ANNEXURE-II

ENVIRONMENTAL MANAGEMENT PLAN

FOR THE TRANSFER & SPLIT OF ENVIRONMENTAL CLEARENCE GRANTED TO M/S. RADHA MADHAV PROCESSORS PVT.LTD.

[Project/Activity No.- 5(f) & 5(b)]

To

M/s. AMULIS FINECHEM PVT. LTD.

Plot No D-2/CH-6, GIDC, Dahej-II
Dist.-Bharuch, State - Gujarat

Prepared By

Anand Environmental Consultants Pvt. Ltd.
(QCI / NABET Accredited and NABL Accredited)
16, Everest Tower, Naranpura, Ahmedabad-380013,Gujarat
Phone No.: 079-27484871, E-mail: anandconsultants2009@gmail.com

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CHAPTER 1

Introduction

1. Introduction

A. Introduction of the Project

The Environmental Clearance was granted by Ministry of Environment, Forest & Climate Change to **M/s. Radha Madhav Processors Pvt. Ltd**. at **Plot No. D2-CH/5&6**, GIDC Estate, Dahej-II, Tal.-Vagra, Dist.-Bharuch, Gujaratvide letter no**. IA-J-11011/274/2014-IA-II (I)** dated **18-05-2018**.The copy is attached as **Annexure-1**.

M/s. Radha Madhav Processors Pvt. Ltd. was granted **Consent to Establish (CTE)** by **Gujarat Pollution Control Board** with **CTE order No. 97272 vide letter no. GPCB/BRCH-B/CTE-525/ID-65008/495240 dated 19/02/2019 valid up to 13/09/2025.**The copy is attached as **Annexure -2.**

M/s. Radha Madhav Processors Pvt. Ltd. now intends to split and transfer the stated EC to **M/s. Amulis Finechem Pvt. Ltd.** for production of **Synthetic Organic Chemicals & Chemical Intermediates under category 5(f) & 5(b)** at **Plot No. D2-CH/6**, GIDC Estate, Dahej-II, Tal.-Vagra, Dist.-Bharuch, Gujarat. No Objection Certificate (NOC) by Radha Madhav Processors Pvt. Ltd. to split and transfer the Environmental Clearance is attached as **Annexure-3**. The undertaking by M/s. Amulis Finechem Pvt. Ltd. accepting the terms and conditions under which prior EC was granted is attached as **Annexure-4.** The certificate of company registration for M/s. Amulis Finechem Pvt. Ltd. is attached as **Annexure-5.**

B. Project Cost & Manpower Requirement

The total estimated cost of the project is **Rs. 74 Crore** out of which**Rs. 7.205 Crores** is allocated for Environment Management System from which **Rs. 1.48 Crore** is for social development/ welfare activities under CER programs. Total employment generation from the proposed project would be approximately **120 nos.** during operation phase. The project cost summary is given in **Table B.1**

Table B-1: Project Cost Summary

Sr. No.	Description	Rs. (in Crores)
1	Land	4.0
2	Factory building and other civil construction	18.1
3	Plant and machinery	42.3
4	Pre- operative expenses	9.6
	Total Project Cost	**74**

C. Corporate Environment Responsibility

Company has allocated fund/ budget of **Rs. 148 lakhs** (approximately 2% of the total project cost) for activities under Corporate Environment Responsibility (CER) as per MoEFCC- Office Memorandum (OM) dated 1st May 2018. The proposed financial and social benefits with emphasizing on the interest of benefit to the local people under CER programme are summarized under **Table C-1.**

Table C-1: Details of budget allocated towards CER activities

Activities*	Budgetary cost (Rs.in Lakhs)*	Implementation schedule
Vocational and skill development training for youth and education for economical weaker children of surrounding villages.	30	2021-2025
Tree Plantation/ rainwater harvesting in Dahej and Jolva village.	20	

Activities*	Budgetary cost (Rs.in Lakhs)*	Implementation schedule
Provision of solid waste composter at Dahej and Jolva Villages.	35	
Provides support to government /hospitals during disaster & epidemic situation.	35	
Provision of roof top solar panel system in Dahej and Jolva Villages.	28	
Total	**148**	

*Note: *Hike in material cost over the years and demand could be more for the desired infrastructure for each year.*

D. Location of the Project

Google image showing the project site & its surrounding area is shown in **Figure D-1.** Layout plan of the industry is shown in **Figure D-2.** Break-up of total land area is given in **Table D-2.**

Figure D-1: Google image showing location of the project and its surroundings

(a) Location of Project site (Source: Google Earth)

(b) Amulis Finechem Pvt. Ltd. after plot bifurcation

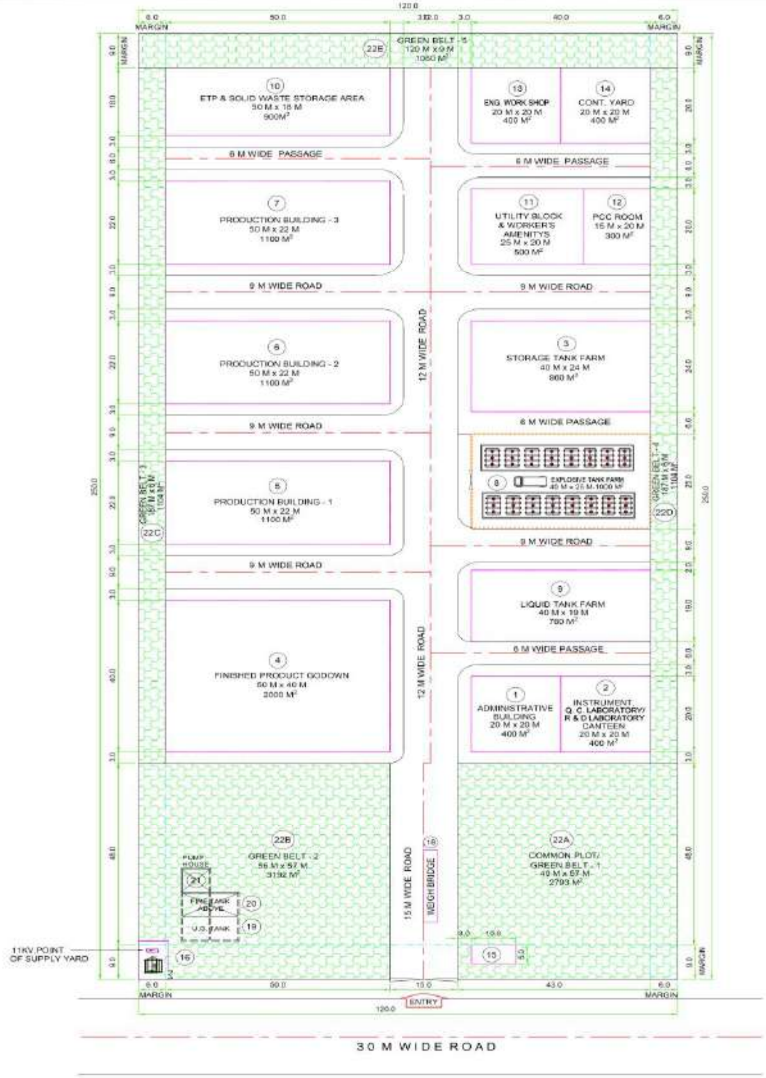
Table D.1: Corner co-ordinates of the project site

S.N.	Description	Latitude	Longitude
A	NW corner of project site	21°43’32.45” N	72°36’59.55” E
B	SW corner of project site	21°43’28.84” N	72°36’59.86” E
C	SE corner of project site	21°43’29.20” N	72°37’08.60” E
D	NE corner of project site	21°43’32.94” N	72°37’08.28” E

Table D.2: Land area break-up

Sr. No.	Description	Area (m^2)
1.	Manufacturing Plant Area	3,300
2.	Raw Material and Finished Goods Area	3,360
3.	Storage Tank Farm Area	1,760
4.	Utility Area	1,400
5.	Water Storage Tank Area	241
6.	Administrative Building and Other Facility Area	1,664
7.	Greenbelt Area*(33% of total plot area)*	9,950
8.	Open Area including road area	8,325
	Total Area	**30,000**

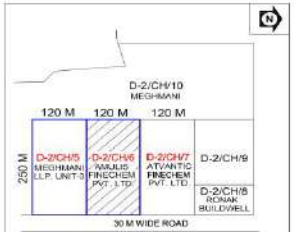
Figure D.2: Layout Plan of the Industry



NO.	DESCRIPTION	SIZE OF BLOCK (LxB)		AREA (SQ.M)	CONSTRUCTION DETAILS					REMARK
					TYPE	PLINTH AREA (SQ.M)	FIRST FLOOR AREA (SQ.M)	SECOND FLOOR AREA (SQ.M)	TOTAL CONSTR. AREA (SQ.M)	
1	ADMINISTRATIVE BUILDING / STORE	20	20	400	G+2	400	400	400	1200	
2	CANTEEN / LABORE WELFARE / LABORATORY	20	20	400	G+2	400	400	400	1200	
3	STORAGE TANK FARM	40	24	960	G	-	-	-	-	
4	FINISHED GOODS WARE HOUSE	50	40	2000	G	2000	-	2000	2000	
5	PRODUCTION BLOCK – 1	50	22	1100	G+2	1100	1100	1100	4400	
6	PRODUCTION BLOCK – 2	50	22	1100	G+3	1100	1100	1100	4400	
7	PRODUCTION BLOCK – 3	50	22	1100	G+3	1100	1100	1100	4400	
8	EXPLOSIVE TANK FARM	40	25	1000	G	1000	-	-	1000	OPEN TO SKY
9	TANK FARM	40	19	760	G	760	-	-	760	OPEN TO SKY
10	ETP & SOLID WASTE STORAGE AREA	50	18	900	G	900	900	-	900	
11	CENTRAL UTILITY BLOCK	25	20	500	G	500	500	-	500	
12	PCC ROOM	15	20	300	G	300	300	-	300	
13	EGG. STORE / ENG. WORK SHOP, WORKER'S AMENITYS	20	20	400	G	400	400	400	400	
14	CONT. YARD	20	20	400	G	400	400	400	400	
15	SECURITY CABIN	10	5	50	G	50	-	-	50	
16	METERING ROOM	10	6	60	G	60	60	-	60	
18	WEIGH BRIDGE	18	3	54	G	54	-	-	54	
19	U.G. WATER TANK	12	12	144	U.G	144	-	-	144	
20	ABOVE GROUND WATER TANK	12	6	72	G	72	-	-	72	ABOVE U.G. WATER TANK
21	PUMP HOUSE	5	5	25	G	25	-	-	25	ABOVE WATER TANK
22A	COMMON PLOT / GREEN BELT – 1	49	57.0	2793	G	-	-	-	-	OPEN TO SKY
22B	GREEN BELT – 2	56	57.0	3192	G	-	-	-	-	OPEN TO SKY
22C	GREEN BELT – 3	6	187.0	1122	G	-	-	-	-	OPEN TO SKY
22D	GREEN BELT – 4	6	187.0	1122	G	-	-	-	-	OPEN TO SKY
22E	GREEN BELT – 5	120	9.0	1080	G	-	-	-	-	OPEN TO SKY
	TOTAL			21034		10765	6660	6900	22265	

AREA STATEMENT SUMMARY

DESCRIPTION	AREA (SQ.M)
TOTAL AREA OF THE LAND	30000
REQUIRED C.O.P.	2100
PROVIDED C.O.P. AREA	2793
REQUIRED GREEN BELT AREA	9900
PROVIDED GREEN BELT AREA (22A+22B+22C+22D+22E)	9300
NET AREA OF THE PLOT	27207
PERMISSIBLE BUILT-UP AREA (50%) ON GROUND FLOOR	15000
PROPOSED BUILT-UP AREA ON GROUND FLOOR	10765
PERMISSIBLE F.S.I. - 1.6	48000
CONSUMED F.S.I. AREA	22265
CONSUMED F.S.I.	0.742



KEY PLAN

CLIENT AMULIS FINECHEM PVT. LTD.
PROJECT -
TITLE PLOT PLAN FOR D2-CH-6
DOC. NO. U.303.PP.401 REV. P
SH 1 OF 1
SCALE 1:500 SIZE A1

REV.	DATE	DESCRIPTION	DRN	BY	APD.
P	07.09.20	PRELIMEANRY			

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Table D.3 Details of Sensitive areas within 10 km radius from the Project Site

Sr. No.	Areas	Name/Identity	Aerial Distance(km)	Direction
1	Distance to Critically Polluted Areas from project site	None	-	-
2	National Park/Wildlife Sanctuary	None	-	-
3	Tiger Reserve / Elephant Reserve / Turtle Nesting Ground	None	-	-
4	Core Zone of Biosphere Reserve	None	-	-
5	Reserved/Protected/Social Forests	Dahej R.F	~8.3	WNW
6	Habitat for migratory birds	None	-	-
7	Inland, coastal, marine or underground waters	Narmada Estuary	~6.75	S
8	Mangroves	Afforested Mangroves	~8.3	WSW
9	Mountains / Hills	None	-	-
10	Archaeological Sites (as per ASI)	None	-	-
11	Defense Installation	None	-	-
12	Industries	Project site islocated in GIDC Industrial Estate	-	-
13	Airports	None	-	-
14	Railway Lines	Dahej Railway station	~2.85	SW
15	National / State Highway	SH-6	~1.25	S

CHAPTER 2

Project Details

2. Project Details

A. Details of Products & Its Storage Facilities

The total manufacturing capacity of proposed products would be **7500 MT/Month.**

Table A.1: Details of Products and Production Capacity

Sr. No.	Common Name	Products	Capacity (MT/ Month)
1.	Chlorination of Benzene and Toluene	Benzyl Chloride	2000
		2,6 Dichloro Phenol	
		2,4 Dichloro Phenol	
		2/4-Chloro Phenol	
		Benzyl Chloride/Benzo Trichloride/Benzal Chloride	
		p-ChlorobenzylChloride/p-ChlorobenzalChloride/p-ChloroBenzotrichloride	
		o-Chlorobenzyl Chloride/o-Chlorobenzal Chloride/o-ChloroBenzotrichloride	
		Chloro Benzene/Di Chloro Benzene	
		Mono Chloro Benzene (MCB)	
		Dichloro Benzene (DCB) (Ortho/Meta/Para)	
		Para Chloro Toluene/Ortho Chloro Toluene	
2.	Chlorination of Acetic Acid	Mono Chloro Acetic Acid	1500
		Tri Chloro Acetyl Chloride	
3.	Hydrolysis of Chlorinated Compound	IsoPhthaloyl Chloride	1500
		Phthaloyl Chloride	
		o-Chlorobenzaldehyde	
		p-Chlorobenzaldehyde	
		Benzyl Alcohol	
		o-Chloro Benzyl Alcohol	
		p-Chloro Benzyl Alcohol	
		Benzoyl Chloride	
		Benzaldehyde	

Sr. No.	Common Name	Products	Capacity (MT/ Month)
		2-Methoxy 5-Bromo 6-Methyl Benzoyl Chloride	
		2,4 DichloroBenzoyl Chloride	
		4 Methyl Benzoyl Chloride	
		Propargyl Chloride	
		Pivaloyl Chloride	
		4-Chloro Butyryl Chloride	
		Terephthaloyl Chloride	
		n-Valeroyl Chloride	
		4-Chloro Benzoyl Chloride	
		3-Nitro Benzoyl Chloride	
		4-Nitro Benzoyl Chloride	
4.	Amines	Primary Amines	1000
		Ethoxylation of Primary Amines	
5.	Nitro Compounds	4-Chloro 3,5 Dinitro Benzoic Acid	1000
		6, Nitro 3,4 Dichloro Aniline	
		4-Nitro, 5-Chloro, 2-Methyl Aniline	
		2-Nitro 4-Methyl Aniline	
		3, Nitro 4-Chloro Benzoic Acid	
		3-Nitro-para Toluic Acid	
		2,4 Dichloro 6-Nitro Phenol	
		2,3 Dichloro 4-Nitro Phenol	
		2,5 Dichloro 4-Nitro Phenol	
		1,3 Di Nitro Benzene	
		Nitro Benzene	
		2/3/4 Nitro Toluene	
		3,5 Di Nitro Benzoic Acid	
		p-Nitro Salicylic Acid	
		2,5 Dichloro Nitro Benzene	
		3,4/2,3 Dichloro Nitro Benzene	
6.	Hydrogenation	3,4 Dichloro Aniline	500

Sr. No.	Common Name	Products	Capacity (MT/ Month)
	Compounds	3-Iso Propoxy Aniline	
		o-Toluidine	
		m-Toluidine	
		p-Toluidine	
		Aniline	
		3,4 Diamine Toluene	
		2,5 Dimethyl 1,4 Phenylene Diamine	
		2, Chloro, 5-Methyl, 1,4 Phenylene Diamine	
		2, Chloro 1,4 Phenylene Diamine	
		2,5 Dichloro 1,4 Phenylene Diamine	
		2,4,5 Trichloro Aniline	
		6-Methyl 5-AminoBenzimidazolone	
		5-Amino Benzimidazolone	
		3-Amino 4-Chloro Benzoic Acid	
		3-Amino 4-Chloro Benzotrifluoride	
		3-Amino Benzotrifluoride	
		3,5 Dichloro Aniline	
		2,5 Dichloro Aniline	
		2,3 Dichloro Aniline	
		3 Amino 4-Methyl Benzoic Acid	
		Total Production Capacity	**7,500**

Table A.2: Storage Details of Products

Sr. No.	Common Name	Products	Production MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
1	Chlorination of Benzene and Toluene and Phenol	Benzyl chloride	2,000	Liquid	SS Tank, above Ground	100 kL	2	200
		2,6 dichloro phenol		Solid	HDPE Bags	50 Kg	2660	133
		2,4 dichloro phenol		Solid	HDPE Bags	50 Kg	2660	133
		2/4 Chloro Phenol		Solid	HDPE Bags	50 Kg	2660	133
		Benzyl chloride		Liquid	SS Tank, above Ground	100 kL	2	133
		Benzo Trichloride		Liquid	SS Tank, above Ground	100 kL	2	200
		Benzal chloride		Liquid	SS Tank, above Ground	100 kL	2	200
		P-chorobenzyl chloride		Solid	HDPE Bags	50 Kg	2660	133
		P-chorobenzal chloride		Solid	HDPE Bags	50 Kg	2660	133
		P-chloro benzotrichloride		Solid	HDPE Bags	50 Kg	2660	133
		o-chorobenzyl chloride		Liquid	SS Tank, above Ground	100 kL	2	200
		o-chorobenzal chloride		Liquid	SS Tank, above Ground	100 kL	2	200
		o-chloro Benzotrichloride		Liquid	SS Tank, above Ground	100 kL	2	200
		Mono chloro benzene		Liquid	SS Tank, above Ground	100 kL	2	200
		Meta Dichloro Benzene		Liquid	SS Tank, above Ground	100 kL	2	200
		Ortho Dichloro Benzene		Liquid	SS Tank, above Ground	100 kL	2	200

Sr. No.	Common Name	Products	Production MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
		Para Dichloro Benzene		Solid	HDPE Bags	50 Kg	2660	133
		Para Chloro Toluene		Liquid	SS Tank, above Ground	100 kL	2	200
		Ortho Chloro Toluene		Liquid	SS Tank, above Ground	100 kL	2	200
2	Chlorination of Acetic Acid	Mono Chloro Acetic Acid	1,500	Solid	HDPE Bags	50 Kg	2000	100
		Tri Chloro Acetyl Chloride		Liquid	MS Tank, above Ground	50 kL	2	100
3	Hydrolysis of Chlorinated Compound	Isophthaloyl chloride	1,500	Liquid	MS Tank, above Ground	50 kL	2	100
		Phthaloyl chloride		Liquid	SS Tank, above Ground	100 kL	1	100
		O-chlorobenzaldehyde		Solid	HDPE Bags	50 Kg	2000	100
		P-chlorobenzaldehyde		Solid	HDPE Bags	50 Kg	2000	100
		Benzyl Alcohol		Liquid	MS Tank, above Ground	50 kL	2	100
		O-Chloro Benzyl Alcohol		Solid	HDPE Bags	50 Kg	2000	100
		Para Chloro Benzyl Alcohol		Solid	HDPE Bags	50 Kg	2000	100
		Benzoyl Chloride		Solid	HDPE Bags	50 Kg	2000	100
		Benzaldehyde		Liquid	SS Tank, above Ground	100 kL	1	100
		2-methoxy-5-bromo- 6-methyl benzoyl		Liquid	SS Tank, above Ground	100 kL	1	100

Sr. No.	Common Name	Products	Production MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
		Chloride						
		2,4 dichloro benzoyl chloride		Liquid	SS Tank, above Ground	100 kL	1	100
		4-methyl benzoyl chloride		Liquid	SS Tank, above Ground	100 kL	1	100
		propargyl chloride		Liquid	PP container/drum	100 kL	1	100
		Pivaloyl chloride		Liquid	PP container/drum	100 kL	1	100
		4-chloro butyryl chloride		Liquid	PP container/drum	100 kL	1	100
		Terephthaloyl chloride		Solid	HDPE Bags	50 Kg	2000	100
		N-valeroyl chloride		Liquid	SS Tank ,above Ground	100 kL	1	100
		4-chloro benzoyl chloride		Liquid	SS Tank ,above Ground	100 kL	1	100
		3-Nitro Benzoyl Chloride		Solid	HDPE Bags	50 Kg	2000	100
		4-Nitro Benzoyl Chloride		Solid	HDPE Bags	50 Kg	2000	100
4	Amines	Primary Amines	1,000	Liquid	SS Tank ,above Ground	100 kL	1	100
		Ethoxylation of Primary Amines		Liquid	SS Tank ,above Ground	100 KL	1	100
5	Nitro Compounds	4-Chloro 3,5 Dinitro Benzoic Acid	1,000	Solid	HDPE Bags	50 Kg	1340	67
		6-nitro 3,4 dichloro aniline		Solid	HDPE Bags	50 Kg	1340	67
		4-Nitro ,5-Chloro, 2- methyl Aniline		Solid	HDPE Bags	50 Kg	1340	67

Sr. No.	Common Name	Products	Production MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
		2-Nitro 4-Methyl Aniline		Solid	HDPE Bags	50 Kg	1340	67
		3-Nitro 4-Chloro Benzoic Acid		Solid	HDPE Bags	50 Kg	1340	67
		3 Nitro Para toluic Acid		Solid	HDPE Bags	50 Kg	1340	67
		2,4 Dichloro 6 Nitro Phenol		Solid	HDPE Bags	50 Kg	1340	67
		2,3-dichloro 4-nitro phenol		Solid	HDPE Bags	50 Kg	1340	67
		2,5 Di Chloro 4 Nitro Phenol		Solid	HDPE Bags	50 Kg	1340	67
		1,3 Di Nitro Benezene		Solid	HDPE Bags	50 Kg	1340	67
		Nitro benzene		Liquid	MS Tank, above Ground	50 KL	2	100
		2/3/4- Nitro Toulene		Liquid	MS Tank, above Ground	50 KL	2	100
		3,5 Di Nitro Benzoic Acid		Solid	HDPE Bags	50 Kg	1340	67
		p-Nitro salicylic acid		Solid	HDPE Bags	50 Kg	1340	67
		2,5 Dichloro Nitro Benzene		Solid	HDPE Bags	50 Kg	1340	67
		3,4/2,3 Dichloro Nitro Benzene		Solid	HDPE Bags	50 Kg	1340	67
6	Hydrogenation Compounds	3,4 Dichloro Aniline	500	Solid	HDPE Bags	50 Kg	660	33
		3-iso propoxy Aniline		Liquid	MS Tank,	50 KL	1	50

Sr. No.	Common Name	Products	Production MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
					above Ground			
		o-Toluidine		Liquid	MS Tank, above Ground	50 KL	1	50
		m-Toluidine		Liquid	MS Tank, above Ground	50 KL	1	50
		p-Toluidine		Solid	HDPE Bags	50 KL	660	33
		Aniline		Liquid	MS Tank, above Ground	50 KL	1	50
		3,4 diamino toluene		Solid	HDPE Bags	50 Kg	660	33
		2,5 Dimethyl 1,4 Phenylene Diamine		Solid	HDPE Bags	50 Kg	660	33
		2-chloro, 5-Methyl, 1,4 phenylene diamine		Solid	HDPE Bags	50 Kg	660	33
		2 chloro 1,4 phenylene diamine		Solid	HDPE Bags	50 Kg	660	33
		2,5 Dichloro 1,4 Phenylene Diamine		Solid	HDPE Bags	50 Kg	660	33
		2,4,5 tri chloro aniline		Solid	HDPE Bags	50 Kg	660	33
		6-Methyl 5-Amino Benzimidazolone		Solid	HDPE Bags	50 Kg	660	33
		5-Amino benzimidazolone		Solid	HDPE Bags	50 Kg	660	33
		3-Amino 4-chloro benzoic acid		Solid	HDPE Bags	50 Kg	660	33
		3-Amino 4-chloro		Liquid	MS Tank,	50 KL	1	50

Sr. No.	Common Name	Products	Production MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
		benzotrifluoride			above Ground			
		3-Amino benzotrifluoride		Solid	HDPE Bags	50 Kg	660	33
		3,5 Dichloro Aniline		Solid	HDPE Bags	50 Kg	660	33
		2,5 Dichloro Aniline		Solid	HDPE Bags	50 Kg	660	33
		2,3 Dichloro Aniline		Solid	HDPE Bags	50 Kg	660	33
		3 Amino 4-Methyl Benzoic Acid		Solid	HDPE Bags	50 Kg	660	33

B. Details of Raw Materials & Its Storage Facilities

The total consumption of raw materials and their storage details are given in **Table B-1**.

Table B-1: Storage Details of Raw Materials

Sr. No.	Raw Material*	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
1.	1C4M2,5DNB	619	Solid	HDPE Bags	50 Kg	825	41
2.	2,3 DCNB	657.5	Solid	HDPE Bags	50 Kg	877	44
3.	2,4,5 TCN	637.5	Solid	HDPE Bags	50 Kg	850	43
4.	2,4-dichloro benzoic acid	1530	Solid	HDPE Bags	50 Kg	2040	102
5.	2,5 DCNB	575	Solid	HDPE Bags	50 Kg	767	38
6.	2,5DC4DNB	564	Solid	HDPE Bags	50 Kg	952	48
7.	2,5DM4DNB	619	Solid	HDPE Bags	50 Kg	825	41
8.	2.3 dichloro phenol	826	Solid	HDPE Bags	50 Kg	1101	55
9.	2.4 dichloro phenol	826	Solid	HDPE Bags	50 Kg	1101	55

Sr. No.	Raw Material*	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
10.	2.5 dichloro phenol	826	Solid	HDPE Bags	50 Kg	1101	55
11.	25 % HCl	7245	Liquid	MSRL/HDPE/FRP tank	200 KL	3	600
12.	2-chloro phenol	1582	Liquid	SS tank	50 KL	2	100
13.	2M5B6MBA	1575	Liquid	SS tank	50 KL	2	100
14.	2-nitro toluene	675.5	Liquid	SS tank	50 KL	1	50
15.	3,4 DCNB	657.5	Solid	HDPE Bags	50 Kg	877	44
16.	3,4 dichloro aniline	869	Solid	HDPE Bags	50 Kg	1159	58
17.	3,4 DNT	643.5	Solid	HDPE Bags	50 Kg	858	43
18.	3,5 DCNB	649	Solid	HDPE Bags	50 Kg	865	43
19.	3-Iso propoxy nitro benzene	666.5	Liquid	SS tank	50 KL	1	50
20.	3N4MBA	474	Solid	HDPE Bags	50 Kg	870	44
21.	3N4CBZ/ 3- Nitro 4-ChloroBenzonitrile	607.7	Solid	HDPE Bags	50 Kg	810	41
22.	3-NBZ	659	Solid	HDPE Bags	50 Kg	879	44
23.	3-Nitro 4-Methyl Benzoic Acid	632.5	Solid	HDPE Bags	50 Kg	843	42
24.	3-nitro toluene	614	Liquid	SS tank	50 KL	1	50
25.	3-nitrobenzoic acid	1524	Solid	HDPE Bags	50 Kg	2032	102
26.	4-chloro benzoic acid	2209	Solid	HDPE Bags	50 Kg	2945	147
27.	4-chloro benzotrifluoride	888	Liquid	SS tank	50 KL	2	100
28.	4-chlorobutanoic acid	1363.5	Liquid	SS tank	50 KL	2	100
29.	4-chloro phenol	1600	Solid	HDPE Bags	50 Kg	2133	107
30.	4-methyl aniline	781	Solid	HDPE Bags	50 Kg	1041	52
31.	4-methyl benzoic acid	2294.5	Solid	HDPE Bags	50 Kg	3059	153
32.	4-nitro toluene	625.5	Solid	HDPE Bags	50 Kg	834	42
33.	4-nitrobenzoic acid	1515	Solid	HDPE Bags	50 Kg	2020	101
34.	5-chloro-2-methyl aniline	854	Liquid	SS tank	50 KL	2	100

Sr. No.	Raw Material*	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
35.	5NBZ	706.5	Solid	HDPE Bags	50 Kg	942	47
36.	60% nitric acid	946	Liquid	SS tank	50 KL	2	100
37.	6M5NBZ	696	Solid	HDPE Bags	50 Kg	928	46
38.	Acetic Anhydride	13.4	Liquid	SS tank	1 KL	1	1
39.	Acetic Acid	1200	Liquid	SS tank	50 KL	2	100
40.	Additives	9	Solid	HDPE Bags	50 Kg	12	1
41.	Ammonia	450	Gas	CS bullets tank/pipeline	50 KL	1/Pipeline	50
42.	Benzal Chloride	2415	Liquid	SS tank	50 KL	3	150
43.	Benzene	1420	Liquid	SS tank	50 KL	3	150
44.	Benzoic acid	578	Liquid	SS tank	50 KL	1	50
45.	Benzotrichloride	3555	Liquid	SS tank	100 KL	3	300
46.	Benzyl Chloride	1858.5	Liquid	SS tank	50 KL	3	150
47.	Catalyst	18.5	Solid	HDPE Bags	50 Kg	25	1
48.	Caustic	8119	Solid	HDPE Bags	50 Kg	10820	541
49.	Chlorine	3515	Gas	CS pressure tank/pipeline	900kg	75/Pipeline	67.5
50.	Ethylene Oxide	642	Liquid	SS tank	50 KL	1	50
51.	$FeCl_3$	3	Solid	HDPE Bags	50 Kg	4	200
52.	Hydrogen gas	240	Gas	CS bullets tank/pipeline	1.5 MT	Pipeline	1.5
53.	IsoPhathlic Acid	1252.5	Solid	HDPE Bags	50 Kg	1670	84
54.	Methanol	2307	Liquid	CS tank (UG)	50 KL	5	250
55.	ML	720	Liquid	CSRL tank	50 KL	1	50
56.	Nitric Acid	775	Liquid	SS tank	50 KL	1	50
57.	Nitro Benzene	1410	Liquid	SS/CS tank	50 KL	2	100
58.	N-valeroyl acid	1606.5	Liquid	SS tank	50 KL	2	100
59.	O-ChloroBenzal Chloride	2190	Liquid	SS tank	50 KL	3	150
60.	ODCB	813	Liquid	CS tank	50 KL	2	100

Sr. No.	Raw Material*	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
61.	P-ChloroBenzal Chloride	2197.5	Solid	HDPE Bags	50 Kg	2930	147
62.	p-DCB	813	Solid	HDPE Bags	50 Kg	1084	54
63.	Phathlic Acid	1260	Solid	HDPE Bags	50 Kg	1680	84
64.	Phenol	1540	Solid	CS/SS tank	50 KL	2	100
65.	Pivalic Acid	1350	Solid	HDPE Bags	50 Kg	1800	90
66.	Primary Amines	333	Liquid	SS tank	50 KL	1	50
67.	Prop-2-yn-1-ol	1200	Liquid	CS tank	50 KL	2	100
68.	Pyridine	3	Liquid	CS/SS tank	1 KL	1	1
69.	Rany Nickel	40	Solid	HDPE Bags	50 Kg	53	3
70.	Salicylic Acid	700	Solid	HDPE Bags	50 Kg	933	47
71.	SMC	370.5	Liquid	CS/SS tank	50 KL	1	50
72.	Sulphuric acid	1854	Liquid	CS tank	50 KL	3	150
73.	Terephthalic acid	1293	Solid	HDPE Bags	50 Kg	1724	86
74.	Toluene	1600	Liquid	CS tank	50 KL	3	150

**The required raw materials will be purchased from local supplies and/import depends on availability and market value.*

C. Mode of Transportation of Raw Materials and Products

The required raw materials for the manufacturing of proposed products would be transported by road andrail/sea/air-ways. Similarly, in case of products it would also be transported by road and rail/sea/air-ways depending on need and location of customers. All the required statutory safety precautionary measures will be taken during handling and transportation of the materials.

D. Details of Manufacturing Process

Details of manufacturing process, chemical reaction and mass balance of each product are illustrated below:

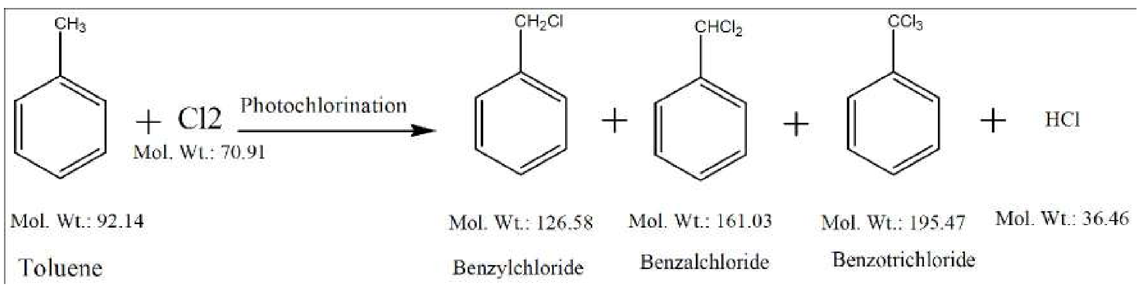
Process description, chemical reaction, Process Flowchart and Mass Balance

1. Benzyl Chloride / Benzal Chloride and Benzo Trichloride

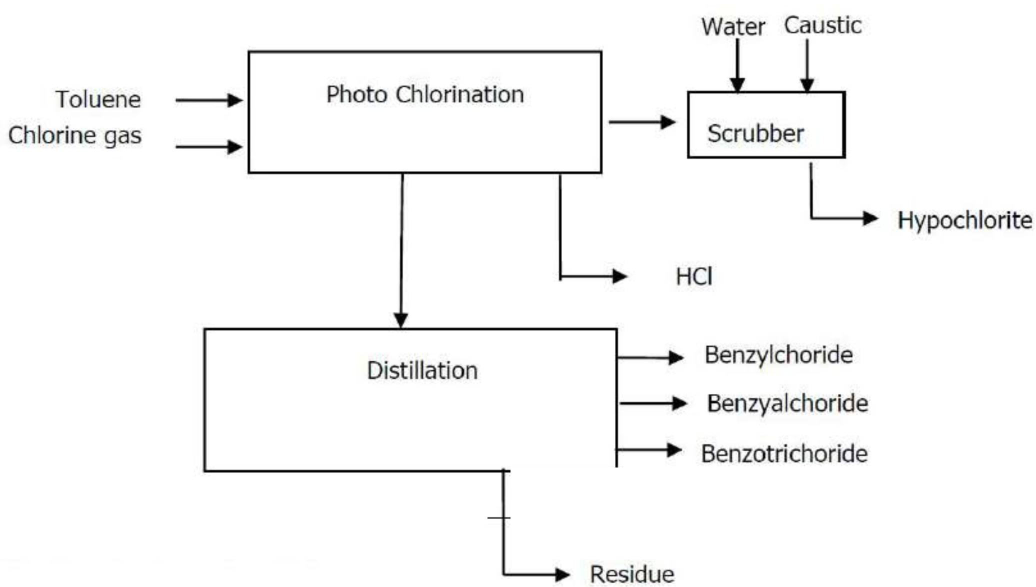
Process Description:

Toluene react with chlorine in presence of UV light to give mixture of Benzylchloride, Benzalchloride & Benzotrichloride. The mixture is isolated by distillation to give pure Benzylchloride, Benzalchloride & Benzotrichloride.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for Benzylchloride, Benzalchloride & Benzotrichloride- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Toulene	0.778
2	Chlorine Gas	0.710
3	Water	0.051
4	Caustic	0.006
Total		**1.545**

Mass Balance for Benzylchloride, Benzalchloride & Benzotrichloride- OUTPUT

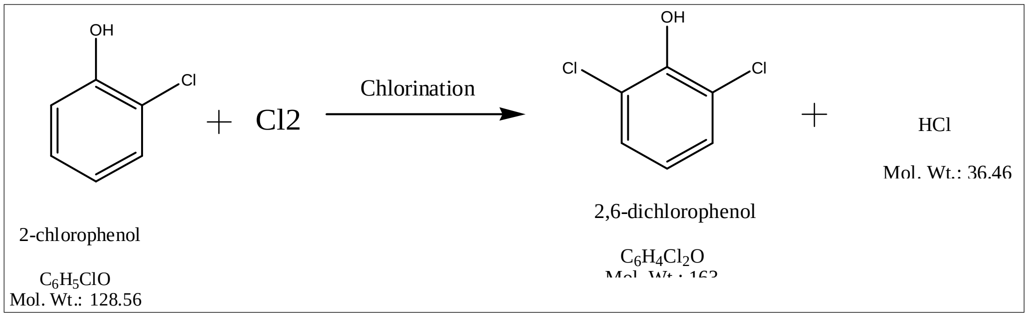
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzylchloride	-	-	0.600	-	Product
2	Benzalchloride	-	-	0.300	-	Product
3	Benzotrichloride	-	-	0.100	-	Product
4	Hypochlorite	-	-	0.067	-	By Product
5	HCL	-	-	0.473	-	By Product
6	Residue	-	-	-	0.005	To CHWIF
Total		**0**	**0**	**1.540**	**0.005**	
		1.545				

2. **2,6-Dichloro phenol**

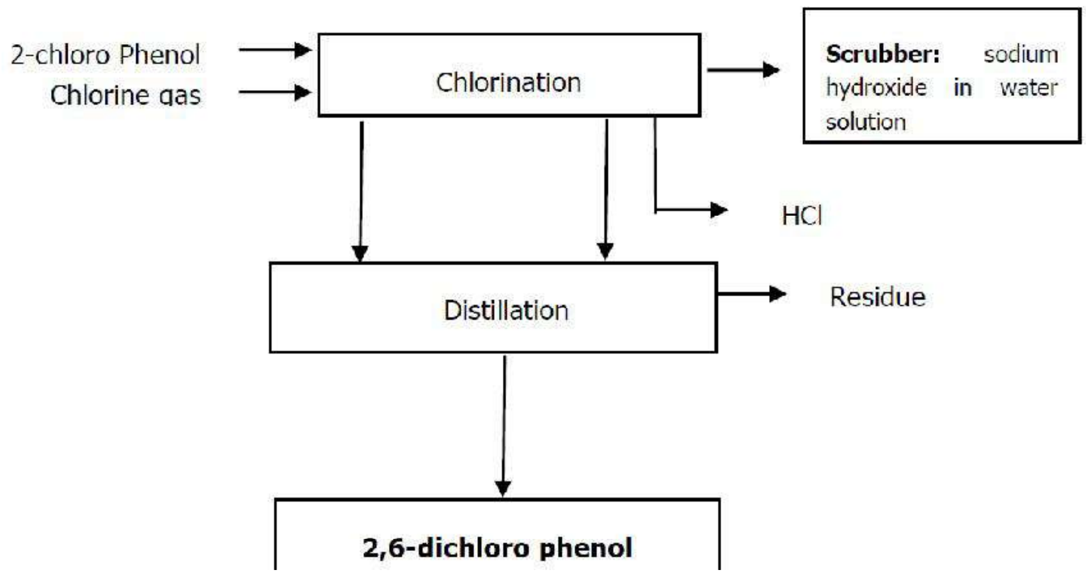
Process Description:

2-chloro Phenol react with chlorine gas to give of 2,6 Dichlorophenol . The product is isolated by distillation to give pure 2,6 Dichloro phenol.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for 2,6 Dichloro phenol - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2-chloro phenol	0.791
2	Chlorine gas	0.434
3	Water	0.475
4	Caustic	0.008
	Total	**1.708**

Mass Balance for 2,6 Dichloro phenol - OUTPUT

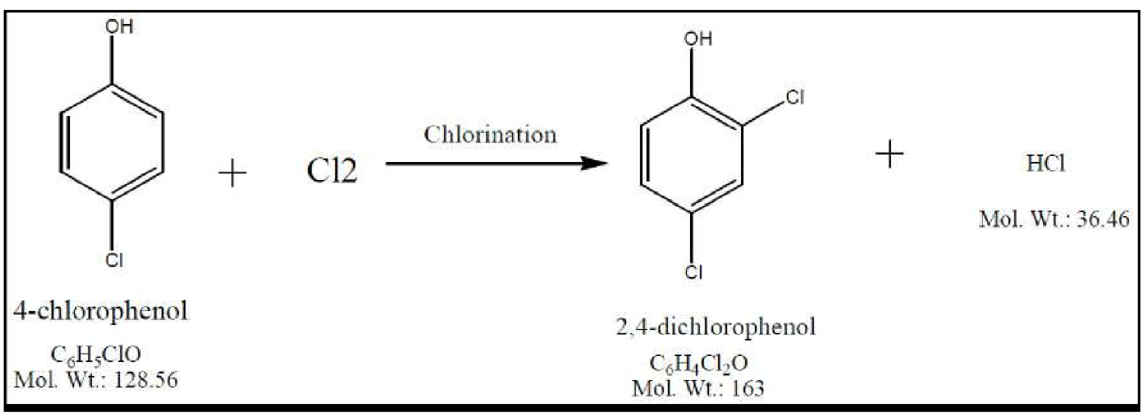
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2,6 dichloro phenol	-	-	1.000	-	Product
2	Residue	-	-	-	0.0060	To CHWIF
3	HCL	-	-	0.6560	-	By-Product
4	Hypochlorite	-	-	0.046	-	By-Product
Total				**1.702**	**0.006**	
		1.708				

3. **2,4-Dichloro phenol**

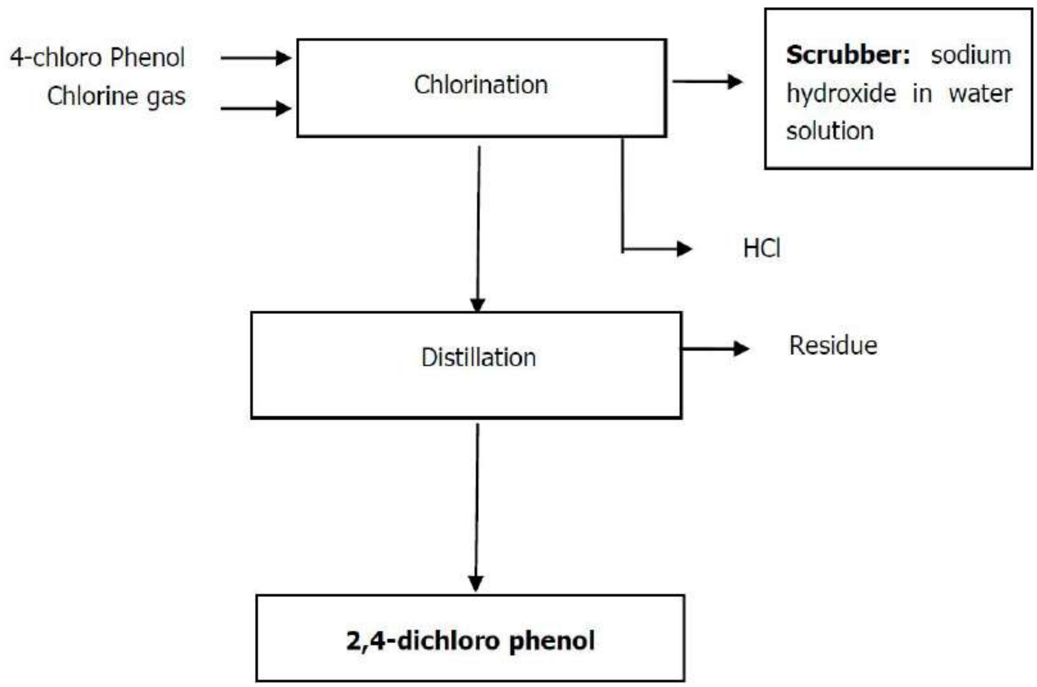
Process Description:

2-chloro Phenol react with chlorine gas to give of 2, 4 Dichloro phenol. The product is isolated by distillation to give pure 2,4 Dichloro phenol.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for 2,4 Dichloro Phenol –INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	2-chloro phenol	0.800
2	Chlorine gas	0.424
3	Water	0.489
4	Caustic	0.006
	Total	**1.719**

Mass Balance for 2,4 Dichloro Phenol –OUTPUT

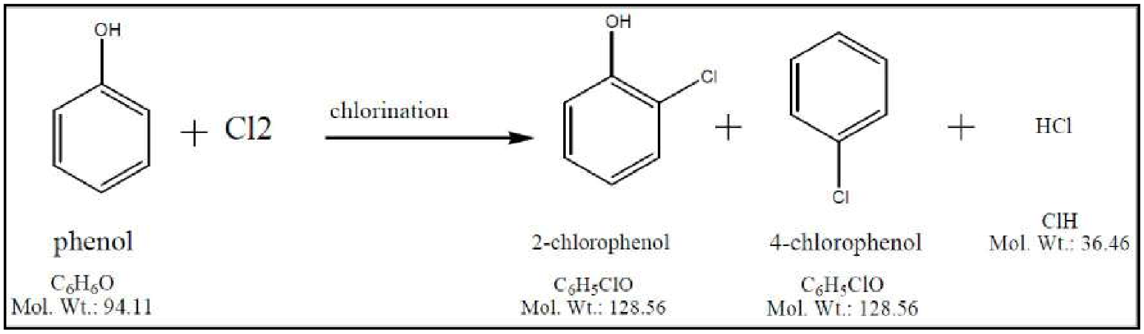
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	2,4 dichloro phenol	-	-	1.000	-	Product
3	Residue	-	-	-	0.0250	To CHWIF
4	HCL	-	-	0.6760	-	By-Product
5	Hypochlorite	-	-	0.018	-	By-Product
Total		**-**	**-**	**1.694**	**0.025**	
		1.719				

4. **2/4-Chlorophenol**

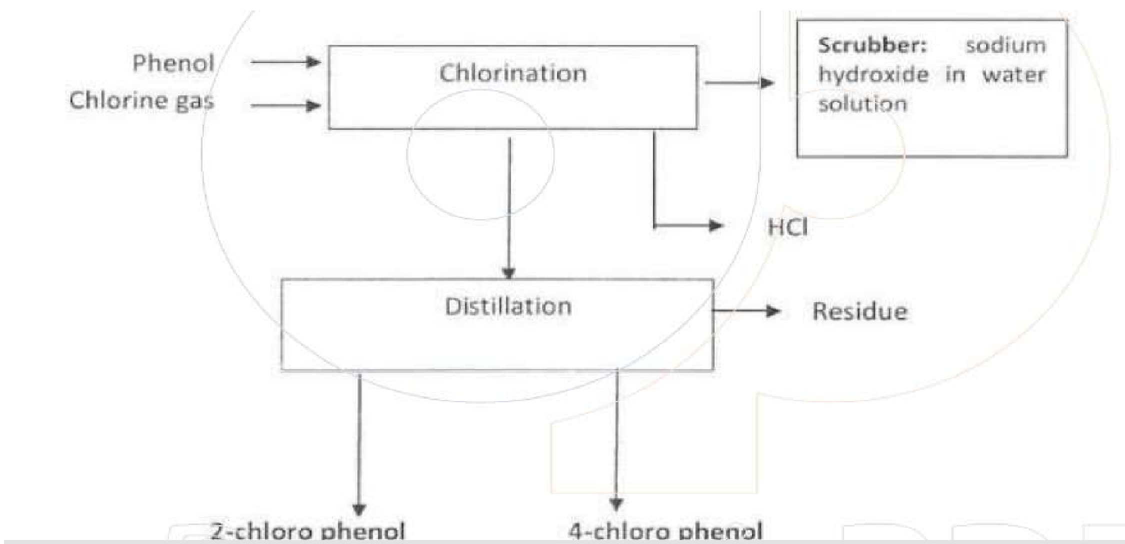
Process Description:

The reaction of Phenol with chlorine gas to give mixture of 2-Chloro Phenol, 4-Chloro Phenol. The mixture is isolated by distillation to give pure 2-Chloro Phenol, and 4-Chloro Phenol.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for 2/4 Chloro Phenol –INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Phenol	0.770
2	Chlorine	0.479
3	Water	0.492
4	Caustic	0.007
Total		**1.748**

Mass Balance for 2 /4 Chloro Phenol –Output

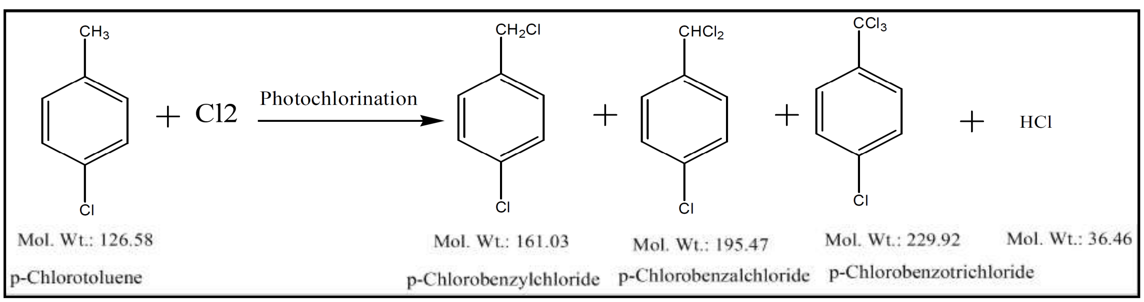
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	2,Chloro phenol	-	-	0.400	-	Product
2	4,Chloro phenol	-	-	0.600	-	Product
3	Residue	-	-	-	0.0330	To CHWIF
4	HCL	-	-	0.6760	-	By-Product
5	Hypochlorite	-	-	0.039	-	By-Product
Total		**-**	**-**	**1.715**	**0.033**	
		1.748				

5. p-Chlorobenzyl Chloride, p-Chlorobenzal Chloride and p-Chlorobenzo Trichloride

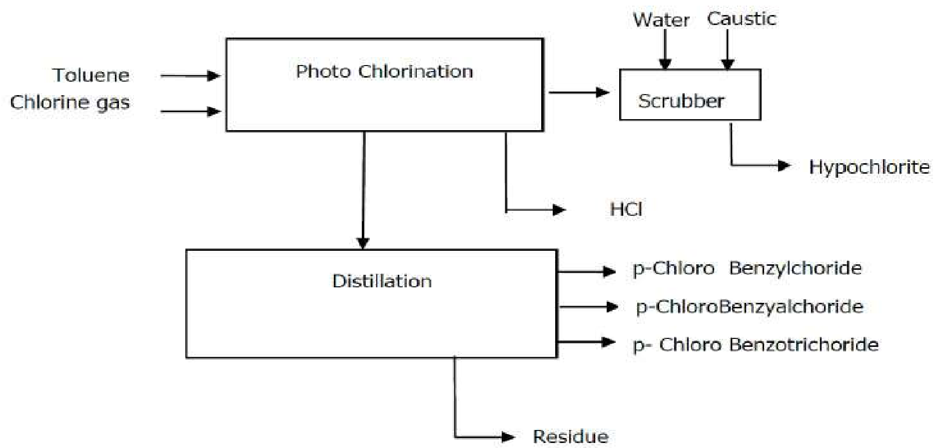
Process Description:

p-Chlorotoluene react with chlorine in presence of UV light to give mixture of p-Chlorobenzylchloride, p-Chlorobenzalchloride & p-Chlorobenzotrichloride. The mixture is isolated by distillation to give pure p-Chlorobenzylchloride, p-Chlorobenzalchloride & p-Chlorobenzotrichloride.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for p-Chlorobenzylchloride, p-Chlorobenzalchloride and p-Chlorobenzotrichloride –INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Toulene	0.800
2	Chlorine Gas	0.364
3	Water	0.051
4	Caustic	0.006
Total		**1.221**

Mass Balance for p-Chlorobenzylchloride, p-Chlorobenzalchloride and p-Chlorobenzotrichloride –OUTPUT

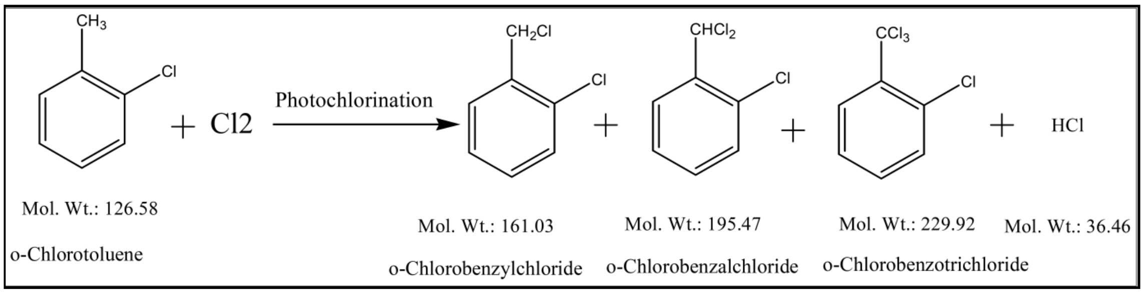
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	P-Chloro Benzylchloride	-	-	0.600	-	Product
2	P-Chloro Benzalchloride	-	-	0.350		Product
3	P-Chloro Benzotrichloride	-	-	0.050	-	Product
4	Hypochlorite	-	-	0.067	-	By- Product
5	HCL	-	-	0.149		By-Product
6	Residue	-	-	-	0.005	To CHWIF
Total		**0**	**0**	**1.216**	**0.005**	
		1.221				

6. o-Chloro Benzyl Chloride, o-Chloro Benzal Chloride and o-Chloro Benzo Trichloride

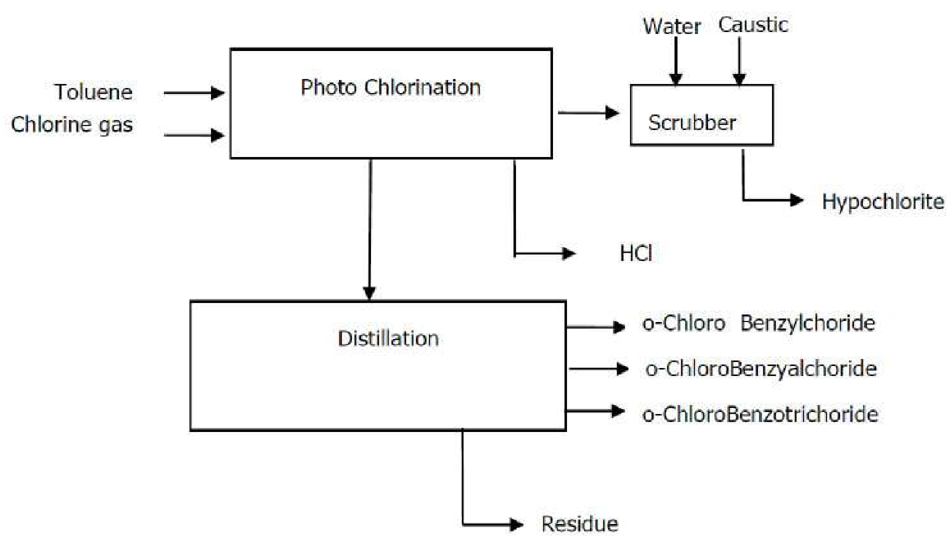
Process Description:

o-Chlorotoluene react with chlorine in presence of UV light to give mixture of o-Chlorobenzylchloride, o-Chlorobenzalchloride & o-Chlorobenzotrichloride. The mixture is isolated by distillation to give pure o-Chlorobenzylchloride, o-Chlorobenzalchloride & o-Chlorobenzotrichloride

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for o-Chlorobenzylchloride, o-Chlorobenzalchloride & o- Chlorobenzotrichloride – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Toulene	0.800
2	Chlorine Gas	0.364
3	Water	0.051
4	Caustic	0.006
	Total	**1.221**

Mass Balance for o-Chlorobenzylchloride, o-Chlorobenzalchloride & o- Chlorobenzotrichloride – OUTPUT

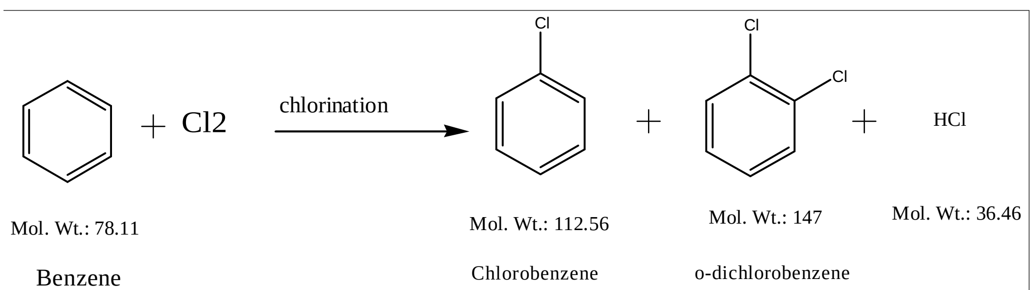
S. No.	Output/MT of Product					Remarks
	Product	Waste Water	Air Emission	Recovery/ Product	Solid Waste	
1	o-Chloro Benzylchloride	-	-	0.600	-	Product
2	o-Chloro Benzalchloride	-	-	0.350	-	Product
3	o-Chloro Benzotrichloride	-	-	0.050	-	Product
4	Hypochlorite	-	-	0.067	-	By Product
5	HCL	-	-	0.149	-	By Product
6	Residue	-	-	-	0.005	To CHWIF
Total		**0**	**0**	**1.216**	**0.005**	
		1.221				

7. Chloro Benzene and o-Dichloro Benzene

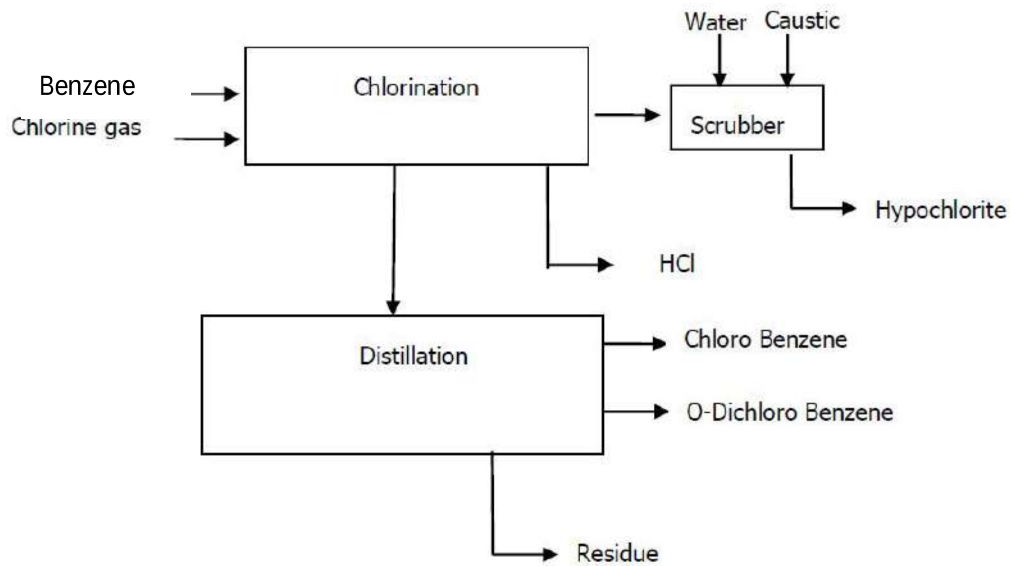
Process Description:

The reaction between benzene and chlorine gives the mixture of Chlorobenzene & o-Dichlorobenzene. The mixture is isolated by distillation to give pure Chlorobenzene and o-Dichlorobenzene.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for Chlorobenzene and o-Dichlorobenzene –INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Benzene	0.670
2	Chlorine Gas	0.365
3	Water	0.051
4	Caustic	0.006
	Total	**1.092**

Mass Balance for Chlorobenzene and o-Dichlorobenzene –OUTPUT

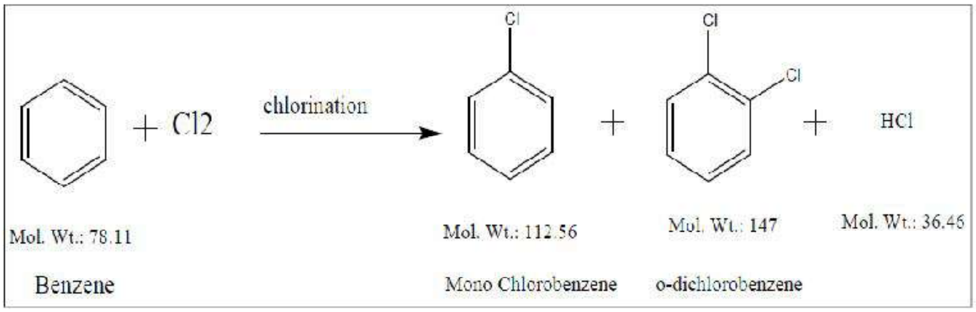
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Chloro Benzene			0.700		Product
2	o-Dichloro Benzene			0.300		Product
3	Residue				0.0050	To CHWIF
4	Hypochlorite			0.067		By product
5	HCL			0.02		By product
Total		**0**	**0**	**1.087**	**0.005**	
		1.092				

8. Mono Chloro Benzene

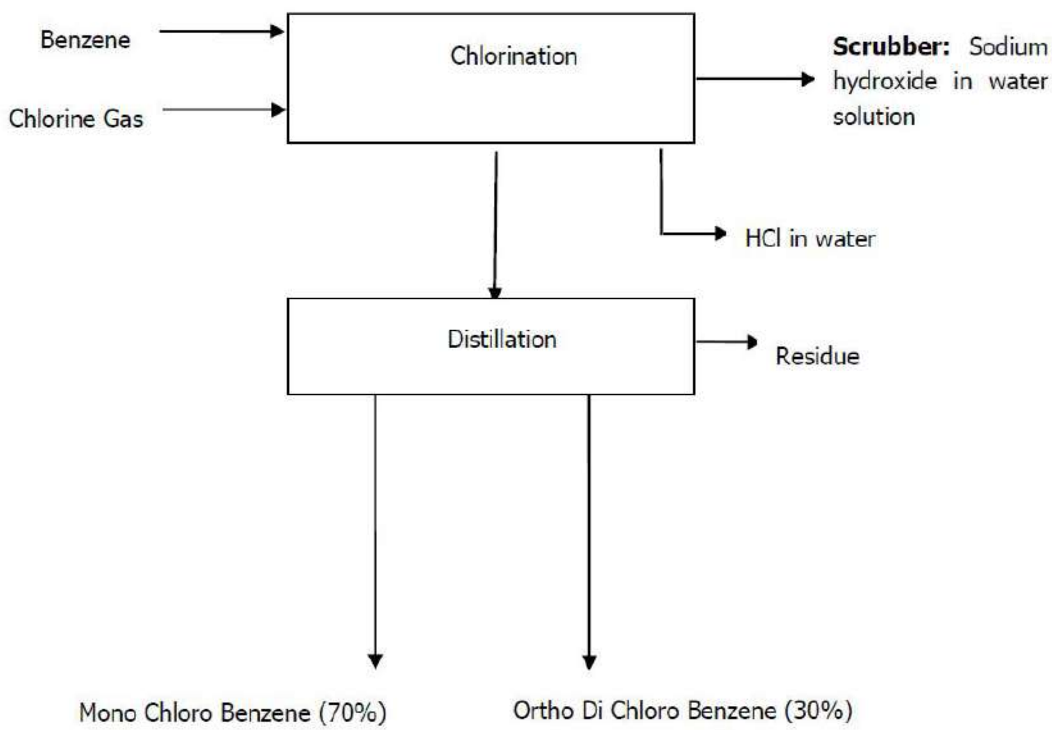
Process Description:

The reaction between benzene and chlorine gives the mixture of Chlorobenzene & o-Dichlorobenzene. The mixture is isolated by distillation to give pure Chlorobenzene & o-Dichlorobenzene.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for Mono Chlorobenzene–INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	Benzene	0.710
2	Chlorine	0.630
3	Water	0.760
Total		**2.100**

Mass Balance for Mono Chlorobenzene–OUTPUT

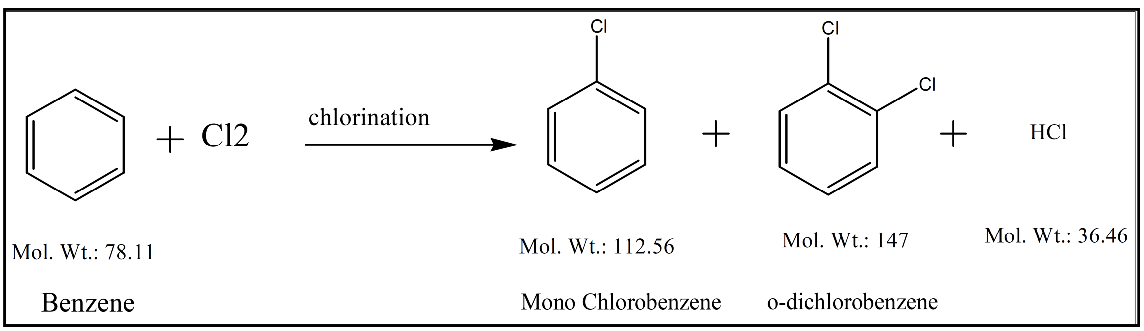
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	MCB	-	-	1.000	-	Product
2	Residue	-	-	-	0.0100	To CHWIF
3	HCL	-	-	1.090	-	By Product
Total		**0**	**0**	**2.090**	**0.010**	
		2.100				

9. (O/M/P) Dichloro Benzene

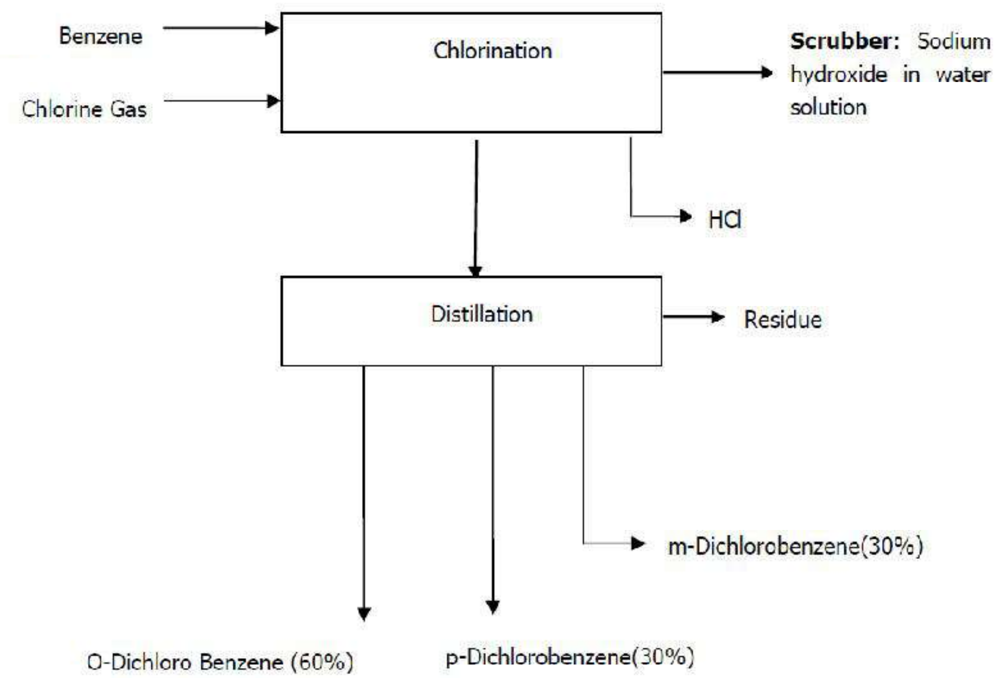
Process description:

The reaction between benzene and chlorine gives the mixture of o-Dichlorobenzene & P-dichloro benzene & m-Dichloro benzene The mixture is isolated by distillation to give pure o-Dichlorobenzene. & p-Dichlorobenzne &m-Dichlorobenzne.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for (O/M/P) Dichloro Benzene –INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	Benzene	0.540
2	Chlorine	0.970
3	Water	1.160
	Total	**2.670**

Mass Balance for (O/M/P) Dichloro Benzene –OUTPUT

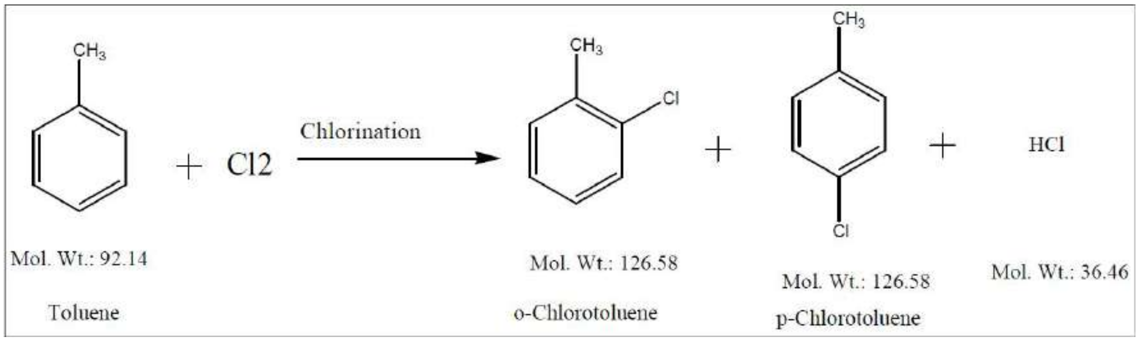
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	DCB	-	-	1.000	-	Product
2	Handling Loss	-	0.01	-	-	
2	HCl	-	-	1.650	-	By Product
3	Residue	-	-	-	0.0100	To CHWIF
Total		**0**	**0.01**	**2.650**	**0.010**	
		2.670				

10. O/P Chloro Toulene

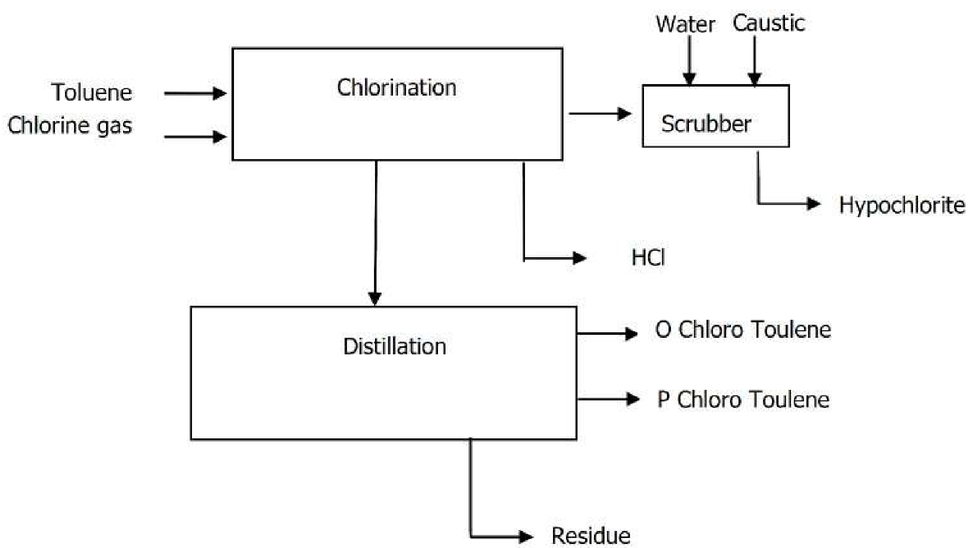
Process Description:

The reaction between Toluene and chlorine gives the mixture of o-chlorotoluene & p-chlorotoluene. The mixture is isolated by distillation to give pure o-chlorotoluene & p-chlorotoluene.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for o/p-Chloro Toluene –INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Toulene	0.750
2	Chlorine gas	0.560
3	Water	0.051
4	Caustic	0.006
	Total	**1.367**

Mass Balance for o/p-Chloro Toluene –OUTPUT

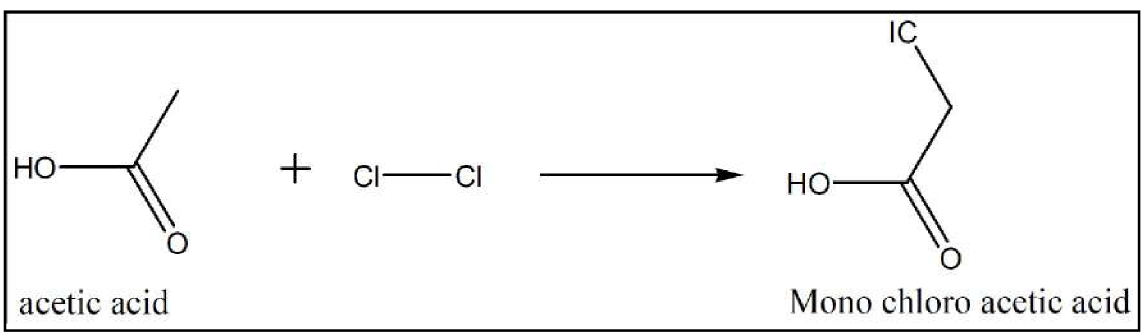
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	o-Chloro Toulene	-	-	0.450	-	Product
2	p-Chloro Toulene	-	-	0.550	-	Product
2	Residue	-	-	-	0.0050	To CHWIF
3	Hypochlorite	-	-	0.067	-	By Product
4	HCl	-	-	0.295	-	By Product
Total		**0**	**0**	**1.362**	**0.005**	
		1.367				

11. Mono Chloro Acetic Acid

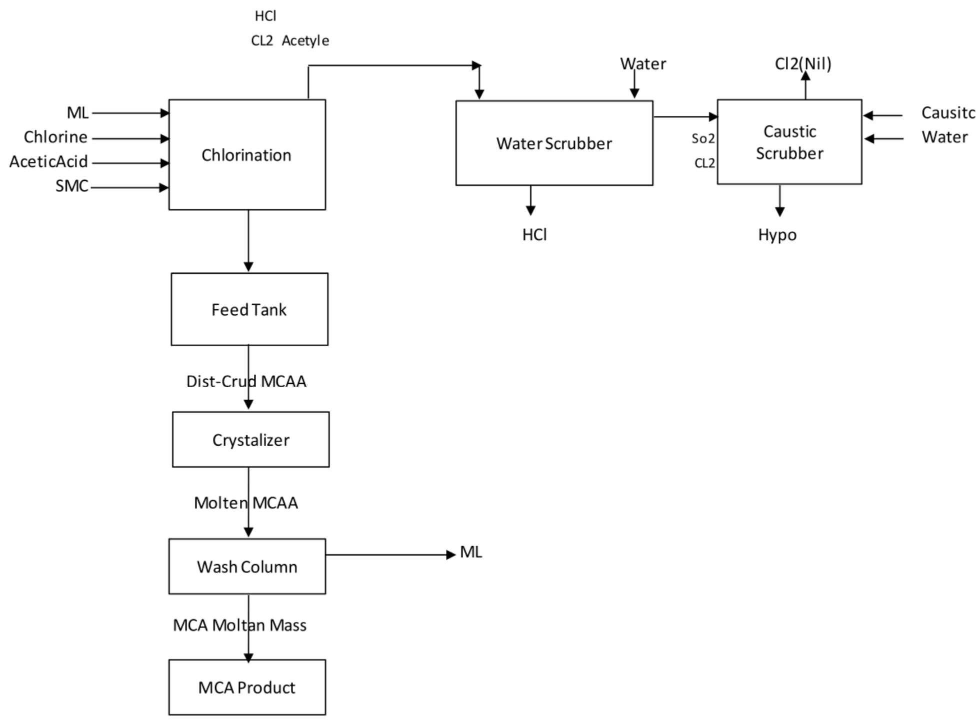
Process Description:

Mono chloro acetic acid produced by passing chlorine in acetic acid to give mono chloro acetic acid

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance for Mono Chloro Acetic Acid –INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Acetic Acid	0.800
2	Chlorine	1.050
3	Acetic Anhydried	0.009
4	SMC	0.027
5	Caustic	0.788
6	Water	1.142
Total		**3.816**

Mass Balance for Mono Chloro Acetic Acid –OUTPUT

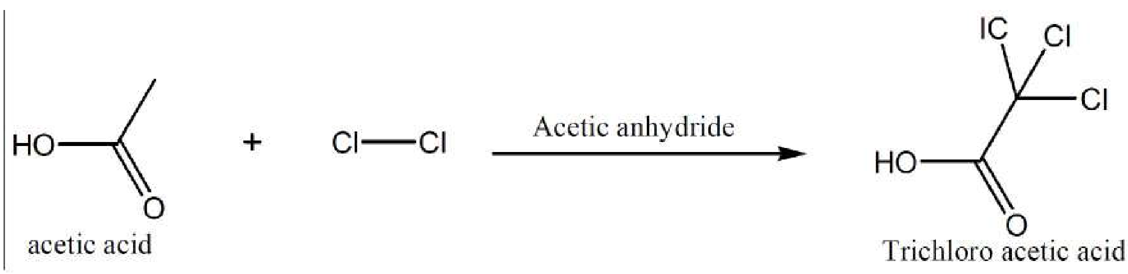
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Hypo	-	-	0.897	-	By Product
2	HCL-32%	-	-	1.622	-	By Product
2	ML	-	-	0.297	-	As a raw material in TCAC
3	MCA	-	-	1.000	-	Product
Total		**0**	**0**	**3.816**	**0.000**	
		3.816				

12. Tri Chloro Acetyl Chloride

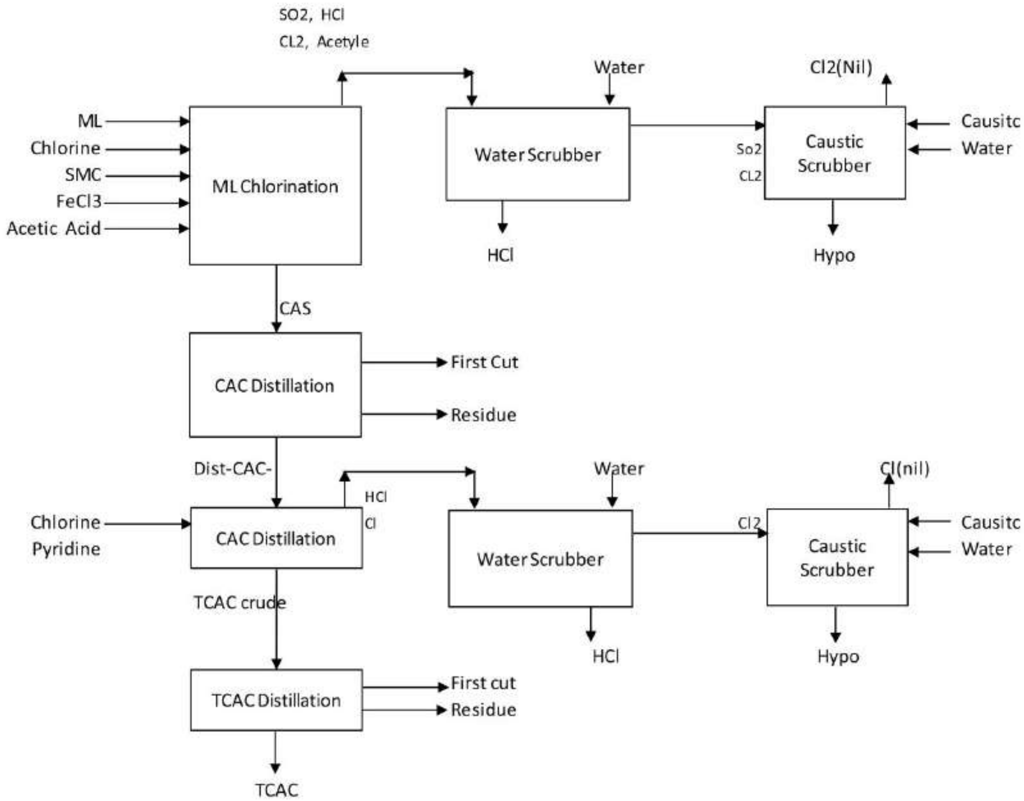
Process Description:

Tri chloro acetic acid prepared by the reaction of chlorine with acetic acid in the presence of a catalyst (acetic anhydride).

