Dispersion Model

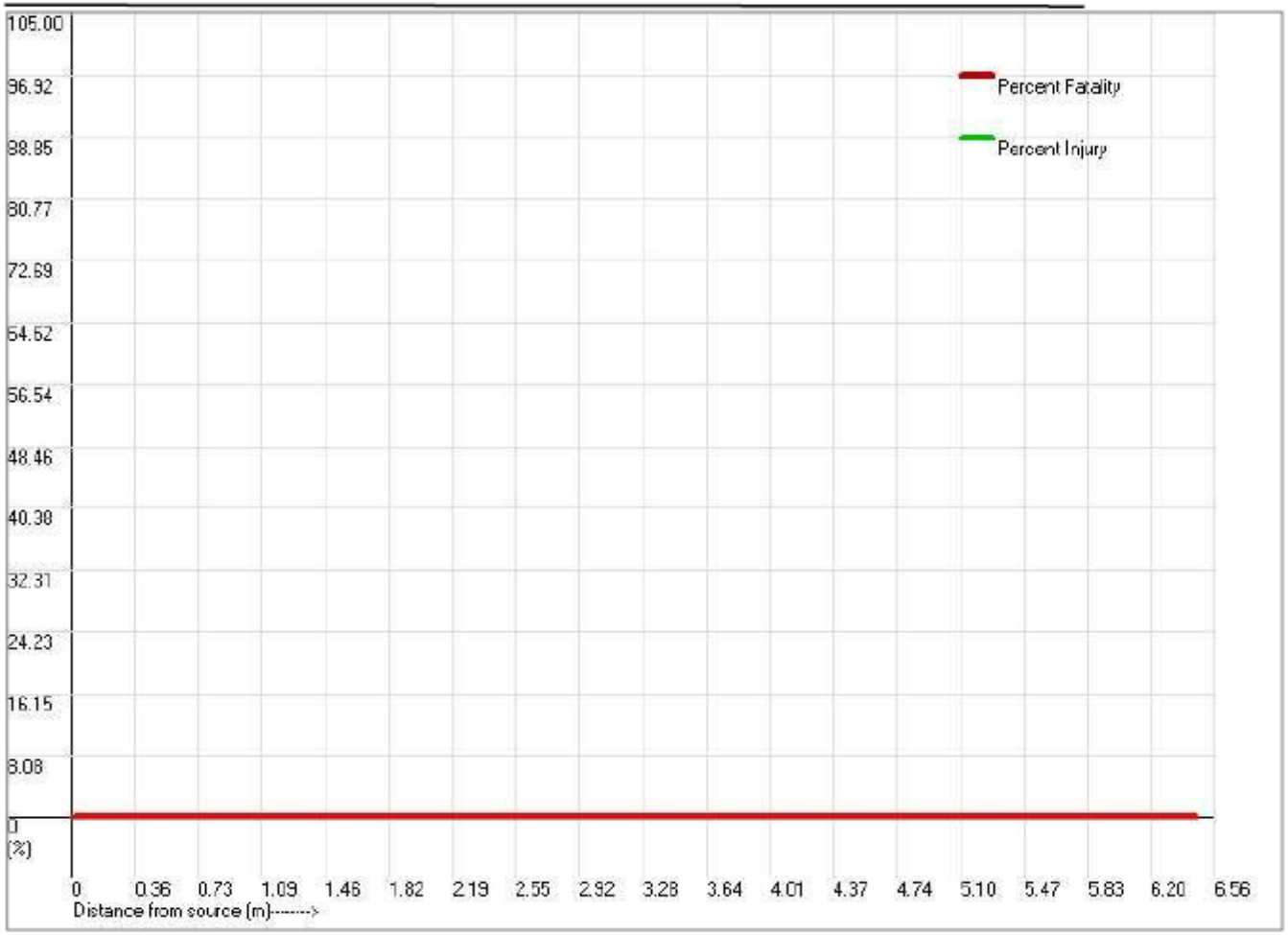
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

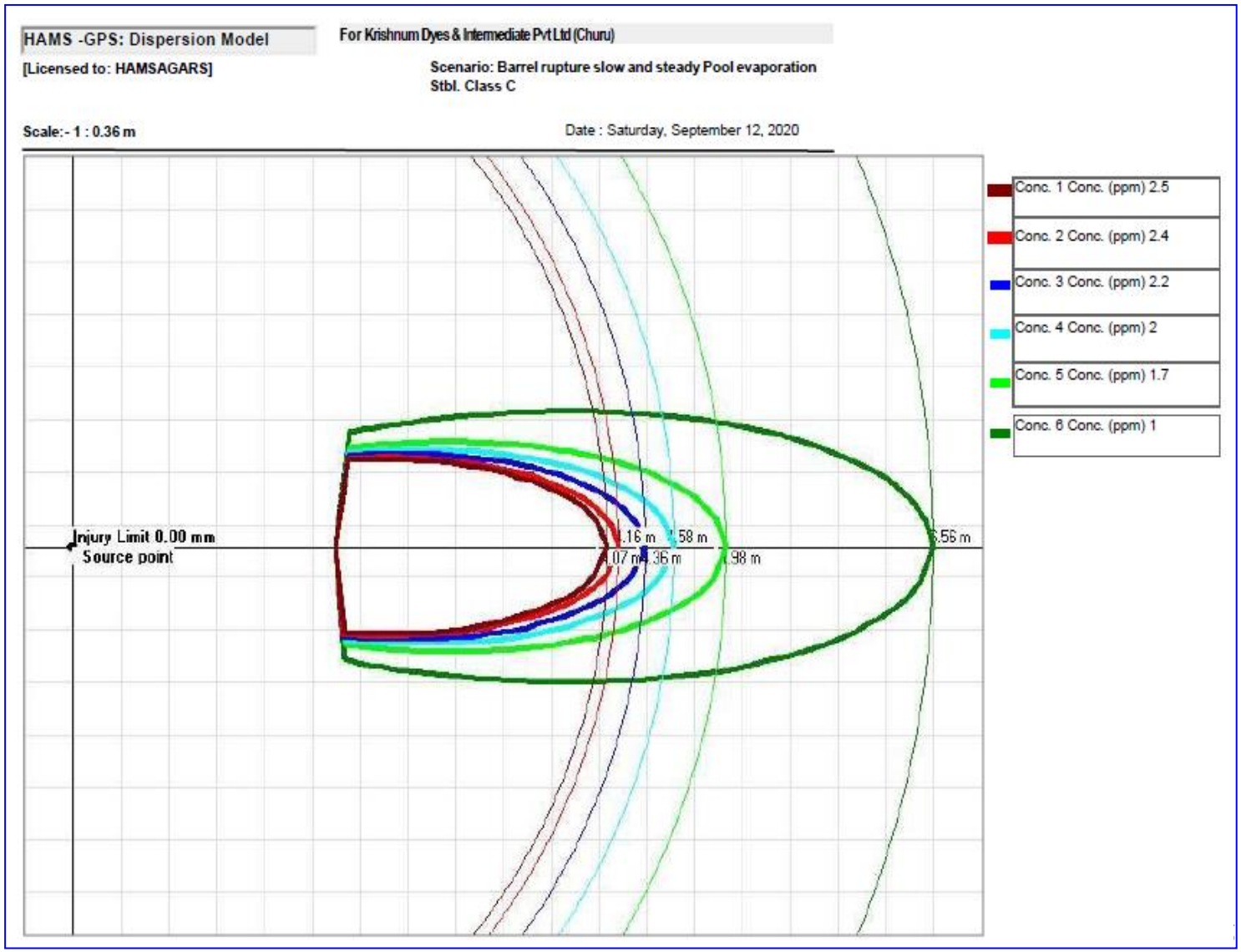
[Licensed to: HAMSAGARS]

Scenario: Barrel rupture slow and steady Pool evaporation
Stbl. Class C

Fatality and Injury profile

Date : Saturday, September 12, 2020




HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Barrel rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 0.36 m
Date : Saturday, September 12, 2020
Conc. 1 Conc. (ppm) 2.5
Conc. 2 Conc. (ppm) 2.4
Conc. 3 Conc. (ppm) 2.2
Conc. 4 Conc. (ppm) 2
Conc. 5 Conc. (ppm) 1.7
Conc. 6 Conc. (ppm) 1
Injury Limit 0.00 mm
Source point
.16 m
.58 m
.07 m
.36 m
.98 m
.56 m