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass Balance Tri Chloro Acetyl Cloride –INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	ML	0.480
2	Chlorine	0.599
3	SMC	0.247
4	FeCl3	0.002
5	AA	0.160
6	Chlorine	0.798
7	Pyridine	0.002
8	Water	2.307
9	Caustic	0.141
	Total	**4.736**

Mass Balance Tri Chloro Acetyl Chloride –OUTPUT

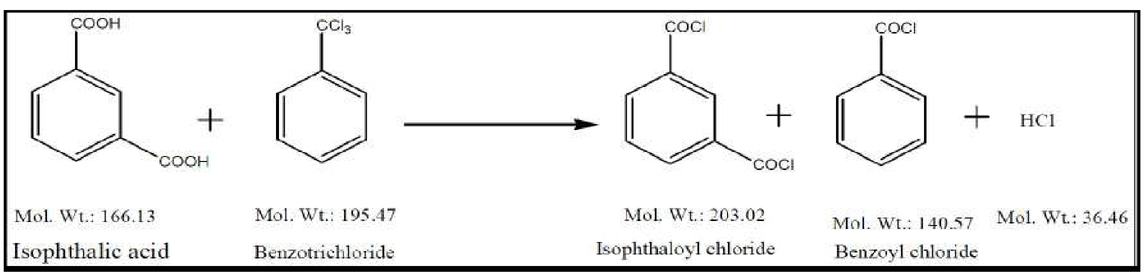
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Hypo			1.139		By Product
2	HCL-32%			2.468		By Product
3	Fist Cut			0.094		By Product
4	Residue				0.0350	To CHWIF
6	TCAC			1.000		Product
Total		**0**	**0**	**4.701**	**0.035**	
		4.736				

13. Iso Phthaloyl Chloride

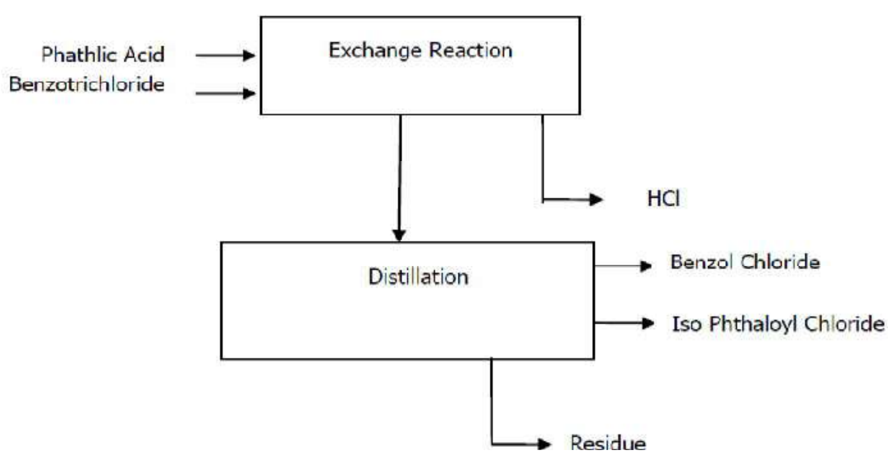
Process Description:

The reaction between Isophthalic acid and Benzotrichloride gives the mixture of Isophthaloyl chloride & Benzoyl chloride. The mixture is isolated by distillation to give pure o-Isophthaloyl chloride & Benzoyl chloride.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance of Iso Phthaloyl Chloride- INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	Iso Phtalic Acid	0.835
2	Benzotrichloride	0.970
	Total	**1.805**

Mass balance of Iso Phthaloyl Chloride- OUTPUT

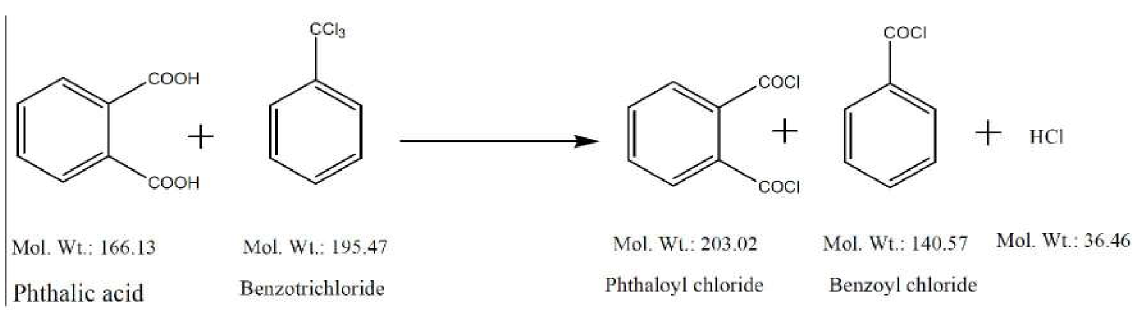
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	HCL			0.120		By Product
2	Residue				0.005	To CHWIF
3	Benzol Chloride			0.680		Product
4	Iso Pthaloyl Chloride			1.000		Product
	Total	**0**	**0**	**1.800**	**0.005**	
		1.805				

14. Phthaloyl Chloride

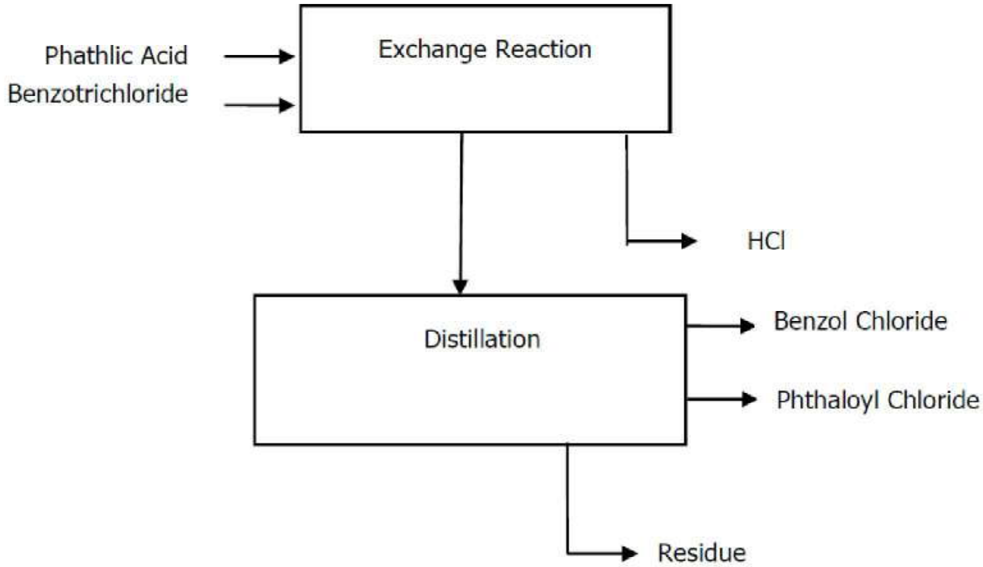
Process Description:

The reaction between Phthalic acid and Benzotrichloride gives the mixture of Phthaloyl chloride & Benzoyl chloride. The mixture is isolated by distillation to give pure o-Phthaloyl chloride & Benzoyl Chloride.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance of Phthaloyl Chloride- INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	Phthalic Acid	0.840
2	Benzotrichloride	0.970
Total		**1.810**

Mass balance of Phthaloyl Chloride- OUTPUT

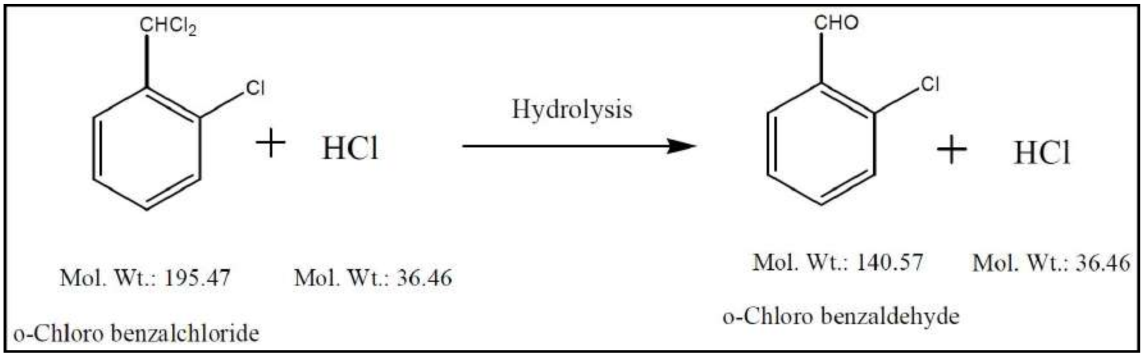
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	HCL			0.125		By Product
2	Residue				0.005	To CHWIF
3	Benzol Chloride			0.680		By Product
4	Pthaloyl Chloride			1.000		Product
Total		**0**	**0**	**1.805**	**0.005**	
		1.810				

15. o-Chloro Bezaldehyde

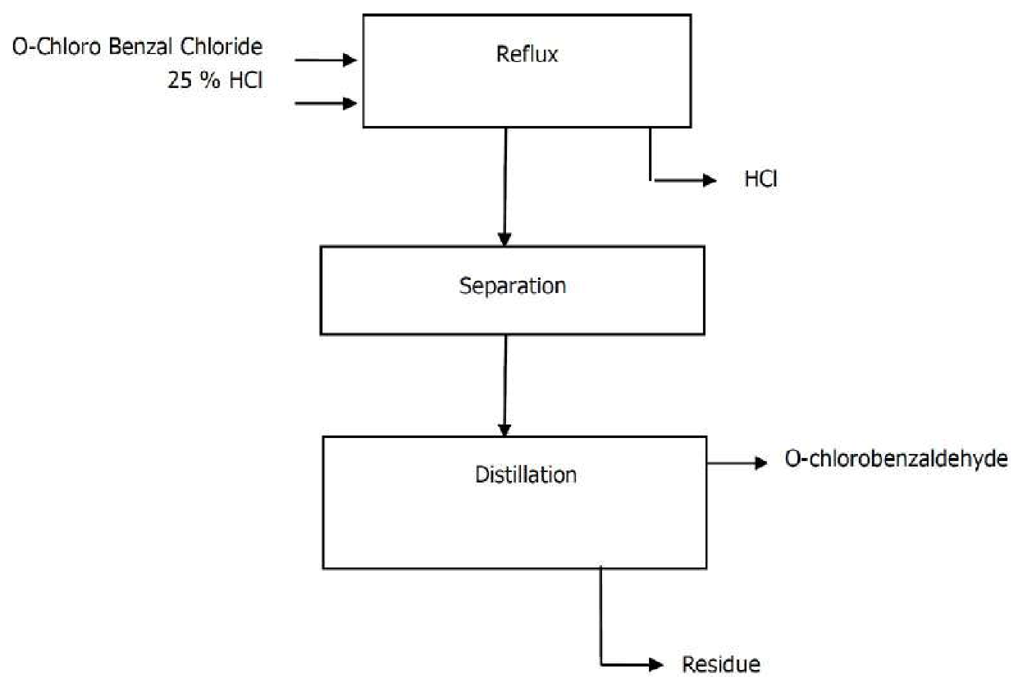
Process Description:

o-Chloro Benzal Chloride is hydrolyzed by hydrochloric acid in water. The Organic layer is separated by phase separation. The Organic layer is distilled to give o-Chloro Benzaldehyde.

Chemical Reaction:



Flow Diagram



Mass Balance:

Mass balance of o-Chloro Benzaldehyde – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	o-Chloro Benzal Chloride	1.460
2	25% HCl	4.800
Total		**6.260**

Mass balance of o-Chloro Benzaldehyde- OUTPUT

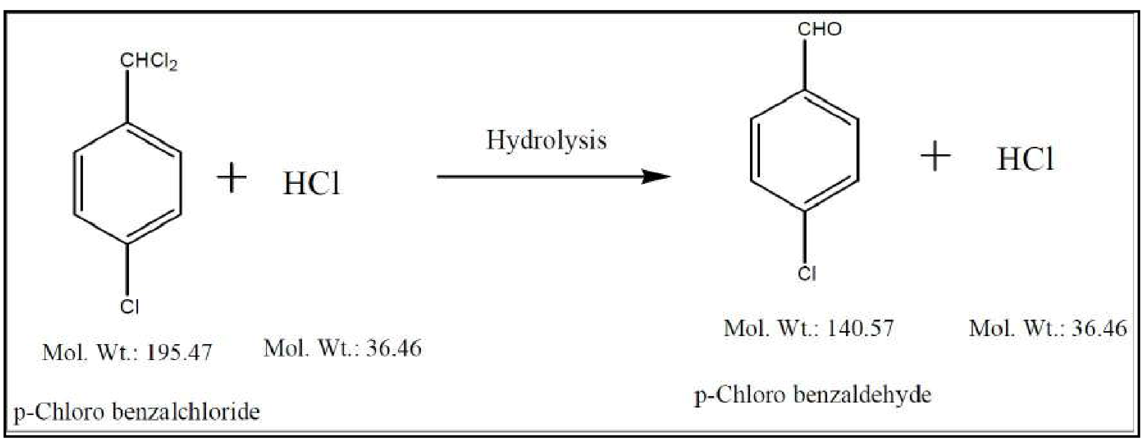
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	HCL			0.255		By-Product
2	Waste water	5				To ETP
3	Residue				0.005	To CHWIF
4	o-Chloro Benzaldehyde			1.000		Product
Total		**5**	**0**	**1.255**	**0.005**	
		6.260				

16. p-Chloro Benzaldehyde

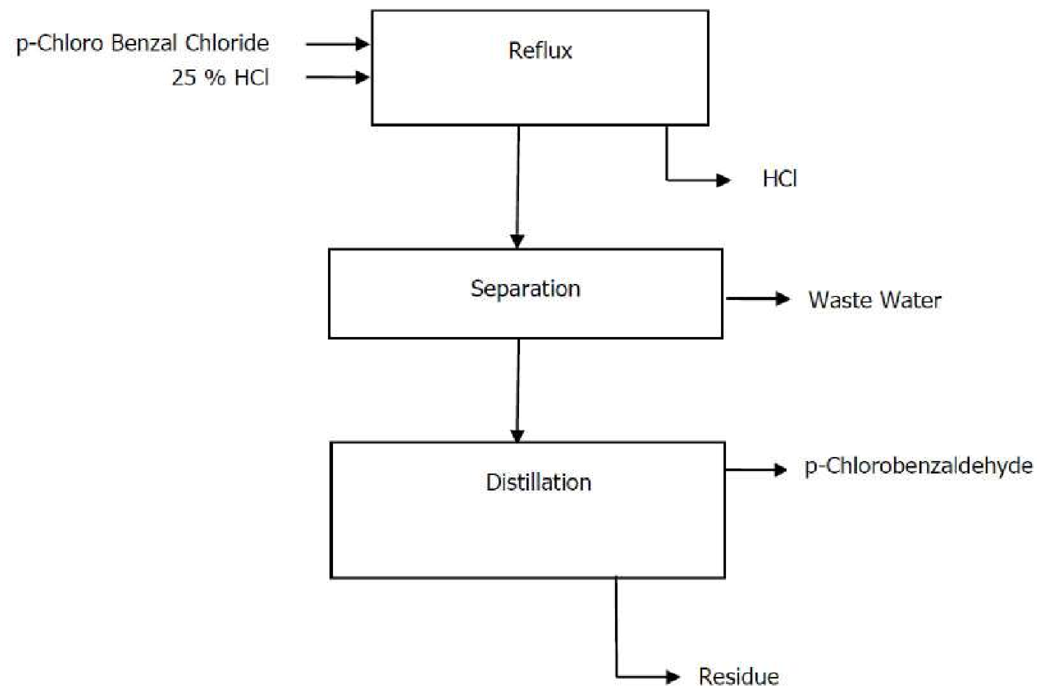
Process Description:

p-Chloro Benzal Chloride is hydrolyzed by hydrochloric acid in water. The Organic layer is separated by phase separation. The Organic layer is distilled to give p-Chloro benzaldehyde.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance for p-Chloro Benzaldehyde- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	P-Chloro Benzal Chloride	1.465
2	25% HCl	4.800
Total		**6.265**

Mass balance of p-Chloro Benzaldehyde- OUTPUT

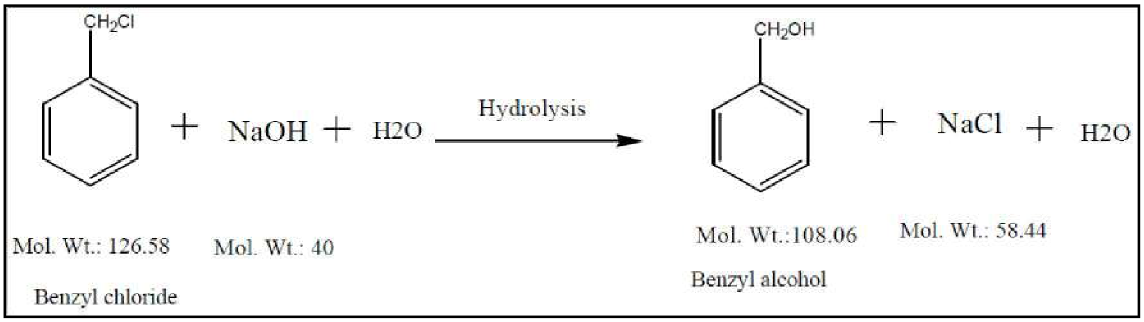
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	HCL	-	-	0.260	-	By-Product
2	Waste water	5	-	-	-	To ETP
3	Residue	-	-	-	0.005	To CHWIF
4	P-Chloro Benzaldehyde	-	-	1.000	-	Product
Total		**5**	**0**	**1.260**	**0.005**	
		6.265				

17. Benzyl Alcohol

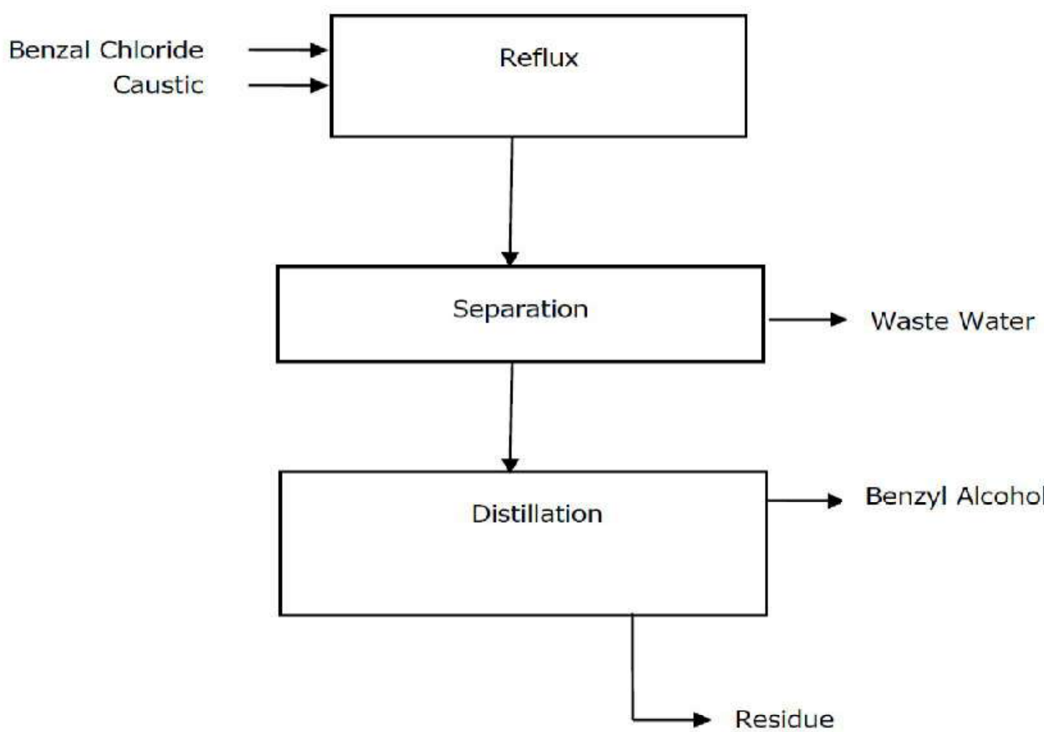
Process Description:

Benzyl Chloride is hydrolyzed by sodium hydroxide in water. The Organic layer is separated by phase separation. The Organic layer is distilled to give Benzyl Alcohol.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance for Benzyl Alcohol- INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	Benzyl Chloride	1.576
2	Caustic	6.605
Total		**8.181**

Mass balance for Benzyl Alcohol- OUTPUT

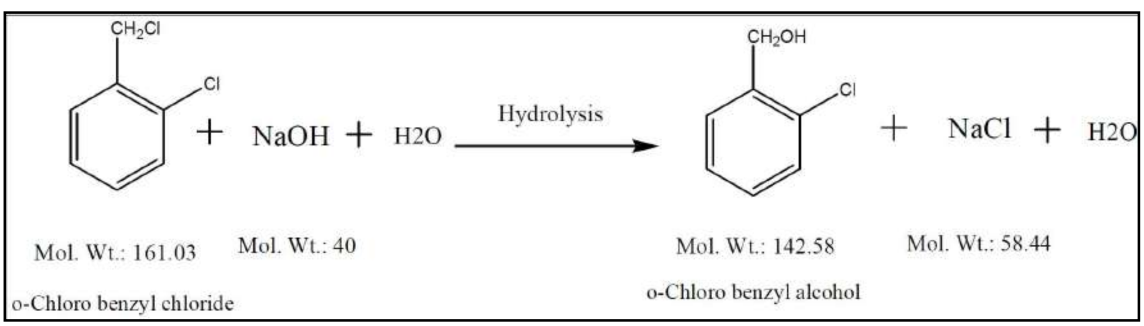
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Waste water	7.125	-	-	-	To ETP
2	Residue	-	-	-	0.056	To CHWIF
3	Benzyl Alcohol	-	-	1.000	-	Product
Total		**7.125**	**0**	**1.000**	**0.056**	
		8.181				

18. o-Chloro Benzyl Alcohol

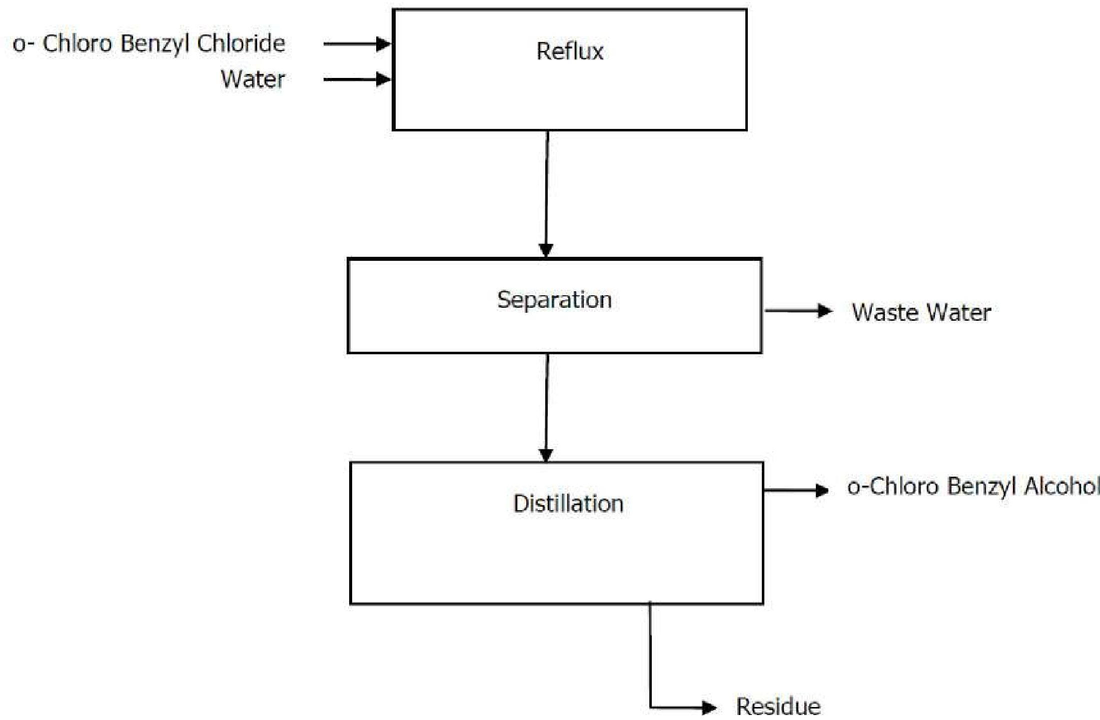
Process Description:

o-Chlorobenzyl chloride is hydrolyzed by sodium hydroxide in water. The Organic layer is separated by phase separation. The Organic layer is distilled to give o-Chloro Benzyl Alcohol.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance for o- Chloro Benzyl Alcohol- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	O-Chloro Benzyl Chloride	1.255
2	Caustic	5.112
Total		**6.367**

Mass balance for o- Chloro Benzyl Alcohol- OUTPUT

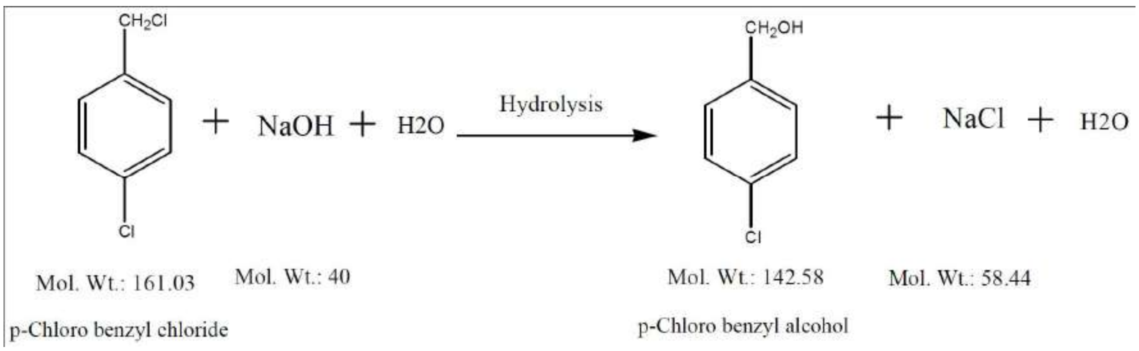
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Waste water	5.356				To ETP
2	Residue				0.011	To CHWIF
3	O- Chloro Benzyl Alcohol			1.000		Product
Total		**5.356**	**0**	**1.000**	**0.011**	
		6.367				

19. p-Chloro Benzyl Alcohol

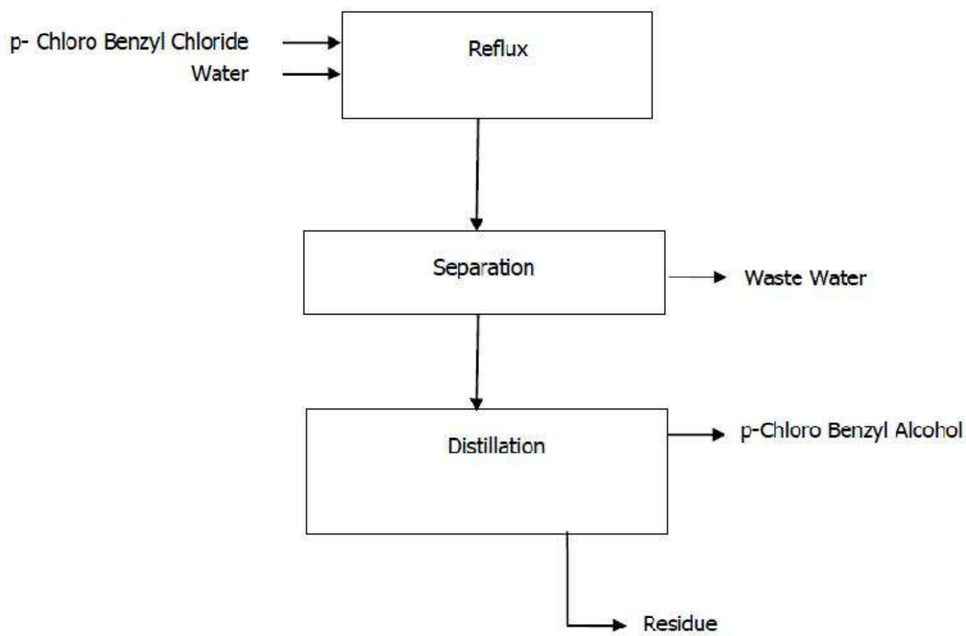
Process Description:

p-Chlorobenzyl chloride is hydrolyzed by sodium hydroxide in water. The Organic layer is separated by phase separation. The Organic layer is distilled to give p-Chloro benzyl alcohol.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance for p- Chloro Benzyl Alcohol- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	p-Chloro Benzyl Chloride	1.255
2	Caustic	5.112
Total		**6.367**

Mass balance for p- Chloro Benzyl Alcohol- OUTPUT

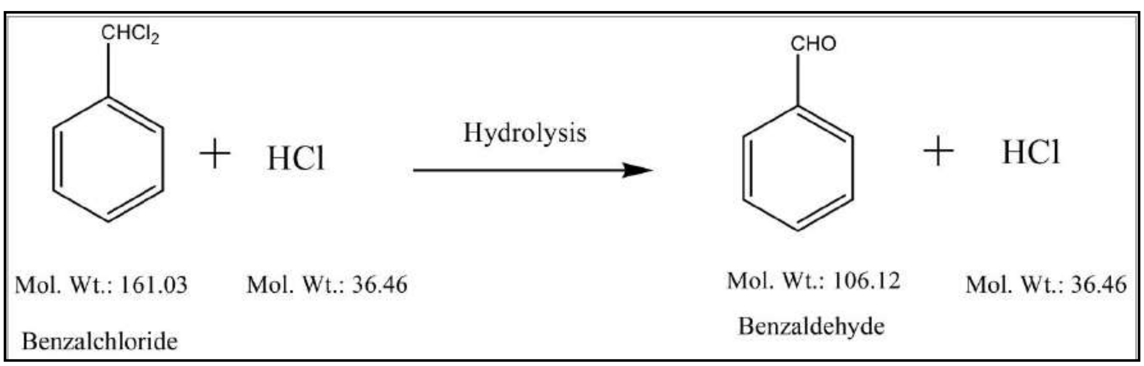
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Waste water	5.356				To ETP
2	Residue				0.011	To CHWIF
3	P- Chloro Benzyl Alcohol			1.000		Product
Total		**5.356**	**0**	**1.000**	**0.011**	
		6.367				

20. Benzaldehyde

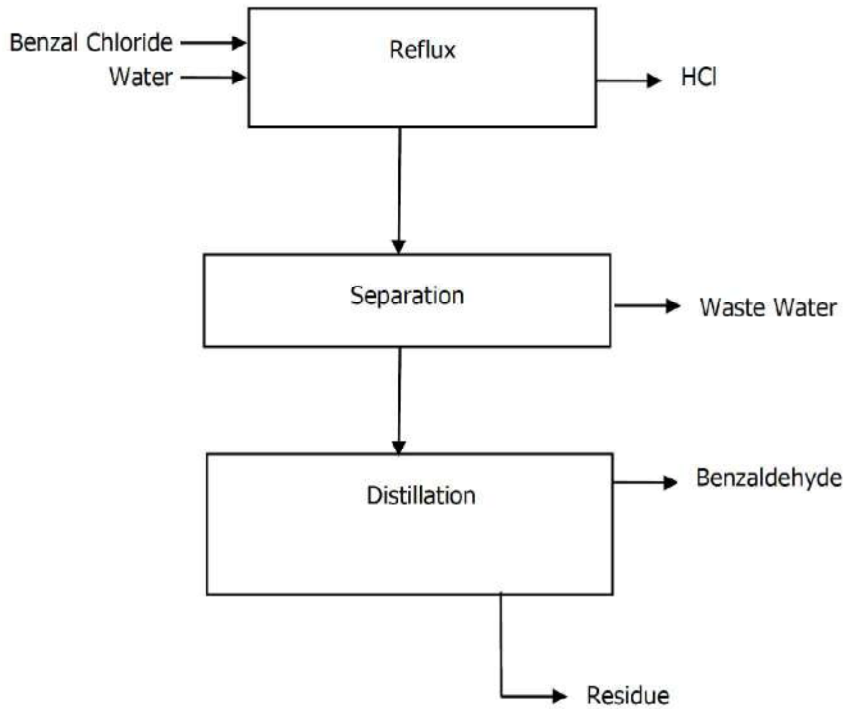
Process Description:

In a process for preparation of Benzaldehyde, hydrolysis of Benzal chloride is carried out by hydrochloric acid in water. The Organic layer is separated by phase separation. The Organic layer is distilled to give Benzaldehyde.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for Benzaldehyde - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Benzal Chloride	1.610
2	25% HCl	4.830
Total		**6.440**

Mass balance for Benzaldehyde – OUTPUT

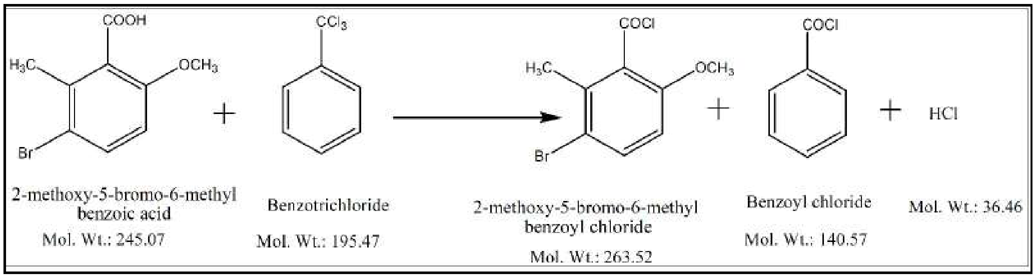
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	HCl	-	-	0.434	-	By-Product
2	Residue	-	-	-	0.006	To CHWIF
3	Waste Water	5.000	-	-	-	To ETP
4	Benzaldehyde	-	-	1.000	-	Product
Total		**5**	**0**	**1.434**	**0.006**	
		6.440				

21. 2-Methoxy 5-Bromo 6-Methyl Benzoyl Chloride

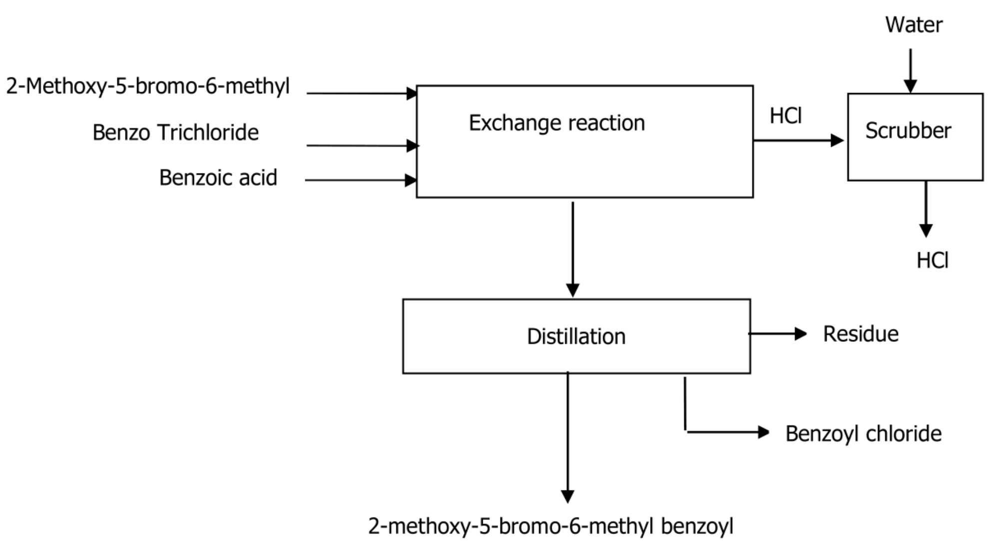
Process Description:

The reaction between 2-methoxy-5-bromo-6-methyl benzoic acid and Benzotrichloride gives the mixture of 2-methoxy-5-bromo-6-methyl benzoyl chloride & Benzoyl chloride. The mixture is isolated by distillation to give pure 2-methoxy-5-bromo-6-methyl benzoyl chloride & Benzoyl chloride

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2-Methoxy-5-Bromo-6-Methyl Benzoyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2M5B6MBA	1.050
2	Benzotrichloride	0.725
3	Water	0.230
	Total	**2.005**

Mass balance for 2-Methoxy-5-Bromo-6-Methyl Benzoyl Chloride - OUTPUT

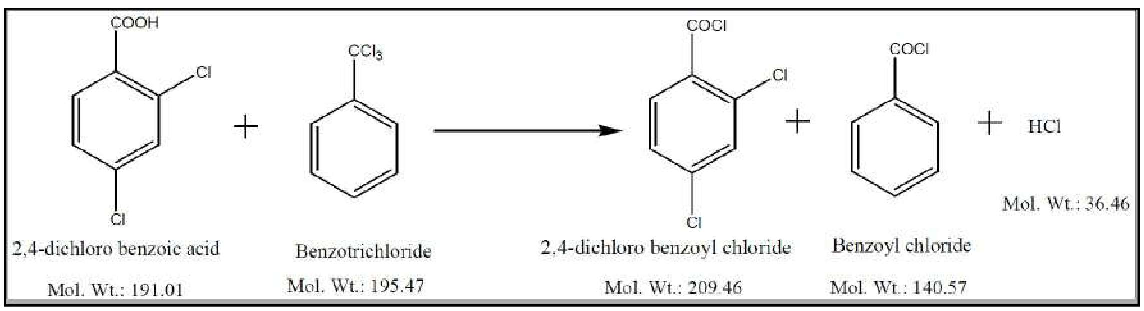
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Residue	-	--	--	0.025	To CHWIF
2	Benzoyl Chloride	-	--	0.650	--	By-Product
3	2-methoxy-5-bromo-6-methyl benzoyl chloride	--	--	1.000	--	Product
4	HCL	--	--	0.330	--	By- Product
Total		**0**	**0**	**1.980**	**0.025**	
		2.005				

22. 2,4 Dichloro Benzoyl Chloride

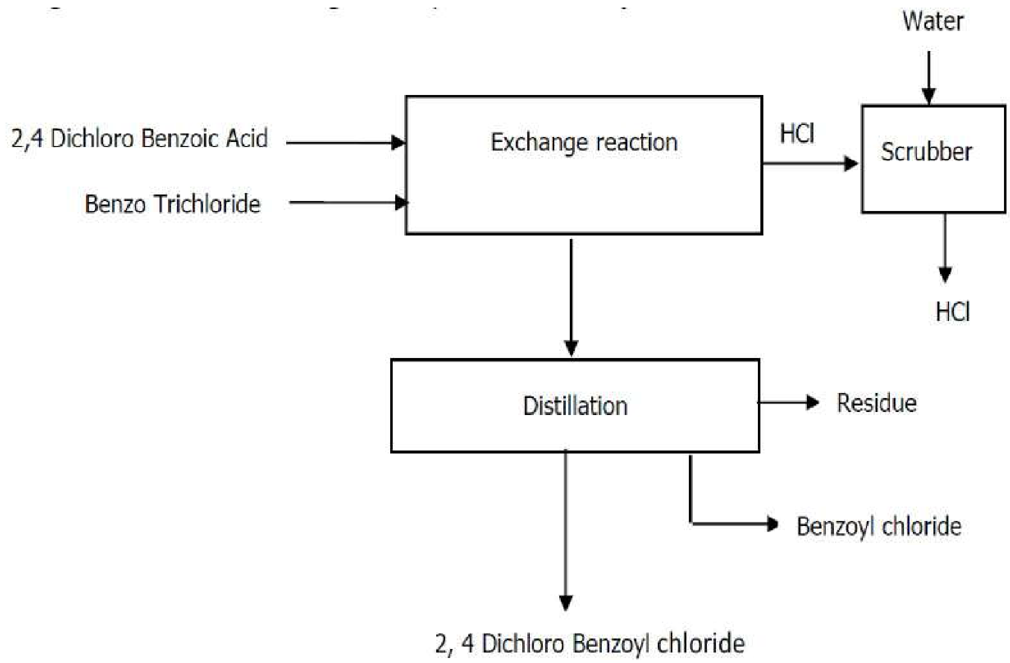
Process Description:

The reaction between 2,4-dichloro benzoic acid and Benzotrichloride gives the mixture of 2,4-dichloro benzoyl chloride and Benzoyl chloride. The mixture is isolated by distillation to give pure 2,4 dichlorobenzoyl chloride and Benzoyl chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,4 Dichlorobenzoyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,4-dichloro benzoic acid	1.020
2	Benzotrichloride	0.860
3	Water	0.345
Total		**2.225**

Mass balance for 2,4 Dichlorobenzoyl Chloride - OUTPUT

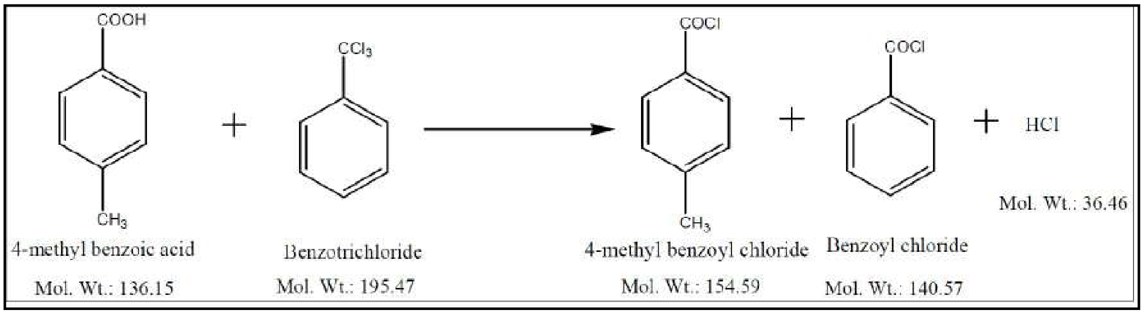
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Residue	-	-	-	0.03	To CHWIF
2	Benzoyl Chloride	-	-	0.700	-	By-Product
3	2,4 dichloro benzoyl chloride	-	-	1.000	-	Product
4	HCL	-	-	0.495	-	By- Product
Total		**0**	**0**	**2.195**	**0.030**	
		2.225				

23. 4 Methyl Benzoyl Chloride

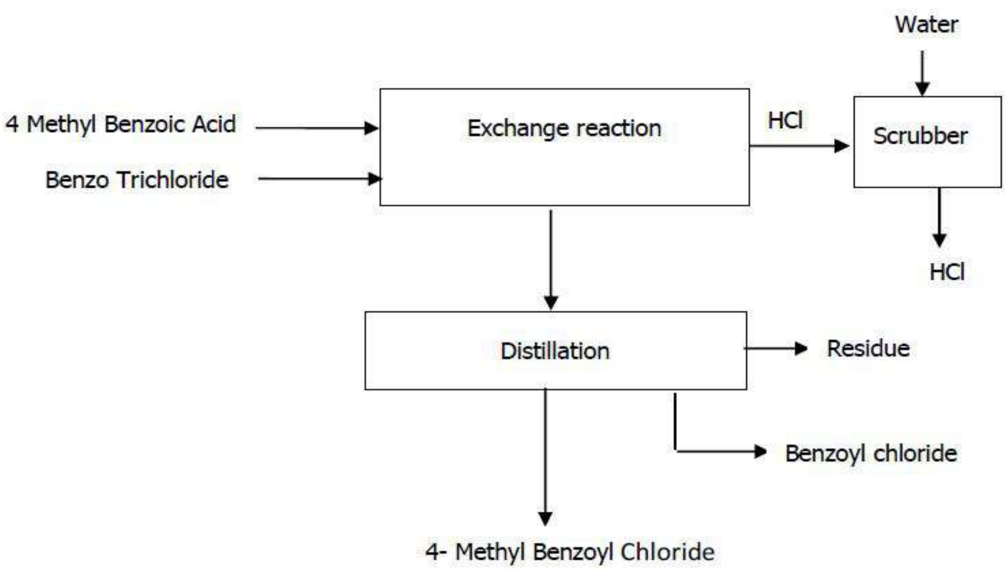
Process Description:

The reaction between 4-methyl benzoic acid and Benzotrichloride gives the mixture of 4-methyl benzoyl chloride& Benzoyl chloride. The mixture is isolated by distillation to give pure 4-methyl benzoyl chloride & Benzoyl chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 4-Methyl Benzoyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-methyl benzoic acid	0.981
2	Benzotrichloride	1.215
3	Water	0.460
	Total	**2.656**

Mass balance for 4-Methyl Benzoyl Chloride - OUTPUT

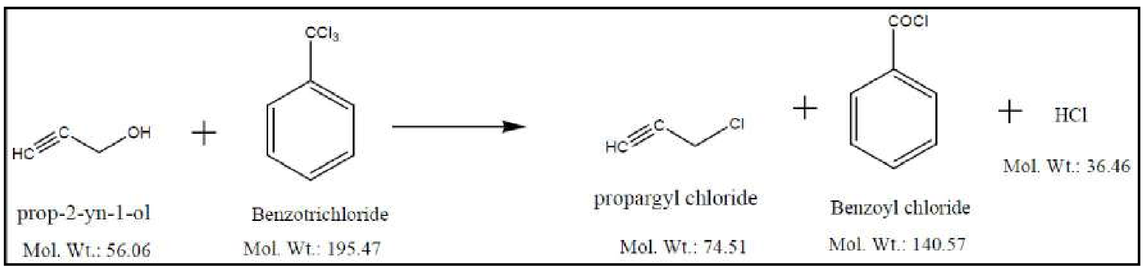
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Residue	-	-	-	0.025	To CHWIF
2	Benzoyl Chloride	-	-	0.908	-	By-Product
3	4 Methyl Benzoyl Chloride	-	-	1.000	-	Product
4	HCL	-	-	0.723	-	By- Product
Total		**0**	**0**	**2.631**	**0.025**	
		2.656				

24. Propargyl Chloride

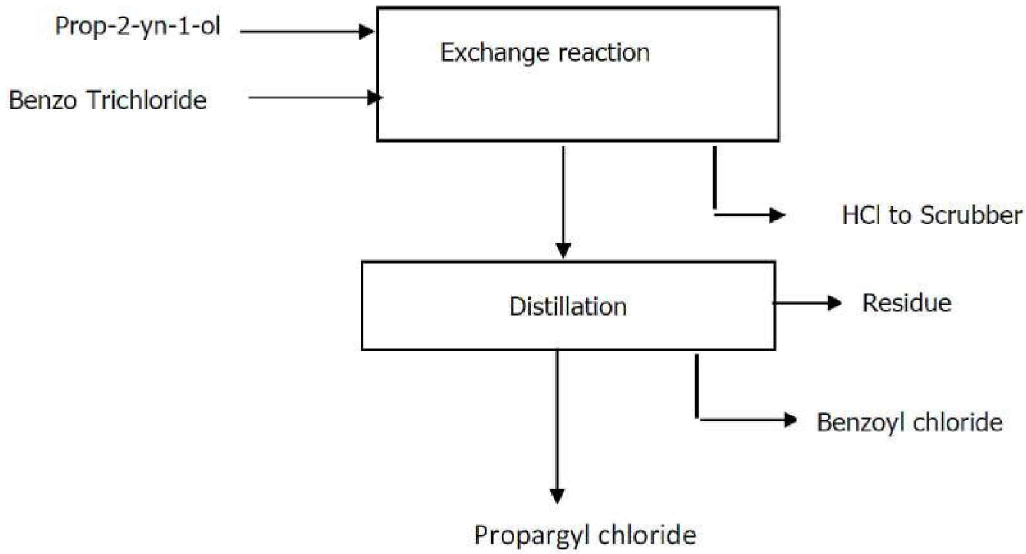
Process Description:

The reaction between pro-2-yn-1-ol and Benzotrichloride gives the mixture of Propargyl Chloride & Benzoyl chloride. The mixture is isolated by distillation to give pure Propargyl Chloride & Benzoyl chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for Propargyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Prop-2-yn-1-ol	0.800
2	Benzotrichloride	2.370
3	Water	0.575
Total		**3.745**

Mass balance for Propargyl Chloride - OUTPUT

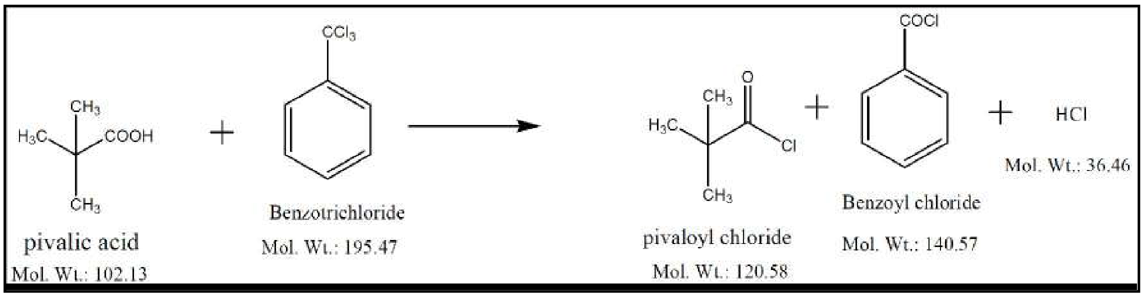
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzoyl chloride			1.89		By-Product
2	Residue				0.03	To CHWIF
3	Propargyl chloride			1		Product
4	HCl			0.825		By- Product
Total		**0**	**0**	**3.715**	**0.030**	
		3.745				

25. PivaloylChloride

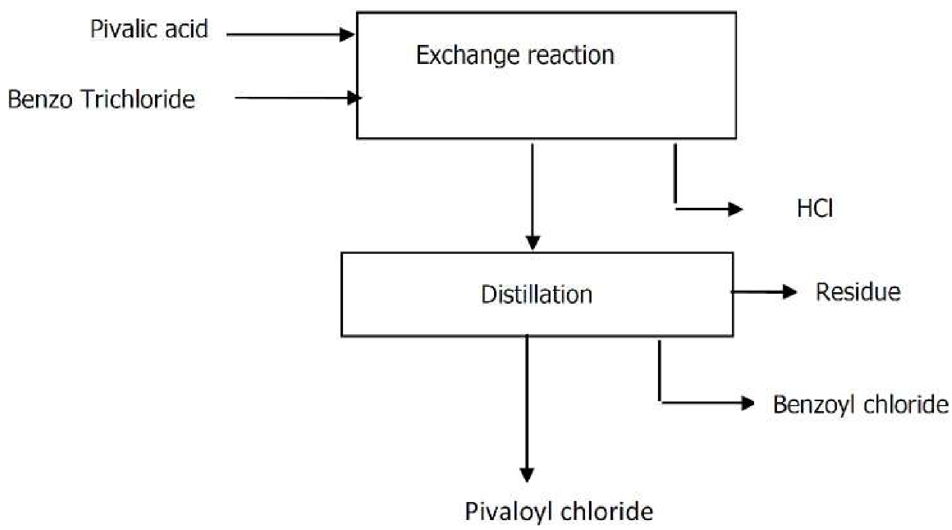
Process Description:

The reaction between Pivalic acid and Benzotrichloride gives the mixture of Pivaloyal Chloride & Benzoyl Chloride. The mixture is isolated by distillation to give pure Pivaloyal Chloride & Benzoyl Chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for Pivaloyal Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Pivalic acid	0.900
	Benzotrichloride	1.536
2	Water	0.529
	Total	**2.965**

Mass balance for Pivaloyal Chloride - OUTPUT

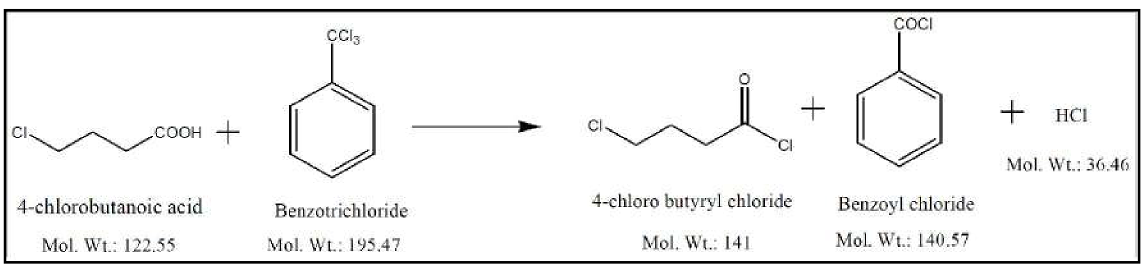
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzoyl chloride			1.176		By-Product
2	Residue				0.03	To CHWIF
3	Pivaloyl chloride			1		Product
4	HCL			0.759		By- Product
Total		**0**	**0**	**2.935**	**0.030**	
		2.965				

26. 4-Chloro Butryl Chloride

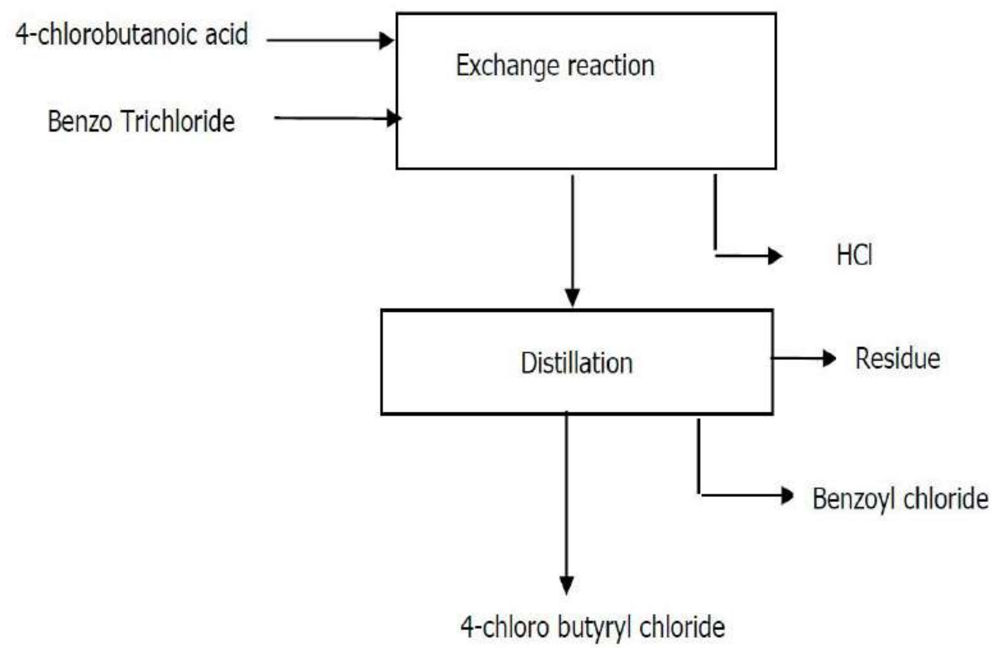
Process Description:

The reaction between 4-Chlorobutanoic Acid and Benzotrichloride gives the mixture of 4-Chlorobutyryl Chloride & Benzoyl Chloride. The mixture is isolated by distillation to give pure 4-Chloro Butyryl Chloride & Benzoyl Chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 4-Chloro Butyryl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-Chlorobutanoic acid	0.909
2	Benzotrichloride	1.338
3	Water	0.484
	Total	**2.731**

Mass balance for 4-Chloro Butyryl Chloride - OUTPUT

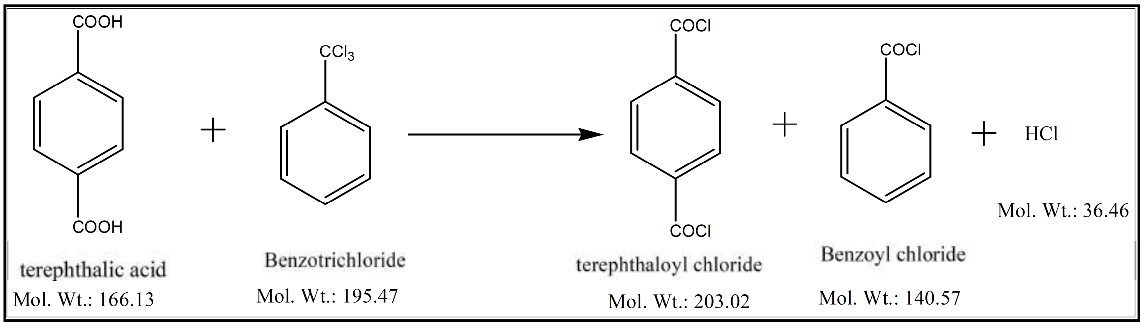
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzoyl chloride			0.997		By-Product
2	Residue				0.03	To CHWIF
3	4-chloro butyryl chloride			1		Product
4	HCL			0.704		By- Product
Total		**0**	**0**	**2.701**	**0.030**	
		2.731				

26. Terephthaloyl Chloride

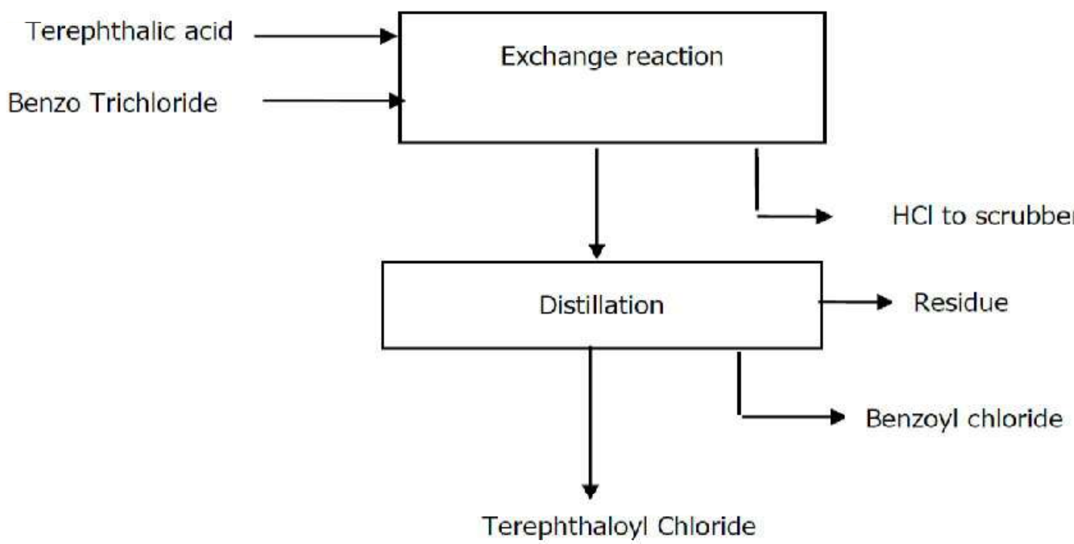
Process Description:

The reaction between Terephthalic acid and Benzotrichloride gives the mixture of Terephthalic Acid & Benzoyl Chloride. The mixture is isolated by distillation to give pure Terephthaloyl Chloride & Benzoyl Chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for Terephthaloyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Terephtalic acid	0.862
2	Benzotrichloride	0.952
3	Water	0.253
	Total	**2.067**

Mass balance for Terephthaloyl Chloride - OUTPUT

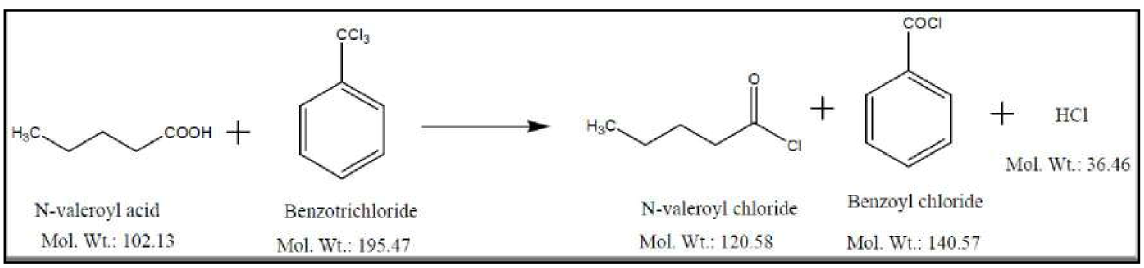
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzoyl chloride			0.674		By-Product
2	Residue				0.03	To CHWIF
3	Terephthaloyl chloride			1		Product
4	HCL			0.363		By- Product
Total		**0**	**0**	**2.037**	**0.030**	
		2.067				

27. n-Valeroyl Chloride

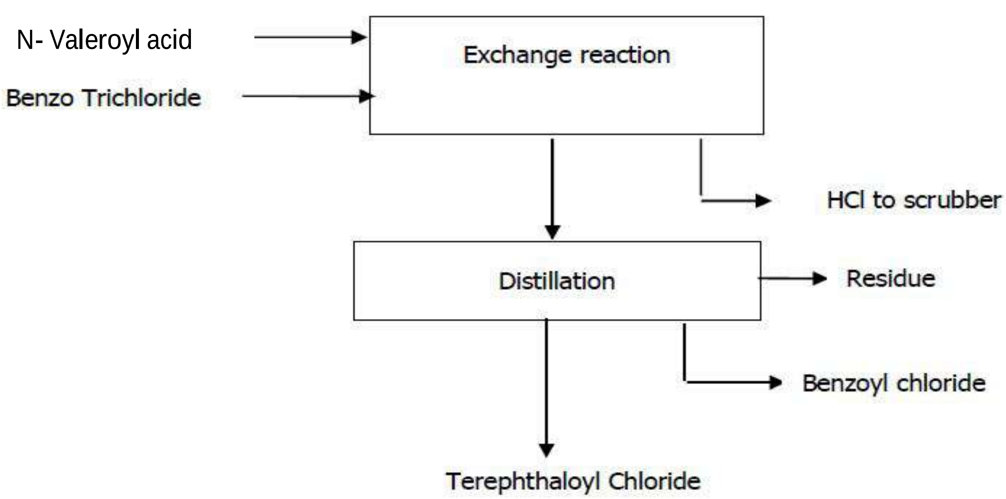
Process Description:

The reaction between N-Valeroyl acid and Benzotrichloride gives the mixture of N-valeroyl Acid & Benzoyl Chloride. The mixture is isolated by distillation to give pure n-Valeroy Chloride & Benzoyl chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for n-Valeroyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	N-valeroyl acid	1.071
2	Benzotrichloride	1.290
3	Water	0.368
	Total	**2.729**

Mass balance for n-Valeroyl Chloride - OUTPUT

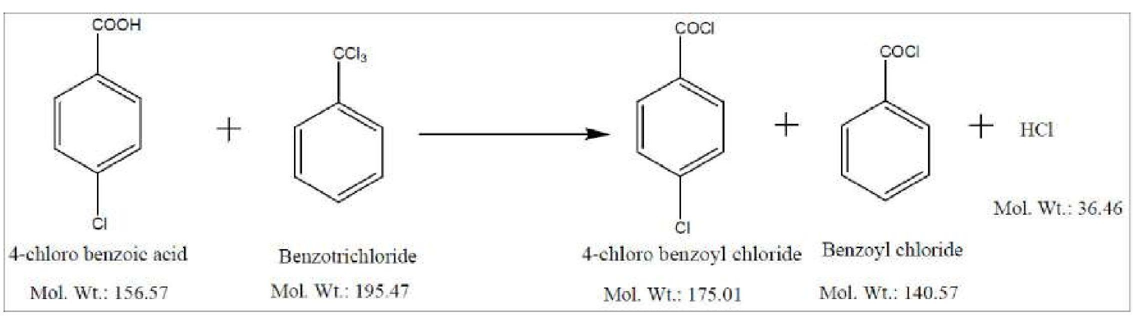
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzoyl chloride			1.176		By-Product
2	Residue				0.025	To CHWIF
3	N-valeroyl chloride			1		Product
4	HCL			0.528		By- Product
Total		**0**	**0**	**2.704**	**0.025**	
		2.729				

28. **4-Chloro Benzoyl Chloride**

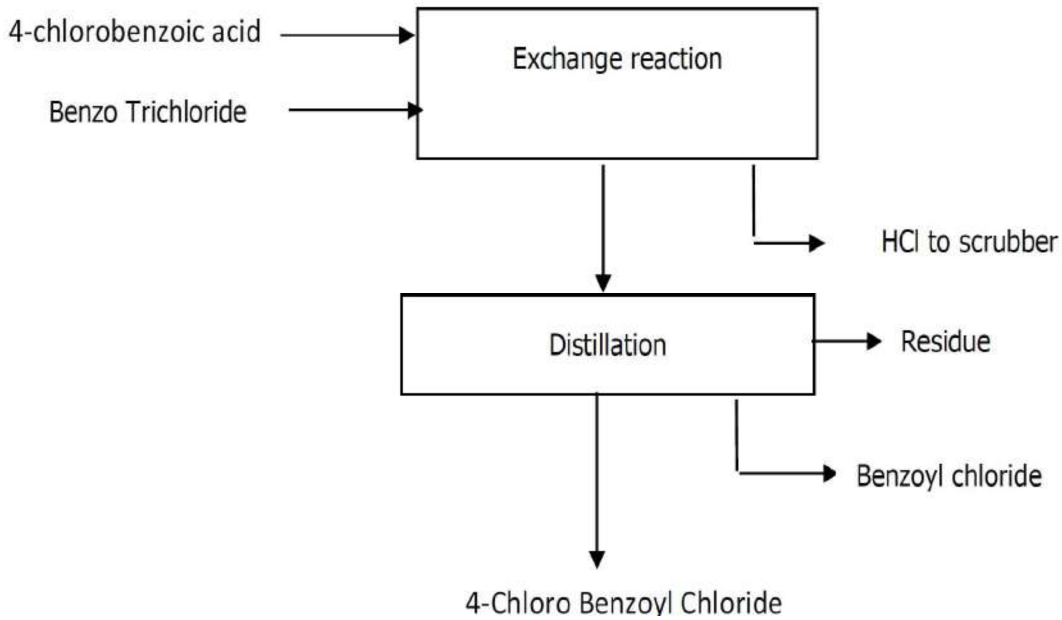
Process Description

The reaction between 4-Chloro benzoicacid and Benzotrichloride gives the mixture of 4-Chlorobenzoyl Chloride& Benzoyl Chloride. The mixture is isolated by distillation to give pure 4-Chlorobenzoyl Chloride & Benzoyl chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 4-Chlorobenzoyl Chloride - INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	4-chlorobenzoic acid	1.000
2	Benzotrichloride	0.952
3	Water	0.264
Total		**2.216**

Mass balance for 4-Chlorobenzoyl Chloride – OUTPUT

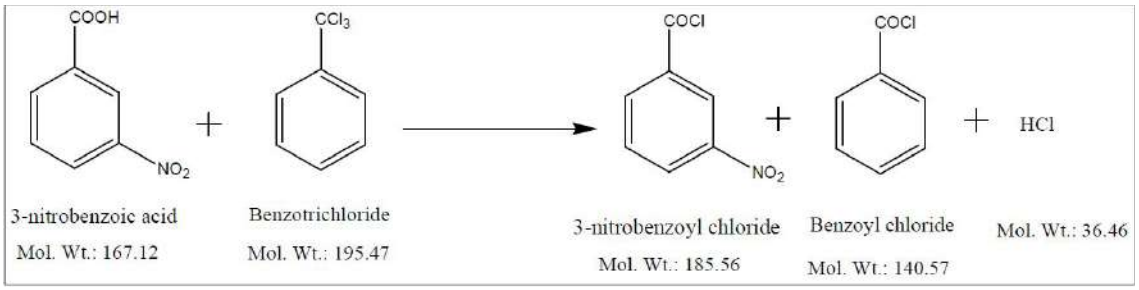
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Benzoyl chloride			0.807		By-Product
2	Residue				0.03	To CHWIF
3	4-chloro benzoyl chloride			1		Product
4	HCL			0.379		By- Product
Total		**0**	**0**	**2.186**	**0.030**	
		2.216				

29. **3-Nitro Benzoyl Chloride**

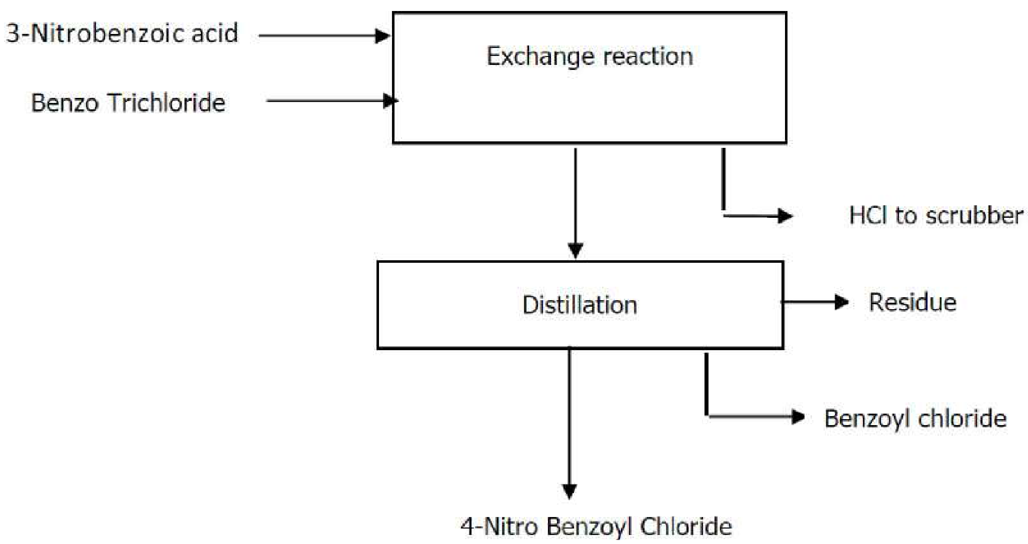
Process Description:

The reaction between 3-nitrobenzoicacid and Benzotrichloride gives the mixture of 3-Nitrobenzoyl Chloride& Benzoyl Chloride. The mixture is isolated by distillation to give pure 3-Nitrobenzoyl chloride & Benzoyl chloride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3-Nitrobenzoyl Chloride- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3-Nitrobenzoic acid	1.016
2	Benzotrichloride	1.064
3	Water	0.242
	Total	**2.322**

Mass balance for 3-Nitrobenzoyl Chloride- OUTPUT

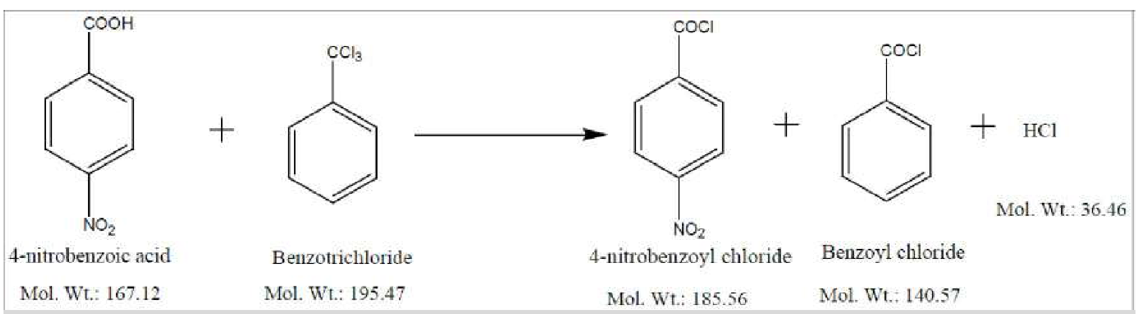
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Benzoyl chloride			0.84		By-Product
2	Residue				0.04	To CHWIF
3	3-Nitro benzoyl chloride			1		Product
4	Water Loss		0.1			
5	HCL			0.342		By- Product
Total		**0**	**0.1**	**2.182**	**0.040**	
		2.322				

30. 4-Nitro Benzoyl Chloride

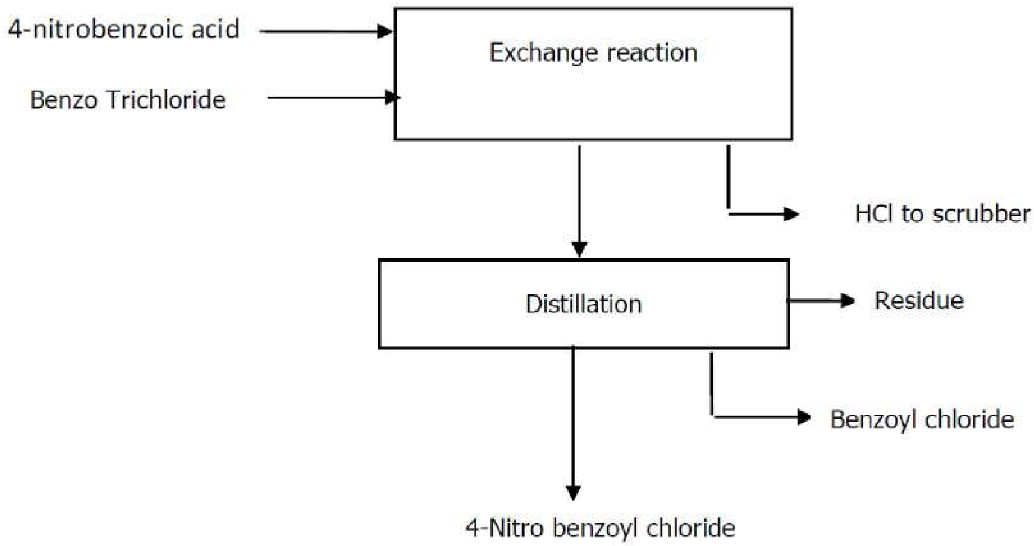
Process Description:

The reaction between 4-Nitrobenzoicacid and Benzotrichloride gives the mixture of 4-Nitrobenzoyl Chloride & Benzoyl chloride. The mixture is isolated by distillation to give pure 4-Nitrobenzoyl Chloride & Benzoyl chloride.

Chemical Reaction:



Flow Diagram:



Mass Balance:

Mass balance for 4-Nitrobenzoyl Chloride- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-Nitrobenzoic acid	1.010
2	Benzotrichloride	0.966
3	Water	0.241
	Total	**2.217**

Mass balance for 4-Nitrobenzoyl Chloride- OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Benzoyl chloride			0.846		By-Product
2	Residue				0.025	To CHWIF
3	4-Nitro benzoyl chloride			1		Product
4	HCL			0.346		By- Product
Total		**0**	**0**	**2.192**	**0.025**	
		2.217				

31. Primary Amines

Process Description:

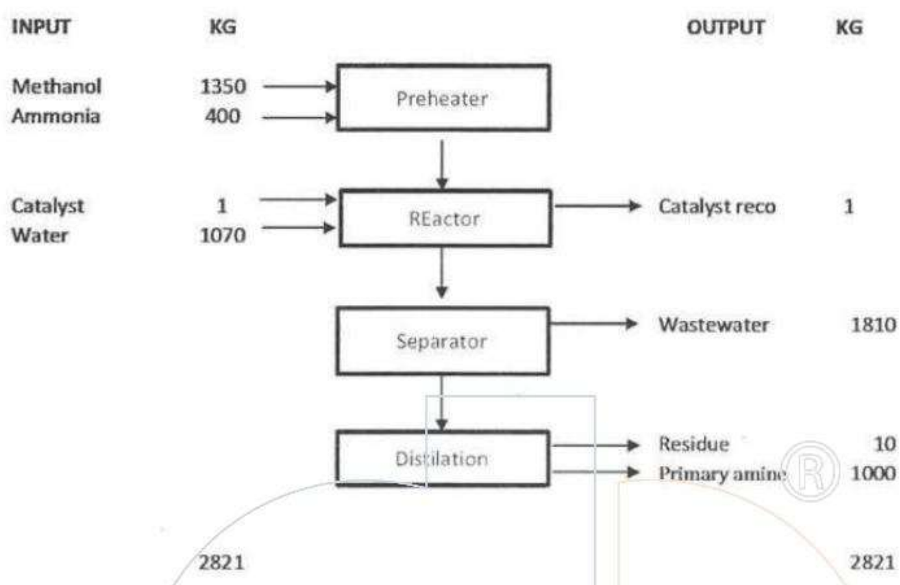
Methylamines Methanol and anhydrous Ammonia are vaporized in a vaporizer, preheated and reacted in a reactor containing proprietary catalyst. Reaction products are a mixture of Monomethylamine (MMA), Dimethylamine (DMA), Trimethylamine (TMA), and Water.

Chemical Reaction:

2CH30H	**+**	**NH3**	→	**(CH3)NH2**	**+**	**H2O**
Methanol		Amnonia		Monomethylamine		**Water**
2CH30H	**+**	**NH3**	→	**(CH3)2NH**	**+**	**H2O**
Methanol		Ammonia		Dimethylamine		**Water**
3CH30H	**+**	**NH3**	→	**(CH3)3N**	**+**	**3H20**
Methanol		**Ammonia**		**Trimethylamine**		**Water**

Converter gases condensed after heat recovery and liquid crude mixture is collected in gas separator fur onward distillation. In distillation section, MMA, DMA, and TMA are separated out as pure products. Reaction water is also separated out and sent to effluent treatment plant.

Process flowchart



Mass Balance

Mass balance for primary Amines- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Methanol	1.350
2	Ammonia	0.400
3	Catalyst	0.001
4	Water	1.070
	Total	**2.821**

Mass balance for primary Amines- OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Residue				0.010	TSDF
2	Primary amine			1		Product
3	Catalyst			0.001		Recover
4	Waste Water	1.81				To ETP
Total		**1.81**	**0**	**1.001**	**0.010**	
		2.821				

32. Ethoxylated Primary amine

Process Description:

Primary Amines and Ethylene Oxide is charged to the reactor. The catalyst is added and the mass Is ethoxylated, After the Ethoxylation, water added. The water mixture then filtered through the Sparkler filter and then transferred to the crystallizer. The required additive is added as filler to keep the final product in flow able free powder Forms.

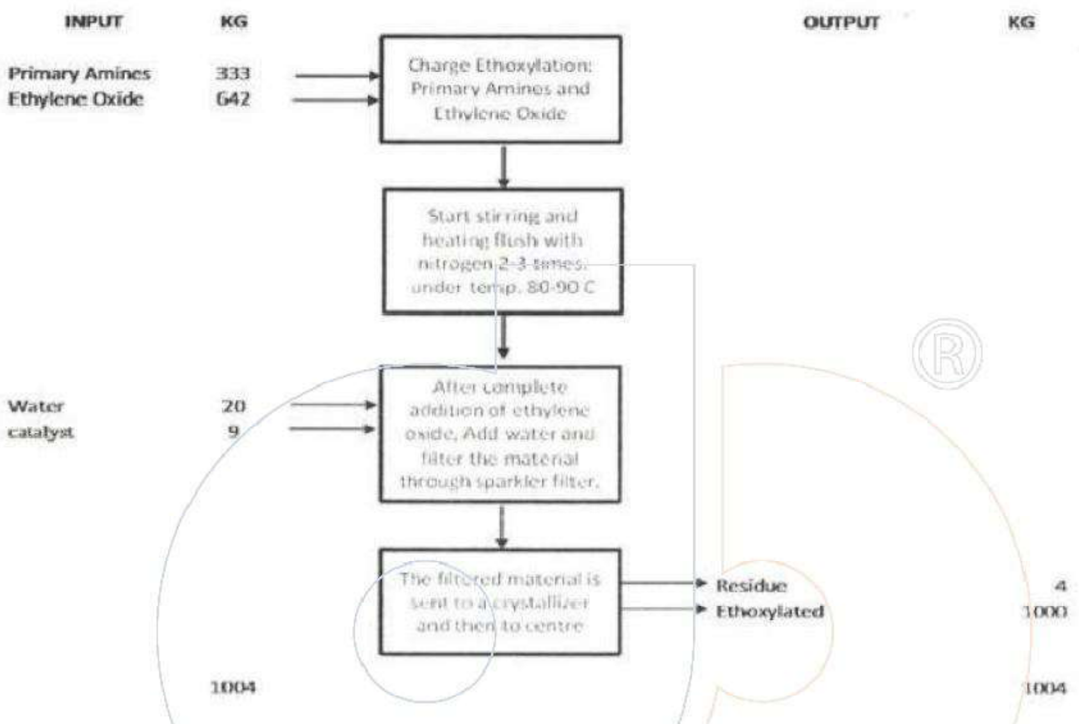
The solution is crystallized in a series stirred crystallizer & then to the screw crystallizer. From the screw crystalliver the slurry taken to the centrifuging machine. The mother liquor is drained out which will be then recycled to extract the Additives during the reprocess.

The product from Centrifuge basket then taken in lots for drying in a Fluidized bed dryer & then passed through a multi-mill for the powder operations of required mesh size of 80 — 100.The multi-mill powder then taken in to the powder blender to have a unarm blending & then taken to a bagging machine system for bagging in to required size. The wet cake from the crystallizer can be led to a noodling machine and then dried on a conveyor belt mechanism and packed as noodles Also the entire powder & conveying blocks should be place under air handling unit operations to avoid the humidity effects .