Bromine Bottle

Distance table and effect of chemicals Concentration

Scenario	Causes	Failure Frequency Per Year	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 30/Hectare Population density
Tank rupture 1 min rapid Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	1	4.91	0.44	20.99	2.57	0.0040808	1.935064	0.00010
Tank rupture slow and steady Pool evaporation Stbl. Class C	Tank integrity Failure	3.261E-05	1	4.91	0.44	20.99	2.57	0.0040808	1.935064	0.00010

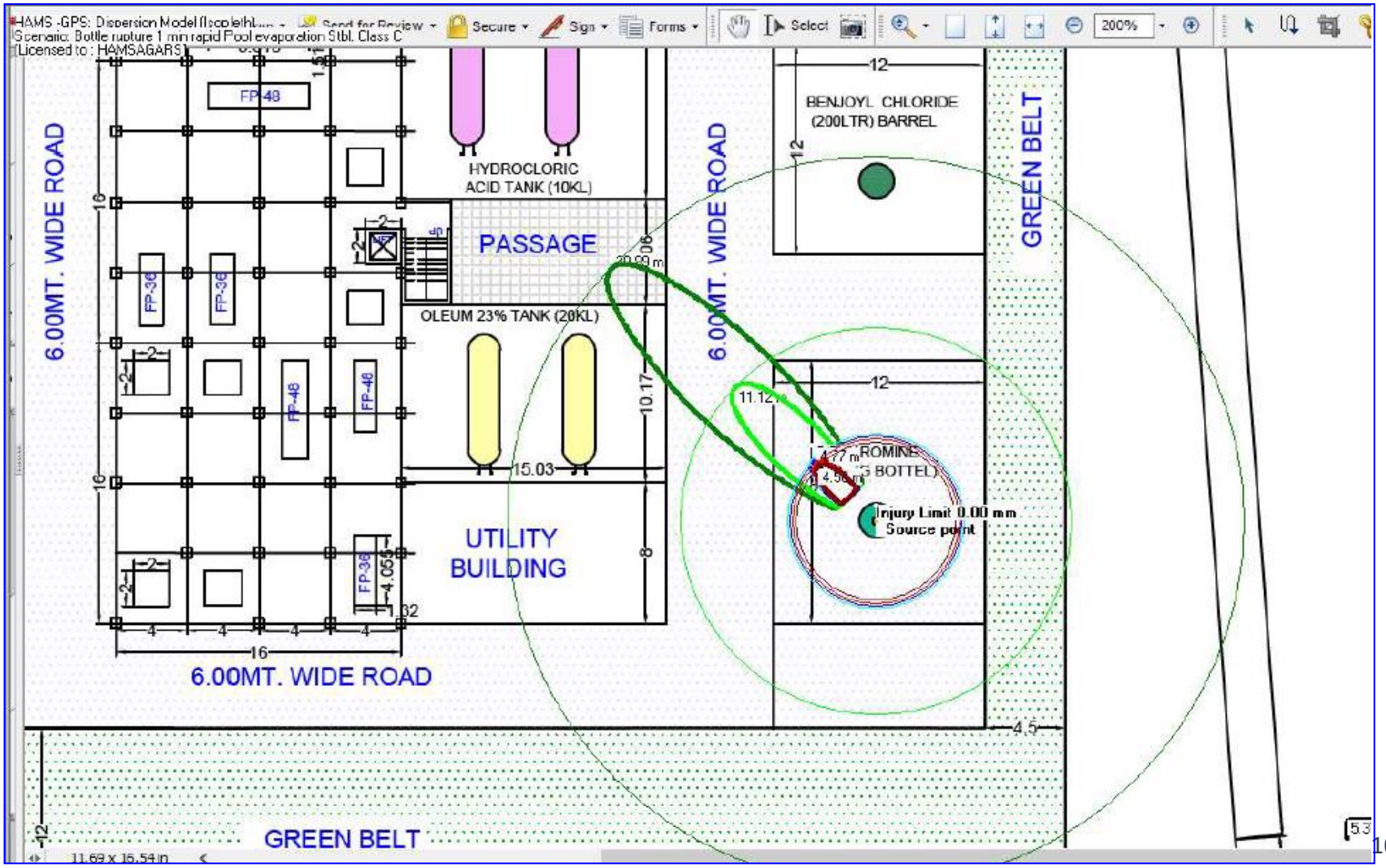
Estimated distance

S.No	Description	Event	Impact Criteria PPM	Distance of Max. ISOPleth from source	Time (Sec)	ISOPleth Angle	Isopleth Area (Ha)
1	Bromine Bottle	Dispersion of Vapor cloud	4	3.50	1.15	9.89	0.00025
2		Tank rupture slow and steady Pool evaporation	4	3.50	1.15	9.89	0.00025

Probability Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc. (ppm) along X-axis	Dose (mg)	Absolute	
							Fatality No.	Injury No.
2.1	0	0	0.53	<0.001	17.34	0	0	0
18.9	0	0	4.73	<0.001	0.26	0	0	0

Scenario-11 Bromine Bottle rupture 1 min rapid Pool Evaporation



HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Data Entered

Reference No. : Bromine Bottles 3Kg
Name of Chemical : Bromine
Scenario : Bottle rupture 1 min rapid Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.02
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 12.02
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 0.29
MGC Distance (m) : 14.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 5.25
*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	4	2.00	4.58	1.15	2.58	1.22	3.50	9.89	0.00025
Conc. 1	3.7	2.00	4.77	1.19	2.77	1.30	3.50	10.52	0.00028
Conc. 3	3.5	2.00	4.91	1.23	2.91	0.87	4.50	5.52	0.00020
TEEL2:	3.3	2.00	5.06	1.27	3.06	1.01	4.50	6.40	0.00024
TEEL1:	0.7	2.00	11.12	2.78	9.12	3.00	7.50	11.31	0.002
TEEL0:	0.22	2.00	20.99	5.25	18.99	5.14	12.50	11.62	0.008

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -12.51 +1(Ln(Conc $^{1.98}$ x Time)

Injury Probit (y): -5.04 +1(Ln(Conc $^{1.98}$ x Time)