Chemical Reaction:

Primary Amines + Ethylene Oxide $\xrightarrow{\text{Catalyst}}$ **Ethoxilated Amines**

Process Flow Diagram:



Mass Balance

Mass balance for Ethoxylated primary Amines- INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Primary Amines	0.333
2	Ethylene Oxide	0. 642
3	Water	0.020
4	catalyst	0.009
Total		**1.004**

Mass balance for Ethoxylated primary Amines- OUTPUT

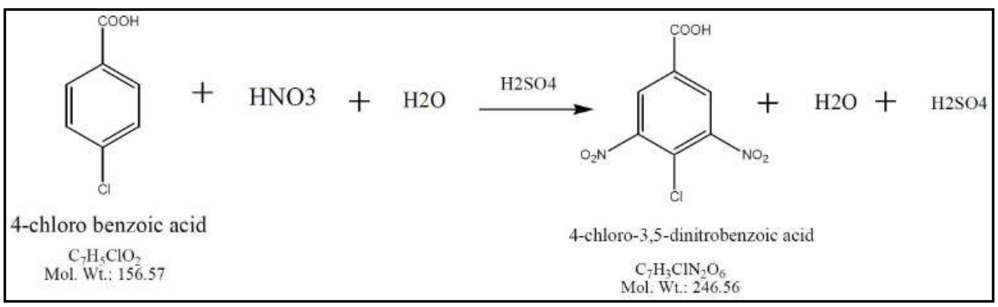
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Residue				0.004	TSDF
2	Ethoxylated primary amine			1		Product
Total		**0**	**0**	**1**	**0.004**	
		1.004				

33. **4-Chloro 3,5 Dinitro Benzoic acid**

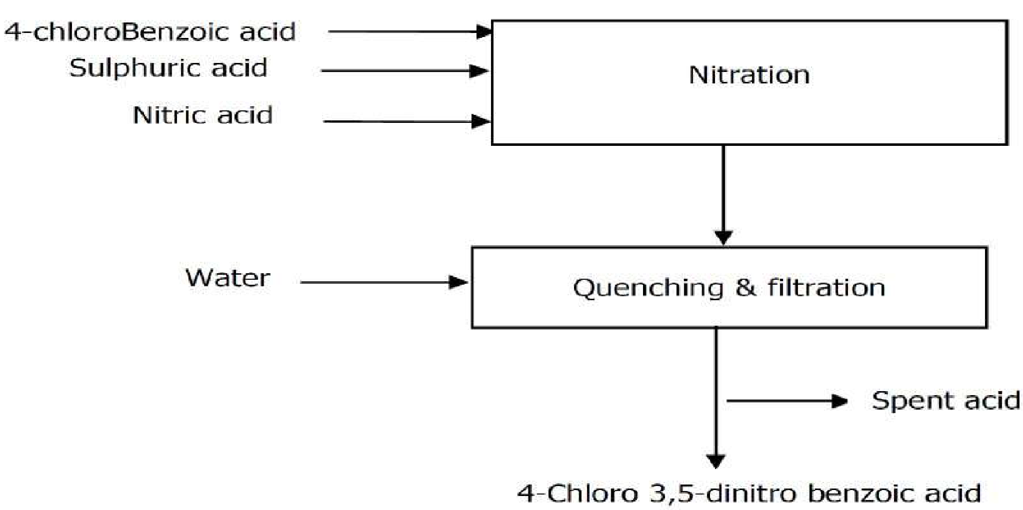
Process Description:

Nitration of 4-chloro benzoic acid by using conc. sulphuric acid nitric acid yields 4-Chloro 3,5 Dinitro Benzoic acid

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 4-Chloro 3,5 Dinitro Benzoic acid - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-chloro benzoic acid	0.709
2	Sulphuric acid	0.887
3	Nitric acid	0.284
4	Water	3.545
	Total	**5.425**

Mass balance for 4-Chloro 3,5 Dinitro Benzoic acid - OUTPUT

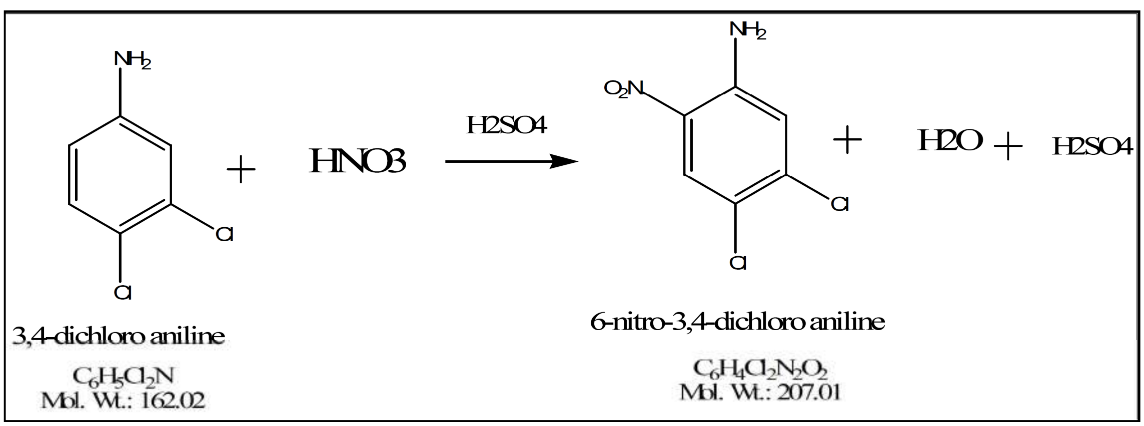
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	4-Chloro 3,5 Dinitro Benzoic Acid			1		Product
2	Spent Acid			4.425		By-Product
Total		**0**	**0**	**5.425**	**0.000**	
		5.425				

34. **6, Nitro 3,4 Dichloro Aniline**

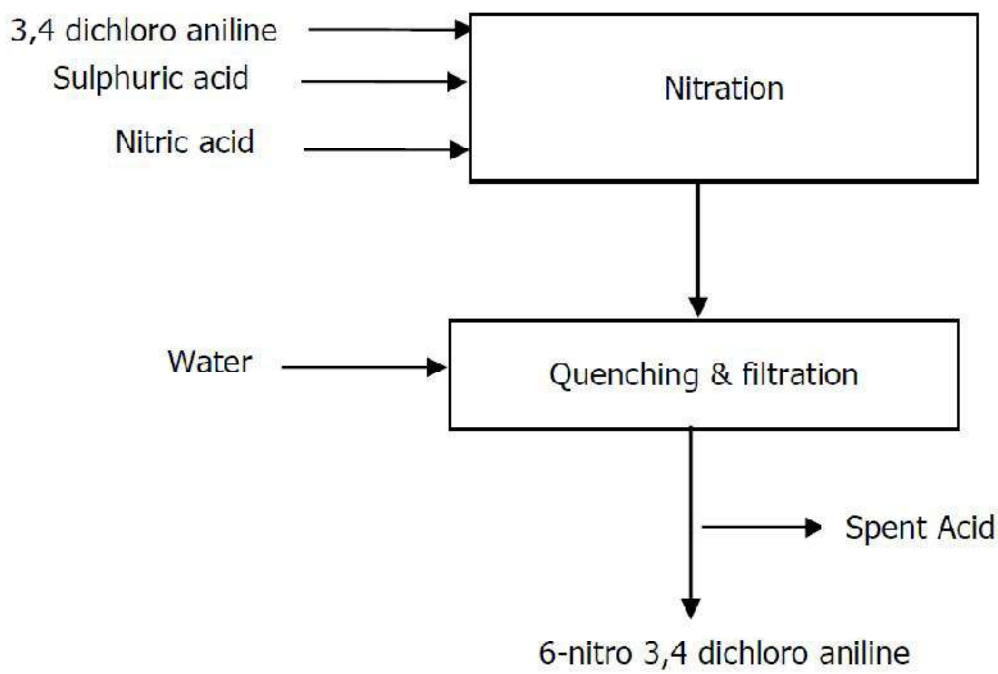
Process Description:

Nitration of 3,4-dichloro aniline by using mixture of conc. sulphuric acid and nitric acid to produce 6- nitro-3,4-Dichloro Aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 6-Nitro-3,4-Dichloro Aniline - INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	3,4 dichloro aniline	0.869
2	Sulphuric acid	1.052
3	Nitric acid	0.338
4	Water	4.354
	Total	**6.613**

Mass balance for 6-Nitro-3,4-Dichloro Aniline - OUTPUT

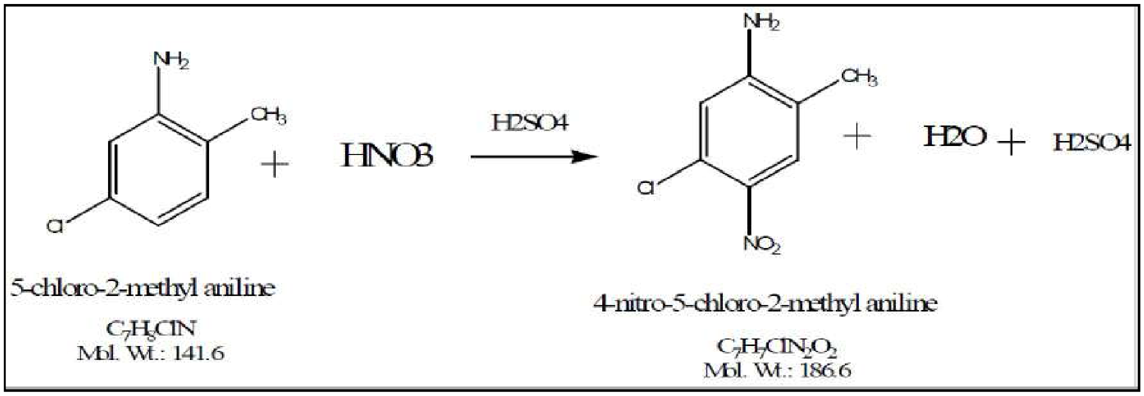
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	6, Nitro 3,4 Dichloro Aniline			1		Product
2	Spent Acid			5.613		By-Product
Total		**0**	**0**	**6.613**	**0.000**	
		6.613				

35. 4, Nitro 5-Chloro 2-Methyl Aniline

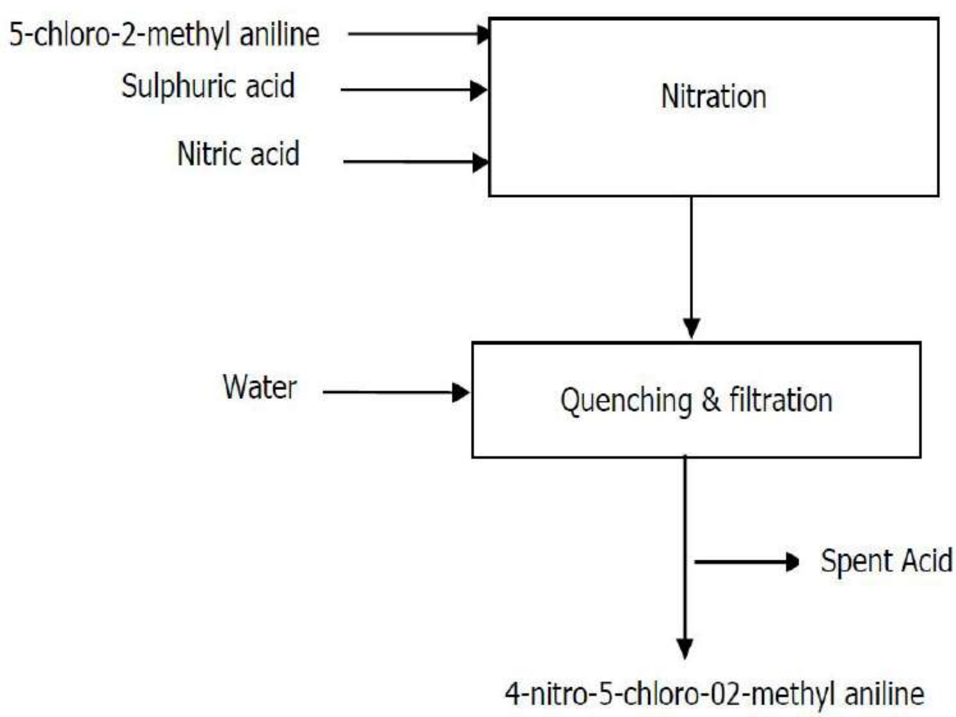
Process Description:

Nitration of 5-chloro-2-methyl aniline by using mixture of conc. Sulphuric acid and nitric acid to produces 4-Nitro-5-Chloro-2-Methyl Aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 4-Nitro-5-Chloro-2-Methyl Aniline - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	5-chloro-2-methyl aniline	0.854
2	Sulphuric acid	1.183
3	Nitric acid	0.379
4	Water	4.270
	Total	**6.686**

Mass balance for 4-Nitro-5-Chloro-2-Methyl Aniline - OUTPUT

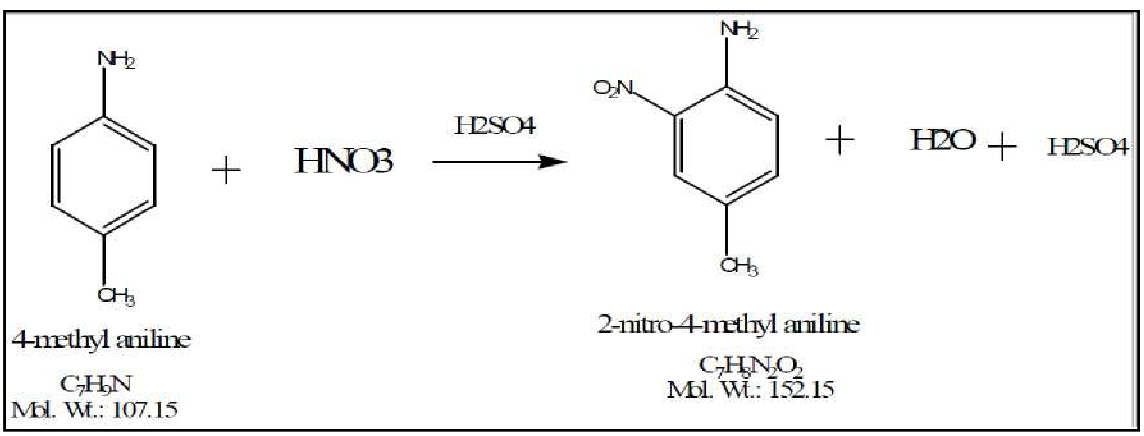
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	4-Nitro ,5-Chloro, 2-methyl Aniline			1		Product
2	Spent Acid			5.686		By-Product
Total		**0**	**0**	**6.686**	**0.000**	
		6.686				

36. 2-Nitro-4-Methyl Aniline

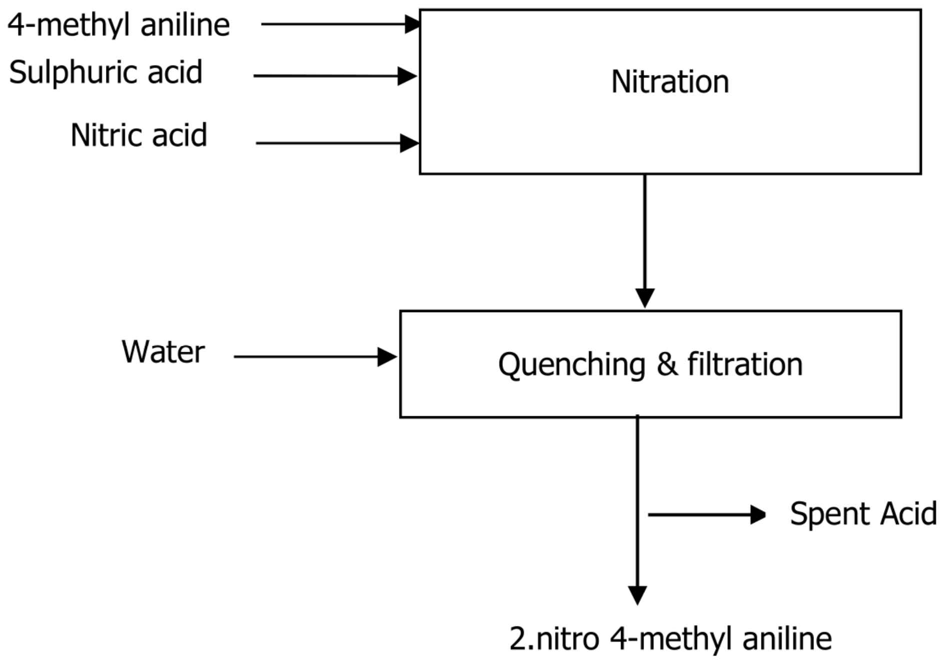
Process Description:

Nitration of 4-methyl aniline by using mixture of conc. sulphuric acid and nitric acid to give 2-nitro-4- methyl aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2-Nitro-4-Methyl Aniline - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-methyl aniline	0.781
2	Sulphuric acid	1.430
3	60% Nitric acid	0.460
4	Water	3.905
	Total	**6.576**

Mass balance for 2-Nitro-4-Methyl Aniline - OUTPUT

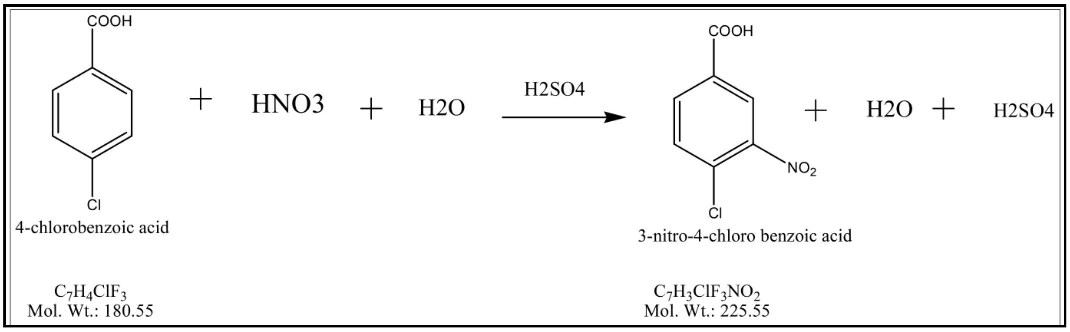
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2-Nitro 4-Methyl Aniline			1		Product
2	Spent Acid			5.576		By-Product
Total		**0**	**0**	**6.576**	**0.000**	
		6.576				

37. **3, Nitro 4-Chloro Benzoic Acid**

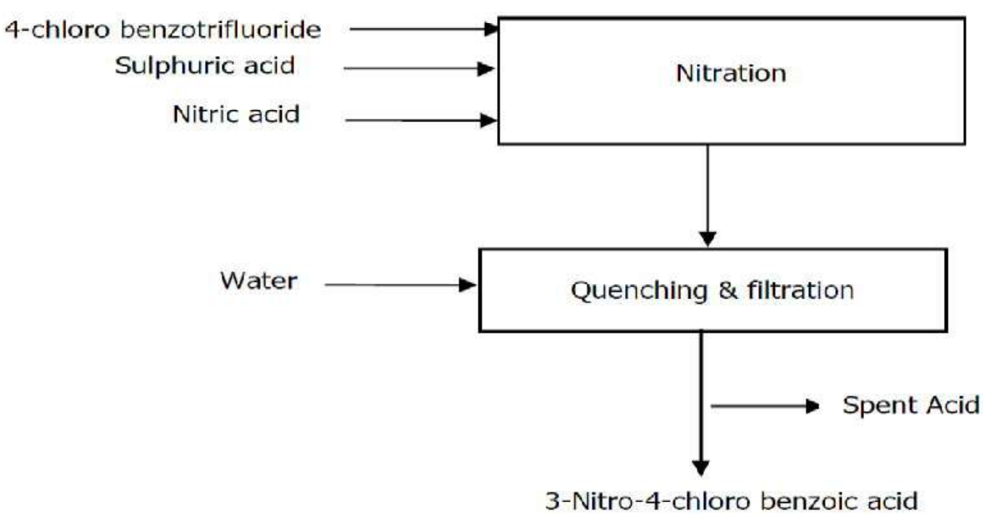
Process Description:

Nitration of 4-chloro benzotrifluoride by using conc. sulphuric acid and nitric acid to produce 3-nitro-4- chloro benzoic acid.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3-Nitro-4-Chloro Benzoic Acid - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-chloro benzotrifluoride	0.889
2	Sulphuric acid	1.068
3	60% Nitric acid	0.342
4	Water	4.165
	Total	**6.463**

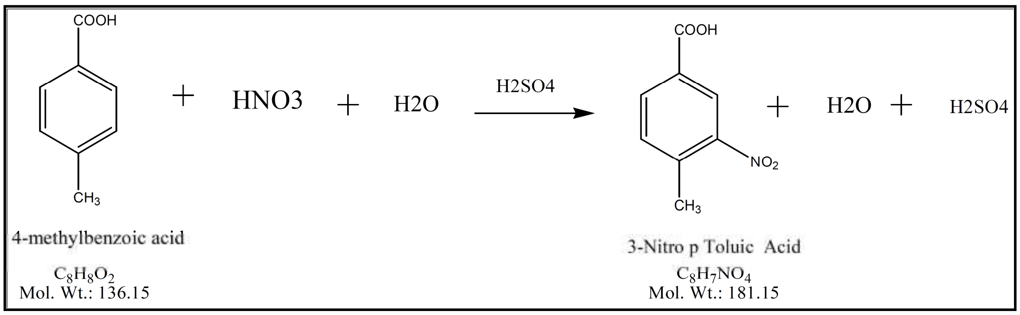
Mass balance for 3-Nitro-4-Chloro Benzoic Acid - OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	3, Nitro 4-Chloro Benzoic Acid			1		Product
2	Spent Acid			5.463		By-Product
Total		**0**	**0**	**6.463**	**0.000**	
		6.463				

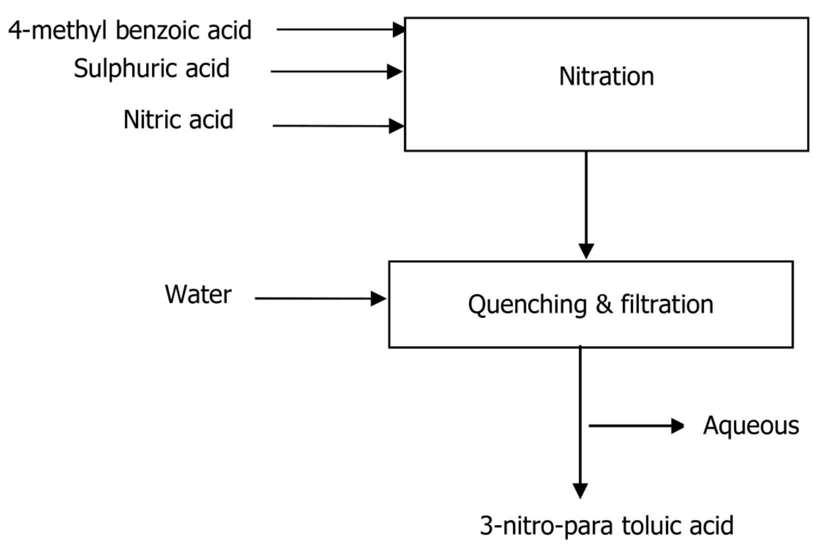
38. 3, Nitro p Toluic Acid Process Description:

Nitration of 4-methyl benzoic acid by using conc. sulphuric acid and nitric acid to give 3-nitro para toluic acid.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3-Nitro para Toulic Acid - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	4-methyl benzoic acid	0.823
2	Sulphuric acid	0.989
3	60% Nitric acid	0.314
4	Water	4.115
Total		**6.241**

Mass balance for 3-Nitro para Toulic Acid - OUTPUT

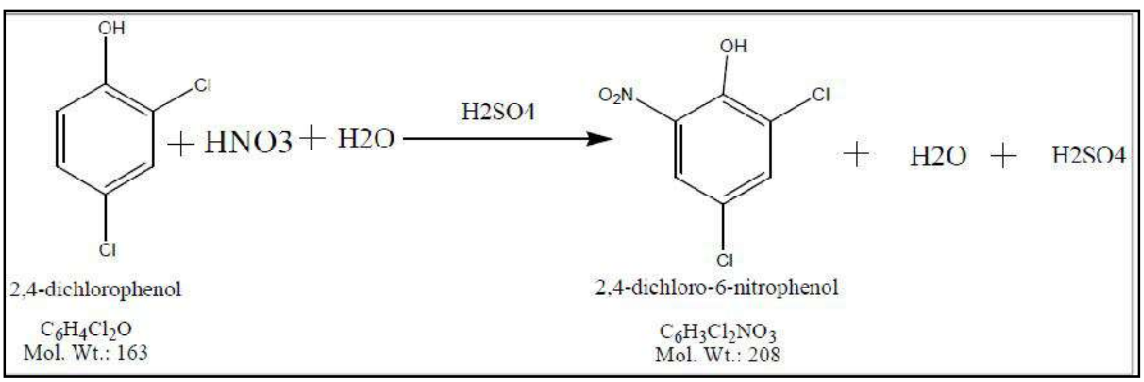
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	3-nitro-para toluic acid			1		Product
2	Spent Acid			5.241		By-Product
Total		**0**	**0**	**6.241**	**0.000**	
		6.241				

39. 2,4 Dichloro 6 Nitro Phenol

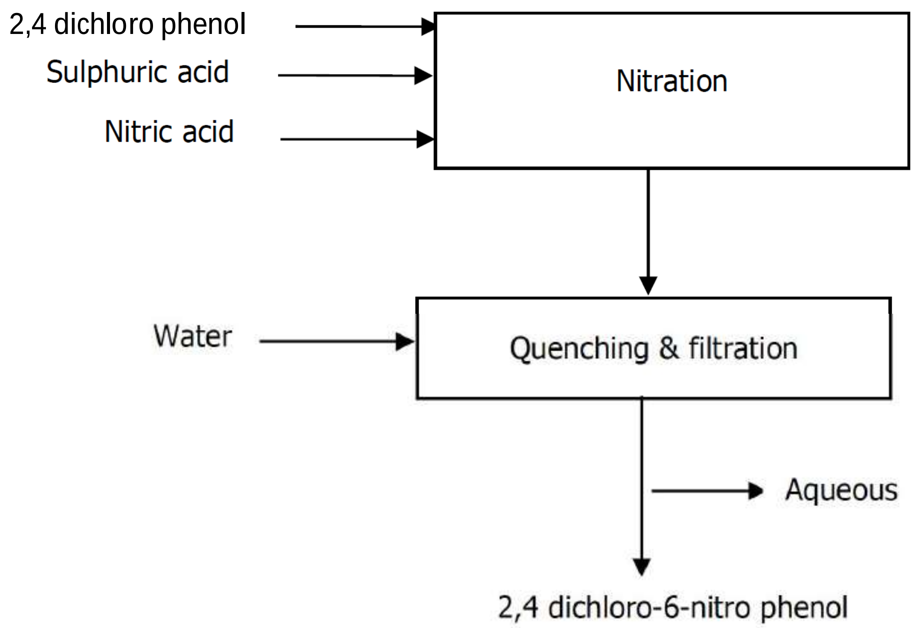
Process Description:

Nitration of 2,4 dichloro phenol by using conc. Sulphuric acid and nitric acid to give 2,4-dichloro-6- nitrophenol.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,4-Dichloro-6-Nitrophenol - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,4 dichloro phenol	0.826
2	Sulphuric acid	0.993
3	60% Nitric acid	0.318
4	Water	4.130
	Total	**6.267**

Mass balance for 2,4-Dichloro-6-Nitrophenol - OUTPUT

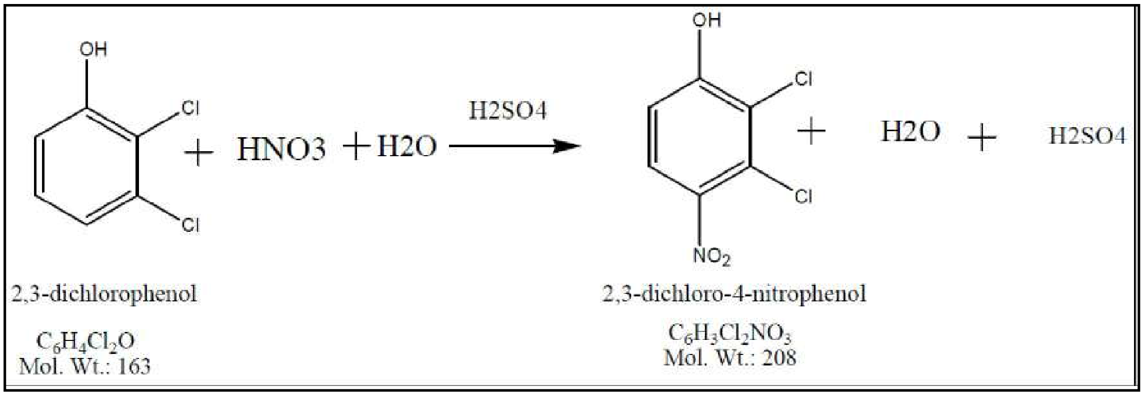
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2,4 Dichloro 6 Nitro Phenol			1		Product
2	Spent Acid			5.267		By-Product
Total		**0**	**0**	**6.267**	**0.000**	
		6.267				

40. **2,3 Dichloro 4 Nitro Phenol**

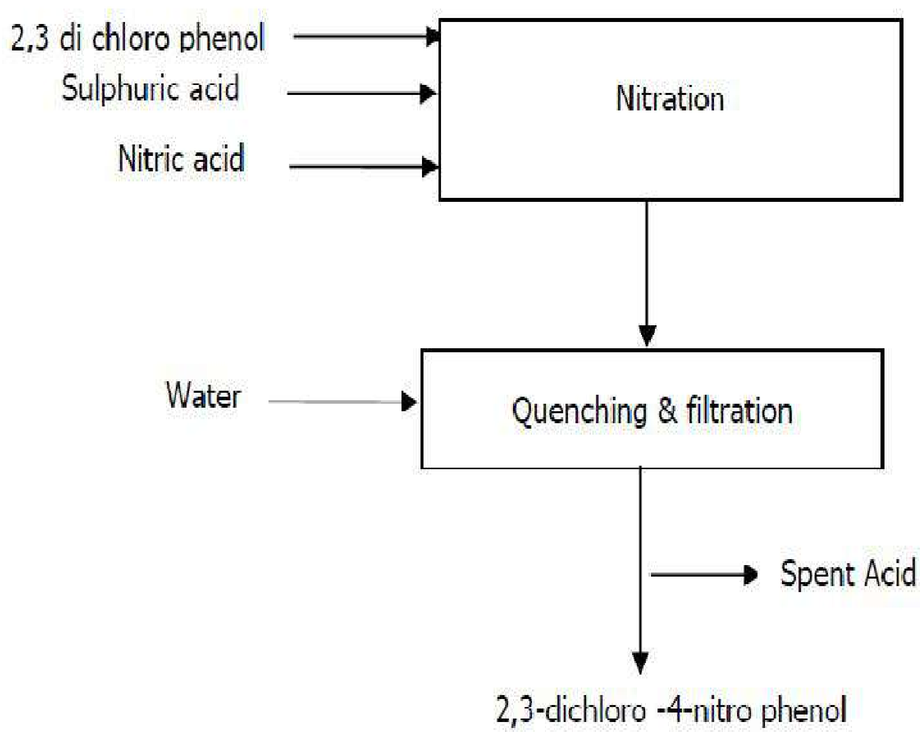
Process Description:

Nitration of 2,3-dichloro phenol by using conc. Sulphuric acid and nitric acid to obtain 2,3-Dichloro-4- Nitro Phenol.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,4-Dichloro-6-Nitrophenol - INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,3 dichloro phenol	0.826
2	Sulphuric acid	0.993
3	60% Nitric acid	0.318
4	Water	4.130
	Total	**6.267**

Mass balance for 2,4-Dichloro-6-Nitrophenol - OUTPUT

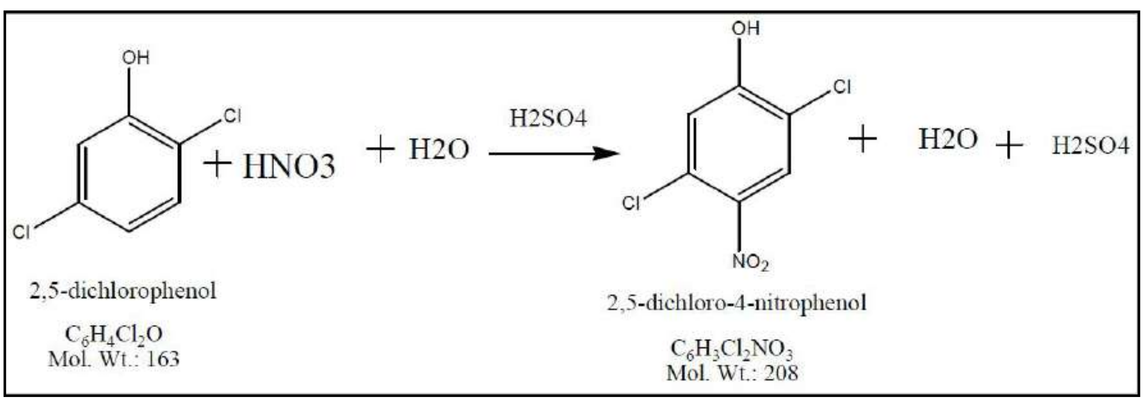
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2,3 Dichloro 4- Nitro Phenol			1		Product
2	Spent Acid			5.267		By-Product
Total		**0**	**0**	**6.267**	**0.000**	
		6.267				

41. 2,5 Dichloro 4 Nitro Phenol

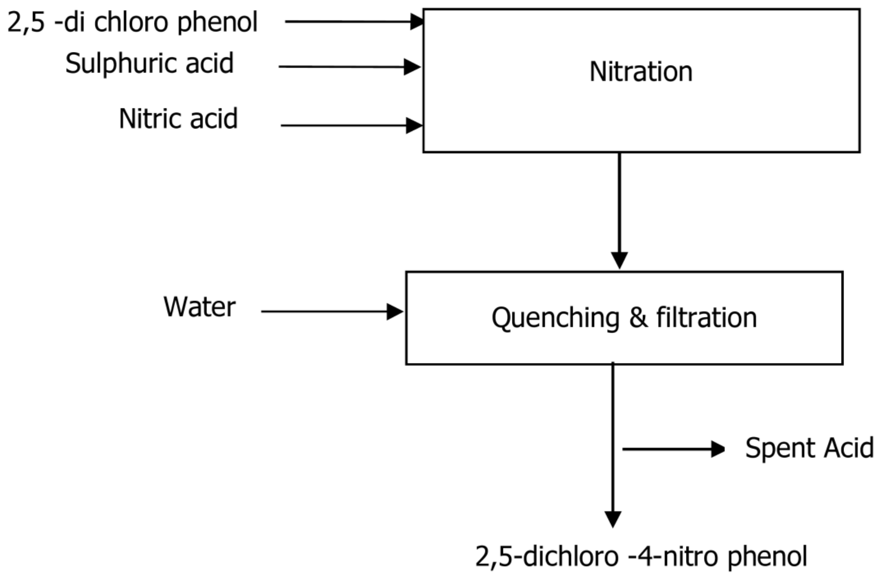
Process Description:

Nitration of 2,5-dichloro phenol by using conc. Sulphuric acid nitric acid to obtain 2,5-dichloro-4- nitrophenol.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,5-Dichloro-4-Nitrophenol – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,5 dichloro phenol	0.826
2	Sulphuric acid	0.993
3	60% Nitric acid	0.318
4	Water	4.130
	Total	**6.267**

Mass balance for 2,5-Dichloro-4-Nitrophenol – OUTPUT

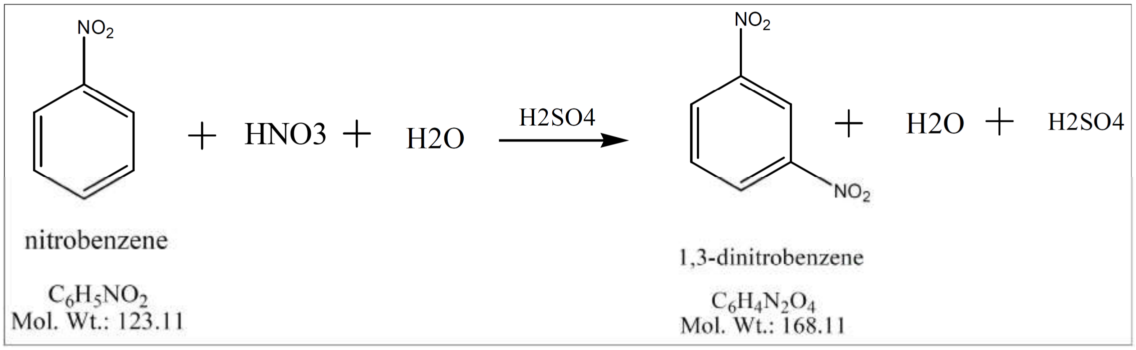
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2,5 Dichloro 4-Nitro Phenol			1		Product
2	Spent Acid			5.267		By-Product
Total		**0**	**0**	**6.267**	**0.000**	
		6.267				

42. 1,3 Dinitro Benzene

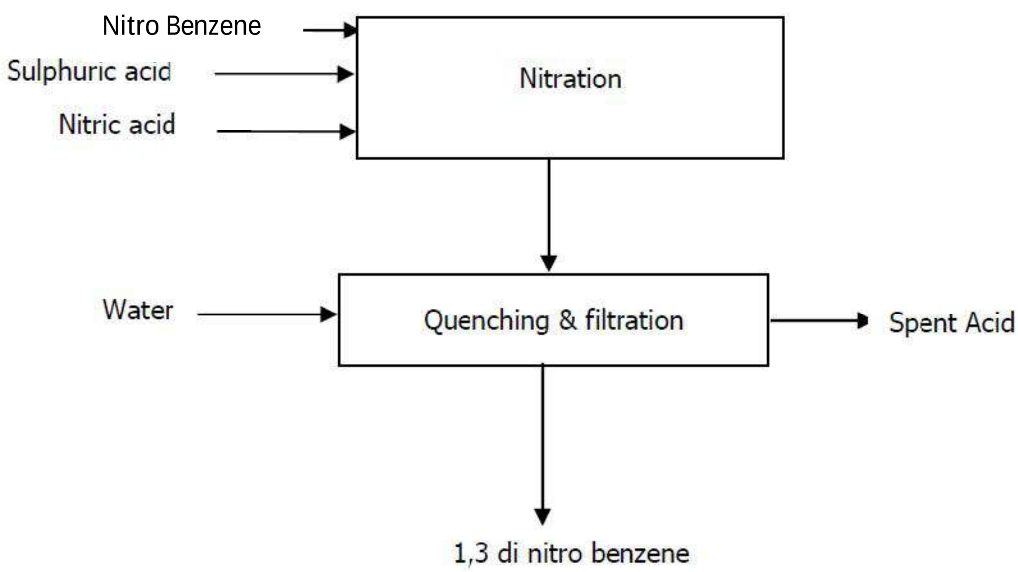
Process Description:

Nitration of Nitrobenzene by using conc. sulphuric and nitric acid to gives 1, 3 Di Nitro benzene.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 1,3 DiNitro Benzene – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Nitro benzene	0.775
2	Sulphuric acid	1.235
3	60% Nitric acid	0.659
4	Water	3.875
	Total	**6.544**

Mass balance for 1,3 DiNitro Benzene – OUTPUT

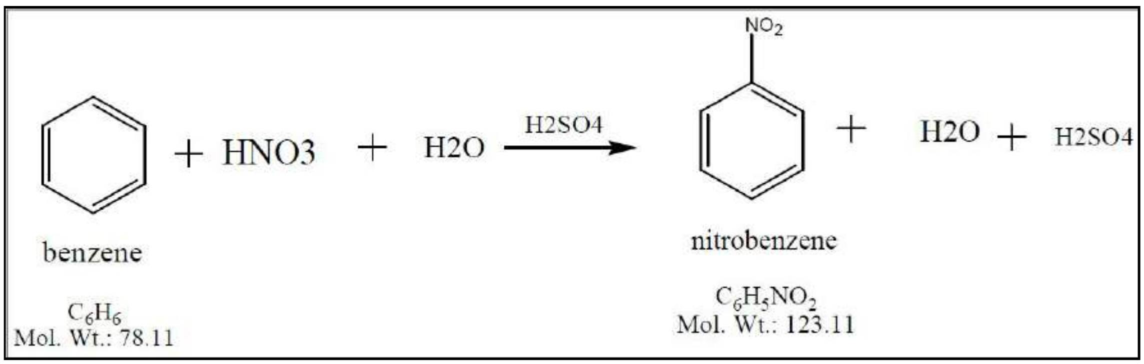
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	1,3 Di Nitro Benzene			1		Product
2	Spent Acid			5.544		By-Product
Total		**0**	**0**	**6.544**	**0.000**	
		6.544				

43. **Nitro Benzene**

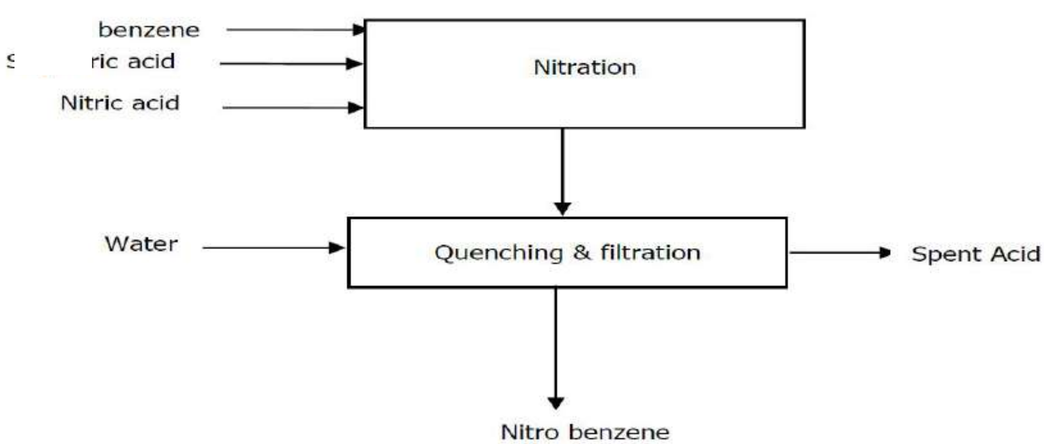
Process Description:

Nitration of benzene by using conc.sulphuric and nitric acid to get Nitro benzene.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for Nitro Benzene – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Benzene	0.704
2	Sulphuric acid	1.768
3	60% Nitric acid	0.946
4	Water	2.816
Total		**6.234**

Mass balance for Nitro Benzene – OUTPUT

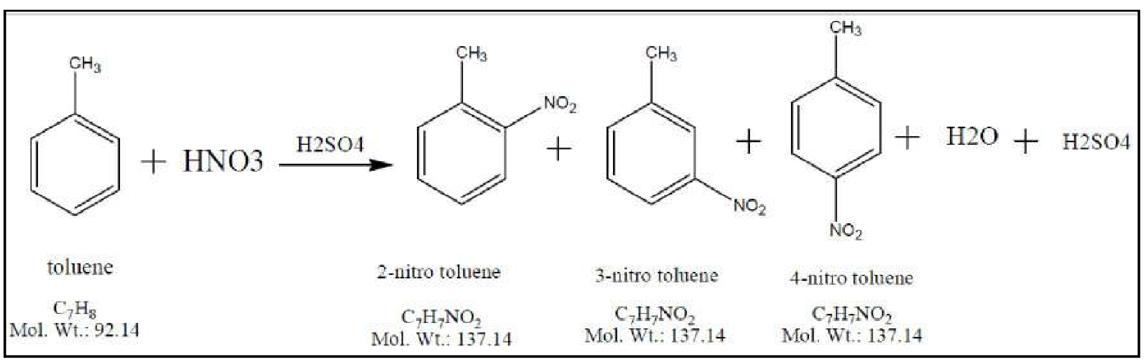
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Nitro Benzene			1		Product
2	Spent Acid			5.234		By-Product
Total		**0**	**0**	**6.234**	**0.000**	
		6.234				

44. **2/3/4 Nitro Toluene**

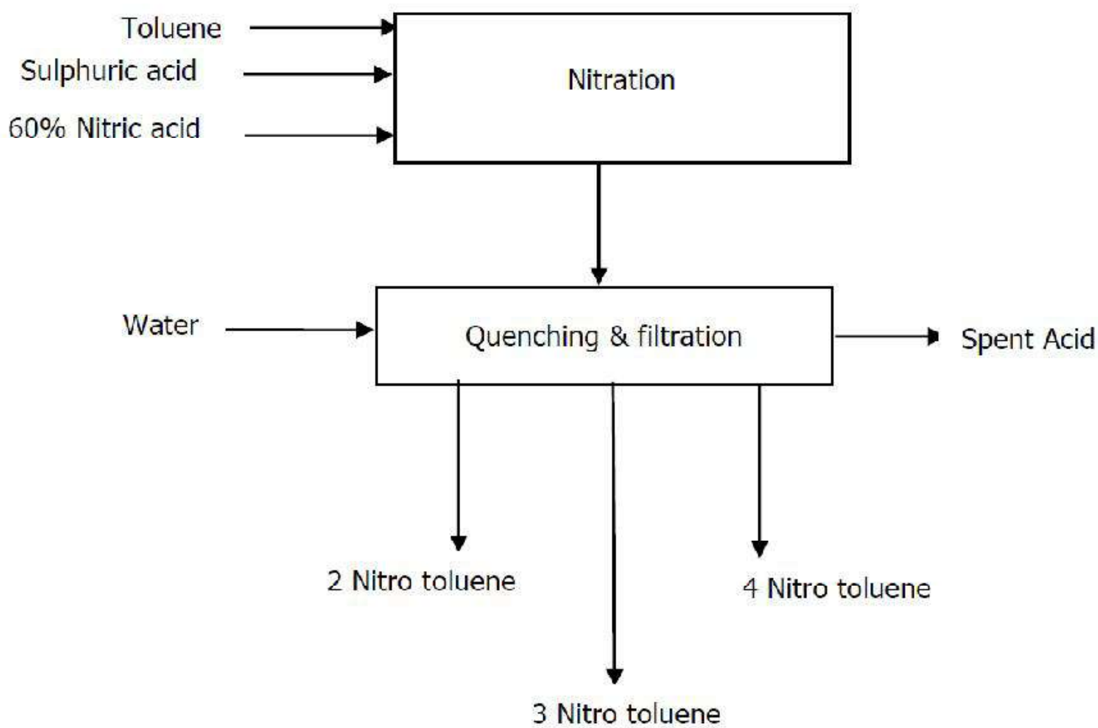
Process Description:

Nitration of toluene by using conc,. Sulphuric and nitric acid to gives 50% 2- nitro toluene and 45% 4- nitro toluene and 5% 3-nitro toluene, which is then separated by distillation.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2/3/4 Nitro Toluene – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Toluene	0.746
2	Sulphuric acid	1.587
3	60% Nitric acid	0.511
4	Water	2.984
	Total	**5.828**

Mass balance for 2/3/4 Nitro Toluene – OUTPUT

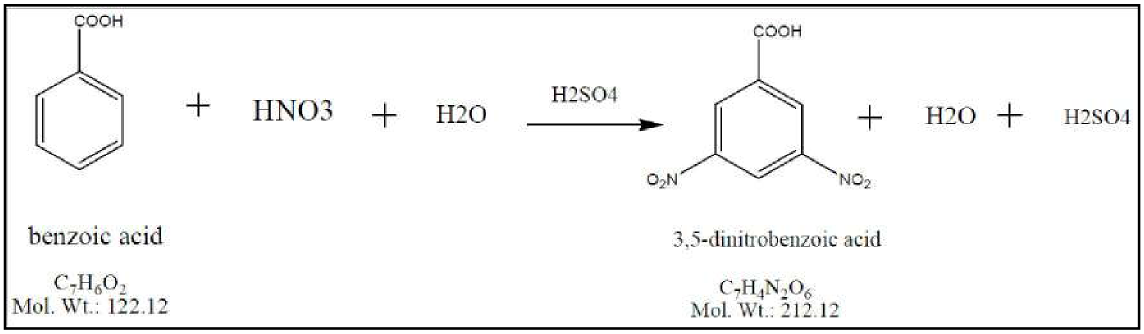
S No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2-Nitro benzene			0.5		Product
2	3-nitro toluene			0.05		Product
3	4-nitro toluene			0.45		Product
4	Spent Acid			4.828		By-Product
Total		**0**	**0**	**5.828**	**0.000**	
		5.828				

45. 3,5 Di Nitro Benzoic Acid

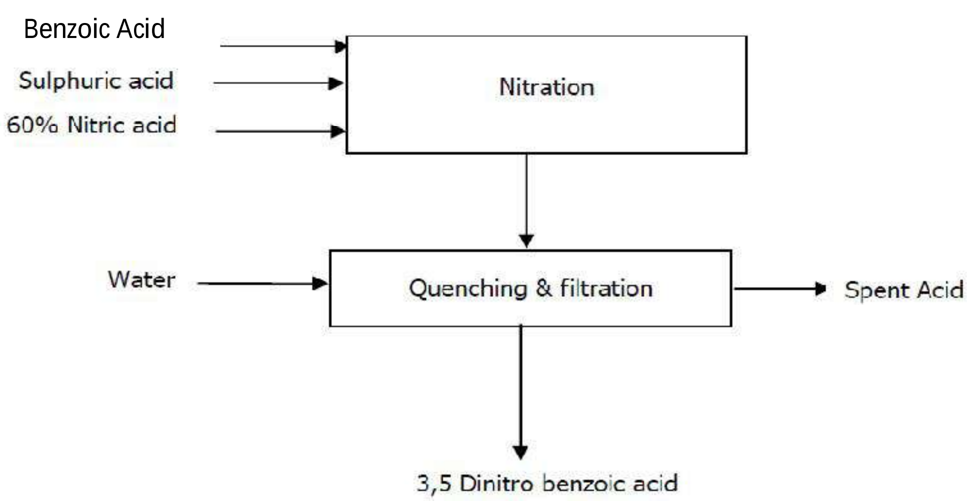
Process Description:

Nitration of benzoic acid by using conc. Sulphuric acid nitric acid, to gives 3,5-Dinitro Benzoic Acid.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3,5 Dinitro Benzoic acid – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Benzoic acid	0.578
2	Sulphuric acid	1.854
3	60% Nitric acid	0.597
4	Water	2.890
Total		**5.919**

Mass balance for 3,5 Dinitro Benzoic Acid – OUTPUT

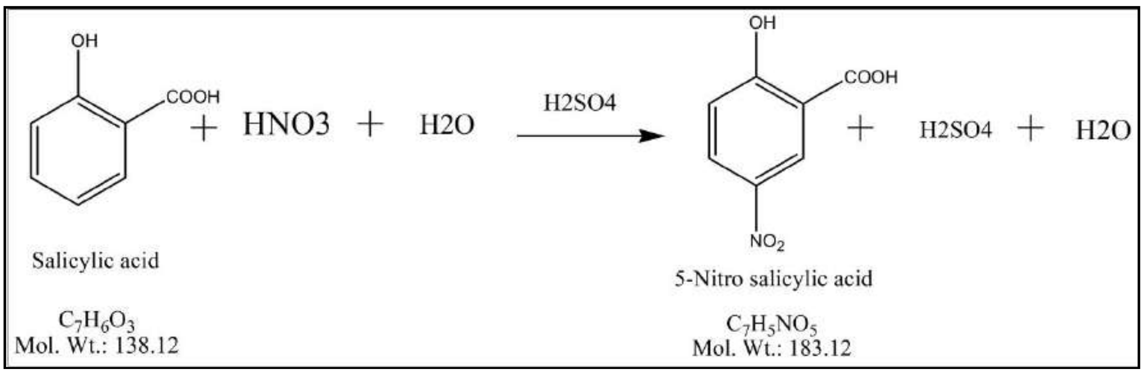
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	3,5 Di Nitro Benzoic Acid			1		Product
2	Spent Acid			4.919		By-Product
Total		**0**	**0**	**5.919**	**0.000**	
		5.919				

46. p-Nitro SalicylicAcid

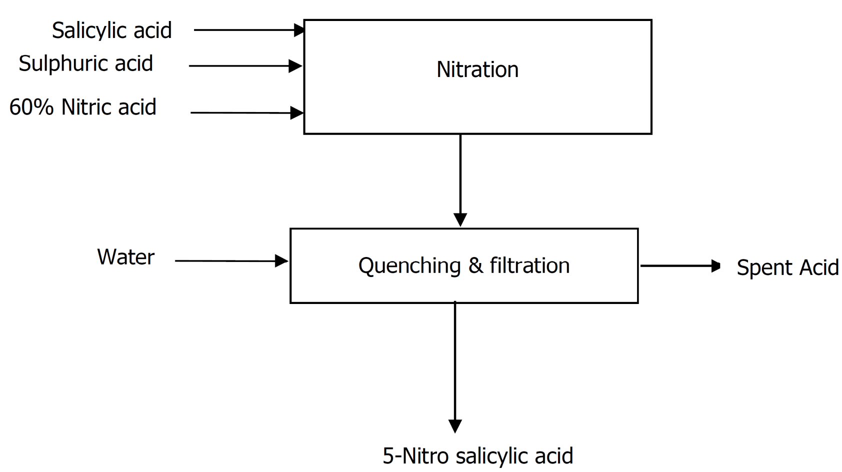
Process Description:

Nitration of salicylic acid by using sulfuric acid /nitric acid/ water to gives 5-nitro salicylic acid.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 5-Nitro Salicylic Acid – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Salicylic acid	0.700
2	Sulphuric acid	0.992
3	60% Nitric acid	0.319
4	Water	3.500
	Total	**5.511**

Mass balance for 5-Nitro Salicylic Acid – INPUT

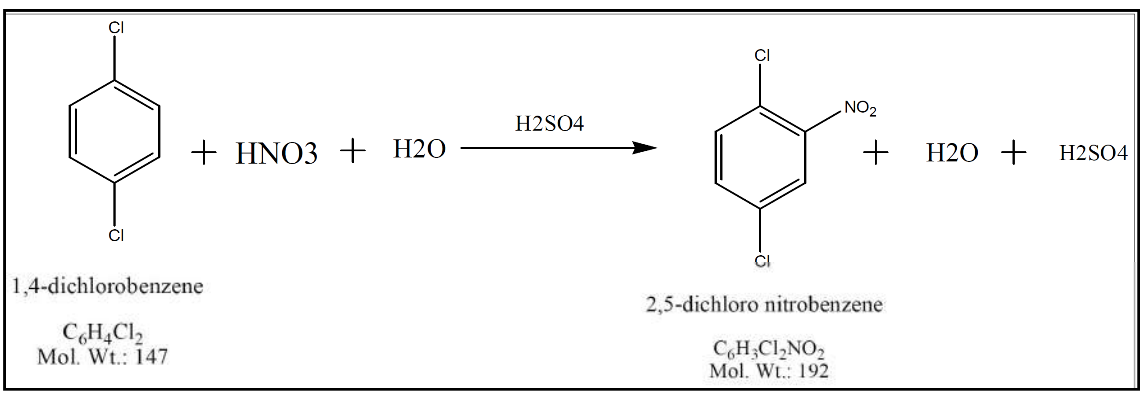
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	p-Nitro salicylic acid			1		Product
2	Spent Acid			4.511		By-Product
Total		**0**	**0**	**5.511**	**0.000**	
		5.511				

47. 2,5 Dichloro Nitro Benzene

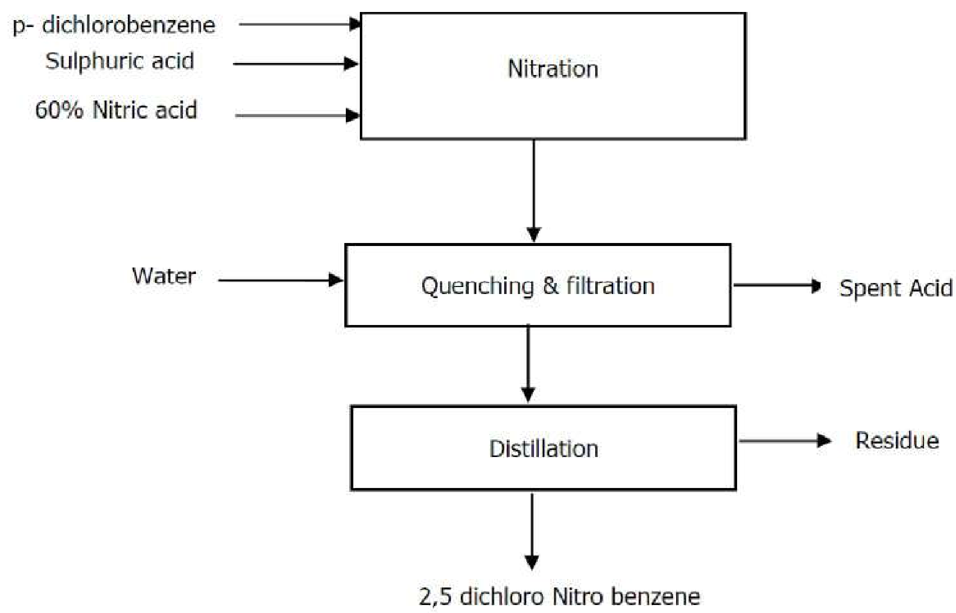
Process Description:

Niitration of p-Dichloro benzene by using Nitric acid & sulfuric acid, gives the crude product of 2,5- dichloro nitro benzene, which is then distilled to get pure 2,5-Dichloro Nitro Benzene.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,5-Dichloro Nitro Benzene – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	P-DCB	0.813
2	Sulphuric acid	1.084
3	60% Nitric acid	0.348
4	Water	4.065
	Total	**6.310**

Mass balance for 2,5-Dichloro Nitro Benzene – OUTPUT

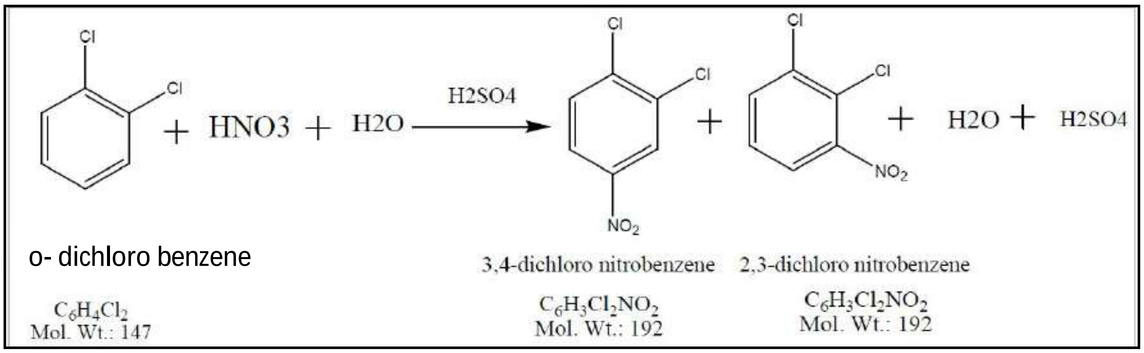
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	2,5 Dichloro Nitro Benzene			1		Product
2	Residue				0.025	To CHWIF
3	Spent Acid			5.285		By-Product
Total		**0**	**0**	**6.285**	**0.025**	
		6.310				

48. 3,4/2,3 Dichloro Nitro Benzene

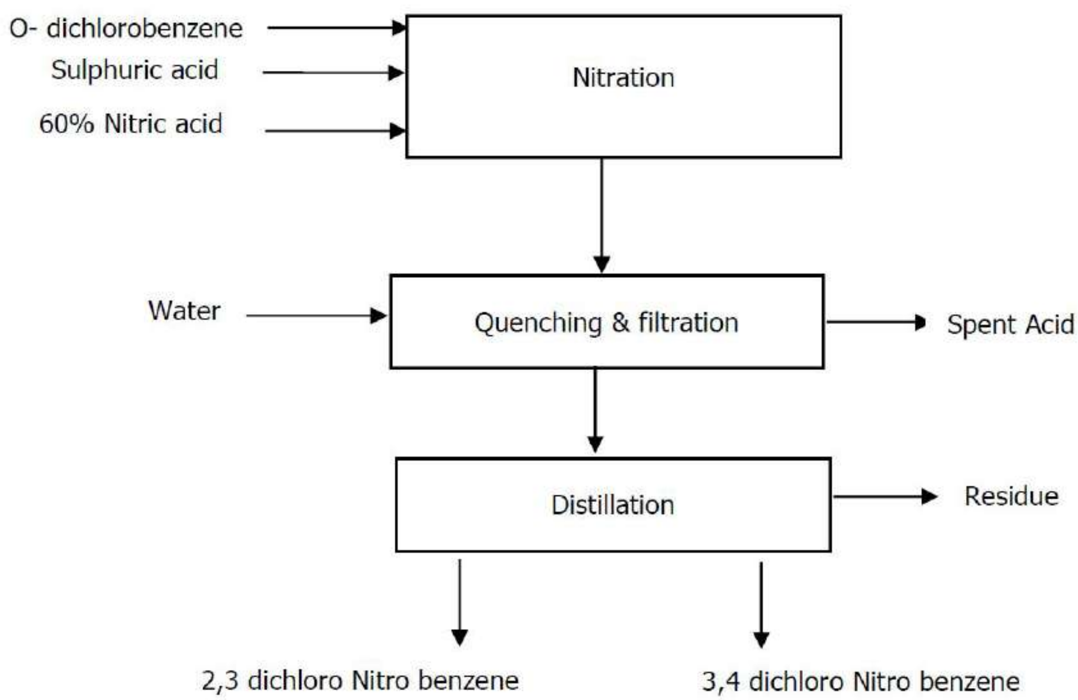
Process Description:

Nitration of o-dichloro benzene by using Nitric acid & Sulfuric acid gives the product mixture of 3,4-dichloronitro benzene & 2,3-dichloro nitro benzene, which is then separated by distillation.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3,4/2,3-Dichloro Nitro Benzene – INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	O-DCB	0.813
2	Sulphuric acid	1.084
3	60% Nitric acid	0.348
4	Water	4.065
	Total	**6.31**

Mass balance for 3,4/2,3-Dichloro Nitro Benzene – OUTPUT

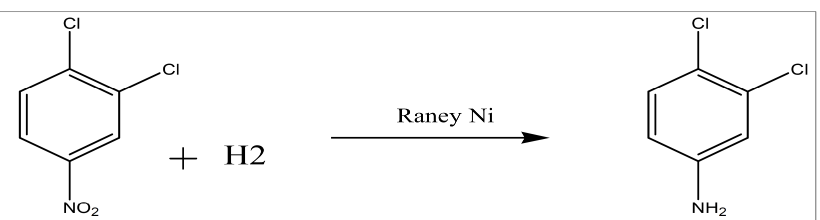
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	3,4 dichloro nitro benzene			0.85		Product
2	2,3 dichloro nitro benzene			0.15		Product
3	Residue				0.025	To CHWIF
4	Spent Acid			5.285		By-Product
Total		**0**	**0**	**6.285**	**0.025**	
		6.310				

49. 3,4 Dichloro Aniline

Process Description:

Reduction of 3,4-dichloro nitrobenzene by using catalyst raney nickel in solvent methanol in presence of hydrogen gas to produce crude 3,4-Dichloro aniline.

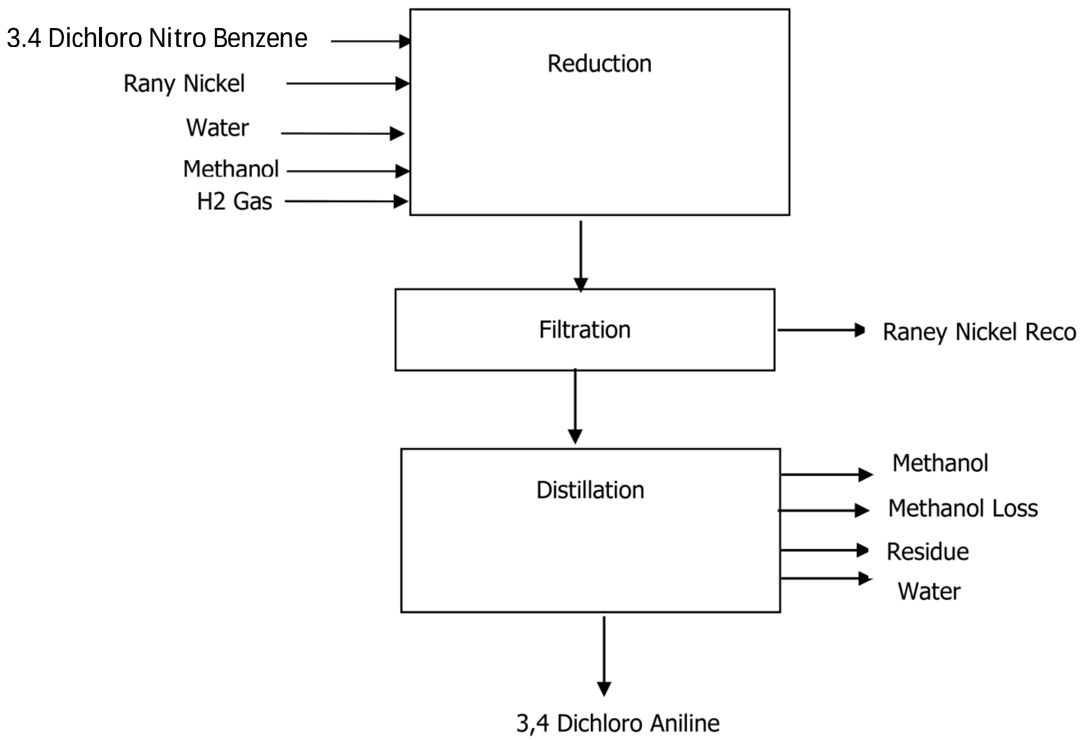
Chemical Reaction:



3,4-dichloro nitrobenzene
$C_6H_3Cl_2NO_2$
Mol. Wt.: 192

3,4-dichloro aniline
$C_6H_5Cl_2N$
Mol. Wt.: 162.02

Process Flow Diagram:



Mass Balance:

Mass balance for 3,4 -Dichloro Aniline – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3,4 DCNB	1.315
2	Rany Nickel	0.066
3	Water	0.066
4	Methanol	3.287
5	H_2 Gas	0.014
Total		**4.748**

Mass balance for 3,4-Dichloro Aniline – OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Reco			0.066		Recovered
2	Methanol			3.155		Solvent Recovered
3	Methanol Loss		0.132			To atmosphere

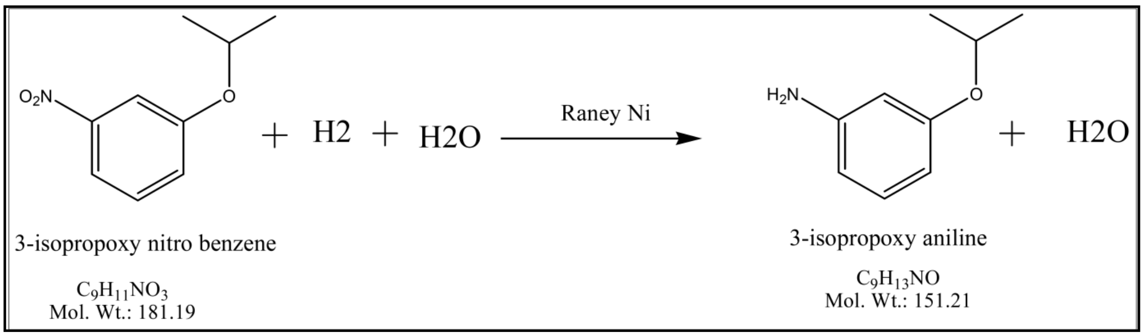
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
4	Residue				0.035	To CHWIF
5	3,4 Dichloro Aniline			1		Product
6	Water	0.36				To ETP
Total		**0.36**	**0.132**	**4.221**	**0.035**	
		4.748				

50. 3-Iso Propoxy Aniline

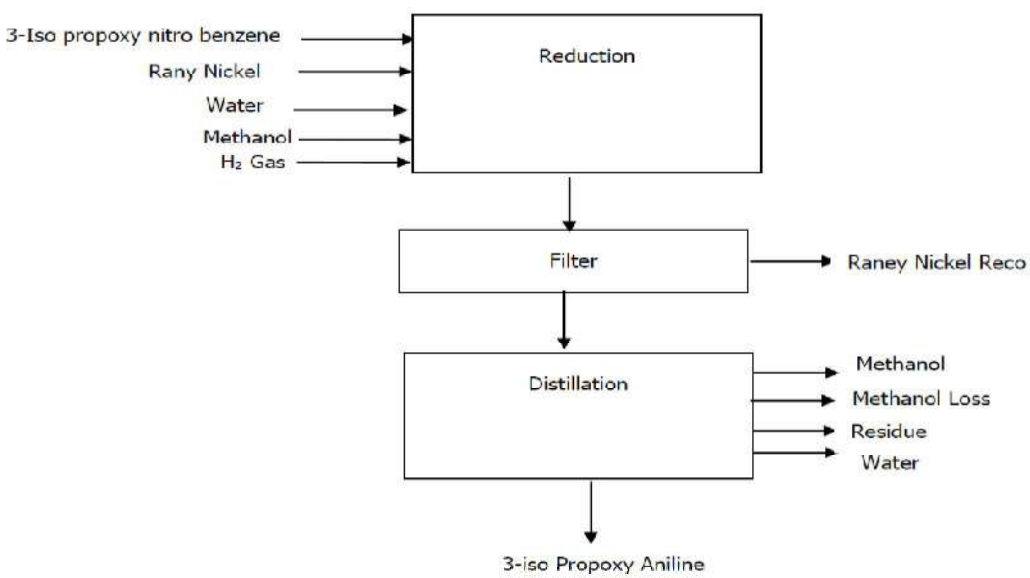
Process Description:

Reduction of 3-iso propoxy nitro benzene by using raney nickel and hydrogen pressure to give 3-Iso propoxy aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3 Iso Propoxy Aniline – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3-Iso propoxy nitro benzene	1.333
2	Rany Nickel	0.066
3	Water	0.066
4	Methanol	4.000
5	H2 Gas	0.015
Total		**5.480**

Mass balance for 3 Iso Propoxy Aniline – OUTPUT

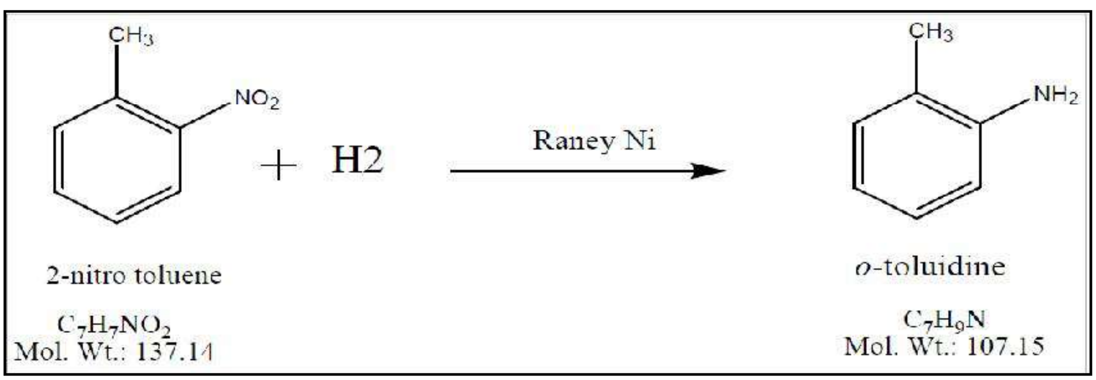
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Reco			0.066		Recovered
2	Methanol			3.84		Solvent recovered
3	Methanol Loss		0.16			To atmosphere
4	Residue				0.03	To CHWIF
5	3-iso propoxy Aniline			1		Product
6	Water	0.384				To ETP
Total		**0.384**	**0.16**	**4.906**	**0.030**	
		5.480				

51. o-Toluidine

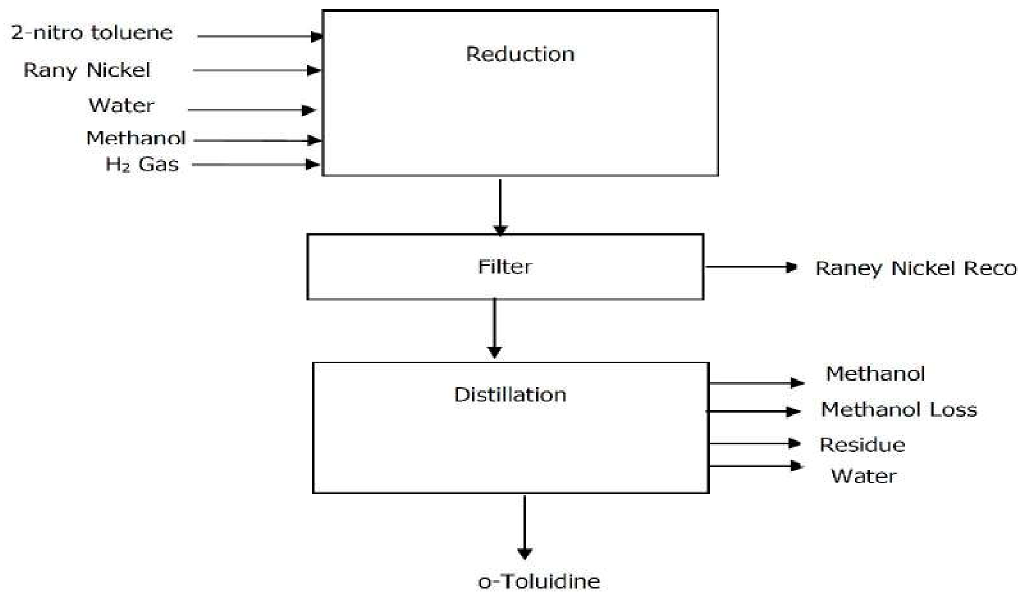
Process Description:

Reduction of 2-Nitro toluene by using catalyst raney nickel in solvent methanol by hydrogen gas to get product o-Toluidine, which is then distilled to get pure o-Toluidine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for o-Toluidine – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2-nitro toluene	1.351
2	Rany Nickel	0.067
3	Water	0.067
4	Methanol	4.054
5	H2 Gas	0.020
	Total	**5.559**

Mass balance for o-Toluidine – OUTPUT

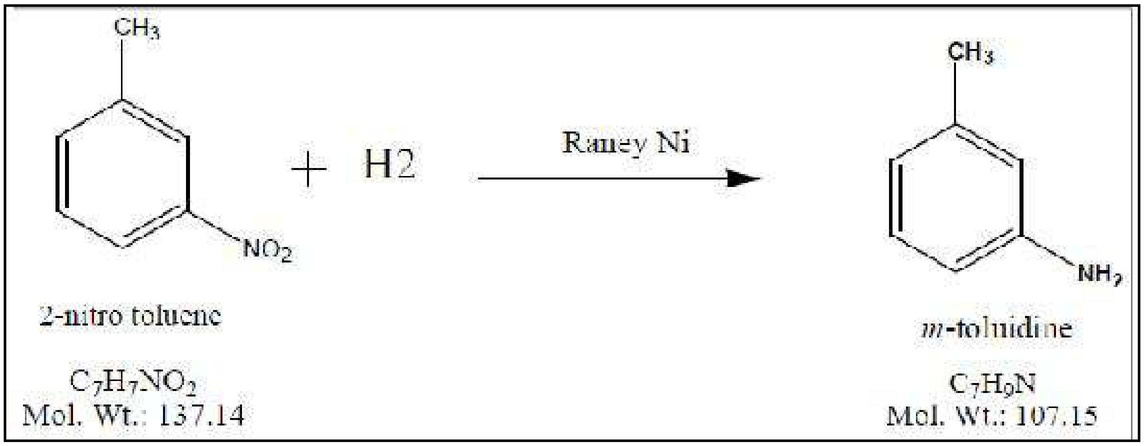
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel			0.067		Recovered
2	Methanol			3.892		Solvent recovered
3	Methanol Loss		0.162			To atmosphere
4	Residue				0.03	To CHWIF
5	o-Toluidine			1		Product
6	Water	0.408				To ETP
Total		**0.408**	**0.162**	**4.959**	**0.030**	
		5.559				

52. m-Toluidine

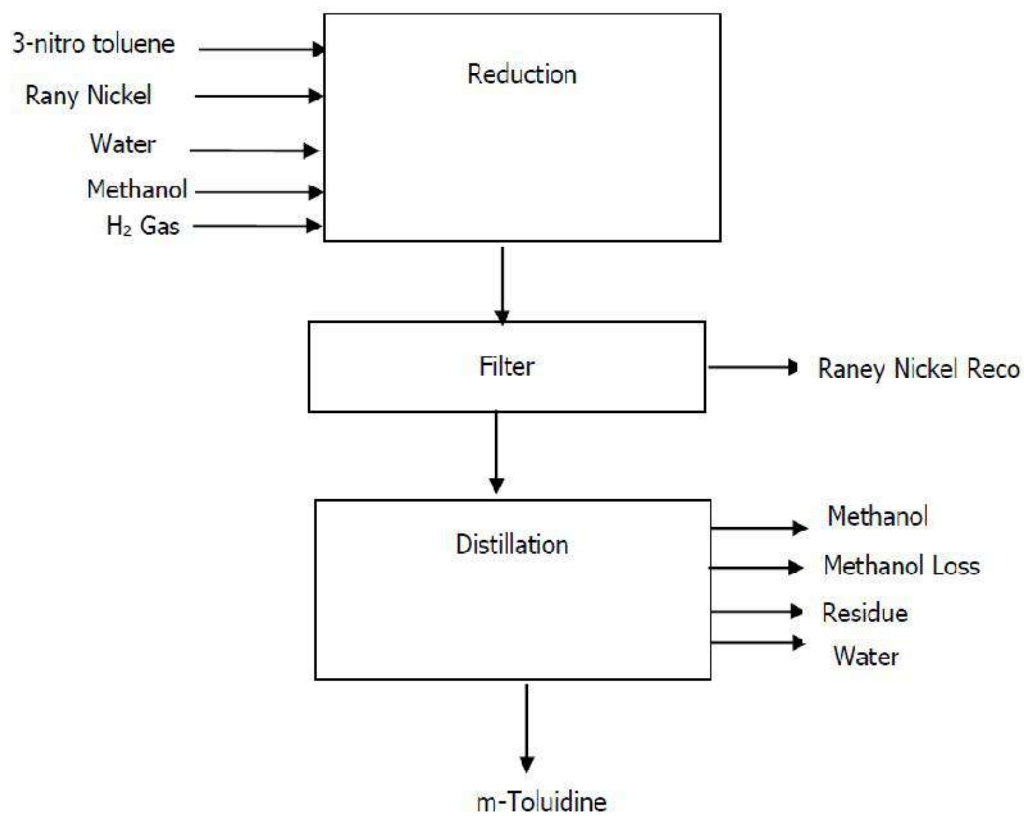
Process Description:

Reduction of 3-Nitro toluene by using catalyst raney nickel in methanol by hydrogen gas to get product m-Toluidine, which is then distilled to get pure m-Toluidine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for m-Toluidine – INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	3-nitro toluene	1.228
2	Rany Nickel	0.071
3	Water	0.071
4	Methanol	3.570
5	H_2 Gas	0.015
Total		**4.955**

Mass balance for m-Toluidine – OUTPUT

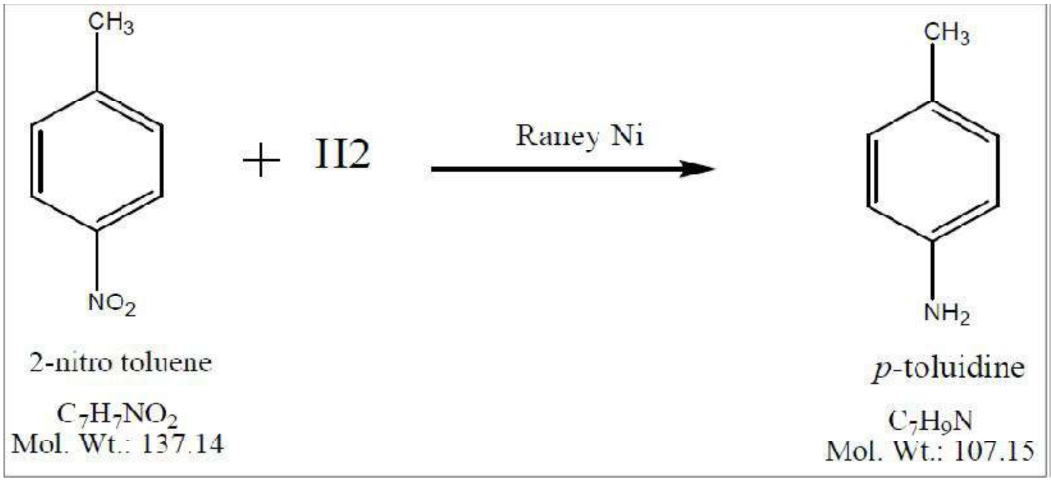
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel			0.067		Recovered
2	Methanol Recovery			3.427		Solvent recovered
3	Methanol Loss		0.142			To atmosphere
4	Residue				0.025	To CHWIF
5	m-Toluidine			1		Product
6	Waste Water	0.294				To ETP
Total		**0.294**	**0.142**	**4.494**	**0.025**	
		4.955				

53. p-Toluidine

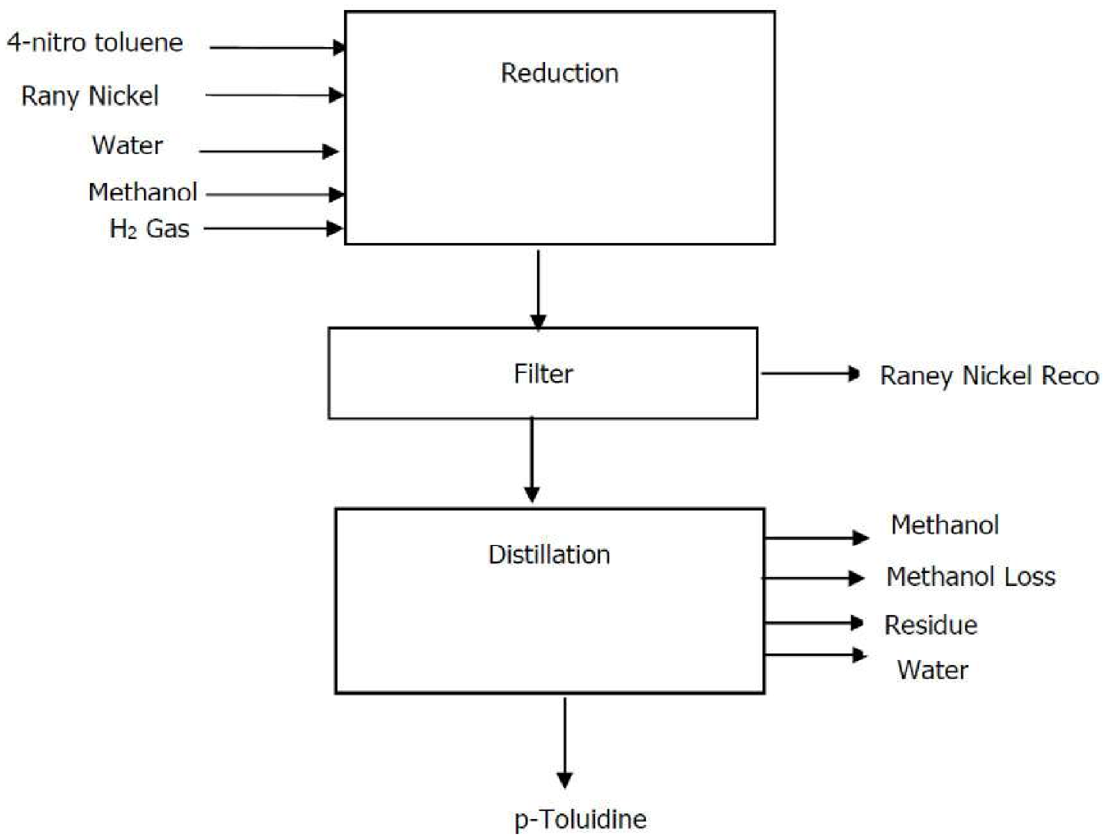
Process Description:

Reduction of 4-Nitro toluene by using catalyst Raney nickel in solvent methanol in presence of hydrogen gas to gives crude p-Toluidine, which is then distilled to get pure p-Toluidine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for p-Toluidine – INPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	4-nitro toluene	1.251
2	Rany Nickel	0.067
3	Water	0.067
4	Methanol	4.054
5	H_2 Gas	0.020
Total		**5.459**

Mass balance for p-Toluidine – OUTPUT

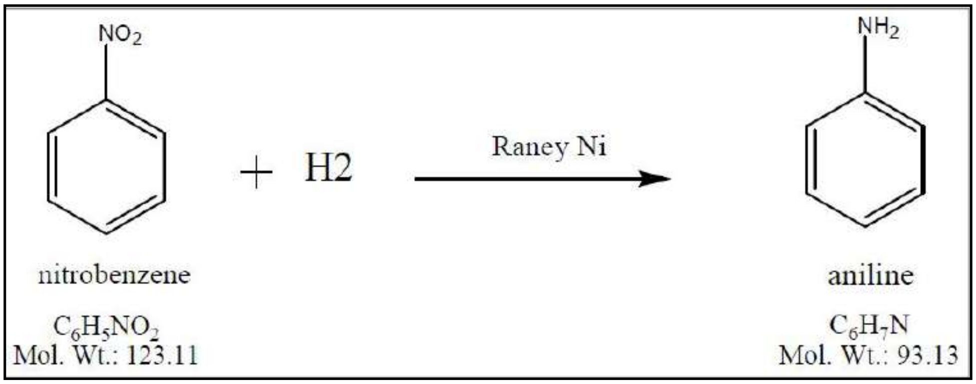
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel			0.067		Recovered
2	Methanol Recovery			3.892		Solvent recovered
3	Methanol Loss		0.162			To atmosphere
4	Residue				0.03	To CHWIF
5	P-Toluidine			1		Product
6	Waste Water	0.308				To ETP
Total		**0.308**	**0.162**	**4.959**	**0.030**	
		5.459				