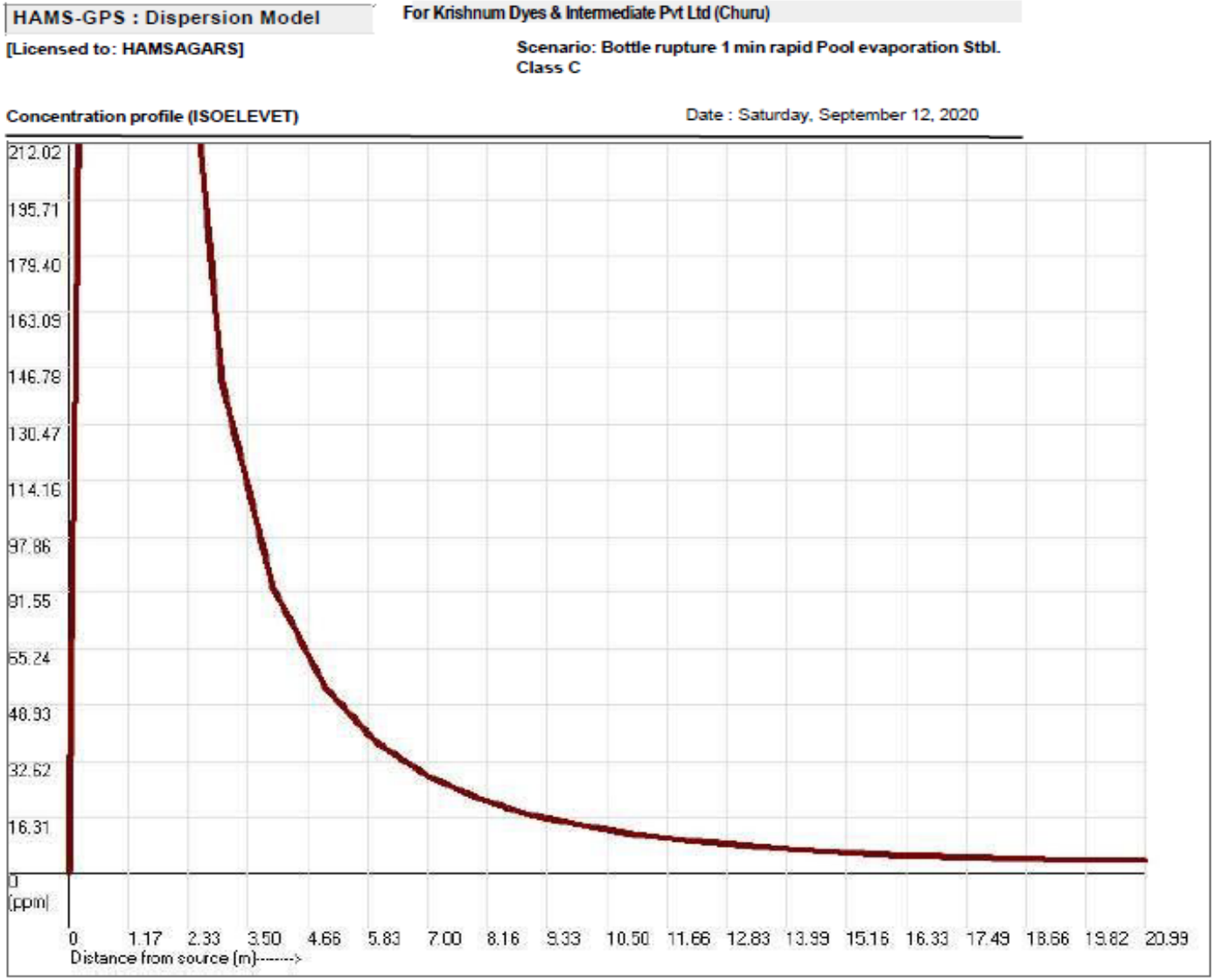
T= time 30 min of exposure

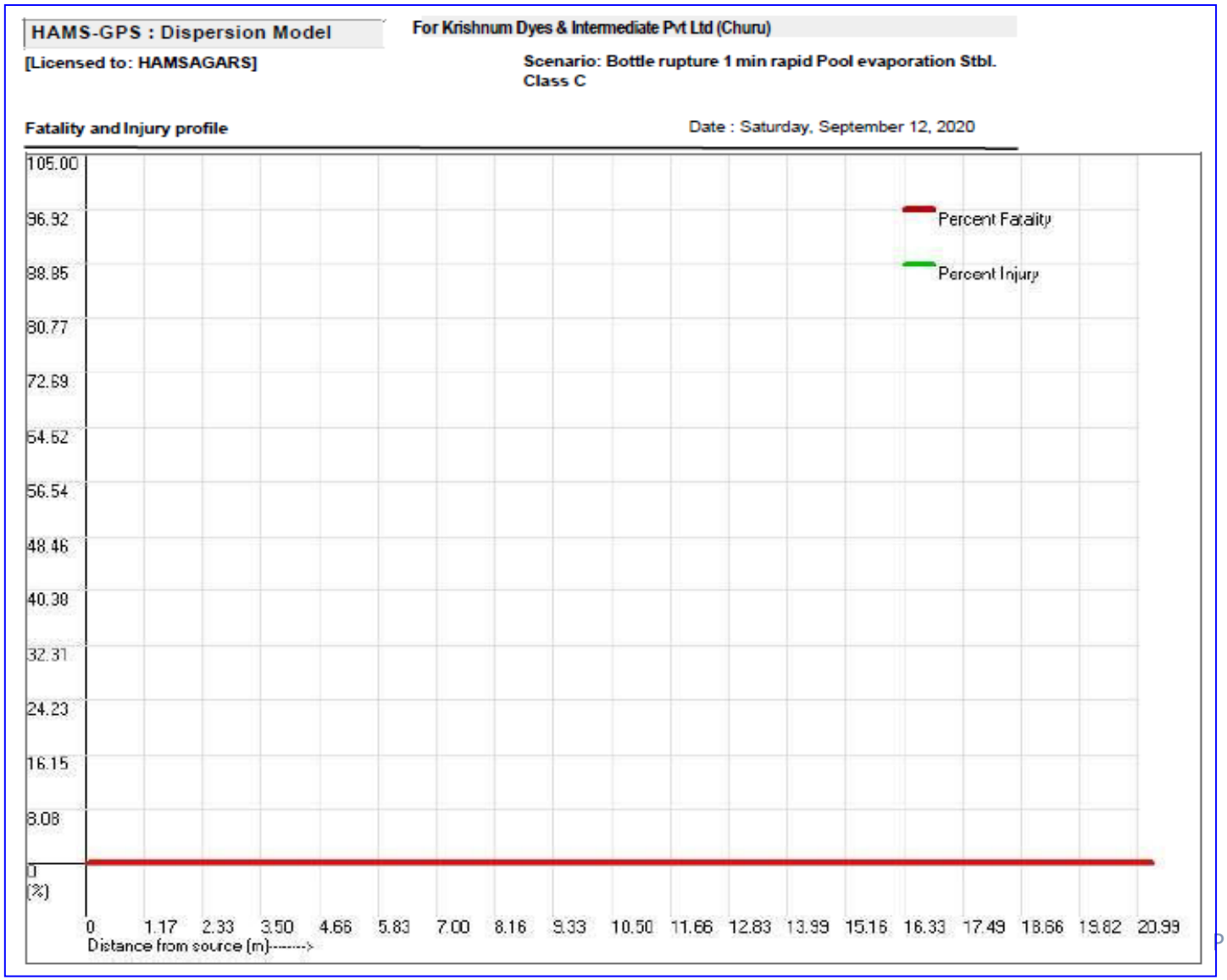
Scenario : Bottle rupture 1 min rapid Pool evaporation Stbl. Class C

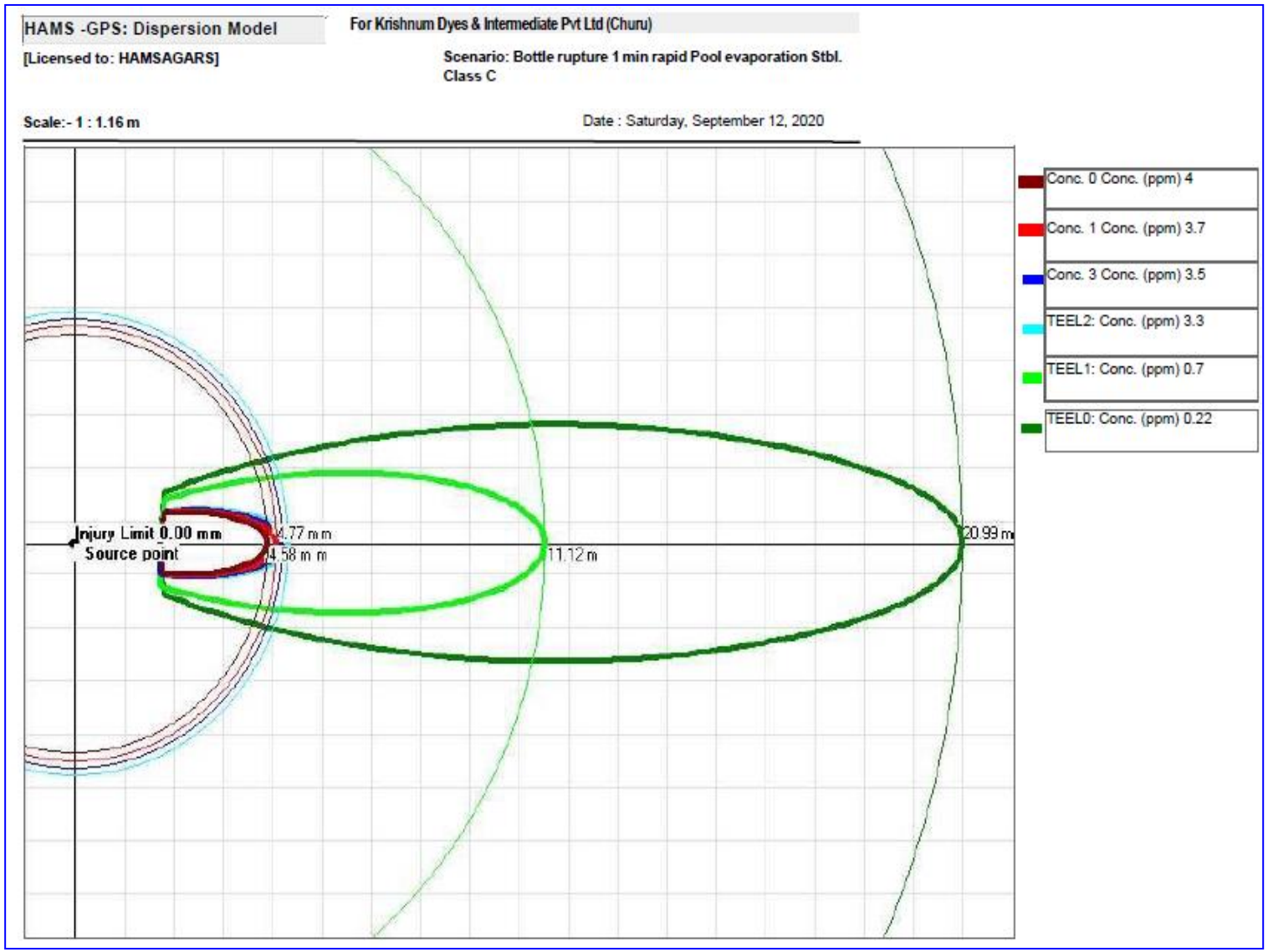
Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

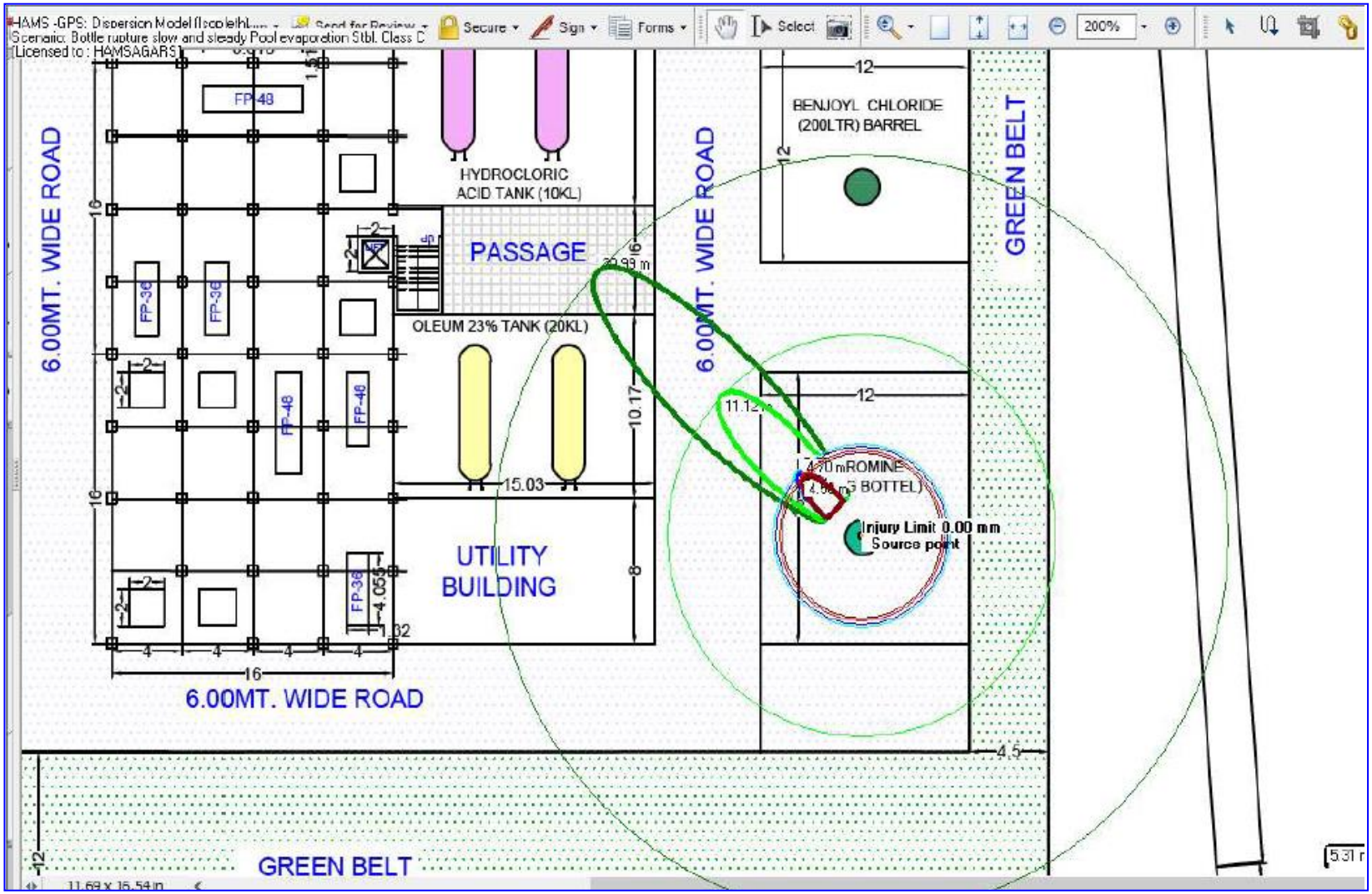
Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	17.34	0	0	0
3.15	0	0	0.79	<0.001	8.12	0	0	0
4.2	0	0	1.05	<0.001	4.71	0	0	0
5.25	0	0	1.31	<0.001	3.07	0	0	0
6.3	0	0	1.58	<0.001	2.16	0	0	0
7.35	0	0	1.84	<0.001	1.6	0	0	0
8.4	0	0	2.10	<0.001	1.23	0	0	0
9.45	0	0	2.36	<0.001	0.97	0	0	0
10.5	0	0	2.63	<0.001	0.79	0	0	0
11.55	0	0	2.89	0.001	0.65	0	0.000	0.000
12.6	0	0	3.15	0.001	0.54	0	0.000	0.000
13.65	0	0	3.41	0.001	0.46	0	0.000	0.000
14.7	0	0	3.68	0.001	0.4	0	0.000	0.000
15.75	0	0	3.94	<0.001	0.35	0	0	0
16.8	0	0	4.20	<0.001	0.31	0	0	0
17.85	0	0	4.46	<0.001	0.28	0	0	0
18.9	0	0	4.73	<0.001	0.26	0	0	0
19.95	0	0	4.99	<0.001	0.24	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Bottle rupture 1 min rapid Pool evaporation Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
212.02
195.71
179.40
163.09
146.78
130.47
114.16
97.86
81.55
65.24
48.93
32.62
16.31
0
(ppm)
0
1.17
2.33
3.50
4.66
5.83
7.00
8.16
9.33
10.50
11.66
12.83
13.99
15.16
16.33
17.49
18.66
19.82
20.99
Distance from source (m)------>


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Bottle rupture 1 min rapid Pool evaporation Stbl. Class C
Fatality and Injury profile
Date : Saturday, September 12, 2020
105.00
96.92
88.85
80.77
72.69
64.62
56.54
48.46
40.38
32.31
24.23
16.15
8.08
0
(%)
Percent Fatality
Percent Injury
0
1.17
2.33
3.50
4.66
5.83
7.00
8.16
9.33
10.50
11.66
12.83
13.99
15.16
16.33
17.49
18.66
19.82
20.99
Distance from source (m)------>


HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Bottle rupture 1 min rapid Pool evaporation Stbl.
Class C
Scale:- 1 : 1.16 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 4
Conc. 1 Conc. (ppm) 3.7
Conc. 3 Conc. (ppm) 3.5
TEEL2: Conc. (ppm) 3.3
TEEL1: Conc. (ppm) 0.7
TEEL0: Conc. (ppm) 0.22
Injury Limit 0.00 mm
Source point
4.77 m m
4.58 m m
11.12 m
20.99 m

Scenario-12 Bromine Bottle rupture slow and steady Pool Evaporation



HAMS-GPS : Dispersion Module — For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

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Date : Saturday, September 12, 2020

Data Entered

Reference No. : Bromine Bottles 3Kg
Name of Chemical : Bromine
Scenario : Bottle rupture slow and steady Pool evaporation Stbl. Class C
Height of release (m) : 1
Height of simulation (m): 1
Atmospheric stability class : C
Wind velocity : 4.00 m/s
Terrain : Level
Rate of Released (g/Sec) : 0.02
Percent Humidity (%) : 22.00

Results

Max Isopleth conc (ppm) : 12.02
Max. Isopleth Conc. Distance from source/release (m) : 2.50
MGC (ppm) : 0.29
MGC Distance (m) : 14.00
Explosion mass (lbm) : N.A.
Time for stabilization concentration zones of dispersion (Secs) 5.25

*MGC : Maximum Ground Concentration in ppm

	Concentration (ppm):	Begin point (m)	End point (m)	Time (Sec)	Isopleth length (m)	Isopleth (Y- Axis) [m]	Distance of Max. ISOP from source [m]	Isopleth angle (deg.)	Isopleth Area (Ha)
Conc. 0	4	2.00	4.58	1.15	2.58	1.22	3.50	9.89	0.00025
Conc. 1	3.8	2.00	4.70	1.18	2.70	1.28	3.50	10.36	0.00027
Conc. 2	3.5	2.00	4.91	1.23	2.91	0.87	4.50	5.52	0.00020
TEEL2:	3.3	2.00	5.06	1.27	3.06	1.01	4.50	6.40	0.00024
TEEL1:	0.7	2.00	11.12	2.78	9.12	3.00	7.50	11.31	0.002
TEEL0:	0.22	2.00	20.99	5.25	18.99	5.14	12.50	11.62	0.008