54. Aniline

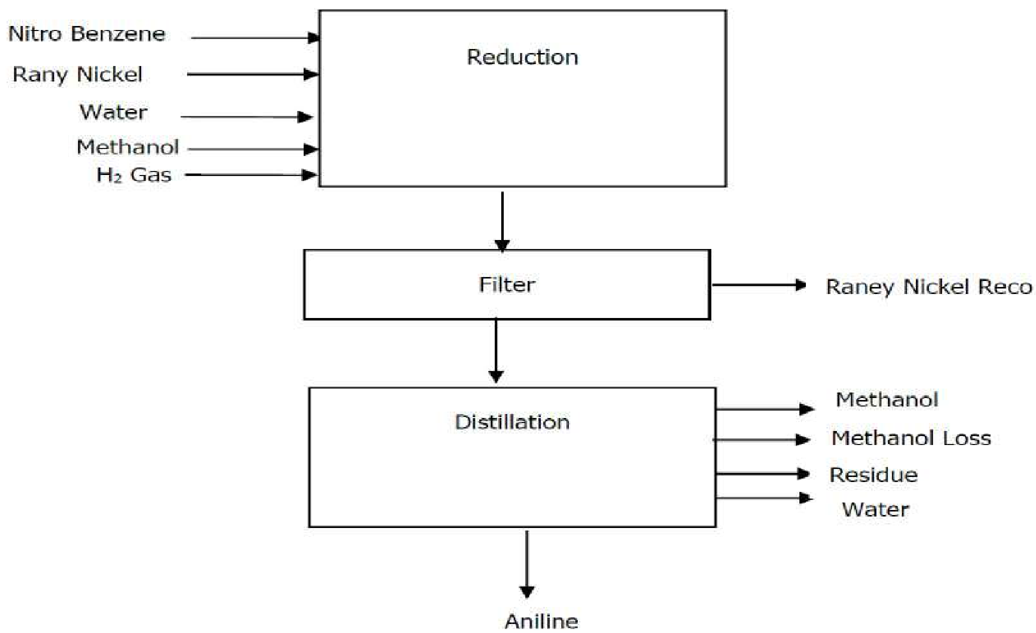
Process Description:

Reduction of nitro benzene by using catalyst renay nickel in solvent methanol in presence of hydrogen gas to gives crude Aniline, which is then distilled to obtain pure aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for Aniline – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	Nitro benzene	1.270
2	Rany Nickel	0.073
3	Water	0.073
4	Methanol	3.675
5	H2 Gas	0.024
	Total	**5.115**

Mass balance for Aniline – OUTPUT

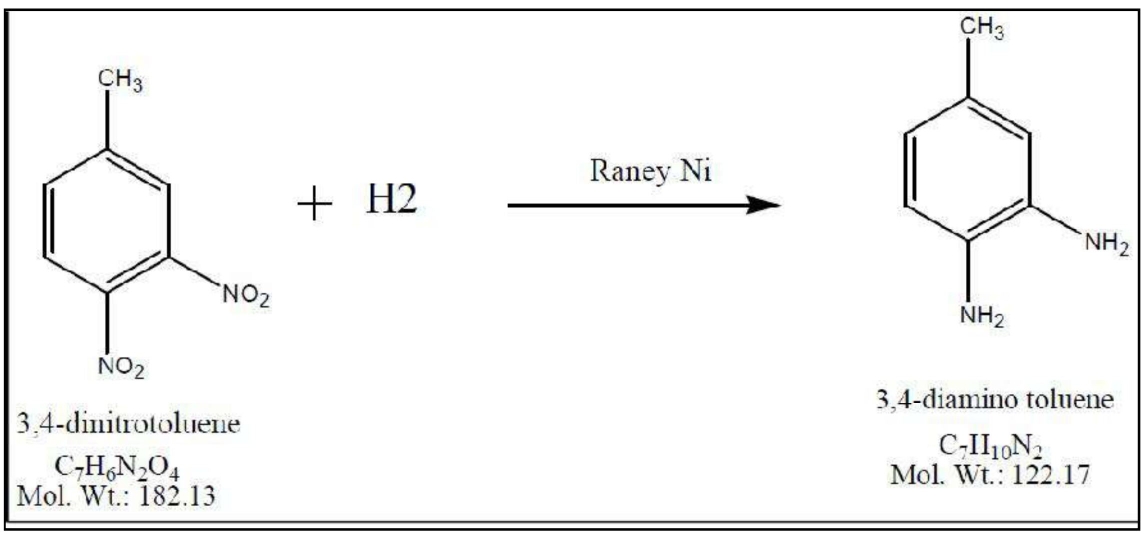
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Reco			0.073		Recovered
2	Methanol Recovery			3.528		Solvent recovered
3	Methanol Loss		0.147			To atmosphere
4	Residue				0.025	To CHWIF
5	Aniline			1		Product
6	Waste Water	0.342				To ETP
Total		**0.342**	**0.147**	**4.601**	**0.025**	
		5.115				

55. 3,4 DiaminoToluene

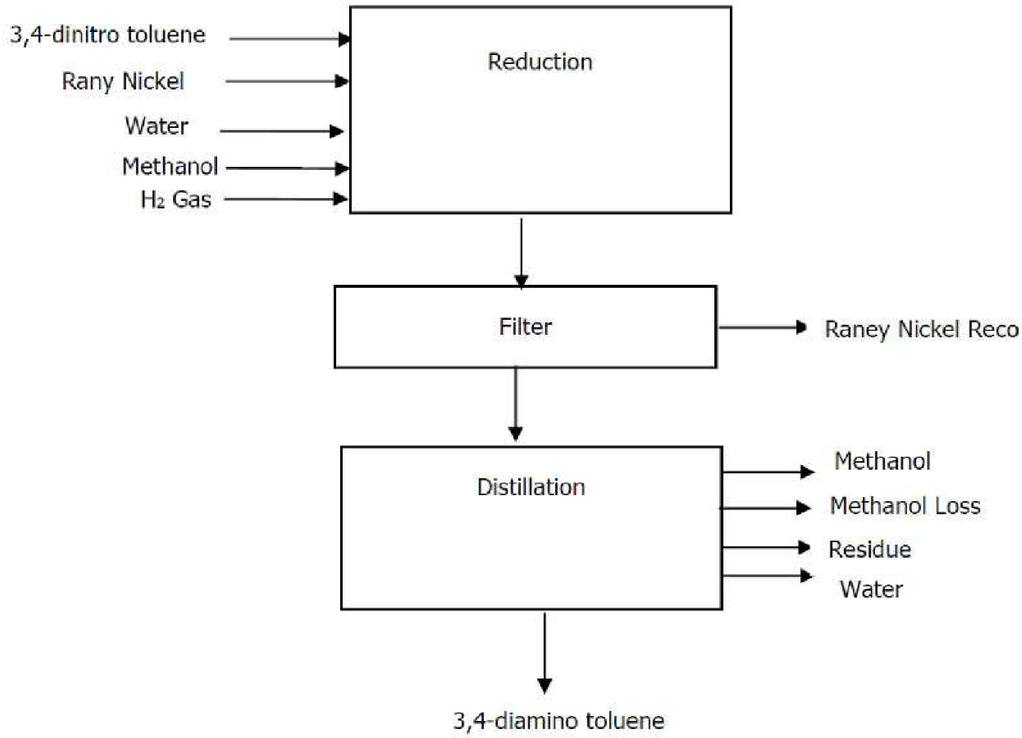
Process Description:

Reduction of 3,4-dinitro toluene by using catalyst Raney nickel in solvent methanol, in presence of hydrogen gas to get product of 3,4-diamino toluene.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3,4-Diamino Toluene – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3,4 DNT	1.287
2	Rany Nickel	0.080
3	Water	0.080
4	Methanol	3.967
5	H2 Gas	0.017
Total		**5.431**

Mass balance for 3,4-Diamino Toluene – OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Reco			0.08		Recovered
2	Methanol Recovery			3.808		Solvent recovered
3	Methanol Loss		0.159			To atmosphere
4	Residue				0.03	To CHWIF
5	3,4 DNT			1		Product
6	Waste Water	0.354				To ETP

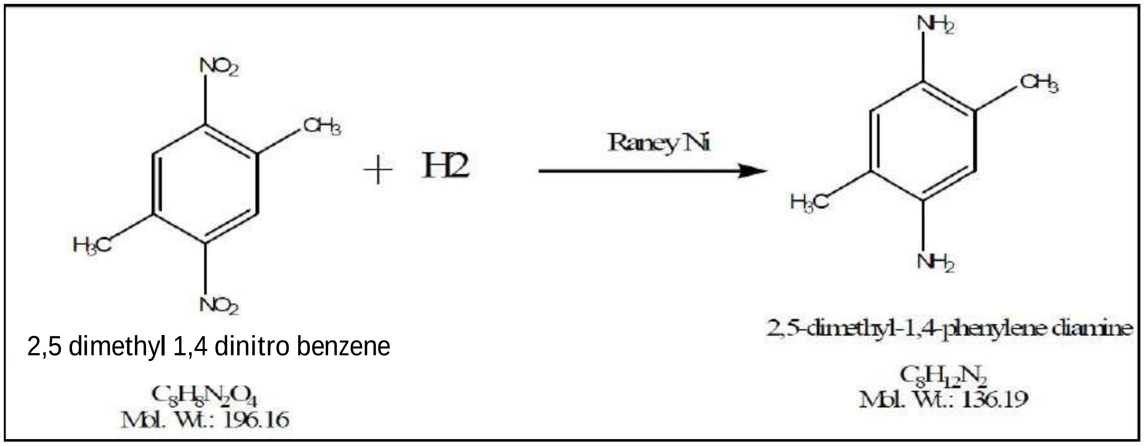
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
Total		0.354	0.159	4.888	0.030	
		5.431				

56. 2,5, Dimethyl 1,4 Phenylene Diamine

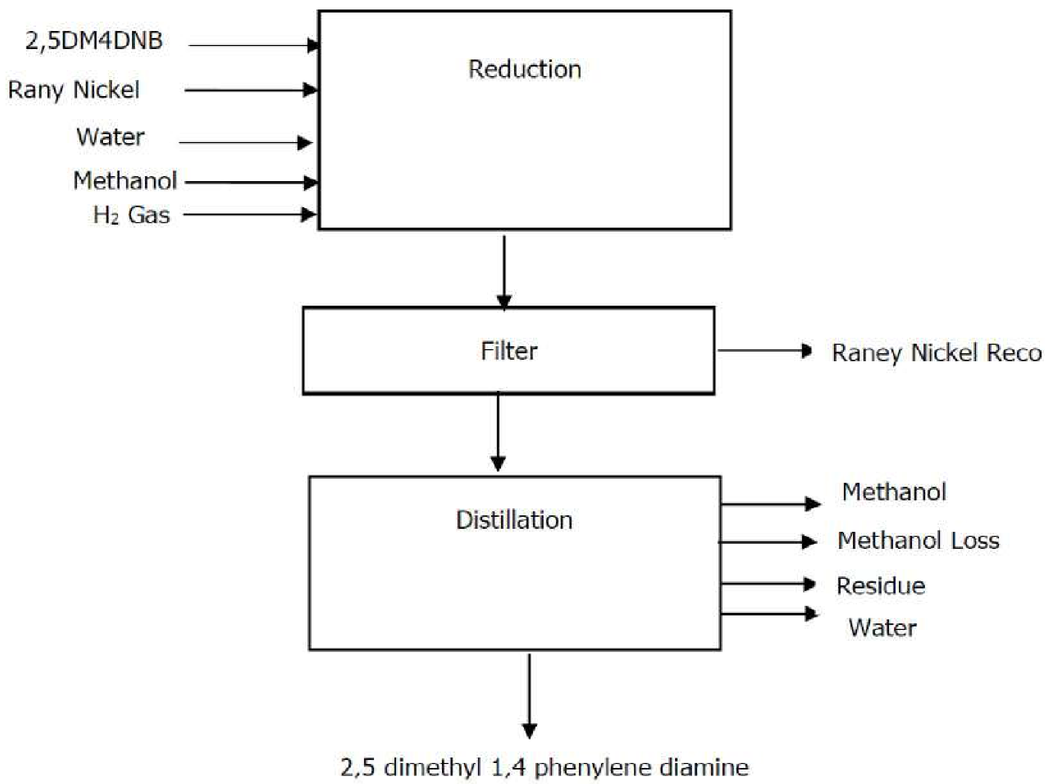
Process Description:

Reduction of 2,5 dimethyl-1-,4 dinitro benzene by using catalyst raney nickel, methanol in presence of hydrogen gas to get product of 2,5 dimethyl-1,4-phenylene diamine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,5 Dimethyl-1,4-Phenylene Diamine – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,5DM4DNB	1.238
2	Rany Nickel	0.076
3	Water	0.076
4	Methanol	4.614
5	H_2 Gas	0.014
	Total	**6.018**

Mass balance for 2,5 Dimethyl-1,4-Phenylene Diamine – OUTPUT

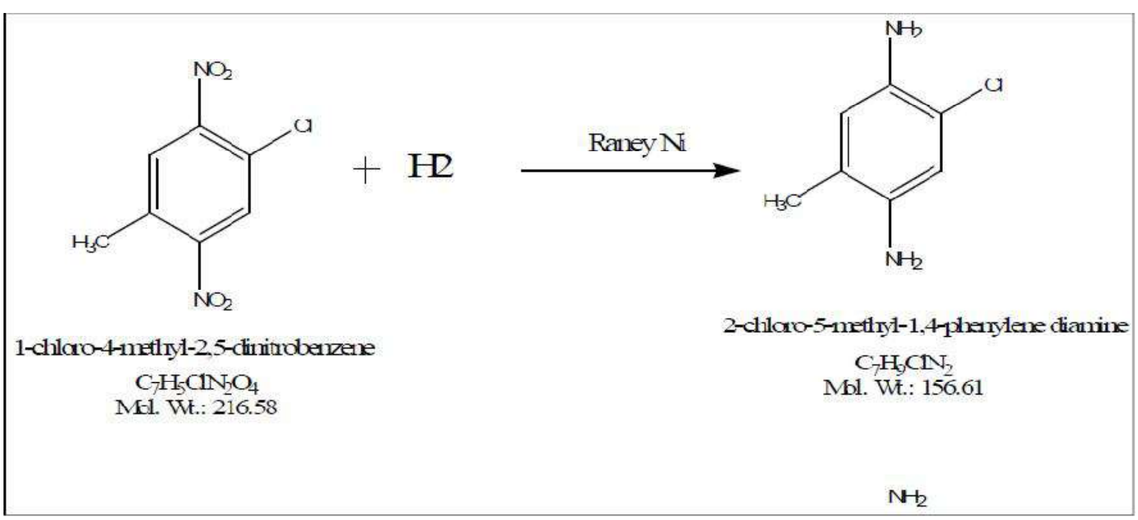
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Recovery			0.076		Recovered
2	Methanol Recovery			4.43		Solvent recovered
3	Methanol Loss		0.184			To atmosphere
4	Residue				0.025	To CHWIF
5	2,5 Dimethyl 1,4 Phenylene Diamine			1		Product
6	Waste Water	0.303				To ETP
Total		**0.303**	**0.184**	**5.506**	**0.025**	
		6.018				

57. 2-Chloro, 5 Methyl, 1,4 Phenylene Diamine

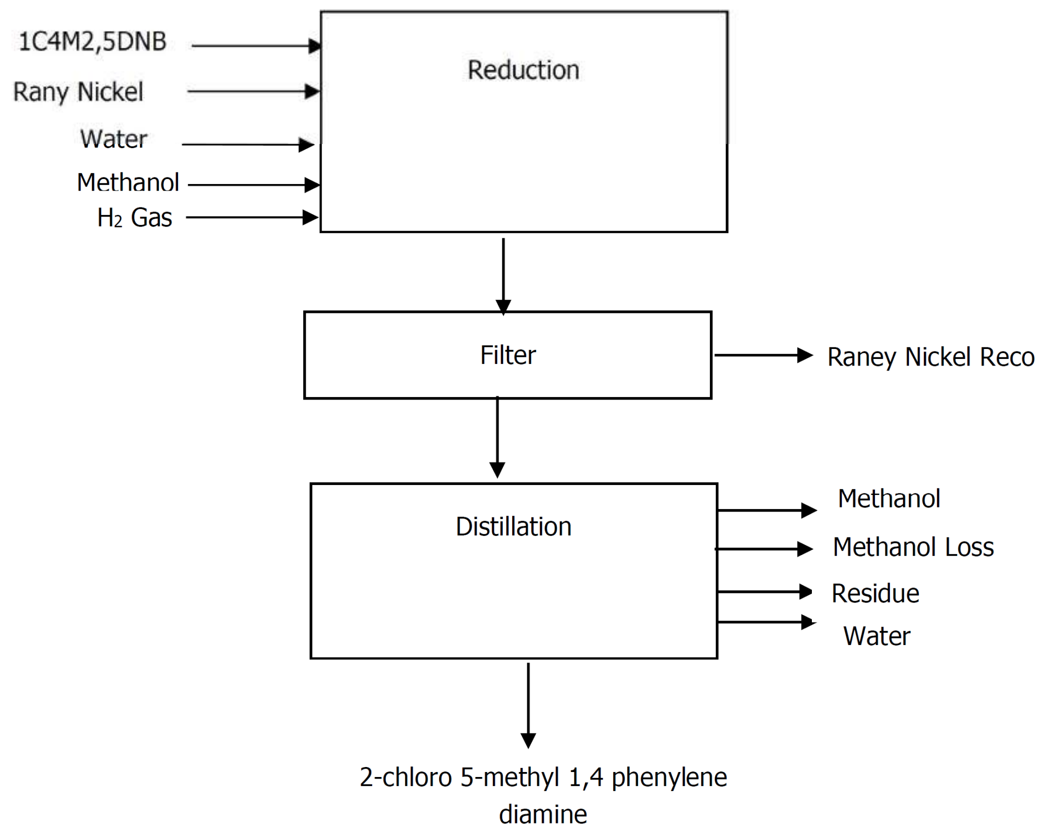
Process Description:

Reduction of 1-chloro-4-methy-2,5-dinitro benzene by using catalyst raney nickel in solvent methanol in presence of hydrogen gas to get product 2-chloro-5-methyl-1,4-phenylene diamine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2-chloro-5-methyl-1,4-phenylene diamine – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	1C4M2,5DNB	1.238
2	Rany Nickel	0.076
3	Water	0.076
4	Methanol	4.614
5	H2 Gas	0.014
Total		**6.018**

Mass balance for 2-chloro-5-methyl-1,4-phenylene diamine – OUTPUT

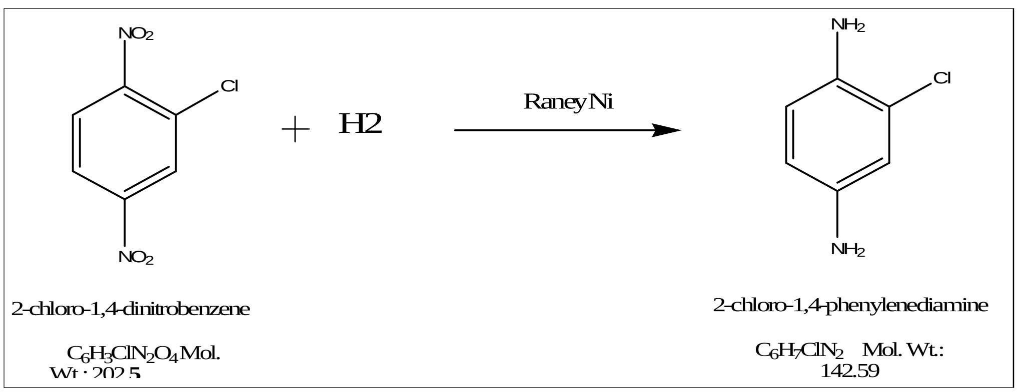
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel Recovery			0.076		Recovered
2	Methanol Recovery			4.43		Solvent recovered
3	Methanol Loss		0.184			To atmosphere
4	Residue				0.03	To CHWIF
5	2 Chloro, 5-Methyl, 1, 4 Phenylene Diamine			1		Product
6	Waste Water	0.298				To ETP
Total		**0.298**	**0.184**	**5.506**	**0.030**	
		6.018				

59. 2 Chloro 1,4 Phenylene Diamine

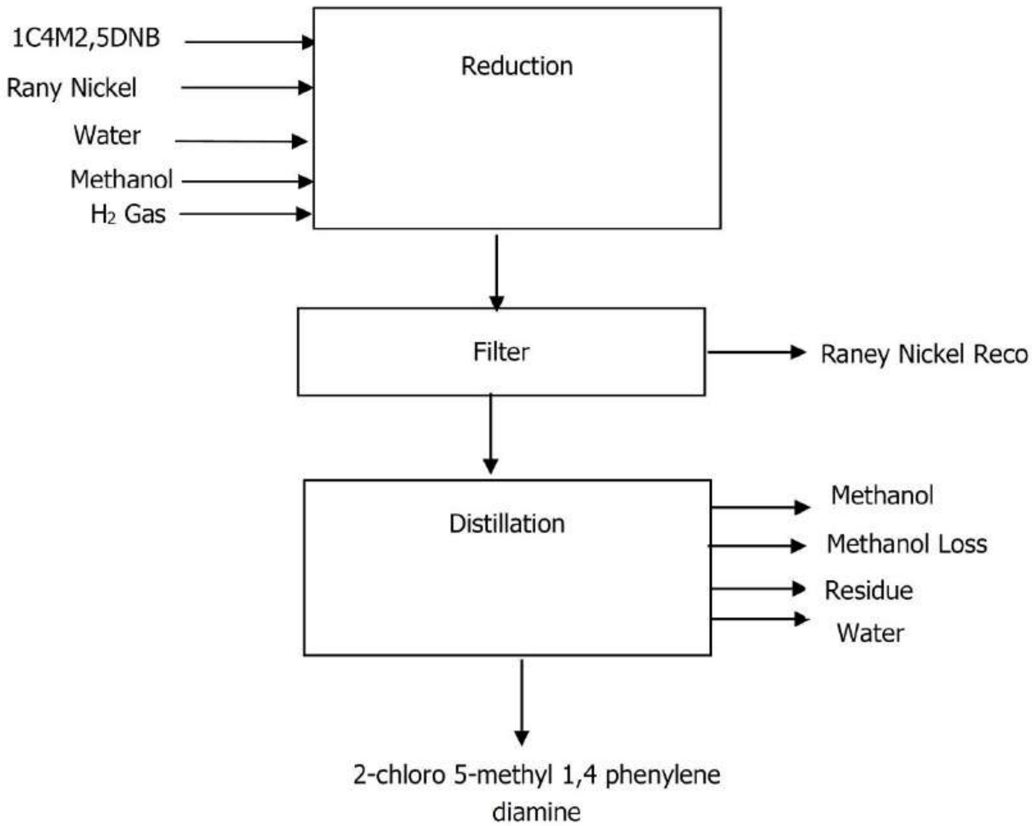
Process Description:

Reduction of 2-chloro-1-,4 dinitro benzene by using catalyst raney nickel, in solvent methanol, in presence of hydrogen gas to get product of 2-chloro1,4 Phenylene Diamine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2-Chloro 1,4 Phenylene Diamine – INPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,5DC4DNB	1.128
2	Rany Nickel	0.071
3	Water	0.071
4	Methanol	3.570
5	H2 Gas	0.015
Total		**4.855**

Mass balance for 2-Chloro 1,4 Phenylene Diamine – OUTPUT

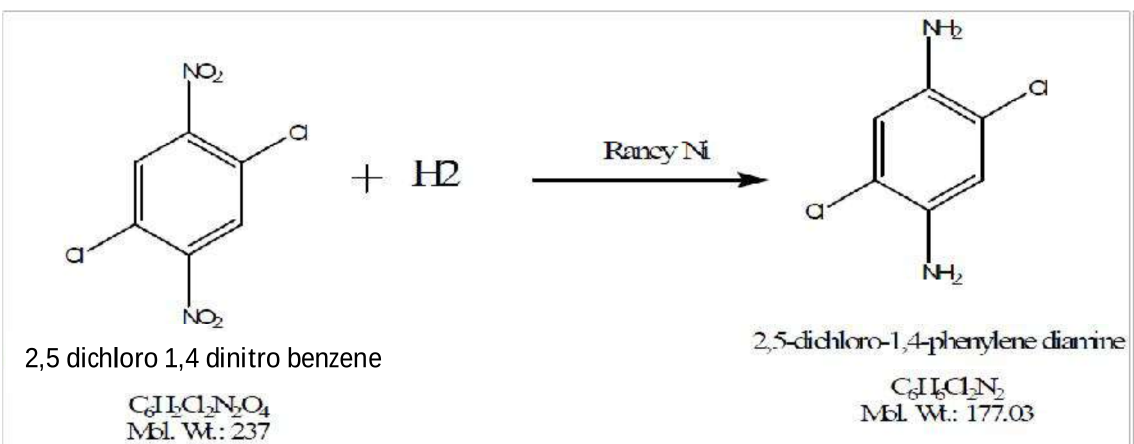
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel			0.071		Recovered
2	Methanol Recovery			3.427		Solvent recovered
3	Methanol Loss		0.143			To atmosphere
4	Residue				0.025	To CHWIF
5	2, chloro 1,4 Phenylene Diamine			1		Product
6	Waste Water	0.189				To ETP
Total		**0.189**	**0.143**	**4.498**	**0.025**	
		4.855				

60. 2, 5 Dichloro 1,4 Phenylene Diamine

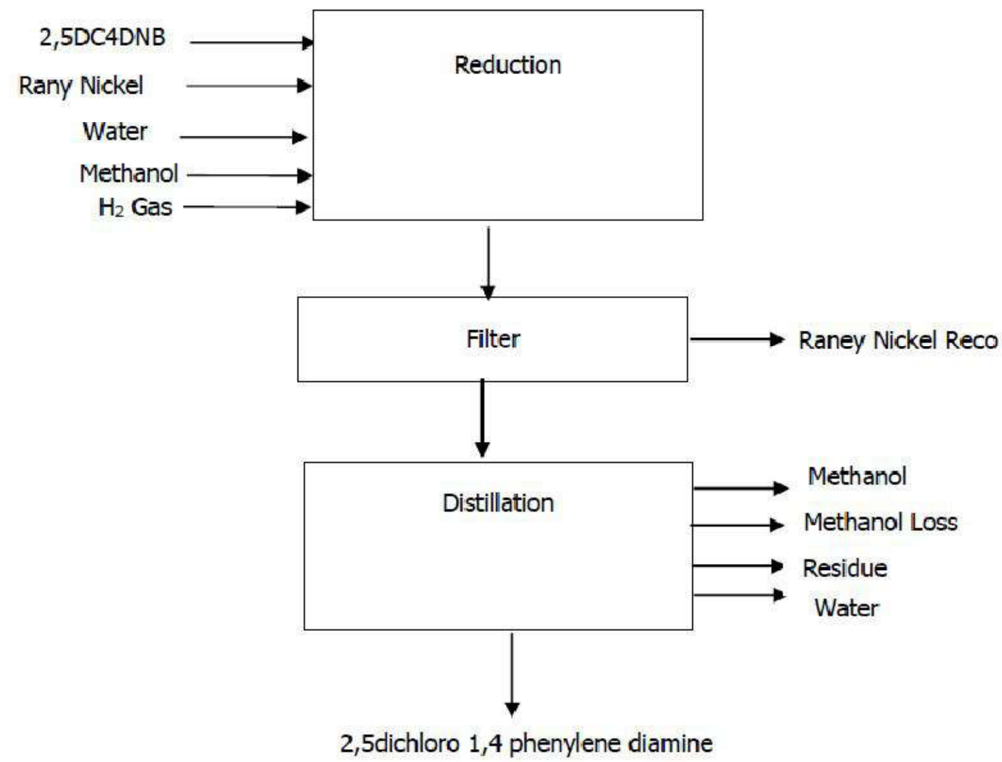
Process Description:

Reduction of 2,5 dichloro-1-,4 dinitro benzene by using catalyst raney nickel in solvent methanol, in presence of hydrogen gas to get product of 2,5-dichloro-1,4-phenylene diamine.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,5-Dichloro-1,4-Phenylene Diamine – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,5DC4DNB	1.128
2	Rany Nickel	0.071
3	Water	0.071
4	Methanol	3.570
5	H_2 Gas	0.015
	Total	**4.855**

Mass balance for 2,5-Dichloro-1,4-Phenylene Diamine – OUTPUT

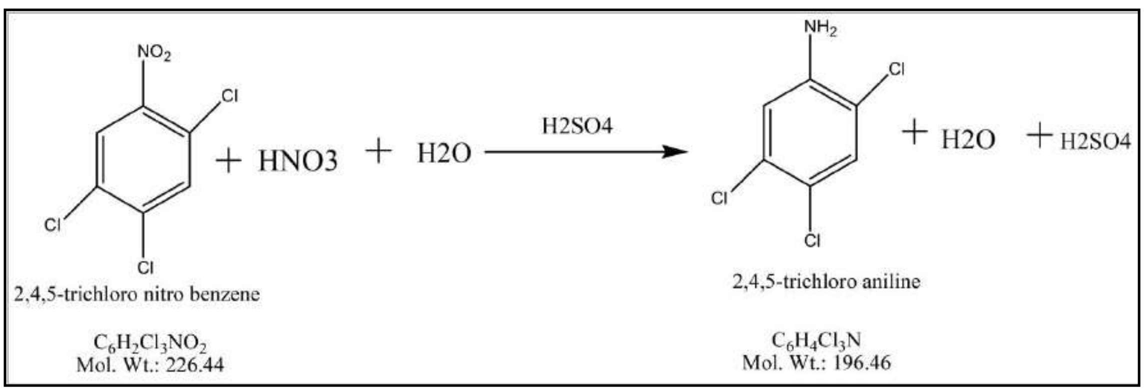
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel			0.071		Recovered
2	Methanol Recovery			3.427		Solvent recovered
3	Methanol Loss		0.143			To atmosphere
4	Residue				0.025	To CHWIF
5	2,5 Dichloro 1,4 Phenylene Diamine			1		Product
6	Waste Water	0.189				To ETP
Total		**0.189**	**0.143**	**4.498**	**0.025**	
		4.855				

61. 2,4,5 Trichloro Aniline

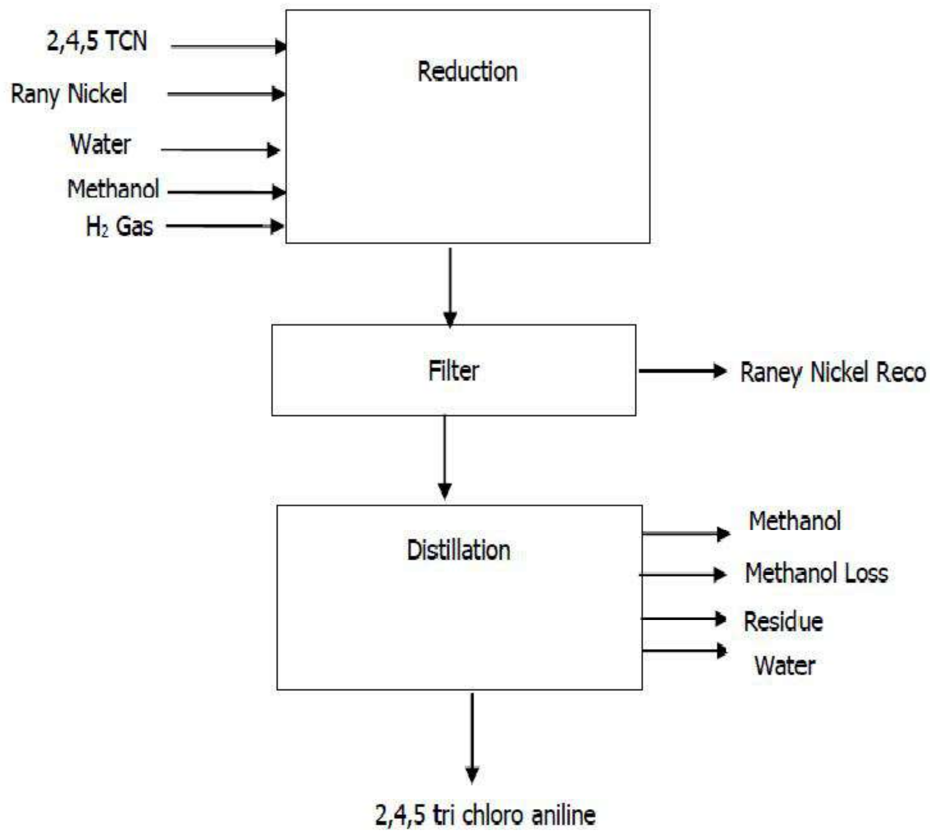
Process Description:

Reduction of 2,4,5 tri chloro nitro benzene by catalyst renay nickel in solvent methanol, in presence of hydrogen gas to get product of 2,4,5 tri chloro aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2, 4, 5 Tri Chloro Aniline – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,4,5 TCN	1.275
2	Rany Nickel	0.064
3	Water	0.064
4	Methanol	3.826
5	H_2 Gas	0.013
	Total	**5.242**

Mass balance for 2,4,5 Tri Chloro Aniline – OUTPUT

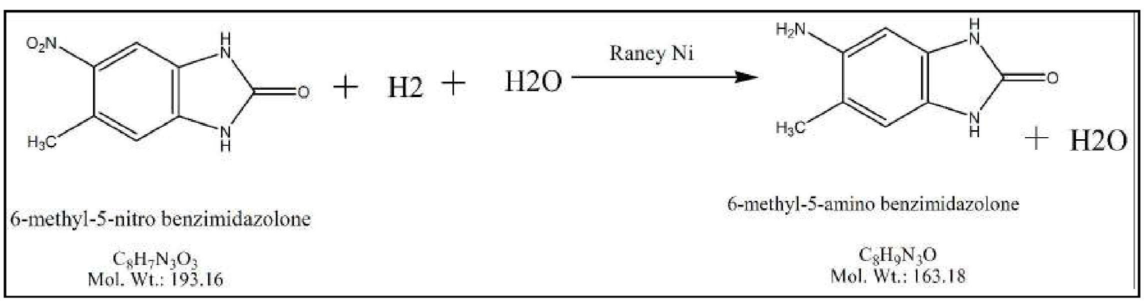
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel			0.064		Recovered
2	Methanol Recovery			3.673		Solvent recovered
3	Methanol Loss		0.153			To atmosphere
4	Residue				0.03	To CHWIF
5	2,4,5 Trichloro Aniline			1		Product
6	Waste Water	0.322				To ETP
Total		**0.322**	**0.153**	**4.737**	**0.030**	
		5.242				

62. **6 Methyl, 5 Amino Benzimidazlone**

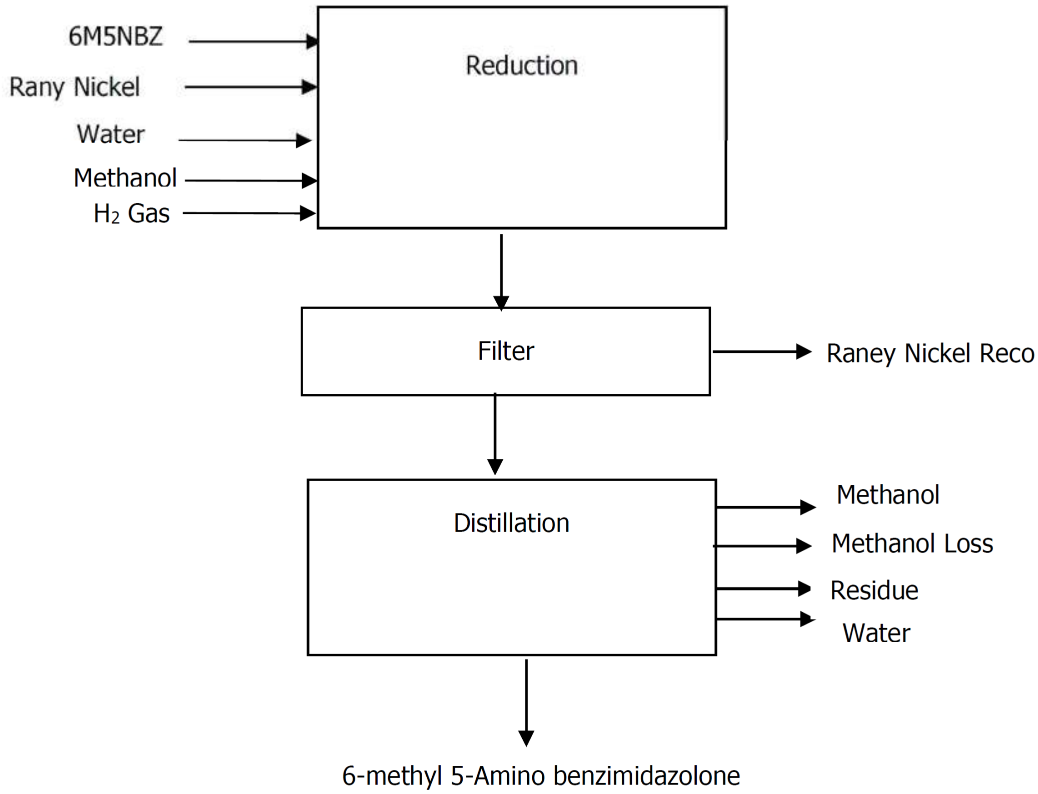
Process Description:

Reduction of 6-methyl-5-nitro benzimidazolone by using catalyst renay nickel in solvent methanol in presence of hydrogen gas to get product of 6-Methyl-5-Amino Benzimidazolone.

Chemical Reaction:



Process Flowchart



Mass Balance:

Mass balance for 6-Methyl-5-Amino Benzimidazolone – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	6M5NBZ	1.392
2	Rany Nickel	0.070
3	Water	0.070
4	Methanol	4.177
5	H2 Gas	0.014
Total		**5.723**

Mass balance for 6-Methyl-5-Amino Benzimidazolone – OUTPUT

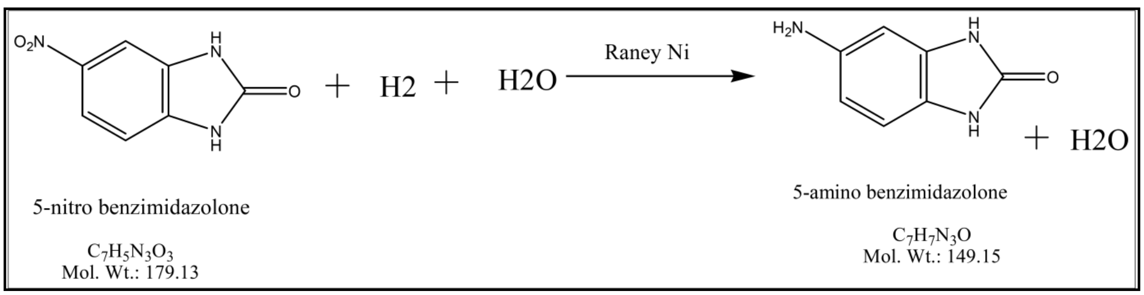
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel Reco			0.07		Recovered
2	Methanol Recovery			4.01		Solvent recovered
3	Methanol Loss		0.167			To atmosphere
4	Residue				0.025	To CHWIF
5	6-Methyl 5- Amino Benzimidazolone			1		Product
6	Waste Water	0.451				To ETP
Total		**0.451**	**0.167**	**5.080**	**0.025**	
		5.723				

63. 5-Amino Benzimidazlone

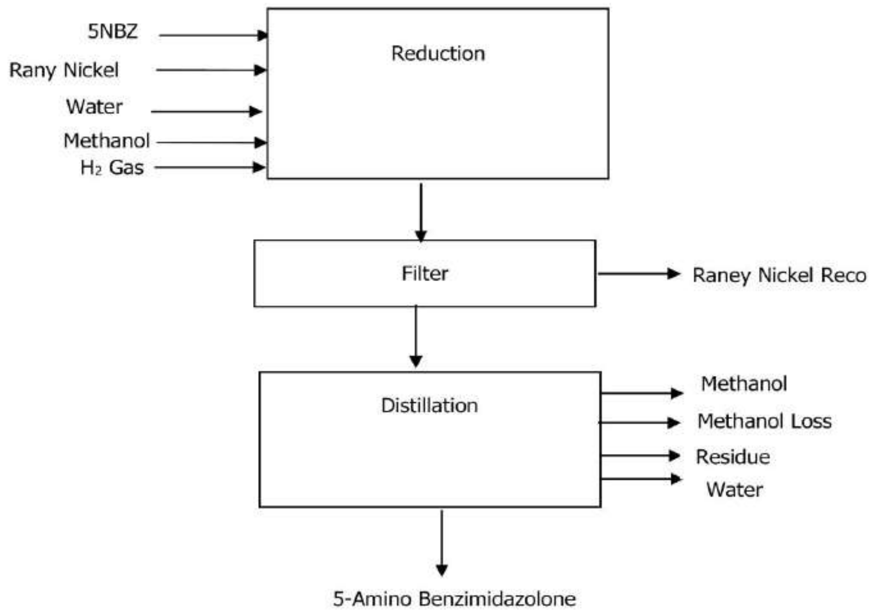
Process Description:

Reduction of 5-nitro benzimidazolone by using catalyst renay nickel in solvent methanol in presence of hydrogen gas to get product of 5-Amino benzimidazolone.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 5-Amino Benzimidazolone – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	5NBZ	1.413
2	Rany Nickel	0.070
3	Water	0.070
4	Methanol	4.239
5	H_2 Gas	0.016
	Total	**5.808**

Mass balance for 5-Amino Benzimidazolone – OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Reco			0.07		Recovered
2	Methanol Recovery			4.069		Solvent recovered
3	Methanol Loss		0.17			To atmosphere
4	Residue				0.02	To CHWIF
5	5-Amino benzimidazolone			1		Product

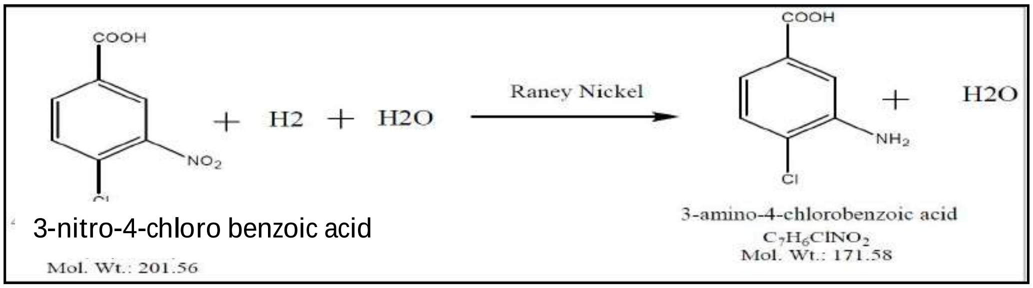
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
6	Waste Water	0.479				To ETP
Total		**0.479**	**0.17**	**5.139**	**0.020**	
		5.808				

64. 3 Amino, 4 Chloro Benzoic Acid

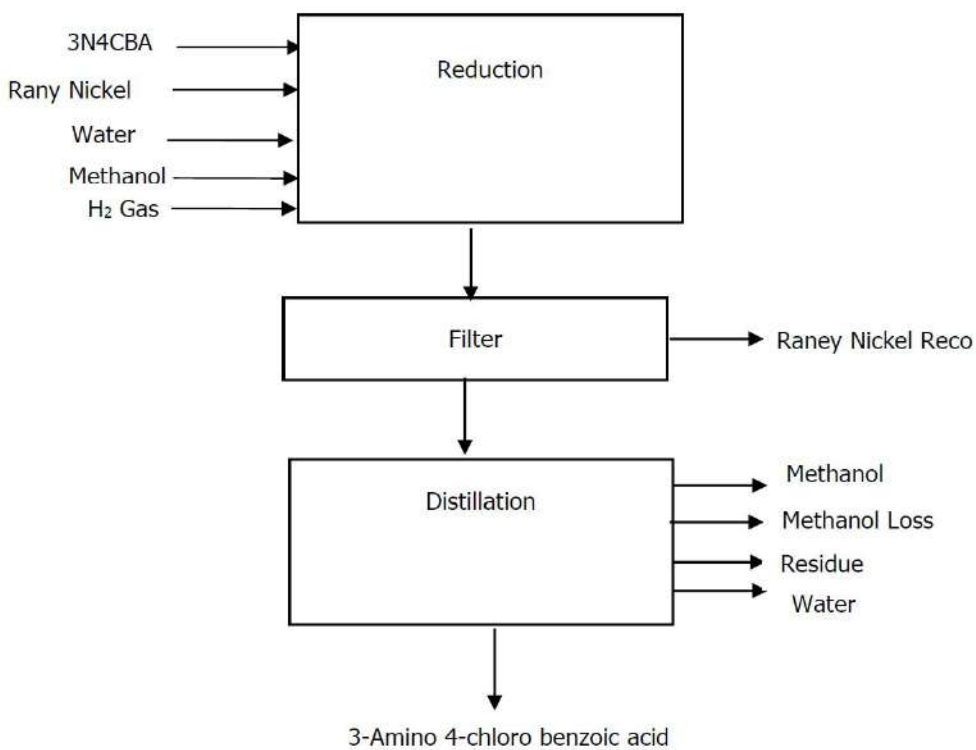
Process Description:

Reduction of 3-nitro-4-chloro benzoic acid by using renay nickel, methanol in presence of hydrogen gas to get product of 3-Amino-4-Chloro Benzoic Acid.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3-Amino-4-Chloro Benzoic Acid – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	3N4CBA	1.305
2	Rany Nickel	0.065
3	Water	0.065
4	Methanol	3.915
5	H_2 Gas	0.013
	Total	**5.363**

Mass balance for 3-Amino-4-Chloro Benzoic Acid – OUTPUT

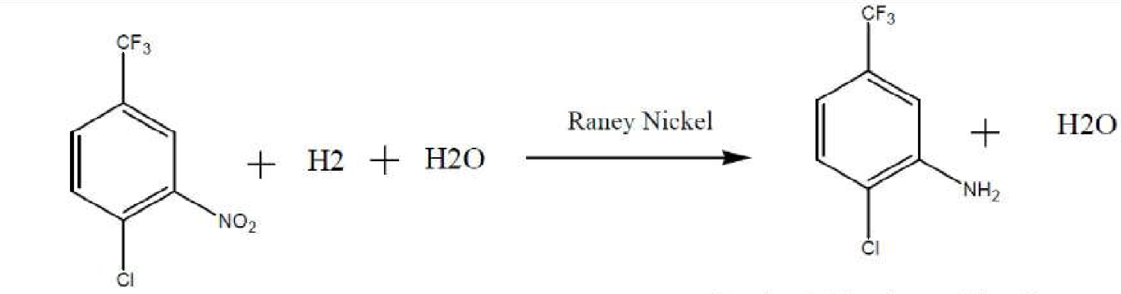
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel Recovery			0.065		Recovered
2	Methanol Recovery			3.758		Solvent recovered
3	Methanol Loss		0.157			To atmosphere
4	Residue				0.03	To CHWIF
5	3-Amino 4-chloro benzoic acid			1		Product
6	Waste Water	0.353				To ETP
Total		**0.353**	**0.157**	**4.823**	**0.030**	
		5.363				

65. 3 Amino, 4 Chloro Benzotriflouride

Process Description:

Reduction of 3-nitro-4-chloro benzotrifluoride by using renay nickel ,methanol in presence of hydrogen gas to get product of 3-Amino-4-chloro benzotrifluoride.

Chemical Reaction:



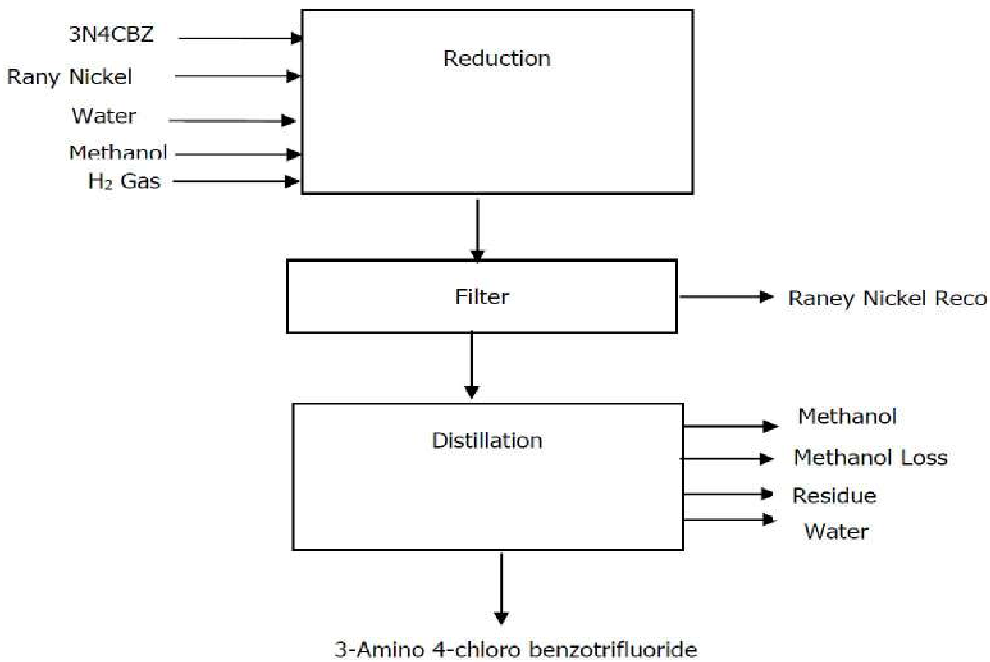
3 Nitro 4 chloro benzotriflouride

$C_7H_3ClF_3NO_2$
Mol. Wt.: 225.55

3-amino-4-chloro benzotrifluoride

$C_7H_5ClF_3N$
Mol. Wt.: 195.57

Process Flowchart



Mass Balance:

Mass balance for 3-Amino-4-Chloro Benzotrifluoride – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3N4CBZ	1.214
2	Rany Nickel	0.061
3	Water	0.061
4	Methanol	3.642
5	H_2 Gas	0.011
	Total	**4.989**

Mass balance for 3-Amino-4-Chloro Benzotrifluoride – OUTPUT

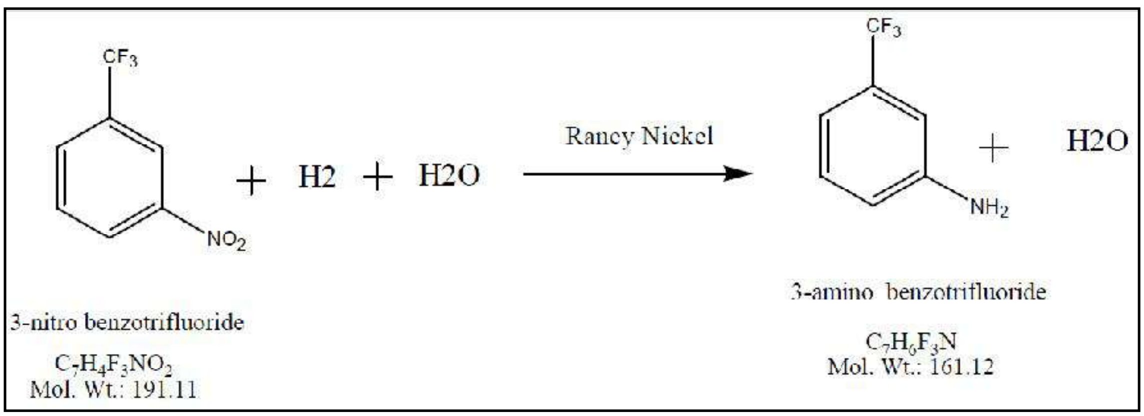
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel Reco			0.061		Recovered
2	Methanol			3.496		Recovered
3	Methanol Loss		0.146			To atmosphere
4	Residue				0.03	To CHWIF
5	3-Amino 4-chloro benzotrifluoride			1		Product
6	Waste Water	0.256				To ETP
Total		**0.256**	**0.146**	**4.557**	**0.030**	
		4.989				

66. 3 Amino, Benzo triflouride

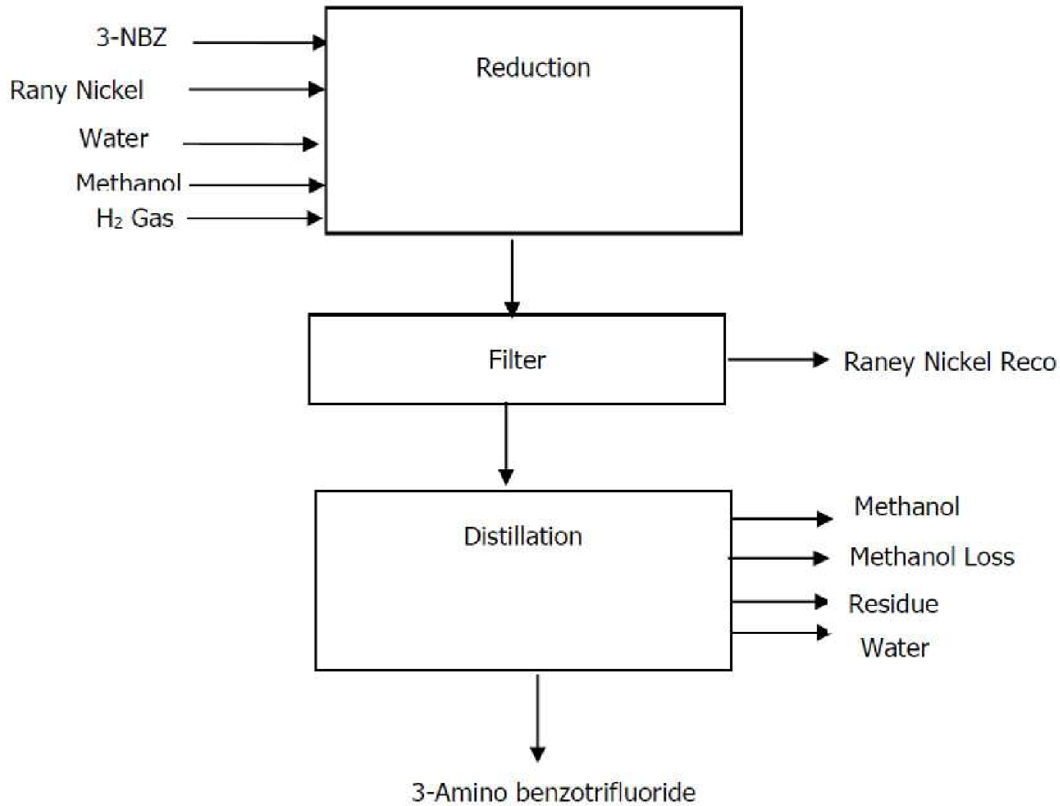
Process Description:

Reduction of 3-nitro benzotrifluoride by using renay nickel ,methanol in presence of hydrogen gas to get product of 3-Amino Benzotrifluoride.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3-Amino Benzotrifluoride – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3-NBZ	1.318
2	Rany Nickel	0.066
3	Water	0.066
4	Methanol	3.954
5	H_2 Gas	0.014
Total		**5.418**

Mass balance for 3-Amino Benzotrifluoride – OUTPUT

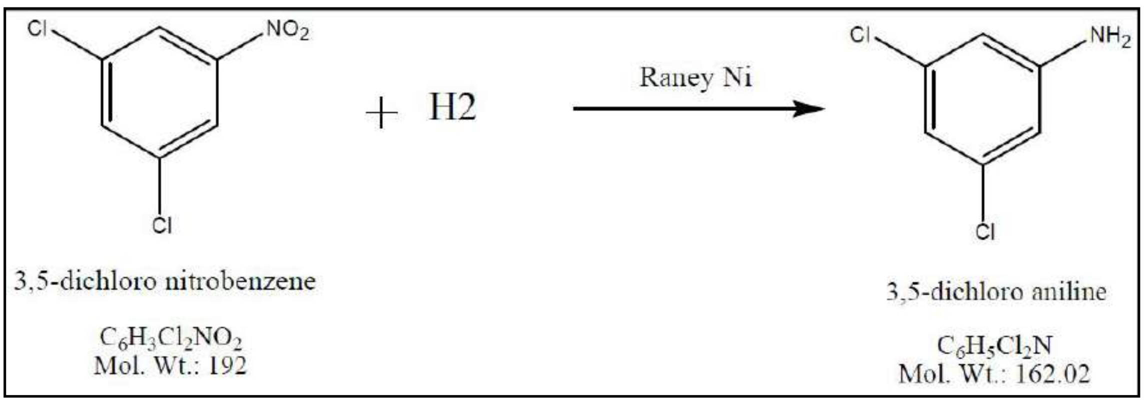
S No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel			0.066		Recovered
2	Methanol Recovery			3.796		Solvent recovered
3	Methanol Loss		0.158			To atmosphere
4	Residue				0.020	To CHWIF
5	3-Amino benzotrifluoride			1		Product
6	Waste Water	0.378				To ETP
Total		**0.378**	**0.158**	**4.862**	**0.020**	
		5.418				

67. 3 ,5 Dichloro Aniline

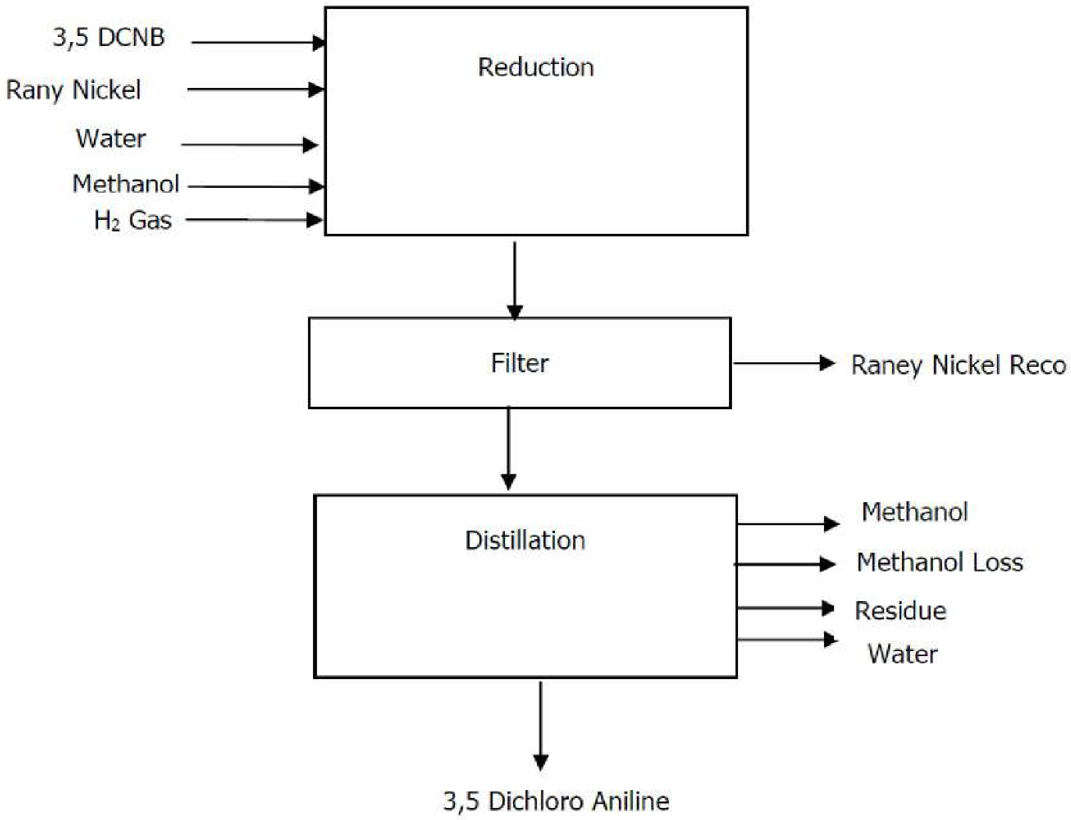
Process Description:

Reduction of 3,5-dichloro nitrobenzene by using catalyst raney nickel in solvent methanol in presence of hydrogen gas to get crude 3,5-Dichloro Aniline, which is purified by crystallization.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 3,5-Dichloro Aniline – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	3,5 DCNB	1.298
2	Rany Nickel	0.064
3	Water	0.064
4	Methanol	3.245
5	H_2 Gas	0.014
	Total	**4.685**

Mass balance for 3, 5-Dichloro Aniline – OUTPUT

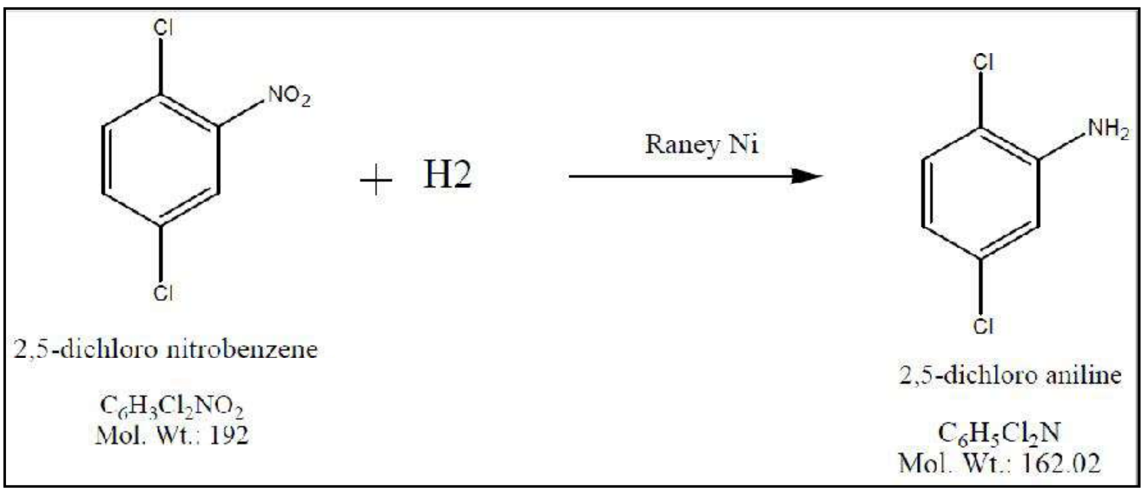
S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel			0.064		Recovered
2	Methanol Recovery			3.115		Solvent recovered
3	Methanol Loss		0.13			To atmosphere
4	Residue				0.03	To CHWIF
5	3,5 Dichloro Aniline			1		Product
6	Waste Water	0.346				To ETP
Total		**0.346**	**0.13**	**4.179**	**0.030**	
		4.685				

68. 2 ,5 Dichloro Aniline

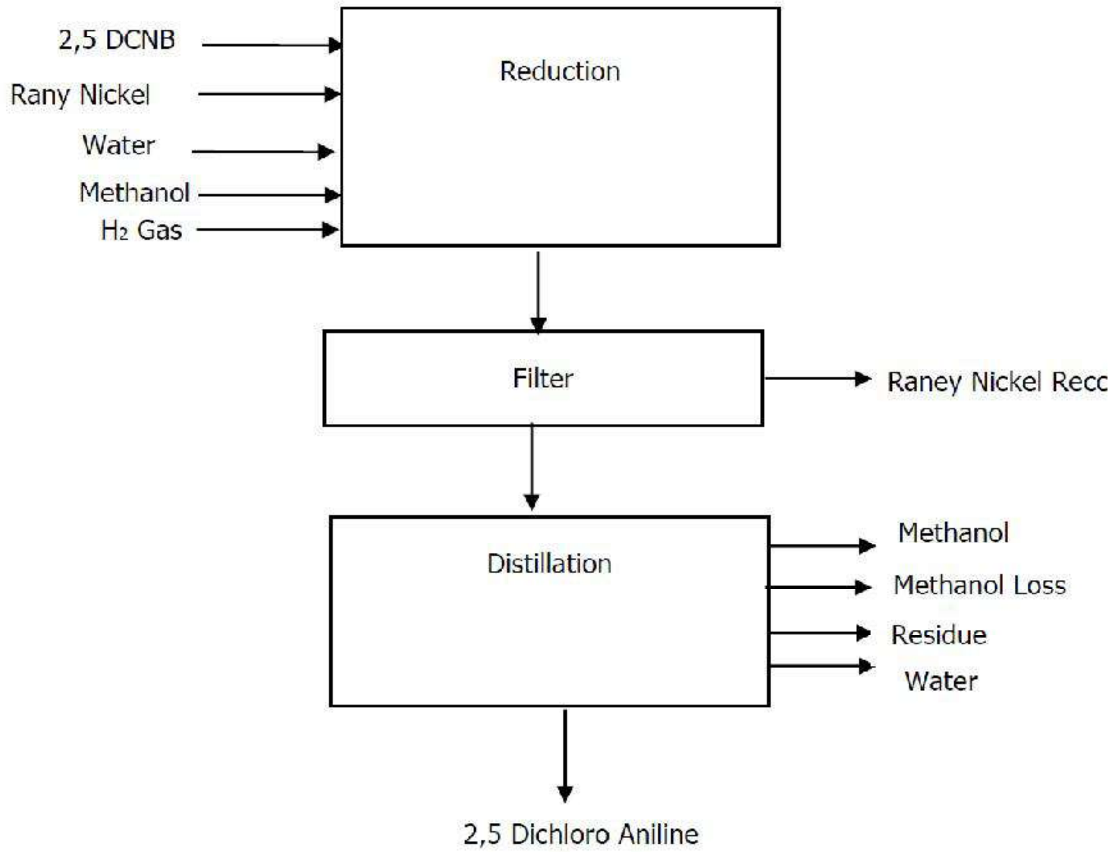
Process Description:

Reduction of 2,5-dichloro nitrobenzene by using catalyst raney nickel in solvent methanol in presence of hydrogen gas to get crude 2,5-Dichloro aniline, which is ten distilled to give pure 2,5- Dichloro aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,5-Dichloro Aniline – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,5 DCNB	1.150
2	Rany Nickel	0.062
3	Water	0.062
4	Methanol	2.500
5	H_2 Gas	0.013
	Total	**3.787**

Mass balance for 2,5-Dichloro Aniline – OUTPUT

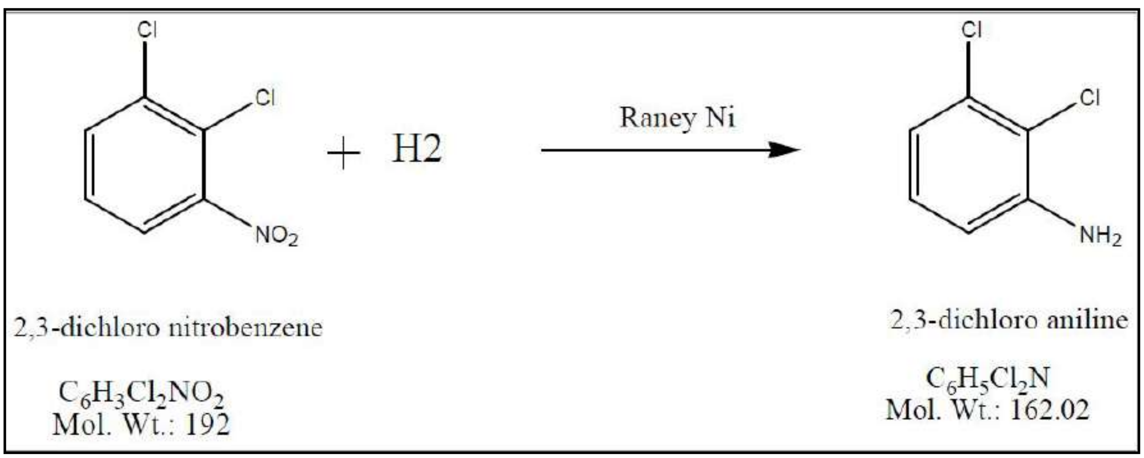
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel			0.062		Recovered
2	Methanol Recovery			2.4		Solvent recovered
3	Methanol Loss		0.1			To atmosphere
4	Residue				0.025	To CHWIF
5	2,5 Dichloro Aniline			1		Product
6	Waste Water	0.2				To ETP
Total		**0.2**	**0.1**	**3.462**	**0.025**	
		3.787				

69. 2 ,3 Dichloro Aniline

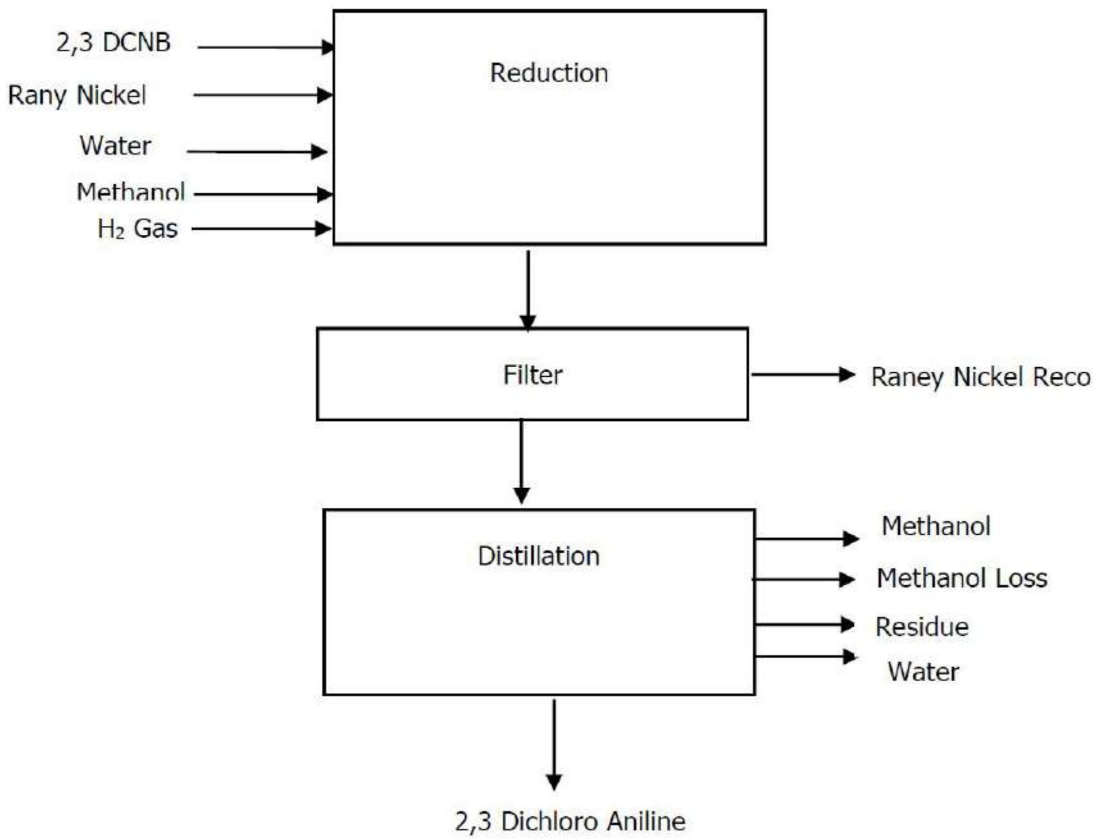
Process Description:

Reduction of 2,3-dichloro nitrobenzene by using catalyst Raney nickel, methanol in presence of hydrogen gas to produce 2,3-Dichloro aniline.

Chemical Reaction:



Process Flow Diagram:



Mass Balance:

Mass balance for 2,3-Dichloro Aniline – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	**Quantity (MT)**
1	2,3 DCNB	1.315
2	Rany Nickel	0.062
3	Water	0.062
4	Methanol	1.219
5	H2 Gas	0.013
Total		**2.671**

Mass balance for 2,3-Dichloro Aniline – OUTPUT

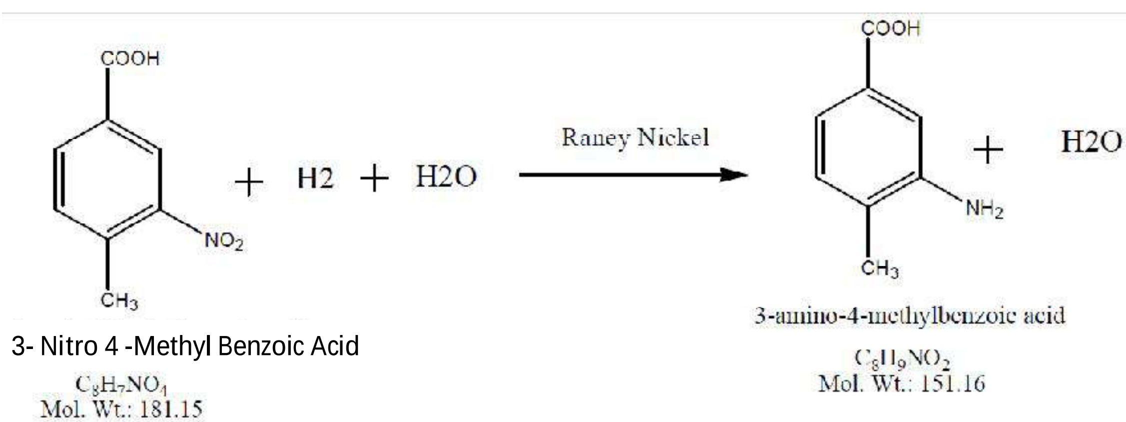
S. No.	Output/MT of Product					Remarks
	Product	**Waste water**	**Air Emission**	**Recovery/ Product**	**Solid Waste**	
1	Rany Nickel			0.062		Recovered
2	Methanol Recovery			1.171		Solvent recovered
3	Methanol Loss		0.048			To atmosphere
4	Residue				0.03	To CHWIF
5	2,3 Dichloro Aniline			1		Product
6	Waste Water	0.36				To ETP
Total		**0.36**	**0.048**	**2.233**	**0.030**	
		2.671				

70. 3 Amino 4-Methyl Benzoic Acid

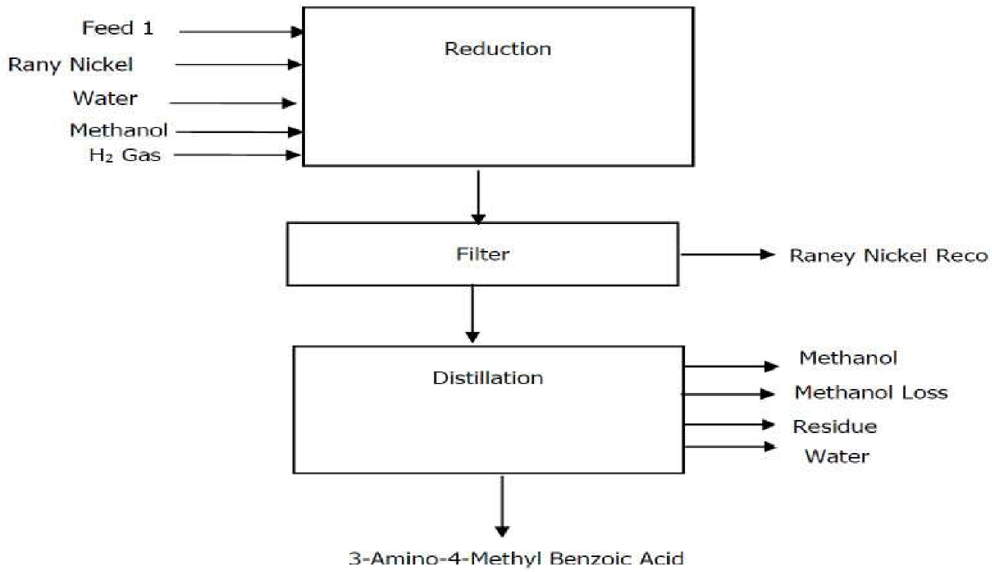
Process Description:

Reduction of 3-nitro-4-methyl benzoic acid by using catalyst raney nickel, in solvent methanol in presence of hydrogen gas to get product of 3-Amino-4-methyl benzoic acid.

Chemical Reaction:



Process Flow chart



Mass Balance:

Mass balance for 3-Amino-4-Methyl Benzoic Acid – INTPUT

S. No.	Input/MT of Product	
	Raw Materials	Quantity (MT)
1	3N4MBA	0.948
2	Rany Nickel	0.063
3	Water	0.063
4	Methanol	3.795
5	H_2 Gas	0.014
	Total	**4.883**

Mass balance for 3-Amino-4-Methyl Benzoic Acid – OUTPUT

S. No.	Output/MT of Product					Remarks
	Product	Waste water	Air Emission	Recovery/ Product	Solid Waste	
1	Rany Nickel			0.063		Recovered
2	Methanol Recovery			3.644		Solvent recovered
3	Methanol Loss		0.151			To atmosphere
4	Residue				0.025	To CHWIF
5	3 Amino 4- Methyl Benzoic Acid			1		Product
Total		**0**	**0.151**	**4.707**	**0.025**	
		4.883				

E. Details of Water Consumption and Wastewater Generation

Water will be supplied by Dahej GIDC and the product wise water and wastewater calculation are given in **Table E.1.** Details of water Consumption and wastewater generation is presented in **Table E.2.**

Table E.1 Product Wise Water and Wastewater Calculation

Products			Water input KL/MT	Waste water KL/MT	Water MAX KL/MT	Waste water MAX KL/MT	Production Capacity MT/Month	KL of water per month	KL of Waste water per month	KL of water per day	KL of Waste water per day
1	**Chlorination of Benzene & Toluene**	Benzyl Chloride	0.051	0	1.16	0	2000	2320	0	77.33	0
		2,6 Dichloro Phenol	0.475	0							
		2,4 Dichloro Phenol	0.489	0							
		2/4 Chloro Phenol	0.492	0							
		Benzyl Chloride/ Benzo Trichloride/ Benzal Chloride	0.051	0							
		p-Chlorobenzyl Chloride/ p-Chlorobenzal Chloride/ p-Chloro Benzotrichloride	0.051	0							
		o-Chlorobenzyl Chloride/ o-Chlorobenzal Chloride/ o-Chloro Benzotrichloride	0.051	0							
		Chloro Benzene/ Di Chloro Benzene	0.051	0							
		Mono Chloro Benzene (MCB)	0.76	0							
		Dichloro Benzene (DCB) (Ortho/Meta/Para)	1.16	0							
		Para Chloro Toluene/ Ortho Chloro Toluene	0.051	0							
2	**Chlorination of Acetic Acid**	Mono Chloro Acetic Acid	1.142	0	2.307	0	1500	3460.5	0	115.35	0
		Tri Chloro Acetyl Chloride	2.307	0							
3	**Hydrolysis of Chlorinated**	IsoPhthaloyl Chloride	0	0	0.575	7.125	1500	862.5	10687.5	28.75	356.25
		Phthaloyl Chloride	0	0							

Products			Water input KL/MT	Waste water KL/MT	Water MAX KL/MT	Waste water MAX KL/MT	Production Capacity MT/Month	KL of water per month	KL of Waste water per month	KL of water per day	KL of Waste water per day
	compounds	o-Chlorobenzaldehyde	0	5							
		p-Chlorobenzaldehyde	0	5							
		Benzyl Alcohol	0	7.125							
		o-Chloro Benzyl Alcohol	0	5.356							
		p-Chloro Benzyl Alcohol	0	5.356							
		Benzoyl Chloride	0	0							
		Benzaldehyde	0	5							
		2-Methoxy 5-Bromo 6-Methyl Benzoyl Chloride	0.23	0							
		2,4 Dichloro Benzoyl Chloride	0.345	0							
		4 Methyl Benzoyl Chloride	0.46	0							
		Propargyl Chloride	0.575	0							
		Pivaloyl Chloride	0.529	0							
		4-Chloro Butyryl Chloride	0.484	0							
		Terephthaloyl Chloride	0.253	0							
		N-Valeroyl Chloride	0.368	0							
		4-Chloro Benzoyl Chloride	0.264	0							
		3-Nitro Benzoyl Chloride	0.242	0							
		4-Nitro Benzoyl Chloride	0.241	0							
4	**Amines**	Primary Amines	1.07	1.81	1.07	1.81	1000	1070	1810	35.67	60.34
		Ethoxylation of Primary Amines	0.02	0							
5	**Nitro Compounds**	4-Chloro 3,5 Dinitro Benzoic Acid	3.545	0	4.354	0	1000	4354	0	145.13	0
		6, Nitro 3,4 Dichloro Aniline	4.354	0							
		4-Nitro, 5-Chloro, 2-Methyl Aniline	4.27	0							
		2-Nitro 4-Methyl Aniline	3.905	0							
		3, Nitro 4-Chloro Benzoic Acid	4.165	0							
		3-Nitro-para Toluic Acid	4.115	0							
		2,4 Dichloro 6 Nitro Phenol	4.13	0							

Products			Water input KL/MT	Waste water KL/MT	Water MAX KL/MT	Waste water MAX KL/MT	Production Capacity MT/Month	KL of water per month	KL of Waste water per month	KL of water per day	KL of Waste water per day
		2,3 Dichloro 4 Nitro Phenol	4.13	0							
		2,5 Dichloro 4 Nitro Phenol	4.13	0							
		1,3 Di Nitro Benzene	3.875	0							
		Nitro Benzene	2.816	0							
		2/3/4 Nitro Toluene	2.984	0							
		3,5 Di Nitro Benzoic Acid	2.89	0							
		p-Nitro Salicylic Acid	3.5	0							
		2,5 Dichloro Nitro Benzene	4.065	0							
		3,4/2,3 Dichloro Nitro Benzene	4.065	0							
6	**Hydrogenation Compounds**	3,4 Dichloro Aniline	0.066	0.36	0.08	0.479	500	40	239.5	1.33	7.98
		3-Iso Propoxy Aniline	0.066	0.384							
		o-Toluidine	0.067	0.408							
		m-Toluidine	0.071	0.294							
		p-Toluidine	0.067	0.308							
		Aniline	0.073	0.342							
		3,4 Diamine Toluene	0.08	0.354							
		2,5 Dimethyl 1,4 Phenylene Diamine	0.076	0.303							
		2, Chloro, 5-Methyl, 1,4 Phenylene Diamine	0.076	0.298							
		2, Chloro 1,4 Phenylene Diamine	0.071	0.189							
		2,5 Dichloro 1,4 Phenylene Diamine	0.071	0.189							
		2,4,5 Trichloro Aniline	0.064	0.322							
		6-Methyl 5-Amino Benzimidazolone	0.07	0.451							
		5-Amino Benzimidazolone	0.07	0.479							
		3-Amino 4-Chloro Benzoic Acid	0.065	0.353							
		3-Amino 4-Chloro	0.061	0.256							

Products			Water input KL/MT	Waste water KL/MT	Water MAX KL/MT	Waste water MAX KL/MT	Production Capacity MT/Month	KL of water per month	KL of Waste water per month	KL of water per day	KL of Waste water per day
		Benzotrifluoride									
		3-Amino Benzotrifluoride	0.066	0.378							
		3,5 Dichloro Aniline	0.064	0.346							
		2,5 Dichloro Aniline	0.062	0.2							
		2,3 Dichloro Aniline	0.062	0.36							
		3 Amino 4- Methyl Benzoic Acid	0.063	0							
									Total	**403.57***	**424.56****

Note:

*The water requirement in mass balance is considering the RO permeate (70% efficiency). Actual raw water requirement will be 580 KLD.