NOTE: According to latest Emergency Planning, one has to use TEEL (Temporary Emergency Exposure Limits-15 min exposures) and ERPG (Emergency Response Planning Guidelines-1-hr. exposure) Limits are to be used

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Date : Saturday, September 12, 2020

Probit Equations :

Fatality Probit (y) -12.51 +1(Ln(Conc 1.98 x Time)

Injury Probit (y): -5.04 +1(Ln(Conc 1.98 x Time)

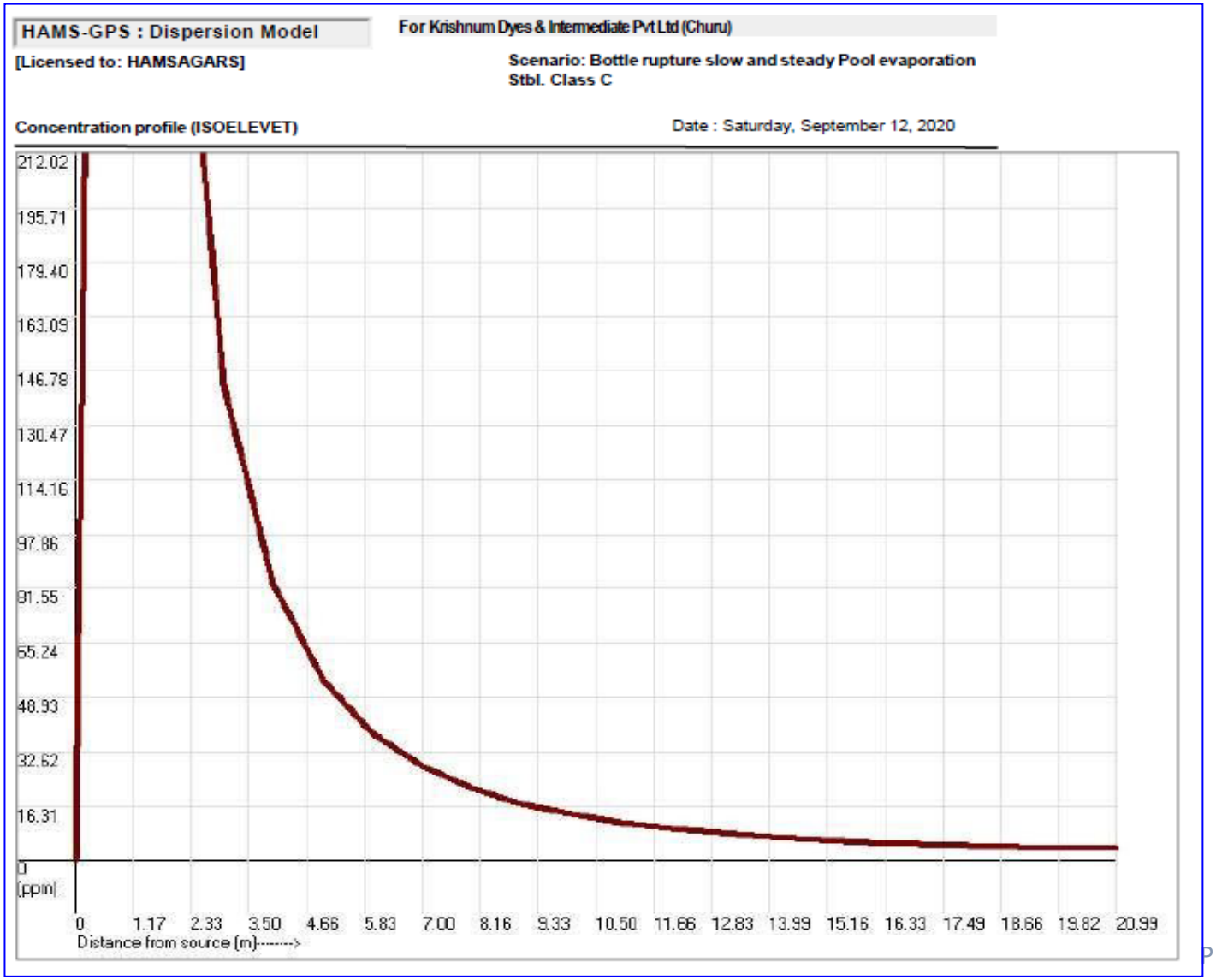
T= time 30 min of exposure

Scenario : Bottle rupture slow and steady Pool evaporation Stbl. Class C

Wind orientation selected :1

Probit Table and Absolute Fatality/Injury at ht. of simulation 1 m

Distance(m)	% Fatality	% Injury	Time (Sec)	Area (Ha)	Conc.(ppm) along X-axis	Dose (mg)	Absolute Fatality No.	Absolute Injury No.
2.1	0	0	0.53	<0.001	17.34	0	0	0
3.15	0	0	0.79	<0.001	8.12	0	0	0
4.2	0	0	1.05	<0.001	4.71	0	0	0
5.25	0	0	1.31	<0.001	3.07	0	0	0
6.3	0	0	1.58	<0.001	2.16	0	0	0
7.35	0	0	1.84	<0.001	1.6	0	0	0
8.4	0	0	2.10	<0.001	1.23	0	0	0
9.45	0	0	2.36	<0.001	0.97	0	0	0
10.5	0	0	2.63	<0.001	0.79	0	0	0
11.55	0	0	2.89	0.001	0.65	0	0.000	0.000
12.6	0	0	3.15	0.001	0.54	0	0.000	0.000
13.65	0	0	3.41	0.001	0.46	0	0.000	0.000
14.7	0	0	3.68	0.001	0.4	0	0.000	0.000
15.75	0	0	3.94	<0.001	0.35	0	0	0
16.8	0	0	4.20	<0.001	0.31	0	0	0
17.85	0	0	4.46	<0.001	0.28	0	0	0
18.9	0	0	4.73	<0.001	0.26	0	0	0
19.95	0	0	4.99	<0.001	0.24	0	0	0
0	0	0	0.00	0	0	0	0.000	0.000
0	0	0	0.00	0	0	0	0.000	0.000


HAMS-GPS : Dispersion Model
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
[Licensed to: HAMSAGARS]
Scenario: Bottle rupture slow and steady Pool evaporation
Stbl. Class C
Concentration profile (ISOELEVET)
Date : Saturday, September 12, 2020
212.02
195.71
179.40
163.09
146.78
130.47
114.16
97.86
81.55
65.24
48.93
32.62
16.31
0
(ppm)
0
1.17
2.33
3.50
4.66
5.83
7.00
8.16
9.33
10.50
11.66
12.83
13.99
15.16
16.33
17.49
18.66
19.82
20.99
Distance from source (m)------>

HAMS-GPS : Dispersion Model

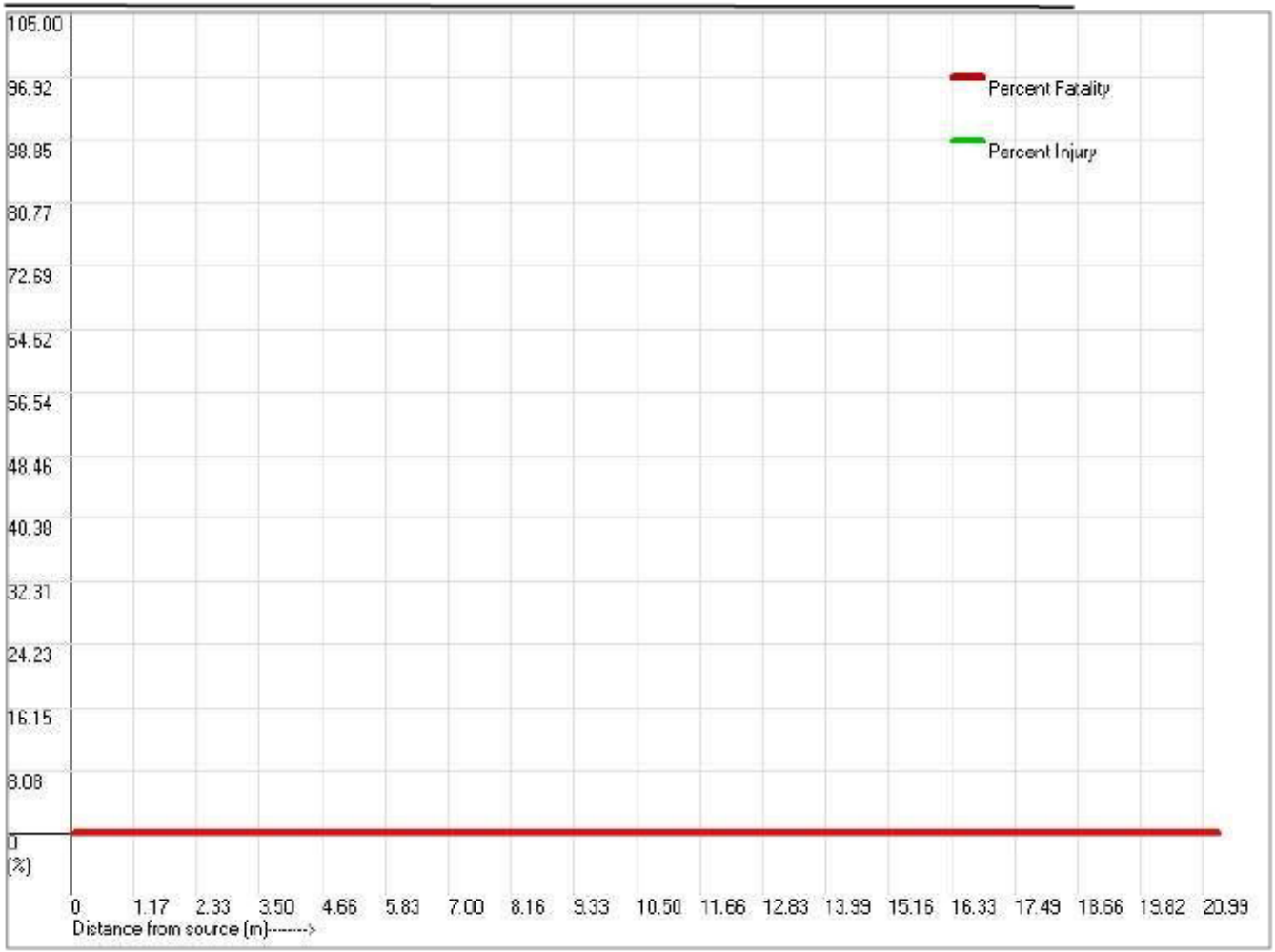
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

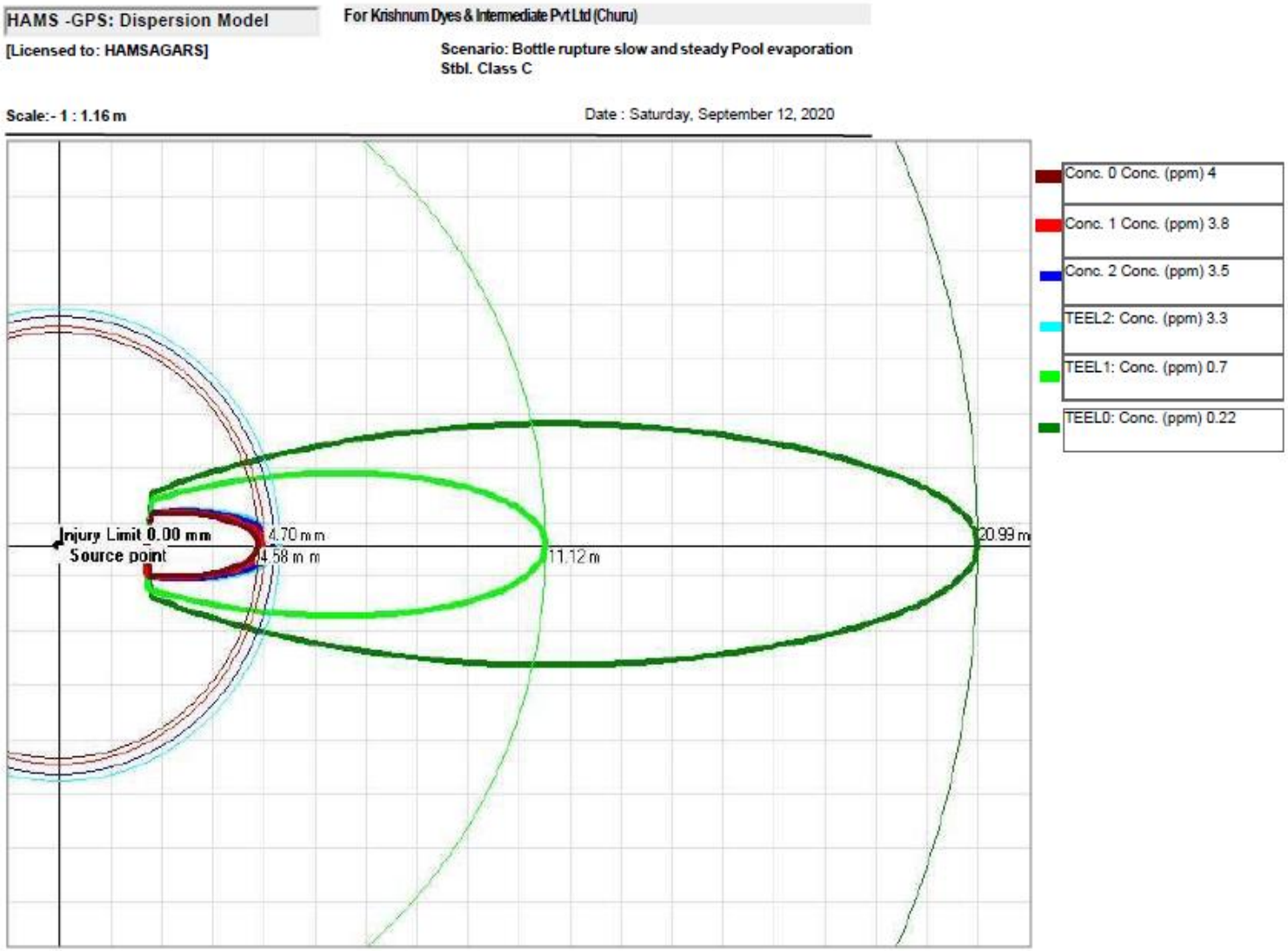
[Licensed to: HAMSAGARS]