** Considering the RO reject (176 KLD) along with the industrial effluent generation from process will be 601 KLD.

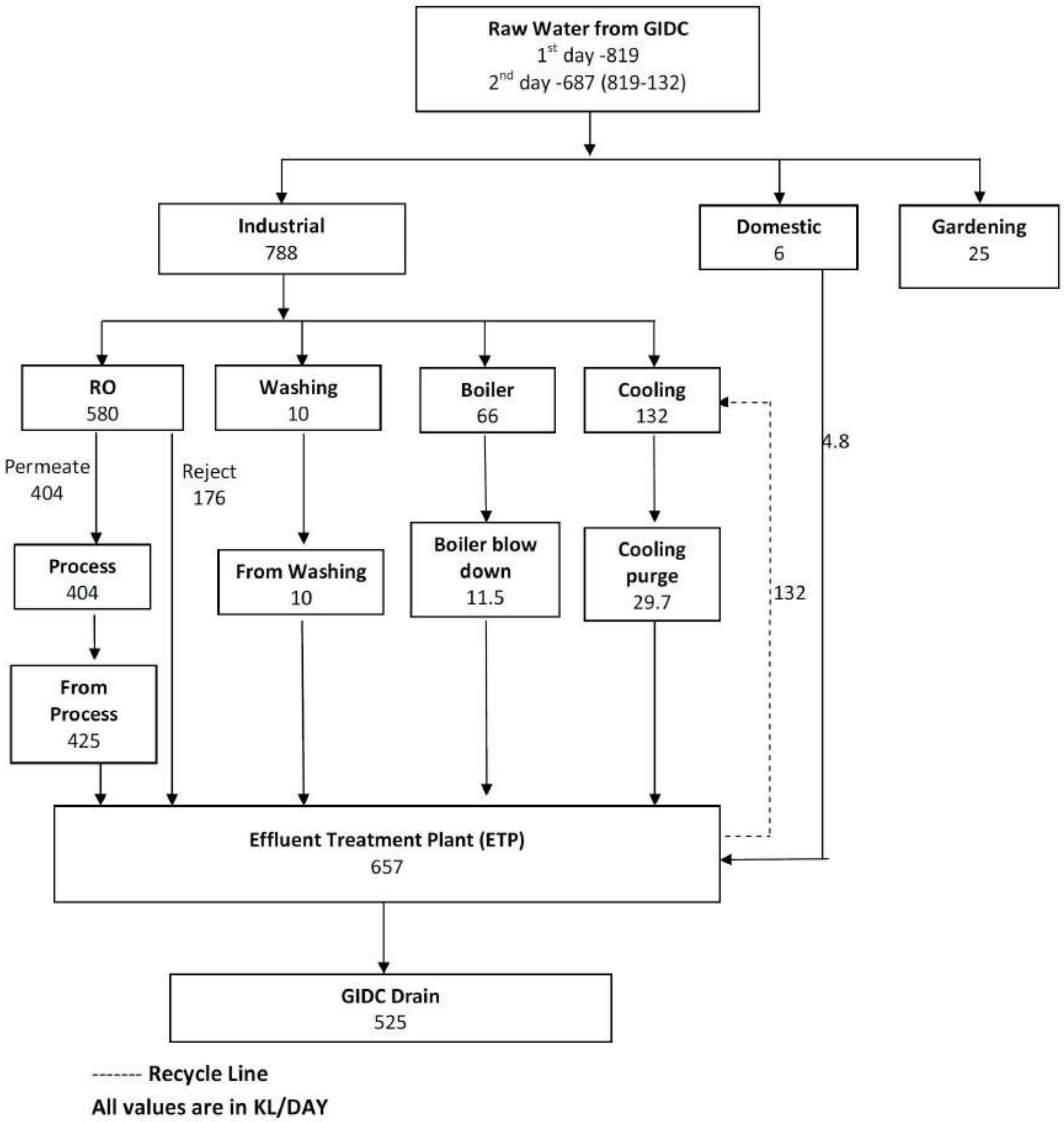
Table E.2: Details of Water Consumption & Wastewater Generation

Category	Water Consumption (KL/Day)	Wastewater Generation (KL/Day)	Remarks
(A) Domestic	**6**	**4.8**	Treated in ETP
(B) Gardening	**25**	**--**	--
(C) Industrial			
1. RO Water	580	176#	#RO Reject
Process	404*	425	*RO Permeate
2. Washing	10	10	
3. Boiler	66	11.5	
4. Cooling	132	29.7	
Total (C)	**788**	**652.2**	
TOTAL (A+B+C)	**819**	**657**	Treated in ETP
Reuse **	132	132	
Requirement from 2nd day onwards	**687**	**525**	Treated wastewater disposed to GIDC Drainage

***Treated wastewater will be reused back in cooling tower.*

WATER BALANCE DIAGRAM

Figure E.1: Water Balance Diagram



F. Effluent Management System

Domestic Effluent

- Domestic wastewater (4.8 KLD) generated will be treated along with industrial wastewater in an Effluent Treatment Plant (ETP).

Industrial Effluent

- The wastewater generating form:
  - Process (425 KLD)
  - RO Reject (176 KLD)
  - Boiler blow down (11.5 KLD)
  - Cooling purge (29.7 KLD) &
  - Washing (10 KLD)

will be treated in a proposed Effluent Treatment Plant having 700 KLD capacity.

Proposed ETP will have primary, secondary and tertiary treatment units. Treated effluent from ETP (132 KLD) will be reused for Cooling purpose. Remaining treated effluent from ETP (525 KLD) will be collected in final collection tank and disposed in to GIDC drainage system which ultimately leads to deep sea for final disposal through pipe line.

<u>Economic & Technical Viability of Effluent Treatment:</u>

(A) Treatment cost of effluent generated from Plant

ETP treatment cost –

Total Effluent to be treated in ETP = 657 KL/day

Considering avg. cost of ETP operation= Rs. 40/KL

Total ETP Cost (A) = 26,280 Rs. /day =Rs. 7,88,400/Month

Total cost of wastewater treatment = Rs 7,88,400/Month

(B) Savings of water reused per day

Savings of water reused = 132 KLD x Rs. 20/KL = Rs. 2640 /day

Monthly Savings of water reused = Rs. 79,200 /month

Overall effective cost of advanced wastewater treatment will be

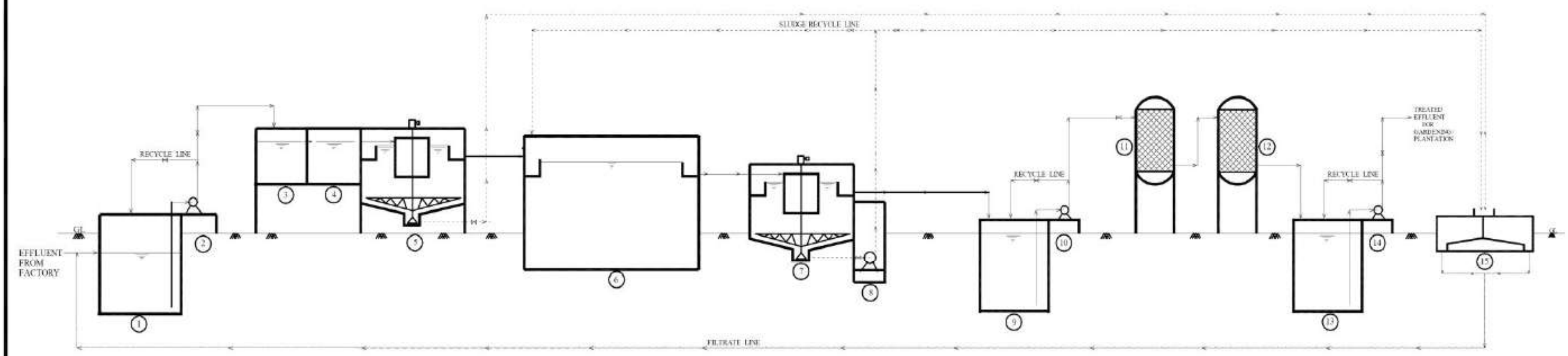
Effective Cost of W/W treatment = 7,88,400-79,200= Rs 7,09,200/month

Production Capacity= 7,500 MT/month

Effective Cost of W/W treatment per Kg of Product = Rs. 0.094/Kg of Product

Which is nominal additional cost for such activity & unit is ready to bear this amount

Figure F.1: Schematic Flow Diagram of ETP



NO	DESCRIPTION	NO	DESCRIPTION
1	EQUALISATION TANK	9	HOLDING TANK
2	EFFLUENT PUMP	10	HOLDING TANK PUMP
3	FLASH MIXING TANK	11	PRESSURE SAND FILTER
4	NEUTRALIZATION TANK	12	ACTIVATED CARBON FILTER
5	PRIMARY CLARIFIER TANK	13	TREATED EFFLUENT WATER STORAGE TANK
6	FIRST AERATION TANK	14	TREATED EFFLUENT WATER STORAGE TANK PUMP
7	SECONDARY CLARIFIER TANK	15	SLUDGE DRYING BEDS
8	SLUDGE PUMP		

NOTES :

* ETP DESIGN IS FOR **7,00,000** LITERS OF EFFLUENT / DAY

PROJ.NO.:	CLIENT : AMULIS FINECHEM PVT. LTD.
DRG.NO. : 01	
DATE : 09.09.20	DRAWING : SCHEMATIC FLOW DIAGRAM OF EFFLUENT TREATMENT PLANT
SCALE : NTS	
DRN. : A.R.Zala	ANAND ENVIRONMENTAL CONSULTANTS PVT. LTD.
CHD. :	

G. Details of Solvents

Details of Solvent used and its proposed recovery system is given in **Table G-1**

Table G-1: Details of Solvents used and it's Recovery Plan

Sr. No	Name of Solvent	Consumption MT/Month	Recovery	Means of Storage	Recovery Plan
1	Methanol	2307	96-97%	MS tank, Under ground	Distillation

The unit will provide solvent recovery system/distillation for the recovery of solvent. The solvent will be recovered and reused back in manufacturing process. The solvent will be recovered through distillation process. The distillation is a process where because of difference in boiling point solvent will be recovered. The unit will have distillation units in their respective plants. For Methanol recovery, separate distillation reactor having feed tank, preheater, distillation column, two overhead condensers, reboilers, coolers and recovered solvent storage tank will be provided.

H.Power, Fuel Consumption and Expected Emissions

Power consumption details for the project activity are given in **Table H.1** and details of Fuel consumption and Air emission and Air Pollution Control Measures (APCM) are presented in **Table H.2.**

Table H.1: Details of Power Consumption

Sr. No.	Source of Power	Quantity
1	DGVCL	2.0 MW
2	D.G.Set*	250 KVA

Note:*for emergency purpose only*

Table H.2: Details of Fuel, Air emissions and APCM

- **Details of Fuel :**

Sr. No.	Type of Fuel	Quantity
1	Coal	40 MT/day
2	HSD	50 L/hr

- **Flue gas emission stack:**

Sr. No.	Stack attached to	Height of stack from ground level (m)	Expected emission (as per CPA)	Air pollution control equipment
1	Boiler (5 TPH)*	30	SPM<150 mg/Nm^3 SO_2 <100 ppm NOx<50 ppm	Multi Cyclone Separator & Bag Filter
2	Thermic Fluid Heater (20 Lakh Kcal/Hr.)			Multi Cyclone Separator & Bag Filter
3	D.G. Set**(250 KVA)	11		Not Applicable

Note

**It may be noted that we also plan to purchase steam from our adjoining unit as and when it is available. This is to reduce the actual coal consumption in our unit.*

***for emergency purpose only*

❖ **Process gaseous emissions stack / vents :**

Sr. No.	Vent attached to	Height of stack from ground level (m)	Stack Diameter (m)	APCM	Expected Pollutants
1	Reactor in MCA plant	15	0.2	Caustic and Water Scrubber	HCl Cl_2
2	Chlorination Reactor in TCAC plant	15	0.2	Caustic and Water Scrubber	
3	CAC reactor in TCAC plant	15	0.2	Caustic and Water Scrubber	
4	Benzene Chlorination Reactor	15	0.2	Caustic and Water Scrubber	
5	Toluene Chlorination Reactor	15	0.2	Caustic and Water Scrubber	

I. Details of Solid / Hazardous Waste Management

All the Hazardous waste generated by manufacturing facility is to be disposed as per Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016. Details of hazardous waste generation and proposed mode of disposal are given in **Table I.1.**

Table I.1: Details of Solid/Hazardous Waste Management

Sr. No.	Type of Waste	Waste Category	Quantity per Month	Mode of Disposal
1.	Used / Spent Oil	5.1 of Sch-1	140 Litres/Year	Disposal by reuse/ selling to registered re-refiner.
2.	Process Residue	28.1 of Sch-1	600 MT/Year	Disposal at CHWIF/sent for co-processing.
3.	Spent Catalyst	28.2 of Sch-1	40 MT/Year	Disposal at TSDF/sent back for regeneration OR reactivation to supplier.
4.	Carbon Waste	28.3 / 36.2 of Sch-1	2,504 MT/Year	Disposal at TSDF/ sent for co-processing.
5.	Discarded Container/ Liners/Bags	33.1of Sch-1	7,800 Nos./Year	Disposal by reuse/ selling to authorized recycler.
6.	ETP Sludge	35.3 of Sch-1	475 MT/Year	Disposal at TSDF.
7.	Sodium Hypochlorite	Class B-7 of Sch-II	22,110 MT/Year	Disposal by selling to actual end users.

Sr. No.	Type of Waste	Waste Category	Quantity per Month	Mode of Disposal
8.	Spent Acid	Class B-15 of Sch-II	68,232 MT/Year	Disposal by selling to actual end users/utilized in mfg. of Gypsum.
9.	Hydrochloric Acid	Class B-15 of Sch-II	98,874 MT/Year	Disposal by selling to actual end users.

Other wastes like E-Waste and Battery Waste (if any) will be managed as per E-Waste (Management) Rules, 2016 and Batteries (Management and Handling) Amendment Rules, 2010 as well asMoEFCC Notification /CPCB guidelines.

CHAPTER 3

Greenbelt Development Plan

3. Green Belt Development Plan

Following parameters have been considered to design green belt:

A. Selection of Plant Species

The main limitation for plants to function as scavenger of pollutants are, plant's interaction to air pollutants, sensitivity to pollutants, climatic conditions and soil characteristics. While making choice of plants species for cultivation in green belts, due consideration has to be given to the natural factor of bio- climate. Xerophytes plants are not necessarily good for greenbelts; they with their sunken stomata can withstand pollution by avoidance but are poor absorber of pollutants.

Character of plants mainly considered for affecting absorption of pollutant gases and removal of dust particle are as follows:

- **For absorption of Gases:**
  1. Tolerance towards pollutants in question, at concentration, that is not too high to be instantaneously lethal
  2. Longer duration of foliage
  3. Freely exposed foliage
  4. Adequate height of crown
  5. Openness of foliage in canopy
  6. Big leaves (long and broad laminar surface)
  7. Large number of stomata apertures

- **For Removal of Suspended Particular matter:**
  1. Height and spread of crown.
  2. Leaves supported on firm petiole
  3. Abundance of surface on bark and foliage
  4. Roughness of bark
  5. Abundance of auxiliary hairs
  6. Hairs or scales on laminar surface
  7. Protected Stomata

B. Guidelines for Plantation

The plant species identified for greenbelt development can be planted using pitting technique. Width of the green belt in the available land area may prove difficult for many industries to attain for one or more reasons. Hence it can be decided to have green belt in places available around the industry (source oriented plantation) as well as around the nearby habituated area (receptors oriented plantation).

The choice of plants for green belt should include shrubs and trees. The intermixing of trees and shrubs should be such that the foliage area density in vertical is almost uniform.

The pit size has to be either 45 cm x 45 cm x 45 cm or 60 cm x 60 cm x 60 cm. bigger pit size will be considered at marginal and poor quality soil. Soil used for filling the pit should be mixed with well decomposed farm yard manure or sewage sludge at the rate of 2.5 kg (on dry weight basis) and 3.6 kg (on dry weight basis) for 45cm x 45 cm x 45 cm and 60 cm x 60 cm x 60 cm size pits respectively. The filling of soil has to be completed at least 5-10 days before actual plantation. Healthy sapling of identified species should be planted in each pit with the commencement of monsoon.

The trees and shrubs selected from the above mention list based on its availability shall be planted.

C. Greenbelt within Project Boundary

Total greenbelt area of 9,950 sq.m. has been allotted for greenbelt development which is including lawn as well as tree covered area within project boundary. Considering 5 trees per 200 sq.m. of plot area plantation of 800 plants of suggested species with about 3 m radius around each tree will be done. Plantation will be carried out around periphery, near/ around built-up areas and along internal roads of the project area**.**

Table C.1 Plant Species Suggested for Greenbelt and Landscaping at Various Locations.

<table>
<tr><th>Sr. No</th><th>Scientific Name</th><th>Common Name</th><th>Ecological performance</th><th>Type</th><th>Location of Plant</th></tr>
<tr><td>1.</td><td>Aegle marmelos</td><td>Bel</td><td>CN, DC</td><td>Evergreen</td><td>A, C</td></tr>
<tr><td>2.</td><td>Azardirachta indica</td><td>Neem</td><td>CN, OGE, DC</td><td>Evergreen</td><td>A, B, C</td></tr>
<tr><td>3.</td><td>Delbergia sissoo</td><td>Shesham</td><td>DC, DR, FR</td><td>Evergreen</td><td>A, B, C</td></tr>
<tr><td>4.</td><td>Ficus bengalensis</td><td>Banyan, Vad</td><td>CN, DC</td><td>Evergreen</td><td>B</td></tr>
<tr><td>5.</td><td>Ficus religiosa</td><td>Peepal</td><td>CN, OGE, DC</td><td>Evergreen</td><td>B</td></tr>
<tr><td>6.</td><td>Syzygium cumini</td><td>Jamun, Jambu</td><td>CN, DC</td><td>Evergreen</td><td>B,A</td></tr>
<tr><td>7.</td><td>Tamarindus indica</td><td>Emali</td><td>CN, OGE, DC</td><td>Evergreen</td><td>B</td></tr>
<tr><td>8.</td><td>Morus alba</td><td>Shetur</td><td>DC</td><td>Evergreen</td><td>B</td></tr>
<tr><td>9.</td><td>Prosopis cineraria</td><td>Khejri</td><td>--</td><td>Evergreen</td><td>B</td></tr>
<tr><td>10.</td><td>Terminalia arjuna</td><td>Arjun</td><td>CN, OGE, DC</td><td>Evergreen</td><td>B</td></tr>
<tr><td>11.</td><td>Anona squamosa</td><td>Sitafal</td><td>DC</td><td>Evergreen</td><td>A,C</td></tr>
<tr><td>13.</td><td>Nerium indicum</td><td colspan="4" rowspan="4">Landscaping: these species will be planted with in interspaces of trees at various locations like along road side, around built-up areas and around outer boundary of the project area (not near to fire prone places)</td></tr>
<tr><td>14.</td><td>Lawsonia inermis</td></tr>
<tr><td>15.</td><td>Hibiscus rosa-sinensis</td></tr>
<tr><td>16.</td><td>Thevetia peruviana</td></tr>
<tr><td colspan="6">Ecological performance: CN –Control Noise level, OGE – Absorb Gas Emission (Sexena 1991)13 and (Abbasi & Khan 2000)14, DC - Dust Controller (CPCB 2007)15.
Location of Plant: A-Around built-up area, B-on Periphery / Boundary, C-Along internal road</td></tr>
</table>

D. Budget Allocation for Greenbelt within Project Site

Greenbelt around the project site will be developed with in initial four years. Detailed budget break-up is given in **Table D.1**

Table D.1 Budget for Proposed Greenbelt Development within Project Site

Work or Activity	1st year	2nd year	3rd year	4th year	Budget (INR)
Within Project Site, totally 800 saplings will be planted (Approx. Cost @ Rs. 100 per sapling / plant)					
Trees	200	200	200	200	80,000
Amount	20,000/-	20,000/-	20,000/-	20,000/-	
Lawn	1,20,000/-				1,20,000
				Total Budget	**2,00,000/-**

CHAPTER 4

Energy Conservation Plan

4. Energy Conservation Plan

M/s. Amulis Finechem Pvt. Ltd. has explored the possibilities of resource conservation through the use of renewable energy to the maximum extent possible.

The calculation of Solar Energy from Rooftop Solar Panels is shown in **Table A.1**

Table A.1: Solar Power Calculation

Particular	
Open Roof Top Area	6100 m²
60% of Open Roof Top Area	3660 m²
Roof Top Area Available For Panel After Leaving Out ≈ 1.5 m Pathway Around The Panel (A)	3306 m²
Footprint of a Solar Panel @150 W solar panel (B)	1.48 m x 0.67 m=0.99 m²
Number of Solar Panels Required(C = A/B)	3340
Power Generation Through One Panel (D)	150 W
Total Power Generation per hour W(C x D)	501000
Total Power Generation per hour [KW] (E=CxD/1000)	**501**
Solar radiation available (5 peak sun-hours per day)(F)	5 hrs. /day
Energy output units(G= E x F)	2505 kWh/day
Saving @Cost of Rs.7 per 1 kWh (G x Rs.7 per 1 kWh x 30)	**5,26,050/- per month**
Estimated Cost Of The Solar Power System Per kW (J)	Rs. 50,000 per kW
Total Estimated Cost Of The Solar Power System (E x J)	**2,50,50,000/-**

Table A.2: Resource Conservation

Particulars	Resource Conservation
Energy	Company will utilize CFL lights within the industrial premises.
	Industry will use solar power of 0.50 MW from total 2.0 MW.
	Industry will explore the use of wind energy for any future increase in requirement.
Water	Partly treated water from ETP will be reused for cooling tower make up.

Table A.3: Energy Conservation Activities

Focus area	Energy conservation activities
With respect to processing	✓ Producing compressed air is expensive. Over time distribution systems will develop leaks that are often undetected for long periods. Losses can amount to 50% of compressor output. Therefore, regular repairing will be done to prevent leaks from pipes, glands, seals and gaskets which significantly reduced energy costs. ✓ Compressed air is always more expensive to produce and should never be the first choice for unit operations requiring movement or power.Energy costs will be reduced by using alternative processes for mixing liquids and solids in tanks. Wherever possible reduce the use of compressed air by switching to higher efficiency electric motors fitted with Variable Speed Drives (VSDs).

Focus area	Energy conservation activities
	✓ High vacuum levels are seldom required for processes. Batch processing can cause severe swings in demand for steam, with substantial swings in boiler output, thus reducing boiler efficiency. Heat recovery is significantly reduced. Therefore examining and scheduling will improve the scope for heat recovery.
With respect to distillation	✓ Fouled or plugged trays and operating outside design criteria can increase energy use. To reduce energy consumption periodical cleaning and maintenance of trays and heat exchanges will be improved. ✓ Modern instrument systems can significantly reduce energy consumption, whilst maintaining column stability. On- stream analyzers will be considered for systems such as feed forward control and material balance controls.
With respect to evaporation	✓ Pressures can be affected by loss of vacuum and line restrictions, including fouling. As pressure rises in the system, the boiling point of the solution rises and additional steam is used to maintain capacity. Correct designed pressure will be maintained to optimize thermal efficiency. ✓ Feed-water composition will be checked is as concentrated as possible. The quantity of water evaporated is the main factor affecting energy consumption. Up-steam adjustments may give a higher feed concentration and result in lower energy use. ✓ Check the system regularly for water leaks. If water enters the process side thermal efficiency will decrease. Possible sources of water include corroded heat exchangers, pump seals and leaking valves for water connections used to flush out and clean the system between batches. ✓ Vapor recompression can significantly reduce energy costs, but requires a careful analysis of operating conditions including boiling point rise and requires steam temperatures and pressures.
With respect to drying	✓ Drying is a major consumer of energy. Therefore monitoring of drying operations enables energy consumption will be assessed and possibly reduced. ✓ Heat losses from dryers by radiation and convection will be minimized by improving the insulation of dryers will save energy costs. ✓ Routine cleaning and maintenance programmes for the combustion system will improve efficiency and reduce energy costs. ✓ Uses of batch drying could consider changing to a continuous drying process. ✓ Check if it is possible to use heat recovered from the dyer exhausts in the drying process.
Others	✓ Gravity flow shall be preferred wherever possible to save pumping energy. ✓ Technically feasible, energy efficient equipments like motors, pumps, air conditioning systems shall be selected to the maximum extent possible. ✓ Automatic switching system for lighting & water tank pumping. ✓ Provision of day light roof to utilize maximum natural light in the production plant instead of electrical lighting. Energy efficient devices and appliances conforming to the Bureau of Energy Efficiency norms shall be installed ✓ Energy conservation measures shall include use of electronic lighting system, use of CFL tubes to minimize energy use, use of programmable timers for pumping system and lighting, water level controllers for water pumps, centralized cooling ✓ The energy audit shall be conducted at regular intervals and the recommendations of the audit report shall be implemented.

CHAPTER 5

Health & Medical Plan

5. Health and Medical Plan

- To minimize the adverse health effects all necessary/ suitable personnel protective equipments like helmet, safety goggles, gum boots, earmuff/ear plug and safety belt etc will be provided for working personnel.
- All suggested/proposed pollution control devices/measure should be installed and operated / maintained properly on regular basis.
- All precautionary methods will be adopted by the company as well unit is also committed towards the Health & Safety of workers and will provide a facility of pre-medical check-up of employees for detecting any kind of adverse effect on the health of employee due to the chemical or work place condition and providing opportunity to improve the working condition.
- The workers exposed to higher noise level will be provided with ear muffs/ear plugs. The workers exposed to higher noise level will be provided with ear muffs/ ear plugs. Proper handling of the materials and the maintenance of Material Safety Data Sheet (MSDS) will be followed to ensure safety within the plant area.
- Drinking water supply for the employees will be provided by the project proponent and the standard of the drinking water will be as per guidelines. Proper sanitary facilities will be made available by the project proponent so that employees do not suffer from any health ailments. The employees will be made aware of general practices sanitary practices.
- Periodical training programme to inform the employees about their task, associated risk, and safe – working practices will be undertaken. Training will also include information on accident prevention, proper control and maintenance of equipment and safe material handling practices. To refresh the academic and skill improvement as per management requirement, induction training and external training will be provided to fresher's with respect to "Industrial Safety & Health Training".
- Onsite-offsite emergency plan/disaster management plan will be developed as per the suggestion made in Risk Assessment Study. A regular monitoring of the occupational Health and Safety will reduce the chances of accidents hence all the records of job related accidents and illness will be maintained as per the requirement of Gujarat Factory Act. This information will be reviewed and evaluated to improve the effectiveness of Environmental Health and Safety programme.
- Occupational Health Centre will be provided in Admin Building and all the required anti-dotes will be stored at site.
- Factory medical officer certified for industrial health will be appointed on casual basis.

- Regular inspection will be carried out for the safety procedures and use of PPEs &safety equipment/material. First Aid Box will be provided at all necessary places of the plant.
- Premedical examination and periodical examination will be carried out once in a six month and record will be maintained in Form No-32 & 33 &regular work place monitoring will be carried out in Form-37 and maintained as per GFR.

CHAPTER 6

Risk Assessment

AMULIS FINECHEM PVT. LTD.

Plot No. D2-CH/6, GIDC Estate, Dahej-II,
Tal.-Vagra, Dist.-Bharuch, Gujarat.

RISK ASSESSMENT STUDY

(Proposed for production of Synthetic Organic Chemicals & Chemical Intermediates)

December -2020

PREPARED BY:-

VAIBHU SAFETY CONSULTANTS

FF 10-11, Akshat Complex,
Nr. Reliance petrol pump,
High Tension Road, Subhanpura,
Vadodara-390023
Phone: 9825756467 / 8980004562(M)/ 0265-2395798(O)
Email: info@vaibhusafety.com
Web site: www.vaibhusafety.com

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RISK ASSESSMENT STUDY

(Proposed for production of Synthetic Organic Chemicals & Chemical Intermediates)

December -2020

PREPARED BY:	***VERIFIED BY:***	***APPROVED BY:***
Mr. Deepak Chanchad **VAIBHU SAFETY CONSULTANTS** FF-10 & 11, Akshat Complex, Nr. Reliance Petrol Pump, High Tension Road, Subhanpura, Vadodara-390 023 Phone: 9825756467 (M) Email : info@vaibhusafety.com	(Factory Manager)	(Occupier)

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DISCLAIMER

This report is prepared by **M/s. Vaibhu Safety Consultants (VSC)**. This report is prepared for **M/s. Amulis Finechem Pvt. Ltd.,** Located at Plot No. D2-CH/6, GIDC Estate, Dahej-II, Tal.-Vagra, Dist.-Bharuch, Gujarat. The material in it reflects VSCs best judgement in the light of the information available and provided to it at the time of preparation. However, as VSC cannot control the conditions under which this report may be used, VSC will not be responsible for damages of any nature resulting from use of or reliance upon this report. VSC's responsibility for advice given is subject to the terms of engagement with Amulis Finechem Pvt. Ltd.

Executive Summary: -

M/s. Amulis Finechem Pvt. Ltd. had appointed to M/s Vaibhu Safety Consultants (VSC) to conduct Risk Assessment study of their manufacturing unit to be located at **Plot No. D2-CH/6, GIDC Estate, Dahej-II, Tal. -Vagra, Dist.-Bharuch, Gujarat**.

Based on the data furnished and the study of the installation, certain hazards have been identified and their consequences are modeled mathematically using DNV **PHAST- SAFETI 8.22 and HAMSGAP** software. Mapping of various scenario are with hazardous distances and safe distances are drawn on site plan for easy understanding of the consequences of the accident/ incident.

The study indicates that possible hazards associated with the plant are confined to (a) PESO 20 KL Road Tanker Unloading Point (b) Phenol 50 KL Storage Tank (c) Acetic Acid 50 KL Storage Tank (d) SMC 50 KL Storage Tank (e) Pyridine 1 KL Storage Tank (f) Chlorine Gas Long Pipeline Rupture (g) Chlorine 900 Kg Tonner Rupture (h) Hydrogen Gas Long Pipeline Rupture.(i) Ethylene Oxide Bullet (j) Ammonia 50 KL Bullet.The results of the analysis have been summarized in the table appended.

The results of the analysis have been summarized as below.

6.1 Conclusion:

Jet Fire

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Short Pipe Ruptureat dispersion fo**r** at **37.5Kw/M^2**, **14.21 meter** at **12.5 Kw/M^2** and **17.98 Meter** at **4.0 Kw/M^2.**

Pool Fire

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Acetic Acid 50 KL Storage Tank Catastrophic Rupture at dispersion of **28.68 meter** at **37.5Kw/M^2**, **77.97 meter** at **12.5Kw/M^2** and **156.2 Meter** at **4.0Kw/M^2**.

Flash Fire Cases

The highest damage distances for flash fire are for isolatable is Scenario of Ethylene Oxide Bullet - Catastrophic Rupture at 1.5F weather condition. The maximum damage distance for Flash Fire is **133.9(3.0 % LEL) &174.0 meter (1/2 LEL)** – 1.5F of whether condition. UFL is defined as burning zone, which means people caught within the burning zone are exposed to a fatality rate of 100%.

Late Explosion Worst case - UVCE

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Catastrophic Rupture dispersion of **223.7 meter** at **0.2068 bar**, **244.9 meter** at **0.1379 bars** and **645.3 meter** at **0.02068 bar**.

Fireball

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Catastrophic Rupture dispersion of **75.52 meter** at **37.5 Kw/M^2**, **145.7 meter** at **12.5 Kw/M^2** and **258.5 Meter** at **4.0 Kw/M^2**.

BLEVE

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Catastrophic Rupture dispersion of **16.78 meter** at **0.2068 bar**, **21.21 meter** at **0.1379 bar** and **87.69 meter** at **0.02068 bar**

Maximum Concentration Footprint

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide 50 MT bullet Catastrophic Rupture at dispersion of **249.4 meter** at **4443 ppm (LC-50 for human)**, **278.1 meter at 800 ppm (IDLH), 571.4 meter** at **500 ppm (ERPG-3)** and **2442 meter** at **50 ppm (ERPG-2).**

Conclusion Based on the

Risk Analysis study and information regarding the layout plan and safety systems provided by the company management.

Discussions with company officials.

CHAPTER II

OBJECTIVE, PHILOSOPHY AND METHODOLOGY OF RISK ASSESSMENT

2.1 Objective:

The main objectives of the Risk Assessment (RA) study is to determine damage due to major hazards having damage potential to life & property and provide a scientific basis to assess safety level of the facility.

The principal 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.

2.2 Philosophy:

This report is limited to the following:

- Identification of major risk areas.
- Hazard identification/Identification of failure cases
- Consequential analysis of probable risks / failure cases
  - Evaluation of heat radiation & pressure wave profiles for identified failure cases
  - Risk assessment on the basic of the above evaluation & risk acceptability
  - Minimum preventive & protective measures to be taken to minimize risks to maximum possible extent.
- Giving pointers for effective disaster management
- Suggesting other measures to further lower the probability of risk

2.3 Methodology

The procedure used for carrying out the Quantitative Risk Assessment Study is outlined below:

Identify Credible Loss Scenarios for the facility under the study by discussion with **M/s. Amulis Finechem Pvt. Ltd.,** Simulate loss Scenarios to determine the vulnerable zones for, pool fire, BLEVE simulation using software packages **DNVPHAST SAFETI-8.22 and HAMSGAP.**

Suggest mitigating measures to reduce the damage, considering all aspects of the facilities. The flowchart of the methodology for the present study is shown in following page.

RISK ASSESSMENT STUDY METHODOLOGY FLOWCHART

START

↓

FACILITY, PROCESS AND METEOROLOGICAL DATA COLLECTION

↓

LISTING OUT OF HAZARDOUS OPERATIONS & STORAGE DETAILS

↓

IDENTIFICATION OF FAILURE SCENARIOS & QUANTIFICATION OF PROBABLE HAZARDS ASSOCIATED WITH THEM

↓

DEFINING OF PARAMETERS FOR EACH OF CHEMICALS & EACH OF HAZARDS

↓

DEFINING RELEASE TYPE (CONTINUOUS OR INSTANTANIOUS) & DETERMINE RELEASE RATES

↓

SIMULATION OF SELECTED CASES FOR CONSEQUENCE MODELING

↓

PREPARATION OF SUMMERY OF CONSEQUENCE RESULTS

↓

EVALUATION OF POTENTIAL RISK TO THE SURROUNDING POPULATION

↓

DISCUSSION & RECOMMENDATION OF MITIGATIVE / REMEDIAL MEASURES

↓

END

SECTION III

INTRODUCTION OF THE UNIT

3.1 COMPANY INTRODUCTION: -

M/s. Radha Madhav Processors Pvt. Ltd. now intends to split and transfer the stated EC to **M/s. Amulis Finechem Pvt. Ltd.** for production of Synthetic Organic Chemicals under category 5(f) & 5 (b) at **Plot No. D2-CH/6**, GIDC Estate, Dahej-II, Tal.-Vagra, Dist.-Bharuch, Gujarat.

The total estimated cost of the project is 74 Crore out of which Rs. 7.205 Crores allocated for Environment Management System including 1.48 Crore for social development/ welfare activities under CER programs. Total employment generation for proposed project would be approximately 120 during operation phase.

3.2 PROJECT SETTING:

Table: 3.1

S.N.	Description	Latitude	Longitude
A	NW corner of project site	21°43'32.45" N	72°36'59.55" E
B	SW corner of project site	21°43'28.84" N	72°36'59.86" E
C	SE corner of project site	21°43'29.20" N	72°37'08.60" E
D	NE corner of project site	21°43'32.94" N	72°37'08.28" E

FIGURE 3.1: HAZARDOUS AREA IDENTIFICATION

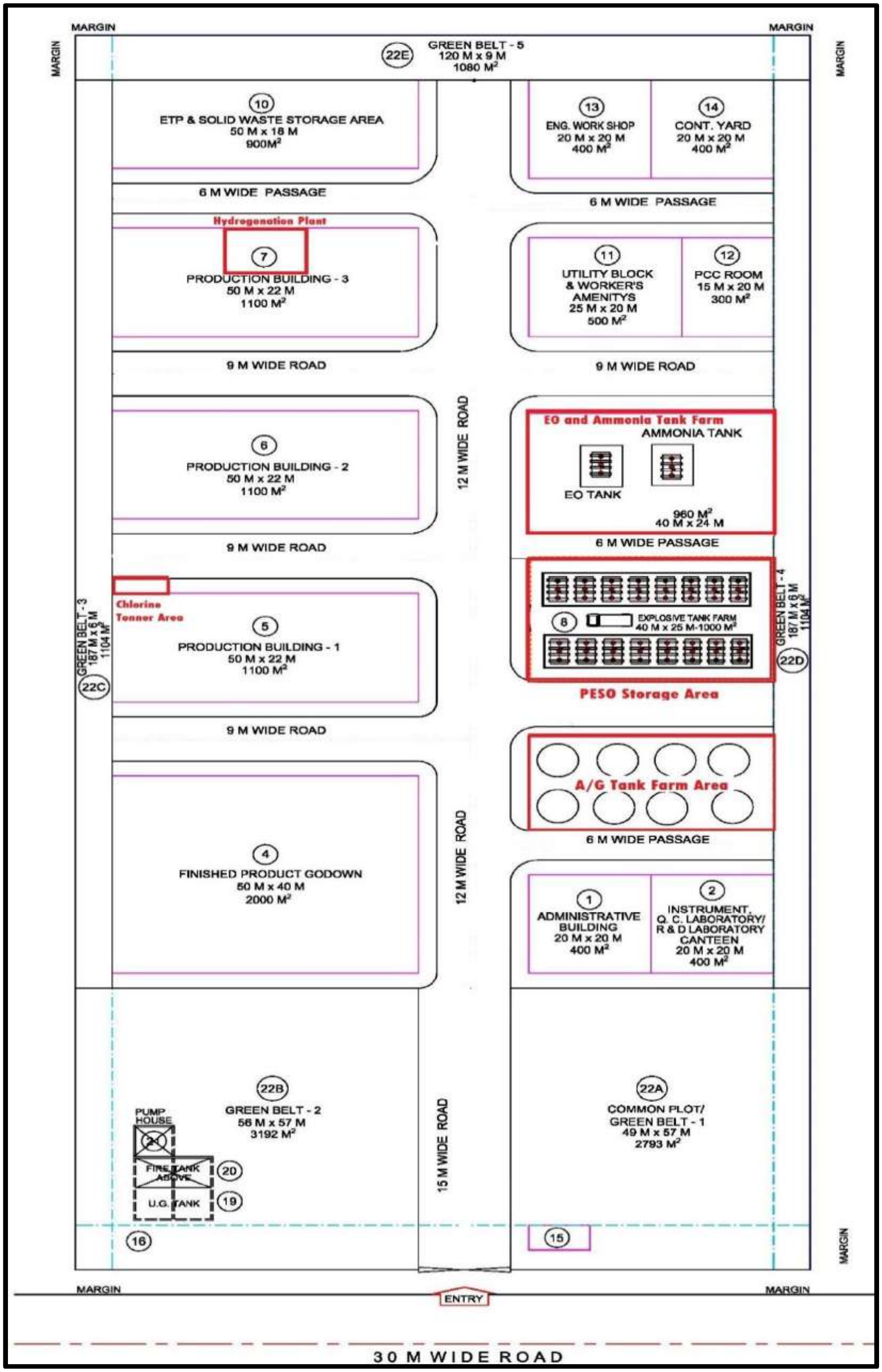
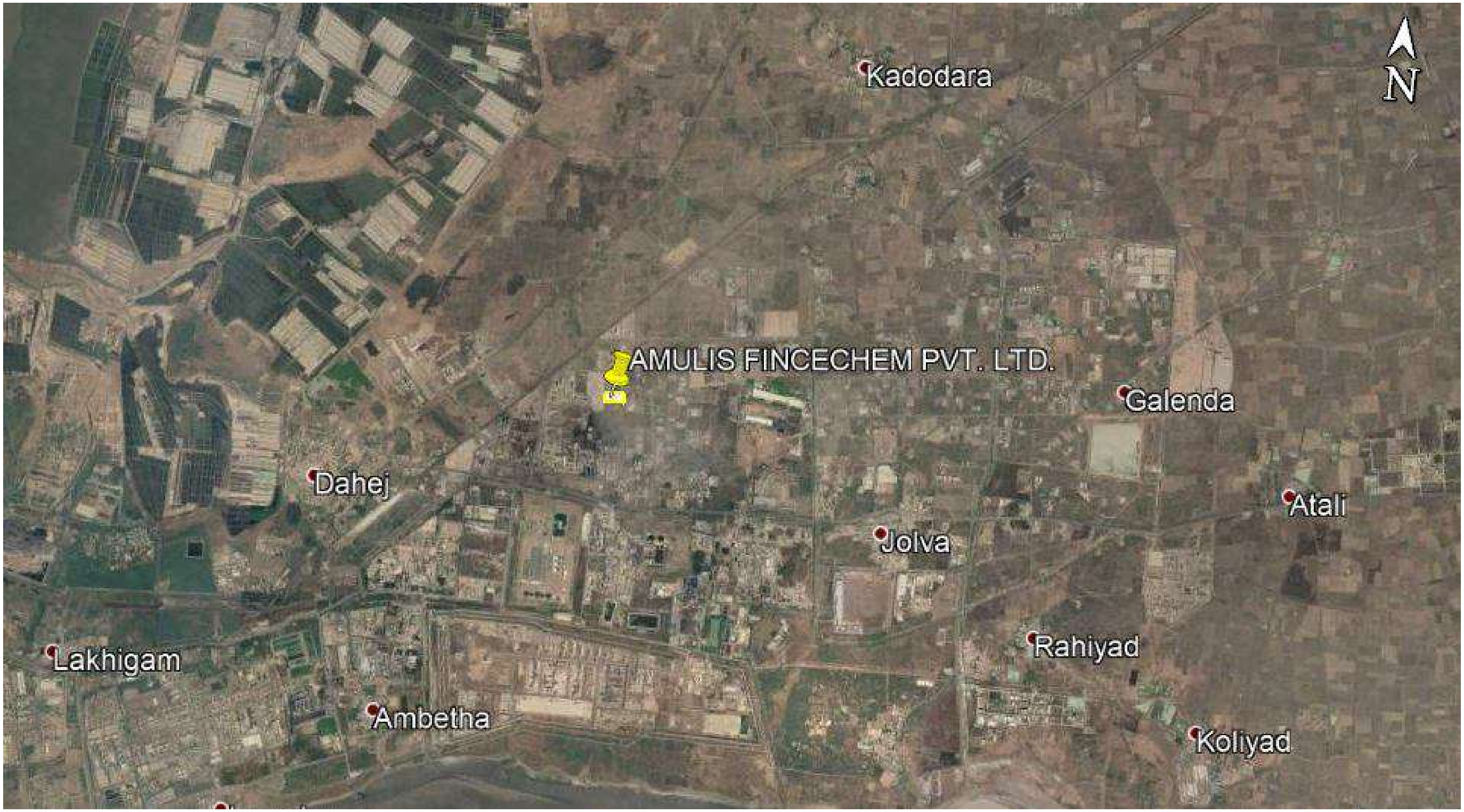


FIGURE 3.2: Google image of the project site



3.3 LIST OF PROPOSED FINISHED PRODUCT-

TABLE: 3.2

Sr. No.	Common Name	Product	Production (MT/ Month	Physical State	Means of Storage	Capacity of Storage Tank/ Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
1	Chlorination of Benzene and Toluene and Phenol	Benzyl chloride	2,000	Liquid	SS AG Tank	100 kL	2	200
		2,6 dichloro phenol		Solid	HDPE Bags	50 Kg	2660	133
		2,4 dichloro phenol		Solid	HDPE Bags	50 Kg	2660	133
		2/4 Chloro Phenol		Solid	HDPE Bags	50 Kg	2660	133
		Benzyl chloride		Liquid	SS AG Tank	100 kL	2	133
		Benzo Trichloride		Liquid	SS AG Tank	100 kL	2	200
		Benzal chloride		Liquid	SS AG Tank	100 kL	2	200
		P-chorobenzylchloride		Solid	HDPE Bags	50 Kg	2660	133
		P-chorobenzalchloride		Solid	HDPE Bags	50 Kg	2660	133
		P-chloro benzotrichloride		Solid	HDPE Bags	50 Kg	2660	133
		o-chorobenzylchloride		Liquid	SS AG Tank	100 kL	2	200
		o-chorobenzalchloride		Liquid	SS AG Tank	100 kL	2	200
		o-chloro Benzotrichloride		Liquid	SS AG Tank	100 kL	2	200
		Mono chloro benzene		Liquid	SS AG Tank	100 kL	2	200
		Meta Dichloro Benzene		Liquid	SS AG Tank	100 kL	2	200
		Ortho Dichloro Benzene		Liquid	SS AG Tank	100 kL	2	200
		Para Dichloro Benzene		Solid	HDPE Bags	50 Kg	2660	133
		Para Chloro Toluene		Liquid	SS AG Tank	100 kL	2	200
		Ortho Chloro Toluene		Liquid	SS AG Tank	100 kL	2	200
2	Chlorination of Acetic Acid	Mono Chloro Acetic Acid	1,500	Solid	HDPE Bags	50 Kg	2000	100
		Tri Chloro Acetyl Chloride		Liquid	MS AG Tank	50 kL	2	100
3	Hydrolysis of Chlorinated	Iso phthaloyl chloride	1,500	Liquid	MS AG Tank	50 kL	2	100
		Phthaloyl chloride		Liquid	SS AG Tank	100 kL	1	100
		O-chlorobenzaldehyde		Solid	HDPE Bags	50 Kg	2000	100
		P-chlorobenzaldehyde		Solid	HDPE Bags	50 Kg	2000	100

Sr. No.	Common Name	Product	Production (MT / Month	Physical State	Means of Storage	Capacity of Storage Tank / Size of the Bag	Nos. of Storage Bags/Tanks	Product Maximum Storage capacity KL or MT
	Compound	Benzyl Alcohol		Liquid	MS AG Tank	50 kL	2	100
		O-Chloro Benzyl Alcohol		Solid	HDPE Bags	50 Kg	2000	100
		Para Chloro Benzyl Alcohol		Solid	HDPE Bags	50 Kg	2000	100
		Benzoyl Chloride		Solid	HDPE Bags	50 Kg	2000	100
		Benzaldehyde		Liquid	SS AG Tank	100 kL	1	100
		2-methoxy-5-bromo- 6-methyl benzoyl chloride		Liquid	SS AG Tank	100 kL	1	100
		2,4 dichloro benzoyl chloride		Liquid	SS AG Tank	100 kL	1	100
		4-methyl benzoyl chloride		Liquid	SS AG Tank	100 kL	1	100
		propargyl chloride		Liquid	PPcontainer/drum	100 kL	1	100
		Pivaloyl chloride		Liquid	PPcontainer/drum	100 kL	1	100
		4-chloro butyryl chloride		Liquid	PPcontainer/drum	100 kL	1	100
		Terephthaloyl chloride		Solid	HDPE Bags	50 Kg	2000	100
		N-valeroyl chloride		Liquid	SS AG Tank	100 kL	1	100
		4-chloro benzoyl chloride		Liquid	SS AG Tank	100 kL	1	100
		3-Nitro Benzoyl Chloride		Solid	HDPE Bags	50 Kg	2000	100
		4-Nitro Benzoyl Chloride		Solid	HDPE Bags	50 Kg	2000	100
4	Amines	Primary Amines	1000	Liquid	SS Tank, above Ground	100 KL	1	100
		Ethoxylation of Primary Amines		Liquid	SS Tank, above Ground	100 KL	1	100
4	Nitro Compounds	4-Chloro 3,5 Dinitro Benzoic Acid	1,000	Solid	HDPE Bags	50 Kg	1340	67
		6-nitro 3,4 dichloro aniline		Solid	HDPE Bags	50 Kg	1340	67
		4-Nitro ,5-Chloro, 2- methyl Aniline		Solid	HDPE Bags	50 Kg	1340	67
		2-Nitro 4-Methyl Aniline		Solid	HDPE Bags	50 Kg	1340	67
		3-Nitro 4-Chloro Benzoic Acid		Solid	HDPE Bags	50 Kg	1340	67
		3 Nitro Para toluic Acid		Solid	HDPE Bags	50 Kg	1340	67
		2,4 Dichloro 6 Nitro Phenol		Solid	HDPE Bags	50 Kg	1340	67
		2,3-dichloro 4-nitro phenol		Solid	HDPE Bags	50 Kg	1340	67
		2,5 Di Chloro 4 Nitro Phenol		Solid	HDPE Bags	50 Kg	1340	67
		1,3 Di Nitro Benezene		Solid	HDPE Bags	50 Kg	1340	67
		Nitro benzene		Liquid	MS AG Tank	50 KL	2	100

Sr. No.	Common Name	Product	Production (MT / Month	Physical State	Means of Storage	Capacity of Storage Tank / Size of the Bag	Nos. of Storage Bags / Tanks	Product Maximum Storage capacity KL or MT
		2/3/4- Nitro Toulene		Liquid	MS AG Tank	50 KL	2	100
		3,5 Di Nitro Benzoic Acid		Solid	HDPE Bags	50 Kg	1340	67
		p-Nitro salicylic acid		Solid	HDPE Bags	50 Kg	1340	67
		2,5 Dichloro Nitro Benzene		Solid	HDPE Bags	50 Kg	1340	67
		3,4/2,3 Dichloro Nitro Benzene		Solid	HDPE Bags	50 Kg	1340	67
5	Hydrogenation Compounds	3,4 Dichloro Aniline	500	Solid	HDPE Bags	50 Kg	660	33
		3-iso propoxy Aniline		Liquid	MS AG Tank	50 KL	1	50
		o-Toluidine		Liquid	MS AG Tank	50 KL	1	50
		m-Toluidine		Liquid	MS AG Tank	50 KL	1	50
		p-Toluidine		Solid	HDPE Bags	50 KL	660	33
		Aniline		Liquid	MS AG Tank	50 KL	1	50
		3,4 diamino toluene		Solid	HDPE Bags	50 Kg	660	33
		2,5 Dimethyl 1,4 Phenylene Diamine		Solid	HDPE Bags	50 Kg	660	33
		2-chloro, 5-Methyl, 1,4 phenylene diamine		Solid	HDPE Bags	50 Kg	660	33
		2 chloro 1,4 phenylene diamine		Solid	HDPE Bags	50 Kg	660	33
		2,5 Dichloro 1,4 Phenylene Diamine		Solid	HDPE Bags	50 Kg	660	33
		2,4,5 tri chloro aniline		Solid	HDPE Bags	50 Kg	660	33
		6-Methyl 5-Amino Benzimidazolone		Solid	HDPE Bags	50 Kg	660	33
		5-Amino benzimidazolone		Solid	HDPE Bags	50 Kg	660	33
		3-Amino 4-chloro benzoic acid		Solid	HDPE Bags	50 Kg	660	33
		3-Amino 4-chloro benzotrifluoride		Liquid	MS AG Tank	50 KL	1	50
		3-Amino benzotrifluoride		Solid	HDPE Bags	50 Kg	660	33
		3,5 Dichloro Aniline		Solid	HDPE Bags	50 Kg	660	33
		2,5 Dichloro Aniline		Solid	HDPE Bags	50 Kg	660	33
		2,3 Dichloro Aniline		Solid	HDPE Bags	50 Kg	660	33
		3 Amino 4-Methyl Benzoic Acid		Solid	HDPE Bags	50 Kg	660	33

3.4 DETAILS OF STORAGE OF RAW MATERIALS.

TABLE: 3.3

Sr. No.	Raw Material	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
1.	1C4M2,5DNB	619	Solid	HDPE Bags	50 Kg	825	41
2.	2,3 DCNB	657.5	Solid	HDPE Bags	50 Kg	877	44
3.	2,4,5 TCN	637.5	Solid	HDPE Bags	50 Kg	850	43
4.	2,4-dichloro benzoic acid	1530	Solid	HDPE Bags	50 Kg	2040	102
5.	2,5 DCNB	575	Solid	HDPE Bags	50 Kg	767	38
6.	2,5DC4DNB	564	Solid	HDPE Bags	50 Kg	952	48
7.	2,5DM4DNB	619	Solid	HDPE Bags	50 Kg	825	41
8.	2.3 dichloro phenol	826	Solid	HDPE Bags	50 Kg	1101	55
9.	2.4 dichloro phenol	826	Solid	HDPE Bags	50 Kg	1101	55
10.	2.5 dichloro phenol	826	Solid	HDPE Bags	50 Kg	1101	55
11.	25 % HCl	7245	Liquid	MSRL/HDPE/FRP tank	200 KL	3	600
12.	2-chloro phenol	1582	Liquid	SS tank	50 KL	2	100
13.	2M5B6MBA	1575	Liquid	SS tank	50 KL	2	100
14.	2-nitro toluene	675.5	Liquid	SS tank	50 KL	1	50
15.	3,4 DCNB	657.5	Solid	HDPE Bags	50 Kg	877	44
16.	3,4 dichloro aniline	869	Solid	HDPE Bags	50 Kg	1159	58
17.	3,4 DNT	643.5	Solid	HDPE Bags	50 Kg	858	43
18.	3,5 DCNB	649	Solid	HDPE Bags	50 Kg	865	43
19.	3-Iso propoxy nitro benzene	666.5	Liquid	SS tank	50 KL	1	50
20.	3N4MBA	474	Solid	HDPE Bags	50 Kg	870	44
21.	3N4CBZ/ 3- Nitro 4- Chloro Benzonitrile	607.7	Solid	HDPE Bags	50 Kg	810	41
22.	3-NBZ	659	Solid	HDPE Bags	50 Kg	879	44
23.	3-Nitro 4-Methyl Benzoic Acid	632.5	Solid	HDPE Bags	50 Kg	843	42
24.	3-nitro toluene	614	Liquid	SS tank	50 KL	1	50
25.	3-nitrobenzoic acid	1524	Solid	HDPE Bags	50 Kg	2032	102

Sr. No.	Raw Material	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
26.	4-chloro benzoic acid	2209	Solid	HDPE Bags	50 Kg	2945	147
27.	4-chloro Benzo trifluoride	888	Liquid	SS tank	50 KL	2	100
28.	4-chlorobutanoic acid	1363.5	Liquid	SS tank	50 KL	2	100
29.	4-chloro phenol	1600	Solid	HDPE Bags	50 Kg	2133	107
30.	4-methyl aniline	781	Solid	HDPE Bags	50 Kg	1041	52
31.	4-methyl benzoic acid	2294.5	Solid	HDPE Bags	50 Kg	3059	153
32.	4-nitro toluene	625.5	Solid	HDPE Bags	50 Kg	834	42
33.	4-nitrobenzoic acid	1515	Solid	HDPE Bags	50 Kg	2020	101
34.	5-chloro-2-methyl aniline	854	Liquid	SS tank	50 KL	2	100
35.	5NBZ	706.5	Solid	HDPE Bags	50 Kg	942	47
36.	60% nitric acid	946	Liquid	SS tank	50 KL	2	100
37.	6M5NBZ	696	Solid	HDPE Bags	50 Kg	928	46
38.	Acetic Anhydride	13.4	Liquid	SS tank	1 KL	1	1
39.	Acetic Acid	1200	Liquid	SS tank	50 KL	2	100
40.	Additives	9	Solid	HDPE Bags	50 Kg	12	1
41.	Ammonia	450	Gas	CS bullets tank	50 KL	1	50
42.	Benzal Chloride	2415	Liquid	SS tank	50 KL	3	150
43.	Benzene	2124	Liquid	SS tank	50 KL	3	150
44.	Benzoic acid	578	Liquid	SS tank	50 KL	1	50
45.	Benzo Trichloride	3555	Liquid	SS tank	100 KL	3	300
46.	Benzyl Chloride	1858.5	Liquid	SS tank	50 KL	3	150
47.	Catalyst	18.5	Solid	HDPE Bags	50 Kg	25	1
48.	Caustic	8119	Solid	HDPE Bags	50 Kg	10820	541
49.	Chlorine	3515	Gas	CS pressure tank/pipeline	0.9 M.T.	75/Pipeline	67.5
50.	Ethylene Oxide	642	Liquid	SS tank	50 KL	1	50
51.	FeCl3	3	Solid	HDPE Bags	50 Kg	4	200
52.	Hydrogen gas	240	Gas	CS bullets tank/pipeline	1.5 MT	Pipeline	1.5
53.	Iso Phthalic Acid	1252.5	Solid	HDPE Bags	50 Kg	1670	84
54.	Methanol	2307	Liquid	CS tank (UG)	50 KL	5	250
55.	ML	720	Liquid	CSRL tank	50 KL	1	50

Sr. No.	Raw Material	Consumption (MT/ Month)	Physical State	Means of Storage	Capacity of Storage Tank/Size of the Bag	Nos. of Storage Bags/Tanks	Raw Material Maximum Storage capacity KL or MT
56.	Nitro Benzene	1410	Liquid	SS/CS tank	50 KL	2	100
57.	N-valeroyl acid	1606.5	Liquid	SS tank	50 KL	2	100
58.	O-Chloro Benzal Chloride	2190	Liquid	SS tank	50 KL	3	150
59.	ODCB	813	Liquid	CS tank	50 KL	2	100
60.	P-Chloro Benzal Chloride	2197.5	Solid	HDPE Bags	50 Kg	2930	147
61.	p-DCB	813	Solid	HDPE Bags	50 Kg	1084	54
62.	Phthalic Acid	1260	Solid	HDPE Bags	50 Kg	1680	84
63.	Phenol	1540	Solid	CS/SS tank	50 KL	2	100
64.	Pivalic Acid	1350	Solid	HDPE Bags	50 Kg	1800	90
65.	Primary Amines	333	Liquid	SS tank	50 KL	1	50
66.	Prop-2-yn-1-ol	1200	Liquid	CS tank	50 KL	2	100
67.	Pyridine	3	Liquid	CS/SS tank	1 KL	1	1
68.	Rany Nickel	40	Solid	HDPE Bags	50 Kg	53	3
69.	Salicylic Acid	700	Solid	HDPE Bags	50 Kg	933	47
70.	SMC (Sulfur Monochloride)	370.5	Liquid	CS/SS tank	50 KL	1	50
71.	Sulphuric acid	1854	Liquid	CS tank	50 KL	3	150
72.	Terephthalic acid	1293	Solid	HDPE Bags	50 Kg	1724	86
73.	Toluene	2346	Liquid	CS tank	50 KL	3	150

3.5 DETAILS OF STORAGE OF HARZARDOUS RAW MATERIALS IN BULK & CONTROL MEASURES.

TABLE: 3.4

Name of Chemical & Cas No.	Phase (L/S/G)	Max. Storage Cap. MT	Place of Storage		Max. Storage container in Nos.	MOC	Operating Pressure and Temp.	Type of Hazard as per NFPA			Control Measure Provided
			Type	Size Ltr. /kg				H	F	R	
Aniline	Liquid	50 KL	UG Tank	50 KL	1	SS	Amb. &Atp.	3	2	0	Provided in 3.6.1
Methanol	Liquid	250	UG Tank	50 KL	5	CS	Amb. &Atp.	1	3	0	Provided in 3.6.1
Toluene	Liquid	150	UG Tank	50 KL	3	CS	Amb. &Atp.	2	3	0	Provided in 3.6.1
Benzene	Liquid	150	UG Tank	50 KL	3	SS	Amb. &Atp.	2	3	0	Provided in 3.6.1
Ethylene Oxide	Liquid	50	AG Bullet	50 KL	1	SS	4 to 10 kg/cm2 &Atp	3	4	3	Provided in 3.6.2
Phenol	Liquid	100	AG Tank	50 KL	2	CS/SS	Amb. &Atp.	4	2	0	Provided in 3.6.3
Pyridine	Liquid	1	AG Tank	1 KL	1	CS/SS	Amb. &Atp.	3	3	0	Provided in 3.6.3
Acetic Acid	Liquid	100	AG Tank	50 KL	2	SS	Amb. &Atp.	3	2	0	Provided in 3.6.3
SMC (Sulfur Monochloride)	Liquid	50	AG Tank	50 KL	1	CS/SS	Amb. &Atp.	4	1	2	Provided in 3.6.3
Ammonia	Gas	50	AG Bullet	50 KL	1	SS	Amb&Atp.	3	1	0	Provided in 3.6.4
Chlorine	Gas	67.5	Pipeline/ Tonner	-/ 900 kg	- / 75	- / MS	3.5 kg/cm2 / 4-10 kg/cm2	3	0	0	Provided in 3.6.5
Hydrogen gas	Gas	1.5	Pipeline	-	-	-	50 kg/cm2	1	4	0	Provided in 3.6.6 & Provided in 3.6.7

3.6 CONTROL MEASURE PROVIDED FOR CHEMCIAL STORAGE.

3.6.1 For Proposed PESO Underground storage tank farm Safety:

1. Class A petroleum products (Solvents) will be received through road tanker and stored in underground storage tank as per petroleum rules.
2. Tank farm will be constructed as per explosive department requirement and separation distance is maintained.
3. Static earthing provision will be made for road tanker as well as storage tank.
4. Flame arrestor with breather valve will be provided on vent line.
5. Road tanker unloading procedure will be prepared and implemented.
6. Fire load calculation will be done and as per fire load Hydrant System is provided as per NFPA std. and Fire extinguishers will be provided as per fire load calculation.
7. Spark arrestor will be provided to all vehicles inside premises.
8. Flame proof type equipment s and lighting will be provided.
9. Lightening arrestor will be provided on the top of chimney.
10. Trained and experience operator will be employed for tank farm area.
11. NFPA label (hazard identification) capacity and content will be displayed on storage tank.
12. Solvents will be transferred by pump only in plant area and day tank will provide. Overflow line will return to the storage tank or Pump On-Off switch will be provided near day tank in plant.
13. Jumpers will be provided on solvent handling pipeline flanges.
14. Flexible SS hose will be used for road tanker unloading purpose and other temp. Connection.

3.6.2 Aboveground EO Bullet Storage

1. EO shall be received through road tanker and stored in above ground Bullet as per petroleum rules.
2. Bullet will be constructed as per explosive department requirement and separation distance maintained.
3. Double static earthing will be provided in Bullet.
4. Road tanker unloading station will be providing equipped with static earthing.
5. Flame arrestor with breather valve will be provided on vent line.
6. Road tanker unloading procedure will be prepared and implemented.
7. Fire hydrant system will be provided as per requirements.
8. Spark arrestor to road tanker will be provided to all vehicles inside premises.
9. Flame proof type equipment and lighting will be provided.
10. Trained and experience operator will be employed for tank farm area.
11. NFPA label (hazard identification) capacity and content needs will be displayed on storage tank.

12. Jumpers will be provided on pipeline flanges.
13. Flexible SS hose will be used for road tanker unloading purpose and other temp. Connection.
14. EO will be transferred by pump only in plant area and day tank is provided. Overflow line is return to the storage tank.

3.6.3 For Above Ground storage tank farm:

1. SS storage tank will be provided as per IS code.
2. Dyke wall will be provided to storage tank.
3. Level gauge will be provided with low-level high-level auto cut-off provision.
4. Fire hydrant monitor with foam trolley facility provided.
5. FLP type pump will be provided.
6. Double static earthing will be provided to storage tank.
7. Double Jumper clip will be provided to all pipeline flanges.
8. Road tanker unloading procedure will be prepared and implemented.
9. Lightening arrestor, Pigswill is provided.
10. Safety shower, eye wash will be provided.
11. NFPA labelling system will be adopted for drums as well as storage tanks.

3.6.4 For Ammonia Gas bullet:

1. Construction and design as per PESO requirements will be provided.
2. Flame proof equipment, pumping transfer, close process will be provided.
3. Double Static earthing provision made to bullet and unloading purpose.
4. Sprinkler system will be provided on bullet and unloading point.
5. Scrubber system will be provided.
6. Jumper clips on flanges will be provided.
7. Hydrant system will be installed in plant.
8. Fire extinguishers will be provided.
9. Tanker unloading procedure will be prepared and implemented.
10. 0 Nos. SCBA sets available and employees are trained for use.
11. Safety Showers will be provided near unloading station.
12. Caution note is will be provided.
13. Level gauge will be provided on bullet.
14. Double drain valve will be provided.
15. Double safety valve will be provided on bullet and safety valve vent connected to Scrubber.
16. Required PPEs will be provided to all employees.

3.6.5 Chlorine pipeline safety:

1. The pipeline to be designed in a manner that ensures adequate safety under all condition likely to be encountered during installation, testing, commissioning, and operating conditions.
2. The operating pressure to be considered which is technically achievable.
3. The minimum ambient temperature and corresponding Chlorine vapour pressure shall be taken into account while defining the operating pressure in pipeline to

avoid the condensation of gas. Associated hazard due to the same to be studied while designing and laying the pipeline. During winter the operating pressure and temperature are adjusted in such a way that no condensation is accrued due to low ambient temperature.

4. Requirement of insulation / electrical heat tracing to be reviewed in order to avoid condensation / liquefaction of Chlorine.
5. If insulation to be provided, the material shall be non-flammable, chemically inert to Chlorine, totally sealed against ingress of moisture, protected against mechanical damage. Aluminium cladding shall not be used over the insulation as it is reactive with Chlorine, Galvanized Iron sheet / Stainless steel sheet / Cementing cladding to be chosen. The bare pipeline shall be coated with anti-corrosive painting before application of insulation.
6. Design temperature of Chlorine pipeline to be considered based on maximum temperature being attained and minimum temperature possible in system. In case possibility of condensation of Chlorine in pipeline, the pipeline shall be designed for minimum temperature of -40°C
7. Adequate control of pressure and temperature to be ensured at producer's end
8. Evacuation plan for the quantity of Chlorine contained in the pipeline system
9. Material of construction for pipeline, valves, instruments suitable for handling the dry Chlorine gas. The metal used for the flanges, nuts, bolts shall be of same characteristics as that of pipeline.
10. Minimum corrosion allowance of 1.5 mm should be considered.
11. Type of manual isolation valve and control valve suitable for handling the Chlorine
12. Pipelines may be installed above ground or below ground. The entire system should be evaluated to determine the preferred method
13. Consider isolation valve at producer end and at consumer end. If offsite isolation valves are required by risk modelling studies like QRA study, etc., they should be located and protected to prevent access by unauthorized persons. Preferably, isolation valves should be located within an industrial site. It is imperative to also ensure that the evacuation system is available for the Chlorine inventory between the onsite isolation and offsite isolation valves
14. Intermediate flange is not recommended in order to avoid the leakage point
15. Site survey from public safety point of view
16. The pipeline should be protected from all risks of external fire or explosion, whether such risk exists at the time of installation of the pipeline or is brought about by subsequent installations
17. Suitable consideration of the consequences of a leak and suitable means of minimizing or handling leaks must be undertaken in the early stages of design
18. In case line is routed above ground, it is preferred to have Chlorine detector at regular intervals less than 60m distance away in order to monitor the pipeline leakage
19. Leak detection system like optical fiber can be considered for underground pipeline
20. For underground pipeline it is preferred to consider earth excavation monitoring system like "Perimeter Intrusion Detection System (PIDS)" to avoid uncontrolled excavation and damage of line due to excavation

Emergency Plan in Case of Pipeline Leak

1. Provision shall be kept isolating the pipeline both at producer end and consumer end in case leak detected.
2. It is also recommended to keep provision to isolate the pipeline by remote operated shut-off valves during emergency.
3. The pipeline after isolation can be evacuated by opening shut off valve to Chlorine absorption unit.
4. It is recommended to have Chlorine absorption unit at producer end as well as at consumer end.
5. Capacity of Chlorine absorption unit can be decided based on capacity of Chlorine inventory to be evacuated and time required to evacuate the inventory is based on risk modeling studies like QRA study, etc. Isolation of pipeline and evacuation of pipeline shall be carried out from DCS or via dedicated SIL certified Emergency Shutdown System (ESD), manual operation is not recommended. In case of pipeline rupture or major leak, communication to be established with SDRF for emergency plan implementation.

3.6.6 Hydrogenation Reaction Safety

1. Total enclosed process system will be adopted.
2. Temperature gauge or temperature indicator will be provided.
3. Pressure gauge will be provided with red mark of S.W.P.
4. Auto cut off temperature and pressure arrangement will be provided.
5. Safety valve will be provided on hydrogen gas line header.
6. Safety valve will be provided on reactor.
7. Rupture disc will be provided for additional safety.
8. Vent line will be connected with scrubber in case of Ammonia used.
9. Vent will be terminated above roof level in case of Hydrogen gas used.
10. Flame arrestor will be provided to vent line.
11. Nitrogen blanketing will be provided before the charging of hydrogen and after completion of reaction. The line and reactor will be flushed with Nitrogen gas properly to avoid fire or explosion in reactor.
12. Chilling cooling arrangement and alternative arrangement for water will be provided to the reactor.
13. Alternative power supply arrangement will be provided to autoclave.
14. Blow down (drawing tank) will be connected to transfer complete reaction mass in case of any extreme emergency.
15. Double Body earthing will be provided to autoclave.
16. Flameproof fittings will be provided in the process area.
17. PRV station with shut off valve, safety valve provision will be made for hydrogenation reaction safety.
18. Before Hydrogen Gas charging into reactor and after completion of reaction Nitrogen flushing will be done.
19. Flame arrestor will be provided on vent line of reactor and it will be extended up to roof level.
20. Open well ventilated and fragile roof will be provided to on reactor.
21. Safe Catalyst charging method will be adopted.

22. SOP will be prepared, and operators will be trained for the same.
23. Static earthing and electric earthing (Double) will be provided.
24. Rector vent will be extended outside the process area and flame arrestor will be provided on vent line.
25. Jumpers for static earthing on pipeline flanges of flammable chemical will be provided

3.6.7 For Hydrogen Cylinder connecting header:

1. PRV station will be provided with auto shutoff valve and safety valve.
2. Flame arrestor will be provided on safety valve
3. Minimum flanges will be provided to Hydrogen pipeline.
4. Gas detectors will be provided in PRV station area.
5. Interlocking on pressure/ flow will be provided.
6. Line safeguards will be provided in engine area if required.
7. Permit to work system will be existence for hot work.
8. Non sparking tools will be used in this area.
9. SOP will be prepared, and operators will be trained for the same.
10. Trained and experience parson will be done the connection.
11. Flame proof light fitting will be installed.
12. Double pressure gauge will be provided
13. Static earthing and electric earthing (Double) will be provided.
14. Jumpers for static earthing on pipeline flanges of flammable gas will be provided.
15. Non sparking tools will be used for hydrogen line operation.

3.6.8 For Warehouse Safety Measures:

1. FLP type light fittings are provided.
2. Proper ventilation is available in go down.
3. Proper label and identification board are provided in the storage area.
4. Pallets are provided for material bag storage.
5. Material handling trolley / stackers/forklift is used.
6. Materials are stored as per its compatibility study and separate area is available for flammable, corrosive and toxic chemical storage.
7. Smoking and other spark, flame generating item are banned from the Gate.

3.7 HAZARDOUS PROPERTIES OF THE CHEMICALS, COMPATIBILITIES AND SPECIAL HAZARD

TABLE-3.5

SR. NO.	NAME OF CHEMICAL	HAZARD	FLASH POINT ^{0}C	BP 0 C	LEL %	UEL %	VD	VP	SOLUBILITY	NFPA H F R	HAZARDOUS COMBUSTION PRODUCT	TLV PPM	IDLH PPM	LC50 MG/M3	TARGET ORGAN	CARCINOGENIC CHARACTERISTIC	ANTIDOTE
1.	Acetic Acid CAS No. 64-19-7	T / F	44.4	117.9	5.4	16.0	2.1	16 hPa @ 20^{0} C	Soluble	2 2 1	Irritating Vapour generated	10 ppm	50 ppm	5620 ppm/1H	Teeth, eyes, skin, mucous membranes	No	Milk of magnesia.
2.	Chlorine CAS # 7782-50-5	T	NF	The lowest known value is 100° C	NA	NA	1.424	0.62	Boils	3 0 0	Toxic and irritating gases	1	10	1017 ppm For human	Eyes, skin, respiratory system	No	Milk butter and milk of magnesia.
3.	Ammonia CAS # 7664-41-7	C	NF	-33.3	16	25	Liq. 608.7 kg/m3 210C Gas 0.771 kg/m3 00C	NA	In soluble	3 1 0	NA	25 ppm	300 ppm	7040 mg/m3	Eyes, skin, respiratory system	No	Smelling Ethanol or Ether
4.	Ethylene oxide CAS # 75-21-8	E/F/T/R	- 17.8	-10.7	3.0	100	1.4	1.5 bar @ 20^{0} C	2.0 %	2 4 3	irritating fumes	1.0	800	4443 PPM for human	Eyes, skin, respirator system	No	No specific antidote

SR. NO.	NAME OF CHEMICAL	HAZARD	FLASH POINT ºC	BP 0 C	LEL %	UEL %	VD	VP	SOLUBILITY	NFPA H F R	HAZARDOUS COMBUSTION PRODUCT	TLV PPM	IDLH PPM	LC50 MG/M3	TARGET ORGAN	CARCINOGENIC CHARACTERISTIC	ANTIDOTE
5.	Hydrogen Gas CAS # 1333-74-0	F/E	N.A.	-252.8°C	3.0	74	NA	NA	Soluble in water	1 4 0	Explosive gas	250 ppm	NA	LC50 >800000 ppm rat	lungs, heart, upper respiratory tract, central nervous system (CNS)	No	No specific Antidote
6.	Phenol CAS#: 108-95-2	F	79.4	182.2	1.7	8.6	3.24	NA	Soluble	2 4 0	Toxic imitating gas-	5 ppm	250 ppm	125 mg/l 24 hr(fish)	Liver and kidney	No	Activated charcoal and 240 ml milk
7.	Aniline CAS # 62 – 53 - 3	C	75.5	184.1	1.3	11	3.3	0.49 mm Hg @ 25 ºC	In soluble	3 2 0	Toxic Vapour	2 ppm	100 ppm	175 ppm for 7H mouse	Eyes, skin,	Yes	Mitholene Blu – 1% Excartric Acid – 5%
8.	Methyl alcohol (Methanol) CAS#: 67-56-1	F	12	64.5	6	36.5	1.1	128 hPa @ 20 ºC	soluble	1 3 0	CO, CO2	200	6000 LEL	64000 ppm for 4H rat	Kidneys, heart, central nervous system, liver, eyes	No	10 mg diazepam through injection Activated Charcoal
9.	Toluene CAS # 108-88-3	F	4.0	111	1.1	7.1	3.2	109 hPa @ 50 ºC	In soluble	2 3 0	Irritating Vapour generated	50	2000	400 ppm for 24Hr Rat	Eyes, skin, respiratory system, central nervous system, liver, kidneys	No	Diazem – 1 mg/Kg.(Intravenous), Epinephina, Efidrine
10.	Benzene CAS # 71-43-2	T/F	-11	80	1.3	7.9	2.8	25 mm Hg @ 20 ºC	In soluble	2 3 0	Toxic fumes	0.5 ppm	500 ppm	24 ml/kg for rat for 2H	Eyes, skin, respiratory system	Yes	Not available

SR. NO.	NAME OF CHEMICAL	HAZARD	FLASH POINT ⁰C	BP 0 C	LEL %	UEL %	VD	VP	SOLUBILITY	NFPA H F R	HAZARDOUS COMBUSTION PRODUCT	TLV PPM	IDLH PPM	LC50 MG/M3	TARGET ORGAN	CARCINOGENIC CHARACTERISTIC	ANTIDOTE
11.	Pyridine CAS # 110 – 86 - 1	F	19	115.. 3	1.8	12. 4	2.73	26.7 hPa @ 25 ºC	Soluble	2 3 0	Irritating vapour	5 PPM	1000	Not available	Skin, eyes	No	No specific Antidote
12.	Sulfur Monochloride (I) (SMC) 10025-67-9	T/F	>130	138	NA	NA	4.6	6.8 mm Hg @ 20 ºC	React with water	4 1 2	Toxic gases generated	1.0	NA	NA	Eyes, skin	No	No specific Antidote

3.8 Transportation, Unloading and handling procedure.

3.8.1 Transportation, Unloading and handling procedure For Ethylene Oxide.

Table: 3.6

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
1	Transportation of Ethylene Oxide by road tanker	Leakage, Spillage, fire, explosion, Toxic release	• Training will be provided to driver and cleaner regarding the safe driving, hazard of Flammable chemicals, emergency handling, use of SCBA sets. • TREM card will kept with Tanker. • SCBA set will be kept with Tanker. • Fire extinguishers will be kept with Tanker. • Flame arrestor will be provided to Tanker exhaust. • Instructions will be given not to stop road tanker in populated area. • Clear Hazard Identification symbol and emergency telephone number will be displayed as per HAZCHEM CODE. • Appropriate PPEs will be kept with Tanker.
2	Transportation of Ethylene Oxide by Road tanker unloading at site.	Leakage, Spillage, fire, explosion, toxic release	• Priority will be given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check Licence, TREM CARD, Fire extinguisher condition; SCBA set condition, Antidote Kit, required PPEs as per SOP laid down. • Store officer will take sample as per sampling SOP from sampling point. • After approval of QC department unloading procedure will be allowed be started. **Following precautions will be adopted during unloading** • Wheel stopper will be provided to Tanker at unloading platform. • Static earthing will be provided to road tanker. • Tanker unloading procedure will be followed according to check list and implemented.

3.8.2 FOR FLAMMABLE MATERIAL ROAD TANKER.

TABLE: 3.7

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
1	Transportation by road tanker	Leakage, Spillage, fire, explosion, Toxic release	• Training will be provided to driver and cleaner regarding the safe driving, hazard of Flammable chemicals, emergency handling, use of SCBA sets. • TREM card will kept with Tanker. • Fire extinguishers will be kept with Tanker. • Spark arrestor will be provided to Tanker exhaust. • Instructions will be given not to stop road tanker in populated area. • Clear Hazard Identification symbol and emergency telephone number will be displayed as per HAZCHEM CODE. • Appropriate PPEs will be kept with Tanker.
2	Road tanker unloading at site.	Leakage, Spillage, fire, explosion, toxic release	• Priority will be given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check License, TREM CARD, Fire extinguisher condition, First Aid Box condition, Antidote Kit, required PPEs as per SOP laid down. • Store officer will take sample as per sampling SOP from sampling point. • After approval of QC/QA department unloading procedure will be allowed be started. **Following precautions will be adopted during unloading** • Wheel stopper will be provided to TANKER at unloading platform. • Static earthing will be provided to road tanker. • Tanker unloading procedure will be followed according to check list and implemented. • Flexible SS hose connection will be done at Tanker outlet line. • Finally earthing connection and wheel stopper will be removed. • Only day time unloading will be permitted.
3	Storage tank safety	Leakage, Spillage, Fire, Explosion, Toxic release.	• Appropriate MOC storage tank will be provided as per IS code. • Dyke wall will be provided to storage tank. • Level transmitter will be provided with low level high level auto cut-off provision. • Vent will be connected with flame arrestor.

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
			• Fire hydrant monitor with foam attachment facility will be provided. • Dumping / Drain vessel/alternate vessel will be provided to collect dyke wall spillage material. • FLP type pump will be provided. • Nitrogen blanketing will be provided to storage tank. • Double static earthing will be provided to storage tank. • Jumper clip will be provided to all Solvent handling pipeline flanges.
4	Transfer from storage tank to Day tank	Leakage, Spillage due to Line rupture, Flange Gasket failure, Fire, Explosion, Toxic release.	• Double mechanical seal type FLP type pump will be provided. • Double on / off switch will provided at tank farm and process area near day tank. Pump auto cut off with day tank high level will be provided. • Flame arrestor will be provided on day tank vent. • Over flow will be provided for additional safety. • NRV will be provided on pump discharge line. • Double Jumper clip will be provided to all solvent handling pipelines. • Double static earthing will be provided to day tank.
5	Transfer from Day tank to reactor.	Leakage, Spillage due to Line rupture, Flange Gasket failure, Fire, Explosion, Toxic release.	• Transfer through closed pumping system. • Total quantity of day tank material will be charged in to reactor at a time. • NRV will be provided on day tank outlet line. • Static earthing will be provided to storage tank. • Jumpers will be provided to pipeline flanges.

3.8.3 Chlorine Transportation, Unloading and handling Procedure:

Table: 3.8

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
1	Transportation of Chlorine Tonners by road tanker	Leakage, Spillage, Toxic release	• Training is provided to driver and cleaner regarding the safe driving, hazard of Chlorine emergency handling, use of SCBA sets. • TREM card will kept with Tanker. • SCBA set is kept with Tanker. • Instructions are given not to stop Chlorine road truck in populated area. • Clear Hazard Identification symbol and emergency telephone number is displayed as per HAZCHEM CODE. • Appropriate PPEs is kept with Tanker.
2	Chlorine tonners unloading at site	Leakage, Spillage, toxic release	• Priority is given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check Licence, TREM CARD, Fire extinguisher condition; SCBA set condition, required PPEs as per SOP laid down.
3	Chlorine tonners storage shed	Leakage, Spillage, Fire, Explosion, Toxic release.	• SOP is prepared for safe handling of Chlorine tonners. • Chlorine Emergency Kit is procured and kept ready at chlorine shed. • Chlorine Hood with blower is provided with scrubbing arrangement. • Safety Shower and eye wash is provided in Chlorine shed area. • Tonner handling EOT crane is installed in Chlorine shed area for safe tonner handling. • Safety Valve is provided on chlorine header line and it is connected to caustic scrubber. • SCBA sets are kept ready at chlorine handling area. • Safety valve is provided on vaporizer header and outlet of safety valve connected to scrubber. • Flow and temperature controllers are provided on process line.
5	Chlorine tonners connected with header	Leakage, Spillage due to Line rupture, Toxic release.	• Teflon or copper tube is used for connection with header. • Pressure gauge and safety valve is provided on header line.