Scenario: Bottle rupture slow and steady Pool evaporation
Stbl. Class C

Fatality and Injury profile

Date : Saturday, September 12, 2020



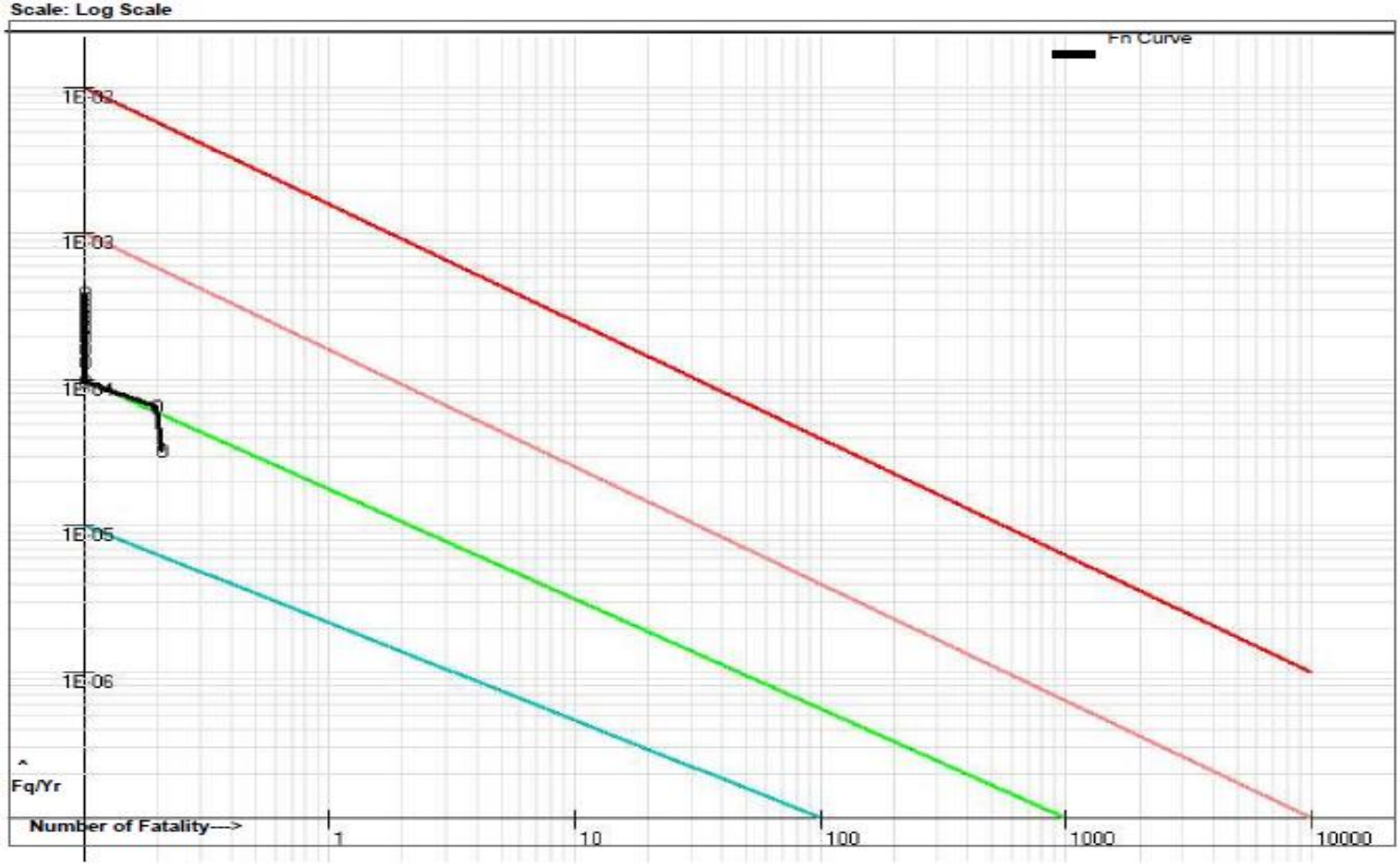

HAMS -GPS: Dispersion Model
[Licensed to: HAMSAGARS]
For Krishnum Dyes & Intermediate Pvt Ltd (Churu)
Scenario: Bottle rupture slow and steady Pool evaporation
Stbl. Class C
Scale:- 1 : 1.16 m
Date : Saturday, September 12, 2020
Conc. 0 Conc. (ppm) 4
Conc. 1 Conc. (ppm) 3.8
Conc. 2 Conc. (ppm) 3.5
TEEL2: Conc. (ppm) 3.3
TEEL1: Conc. (ppm) 0.7
TEEL0: Conc. (ppm) 0.22
Injury Limit 0.00 mm
Source point
4.70 m m
4.58 m m
11.12 m
20.99 m

F-N Curve (Societal Risk Curve) – Aggregate risk (Sensitivity case)

HAMS-GPS : Risk Assessment Simulations (Fn Curve- Cumulative Frequency) For Krishnum Dyes & Intermediate Pvt Ltd (Churu)

[Licensed to : HAMSAGARS]

Scale: Log Scale



Date : Saturday, September 12, 2020

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

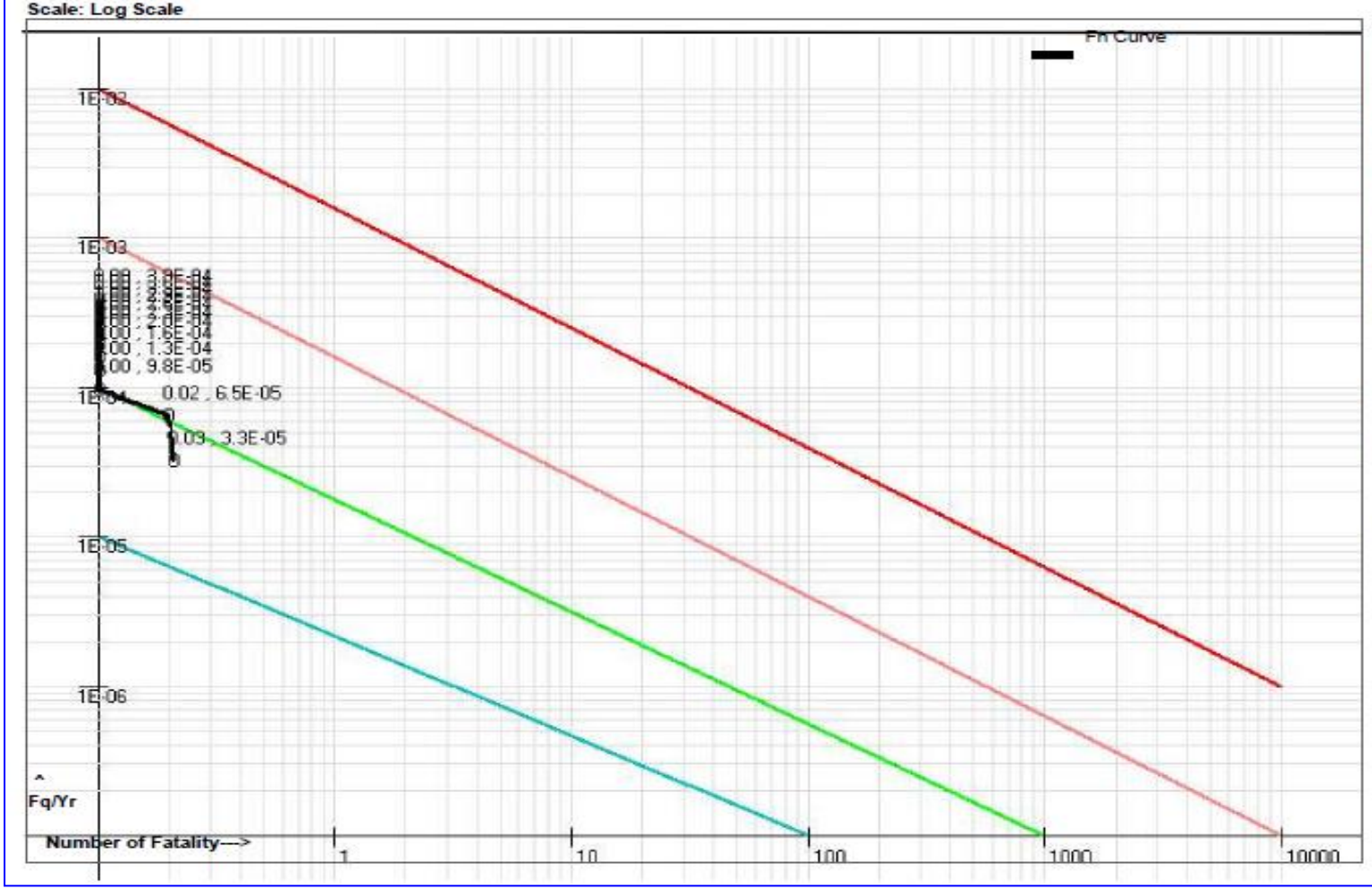
NOTE: Absolute/Number of Fatality fatality is based on population density of 30 per hectare. The number exposed in each scenario depends on product of vulnerability area in hectare for each scenario and population density.

HAMS-GPS : Risk Assessment Simulations (Fn Curve- Cumulative Frequency) For Krishnum Dyes & Intermediate Pvt Ltd (Churu

[Licensed to : HAMSAGARS]

Scale: Log Scale

Date : Saturday, September 12, 2020



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 30 per hectare. The number exposed in each scenario depends on product of vulnerability area in hectare for each scenario and population density.

F-N Curve

The total individual risk graphs show that most of the areas are exposed to lesser risk compared to explosive storage area and are also subjected to considerable risk. The chemical storage area is found to be 3.3E05, 4.32E-08 ,4.56E-06 and 6.5E-05.

The risk levels of facility are found to be lying in the ACCEPTABLE RISK region. As per the risk acceptance criteria specified by UK HSE Societal Risk Criteria, it is observed that the risk levels of the facility are in Acceptable region even for considering domino effects.

It is concluded that safety of the plant, process and product (chemicals) will be accomplished post implementation of the recommendations raised in this report. The impact due to leakages if any will be restricted well within the boundary of the Plant.

Recommendations and Conclusion:-

Name of Chemical	Associate Hazards	Health and Safety impact	Safeguards		
			Preventive	Protective	Mitigative
Methanol	Exposure to Flammable liquid or vapours (due to leakage in pipe/ Container/ valves etc.).	Exposure to excessive vapor causes eye irritation, head- ache, fatigue and drowsiness.	Ensure that procedures are in place to ground, and periodically verify grounding.	Keep Methyl Alcohol out of confined spaces, such as sewers, because of the possibility of an explosion	Use water spray to keep fire exposed containers cool.
	The vapors are slightly heavier than air and may travel some distance to a source of ignition and flash back.	High concentrations can produce central nervous system depression and optic nerve damage	Ensure that procedures are in place to protect from water uptake and accumulation.	Store in tightly closed containers in a cool, well ventilated area away from HEAT SOURCES	Use dry chemical, CO2, water spray or alcohol-resistant foam as extinguishing agents.
	Serious Health and Fire Hazard	Can be absorbed through skin.	Ensure that procedures and provisions are in place for preventing methanol entry into the water table or aquifers.	Use explosion-proof electrical equipment and fittings	SCBA with a level "A" (for Large spill) and "B" (for small spill)
		Swallowing may cause death or eye damage.	Ensure that procedures and equipment are in place for leak detection and alarm.	Use only non-sparking tools and equipment	Evacuate personnel and secure and control entrance to the area.
			Ensure that procedures and equipment are in place for onsite emergency response.	vapor detectors and alarms; and explosive gas detectors to detect and warn of fire and explosion hazards in the event of a release.	Eliminate all ignition sources and Ventilate area of spill or leak.
			Ensure that procedures and possibly specialized equipment are in place for	Allow at least 50 feet (17 meters) of "no ignition source" perimeter around storage and	Absorb liquids in dry sand, earth, or a similar material and place into

Name of Chemical	Associate Hazards	Health and Safety impact	Safeguards		
			Preventive	Protective	Mitigative
			offsite emergency responders	logistics areas containing and/or handling larger volumes of methanol	sealed containers for disposal.
			Where possible, automatically pump liquid methanol from drums or other storage containers to process containers to minimize the potential for exposure.		Stay upwind and keep out of low-lying areas that might accumulate vapor
			overfill protection by means of visible and audible high-level alarms.		The spill surface should be covered with the absorbent materials or activated carbon to capture the pooled methanol.
			automatic instrumented trips to terminate flow prior to overfill.		Onsite and Offsite Emergency Procedure
			vents equipped with flame arresters.		Power supply is cut off to the area to prevent accidental fire.
			All pipelines are of flame proof type and pipeline colors confirm to IS 2379 specifications.		All hot work carried out in the vicinity is stopped
Oleum 23 %	Exposure to toxic liquid or vapours (due to leakage in	Exposure to excessive vapor causes eye	Ensure that procedures are in place to ground, and	Regular checks to prevent leakage	For accidental contact with skin or eye,

Name of Chemical	Associate Hazards	Health and Safety impact	Safeguards		
			Preventive	Protective	Mitigative
	pipe/ Container/ valves etc.).	irritation, head- ache, fatigue and drowsiness.	periodically verify grounding.		nearby provision of eye washing.
	Explosion if comes in contact with water	Skin burns, explosion	Ensure that procedures are in place to ground, and periodically verify grounding.		
	Serious Health issues	Respiratory irritation. Skin burns, eye damage	Ensure that procedures and possibly specialized equipment are in place for offsite emergency responders	vapour detectors and alarms; and explosive gas detectors to detect in the event of a release.	Oleum leakage sensors, work permit system, MSDS
		Can be absorbed through skin.	Ensure that procedures and provisions are in place for preventing methanol entry into the water table or aquifers.	Use explosion-proof electrical equipment and fittings	SCBA with a level "A" (for Large spill) and "B" (for small spill)
		Swallowing may cause death or eye damage.	Ensure that procedures and equipment are in place for leak detection and alarm.	Use only non-sparking tools and equipment	Evacuate personnel and secure and control entrance to the area.
			Ensure that procedures and equipment are in place for onsite emergency response.	vapor detectors and alarms; and explosive gas detectors to detect and warn of fire and explosion hazards in the event of a release.	Eliminate all ignition sources and Ventilate area of spill or leak.
Sulphuric Acid	Exposure to Flammable liquid or vapours (due to leakage in pipe/ Container/ valves etc.).	Inhalation causes irritation of respiratory system	Preventive maintenance of Storage tank should be checked at regular intervals (for any corrosion, weak	The tank should have dyke wall equal to 110% of the tank volume. Use explosion-proof electrical/	Use powder, AFFF, foam, carbon dioxide.

Name of Chemical	Associate Hazards	Health and Safety impact	Safeguards		
			Preventive	Protective	Mitigative
			joints)	ventilating/lighting/equipment	
	Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back	Aspiration causes severe lung irritation	Regular checks and PM of sensors	Keep away from heat and sources of ignition. Ground all equipment containing material.	In case of leakage the contents should be transferred to another spare tank to minimize the Risk level
	Leak will result in Fire /explosion	Ingestion causes nausea, vomiting,	Proper bonding/grounding.	Keep container in a cool, well-ventilated, tightly closed and sealed until ready for use.	Prevent entry into sewers, basements or confined areas
	Serious Health and Fire Hazard	Skin/ Eye irritation	Ensure that procedures, PPEs and possibly specialized equipment are in place for onsite emergency responders.	Provide exhaust ventilation, first aid or other engineering controls	Put water curtain on adjacent tanks to avoid heat radiation to contents of the tank.
	Splash over body	Toxic Vapor inhalation	Basic Process Control System	Hood with Scrubber	Stop flow if safe.
	Spillage	Acid burns	Critical alarms	Use of proper PPEs	Emergency procedures
	Accelerate the burning of other combustible material	Skin burn.	Emergency Shut Down	Precautions against static charges	Sulphuric acid leakage sensors.
Hydrochloric acid	Exposure to Flammable liquid or vapours (due to leakage in pipe/ Container/ valves etc.).	Inhalation causes irritation of respiratory system	Preventive maintenance of Storage tank should be checked at regular intervals (for any corrosion, weak joints)	The tank should have dyke wall equal to 110% of the tank volume.	Use powder, AFFF, foam, carbon dioxide.

Name of Chemical	Associate Hazards	Health and Safety impact	Safeguards		
			Preventive	Protective	Mitigative
	Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back	Aspiration causes severe lung irritation	Check regularly earth pit resistance.	Keep away from heat and sources of ignition. Ground all equipment containing material.	In case of leakage the contents should be transferred to another spare tank to minimize the Risk level
	Leak will result in Fire /explosion	Ingestion causes nausea, vomiting,	Proper bonding/grounding.	Keep container in a cool, well-ventilated, tightly closed and sealed until ready for use.	Prevent entry into sewers, basements or confined areas
	Serious Health and Fire Hazard	Skin/ Eye irritation	Ensure that procedures, PPEs and possibly specialized equipment are in place for offsite emergency responders	vapour detectors and alarms; and explosive gas detectors to detect in the event of a release.	HCl leakage sensors, work permit system, MSDS
Benzoyl Chloride	Exposure to acid fumes (due to leakage in pipe/ Container/ valves etc.).	Skin/ Eye irritation.	Adequate system designing.	Storage temperature below 50 deg C.	Cool down tonner.
	Splash over body	Toxic Vapour inhalation	Basic Process Control System	Hood with Scrubber	-
	Spillage	Acid burns	Critical alarms	Use a backflow preventive device	Emergency procedures
	Accelerate the burning of other combustible material	Skin burn.	Emergency Shut Down	Precautions against static charges	Chlorine leakage sensors.
Bromine	Exposure to Flammable liquid or vapours (due to leakage in pipe/ Container/ valves etc.).	Exposure to excessive vapor causes eye irritation, head- ache, fatigue and drowsiness.	Ensure that procedures are in place to ground, and periodically verify grounding.	Keep Methyl Alcohol out of confined spaces, such as sewers, because of the possibility of an explosion	Use water spray to keep fire exposed containers cool.
	Spillage	Acid burns	Critical alarms, Regular PM	Use a backflow preventive device, first aid training	Emergency procedures

Name of Chemical	Associate Hazards	Health and Safety impact	Safeguards		
			Preventive	Protective	Mitigative
	Accelerate the burning of other combustible material	Skin burn.	Emergency Shut Down	Precautions against static charges	Bromine leakage sensors.

Suggestive Actions:-

- The storage tanks are located in isolated area and far away from dense population area.
- It is suggested to place the adequate numbers of flammable gas detectors near to Methanol tank and surrounding area so that early detection and annunciation of flammable concentration shall be initiated.
- As the gas is being heavier than air, it will travel along with the ground and accumulate to the confined space. It is suggested that Hazardous Area Classification shall be carried out considering Methanol tank.
- It is suggested to place the adequate numbers of toxic gas detectors near to Toxic chemical tanks unit and surrounding area so that early detection shall be initiated.
- Furthermore, it is suggested to provide active and passive fire protection in accordance with national and international codes and standards
- The location is safe for storage and handling of Chemicals and solvents.
- The consequence analysis is carried out for the storage tank and pipeline found the most of the impacts are within the plant boundary.
- All other hazards are easily within control limits and away from habitation area
- The hazards are not harmful to the local people.
- The storage tank and pipelines for handling and transportation of chemical and solvents are considered safe considering the mitigation measures.
- Adequate number of PPEs like, Fire Suit, SCBA sets etc shall be kept.