3.8.4 Transportation, Unloading and handling procedure for Phenol:

Table: 3.9

SR.NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	CONTROL MEASURES AND HANDLING PROCEDURES.
1	Transportation of Phenol by road tanker	Leakage, Spillage, Toxic release	• Training is provided to driver and cleaner regarding the safe driving, hazard of Flammable chemicals, emergency handling, use of SCBA sets administration. • TREM card will kept with Tanker. • Instructions are given not to stop road tanker in populated area. • Clear Hazard Identification symbol and emergency telephone number is displayed as per HAZCHEM CODE. • Appropriate PPEs is kept with Tanker. • Emergency telephone numbers list for OFF site emergency agencies is provided in TREM CARD.
2	Phenol Road tanker unloading at Hemali site.	Leakage, Spillage, toxic release, fire	• Priority is given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check Licence, TREM CARD, Fire extinguisher condition, required PPEs as per SOP laid down. • Store officer will take sample as per sampling SOP from sampling point. • After approval of QC department unloading procedure is allowed be started. **Following precautions is adopted during unloading** • Wheel stopper is provided to Tanker at unloading platform. • Tanker unloading procedure is followed according to check list and implemented. • Flexible hose connection is done at TANKER outlet line and checked for no leakage. • Every time rubber gasket is changed. • The quantity remaining in the hose pipeline is drained to a small container, which is subsequently

SR.NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	CONTROL MEASURES AND HANDLING PROCEDURES.
			transferred to the main storage tank thus ensuring complete closed conditions for transfer from road tanker.
3	Phenol Storage tank safety	Leakage, Spillage, Toxic release.	• Storage tank is stored away from the process plant in tank farm area. • Caution note and emergency handling procedure is displayed at unloading area and trained all operators. • NFPA label is provided. • Required PPEs like full body protection PVC apron, Hand gloves, gumboot, Respiratory mask etc. is provided to operator. • Safety shower, eye wash with quenching unit is provided in acid storage area. • Material is handled in close condition in pipeline. • Dyke wall is provided, collection pit with valve provision. • Jacketed tank is provided, and steam heating is provided in jacket. • Double drain valve will be provided. • Level gauge is provided on storage tank. • Safety permit for loading unloading of hazardous material is prepared and implemented. • Fire hydrant system with jockey pump as per TAC norms is installed.
4	Phenol transferred from storage tank to Day tank	Leakage, Spillage due to Line rupture, Flange Gasket failure, Toxic release.	• Double mechanical seal type pump is provided. • Overflow is provided for additional safety and it is connected to main storage tank. • NRV is provided on pump discharge line. • Flange Guard is provided to all flanges.
5	Phenol transfer from Day tank to reactor.	Leakage, Spillage due to Line rupture, Flange Gasket failure, Toxic release.	• Gravity transfer. • Double valve is installed on day tank outlet line. • Total quantity of day tank material is charged into reactor at a time. • Flange guard is provided to pipeline flanges.

3.8.5 Transportation, Unloading and handling procedure For Ammonia Gas.

TABLE: 3.10

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
1	Transportation of Ammonia Gas by road tanker	Leakage, Spillage, fire, explosion, Toxic release	• Training will be provided to driver and cleaner regarding the safe driving, hazard of Flammable chemicals, emergency handling, use of SCBA sets. • TREM card will kept with Tanker. • SCBA set will be kept with Tanker. • Fire extinguishers will be kept with Tanker. • Flame arrestor will be provided to Tankerexhaust. • Instructions will be given not to stop road tanker in populated area. • Clear Hazard Identification symbol and emergency telephone number will be displayed as per HAZCHEM CODE. • Appropriate PPEs will be kept with Tanker.
2	Transportation of Ammonia Gas by Road tanker unloading at site.	Leakage, Spillage, fire, explosion, toxic release	• Priority will be given to Tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check Licence, TREM CARD, Fire extinguisher condition; SCBA set condition, Antidote Kit, required PPEs as per SOP laid down. • Store officer will take sample as per sampling SOP from sampling point. • After approval of QC department unloading procedure will be allowed be started. **Following precautions will be adopted during unloading** • Wheel stopper will be provided to Tanker at unloading platform. • Static earthing will be provided to road tanker. • Tanker unloading procedure will be followed according to check list and implemented.

3.8.6 Drums Transportation, Unloading and handling procedure

TABLE: 3.11

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
1	Transportation of Solvents drums	Leakage, Spillage, fire, explosion, Toxic release	• Training will be provided to driver and cleaner regarding the safe driving, hazard of Flammable chemicals, emergency handling and use of SCBA sets. • TREM card will kept with Tanker. • First Aid Kit will be kept with Tanker. • Fire extinguishers will be kept with Tanker. • Spark arrestor will be provided to Tanker exhaust. • Instructions will be given not to stop road tanker in populated area. • Clear Hazard Identification symbol and emergency telephone number will be displayed as per HAZCHEM CODE. • Appropriate PPEs will be kept with Tanker.
2	Drums unloading at site.	Leakage, Spillage, fire, explosion, toxic release	• Priority will be given to truck to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. • Security person will check Licence, TREM CARD, Fire extinguisher condition, First Aid Kit condition, Antidote Kit, required PPEs as per SOP laid down. • QA/QC Chemist will take sample as per sampling SOP from sampling point. • After approval of QA/QC department unloading procedure will be allowed be started. **Following precautions will be adopted during unloading** • Wheel stopper will be provided to Tanker at unloading platform. • Only daytime unloading will be permitted.
3	Godown/warehouse safety	Leakage, Spillage, Fire, Explosion, Toxic release.	• FLP type light fittings will be provided. • Proper ventilation will be provided in godown. • Proper label and identification board

SR. NO.	ACTIVITY	TYPE OF POSSIBLE HAZARD	PROCEDURES.
			/stickers will be provided in the storage area. • Conductive drum pallets will be provided. • Drum handling trolley / stackers/forklift will be used for drum handling. • Separate dispensing room with local exhaust and static earthing provision will be made. • Materials will be stored as per its compatibility study and separate area will be made for flammable, corrosive and toxic chemical drums storage. • Smoking and other spark, flame generating item will be banned from the Gate.
4	Solvents transfer from drum to Day tank/ reactor	Leakage, Spillage due to Line rupture, Flange Gasket failure, Fire, Explosion, Toxic release.	• Solvent transfer by vacuum or by pump only. • Static earthing will be provided. • SS flexible hose / conductive hose will be used.
5	Solvent transfer from Day tank to reactor.	Leakage, Spillage due to Line rupture, Flange Gasket failure, Fire, Explosion, Toxic release.	• Transferred solvent from drums to storage tank/reactor in closed loop by pump. • Total quantity of day tank material will be charged into reactor at a time. • NRV will be provided on day tank outlet line. • Static earthing will be provided to storage tank. • Jumpers will be provided to pipeline flanges.

3.9 FIRE PREVENTION & PROTECTION SYSTEM.

TABLE: 3.12

Department wise List of fire extinguishers with hydrant details, mapping if available	Department wise fire Extinguishers will be provided throughout the plant. Hydrant Layout system available.
Fire hydrant system with drawing	Main Pump, Diesel pump and Jockey Pump will be available in Fire Hydrant system. Fire hydrant system drawing available. Emergency equipment list drawing available.
Fire and safety team On site emergency plan report	Onsite emergency plan, Firefighting team and various other teams prepared and trained. Mock drills conducted regularly at every six months.
Smoke detectors, MCP and gas detectors details	Smoke detectors, MCP and gas detectors will be provided. Preventive maintenance Schedule will be prepared.
Environment control plan.	Environment control plan will be prepared.
Workplace monitoring data record of last year.	Regular workplace monitoring will be carried out twice in a year and records maintain in form no 37.

3.10 Details of occupational health program.

i) To which chemicals, workers are exposed directly or indirectly.

Provided in Table No: 3.8 column B

ii) Whether these chemicals are within Threshold Limit Values (TLV)/ Permissible Exposure Levels as per ACGIH recommendation.
Yes, regular Workplace monitoring carried out and checked where it is in TLV limit or not. If required control measures to be provided to control under TLV limit.

iii) What measures company has taken to keep these chemicals within PEL/TLV?

Measures to keep exposure below TLV/ PEL are provided in below table 3.8 column D.

iv) How the workers are evaluated concerning their exposure to chemicals during replacement and periodical medical monitoring.

Premedical examination and periodical medical examination is carried out once in a year and record maintained in Form No-32 & 33

v) What are onsite and offsite emergency plan during chemical disaster.
Onsite and offsite emergency plan provided in Table-3.8 column E

vi) Liver function tests (LFT) during pre-placement and periodical examination.

LFT will be done for those workers who are working in process area and record will be maintained.

vii) Details of occupational health surveillance program.

- In process there is not any high noise, high heat stress and low-level illumination exposure to workers.
- Manual material handling only the causes of musculo-sketal disorders (MSD), backache, pain in minor and major joints, fatigue etc. following measure have been taken to avoid above mentioned ill health effect to workers.
- Below 25 kgs weight will be handling by a worker if required to do so.
- Material handling lorry-cart, drum handling trolley, forklift, stacker, etc. will be used for material handling.
- Training will be carried out for Manual material handling.
- Ergonomics study will be carried out before commissioning of the plant and correct material flow, Process flow of workplace will be designed.

Following activities will be carried out for Occupational health of the workers.

- Treatment part (OPD) for both company and contractor employees.
- Occupational related problems will be studied like ergonomic issues and control measures
- Prevention part- Premedical examination and periodical medical examination for operators, helpers, chemists.
- Profile active (Health Awareness programme)

3.11 OCCUPATIONAL HEALTH IMPACT ON EMPLOYEES, CONTROL MEASURES, ACTION PLAN IF ACCIDENT OCCUR AND ITS ANTIDOTES

TABLE-3.13

Sr. No.	Chemical	Occupational health impact on employees	Measures to keep exposure below TLV/ PEL	EMP for STEL & IDLH
A	B	C	D	E
1.	Methanol CAS# 67-56-1	The substance is toxic to blood, the reproductive system, liver, upper respiratory tract, skin, central nervous	Provide close process	Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth,Sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed.
2.	Toluene CAS # 108-88-3	The substance is toxic to blood, the reproductive system, liver, upper respiratory tract, skin, central nervous	Provide close process	Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, Sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed.
3.	Acetic Acid CAS No. 64-19-7	Chronic respiratory disease due to long term exposure inhalation Skin disease due to skin contact	Process enclosure, Local exhaust, General dilution ventilation, Personal protective equipments	Remove victim from the spillage location into fresh air area. Small spillage control absorbs on paper towel. Large spillage – Evacuate area and stop source of ignition. Dilute with water and collect washed out water in tank and neutralize it in safe manner.
4.	Phenol CAS#: 108-95-2	The substance may be toxic to kidneys, liver, central nervous system (CNS). Repeated or	Use process enclosures, local exhaust ventilation, or other engineering controls to keep	Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to

Sr. No.	Chemical	Occupational health impact on employees	Measures to keep exposure below TLV/ PEL	EMP for STEL & IDLH
		prolonged exposure to the substance can produce target organs damage. Repeated p. 2 Exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.	airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.	reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV.
5.	Chlorine CAS # 7782-50-5	Toxic by inhalation. Irritating to eyes, respiratory system and skin. Very toxic to aquatic organisms.	Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or Other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.	Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment. Eliminate all ignition sources if safe to do so. Do not touch or walk-through spilled material. Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
6.	Pyridine CAS # 110 – 86 - 1	Target organs: Liver, kidneys, nerves, Bone Marrow. Persons with pre-existing disorders may be more susceptible. This Product has been reported to be a	Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels	Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all

Sr. No.	Chemical	Occupational health impact on employees	Measures to keep exposure below TLV/ PEL	EMP for STEL & IDLH
		possible carcinogen. Long-term exposure may cause liver, kidney or CNS damage. Typical STEL 10 ppm. Typical PEL 15 ppm.	below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Ventilation fans and other electrical service must be non-sparking and have an explosion-proof design.	sources of ignition. Use a spark-proof tool. Provide ventilation. Prevent spreading of vapours through sewers, ventilation systems and confined areas. Evacuate unnecessary personnel. Approach spill from upwind. Use water spray to cool and disperse vapours, protect personnel, and dilute spills to form non-flammable mixtures. Control runoff and isolate discharged material for proper disposal.
7.	Ammonia	Very hazardous in case of skin contact (corrosive, irritant, permeator), Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking or shortness of breath. Severe over-exposure can result in death. The substance is toxic to upper respiratory tract	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.	Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid. Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid.

SECTION IV

HAZARD IDENTIFICATION

4.1 INTRODUCTION

Risk assessment process rests on identification of specific hazards, hazardous areas and areas vulnerable to effects of hazardous situations in facilities involved in processing and storage of chemicals.

In Fact the very starting point of any such assessment is a detailed study of materials handled & their physical / chemical / thermodynamic properties within the complex at various stages of manufacturing activity. Such a detailed account of hazardous materials provides valuable database for identifying most hazardous materials, their behaviour under process conditions, and their inventory in process as well as storage and hence helps in identifying vulnerable areas within the complex.

Hazardous posed by particular installation or a particular activity can be broadly classified as fire and explosive hazards and toxicity hazards. Whether a particular activity is fire and explosive hazardous or toxicity hazardous primarily depends on the materials handled and their properties.

It will be from the above discussion that study of various materials handled is a prerequisite from any hazard identification process to be accurate. Based on this study the hazard indices are calculated for subsequent categorization of units depending upon the degree of hazard they pose.

Identification of hazards is the most important step to improve the safety of any plant. The hazard study is designed to identify the hazards in terms of chemicals, inventories and vulnerable practices /operations.

The hazard evaluation procedures use as a first step by checklists and safety reviews. Dow and Mond fire and explosion indices, which make use of past experience to develop relative ranking of hazards, is also extensively used. For predictive hazard analysis, Hazard and Operability studies (HAZOP), Fault tree analysis, Event tree analysis, Maximum credible accident and consequence analysis etc are employed.

4.2 Dow's fire and Explosion Index (F & EI)

TABLE- 4.1

Sr. No.	Material stored	Nh	Nf	Nr	MF	GPH	SPH	FEI	Degree of Hazard	Radius of Exp. (ft.)	Th	Ts	TI	Degree of Hazard
1.	Acetic Acid	3	2	1	14	2.2	3.08	95	Intermediate	27.84	125	125	15.7	Severe
2.	Chlorine	3	0	0	1	2.05	2.82	5.8	Light	4.9	325	125	26.41	Severe
3.	Ammonia Gas	3	1	0	4	3.1	3.2	32	Light	8.1	250	125	27	Severe

Sr. No.	Material stored	Nh	Nf	Nr	MF	GPH	SPH	FEI	Degree of Hazard	Radius of Exp. (ft.)	Th	Ts	TI	Degree of Hazard
4.	Ethylene Oxide	2	4	3	29	3.0	3.2	278	Severe	200	125	125	18.0	Severe
5.	Benzene	2	3	0	16	2.55	3	122.4	Intermediate	106	125	125	16.38	Heavy
6.	Toluene	0	3	0	16	2.55	3	122.4	Moderate	106	125	50	11.4	Severe
7.	Phenol	3	2	0	10	1.45	2.63	38	Light	36	25.0	75	18.5	Severe
8.	Hydrogen	0	4	0	21	3.0	2.29	156	Heavy	135	-	-	-	-

4.3 Identification of Hazardous Areas:

A study of process for manufacturing as given in chapter 2 of the report indicates the following:

Various raw materials used in the manufacturing processes are listed in **Table-3.3** with mode / type of storage & storage conditions. Some hazardous raw materials, such as Acetic Anhydride, Chlorine, Hydrogen etc., are used in process & their inventory requirement is higher. Most of hazardous chemicals are stored in dedicated storage tanks in tank farm area or incoming through pipeline. List of chemicals stored in larger quantities is provided in **Table-3.3**.

4.3.1 Following areas considered as a Hazardous area of the plant.

1. PESO 20 KL Road tanker unloading point.
2. Phenol, Pyridine, Acetic Acid, Sulfur Monochloride storage tank area
3. Ammonia Gas &Ethylene Oxide Bullet storage area
4. Chlorine Gas Pipeline/Tonners Area
5. Hydrogen gas pipeline

4.4 Failure Frequencies

4.4.1 Hazardous material release scenarios can be broadly divided into 2 categories

1. Catastrophic failures which are of low frequency and
2. Ruptures and leaks which are of relatively high frequency.
3. Releases from failure of gaskets, seal, rupture in pipelines and vessels fall in the second category whereas catastrophic failure of vessels and full-bore rupture of pipelines etc. fall into the first category.

4.4.2 Typical failure frequencies are given below: -

TABLE-4.2

Item	Mode of failure	Failure frequencies
Atmospheric storage	Catastrophic failure Significant leak	10-9 /yr 10-5 /yr
Process Pipelines		
< = 50 mm dia	Full bore rupture Significant leak	8.8 x 10-7 /m.yr 8.8 x 10-6 /m.yr

Item	Mode of failure	Failure frequencies
> 50 mm <=150mm dia	Full bore rupture Significant leak	2.6 x 10-7 /m.yr 5.3 x 10-6 /m.yr
< 150 mm dia	Full bore rupture Significant leak	8.8 x 10-8 /m.yr 2.6 x 10-6 /m.yr
Hoses	Rupture	3.5 x 10-2 /m.yr

TABLE-4.3: TABLE OF ESTIMATED FREQUENCIES OF VAPOUR CLOUD EXPLOSION (FROM LESS 1996):

(1) Caused by failure of:	**Frequency**	**Units**
Pressure vessel	1E-5	Occ/plant. yr
Special Pipeline	1E-5 to 1E-4	Occ/plant. yr
Normal Pipeline	1E-4 to 1E-3	Occ/plant. yr
Pump normal duty	1E-2	Occ/plant. yr
Pump: severe duty pump	1E-1	Occ/plant. yr
Reciprocating Compressor	1E-1	Occ/plant. yr
(2) caused by leak from:		
Batch reactor	1E-2 to 1E-1	Occ/plant. yr
Tanker filling hose	1E-2 to 1E-1	Occ/plant. yr

TABLE-4.4: Table of Failure rates For Pressure Storage:

Event	**Frequency or Probability**
Catastrophic failure of vessel • Complete failure • Failure equivalent of 6 in. nozzle	 3E-6 occ/vessel. yr 7E-6 occ/vessel. yr
Fracture in Liquid line: • Pipework • Fittings	 3E-7 occ/m. yr 5E-6 occ/item. yr
Release due to overfilling	1E-4 occ/vessel. yr
Fracture of vapour line	3E-6 occ/m. yr
Serious leak (1kg/s): • 6 in Pipework • 3 in Pipework • Flange • Pump seal	 6E-6 occ/m. yr 6E-5 occ/m. yr 6E-4 occ/m. yr 5E-3 occ/m. yr
Release in course of draining or sampling (1.5kg/s) • Release pre operation • Draining operation • Sampling operation • Failure to recover during draining • Failure to recover during sampling	 1E-4 (release/operation) 50 occ/yr 100 occ/yr P-1E-1 P-1E-2

SECTION V

RISK ASSESSMENT

5.1 Effects of Releases of Hazardous Substances

Hazardous substances may be released as a result of failures / catastrophes, causing possible damage to the surrounding area. In the following discussion, an account is taken of various effects of release of hazardous substances and the parameters to be determined for quantification of such damages.

In case of release of hazardous substances, the damages will depend largely on source strength. The strength of the source means the volume of the substance released. The release may be instantaneous or semi-continuous. In the case of instantaneous release, the strength of the source is given in kg and in semi-continuous release the strength of the source depends on the outflow time (kg/s.).

In order to fire the source strength, it is first necessary to determine the state of a substance in a vessel. The physical properties, viz. Pressure and temperature of the substance determine the phase of release. This may be gas, gas condensed to liquid and liquid in equilibrium with its vapour or solids.

Instantaneous release will occur, for example, if a storage tank fails. Depending on the storage conditions the following situations may occur.

The source strength is equal to the contents of the capacity of the storage system.

In the event of the instantaneous release of a liquid a pool of liquid will form. The evaporation can be calculated on the basis of this pool.

5.2 Fire

5.2.1 Jet Fire:

Jet fire causes damage due to the resulting heat radiation. The working level heat radiation impact will vary widely depending on the angle of the flame to the horizontal plane, which mainly depends on the location of the leak. The flame direction was considered horizontal for consequence analysis of leaks and ruptures from process equipment. Jet fire heat radiation impacts were estimated for the identified credible and worst-case scenarios.

Upon accidental leakage, the pressurized fluid will disperse as a jet, initially moving forward in the spatial direction of the leak till the kinetic energy is lost and gravity slumping or lifting of the cloud occurs, dependent upon whether the fluid is heavier or lighter than air.

5.2.2 Tank on Fire/Pool Fire:

In the event of the instantaneous release of a liquid a pool of liquid will form. The evaporation can be calculated on the basis of this pool.

The heat load on object outside a burning pool of liquid can be calculated with the heat radiation model. This model uses average radiation intensity, which is dependent on the liquid. Account is also taken of the diameter-to-height ratio of the fire, which depends on the burning liquid. In addition, the heat load is also influenced by the following factors:

- Distance from the fire
- The relative humidity of the air (water vapour has a relatively high heat-absorbing capacity)
- The orientation i.e. horizontal/vertical of the objective irradiated with respect to the fire.

5.2.3 Flash Fire:

The vapour / gas release from a pool would disperse under the influence of the prevailing wind; with material concentration in air reducing with distance. At a particular location downwind, the concentration will drop below its lower flammable level (LFL) value. If ignited within the flammable envelope, the mass of the material available between the LFL and ½ LFL will be likely to burn as a flash fire; rapidly spreading through the cloud from the point of ignition back to the source of release.

Although flash fires are generally low intensity transitory events, the burning velocity is quite high and escape following ignition is not possible. Flash fires often remain close to the ground, where most ignition sources are present. It is assumed that personnel caught inside a flash fire will not survive while those outside suffer no significant harm. If other combustible material is present within the flash fire it is also likely to ignite and a secondary fire could result.

5.3 Explosion:

5.3.1 Late Explosion (UVCE):

The magnitude of the vapour cloud explosion is dependent on the size of the gas cloud that has formed and the degree of congestion in the area, as these determine the acceleration of the flame front.

The TNO GAMES model is used for modeling of vapour cloud explosions, as the model incorporates the characteristics of the explosion, such as the type of fuel, its reactivity, the effect of obstacles in the congested region, etc. Turbulence is the governing factor in blast generation, which could intensify combustion to the level that will result in an explosion. Obstacles in the path of vapour cloud or when the cloud finds a confined area, as under the bullets, often create turbulence.

Insignificant level of confinement will result in a flash fire. The VCE will result in overpressures.

It may be noted that VCEs have been responsible for very serious accidents involving severe property damage and loss of lives. Vapour Cloud Explosions in the open area with respect to Pure Methane is virtually impossible due to their lower density.

5.3.2 Ball Fire / BLEVE:

This happens during the burning of liquid, the bulk of which is initially over rich (i.e.above the upper flammable limit.). The whole cloud appears to be on fire as combustion is taking place at eddy boundaries where air is entrained (i.e. a propagating diffusion flame). The buoyancy of the hot combustion products may lift the cloud form the ground, subsequently forming a mushroom shaped cloud. Combustion rates are high and the hazard is primarily thermal.

5.4 Modes of Failure:

- Liquid release due to catastrophic failure of storage vessel or road tanker.
- Liquid release through a hole/crack developed at welded joints/flanges / nozzles / valves etc.
- Vapour release due to exposure of liquid to atmosphere in the above scenarios.
- Gas release due to catastrophic failure of Ammonia cylinder or outlet valve/line failure.

Event	Causes
Tank on Fire/	- Catastrophic failure of tank + Ignition availability
Pool fire	- Failure of liquid outlet line + Ignition availability
Fire Ball/BLEVE	- Catastrophic failure of road tanker/ storage tank
Flash Fire	-Vapour generation due to substrate and wind
UVCE	-Vapour cloud generation and about 15 % of total vapour mass Above the UEL-LEL % Ignition availability
Toxic gas dispersion	-Toxic Gas release due to catastrophic failure of tonner/bullet/ Tanks and ignition not available within LEL- UEL range.

Considering the quantity of storages & nature of Toxic nature and Flammable storage, following scenarios were taken up for detailed analysis & safe distances computed:

Failure cases considered for consequence analysis are representative of worst-case scenarios. Probability of occurrence of such cases is negligible (less than 1 x 10-6 per year) because of strict adherence to preventive maintenance procedures within the complex. General probabilities for various failure is provided in Table-4.2, 4.3 and 4.4, but consequences of such cases can be grave & far reaching in case such systems fail during life history of the company. Hence such scenarios are considered for detailed analysis. It is to be noted however that such situations are not foreseeable or credible as long as sufficient measures are taken. Also, consequence analysis studies help us evaluate emergency planning measures of the Company.

5.5 Impact Criteria:

Consequence assessment is conducted to understand the impact of identified scenarios in terms of Thermal radiation (Jet fire, Flash Fire), Explosion (vapor cloud explosion- UVCE). A range of potential consequences are assessed for each of the release scenarios identified. This step identifies the fatality probability, based on hazard type and caused by each release case, to personnel at a range of distances.

Estimate of damage or impact caused due to thermal radiation, explosion overpressure and toxic effects is generally based on the published literature on the subject. The actual potential consequences from these likely impacts can then be visualized by superimposing the damage effect zones on the proposed layouts and identifying the elements within the project which might be adversely affected, should one or more hazards materialize in practice. The damage criteria used in the present study is described in the following sections.

5.6 Damage Criteria For Heat Radiation:

Damage effects vary with different scenarios. Calculations for various scenarios are made for the above failure cases to quantify the resulting damages.

The results are translated in term of injuries and damages to exposed personnel, equipment, building etc.

Tank on fire /Pool fire due to direct ignition source on tank or road tanker or catastrophic failure or leakage or damage from pipeline of storage facilities or road tanker unloading arm, can result in heat radiation causing burns to people depending on thermal load and period of exposure.

All such damages have to be specified criteria for each such resultant effect, to relate the quantifier damages in this manner, damage criteria are used for Heat Radiation.

TABLE 5.1
Practical Significance of Radiation Intensity

Heat Radiation (kW/m^2)	Damage to Equipment	Damage to People
1.2	Solar Heat at Noon	
1.6	---	Minimum Level of pain threshold
2.0	PVC insulated cables damaged	---
4.0	**---**	**Causes pain if duration is longer than 20 seconds. Blistering is unlikely.**

Heat Radiation (kW/m^2)	Damage to Equipment	Damage to People
4.5	---	Blistering of skin
6.0	---	First degree burn
9.5	---	Pain threshold reached after 8 seconds. Second degree burns after 20 seconds.
12.0	---	Initiation of secondary fires
12.5	**Minimum energy to ignite wood with a flame; Melts plastic tubing.**	**First degree burns in ten seconds. 1% Fatality in 20 sec, 30% Fatality in 30 seconds.**
16.0	---	Severe burns after 5 seconds.
21.2	---	1% Fatality in 10 seconds, with protection of clothing
25.0	Minimum energy to ignite wood at indefinitely long exposure without a flame.	100 % Fatality in 1 (one) minute.
27	--	Third degree burns (30secs)
30.0	Damage to plant & machinery	--
37.5	**Severe damage to plant**	**100 % Fatality**

5.7 Explosion / Over Pressure:

In case of vapor cloud explosion, two physical effects may occur:

A flash fire over the whole length of the explosive gas cloud.
A blast wave, with typical peak overpressures circular around ignition source.

Table 5.2: Practical Significance of Overpressure

Overpressure (bar)	Mechanical Damage to Equipment	Damage to People
0.2068	Heavy damage to plant & structure	Fatality probability = 1 for humans indoor as well as outdoor > 50% eardrum damage > 50% serious wounds from flying objects
0.1379	Repairable damage to building and house	1% death > 1% eardrum damage > 1% serious wounds from flying objects
0.02068	10% glass damage, Safe distance	---

SECTION VI

CONSEQUENCE ANALYSIS

6.1 CONSEQUENCE ANALYSIS.

In the risk analysis study, probable damages due to worst case scenarios were quantified and consequences were analyzed with object of emergency planning. Various measures taken by the company and findings of the study were considered for deciding acceptability of risks.

6.2 The catastrophic/ rupture failure and Maximum Credible Loss Scenarios (MCLS) identified for plant base on above criteria is listed below:

TABLE: 6.1

Sec. No.		Scenario Description	Longitude/ Latitude	Material	Equipment	Capacity KL / MT	Operating Pressure Kg/cm²& temperature ⁰C
1		PESO 20 KL Road Tanker Catastrophic Rupture	21°43'31.81"N 72°37'3.79"E	Class A Petroleum Products	Road Tanker	20 KL	ATP & AMB
	1.1	Pool Fire					
	1.2	Flash Fire					
		Explosion Worst case					
2		PESO 20 KL Road Tanker Unloading Hose Rupture					
	2.1	Jet Fire					
	2.2	Pool Fire					
	2.3	Flash Fire					
3		Phenol 50 KL Storage Tank Catastrophic Rupture	21°43'31.58"N 72°37'5.11"E	Phenol	Storage Tank	50 KL	ATP & AMB
	3.1	Pool Fire					
	3.2	Flash Fire					
4		Phenol 50 KL Storage Tank Short Pipe Rupture					
	4.1	Pool Fire					
5		Acetic Acid 50 KL Storage Tank Catastrophic Rupture	21°43'31.88"N 72°37'4.76"E	Acetic Acid	Storage Tank	50 KL	ATP & AMB
	5.1	Pool Fire					
	5.2	Flash Fire					
6		Acetic Acid 50 KL Storage Tank Short Pipe Rupture					
	6.1	Pool Fire					
7		SMC 50 KL Storage Tank Catastrophic Rupture	21°43'32.17"N 72°37'5.06"E	Sulfur Monochloride	Storage Tank	50 KL	ATP & AMB
	7.1	Maximum Concentration footprint					
8		SMC 50 KL Storage Tank Short Pipe Rupture					
	8.1	Maximum Concentration footprint					

Sec. No.		Scenario Description	Longitude/ Latitude	Material	Equipment	Capacity KL / MT	Operating Pressure Kg/cm²& temperature ^0C
9		Pyridine 1 KLStorage Tank Catastrophic Rupture	21°43'32.46"N 72°37'4.72"E	Pyridine	Storage Tank	1 KL	ATP & AMB
	9.1	Maximum Concentration footprint					
10		Pyridine 1 KLStorage Tank Short Pipe Rupture					
	10.1	Maximum Concentration footprint					
11		Chlorine Gas Long pipeline 20 % Breach	Pipeline from Meghmani-Caustic chlorine Plant	Chlorine Gas	Pipeline	-	3.5 Kg/cm² &AMB
	11.1	Maximum Concentration Footprint					
12		Chlorine Gas Long pipeline 100 % Breach					
	12.1	Maximum Concentration Footprint					
13		Chlorine 900 Kg Tonner Catastrophic Rupture	21°43'29.30"N 72°37'3.70"E	Chlorine Gas	Tonner	900 KG	4-10 Kg/cm² &AMB
	13.1	Maximum Concentration Footprint					
14		Chlorine 900 Kg Tonner Short Pipe Rupture					
	14.1	Maximum Concentration Footprint					
15		Hydrogen Gas Long pipeline 20 % Breach	Pipeline from Meghmani-Caustic chlorine Plant	Hydrogen Gas	Pipeline	-	50 Kg/cm² &AMB
	15.1	Explosion Worst case					
16		Hydrogen Gas Long pipeline 100 % Breach					
	16.1	Jet Fire					
	16.2	Explosion Worst case					
17		Ethylene Oxide Bullet - Catastrophic Rupture	21°43'31.66"N 72°37'2.71"E	Ethylene Oxide	Bullet	50 KL	4-10 Kg/Cm² &AMB
	17.1	Pool Fire					
	17.2	Fire Ball					
	17.3	Flash Fire					
	17.4	Explosion Worst case					
	17.5	Maximum Concentration Footprint					
18		Ethylene Oxide Bullet - Short Pipe Rupture					
	18.1	Jet Fire					

Sec. No.		Scenario Description	Longitude/ Latitude	Material	Equipment	Capacity KL / MT	Operating Pressure Kg/cm^2& temperature ^{0}C
	18.2	Pool Fire					
	18.3	Explosion Worst case					
	18.4	Maximum Concentration Footprint					
19	19.1	Ethylene Oxide Bullet - BLEVE					
20		Ammonia 50 KL Bullet - Catastrophic Rupture	21°43'32.04"N 72°37'2.69"E	Ammonia	Bullet	50 KL	4-10 Kg/Cm^2 &AMB
	20.1	Maximum Concentration Footprint					
21		Ammonia 50 KL Bullet- Short Pipe Rupture					
	21.1	Maximum Concentration Footprint					

6.3 CONSEQUENCE RESULTS:

TABLE: 6.2

Sr. No.	Scenario	Failure Case	Jet Fire Radiation Intensity (Kw/ M²)			Pool Fire Radiation Intensity (Kw/ M²)			Flash Fire (ppm)		Explosion Worst case (bar)		
			37.5	12.5	4.0	37.5	12.5	4.0	7.3 % LEL	½ LEL	0.2068	0.1379	0.02068
1	PESO 20 KL Road Tanker	Catastrophic Rupture	NR	NR	NR	37.44	60.05	92.89	7.52	12.95	12.81	13.75	29.35
2		Unloading Hose Rupture	NR	NR	9.56	28.40	45.60	71.40	1.70	6.42	NR	NR	NR

Sr. No.	Scenario	Failure Case	Pool Fire Radiation Intensity (Kw/ M²)			Flash Fire (ppm)	
			37.5	12.5	4.0	1.5% LEL	½ LEL
3	Phenol50 KL Storage Tank	Catastrophic Rupture	14.81	18.78	38.73	NR	8.88
4		Short Pipe Rupture	12.27	17.27	34.97	NR	NR

Sr. No.	Scenario	Failure Case	Pool Fire Radiation Intensity (Kw/ M²)			Flash Fire (ppm)	
			37.5	12.5	4.0	2.9% LEL	½ LEL
5	Acetic Acid50 KL Storage Tank	Catastrophic Rupture	28.68	77.97	156.2	NR	8.79
6		Short Pipe Rupture	22.25	61.39	124.6	NR	NR

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			500 ppm	250 ppm	100 ppm	50 ppm
7	SMC 50 KL Storage Tank	Catastrophic Rupture	98.64	146.2	331.1	574.6

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			750 ppm	500 ppm	250 ppm	100 ppm
8	SMC 50 KL Storage Tank	Short Pipe Rupture	75.90	95.42	163.9	353.4

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			1000 ppm IDLH	250 ppm	100 ppm	50ppm
9	Pyridine 1KL Storage Tank	Catastrophic Rupture	47.95	64.95	89.10	173.0
10		Short Pipe Rupture	10.09	37.00	72.85	147.4

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			20 ppm ERPG-3	10 ppm	5 ppm	3 ppm ERPG-2
11	Chlorine Gas Long Pipeline Rupture	20 % breach	75.95	171.8	323.0	482.2

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			100 ppm	50 ppm	20 ppm EPRG-3	10 ppm IDLH
12	Chlorine Gas Long Pipeline Rupture	100 % breach	28.29	62.68	138.1	277.6

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			1017 ppm LC-50 For Human	500 ppm	100 ppm	50 ppm
13	Chlorine 900 Kg Tonner	Catastrophic Rupture	204.0	271.8	478.2	736.5
14		Short Pipeline Rupture	21.50	36.95	91.59	172.8

Sr. No.	Scenario	Failure Case	Jet Fire Radiation Intensity (Kw/ M²)			Explosion Worst case (bar)		
			37.5	12.5	4.0	0.2068	0.1379	0.02068
15	Hydrogen Gas Long Pipeline Rupture	20 % breach	NR	NR	10.21	24.72	26.32	52.53
16		100 % breach	NR	NR	NR	23.90	25.21	46.83

Sr. No.	Scenario	Failure Case	Jet Fire Radiation Intensity (Kw/ M²)			Pool Fire Radiation Intensity (Kw/ M²)			Fire Ball Radiation Intensity (Kw/ M²)			Flash Fire (ppm)		Explosion Worst case (bar)			Maximum Concentration Footprint			
			37.5	12.5	4.0	37.5	12.5	4.0	37.5	12.5	4.0	3.0 % LEL	½ LEL	0.2068	0.1379	0.02068	4443 ppm LC-50 Human	800 ppm IDLH	500 ppm ERPG-3	50 ppm ERPG-2
17	EO Bullet	Catastrophic Rupture	NR	NR	NR	11.43	26.51	44..08	75.52	145.7	258.5	133.9	174.0	223.7	244.9	645.3	249.4	278.1	571.4	2442
18		Short Pipeline Rupture	NR	14.21	17.98	8.45	17.79	32.61	NR	NR	NR	NR	NR	12.96	13.96	30.38	40.65	104.3	158.1	983.0

Sr. No.	Scenario	BLEVE (bar)		
		0.2068	0.1379	0.02068
19	EO Bullet - BLEVE	16.78	21.21	87.69

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			1500 ppm	150 ppm ERPG-2	35ppm STEL	25ppm TLV
20	Ammonia 50 KL Bullet	Catastrophic Rupture	118.2	826.2	1151	1221

Sr. No.	Scenario	Failure Case	Maximum Concentration Footprint			
			300 ppm IDLH	150 ppm ERPG-2	35ppm STEL	25ppm TLV
21	Ammonia 50 KL Bullet	Short Pipeline Rupture	123.5	169.8	286.0	315.9

6.4 CONCLUSION:

JET FIRE

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Short Pipe Rupture at dispersionof**NR** at **37.5Kw/M²**, **14.21 meter** at **12.5 Kw/M²** and **17.58 Meter** at **4.0 Kw/M².**

POOL FIRE

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Acetic Anhydride 50 KL Storage Tank Catastrophic Rupture at dispersion of **28.68 meter** at **37.5Kw/M²**, **77.97meter** at**12.5Kw/M²** and **156.2 Meter** at **4.0Kw/M²**.

FLASH FIRE CASES

The highest damage distances for flash fire are for isolatable is Scenario of Ethylene Oxide Bullet - Catastrophic Rupture at 1.5F weather condition. The maximum damage distance for Flash Fire is **133.9(3.0 % LEL) &174.0 meter (1/2 LEL)** – 1.5F of whether condition. UFL is defined as burning zone, which means people caught within the burning zone are exposed to a fatality rate of 100%.

LATE EXPLOSION WORST CASE - UVCE

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Catastrophic Rupture dispersion of **223.7 meter** at **0.2068 bar**, **244.9 meter** at **0.1379 bars** and **645.3 meter** at **0.02068 bar**.

FIREBALL

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Catastrophic Rupture dispersion of **75.52 meter** at **37.5 Kw/M²**, **145.7 meter** at **12.5 Kw/M²** and **258.5 Meter** at **4.0 Kw/M²**.

BLEVE

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide Bullet - Catastrophic Rupture dispersion of **16.78 meter** at **0.2068 bar**, **21.21 meter** at **0.1379 bar** and **87.69 meter** at **0.02068 bar**

MAXIMUM CONCENTRATION FOOTPRINT

As can be seen from the results of the summary of the Quantitative Risk Analysis study, the Fatality distance due to Scenario of Ethylene Oxide 50 MT bullet Catastrophic Rupture at dispersion of **249.4 meter** at **4443 ppm (LC-50 for human)**, **278.1 meter at 800 ppm (IDLH), 571.4 meter** at**500 ppm (ERPG-3)** and2442 **meter** at **50 ppm (ERPG-2).**

7.1 EMERGENCY CONTROL FACILITIES AND EMERGENCY MITIGATION MEASURES

Sr. No.	Chemical Name	Possible Scenario	Emergency Mitigation measures	First Aid in case of Exposure	Initial isolation and protection distance.
1.	Methanol/ Toluene	Fire & Explosion	**Fire** **CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.** **Small Fire** · Dry chemical, CO2, water spray or alcohol-resistant foam. **Large Fire** · Water spray, fog or alcohol-resistant foam. · Move containers from fire area if you can do it without risk. · Dike fire-control water for later disposal; do not scatter the material. · Use water spray or fog; do not use straight streams. **Fire involving Tanks or Car/Trailer Loads** · Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. · Cool containers with flooding quantities of water until well after fire is out. · Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. · ALWAYS stay away from tanks engulfed in fire.	**FIRST AID** · Move victim to fresh air. · Call 911 or emergency medical service. · Give artificial respiration if victim is not breathing. **· Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.** · Administer oxygen if breathing is difficult. · Remove and isolate contaminated clothing and shoes. · In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. · Wash skin with soap and water. · In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin. · Keep victim warm and quiet. · Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. · Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.	**SPILL OR LEAK** · Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. · ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). · All equipment used when handling the product must be grounded. · Do not touch or walk through spilled material. · Stop leak if you can do it without risk. · Prevent entry into waterways, sewers, basements or confined areas. · A vapor suppressing foam may be used to reduce vapors. **Small Spill** · Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. · Use clean non-sparking tools to collect absorbed material. **Large Spill** · Dike far ahead of liquid spill for later disposal. · Water spray may reduce vapor; but may not prevent ignition in closed spaces.

Sr. No.	Chemical Name	Possible Scenario	Emergency Mitigation measures	First Aid in case of Exposure	Initial isolation and protection distance.
			· For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.		
2.	Hydrogen	Fire & Explosion	**Fire** **· DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.** **Small Fire** · Dry chemical or CO2. **Large Fire** · Water spray or fog. · Move containers from fire area if you can do it without risk. **Fire involving Cylinder** · Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. · Cool containers with flooding quantities of water until well after fire is out. · Do not direct water at source of leak or safety devices; icing may occur. · Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. · ALWAYS stay away from tanks engulfed in fire. · For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.	Move victim to fresh air. · Call 911 or emergency medical service. · Give artificial respiration if victim is not breathing. · Administer oxygen if breathing is difficult. · Remove and isolate contaminated clothing and shoes. · Clothing frozen to the skin should be thawed before being removed. · In case of contact with liquefied gas, thaw frosted parts with lukewarm water. · In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin. · Keep victim warm and quiet. · Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.	**Large Spill** · Consider initial downwind evacuation for at least 800 meters (1/2 mile). **Fire** · If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
3.	Chlorine	Toxic Release due to catastrophic rupture, pipeline	Substance does not burn but will support combustion. · Vapors from liquefied gas are initially heavier than air and spread along ground.	· Move victim to fresh air. · Call 911 or emergency medical service. · Give artificial respiration if victim is not breathing. **· Do not use mouth-to-mouth method if**	**Small Spills** (From a small Package or small Leak): First Isolate in / Then **Protect** Persons **Large Spills** (from a Large package or many small Packages): First Isolate in all / Then Protect persons

<table>
<tr><th>Sr. No.</th><th>Chemical Name</th><th>Possible Scenario</th><th>Emergency Mitigation measures</th><th>First Aid in case of Exposure</th><th>Initial isolation and protection distance.</th></tr>
<tr><td></td><td></td><td>Rupture, Leakage/ Spillage.</td><td>· These are strong oxidizers and will react vigorously or explosively with many materials including fuels.
· May ignite combustibles (wood, paper, oil, clothing, etc.).
· Some will react violently with air, moist air and/or water.
· Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.
· Containers may explode when heated.
· Ruptured cylinders may rocket.</td><td>victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
· Administer oxygen if breathing is difficult.
· Clothing frozen to the skin should be thawed before being removed.
· Remove and isolate contaminated clothing and shoes.
· In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
· Keep victim warm and quiet.
· Keep victim under observation.
· Effects of contact or inhalation may be delayed.
· Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.</td><td><table>
<tr><td rowspan="2">Directions (meter)</td><td colspan="2">Downwind during</td><td rowspan="2">Directions (Meter)</td><td colspan="2">Downwind during</td></tr>
<tr><td>Day (KM)</td><td>Night (KM)</td><td>Day (KM)</td><td>Night (KM)</td></tr>
<tr><td>60</td><td>0.4</td><td>1.6</td><td>600</td><td>3.5</td><td>8.0</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Pyridine</td><td>Flammable, Toxic</td><td>Fire
CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.
Small Fire
· Dry chemical, CO2, water spray or alcohol-resistant foam.
· Do not use dry chemical extinguishers to control fires involving nitro methane or nitro ethane.
Large Fire
· Water spray, fog or alcohol-resistant foam.
· Do not use straight streams.
· Move containers from fire area if you can do it without risk.</td><td>FIRST AID
· Move victim to fresh air.
· Call 911 or emergency medical service.
· Give artificial respiration if victim is not breathing.
· Administer oxygen if breathing is difficult.
· Remove and isolate contaminated clothing and shoes.
· In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
· Wash skin with soap and water.
· In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
· Keep victim warm and quiet.</td><td>Large Spill
· Consider initial downwind evacuation for at least 300 meters (1000 feet).
Fire
· If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.</td></tr>
</table>

Sr. No.	Chemical Name	Possible Scenario	Emergency Mitigation measures	First Aid in case of Exposure	Initial isolation and protection distance.
			Fire involving Tanks or Car/Trailer Loads · Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. · Cool containers with flooding quantities of water until well after fire is out. · Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. · ALWAYS stay away from tanks engulfed in fire. · For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.	· Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. · Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.	
5.	Sulphur Monochloride	Toxic, Water Reactive, Corrosive	**Fire** · When material is not involved in fire, do not use water on material itself. Small Fire · Dry chemical or CO2. · Move containers from fire area if you can do it without risk. Large Fire · Flood fire area with large quantities of water, while knocking down vapors with water fog. If insufficient water supplies: knock down vapors only. Fire involving Tanks or Car/Trailer Loads · Cool containers with flooding quantities of water until well after fire is out. · Do not get water inside containers. · Withdraw immediately in case of	**FIRST AID** · Move victim to fresh air. · Call 911 or emergency medical service. · Give artificial respiration if victim is not breathing. · Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. · Administer oxygen if breathing is difficult. · Remove and isolate contaminated clothing and shoes. · In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. · For minor skin contact, avoid spreading material on unaffected skin. · Removal of solidified molten material from skin requires medical assistance.	See table below

Small Spills (From a small Package or small Leak)			**Large Spills** (from a Large package or many small Packages)		
First Isolate in Directions (meter)	Then Protect Persons Downwind during		First Isolate in all Directions (Meter)	Then Protect persons Downwind during	
	Day (KM)	Night (KM)		Day (KM)	Night (KM)
30	0.1	0.2	60	0.7	1.2

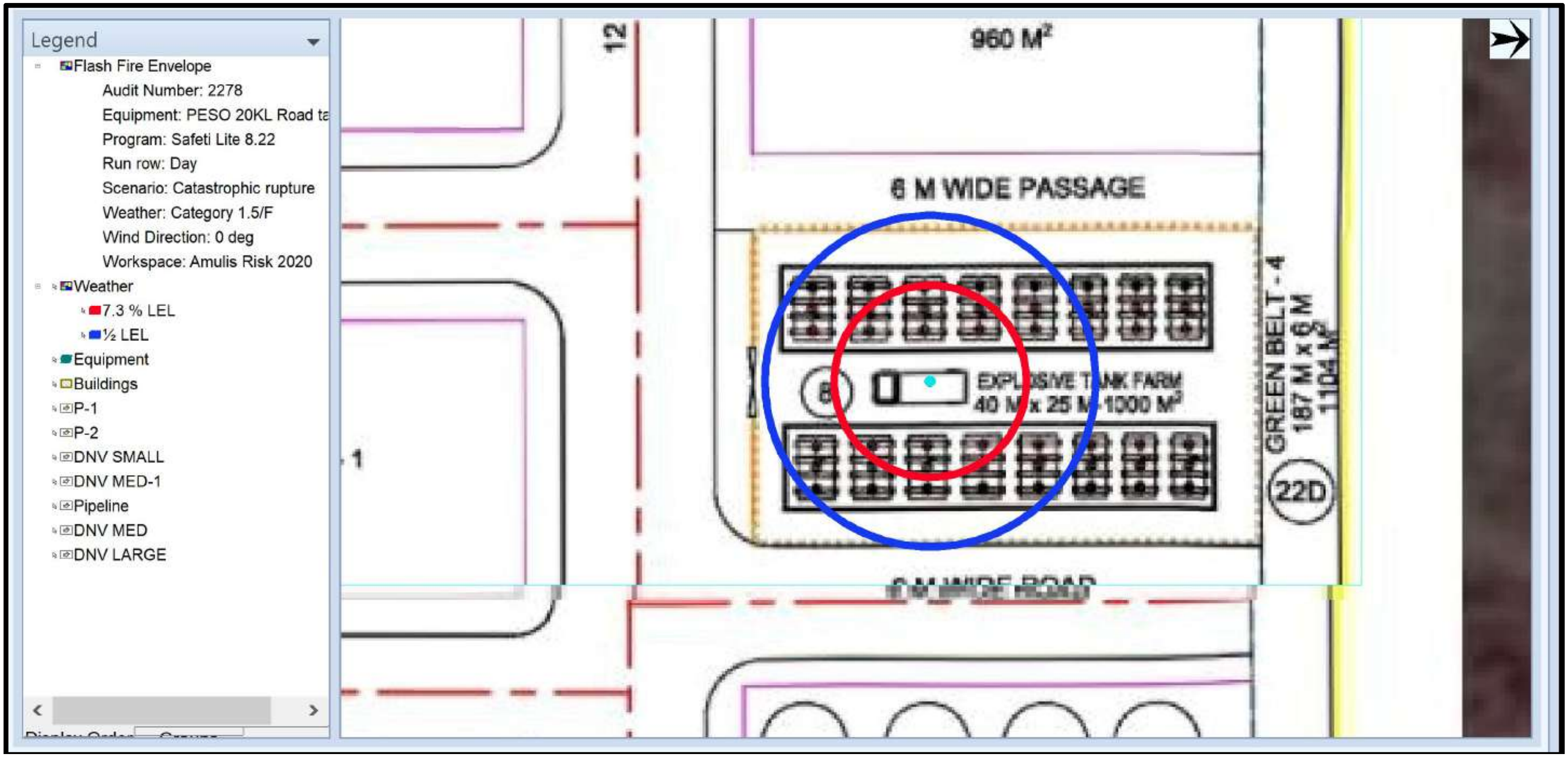
Sr. No.	Chemical Name	Possible Scenario	Emergency Mitigation measures	First Aid in case of Exposure	Initial isolation and protection distance.
			rising sound from venting safety devices or discoloration of tank. · ALWAYS stay away from tanks engulfed in fire	· Keep victim warm and quiet. · Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. · Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.	
6.	Ammonia	Toxic. Explosion	**Fire** Small Fire · Dry chemical or CO2. Large Fire · Water spray, fog or regular foam. · Move containers from fire area if you can do it without risk. · Do not get water inside containers. · Damaged cylinders should be handled only by specialists. Fire involving Tanks · Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. · Cool containers with flooding quantities of water until well after fire is out. · Do not direct water at source of leak or safety devices; icing may occur. · Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. · ALWAYS stay away from tanks engulfed in fire.	**FIRST AID** · Move victim to fresh air. · Call 911 or emergency medical service. · Give artificial respiration if victim is not breathing. · Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. · Administer oxygen if breathing is difficult. · Remove and isolate contaminated clothing and shoes. · In case of contact with liquefied gas, thaw frosted parts with lukewarm water. · In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. · In case of contact with Hydrogen fluoride, anhydrous (UN1052), flush skin and eyes with water for 5 minutes; then, for skin exposures rub on a calcium/jelly combination; for eyes flush with a water/calcium solution for 15 minutes. · Keep victim warm and quiet. · Keep victim under observation. · Effects of contact or inhalation may be delayed. · Ensure that medical personnel are aware of the material(s) involved and	**Small Spills** (From a small Package or small Leak): First Isolate in Directions (meter): 30; Then Protect Persons Downwind during: Day (KM): 0.1, Night (KM): 0.2 **Large Spills** (from a Large package or many small Packages): First Isolate in all Directions (Meter): 150; Then Protect persons Downwind during: Day (KM): 0.8, Night (KM): 2.3

<table>
<tr><th>Sr. No.</th><th>Chemical Name</th><th>Possible Scenario</th><th>Emergency Mitigation measures</th><th>First Aid in case of Exposure</th><th>Initial isolation and protection distance.</th></tr>
<tr><td></td><td></td><td></td><td></td><td>take precautions to protect themselves.</td><td></td></tr>
<tr><td>7.</td><td>Ethylene Oxide</td><td>Fire & Explosion</td><td>Fire
· DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Small Fire
· Dry chemical, CO2, water spray or alcohol-resistant foam.
Large Fire
· Water spray, fog or alcohol-resistant foam.
· FOR CHLOROSILANES, DO NOT USE WATER; use AFFF alcohol-resistant medium expansion foam.
· Move containers from fire area if you can do it without risk.
· Damaged cylinders should be handled only by specialists.
Fire involving Tanks
· Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
· Cool containers with flooding quantities of water until well after fire is out.
· Do not direct water at source of leak or safety devices; icing may occur.
· Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
· ALWAYS stay away from tanks engulfed in fire.</td><td>FIRST AID
· Move victim to fresh air.
· Call 911 or emergency medical service.
· Give artificial respiration if victim is not breathing.
· Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
· Administer oxygen if breathing is difficult.
· Remove and isolate contaminated clothing and shoes.
· In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
· In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
· In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
· Keep victim warm and quiet.
· Keep victim under observation.
· Effects of contact or inhalation may be delayed.
· Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.</td><td>
<table>
<tr><th colspan="3">Small Spills
(From a small Package or small Leak)</th><th colspan="3">Large Spills
(from a Large package or many small Packages)</th></tr>
<tr><td rowspan="2">First Isolate in Directions (meter)</td><td colspan="2">Then Protect Persons Downwind during</td><td rowspan="2">First Isolate in all Directions (Meter)</td><td colspan="2">Then Protect persons Downwind during</td></tr>
<tr><td>Day (KM)</td><td>Night (KM)</td><td>Day (KM)</td><td>Night (KM)</td></tr>
<tr><td>30</td><td>0.1</td><td>0.2</td><td>150</td><td>0.8</td><td>2.5</td></tr>
</table>
</td></tr>
</table>

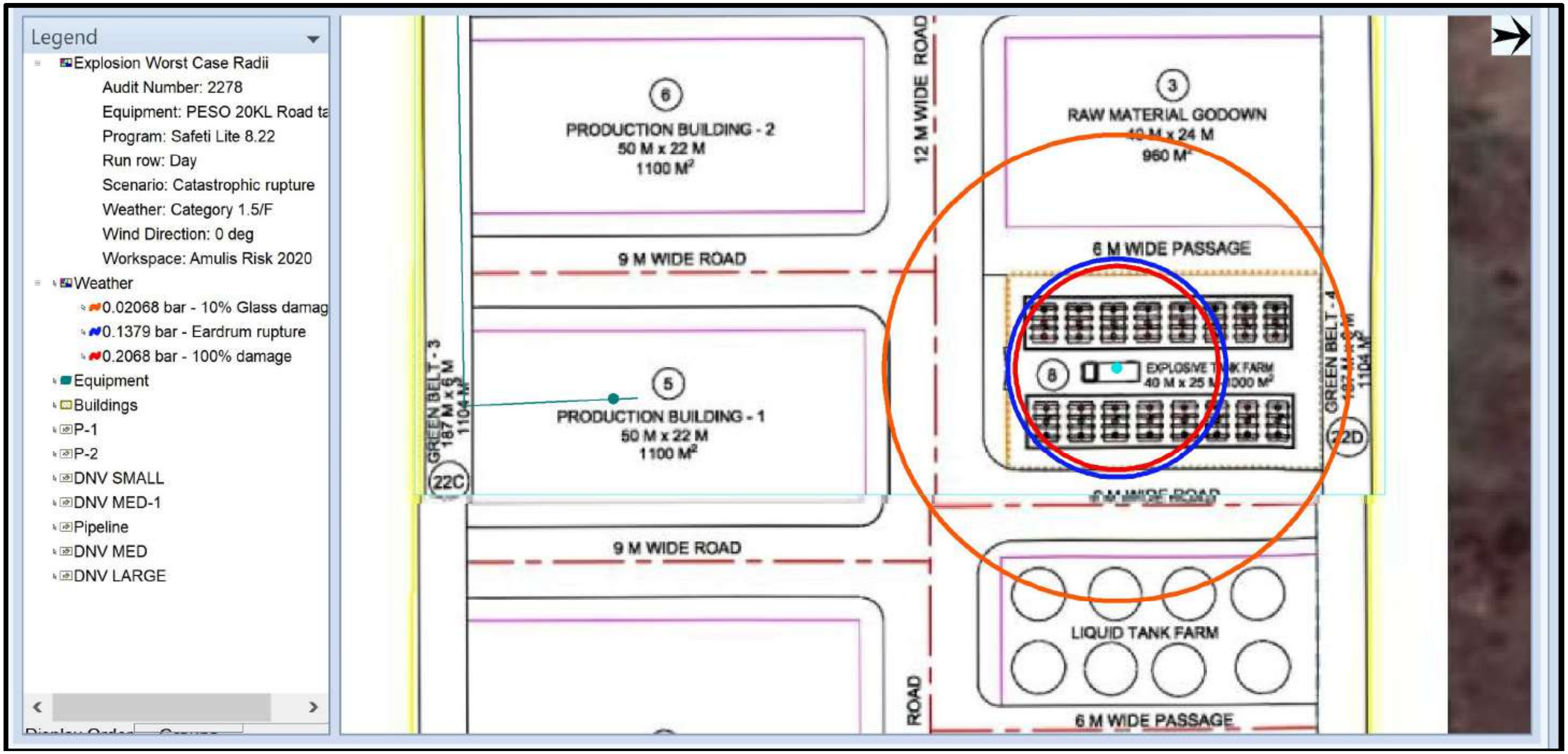
CONSEQUENCE CONTUORS

1.1 PESO 20 KL Road Tanker Catastrophic Rupture-Pool Fire

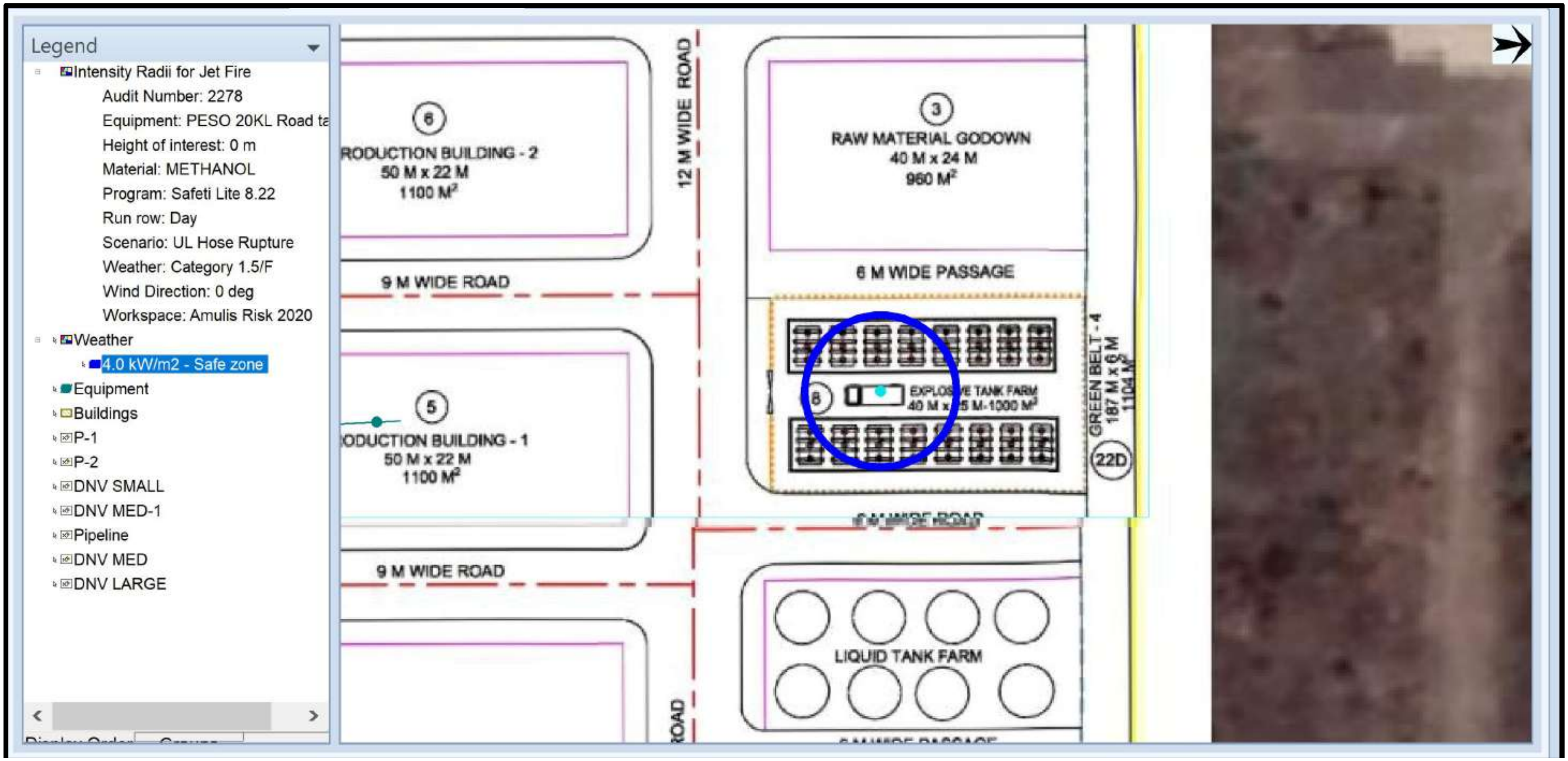
1.2 PESO 20 KL Road Tanker Catastrophic Rupture- Flash Fire



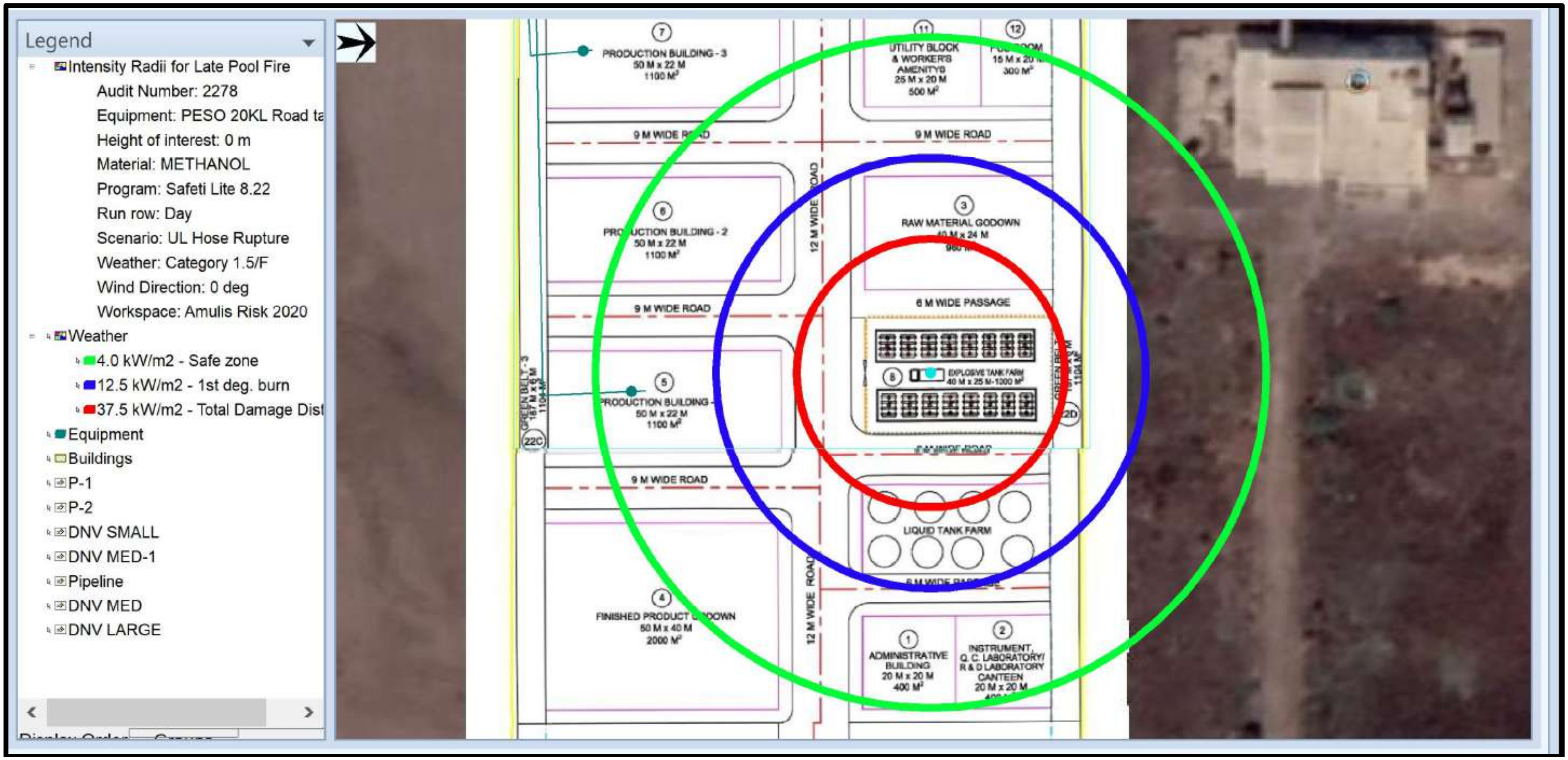
1.3 PESO 20 KL Road Tanker Catastrophic Rupture- Explosion Worst case



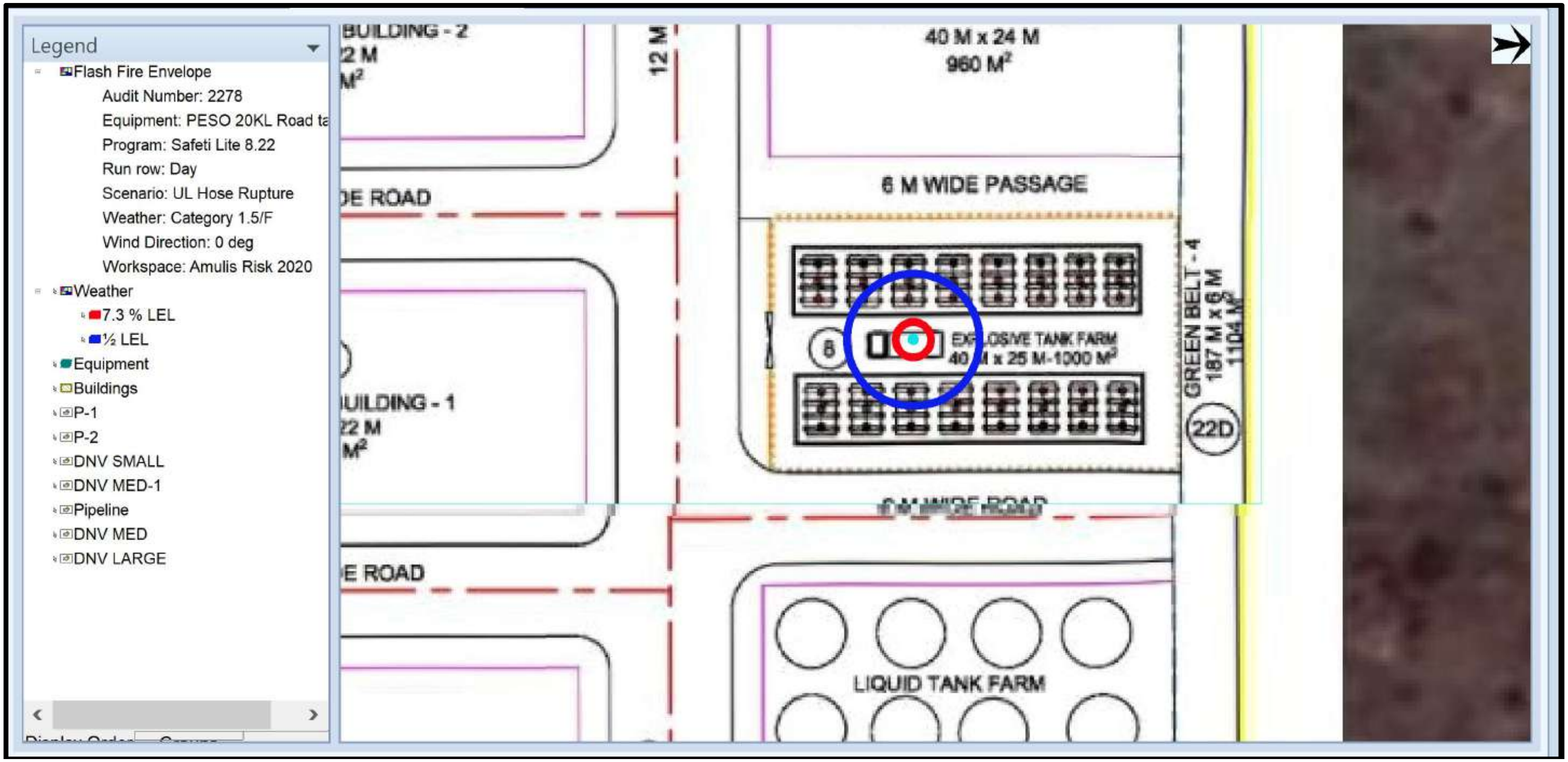
2.1 PESO 20 KL Road Tanker Unloading Hose Rupture-Jet Fire



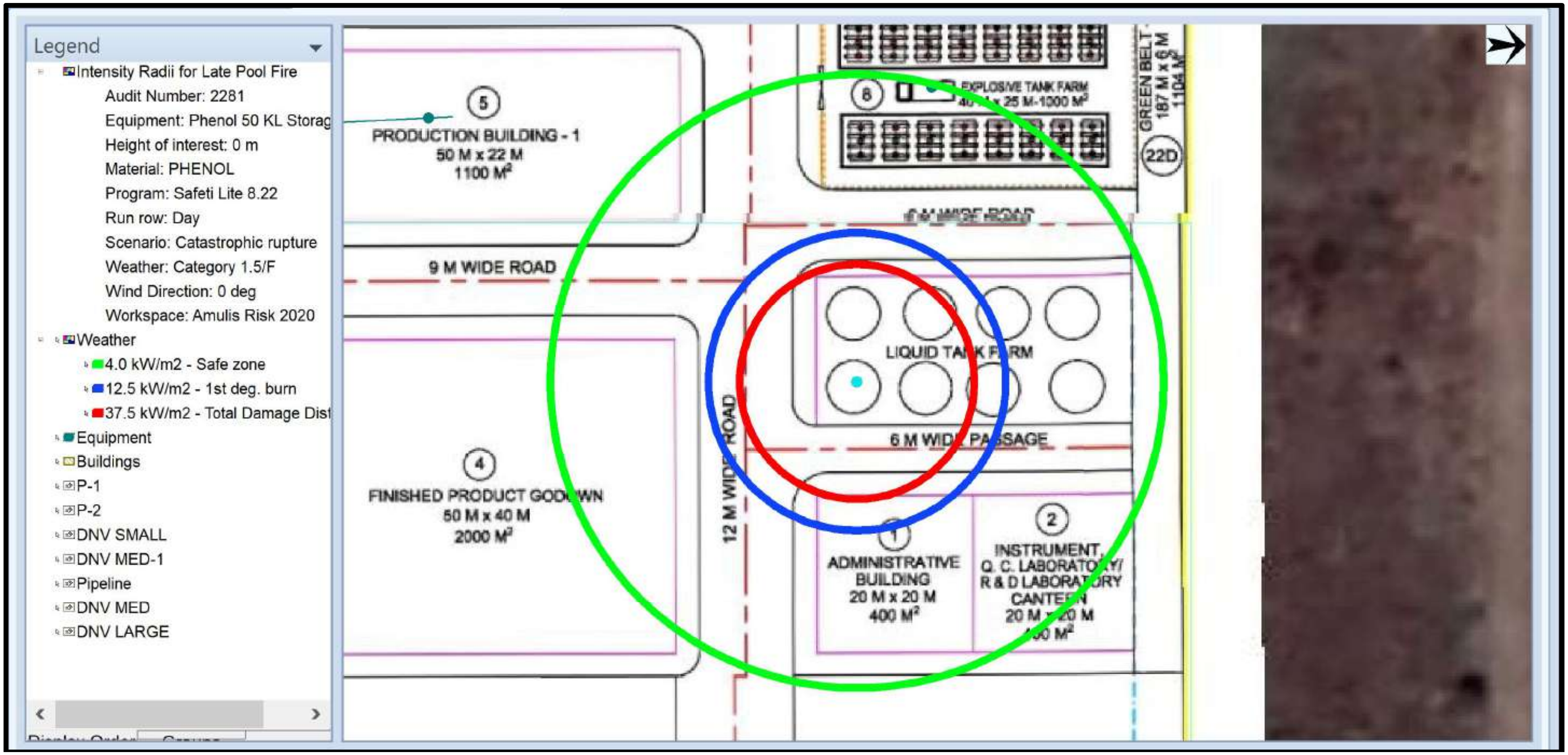
2.2 PESO 20 KL Road Tanker Unloading Hose Rupture- Pool Fire



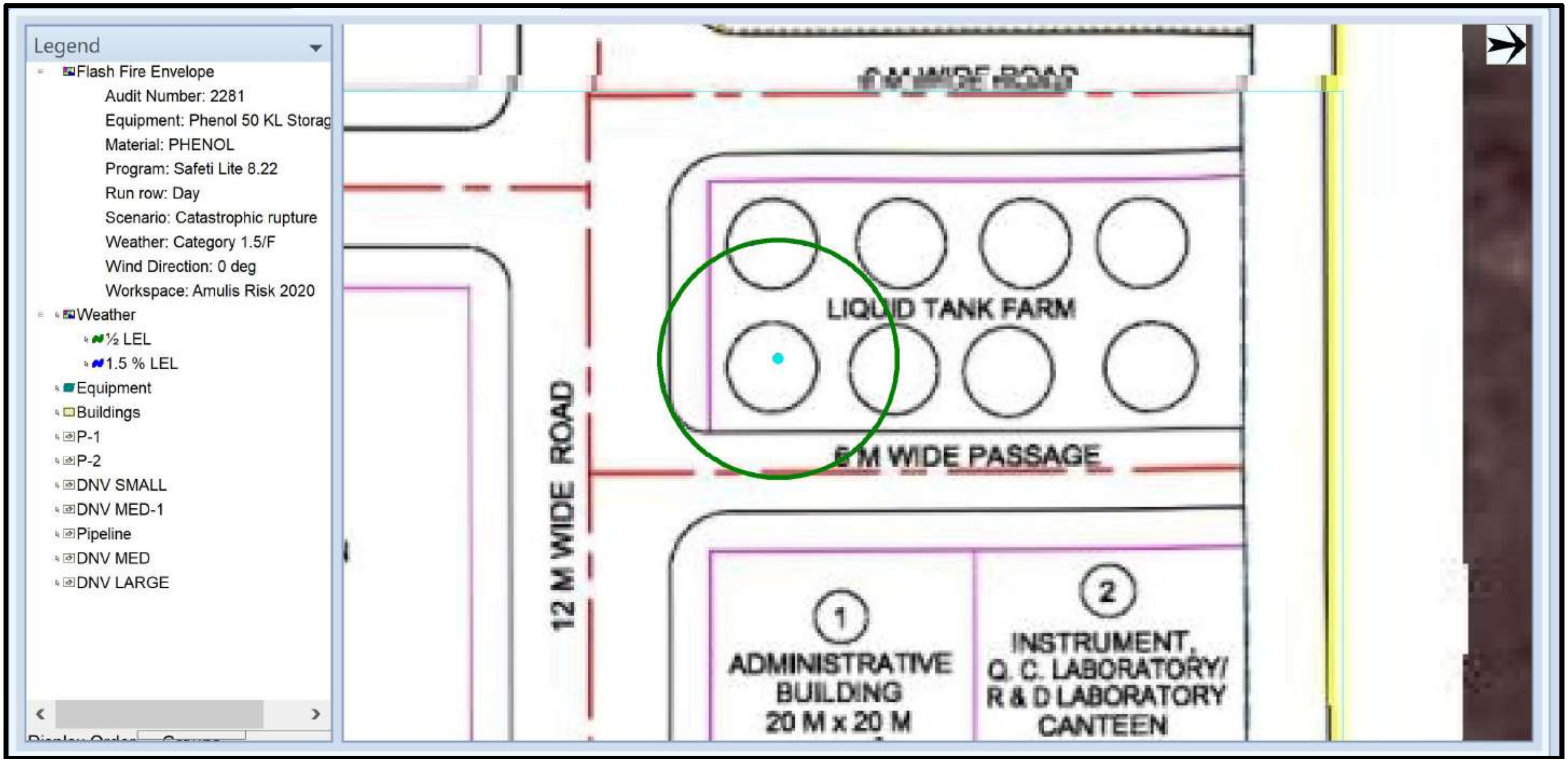
2.3 PESO 20 KL Road Tanker Unloading Hose Rupture- Flash Fire



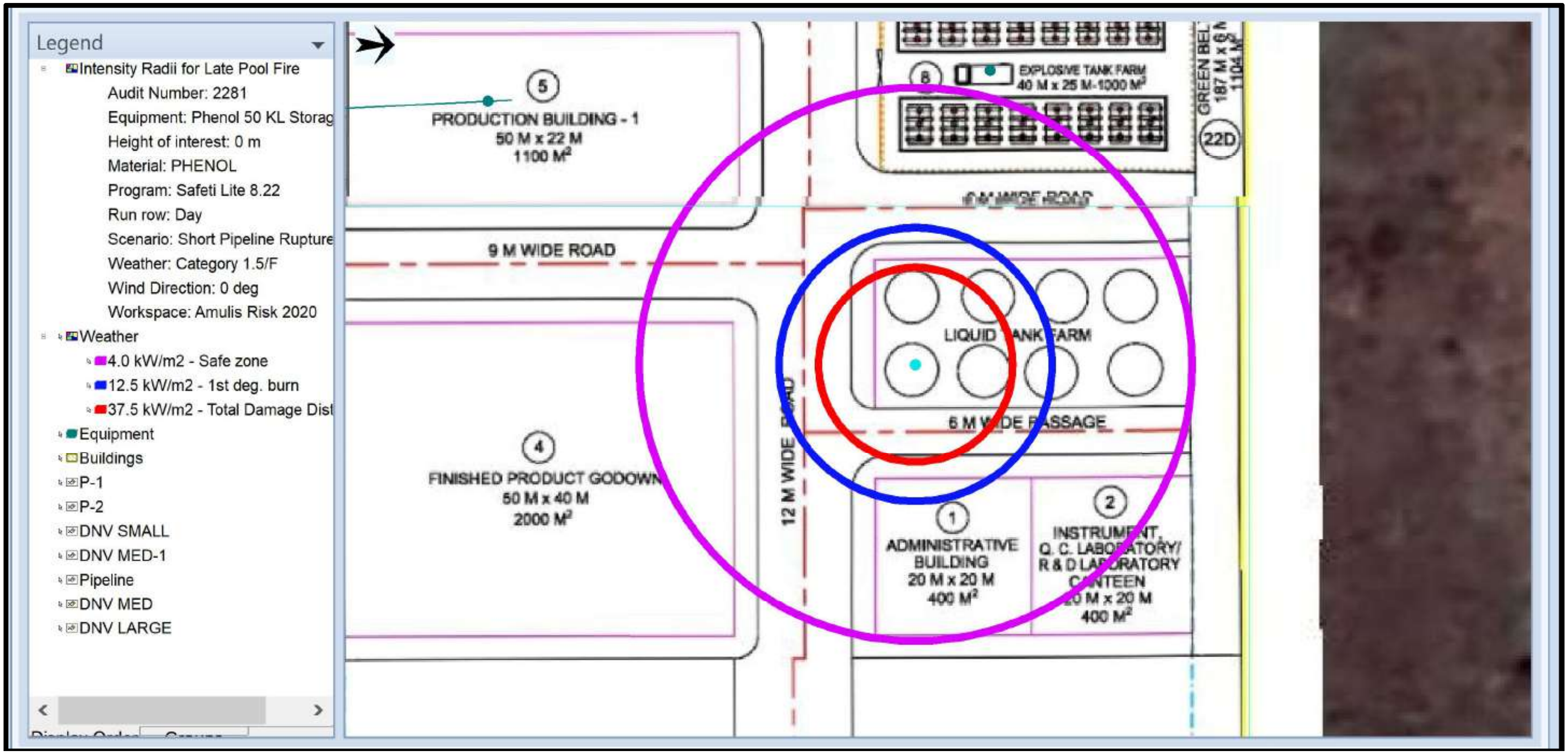
3.1 Phenol 50 KL Storage Tank Catastrophic Rupture- Pool Fire



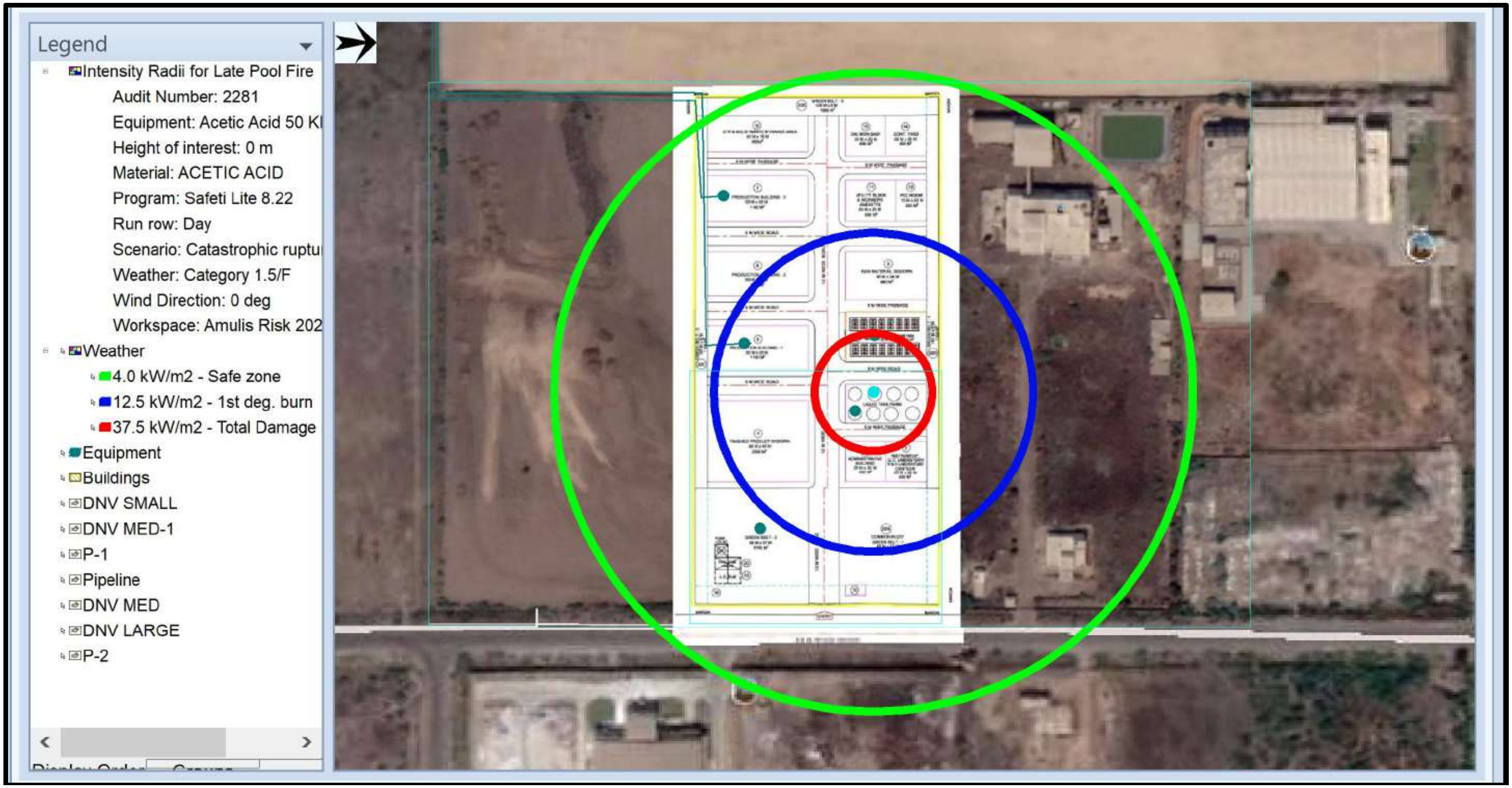
3.2 Phenol 50 KL Storage Tank Catastrophic Rupture- Flash Fire



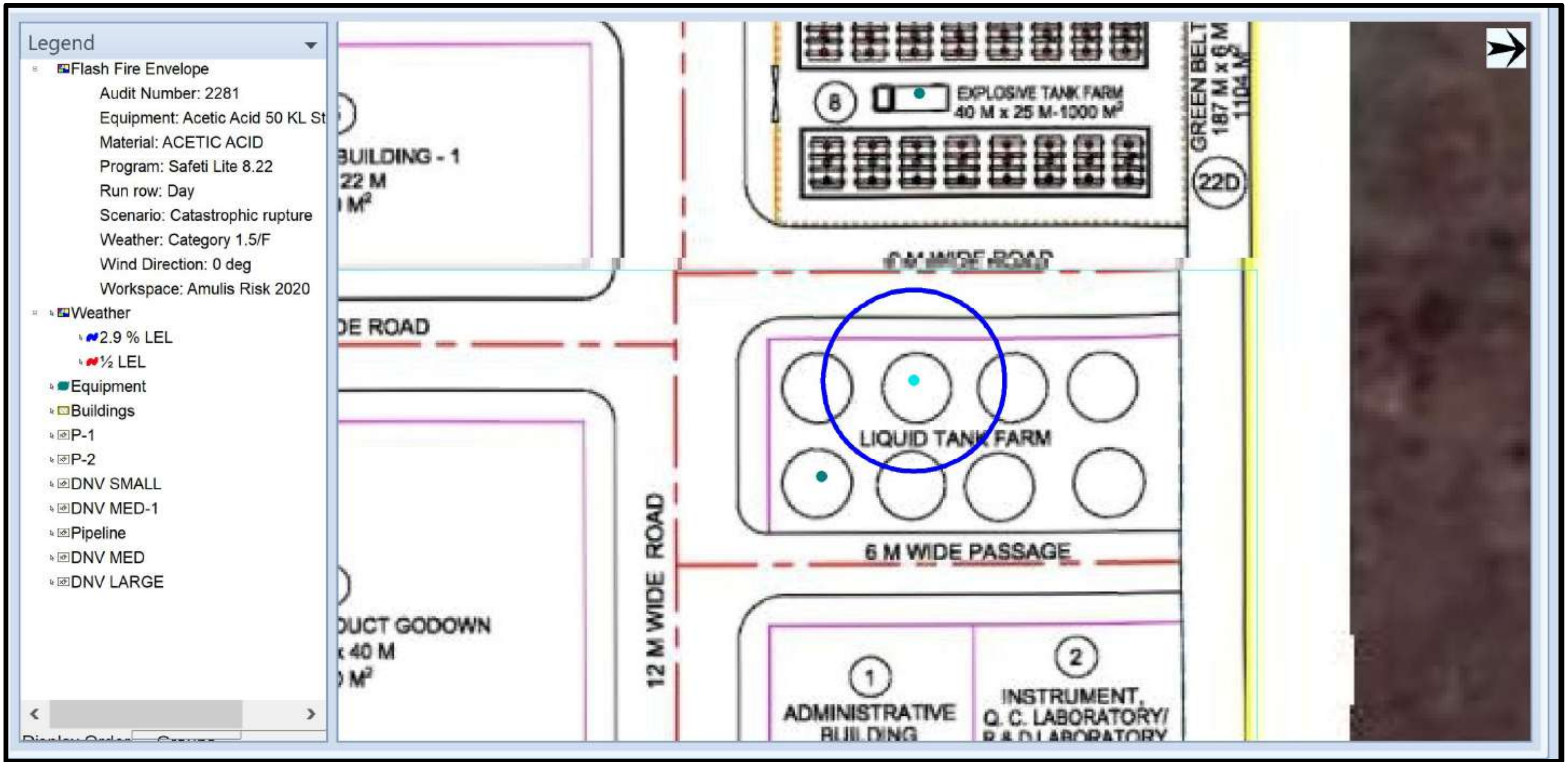
4.1 Phenol 50 KL Storage Tank Short Pipe Rupture- Pool Fire



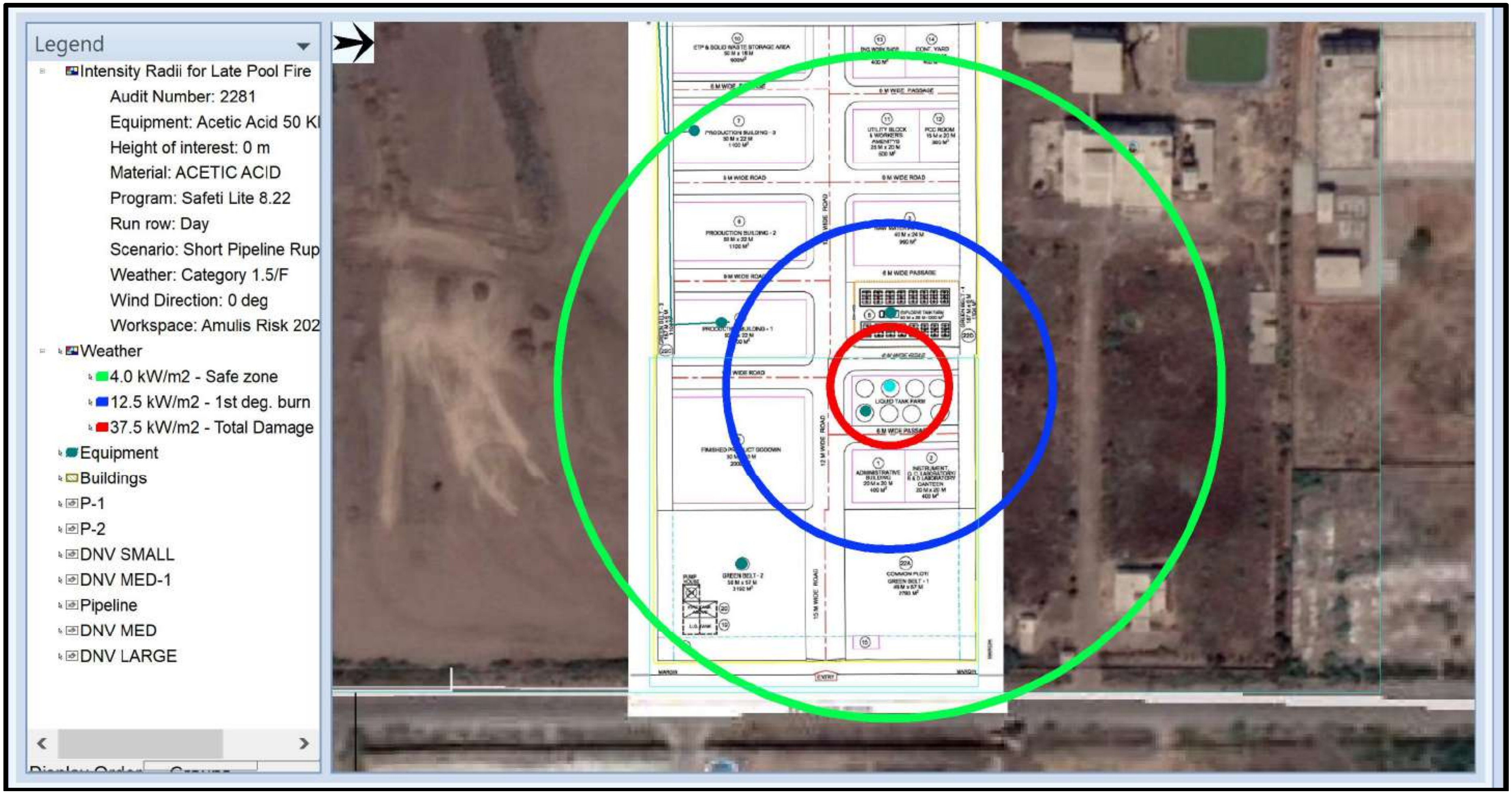
5.1 Acetic Acid 50 KL Storage Tank Catastrophic Rupture- Pool Fire



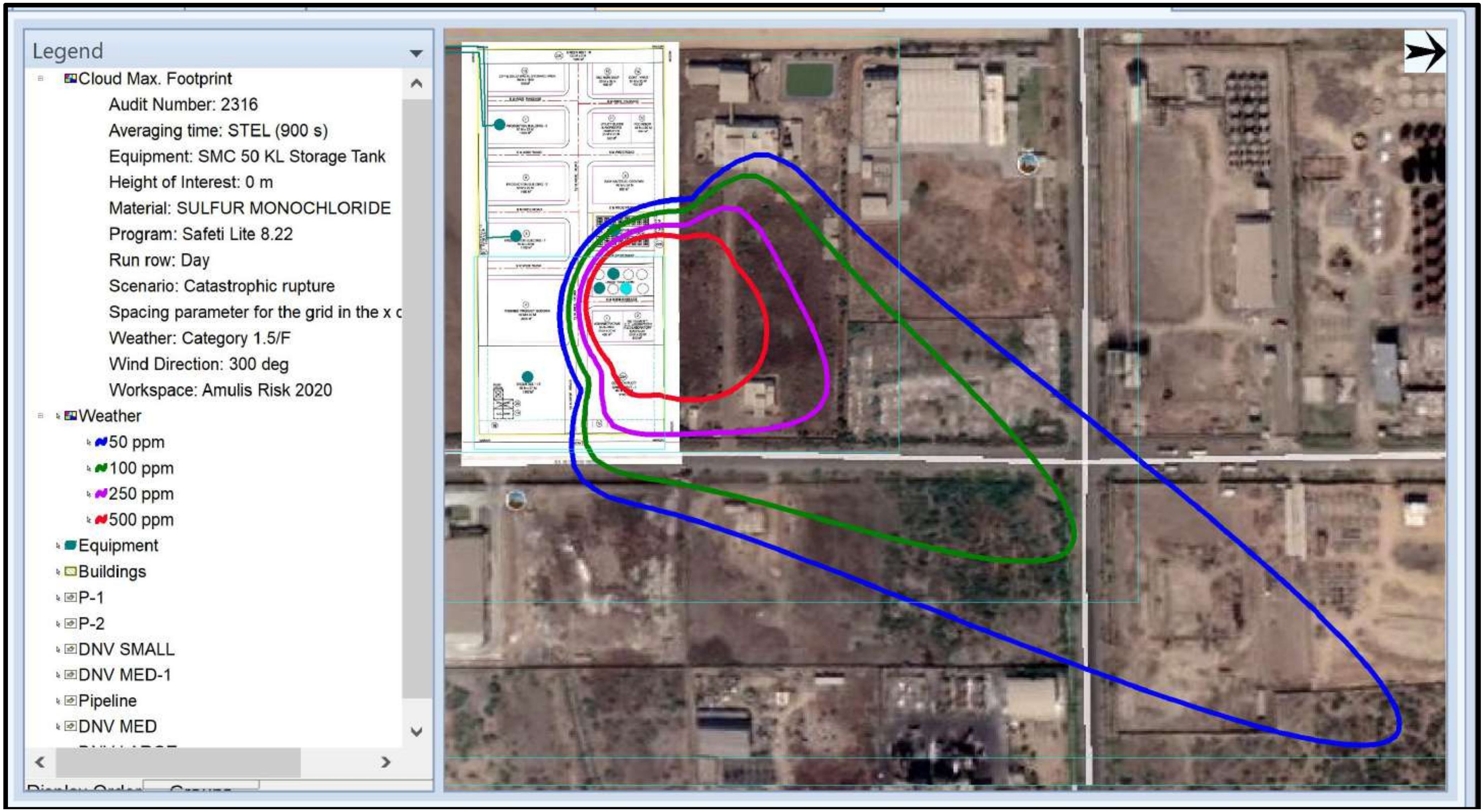
5.2 Acetic Acid 50 KL Storage Tank Catastrophic Rupture- Flash Fire



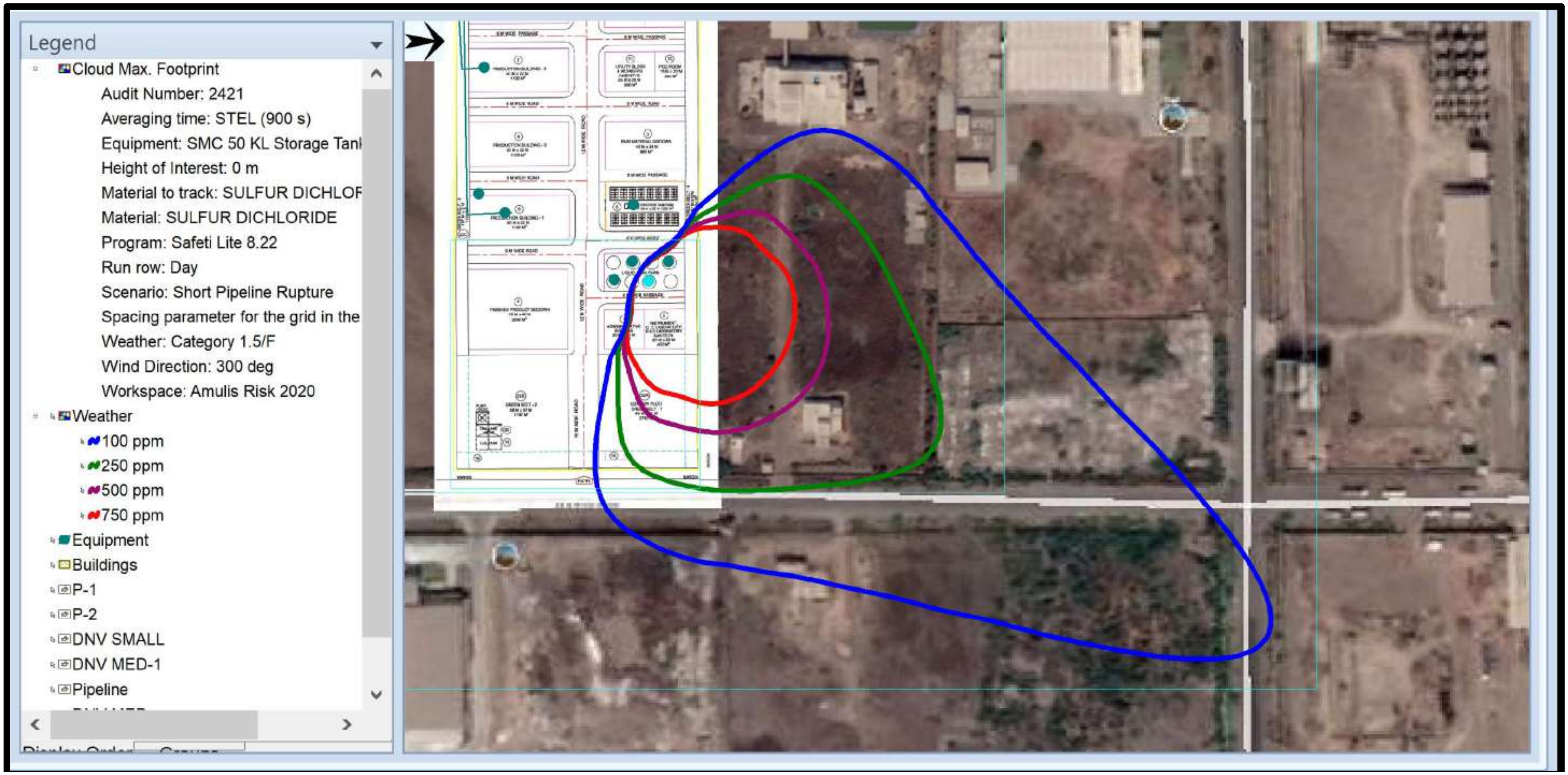
6.1 Acetic Acid 50 KL Storage Tank Short Pipe Rupture- Pool Fire



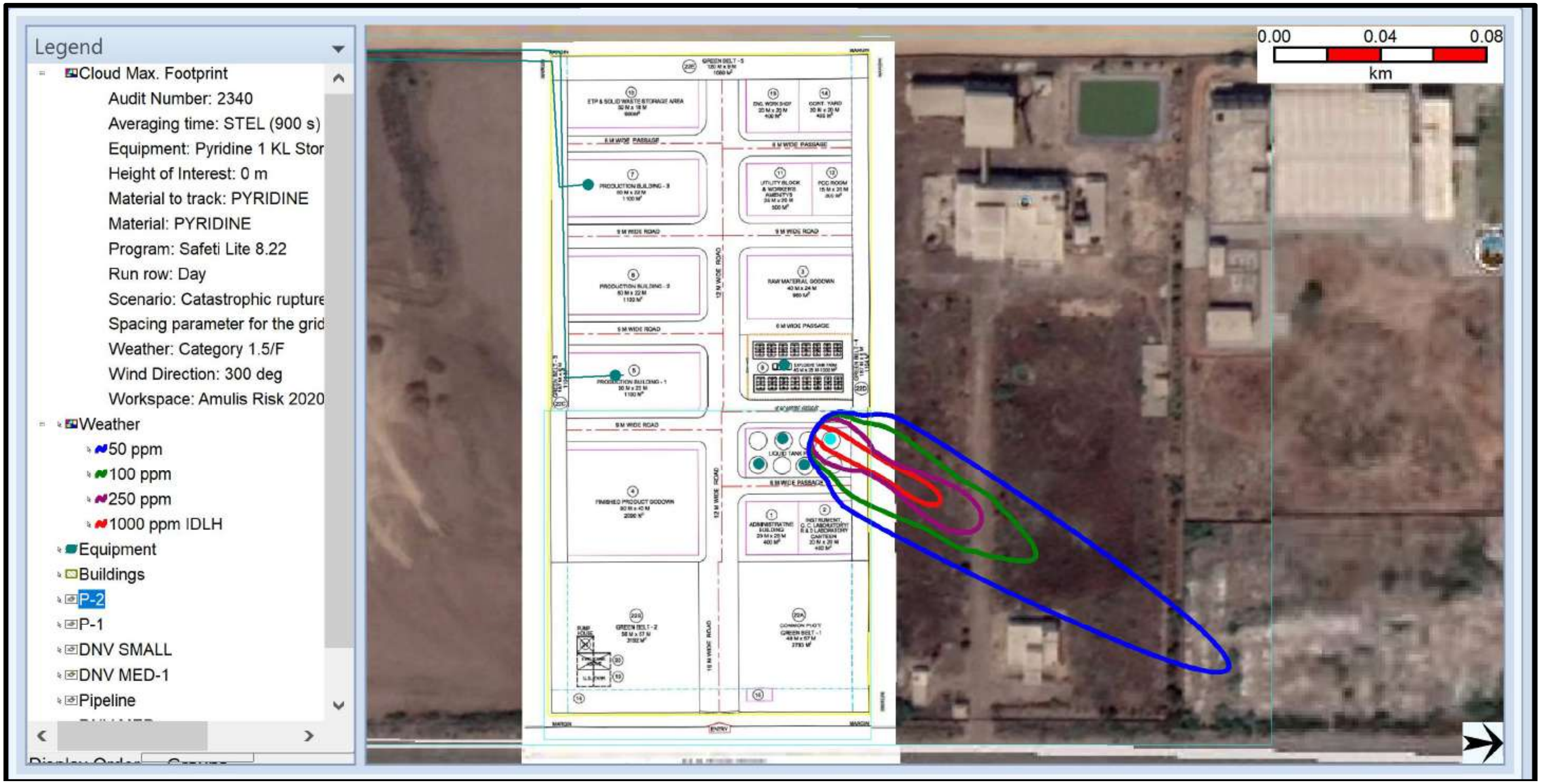
7.1 SMC 50 KL Storage Tank Catastrophic Rupture- Maximum Concentration footprint



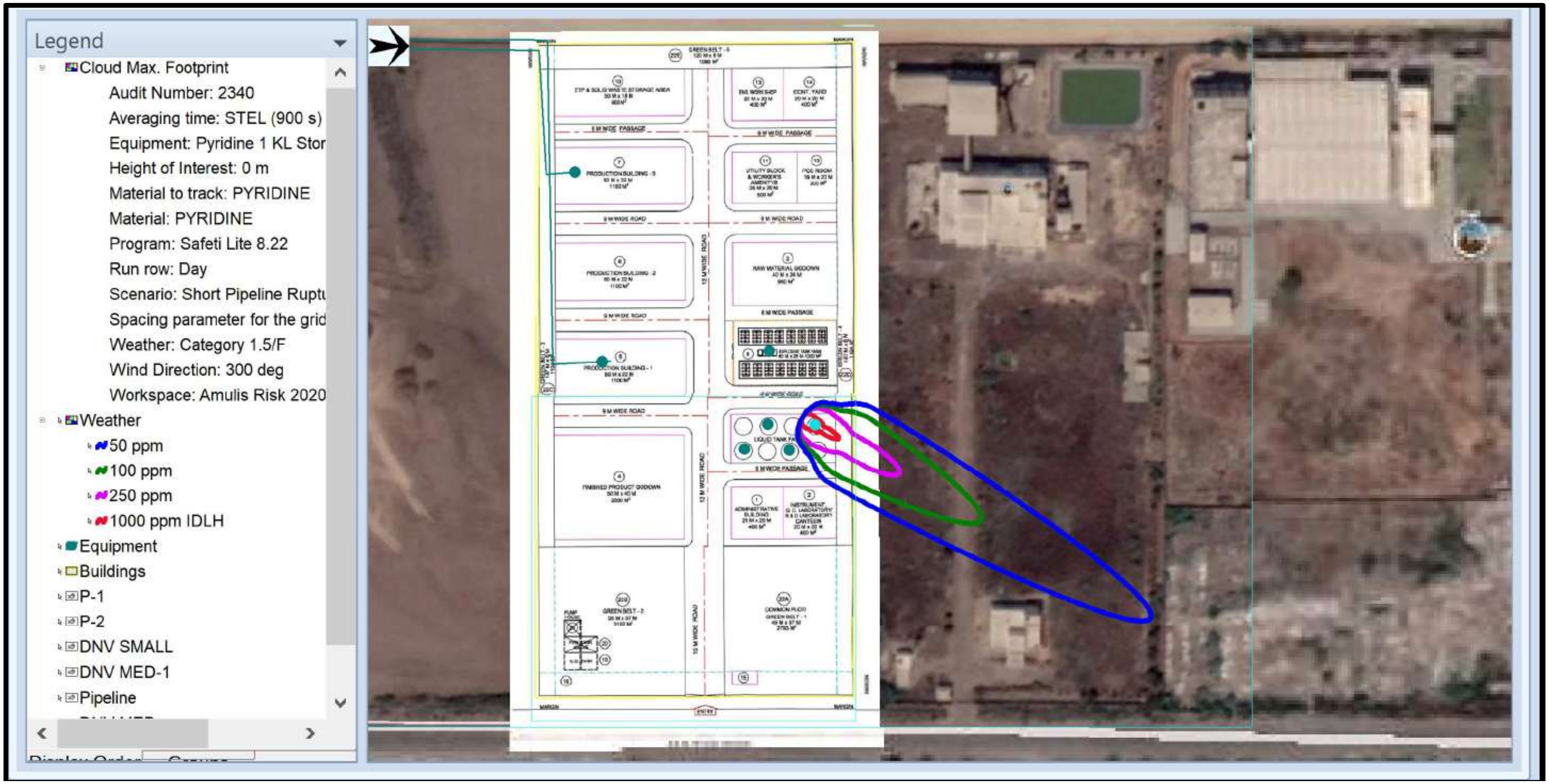
8.1 SMC 50 KL Storage Tank Short Pipe Rupture- Maximum Concentration footprint



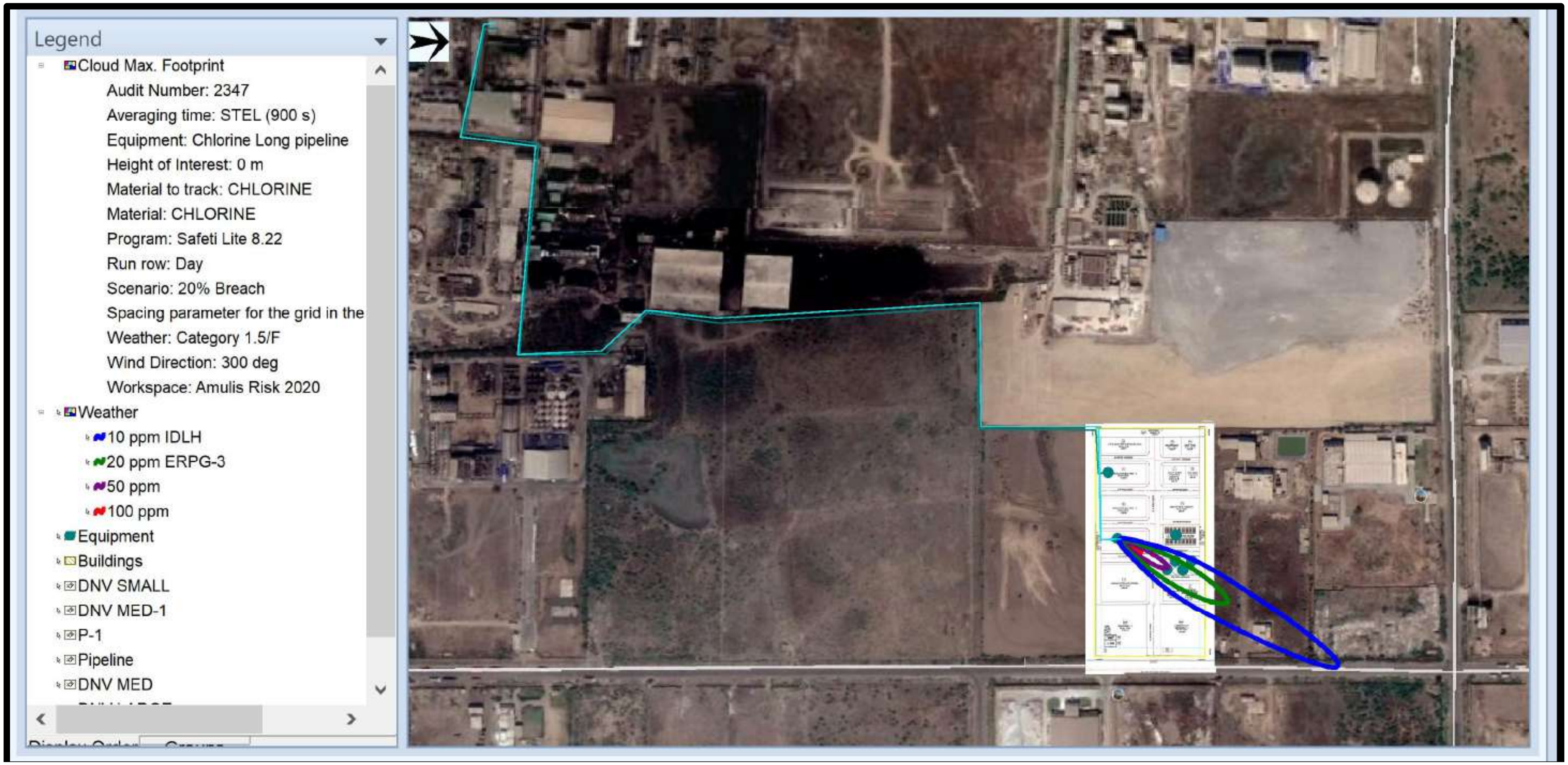
9.1 Pyridine 1 KL Storage Tank Catastrophic Rupture- Maximum Concentration footprint



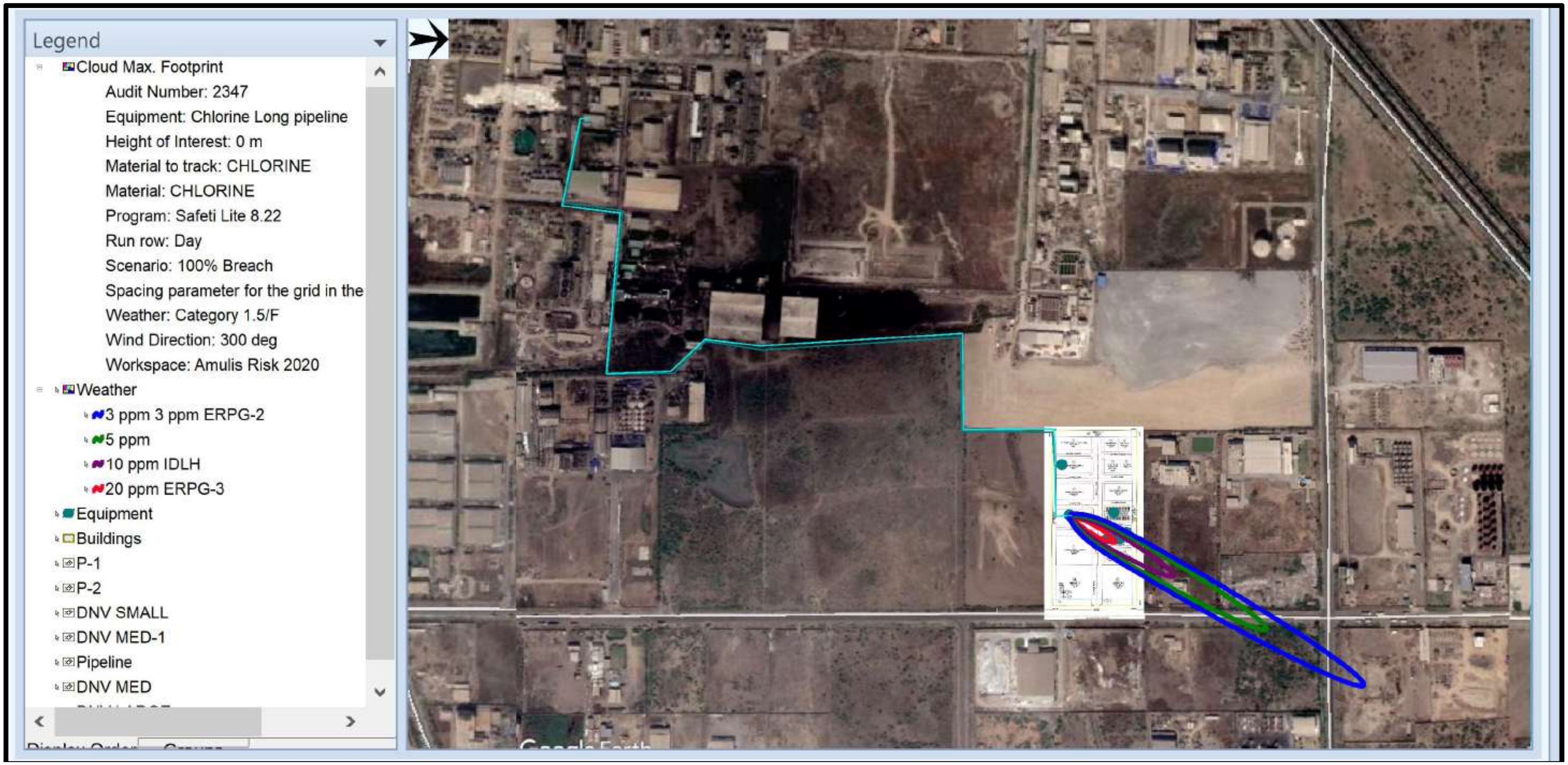
10.1 Pyridine 1 KL Storage Tank Short Pipe Rupture- Maximum Concentration footprint



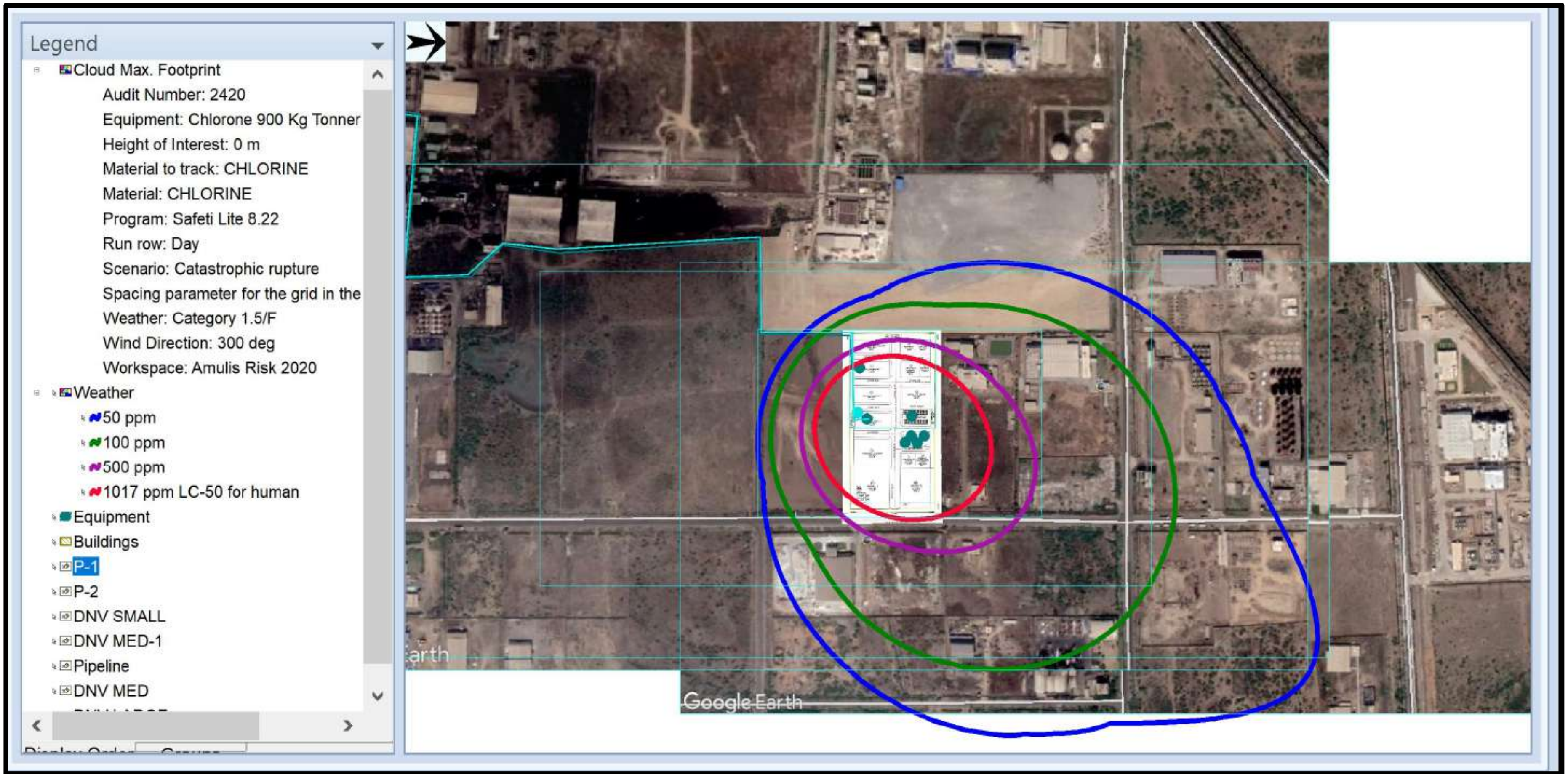
11.1 Chlorine Gas Long pipeline 20 % Breach- Maximum Concentration footprint



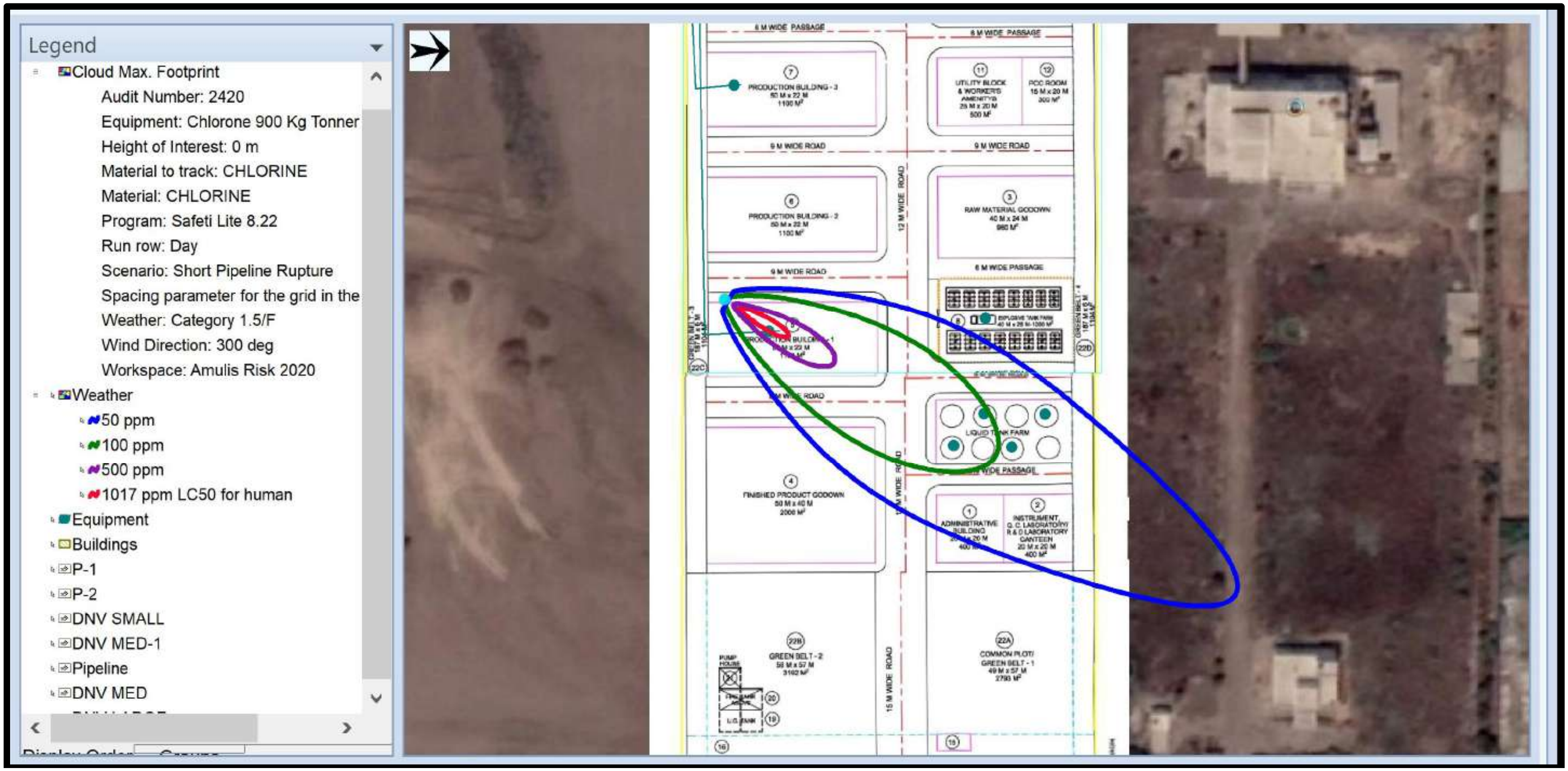
12.1 Chlorine Gas Long pipeline 100 % Breach- Maximum Concentration footprint



13.1 Chlorine 900 Kg Tonner Catastrophic Rupture- Maximum Concentration footprint



14.1 Chlorine 900 Kg Tonner Short Pipe Rupture- Maximum Concentration footprint

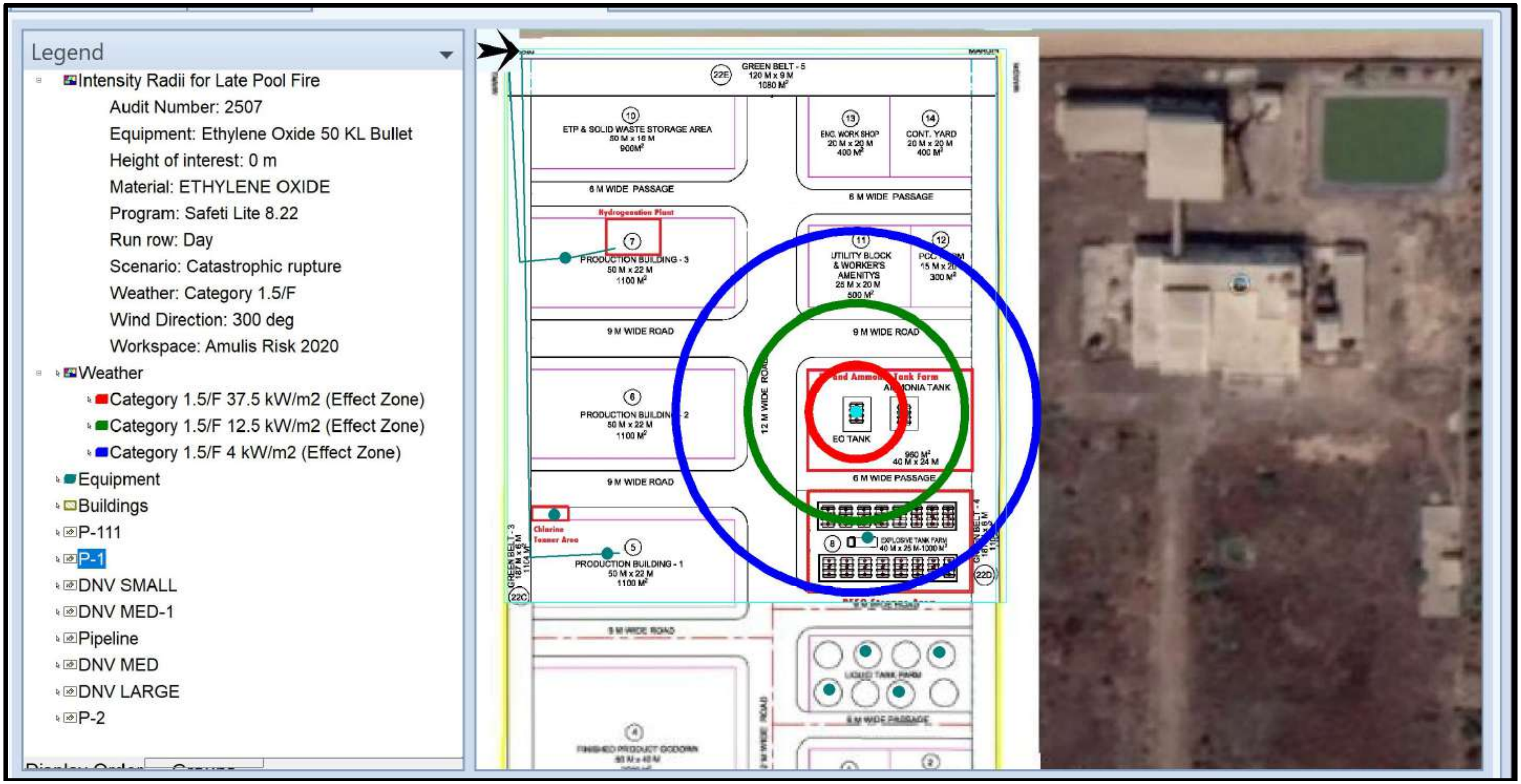


15.1 Hydrogen Gas Long pipeline 20 % Breach-- Explosion Worst case

16.1 Hydrogen Gas Long pipeline 100 % Breach—Jet Fire

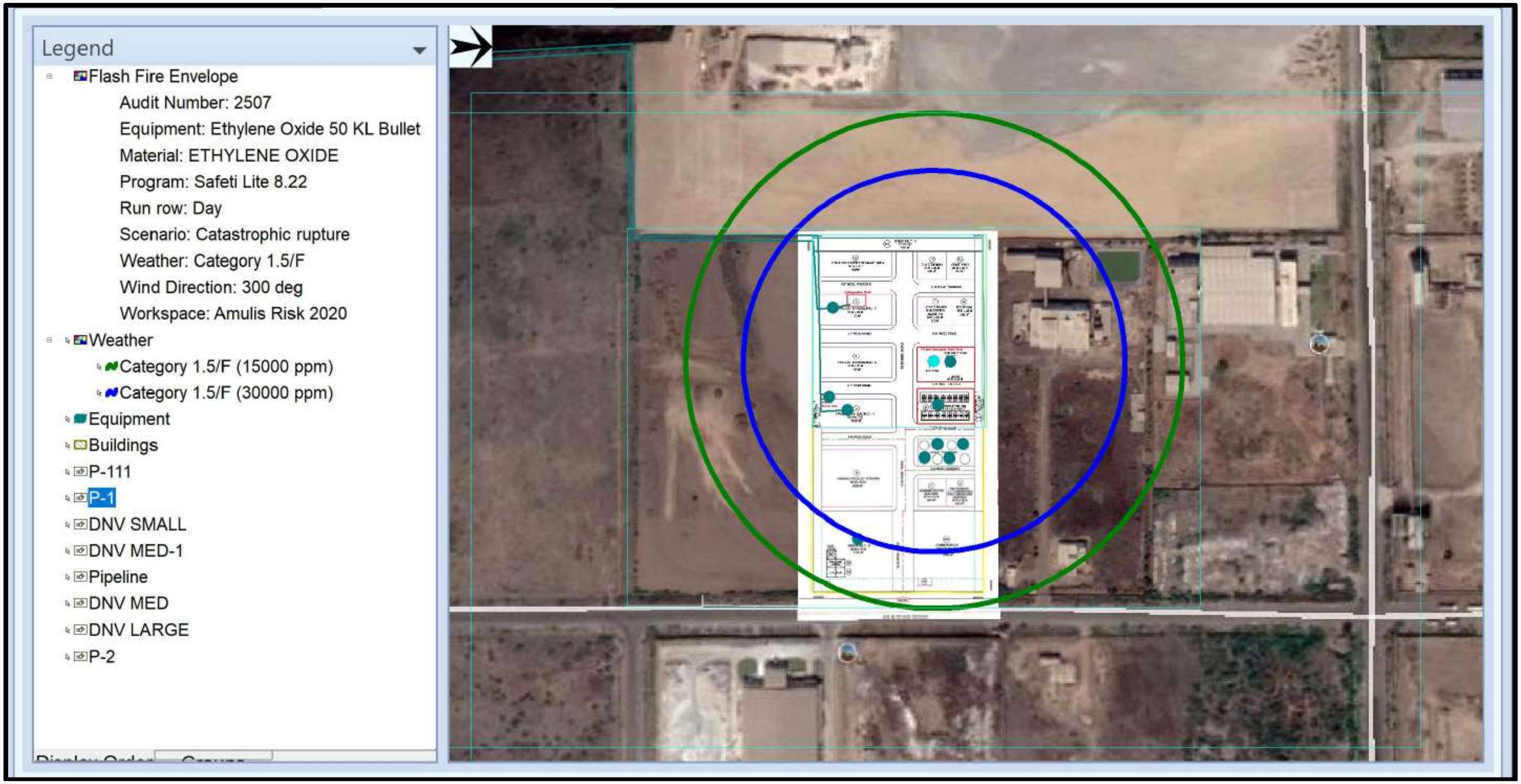
16.2 Hydrogen Gas Long pipeline 100 % Breach-- Explosion Worst case

17.1 Ethylene Oxide Bullet - Catastrophic Rupture- Pool Fire

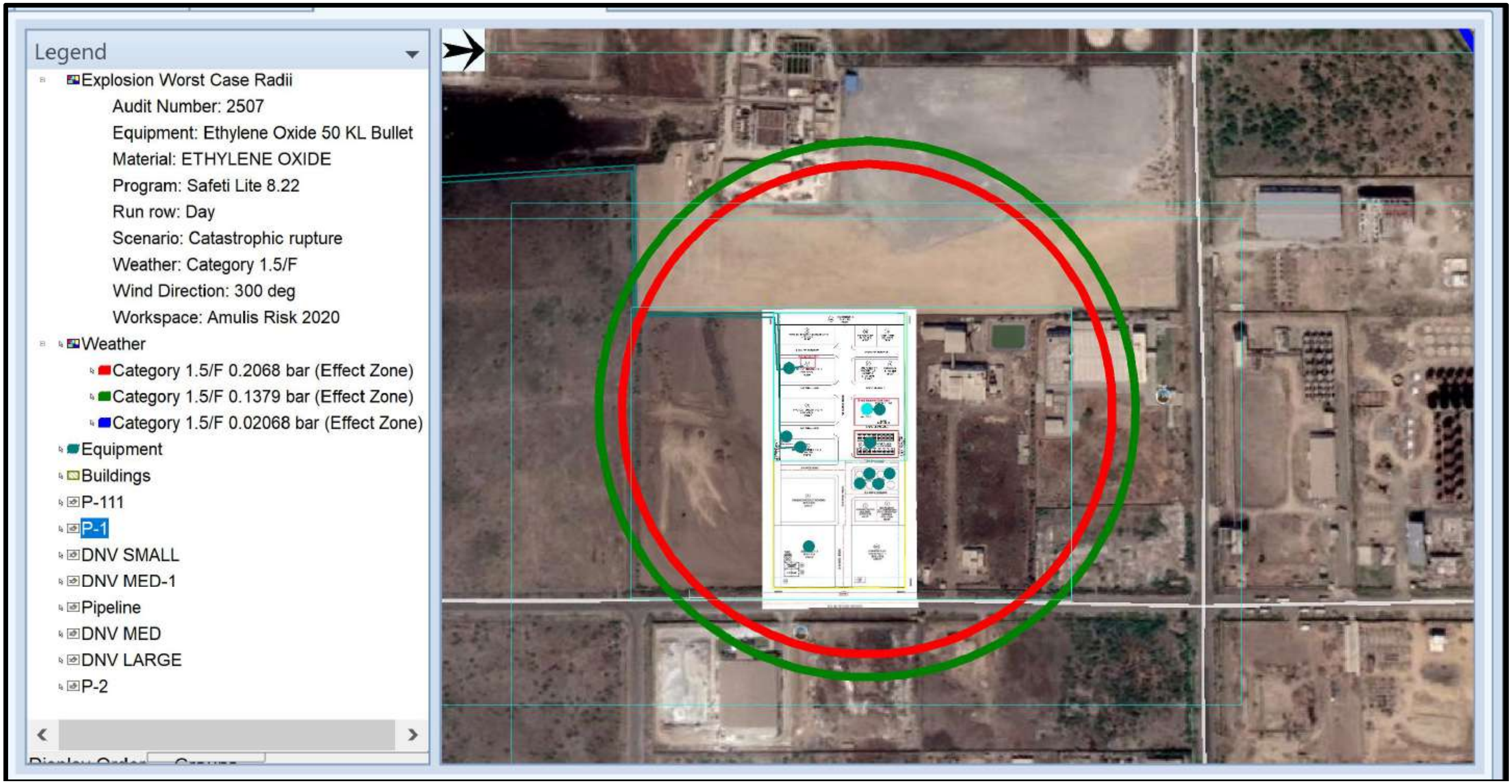


17.2 Ethylene Oxide Bullet - Catastrophic Rupture- Fire Ball

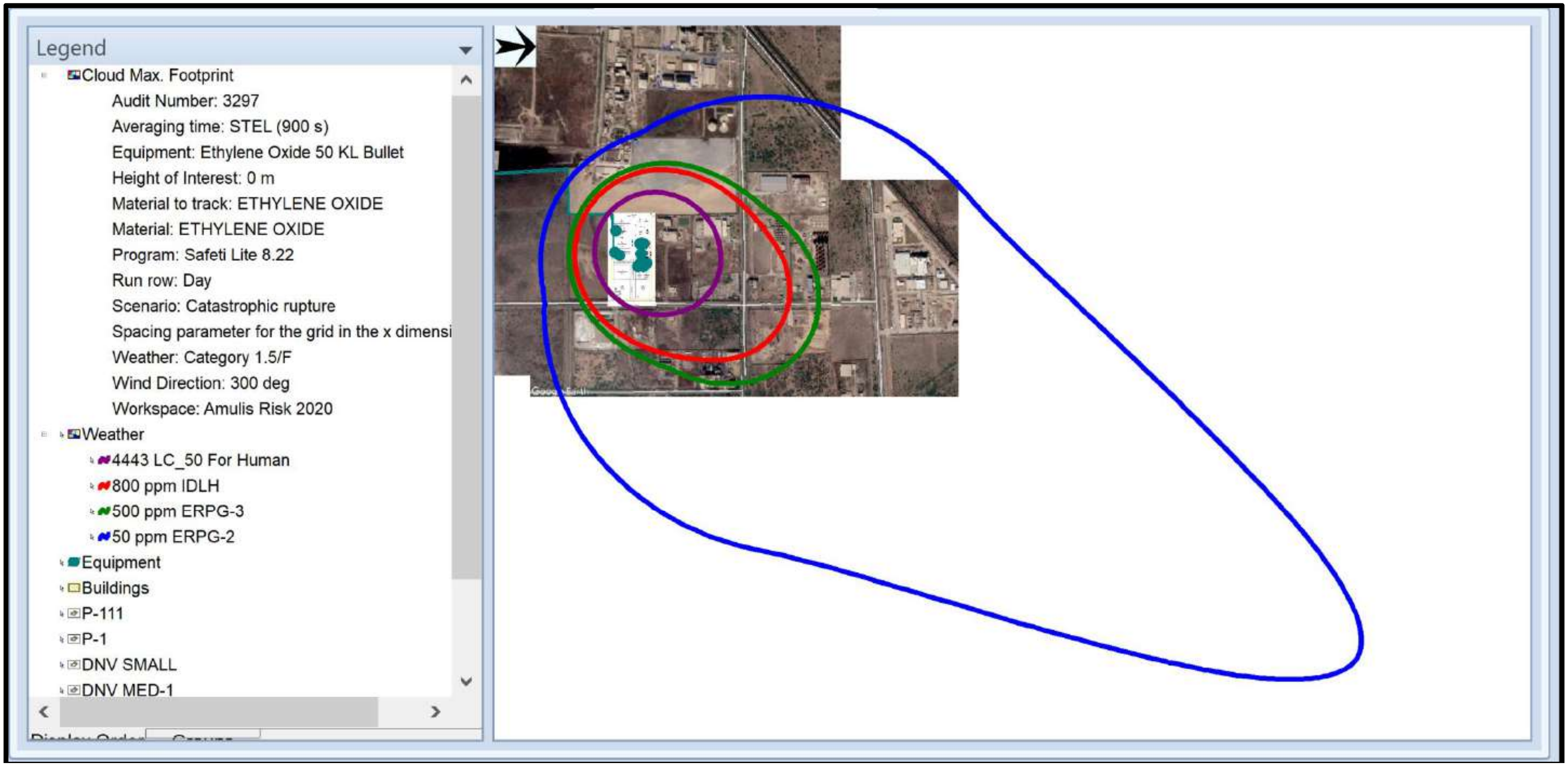
17.3 Ethylene Oxide Bullet - Catastrophic Rupture- Flash Fire



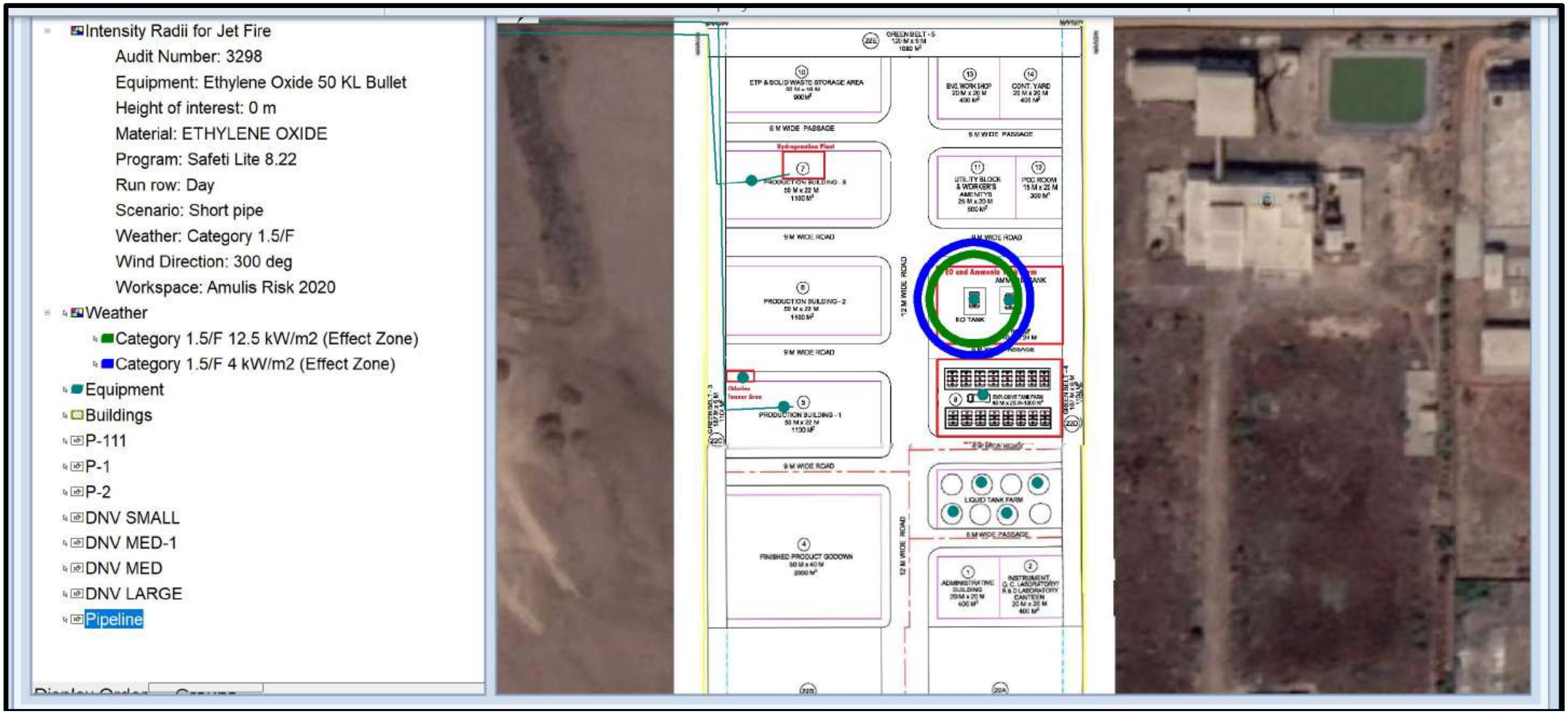
17.4 Ethylene Oxide Bullet - Catastrophic Rupture- Explosion Worst case



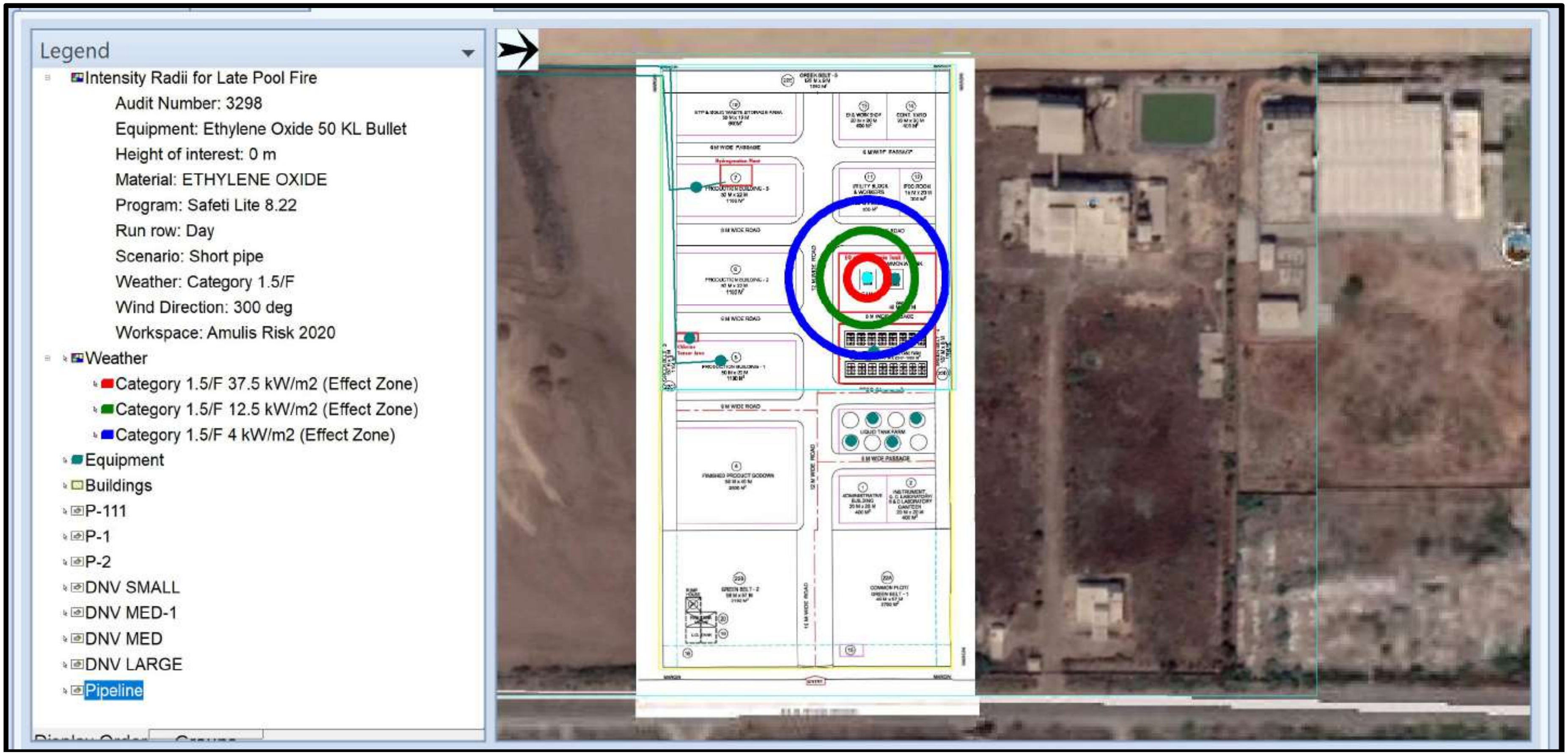
17.5 Ethylene Oxide Bullet - Catastrophic Rupture- Maximum Concentration Footprint



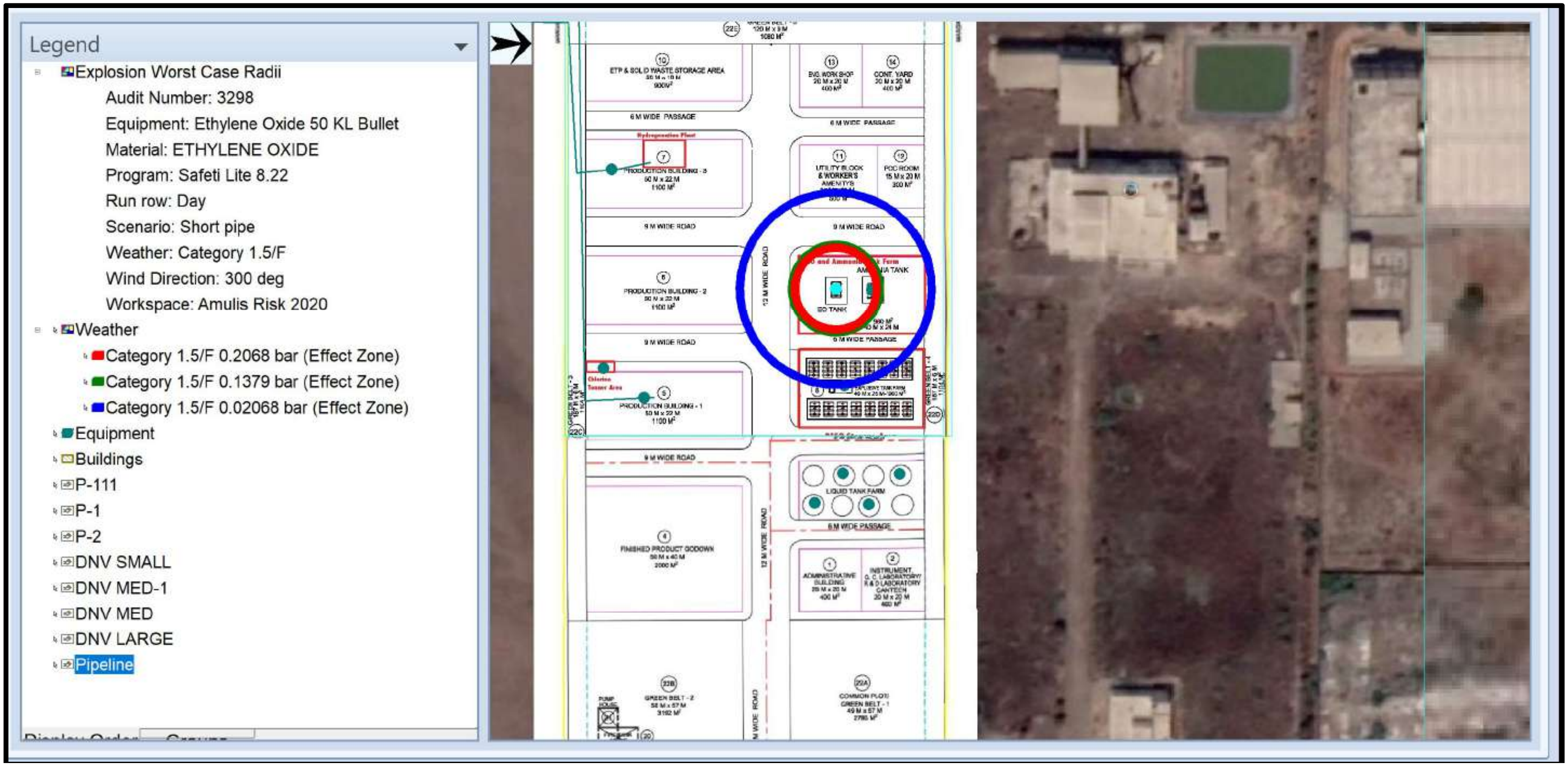
18.1 Ethylene Oxide Bullet - Short Pipe Rupture- Jet Fire



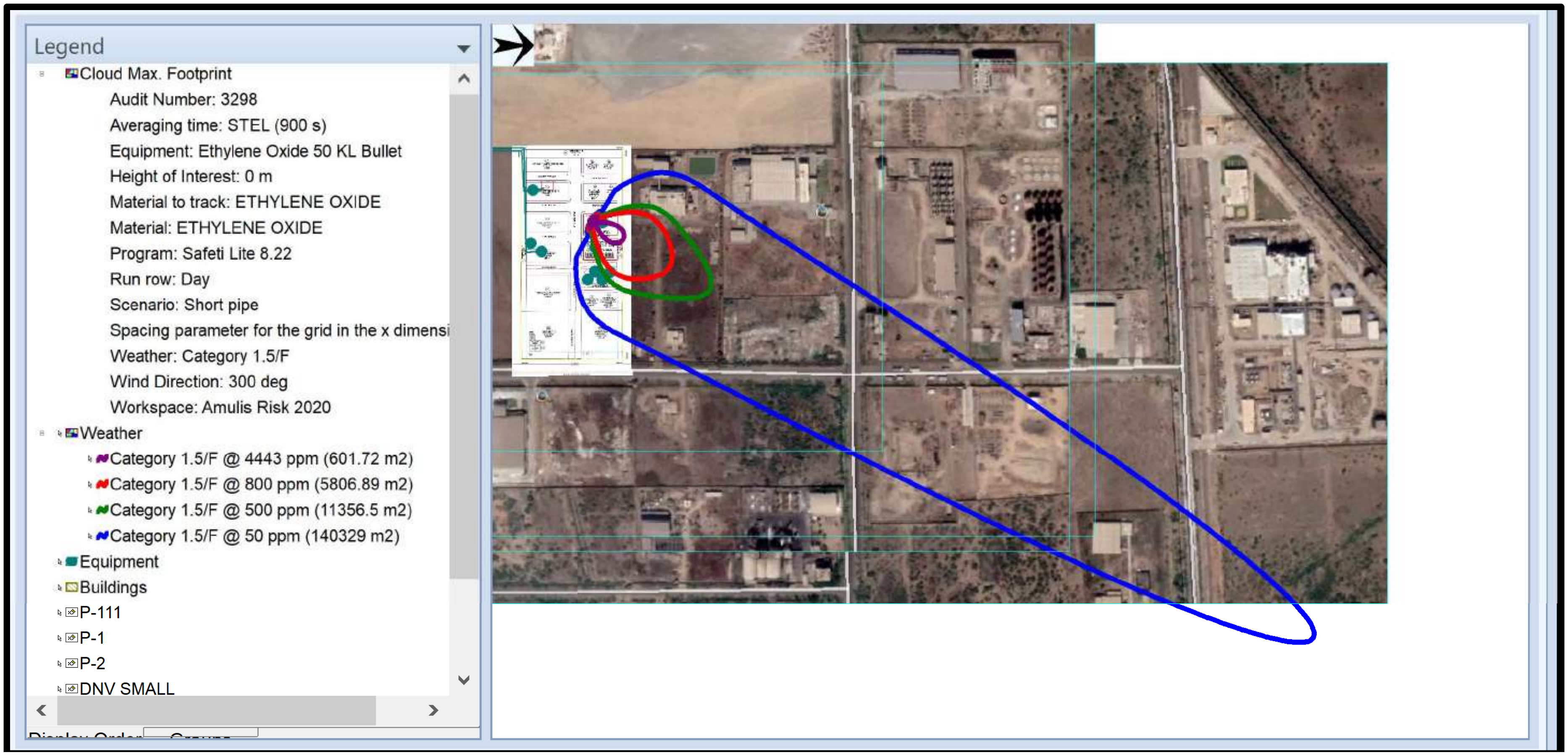
18.2 Ethylene Oxide Bullet - Short Pipe Rupture- Pool Fire



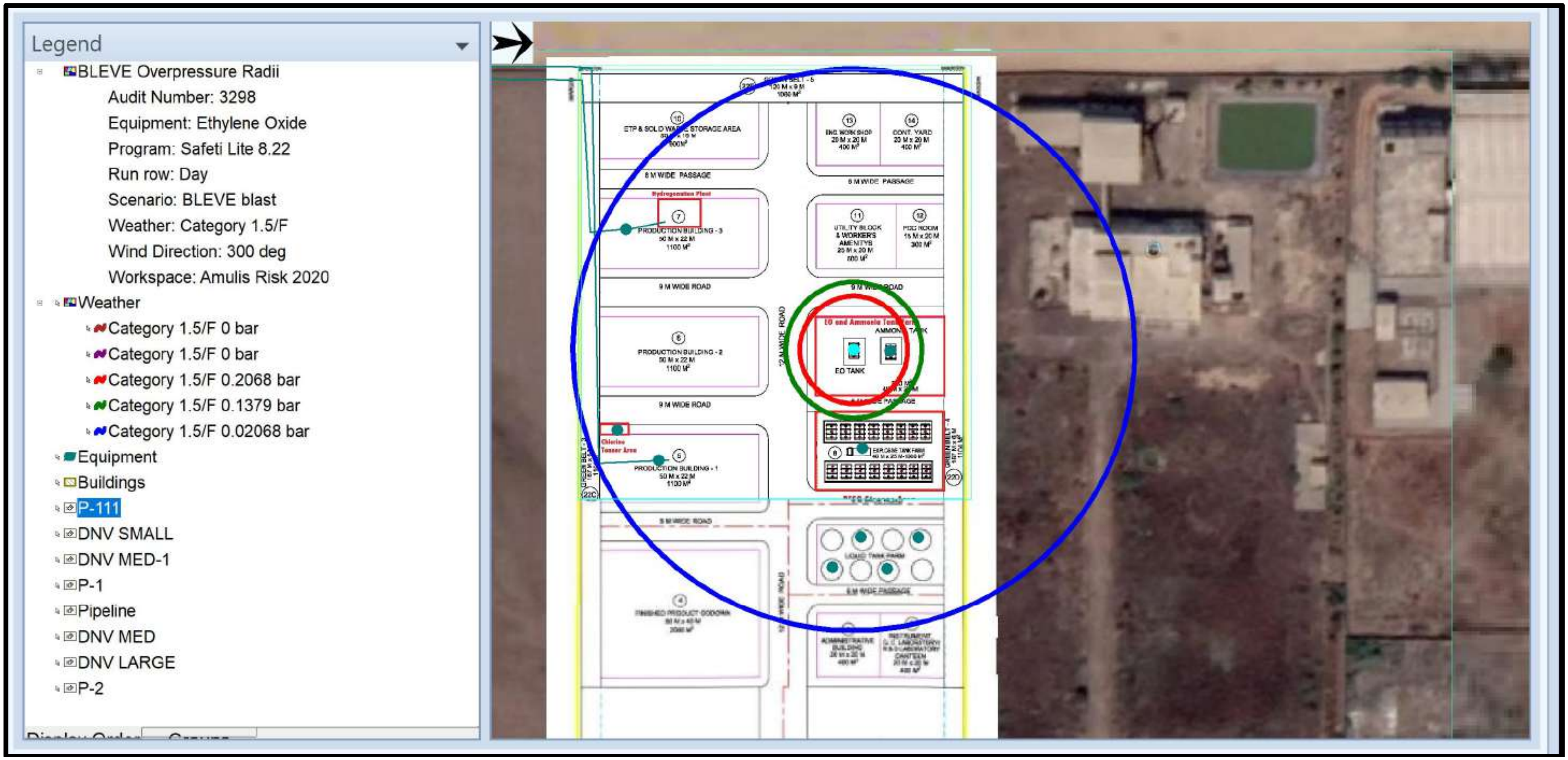
18.3 Ethylene Oxide Bullet - Short Pipe Rupture- Explosion Worst case



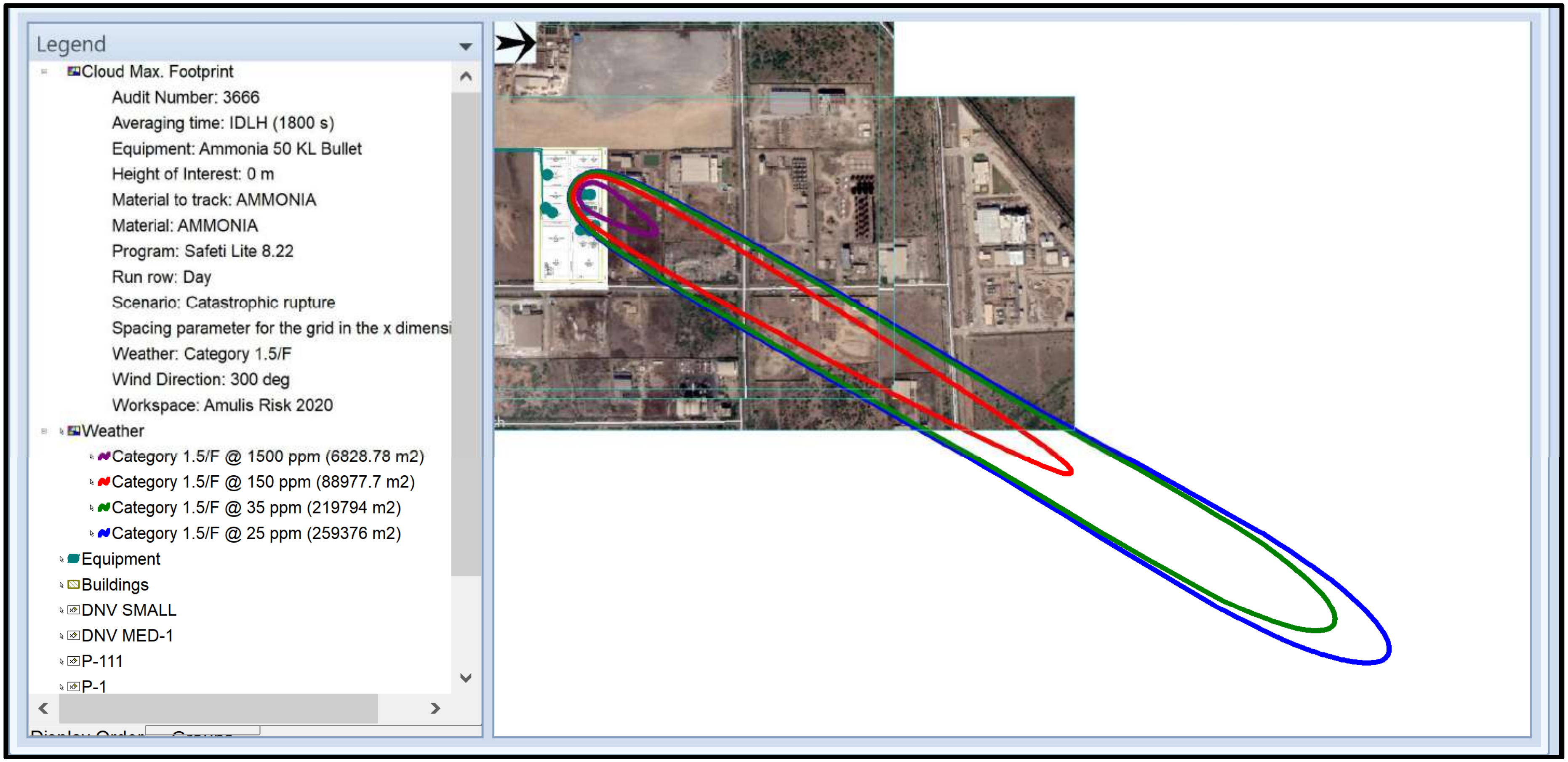
18.4 Ethylene Oxide Bullet - Short Pipe Rupture- Maximum Concentration Footprint



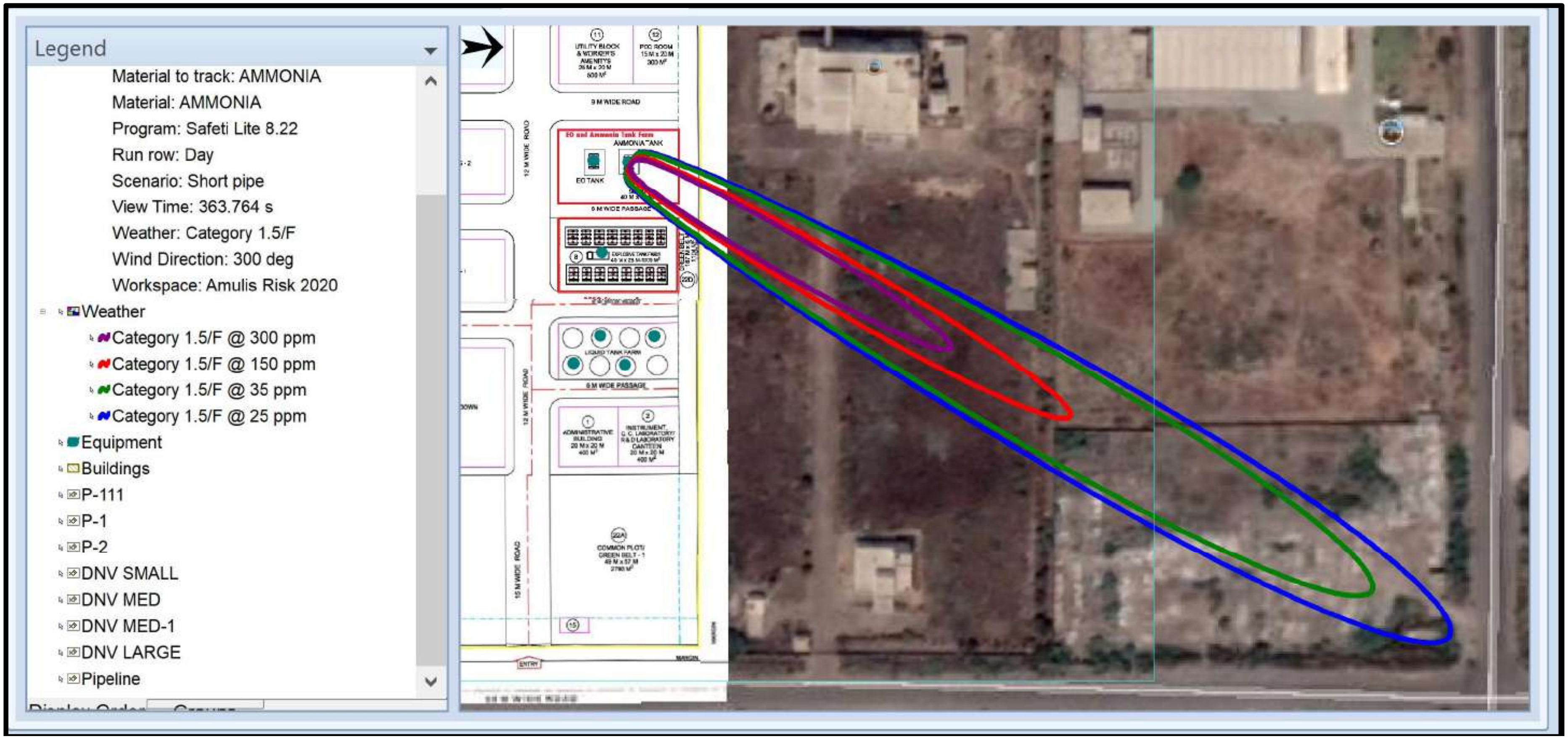
19.1 Ethylene Oxide Bullet – BLEVE



20.1 Ammonia 50 KL Bullet Catastrophic Rupture- Maximum Concentration Footprint



21.1 Ammonia 50 KL Bullet Short Pipe Rupture- Maximum Concentration Footprint



SECTION VIII

DESASTER MANAGEMENT PLAN

An onsite emergency in the industries involving hazardous processes or in hazardous installations is one situation that has potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption in the work area and usually, the effects are confined to factory or in several departments of factory, premise. An emergency begins when operator at the plant or in charge of storage cannot cope up with a potentially hazardous incident, which may turn into an emergency.

8.1 ONSITE EMERGENCY PLAN

8.1.1 OBJECTIVES OF ONSITE EMERGENCY PLAN

A quick and effective response at during an emergency can have tremendous significance on whether the situation is controlled with little loss or it turns into a major emergency. Therefore, purpose an emergency plan is to provide basic guidance to the personnel for effectively combating such situations to minimize loss of life, damage to property and loss of property.

An objective of Emergency Planning is to maximize the resource utilization and combined efforts towards emergency operations are as follows. :

8.1.2 DURING AN EMERGENCY.

- To increase thinking accuracy and to reduce thinking time.
- To localize the emergency and if possible, eliminates it.
- To minimize the effects of accident on people and property.
- To take correct remedial measures in the quickest time possible to
- Contain the incident and control it with minimum damage.
- To prevent spreading of the damage in the other sections.
- To mobilize the internal resources and utilize them in the most effective way
- To arrange rescue and treatment of causalities.

8.1.3 DURING NORMAL TIME.

- To keep the required emergency equipment in stock at right places and ensure the working condition.
- To keep the concerned personnel fully trained in the use of emergency equipment.
- To give immediate warning tooth surrounding localities in case of an emergency situation arising.
- To mobilize transport and medical treatment of the injured.
- To get help from the local community and government officials to supplement manpower and resources.
- To provide information to media & Government agencies, Preserving records, evidence of situation for subsequent emergency etc.

8.2 SCOPE OF OSEP

This OSEP is prepared for industrial emergencies like fires, explosions, toxic releases and asphyxia and does not cover natural calamities and societal disturbances related emergencies (like strikes, bomb threats, civil commission's etc.)

8.3 ELEMENTS OF ONSITE EMERGENCY PLAN

The important elements to be considered in plan are

- Emergency organization
- Emergency Facilities.
- Roles and Responsibilities of Key Personnel and Essential Employee.
- Communications during Emergency
- Emergency Shutdown of Plant & Control of situation.
- Rescue Transport & Rehabilitation.
- Developing Important Information.

8.4 METHODOLOGY.

The consideration in preparing Emergency Plan will be included the following steps:

- Identification and assessment of hazards and risks.
- Identifying, appointment of personnel & Assignment of Responsibilities.
- Identification and equipping Emergency Control Centre.
- Identifying Assembly, Rescue points Medical Facilities.
- Formulation of plan and of emergency sources.
- Training, Rehearsal & Evaluation.
- Action on Site.

Earlier, a detailed Hazard Analysis and Risk Assessment were carried out on hazards and their likely locations and consequences are estimated following the standard procedure.

However, the causing factors for above discussed end results may be different and causing factors are not discussed in this plan.

8.5 EMERGENCIES IDENTIFIED

Emergencies that may be likely at bulk fuel storage area, process plant, cylinder storage area, and drum storage shed, and autoclave reactor area. There are chances of fire and explosive only.

8.6 OTHERS

Other risks are earthquake, lightning, sabotage, bombing etc., which are usually, not in the purview of management control.

8.7 EMERGENCY ORGANISATION.

Plant organization is enclosed. Based on the plant organization, which includes shift organization, an Emergency Organization is constituted towards achieving objectives of this emergency plan.

Plant Manager is designated as Overall in Charge and is the Site Controller.

The following are designated as Incident Controllers for respective areas under their control. Shift in charge Engineer (Plant Operations) is designated at Incident Controller for all areas of plant.

8.8 EMERGENCY FACILITIES

8.8.1 EMERGENCY CONTROL CENTRE (ECC)

It is a location, where all key personnel like Site Controller; Incident Controller etc. can assemble in the event of onset of emergency and carry on various duties assigned to them.

Plant Manager's Office is designated as Emergency Control Centre. It has P&T telephone as well as internal telephones, ECC is accessible from plant located considerably away from process plant, Storage's and on evaluation of other locations, Plant Manager's Room find merit from the distance point of view, communication etc.

8.8.2 FACILITIES PROPOSED TO BE MAINTAINED AT EMERGENCY CONTROL CENTRE (ECC)

The following facilities and information would be made available at the ECC

- Latest copy of Onsite Emergency Plan and off sites Emergency Plan (as provided by District Emergency Authority).
- Intercom Telephone.
- P&T Telephone.
- Telephone directories (Internal, P&T)
- Factory Layout, Site Plan
- Plans indicating locations of hazardous inventories, sources of safety equipment, hydrant layout, location of pump house, road plan, assembly points, vulnerable zones, escape routes.
- Hazard chart.
- Emergency shut-down procedures.
- Nominal roll of employees.
- List and address of key personnel
- List and address of Emergency coordinators.
- List and address of first aides,
- List and address of first aid fire-fighting employees,
- List and address of qualified trained persons.

8.8.3 FIRE FIGHTING FACILITIES.

- Internal hydrant system
- Portable extinguishers

8.8.4 FIRE PROTECTION SYSTEMS

These systems are proposed to protect the plant by means of different fire protection facilities and consist of

- Hydrant system for exterior as well as internal protection of various buildings/areas of the plant.
- Portable extinguishers and hand appliances for extinguishing small fires in different areas of the plant.
- Water cum foam monitor to be provided in bulk fuel storage area.
- Fire water pumps.
- Two (2) independent motor driven pumps each of sufficient capacity and head are proposed for the hydrant systems which are capable to extinguish Fire or cooling purpose.

8.8.5 HYDRANT SYSTEM.

Adequate number of fire hydrants and monitors will be provided at various locations in and around the buildings and other plant areas. The hydrants will be provided on a network of hydrant mains drawing water from the hydrant pump, which starts automatically due to drop of pressure in the event of operating the hydrant valves. We are suggesting you to go for TAC approved hydrant system for foolproof safety and benefit from fire policy premium.

8.9 EMERGENCY ESCAPES

The objective of the emergency escape is to escape from the hazardous locations, to the nearest assembly point or the other safe zone, for rescue and evacuation.

8.10 ASSEMBLY POINT.

Assembly point is location, where, persons unconnected with emergency operations would proceed and wait for rescue operation.

8.11 WIND SOCK.

Wind socks for knowing wind direction indication would be provided at a suitable location to visible from many locations. It is proposed to install windsocks at plant and Administration Building so as to be visible from different locations in the plant.

8.12 EMERGENCY TRANSPORT.

Emergency Ambulance would be stationed at the Administration Office and round the clock-driver would be made available for emergency transportation of injured etc. However, the other vehicles of the company also would be available for emergency services.

8.13 EMERGENCY COMMUNICATION.

There are two kinds of communication system provided.

(a) Regular P&T phones with intercom facility.
(b) Mobile phone

8.14 WARNING/ALARM/COMMUNICATION OF EMERGENCY

The emergency would be communicated by operating electrical siren for continuously for five minutes with high and low pitch mode.

8.15 EMERGENCY RESPONSIBILITIES:

Priority of Emergency Protection.

- Life safety
- Preservation of property
- Restoration of the normalcy

8.16 MUTUAL AID

While necessary facilities are available and are updated from time to time, sometimes, it may be necessary to seek external assistance; it may be from the neighboring factories or from the State Government as the case may be.

8.17 MOCK DRILL

Inspite of detailed training, it may be necessary to try out whether, the OSEP works out and will there be any difficulties in execution of such plan. In order to evaluate the plan and see whether the plan meets the objectives of the OSEP, occasional mock drills are contemplated. Before undertaking the drill, it would be very much necessary to give adequate training to all staff members and also information about possible mock drill. After few pre-informed mock drills, few UN-informed mock drills would be taken. All this is to familiarize the employees with the concept and procedures and to see their response. These scheduled and unscheduled mock drills would be conducted during shift change, public holidays, in night shift etc. To improve preparedness once in 6 months and performance is evaluated and Site Controller maintains the record. Incident Controller (IC) coordinates this activity.

8.18 Scenarios based emergency action plan:

8.18.1 Possible Emergency: - Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. Chemicals from road tanker.

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, AnilineEtc.Chemicals road tanker unloading point	Heavy spillage of Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. from the road tanker unloading hose	(1) Vapour generated and run in down wind direction. (2) Fire and explosion.	(1) Connecting hose disconnected from the flange and 100 % release of material from valve. (2) Rupture of unloading hose. (3) Leaking from flange gasket (4) Fire in spill collection drum.	Raised alarm immediately for warning the people if large spillage observed. Do not entre in spillage are. Stop all hot work in this area. Call fire and Safety department Close valve immediately if it is safe to do. Cordon the area immediately. Do not touch any electrical switches in spillage area. Stop all activities in tank farm area.	First observer/ driver/ cleaner/ operator All employees Operator Operator Driver cleaner Security team IC Rescue team Rescue team	Tanker unloading procedure to be prepared and implemented strictly. Sampling method to be prepared and implemented. Wheel stopper to be provided. Static earthing with interlocking shall be provided. Leakage proof connection hose to be done before starting the unloading. No spillage of Heavy

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				Evacuate non-essential persons from the affected area immediately. Evacuate the surrounding area up to 200 meter in all direction. Try to control situation at department level with available resources with full PPEs. Identify the spillage material and refer MSDS for control plan. Inform the Site main Controller (SMC) in detail. Take decision to Declare onsite emergency. Efforts to be made to prevent spreading of Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia	IC IC IC SMC Fire and spill control team Fire team Fire team	Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. to be allowed in tank farm area. All firefighting equipment to be kept in good working condition. 200 Lit AFFF foam drum to be kept ready in tank farm area for firefighting. All employees in area to be trained for firefighting and such scenarios base emergencies. Strict supervision of whole activity responsibility to be define.

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, AnilineEtc.to a large area by containing it in a small area by temporary arrangements or by diverting the spreading oil to a low-lying area away from strategic plant areas. Start to spread AFFF foam on spilled material to control evaporation rate. Do not drain spilled material in any trench or sump. Ensure search and rescue and causalities receive attention. Administer first aid to the victim. Make arrangement to send injured person/s to Hospital. If off site emergency situation occurs –Inform to following agencies Request for Mutual aiders, local authorities like – DISH	Rescue team First Aid team Rescue team Administration team SMC	LEL % base gas detection system to be provided and to be maintained in good working condition. Emergency telephone number list to be displayed in this area. In case of emergency – action plan and communication chart to be displayed in this area. Remaining Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. collection crude method of road tanker run forward and backward practices to be

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				office, Collectorate office, Disaster management cell, Police, fire brigade, nearby hospital, local GPCB office		stopped immediately. Such crude method will lead road tanker disaster.

8.18.2 Possible Emergency: - Unconfined pool fire due to heavy spillage of Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. from road tanker unloading hose

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Heavy Spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, AnilineEtc.Unloading point	Heavy spillage of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, AnilineEtc. from the road tanker unloading hose and it	(1) Unconfined Pool fire (2) In case of Flammable Chemicalsif the liquid does not catch fireMethanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur	Immediate ignition available.	Raise fire siren or shouting Fire...Fire.... Fire... Evacuate the area immediately. Inform the area incharge. Inform IC in detail. Affected area to be cordoned off. Call fire department immediately and help them for	First Observer All employees in this area First observer Department employee Security team IC	Tanker unloading procedure to be prepared and implemented strictly. Sampling method to be prepared and implemented. Wheel stopper to be provided. Static earthing with interlocking shall be provided.

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
	got fire. (Unconfined pool fire)	Monochloride, AnilineEtc.can evaporate and if the vapor cloud in its movement in the direction of wind, meets any source of ignition, it may result in a vapor cloud explosion.		firefighting. Try to control situation at department level with available resources with full PPEs. If it is found uncontrollable condition by department level inform SMC for onsite emergency situation. Declare on site emergency if required. Start fire hydrant system or water hose rill and spray water on nearby tank farm area for cooling purpose. Use foam fire extinguishers for firefighting of Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. Chemicals fire.	Department firefighting team. IC SMC Fire team Fire team All team member SMC	Leakage proof connection hose to be done before starting the unloading. No spillage of Flammable Chemical sto be allowed in tank farm area. All fire fighting equipments to be kept in good working condition. 200 Lit AFFF foam drum to be kept ready in tank farm area for fire fighting. All employees in area to be trained for fire fighting and such scenarios base emergencies. Strict supervision of

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				Do not enter in fire prone area. If the fire is not controlled, Emergency may be declared and on-site emergency plan to be brought into action and services from outside agencies to be requisitioned, if considered necessary. If fire found uncontrollable condition call fire brigade and mutual aider for help. All hazardous activates stop at site. Ensure search and rescue and causalities receive attention. Administer first aid to the victim. Make arrangement to send injured person/s to Hospital. And inform victim's family.	SMC and all dept. head. SMC Rescue team First Aid team Administration team SMC	whole activity responsibility to be define. LEL % base gas detection system to be provided and to be maintained in good working condition. Emergency telephone number list to be displayed in this area. In case of emergency – action plan and communication chart to be displayed in this area. Remaining Methanol, Toluene, Benzene, Phenol, Pyridine, Ammonia Gas, Ethylene Oxide, Acetic Acid, Sulfur Monochloride, Aniline Etc. collection

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				If off site emergency situation occurs –Inform to following agencies. Request for Mutual aiders, local authorities like – DISH office, Collectorate office, Disaster management cell, Police, fire brigade, nearby hospital, local GPCB office.		crude method of road tanker run forward and backward practices to be stopped immediately. Such crude method will lead road tanker disaster.

8.18.3 Possible Emergency: - Heavy Spillage of Acid from Storage tank

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Acid storage tank	Heavy spillage of Acid from Storage tank	(1) Heavy spillage of Acid in dyke area and due to contact with humid air and water contact with spilled material mist / fumes will be generated and	Over filling due to malfunction of level gauge and level transmitter. Bottom valve leakage	Raised alarm immediately for warning the people if large spillage observed. Do not entre in spillage are. Evacuate area in down wind direction up to 200 meters	First observer/ driver/ cleaner/ operator All employees	High level indication shall be provided. High level cutoff shall be provided on storage tank. Integrity of the tank, pump and piping

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
		travelled in down wind direction.	Bottom line rupture. Puncher in tank wall .	Call fire and Safety department for spill control Close valve immediately if it is safe to do. Cordon the area immediately. Stop all activities in tank farm area. Evacuate nonessential persons from the affected area immediately. Try to control situation at department level with available resources with full PPEs. Identify the spillage material and refer MSDS for control plan. Inform the Site main Controller (SMC) in detail. Take decision to Declare onsite emergency. Efforts to be made to prevent spreading	Operator Operator Security team Operator Rescue team IC Rescue team Rescue team IC IC	shall be checked regularly. Spill control plan to be prepared and training to be conducted to all operators. Emergency telephone number list to be displayed in this area. In case of emergency – action plan and communication chart to be displayed in this area. Neutralized material to be collect in close containers and disposed off in safe manner.

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				of Acid to a large area by containing it in a small area by temporary arrangements or by diverting the spreading liquid to a low-lying area away from strategic plant areas. Start to spread soda ash on spilled material to neutralize the acid. Ensure search and rescue and causalities receive attention. Administer first aid to the victim. Make arrangement to send injured person/s to Hospital. If off site emergency situation occurs – Inform to following agencies Request for Mutual aiders, local authorities like – DISH office, Collectorate office, Disaster management cell, Police, fire brigade, nearby hospital, local GPCB office	 SMC Fire and spill control team Fire and spill control team Rescue team First Aid team SMC	

8.18.4 Possible Emergency :- Chlorine tonner catastrophic failure puff release scenario

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Chlorine tonner storage shed	Puff release from chlorine tonner	Toxic release in down wind direction at LC 50 , IDLH & TLV concentration Fatality to human up to 204meter at 1017 ppm LC-50 distance Immediate danger to life and health (10 ppm IDLH) Distance 278 m in case of short pipeline rupture i.e. Evacuation area	Over pressure due to temp. increase Reaction in tonner with incompetitive material.	Evacuate the surrounding area up to 204 m in factory premises. Raised alarm immediately for warning the people. Call fire and Safety department Evacuate non essential persons from the affected area immediately. Inform the area in charge Try to control situation at department level with available resources. Inform the Site main Controller (SMC) in detail. Declare onsite emergency Start blower Barricade and restrict movement in	Incident controller (IC) IC IC Non-essential workers First observer IC and department team IC SMC Toxic team Security staff	• Store tonner in dry and cool place • Check tonner condition before unloading in our premises. • Hydraulic test certificate, testing date and due date to be checked at site. • NRV and reversed flow control to be provided on header. • Distance to be kept between two tonners. • Blower with scrubber and pipeline to be provided surrounding storage shed to absorbed chlorine gas. • Chlorine gas

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				affected area.		detectors to be provided in storage area.
				Provide Mayur curtain in down wind direction to restrict dispersion.	Fire and toxic control team	
				Spray Dil. Ammonia solution on gas cloud of chlorine.	Fire and toxic control team	
				OR		
				Spread Sodium thiosulphate powder on liquid chlorine spillage.	Fire and toxic control team	
				Ensure search and rescue and causalities receive attention.	Rescue team	
				Administer first aid to the victim.	First aid team	
				Make arrangement to send injured person/s to Hospital.	Administration team	
				If off site emergency situation occur – Inform to following agencies Request for Mutual aiders, local authorities like – DISH office, Collectorate office, Disaster management cell, Police, fire brigade, nearby hospital, local GPCB office	SMC	

8.18.5 Possible Emergency:- Chlorine tonner catastrophic failure Point source release scenario

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Chlorine tonner storage shed	Point source release from chlorine tonner liquid/ Gas phase valve	Toxic release in down wind direction at LC 50 , IDLH & TLV concentration Fatality to human up to 204meter at 1017 ppm LC-50 distance Immediate danger to life and health (10	Connecting tube 100 % leakage Gas phase / liquid Valve leaking Pipe line leakage Rupture of pipeline	Evacuate the surrounding area up to 204 m in factory premises. Inform the area in charge Raised alarm immediately for warning the people. Call fire and Safety department Evacuate non essential persons from the affected area immediately. Try to control situation at department level with available resources. Inform the Site main Controller (SMC) in detail. Declare onsite emergency Start blower Barricade and restrict movement in affected area. Applied chlorine kit to control leakage from valve	Incident controller (IC) First observer IC IC Non essential workers IC and department team IC SMC Toxic team Security staff Toxic control	• Store tonner in dry and cool place • Check tonner condition before unloading in our premises. • Hydraulic test certificate, testing date and due date to be checked at site. • NRV and reversed flow control to be provided on header. • Distance to be kept between two tonners. • Blower with scrubber and pipeline to be provided surrounding storage shed to

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
		ppm IDLH) Distance 278 m in case of short pipeline rupture i.e. Evacuation area		Provide Mayur curtain in down wind direction to restrict dispersion. Spray Dil. Ammonia solution on gas cloud of chlorine. OR Spread Sodium thiosulphate powder on liquid chlorine spillage. Ensure search and rescue and causalities receive attention. Administer first aid to the victim. Make arrangement to send injured person/s to Hospital. If off site emergency situation occur –Inform to following agencies Request for Mutual aiders, local authorities like – DISH office, Collectorate office, Disaster management cell, Police, fire brigade, nearby hospital, local GPCB office	team Fire and toxic control team Fire and toxic control team Fire and toxic control team Rescue team First aid team Administration team SMC	absorbed chlorine gas. • Chlorine gas detectors to be provided in storage area.

8.18.6 Possible Emergency: - Major electrical fire in HT/LT panel, cable trench, cable tray, electrical equipment.

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Plant area	Fire in panel, cable, cable trench, electrical equipments like motor, etc.	Fire	Electrocution and flashing due to short circuit or overload	Raise fire siren or shouting Fire…Fire…. Fire…	First observer	1. Safety measures taken at design level and facilities installed as per requirements and electrical load. 2. Double earthing provided to all electrical equipments. 3. Rubber met provided near electrical panels and switches. 4. All safety measures taken at design stage. 5. Magger test and earthing continuity test regularly carried out and log sheet maintained. 6. All electrical
				Evacuate the area immediately.	Non-essential workers.	
				Inform the area in charge.	Department employee	
				Inform IC in detail.	Department employee	
				OFF electrical supply in fire porn area.	Electrical head	
				Call fire department immediately and help them for firefighting.	Department employee IC	
				Try to control situation at department level with available resources with full PPEs.	Department firefighting team.	
				If it is found uncontrollable condition by department level inform SMC for onsite emergency situation.	IC	

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				Declare on site emergency if required.	SMC	hazardous condition known to all concern dept. 7. Appropriate firefighting arrangement is provided to control electrical fire.
				Start fire hydrant system and spray water on fire.	Fire team	
				Do not enter in fire prone area. Due to toxic gas liberate in cable fire.	All team member	
				Remove combustible and flammable material from the fire site.	Rescue team	
				If fire found uncontrollable condition call fire brigade and mutual aider for help.	SMC	
				All hazardous activates stop at site.	SMC and all dept. head	
				Ensure search and rescue and causalities receive attention.	Rescue team	
				Administer first aid to the victim.	First aid team	
				Make arrangement to send injured person/s to Hospital. And inform victim's family.	Administration team	
				If off site emergency situation occurs –Inform to following agencies. Request for Mutual aiders, local authorities like – DISH office, Collectorate office, Disaster management cell, Police, fire brigade, nearby hospital, local GPCB office.	SMC	

8.18.7 Possible Emergency: - Leak from flanges, valves, during transfer from/to main tank

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pipeline network	Spillage	Fire, spillage, corrosion, burn effect on human.	Gasket failure, corrosion, improper maintenance.	Detect the source of leakage.	Maintenance team	Proper PMS system prepared and implemented.
				If the leakage is found significant then isolate branch of line & stop the flow.	Maintenance team	
				Stop the loading /unloading operation in the Tank.	Maintenance team	
				Bring the portable fire extinguishers near to the area of leakage	Maintenance team	
				Ensure operation of the fire pump	Fire team	
				In case of major leakage follow action plan as per spill control plan.	-	

8.18.8 Possible Emergency: - Earth Quack

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Whole plant	Earth quack	Building, structure collapse	Natural calamities	Do not panic. Raise alarm.	First observer	Planning & Preparedness 1. Constitute Emergency Response Team 2. Identify control centers 3. Control centers to be equipped with 4. Communication facilities 5. Emergency vehicles/ equipment 6. List of emergency contacts & suppliers 7. Medical facilities
				Evacuate building /plant immediately.	All employees	
				Avoid standing near to windows, external walls.	All employees	
				Stand near the columns or duck under sturdy furniture.	All employees	
				Assemble at emergency assembly point.	All employees	
				Take head count	HR dept.	
				Activate plant emergency plan as situation demands.	SMC	
				Assess situation and initiate shut down of plants (if required)	SMC and plant head	
				Initiate search & rescue (if required)	Rescue team	
				Provide first aid to victims. Remove casualties Key persons to report to site	First aid team	
				Assess damage	Key personals	
				Undertake restorative measures & repairs	Engg. team	

8.18.9 Possible Emergency: - Floods:

Besides this, flooding of plants during monsoon due to clogging of storm water drains/ outlets may also take place. The plan to deal with floods can be divided in following stages:

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Whole plant	Floods	Floods	Natural calamities	Stop all field activities.	IC	**Check** 1. All storm water drains & outlets are cleaned & de-choked. **Constitute** 2. Plant Emergency Response Team comprising of (at least) one engineer, one HSE member, two operators & one Electrician. 3. Civil & Mechanical support team (including supply of spares). **Maintain** 4. Inventory of emergency items such as torches, ropes, lines, wire, tarpaulins, plastic sheets, tool kits, duct tapes, assorted gears &sand bags etc. 5. Food stock, water, blankets &bedding and medicines for distribution.
				Stop all permits to work.	IC	
				❑ Remain indoor observant to ❖ Detect any damage to equipment or buildings. ❖ Detect development of unsafe conditions. ❖ Maintain communication with Emergency Control Center.	IC and employees	
				Respond to emergency call		
				Audit plant area(s) for damage assessment Implement fire preventive measures Undertake restorative measures & repairs Restart the plant(s)	Engineering team	

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
						Obtain & circulate 6. Advance forecast warnings to be continuously updated. 7. Mobilize emergency response team 8. Release non-essential personnel 9. Initiate shut down of plants(s) if required 10. Audit plant safety measures 11. Implement preventive & precautionary measures especially 12. Hot equipment to be cooled down. 13. Exposed machinery & equipment to be coated with grease. 14. Open flames should be extinguished

8.18.10 Possible Emergency: - Cyclonic Storms / Hurricane

Cyclonic storms/ hurricanes are intense depressions, which develop in tropical latitudes and are often the cause of very high winds and seas. The wind blows around the center of a tropical storm in a spiral flow inward, anti-clockwise in Northern Hemisphere and clockwise in Southern Hemispheres. Plan for tackling cyclonic storm/ hurricane can be broadly divided in following stages:

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Whole plant	Cyclonic Storms / Hurricane	Cyclonic Storms / Hurricane	Natural calamities	Mobilize emergency response team	IC	1. Inventory of emergency items such as torches, ropes, lines, wire, tarpaulins, plastic sheets, tool kits, duct tapes, assorted gears &sand bags etc. 2. Food stock, water, blankets &bedding and medicines for distribution. 3. Implement preventive & precautionary measures
				Release non-essential personnel	IC	
				Initiate shut down of plants(s) if required	IC and employees	
				Stop field activities. Stop all permits to work.	IC	
				❑ Remain indoor observant to ❖ Detect any damage to equipment or buildings. ❖ Detect development of unsafe conditions. Maintain communication with Emergency Control Center.	Engineering team	

8.18.11 Possible Emergency: - Bomb Threat

All telephone calls and emails threatening harm to people or property, such as bomb threats, should be taken seriously

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Whole plant	Bomb Threat	Fatality and injury to employees		**If the threat is by Email** Contact immediately your site Security & Crisis Management Leader / EHS Leader or Emergency Response Team and report that you have received a threatening e-mail.	E-mail receiver	1. Security system is provided. 2. CCTV camera provided in all areas of the plant. 3. Without photo ID no one can enter in premises. 4. Vehicles are checked at main gate thoroughly for suspicious material during entry of vehicle.
				1. Be calm. 2. Contact the C M Leader/EHS Manager/ IC/ Functional Leader if you have received the call and give all information regarding the call or Email. 3. Evacuate immediately through the nearest exit after hearing the alarm and announcement, 4. Shut down critical operation. 5. Do not disturb anything while evacuating. 6. Follow evacuation procedure and reach the designated assembly point. 7. Do not run or dash. 8. Keep the doors & windows open.	IC and employees	
				WHAT TO DO IF YOU RECEIVE A BOMB THREAT ON YOUR TELEPHONE.		

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				Contact immediately your site Security & Crisis Management Leader / EHS Leader or Emergency Response Team and report that you have received a threatening Phone		
				Question to Ask: 1. When is it going to occur (or explode)? Where is the harmful item (or bomb) right now? 2. What kind of item (or bomb) is it? 3. What does it look like? 4. Why did you place the item (or bomb)? **5.** Where are you calling?	Call Recipient	
				Things to note: 1. Apparent sex, age and maturity of the caller. 2. Peculiarities of voice or speech 3. Speech impediment, foreign accent, regional flavor, signs of intoxication, irrationality, and "pet phrases," or their mannerisms. 4. Listen for background noises	Call Recipient	
				What to do if...You observe Suspicious Behavior: 1. Description of the suspicious behavior. 2. Description of person(s). 3. Make/Year of vehicle (if applicable). 4. Color of vehicle. 5. License plate number and State. 6. Time 7. Vehicle's location and/or direction of travel. 8. Vehicle in restricted areas without proper	Observer	

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				identification. 9. Passengers taking photographs or video of any part of the facility.		
				10. Inform Site Shift Manager & Security	Observer/ Call Recipient	
				11. Inform all personnel to provide information regarding any unidentified or suspicious objects/ persons	Observer/ Call Recipient	
				12. Intensify vigilance & patrolling	Security head	
				13. Initiate bomb search	Security head	
				14. If any suspicious object is detected, inform Police Commissioner for arranging bomb disposal squad	SMC	
				15. Make arrangement to minimize effects	SMC	
				16. Make arrangement for evacuation	SMC	
				17. Liaise with police	SMC	
				18. If bomb recovered/ no untoward incident occurs restore normalcy.	SMC	
				If blast occurs 1. Activate concerned plant(s) emergency plan – tackle fire/ toxic leakage/ structural collapse etc. Assess damage. 2. Take restorative measures. 3. Liaise with authorities (police, insurance etc.).	SMC	

8.18.12 Possible Emergency: - Industrial Unrest

Industrial relation between personnel and management may deteriorate because of any reason. Problems, which may arise due to industrial unrest, include:

Dharna/ Strike/ Hunger strike	Unofficial gatherings/ Gate meetings/ Forceful entry
Work to rule/ Go slow/ Disobedience	Gherao/ Rasta rook
Intimidation & Use of force	Support from local & criminal elements
Sabotage	

In such a scenario, to ensure smooth operation of plant(s), protection of lives and property, well-coordinated effort is needed from all concerned. Plan to deal with industrial unrest can be broadly divided in following stages:

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Whole plant	Industrial Unrest	Unofficial gatherings/ Gate meetings/ Forceful entry	Industrial Unrest	Any employee noticing or heard about the Civil Disturbance immediately call EHS / Security department to give the information.	First victim	
		Gherao/ Rasta rook		Don't allow to enter any unknown person in the site	Security team	
		Support from local & criminal elements		Strengthen security at sensitive points	Security team	
				Ensure protection lives & property	Security team	

Location	Scenario considered	Hazard Consequence	Possible Causes	Action to be taken	Action by	Remedial measures to prevent recurrence of such incident
				Intensify vigilance & patrolling	Security team	
				Assemble in designated Safe Assembly point.	All employees	
				Brief to Site main controller and Crisis management Leader.	First victim	
				Join your group at assembly point and present yourself for headcount to head count coordinator.	All employees	
				Communicate to ECC/Emergency team for missing or trapped employees.	Victim /IC	
				Give this information to site main controller/ EHS dept. / Manufacturing Head.	Victim /IC	
				Maintain law & order	SMC	
				Ask help form nearest police station.	SMC	
				Assess damage (if any)	SMC	
				Restore normalcy	SMC	

CHAPTER 7

Environmental Management Plan

7. Environmental Management Plan

A. Objectives of Environmental Management Plan

The main objectives in formulating this environmental management plan are:

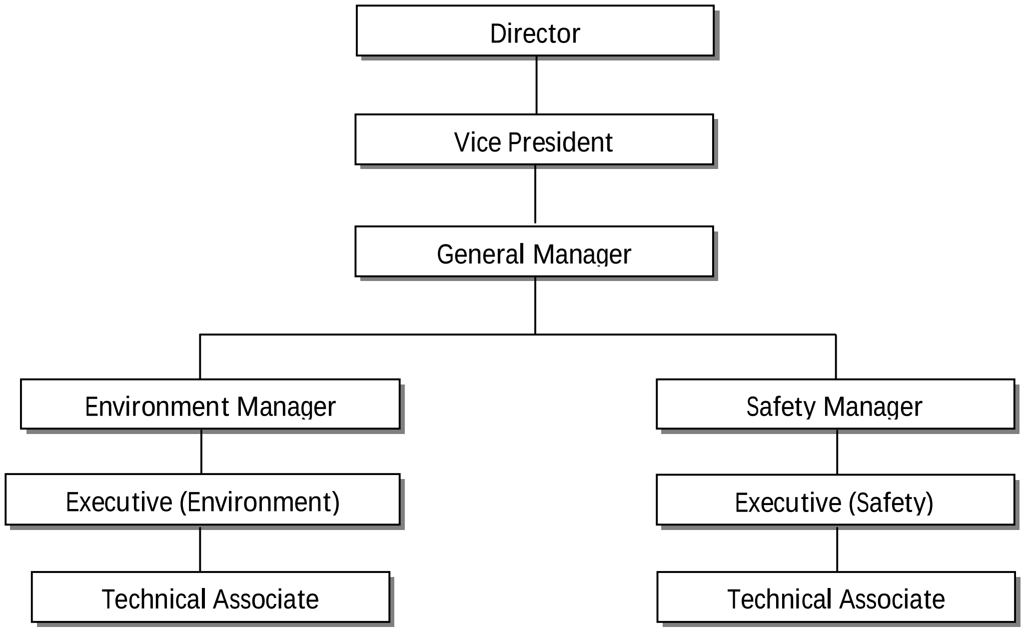
- To treat all the pollutants viz. liquid, solid and gaseous those contribute to the degradation of the environment with appropriate technology.
- To comply with all regulations stipulated by the Ministry of Environment, Forest & Climate Change (MoEFCC) /Pollution Control Board (PCB) regarding air emissions and liquid effluent discharge under various Act/Rules/Laws for prevention and control of pollution.
- To handle hazardous wastes as per the The Hazardous and other wastes (Management, Handling and Transboundary Movement Rules) 2016 and Solid Waste Management Rules 2016.
- To encourage support and conduct developmental work for achieving environmental standards and to improve the methods of environmental management.
- To create good working conditions (avoidance of air and noise pollution) for employees.
- To reduce fire and risk/ accident hazards.
- Perspective budgeting and allocation of funds for environmental management expenditure. Continuous development and search for innovative technologies for a cleaner and better environment.

B. Environmental Management Cell

A separate Environmental Management Cell / Organogram as shown in **Figure- B.1** to be set-up to undertake the monitoring of the environmental pollution level by measuring stack emissions, ambient air quality, wastewater quality, noise level etc., and development of greenbelt as per Environmental Management Plan. Environmental Management Cell will meet at least once a month to assess the progress and analyze the data collected for the month. Any deviation/variation noticed shall be immediately taken into consideration for improvement of the same. Yearly action plan of EMP will be updated with respect to results achieved and proposed activities for next year.

M/s. Amulis Finechem Pvt. Ltd. will carry out the monitoring to ensure that the pollution is limited to allowable values and to take preventive/corrective action either by providing new equipments or by improving the performance of the existing pollution control equipments. The Environmental Management Organogram will also co-ordinate with all the related activities such as collection of statistics of health of workers and greenbelt development.

Figure B.1: Environmental Management Organogram



C. Pollution Control Arrangement / Mitigative Measures

Environmental Management Plan would specifically consist of the following and industry will follow the said plan physically as well as in spirit. Pollution control arrangements/mitigative measures for different types/sources of pollution are presented in the **Table- C.1** and **Table- C.2.**

Table C.1: Environmental management plan for different pollution sources (construction phase)

Description	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
Environmental parameters Air, Water, Noise, Land/soil, Flora &fauna, Socio-economic, Health & safety	Particulate matter, fugitive emissions, domestic waste water, noise , municipal solid / hazardous waste	Various construction activities like site cleaning, excavation, installation of equipments, transportation and material handling etc.	▸ Loading and unloading of materials from tankers may lead to fugitive emissions. To avoid the same, the materials transfer will be done through fixed piping connections. ▸ Tarpaulin sheet covers will be used on the materials during transportation. ▸ To reduce the noise generation during the transportation activities; the vehicle will be kept periodically serviced and maintained as per the requirement in automobile industry. ▸ The vehicles having PUCs and spark arrestors will only allowed for the transportation. ▸ All the vibrating parts will be checked periodically and serviced to reduce the noise generation. Sound producing equipments will be enclosed in the sound proofing enclosure to give residual sound pressure level of 75 dB (A). ▸ Sources of high noise level will be provided adequate sound enclosures. ▸ Domestic wastewater will be treated and disposed off

Description	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
			through a treatment plant ▸ All municipal solid waste will be properly stored on site before it is collected by municipality/other agency for its ultimate disposal. ▸ All workers will be trained to use welding shields and follow safer practice. ▸ To minimize the adverse health effects all necessary/ suitable personnel protective equipments like helmet, safety goggles, gum boots, earmuff/ear plug and safety belt etc will be provided for working personnel. ▸ Excavated earth will be used for re-filling of foundation & plinth, green belt and leveling low-lying areas at project site itself. ▸ Construction and demolition materials (if any) will be used for leveling low-lying areas. ▸ Top soil will be stored onsite and used for development of greenbelt/ landscaping. ▸ Regular water sprinkling will be done. ▸ Greenbelt will be developed and maintained (as per EB expert and CPCB guidelines) within the premises / around the premises.

Table C-2: Environmental management plan for different pollution sources (operation phase)

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
Air Environment	PM, SO_2, NOx	Flue gas emission from Steam Boiler	▸ Multicyclone separator and Bag filter will be provided to control the emission of particulate matter.
		Flue gas emission from TFH.	▸ Multicyclone separator and Bag filter will be provided to control the emission of particulate matter.
		Flue gas emission from DG Set.	▸ High Speed Diesel will be used for proposed DG Sets. Diesel is considered as cleaner fuel.
	CO_2 and other gases	Fugitive emissions from Sources such as open surfaces , ETP , surface impoundments, retention ponds	▸ Leak proof technology for valve and pumps. ▸ Plugs, caps and blinds for open ended lines. ▸ Rupture discs and soft seals for pressure valves. ▸ Dual mechanical seals with Non-VOC barrier fluid/ degassing vent system. ▸ Closed loop sampling system. ▸ Enclosure of seal area double condenser system will be provided. ▸ The vents of the secondary condenser connected with the scrubber. ▸ Covering of all open surfaces wherever possible. ▸ Sensors will be provided in work place area.

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
		--	▸ Air borne dust is generated in minor quantity from the material storage yard due to wind, though the storage yard will be properly covered. ▸ Unit has adopted water sprinkling method in storage yard to suppress dust generation. The unit has also developed plantation around the storage yard to control the fugitive emission. ▸ Only PUC certified vehicle are being allowed to use. ▸ Water is being sprayed to suppress the particle and control the fugitive emission. ▸ Dual mechanical seals with Non-VOC barrier fluid/ degassing vent system. ▸ Mechanical / turbo ventilation system in process area ▸ Organic gaseous emissions (Odorous and toxic) be routed to activated carbon beds (adsorption) ▸ Air handling unit equipped with fine filters. ▸ Other related measures will be taken as per EPA guidelines for VOC fugitive emissions for chemicals industry. ▸ To reduce fugitive emissions from the plants, proper Leak Detection and Repair (LDAR) Program will be adopted.
	Odour control	--	▸ Ensuring that the operation will be carried out under the best management practices ▸ Nozzles/ sprayers /atomizers will be used so that it sprays ultra-fine particles of water or chemicals will be used along the boundary lines of area sources to suppress odors. ▸ Wet scrubbing system will be provided to remove odor involve either absorption in a suitable solvent or chemical treatment with a suitable reagent. Hot, moist streams will be cooled before the contact with scrubbing solutions ▸ Green belts are used to form a surface capable of sorbing and forming sinks for odorous gases. Leaves with their vast area in a tree crown, sorbs pollutants on their surface, thus effectively reduce their concentrations in the ambient air. (Please refer greenbelt development plan details). ▸ Mechanical/process ventilation will be provided which will help in dispersion of odors generated from sweating from room after hard physical labor. Increasing cooling rate of hot vessel and removal of contaminants (gas, vapor and dust).
Water Environment	Low pollution potential	Domestic wastewater	▸ Domestic effluent & Industrial effluent from various processes and utility will be treated in effluent

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
	Slightly higher pollution potential	Industrial wastewater	treatment plant (ETP) to achieve the stipulated norms/standards by statutory authority. ▸ The treated effluent from ETP will ultimately disposed to marine through GIDC drain.
Solid / Hazardous Waste	Used / Spent Oil	Manufacturing process	▸ Disposal by reuse/ selling to registered re-refiner.
	Process Residue	Manufacturing process	▸ Disposal at CHWIF/sent for co-processing.
	Spent Catalyst	Manufacturing process	▸ Disposal at TSDF/sent back for regeneration OR reactivation to supplier.
	Carbon Waste	Manufacturing process/ETP	▸ Disposal at TSDF/ sent for co-processing.
	Discarded Container/ Liners/Bags	Raw material/other material supplier	▸ Disposal by reuse/ selling to authorized recycler.
	ETP Sludge	ETP	▸ Disposal at TSDF.
	Sodium Hypochlorite	Manufacturing process	▸ Disposal by selling to actual end users.
	Spent Acid	Manufacturing process	▸ Disposal by selling to actual end users/utilized in mfg. of Gypsum.
	Hydrochloric Acid	Manufacturing process	▸ Disposal by selling to actual end users.
Noise Environment	Structure-borne noise: The vibration transmitted may activate the building structure where it mounted without proper installation. Air-borne noise due to air turbulence at equipment/ structure and etc.	Vehicle, Transportation, Water Cooling Towers, Air-cooled chillers, Fans, Ducts, Other plant equipment & machinery	▸ To reduce the noise generation during the transportation activities; the vehicle will be kept periodically serviced and maintained as per the requirement of latest trend in automobile industry. ▸ Acoustic mat on the water surface will be provided to reduce the water splashing noise. ▸ All the vibrating parts will be checked periodically and serviced to reduce the noise generation. ▸ Complete enclosure with silencers at condenser fan outlets and at air inlets of the enclosure will be fabricated. ▸ Greenbelt will be developed around the plant peripheral which act as a curtain/barrier between the plant and nearby buildings. ▸ The vehicles having PUCs and spark arrestors will only allowed for the transportation. ▸ Vibration isolators to support a water cooling tower, thereby isolating it from the building structure will be provided. Equipments will be properly mounted on structure to provide support/add rigidity.

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
Land Environment	Gaseous/ Particulate emission	Manufacturing process, Transportation	▸ Pollution control devices/measures will be installed/implemented properly to treat air & liquid effluent, it will be periodical checked/maintained. Solid/hazardous waste will be collected, stored in a designated storage area with proper flooring & roofing before it's final disposal. ▸ Tarpaulin sheet covers will be used on the materials during transportation. ▸ Soil samples will be collected at regular interval for mitigation. ▸ Proper paving will be done to avoid land contamination due to leakage/spillage of fuel or material.
Risk & Safety Management	Fire hazards	Storage & handling of materials, manufacturing process	▸ Risk Assessment study for proposed project has been carried out. Details of Risk assessment study report along with mitigation measure/emergency plan to control / minimize the probable hazard due to proposed project are given in risk study. ▸ Fire fighting equipments/system and extinguishers will be installed as per the requirement of the fire risk in all plants/sections/departments and/or as per the requirement of Factory Act/ Rules/ IS 2190:1992/suggestion made in Risk Assessment Study.
Socio-Economic Environment and Corporate Social Responsibility (CSR)	--	--	▸ To minimize strain on existing infrastructure adequate provision of basic amenities education, health, transport etc. will be made considering the needs of workplace and migrating population. ▸ Sanitation facilities will be graduallyimproved for better hygiene and health. ▸ Employment strategy would prefer employment of local people, promote Skill development. ▸ To mitigate the adverse impact likely to arise in social, cultural and economical aspects in the surrounding region and the proposed project is expected to contribute towards enlistment of local people quality of life CER activity will be organized. ▸ Refer Chapter 1 section C for budget allocation for CER activities.

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
Biological Environment (Green belt Development)	Particulate emission	Manufacturing process and other ancillary activities	▸ Greenbelt will be developed and maintained (as per EB expert and CPCB guidelines) within the premises/ around the premises to control the expected pollutants due to proposed project activity as well as to improve the aesthetic. ▸ Characteristic of plants mainly considered for affecting absorption of pollutant gases and removal of dust particle are as follows **For absorption of Gases**: - Tolerance towards pollutants in question, at concentration, that are not too high to be instantaneously lethal - Longer duration of foliage - Freely exposed foliage - Adequate height of crown - Openness of foliage in canopy - Big leaves(long and broad laminar surface) - Large number of stomata apertures **For Removal of Suspended Particular matter** - Height and spread of crown. - Leaves supported on firm petiole - Abundance of surface on bark and foliage - Roughness of bark - Abundance of axillary hairs - Hairs or scales on laminar surface - Protected Stomata
Occupational / workers health & safety	Occupational health & safety hazards	Storage & handling of materials, manufacturing process	▸ To minimize the adverse health effects all necessary/ suitable personnel protective equipments like helmet, safety goggles, gum boots, earmuff/ear plug and safety net etc will be provided for working personnel. ▸ All suggested/proposed pollution control devices/measure should be installed and operated / maintained properly on regular basis. ▸ All precautionary methods will be adopted by the company as well unit is also committed towards the Health & Safety of workers and will provide a facility of pre-medical check-up of employees for detecting any kind of adverse effect on the health of employee due to the chemical or work place condition and providing opportunity to improve the working condition. ▸ Regular work place monitoring will be carried out in Form-37 and will be maintained as per GFR

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
			▸ The workers exposed to higher noise level will be provided with ear muffs/ear plugs. Proper handling of the materials and the maintenance of Material Safety Data Sheet (MSDS) will be followed to ensure safety within the plant area. ▸ The project proponent will provide drinking water supply for the employees and the standard of the drinking water will be as per guidelines. Proper sanitary facilities will be made available by the project proponent so that employees do not suffer from any health ailments. The employees will be made aware of general practices sanitary practices. ▸ Periodical training programme to inform the employees about their task, associated risk, and safe –working practices will be undertaken. Training will also include information on accident prevention, proper control and maintenance of equipment and safe material handling practices. To refresh the academic and skill improvement as per management requirement, induction training and external training will be provided to fresher's with respect to "Industrial Safety & Health Training". ▸ Onsite-offsite emergency plan/disaster management plan will be developed as per the suggestion made in Risk Assessment Study. A regular monitoring of the occupational Health and Safety will reduce the chances of accidents hence all the records of job related accidents and illness would be maintained as per the requirement of Gujarat Factory Act. This information will be reviewed and evaluated to improve the effectiveness of Environmental Health and Safety programme.

	Type of Pollutant / Wastes	Source	Pollution Control Arrangements / Mitigation Measures
Cleaner Production , Resource / Energy Conservation	Solid/liquid/gas pollutants	Manufacturing process & material handling/ storage	▸ Following measures will be taken by the industry towards cleaner production: ▸ Liquid raw materials will be charged by pumping and closed loops and dosing will be done by metering system to avoid fugitive emissions, double mechanical seals will be provided to the process vessels having agitator for reduction of fugitive emissions and leakages, storage tanks for products as well as raw materials will be fitted with appropriate control devices to avoid possible leakages, dedicated measuring tanks will be provided for each reactor, fixed transfer pipe lines will be provided and loose pipes will be avoided for handling reactants, in manufacturing process reactants will be used as far as possible a near to molar ratio in order to avoid use of excess chemicals, which in turn will minimize the organic load in the effluent. ▸ Energy Conservation would be adopted by industry through gravity flow as it will be preferred wherever possible to save pumping energy, automatic switching system for lighting & water tank pumping, provision of day light roof to utilize maximum natural light in the production plant instead of electrical lighting, use of electronic lighting system, use of CFL tubes to minimize energy use, use of programmable timers for pumping system and lighting, water level controllers for water pumps, centralized cooling etc, installation of energy efficient devices and appliances conforming to the Bureau of Energy Efficiency norms. ▸ Use of Solar and wind energy as renewable energy alternatives will be explored.

D. Environment Monitoring Program

Table D-1: Environment Monitoring Plan

S. No.	Activity	Frequency
	Air Pollution Monitoring	
1	Ambient air monitoring of parameters specified by GPCB in theirair consents from time to time within the premises	Once in every quarter or as per EC and CC&A
2	Stack Monitoring of process stacks/ vents & flue gas stacks asgiven in air consent from time to time	Once in every month or as per EC and CC&A
3	Ambient air monitoring of parameters specified by GPCB in theirair consents from time to time at stations outside the premises	Once in every year or as per EC and CC&A
4	Work Place Monitoring	Once in a year

S. No.	Activity	Frequency
Water Pollution Monitoring		
1	Monitoring of water consumed in various activities and wastewater generated from various areas of plants	Daily
2	Monitoring of wastewater inlet and outlet at ETP plant for theprincipal parameters (such as pH, SS, TDS, COD, BOD).	Daily
3	Monitoring of other parameters as per PCB consent conditions inoutlet of ETP Waste Water	Once in every month or as per EC and CC&A
4	Monitoring of ground water samples at site. Parameters are essential parameters as per IS: 10500:2012.	Once in a year
Noise Quality Monitoring		
1	Work Place Noise Monitoring	Once in six months
2	Ambient Noise Monitoring	Once in six months
Solid Waste Generation Monitoring/Record Keeping		
1	Monitoring of solid / hazardous waste generated from process andETP area.	Quarterly
2	Records of generation of Solid / Hazardous Wastes	Daily
3	Record of storage, treatment, transportation and disposal of solid	Daily

E. Budgetary Allocation for Pollution Control Arrangements

The budgetary allocation towards pollution control arrangements for the proposed project is presented in the **Table- E.1**.

Table E-1: Budgetary allocation towards pollution control arrangements

Sr. No.	Head	Basis for cost estimates	Approx. Capital cost (Rs. In Lacs)	Approx. Recurring cost per annum (Rs. In Lacs)
1	**Air pollution control**	**Capital Cost:** Stacks of Boiler, Thermic Fluid heater and DG Set i.e. 5 Lac per stack Capital cost:	250	3.43
		1) MultiiCyclone and Bag filter (2 No): 30 Lac each		
		2) Caustic and Water Scrubber (5 No.): 35 Lac each		
		Recurring cost:		
		1) Cost of monitoring of Stacks : Rs. 6200 per stack		
		2) Cost of monitoring of AAQM: Rs. 5000* 2 locations monthly		
2	**Water pollution control**	**Capital Cost:** Cost of Design, Engineering,	42	736

Sr. No.	Head	Basis for cost estimates	Approx. Capital cost (Rs. In Lacs)	Approx. Recurring cost per annum (Rs. In Lacs)
		Manufacture, of		
		1) ETP of Capacity 700 KLD: 40 Lac		
		3) GIDC Drain permission charge: 2 Lac		
		Recurring cost: ETP cost: Rs. 300/KL (approx)		
		Disposal cost in GIDC: Rs. 8.9/KL		
3	**Noise pollution monitoring**	Cost of noise monitoring: Rs. 1000 per month.	1	0.12
4	**Solid and Hazardous WasteManagement**	**Capital Cost:** 1) Membership fee of TSDF Site for Large Scale industry: Rs. 55000	20	202.4
		2) Cost of providing storage area of hazardous waste : 19.45		
		Recurring Cost:		
		1)Cost of Landfillable to TSDF: Rs. 1250/Ton		
		2) Cost of incineration : Rs. 25/Kg		
		3) Cost of Transportation Rs. 500/Ton		
5	**Environment monitoring and management**	**Capital cost:** Cost on hiring of consultants and payment of various statutory fees to regulatory agencies	7	3
		Recurring cost: The recurring cost would be incurred as cost of hiring consultants / third party for carrying out monitoring and for environmental audits.		
6	**Green belt**	--	2	1
7	**CER**	As per MoEFCC- Office Memorandum (OM) dated 1st May 2018.	148	--
8	**Energy Conservation**	Installation and maintenance of solar panels	250.5	1
		Total	**720.5**	**946.95**

It is expected that unit shall expend a **capital cost** about **Rs. 7.20 Crores** and annual **recurring cost** about **Rs. 9.46 Crores** towards environment management, which is based on current financial assets of environmental management systems/techniques.

CHAPTER 8

Consultant Details

8. Consultant Details

Anand Environmental Consultants Pvt. Ltd. (AECPL) is a group of young professionals dedicated to assignments in Pollution Control under the dynamic leadership of Mr. Rakesh Shah be it Air, Solid or Water related Pollution Control.

Since 1978 Anand Environmental Consultants Pvt. Ltd. (earlier known as Anand Consultants) has been working as Environmental Engineers in India as well as Bangladesh. During the said 42 years AECPL have worked for different type of industries providing various services related to consultancy, laboratory, field studies, project execution as well as operation and maintenance. Turnkey assignments are undertaken by a sister concern.

AECPL happen to be Environmental Auditors appointed by the Gujarat Pollution Control Board as per the directives of the Honorable High Court of Gujarat.

AECPL has been accredited by QCI/ NABET. Refer **Annexure 6**.

AECPL have the necessary manpower and expertise in various fields as also the required infrastructure facilities to carry out work related to environmental engineering.

Contact information:

16, Everest Tower, Nr. Ankur Society, Naranpura, Ahmedabad 380013, Gujarat.
Ph./Fax:079-27484871
E-mail: anandconsultants2009@gmail.com
Web.: www.pollutioncontrol.co.in

Annexures

Annexure 1

F. No. IA-J-11011/274/2014-IA-II(I)
Government of India
Ministry of Environment, Forest and Climate Change
(IA- II Section)

Indira Paryavaran Bhawan
Jorbagh Road, New Delhi - 3

Dated: 18th May, 2018

To

M/s Radha Madhav Processors Pvt Ltd
Plot No. D-2/CH/5&6, GIDC Industrial Estate
Dahej-II, Tehsil Vagra
District **Bharuch** (Gujarat)

Sub: Manufacturing Chlorinated and Hydrogenated derivatives for Agro Intermediates Plant at Plot No. D-2/CH/5&6, Survey No. 843/P, 844/P, 845/P, 850/P, 851/P, 852/P, GIDC Industrial Estate, Dahej-II, Tehsil Vagra, District Bharuch (Gujarat) by M/s Radha Madhav Processors Pvt Ltd - Environmental Clearance - reg.

Sir,

This has reference to your proposal No. IA/GJ/IND2/59261/2015 dated 9th October, 2017 submitting the EIA/EMP report on the above subject matter.

2. The Ministry of Environment, Forest and Climate Change has examined the proposal for environmental clearance to the project for manufacturing chlorinated and hydrogenated derivatives of total capacity of 11000 TPM for Agro Intermediates Plant by M/s Radha Madhav Processors Pvt Ltd at Plot No. D-2/CH/5&6, Survey No. 843/P, 844/P, 845/P, 850/P, 851/P, 852/P, GIDC Industrial Estate, Dahej-II, Tehsil Vagra, District Bharuch (Gujarat).

3. Total land area available for the project is 60,000 sq.m, out of which greenbelt will be developed in an area of 19,900 sq.m. The estimated project cost of is Rs.97.4 crores. Total capital cost earmarked for pollution control measures is Rs. 503.19 lakhs and the recurring cost (operation and maintenance) will be about Rs. 2383.52 lakhs per annum. Total employment opportunity will be for 200 persons as direct and 100 persons during construction phase.

4. There are no National parks, Wildlife sanctuaries, Biosphere reserves, Tiger/Elephant reserves, Wildlife corridors etc. within 10 km from the project site. Narmada estuary is at a distance of 6.7 km in the North and Gulf of Khambhat is at a distance of 11.8 km in the West from the project site.

5. The details of products are as under:-

Plant Code	Common Name	Products	Capacity (TPM)
Plant A	CPVC	Chlorinated Poly Vinyl Chloride	1,500
Plant B	Chlorination of Benzene and Toluene	Benzyl chloride, 2,6 Dichloro Phenol, 2,4 Dichloro Phenol, 2,4 Chloro Phenol, Benzyl chloride/Benzo Trichloride/Benzal chloride, P-Chorobenzyl choride/P-Chorobenzal Choride/P-Chloro Benzotrichloride, o-Chorobenzyl Choride/o-Chorobenzal Choride/o-Chloro Benzotrichloride, Chloro Benzene/Di Chloro Benzene, Mono Chloro Benzene (MCB), Dichloro Benzene (DCB) (Ortho/Meta/Para), Para Chloro Toluene/ Ortho Chloro Toluene	2,000
Plant C	Chlorination of Acetic Acid	Mono Chloro Acetic Acid, Tri Chloro Acetyl Chloride	1,500
Plant D	Hydrolysis of Chlorinated Compound	Iso Phthaloyl chloride, Phthaloyl chloride, o-Chlorobenzaldehyde, p-Chlorobenzaldehyde, Benzyl Alcohol, o-Chloro Benzyl Alcohol, p-Chloro Benzyl Alcohol, Benzoyl Chloride, Benzaldehyde, 2-Methoxy 5-Bromo 6-Methyl Benzoyl Chloride, 2,4 Dichloro Benzoyl Chloride, 4 Methyl Benzoyl Chloride, Propargyl Chloride, Pivaloyl Chloride, 4-Chloro Butyryl Chloride, Terephthaloyl Chloride, N-Valeroyl Chloride, 4-Chloro Benzoyl Chloride, 3-Nitro Benzoyl Chloride, 4-Nitro Benzoyl Chloride	1,500
Plant E	Amines	Primary Amines, Ethoxylation of Primary Amines	1,000
Plant F		Paracetamol	1,000
Plant G	Nitro Compounds	4-Chloro 3,5 Dinitro Benzoic Acid, 6, Nitro 3,4 Dichloro Aniline, 4-Nitro ,5-Chloro, 2-methyl Aniline, 2-Nitro 4-Methyl Aniline, 3, Nitro 4-Chloro Benzoic Acid, 3-Nitro-para Toluic	1,000

		acid, 2,4 Dichloro 6 Nitro Phenol, 2,3 Dichloro 4 Nitro Phenol, 2,5 Dichloro 4 Nitro Phenol, 1,3 Di Nitro Benzene, Nitro Benzene, 2/3/4 Nitro Toluene, 3,5 Di Nitro Benzoic Acid, p-Nitro Salicylic Acid, 2,5 Dichloro Nitro Benzene, 3,4/2,3 Dichloro Nitro Benzene	
Plant H	Hydrogenation compounds	p-Hydroxy Aniline/o-Hydroxy Aniline	1,000
		3,4 Dichloro Aniline, 3-Iso Propoxy Aniline, o-Toluidine, m-Toluidine, p-Toluidine, Aniline, 3,4 Diamine Toluene, 2,5 Dimethyl 1,4 Phenylene Diamine, 2 Chloro, 5-Methyl, 1,4 Phenylene Diamine, 2, Chloro 1,4 Phenylene Diamine, 2,5 Dichloro 1,4 Phenylene Diamine, 2,4,5 Trichloro Aniline, 6-Methyl 5-Amino Benzimidazolone, 5-Amino Benzimidazolone, 3-Amino 4-Chloro Benzoic acid, 3-Amino 4-Chloro Benzotrifluoride, 3-Amino Benzotrifluoride, 3,5 Dichloro Aniline, 2,5 Dichloro Aniline, 2,3 Dichloro Aniline, 3 Amino 4-Methyl Benzoic Acid	500
		Total	**11,000**

6. Out of the total water requirement of 2156 cum/day, fresh water requirement of 1956 cum/day shall be met from GIDC Water Supply. Remaining 200 cum/day shall be through recycled water.

Total industrial effluent generation is 1885 cum/day and domestic effluent generation is 8 cum/day. High COD, high TDS stream of 1237 cum/day will be treated in ETP of capacity 1250 cum/day). Low COD and low TDS stream of 656 cum/day will be treated in ETP of capacity 700 cum/day. Around 200 cum/day of water will be recycled and 1693 cum/day will be disposed in GIDC drain.

The power requirement for the proposed plant is 1 MW and will be met from Dakshin Gujarat Vij Company Ltd (DGVCL). The unit has DG set of 250 kVA capacity, stack (height 11 meter) will be provided as per CPCB norms to the proposed DG set.

The unit will have 2x5 TPH coal fired boilers and 20 Lac KCal capacity Thermic Fluid Heater. Multi cyclone separator/ bag filter with a stack height of 40 m will be installed for controlling the particulate emissions within the statutory limit of 115 mg/Nm^3.

7. The project/activities are covered under category A of item 5(b) 'Pesticides industry and pesticide specific intermediates (excluding formulation)' and 5(f) 'Synthetic Organic Chemical Industries' of the Schedule to the Environment Impact Assessment Notification, 2006, and requires appraisal at central level by the sectoral Expert Appraisal Committee (EAC) in the Ministry.

8. The Terms of Reference (ToR) for the project was granted on 6th January, 2015 followed by amended therein on 18th April, 2017. Public hearing is exempted under the provisions as per Section 7 (i), III. Stage (3), Para (i) (b) of the EIA Notification 2006.

9. The proposal for environmental clearance (EC) was placed before the EAC (Industry-2) in its meetings held on 2-3 November, 2017 and 23-24 November, 2017 in the Ministry. The project proponent and their consultant M/s Kadam Environmental Consultants have presented the EIA/EMP report as per the ToR. The committee found the EIA/EMP report satisfactory and in consonance with the ToR, and recommended the proposal for environmental clearance with certain conditions.

10. Based on the proposal submitted by the project proponent and recommendations of the EAC (Industry-2), the Ministry of Environment, Forest and Climate Change hereby accords environmental clearance to the project for **Manufacturing Chlorinated and Hydrogenated Derivatives of total capacity of 11000 TPM for Agro Intermediates Plant** by M/s Radha Madhav Processors Pvt Ltd at Plot No. D-2/CH/5&6, Survey No. 843/P, 844/P, 845/P, 850/P, 851/P, 852/P, GIDC Industrial Estate, Dahej-II, Tehsil Vagra, District Bharuch (Gujarat), under the provisions of EIA Notification, 2006 and the amendments made therein, subject to the compliance of terms and conditions, as under:-

(i) Consent to Establish/Operate for the project shall be obtained from the State Pollution Control Board as required under the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974.

(ii) The effluent discharge shall conform to the standards prescribed under the Environment (Protection) Rules, 1986.

(iii) Necessary authorization required under the Hazardous and Other Wastes (Management and Trans-Boundary Movement) Rules, 2016, Solid Waste Management Rules, 2016 shall be obtained and the provisions contained in the Rules shall be strictly adhered to.

(iv) National Emission Standards for Organic Chemicals Manufacturing Industry issued by the Ministry vide G.S.R. 608(E) dated 21st July, 2010 and amended from time to time shall be followed.

(v) To control source and the fugitive emissions, suitable pollution control devices shall be installed to meet the prescribed norms and/or the NAAQS. Sulphur content should not exceed 0.5% in the coal for use in coal fired boilers to control particulate emissions within permissible limits. The gaseous emissions shall be dispersed through stack of adequate height as per CPCB/SPCB guidelines.

(vi) Total fresh water requirement shall not exceed 1956 cum/day to be met from GIDC Water Supply. Prior permission in this regard shall be obtained from the concerned regulatory authority.

(vii) Process effluent/any wastewater shall not be allowed to mix with storm water. Storm water drain shall be passed through guard pond.

(viii) Hazardous chemicals shall be stored in tanks, tank farms, drums, carboys etc. Flame arresters shall be provided on tank farm, and solvent transfer through pumps.

(ix) Process organic residue and spent carbon, if any, shall be sent to cement industries. ETP sludge, process inorganic & evaporation salt shall be disposed off to the TSDF.

(x) The Company shall strictly comply with the rules and guidelines under Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 as amended time to time. All transportation of Hazardous Chemicals shall be as per the Motor Vehicle Act (MVA), 1989.

(xi) The company shall undertake waste minimization measures as below:-

(a) Metering and control of quantities of active ingredients to minimize waste.

(b) Reuse of by-products from the process as raw materials or as raw material substitutes in other processes.

(c) Use of automated filling to minimize spillage.

(d) Use of Close Feed system into batch reactors.

(e) Venting equipment through vapour recovery system.

(f) Use of high pressure hoses for equipment clearing to reduce wastewater generation.

(xii) The green belt of 5-10 m width shall be developed in more than 33% of the total project area, mainly along the plant periphery, in downward wind direction, and along road sides etc. Selection of plant species shall be as per the CPCB guidelines in consultation with the State Forest Department.

(xiii) At least 2% of the total project cost shall be allocated for Corporate Environment Responsibility (CER) and item-wise details along with time bound action plan shall be prepared and submitted to the Ministry's Regional Office.

(xiv) The company shall make all arrangements for control of noise from the drilling activity. Acoustic enclosure shall be provided for the DG sets along with the adequate stack height as per CPCB guidelines.

(xv) The unit shall make the arrangement for protection of possible fire hazards during manufacturing process in material handling. Fire fighting system shall be as per the norms.

(xvi) Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.

(xvii) Continuous online (24X7) monitoring system for stack emissions and the effluent, shall be installed for measurement of flow/discharge and the pollutants concentration, and the emission and effluent monitoring data to be transmitted to the CPCB and SPCB server as per the directions of CPCB in this regard.

(xviii) Storage of raw materials, coal etc shall be either stored in silos or in covered areas to prevent dust pollution and other fugitive emissions. Raw material storage should not exceed 3 days at any point of time.

(xix) The energy sources for lighting purposes shall preferably be LED based. A minimum of 10-20% of the total power requirement for the industrial operations shall be met from non-conventional energy resources/solar supply

10.1. The grant of environmental clearance is subject to compliance of other general conditions, as under:-

(i) The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board, Central Pollution Control Board, State Government and any other statutory authority.

(ii) No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forest and Climate Change. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry to assess the adequacy of conditions imposed and to add additional environmental protection measures required, if any.

(iii) The locations of ambient air quality monitoring stations shall be decided in consultation with the State Pollution Control Board (SPCB) and it shall be ensured that at least one station each is installed in the upwind and downwind direction as well as where maximum ground level concentrations are anticipated.

(iv) The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 shall be followed.

(v) The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under Environment (Protection) Act, 1986 Rules, 1989 viz. 75 dBA (day time) and 70 dBA (night time).

(vi) The Company shall harvest rainwater from the roof tops of the buildings and storm water drains to recharge the ground water and use the same water for the process activities of the project to conserve fresh water.

(vii) Training shall be imparted to all employees on safety and health aspects of chemicals handling. Pre-employment and routine periodical medical examinations for all employees shall be undertaken on regular basis. Training to all employees on handling of chemicals shall be imparted.

(viii) The company shall also comply with all the environmental protection measures and safeguards proposed in the documents submitted to the Ministry. All the recommendations made in the EIA/EMP in respect of environmental management, and risk mitigation measures relating to the project shall be implemented.

(ix) The company shall undertake all relevant measures for improving the socio--economic conditions of the surrounding area. CER activities shall be undertaken by involving local villages and administration.

(x) The company shall undertake eco-developmental measures including community welfare measures in the project area for the overall improvement of the environment.

(xi) A separate Environmental Management Cell equipped with full fledged laboratory facilities shall be set up to carry out the Environmental Management and Monitoring functions.

(xii) The company shall earmark sufficient funds towards capital cost and recurring cost per annum to implement the conditions stipulated by the Ministry of Environment, Forest and Climate Change as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so earmarked for environment management/ pollution control measures shall not be diverted for any other purpose.

(xiii) A copy of the clearance letter shall be sent by the project proponent to concerned Panchayat, Zilla Parishad/Municipal Corporation, Urban local Body and the local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal.

(xiv) The project proponent shall also submit six monthly reports on the status of compliance of the stipulated Environmental Clearance conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF&CC, the respective Zonal Office of CPCB and SPCB. A copy of Environmental Clearance and six monthly compliance status report shall be posted on the website of the company.

(xv) The environmental statement for each financial year ending 31st March in Form-V as is mandated shall be submitted to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Offices of MoEF&CC by e-mail.

(xvi) The project proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the SPCB/Committee and may also be seen at Website of the

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Ministry at http://moef.nic.in. This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same shall be forwarded to the concerned Regional Office of the Ministry.

(xvii) The project authorities shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of the project.

11. The Ministry may revoke or suspend the clearance, at subsequent stages, if implementation of any of the above conditions is not satisfactory.

12. The Ministry reserves the right to stipulate additional conditions, if found necessary. The company in a time bound manner will implement these conditions.

13. The above conditions will be enforced, *inter alia* under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, Air (Prevention &. Control of Water Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and rules.

SKS
18/5/2018
(S. K. Srivastava)
Scientist E

Copy to:-

1. The Additional PCCF(C), MoEF&CC Regional Office (WZ), E-5, Kendriya Paryavaran Bhawan, E-5 Arera Colony, Link Road-3, Ravishankar Nagar, Bhopal - 16
2. The Principal Secretary, Forests and Environment Department, Government of Gujarat, Block 14, 8th floor, Sachivalaya, Gandhinagar (Gujarat) -10
3. The Member Secretary, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 32
4. The Member Secretary, Gujarat Pollution Control Board, Paryavaran Bhavan, Sector-10A, Gandhinagar (Gujarat) - 10
5. Guard File/Monitoring File/Website/Record File

SKS
18/5/2018
(S. K. Srivastava)
Scientist E

GPCB

GUJARAT POLLUTION CONTROL BOARD

PARYAVARAN BHAVAN
Sector-10-A, Gandhinagar-382 021.
Website : www.gpcb.gov.in

BY R.P.A.D

Consent to Establish (CTE)
(CTE No –97272)

NO: GPCB/ BRCH-B/CTE–525/ ID -65008/

TO,
M/s. RADHA MADHAV PROCESSORS PVT LTD
PLOT NO. D-2/CH/5 & 6,
GIDC DAHEJ-II,
TAL-VAGRA, DIST-BHARUCH.

SUB: Consent to Establish (CTE) under Section 25 of Water Act 1974 and Section 21 of Air Act 1981.
REF: Your CTE application vide inward Id No: - 141816 dated: - 14/09/2018.

Sir,

Without prejudice to the powers of this Board under the Water (Prevention and Control of Pollution) Act-1974, the Air Act-1981 and the Environment (Protection) Act-1986 and without reducing your responsibilities under the said Acts in any way, this is to inform you that this Board grants Consent to Establish (CTE) for setting up of an industrial plant/activities by M/S. RADHA MADHAV PROCESSORS PVT LTD at PLOT NO: D-2/CH/5 & 6, GIDC DAHEJ-II, TAL: VAGRA, DIST: BHARUCH for the manufacturing of the following items.

The Validity period of the order will be Seven years from date of issue. i.e. up to 13/09/2025.

1. NAME OF THE PRODUCTS ALONG WITH QUANTITY:-

Plant Code	Common Name	Products	Capacity (MT/Month)
Plant A	CPVC	Chlorinated Poly Vinyl Chloride	1,500
Plant B	Chlorination of Benzene and Toluene	Benzyl Chloride	2,000
		2,6 Dichloro Phenol	
		2,4 Dichloro Phenol	
		2,4 Chloro Phenol	
		Benzyl Chloride/Benzo Trichloride/Benzal Chloride	
		p-Chorobenzyl Choride/p-Chorobenzal Choride/ p-Chloro Benzotrichloride	
		o-Chorobenzyl Choride/o-Chorobenzal Choride/ o-Chloro Benzotrichloride	
		Chloro Benzene/Di Chloro Benzene	
		Mono Chloro Benzene (MCB)	
		Dichloro Benzene (DCB) (Ortho/Meta/Para)	
		Para Chloro Toluene/ Ortho Chloro Toluene	
Plant C	Chlorination	Mono Chloro Acetic Acid	1,500

Plant Code	Common Name	Products	Capacity (MT/Month)
	of Acetic Acid	Tri Chloro Acetyl Chloride	
Plant D	Hydrolysis of Chlorinated Compound	Iso Phthaloyl Chloride	1,500
		Phthaloyl Chloride	
		o-Chlorobenzaldehyde	
		p-Chlorobenzaldehyde	
		Benzyl Alcohol	
		o-Chloro Benzyl Alcohol	
		p-Chloro Benzyl Alcohol	
		Benzoyl Chloride	
		Benzaldehyde	
		2-Methoxy 5-Bromo 6-Methyl Benzoyl Chloride	
		2,4 Dichloro Benzoyl Chloride	
		4 Methyl Benzoyl Chloride	
		Propargyl Chloride	
		Pivaloyl Chloride	
		4-Chloro Butyryl Chloride	
		Terephthaloyl Chloride	
		N-Valeroyl Chloride	
		4-Chloro Benzoyl Chloride	
		3-Nitro Benzoyl Chloride	
		4-Nitro Benzoyl Chloride	
Plant E	Amines	Primary Amines	1,000
		Ethoxylation of Primary Amines	
Plant F		Paracetamol	1,000
Plant G	Nitro Compounds	4-Chloro 3,5 Dinitro Benzoic Acid	1,000
		6, Nitro 3,4 Dichloro Aniline	
		4-Nitro ,5-Chloro, 2-Methyl Aniline	
		2-Nitro 4-Methyl Aniline	
		3, Nitro 4-Chloro Benzoic Acid	
		3-Nitro-para Toluic Acid	
		2,4 Dichloro 6 Nitro Phenol	
		2,3 Dichloro 4 Nitro Phenol	
		2,5 Dichloro 4 Nitro Phenol	
		1,3 Di Nitro Benzene	
		Nitro Benzene	
		2/3/4 Nitro Toluene	

Plant Code	Common Name	Products	Capacity (MT/Month)
		3,5 Di Nitro Benzoic Acid	
		p-Nitro Salicylic Acid	
		2,5 Dichloro Nitro Benzene	
		3,4/2,3 Dichloro Nitro Benzene	
Plant H	Hydrogenation compounds	p-Hydroxy Aniline/o-Hydroxy Aniline	1,000
		3,4 Dichloro Aniline	500
		3-Iso Propoxy Aniline	
		o-Toluidine	
		m-Toluidine	
		p-Toluidine	
		Aniline	
		3,4 Diamine Toluene	
		2,5 Dimethyl 1,4 Phenylene Diamine	
		2, Chloro, 5-Methyl, 1,4 Phenylene Diamine	
		2, Chloro 1,4 Phenylene Diamine	
		2,5 Dichloro 1,4 Phenylene Diamine	
		2,4,5 Trichloro Aniline	
		6-Methyl 5-Amino Benzimidazolone	
		5-Amino Benzimidazolone	
		3-Amino 4-Chloro Benzoic Acid	
		3-Amino 4-Chloro Benzotrifluoride	
		3-Amino Benzotrifluoride	
		3,5 Dichloro Aniline	
		2,5 Dichloro Aniline	
		2,3 Dichloro Aniline	
		3 Amino 4-Methyl Benzoic Acid	
TOTAL			11,000

2. SUBJECT TO THE FOLLOWING SPECIFIC CONDITIONS RELATED TO ENVIRONMENT CLEARANCE (EC):-

2.1 The applicant shall not produce any products as well as not carry out any activities for products/process listed in the EIA Notification dated 14/09/2006 as amended from time to time, requiring prior Environmental Clearance from competent authority.

2.2 Applicant shall strictly comply/fulfill with all the conditions stipulated by competent authority in the order of Environmental Clearance as and when issued.

3. CONDITIONS UNDER WATER ACT:-

3.1 The quantity of total water consumption shall not exceed 2156 KL/day. (Fresh- 1956 KL/day + Recycle- 200 KL/day) (Break up as below)

a) Domestic - 10 KL/day
b) Industrial - 2096 KL/day (Fresh- 1896 KL/day + Recycle- 200 KL/day)
c) Gardening - 50 KL/day

3.2 The quantity of total waste water generation shall not exceed 1893 KL/day. (Break up as below)

a) Domestic - 8 KL/day
b) Industrial - 1885 KL/day

3.3 The quantity of the industrial effluent from the manufacturing process and other ancillary industrial operations shall be 1885 KL/day and the quantity of domestic waste water (sewage) shall not exceed 8 KL/day.

3.4 Out of 1803 KL/day, @1237 KL/day of high COD/ high TDS effluent shall be sent to ETP-2 for primary, secondary and tertiary treatment followed by RO. @566 KL/day of low COD/ low TDS effluent shall be sent to ETP-1 for primary & tertiary treatment.

3.5 @200 KL/day of RO permeate shall be reused in cooling tower.

3.6 @21 KL/day of boiler blow down, 45 KL/day from cooling, 16 KL/day of washing and 8 KL/day of sewage shall be treated in ETP-1.

3.7 After treatment @1693 KL/day of treated effluent shall be sent to GIDC effluent collection system Line - Dahej Vilayat Pipeline/Common Disposal System up to the sea.

3.8 The Effluent Treatment Plant consisting of the treatment units shall be installed:

Sr. no.	Name of equipment
ETP-1	
1	Oil & Grease tank
2	Equalization tank
3	Neutralization tank
4	Primary clarifier
5	Pressure sand filter
6	Activated carbon filter
7	Final collection tank
8	Sludge collection sump
ETP-2	
1	Oil & Grease tank
2	Equalization tank
3	Neutralization tank
4	Primary clarifier
5	Aeration tank-1
6	Secondary clarifier
7	Aeration tank-2

8	Final clarifier
9	Intermediate collection tank
10	Pressure sand filter
11	Activated carbon filter
12	Final collection tank
13	Sludge collection sump

3.9 The quality of treated effluent shall conform to the following standards prior to disposal GIDC effluent collection system Line - Dahej Vilayat Pipeline/Common Disposal System up to the sea for final disposal at NIO designated point.

PARAMETERS	PERMISSIBLE LIMIT
pH	6 to 9
Temperature	Shall not exceed more than 5° C above ambient water temperature
Total Suspended Solids	100 mg/l
Oil and Grease	10 mg/l
Phenolic Compounds	5 mg/l
Cyanides	0.2 mg/l
Fluoride	15 mg/l
Sulphides	5 mg/l
Ammonical Nitrogen	50 mg/l
Total Kjeldahl Nitrogen (TKN)	50 mg/l
Nitrate- Nitrogen	50 mg/l
Total Res. Chlorine	1 mg/l
Arsenic	0.2 mg/l
Trivalent Chromium	2 mg/l
Hexavelent Chromium	0.1 mg/l
Copper	3 mg/l
Lead	0.1 mg/l
Mercury	0.01 mg/l
Nickel	3 mg/l
Zinc	15 mg/l
Cadmium	0.05 mg/l
BOD (3 days at 27° C)	100 mg/l
COD	250 mg/l
Selenium	0.05 mg/l
Vanadium	0.2 mg/l
Manganese	2 mg/l
Iron	3 mg/l
Bio-assay test	90 % Survival of fish after 96 hours in 100 % effluent.

3.10 The unit shall affix water meters and shall keep it operational for the purpose of measuring and recording the quantity of water consumed at such places as may be required and it shall be presumed that the quantity indicated by the meter has been consumed by the industry until the contrary is proved.

3.11 SUBJECT TO THE FOLLOWING SPECIFIC CONDITIONS UNDER WATER ACT:-

3.11.1 Applicant shall be a member of Dahej CETP as & when come up and sent its industrial waste water, if required.

3.11.2 The effluent shall be stripped off, of VOC's in a closed system before further treatment into ETP.

3.11.3 Unit shall provide treated effluent holding facility for at least 48 hrs, having vertical tank design preferably.

3.11.4 Applicant shall carry out Bio Assay and Toxicity test for the treated waste water and same shall be submitted to the GPCB.

3.11.5 Unit shall install continuous monitoring as well as alarm system for parameters of treated effluent, such as:-pH meter, TOC analyzer, magnetic flow meter along with totalizer and recorder at the final outlet of factory drain/pipe of ETP. Records of the same shall be maintained invariably by the unit and shall be submitted to GPCB every month.

3.11.6 Applicant shall ensured & undertake on Rs. 100 stamp paper that it has one & only one outlet in GIDC U/G drain.

3.11.7 Name of the unit & technical relevant details shall be prominently written /printed on mouth of pipeline opening in to GIDC U/G drain & shall be made visible to inspecting officials.

4. CONDITIONS UNDER AIR ACT:-

4.1 The following shall be used as fuel in the Boiler / Thermic fluid heater/ D G Set as following rates:

Sr. No.	Name of Fuel	Quantity
1	Imported coal	60 TPD
2	HSD	50 lit/hr

4.2 The flue gas emission through stack attached to Boiler / Thermic fluid heater/ D G Set shall conform to the following standards:

Sr No	Stack attached to	Height (M)	APCM	Pollutant	Permissible Limit
1	Boilers-2 Nos (5 TPH Capacity each)	40	Cyclone & bag filter	Particulate Matter SOx NOx	150mg/Nm3 100 ppm 50 ppm
2	Thermic Fluid Heater (20 lakh kcal)	40	Cyclone & bag filter		
3	D.G Set (250 KVA)	11	---		

4.3 The Process emission through various stacks/ vents of reactors, process, vessel shall conform to the following standards:

Sr No	Stack attached to	Height (M)	APCM	Pollutant	Permissible Limit
1	Reactor in MCA plant	15	Caustic and water scrubber	Cl2 HCl	9 mg/Nm3 20 mg/Nm3

2	CPVC plant reactor	15	Alkali scrubber		
3	CPVC dryer	15	Water scrubber		
4	Chlorination Reactor in TCAC plant	15	Caustic and water scrubber		
5	CAC reactor in TCAC plant	15	Caustic and water scrubber		
6	Benzene Chlorination Reactor	15	Caustic and water scrubber		
7	Toluene Chlorination Reactor	15	Caustic and water scrubber		

4.4 The applicant shall install & operate a comprehensive adequate air pollution control measures in order to achieve prescribed below.

4.5 Stack monitoring facilities like port hole, platform/ladder etc, shall be provided with stacks/vents chimney in order to facilitate sampling of gases being emitted into the atmosphere.

4.6 Ambient air quality within and outside the premises of the unit shall conform National Ambient Air Quality standards notified by MOEF vide notification dated 16/11/2009 and mainly to the following standards:-

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient air
1.	Sulphur Dioxide (SO2), μg/m3	Annual 24 Hours	50 80
2.	Nitrogen Dioxide (NO2), μg/m3	Annual 24 Hours	40 80
3.	Particulate Matter (Size less than 10 μm) OR PM10 μg/m3	Annual 24 Hours	60 100
4.	Particulate Matter (Size less than 2.5 mm) OR PM 2.5 μg/m3	Annual 24 Hours	40 60

*Annual arithmetic mean of minimum of 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 Hourly or 08 Hourly or 01 Hourly monitored values as applicable, shall be complied with 98 % of the tome in a year, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note: - Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

4.7 The applicant shall operate industrial plant / air pollution control equipment very efficiently and continuously so that the gaseous emission always conforms to the given standards.

4.8 The consent to operate the industrial plant shall lapse if at any time the parameters of the gaseous emission are not within the tolerance limits specified in the conditions.

4.9 The applicant shall provide portholes, ladder, platform etc. at chimney(s) for monitoring the air emissions and the same shall be open for inspection to / and for use of Board's staff. The chimney(s) vents attached to various sources of emission shall be designed by numbers such as S-1, S-2, etc. and these shall be painted /displayed to facilitate identification.

4.10 All measures for the control of environmental pollution shall be provided before commencing production.

4.11 <u>SUBJECT TO THE FOLLOWING SPECIFIC CONDITIONS UNDER AIR ACT:-</u>

4.11.1 Total control of odour nuisance from the plant premises, shall be achieved & maintained by the applicant continuously.

4.11.2 The applicant shall install continuous /online monitoring system on the stacks for the parameters such as SO_2, NO_x, PM, Cl_2, HCl etc.

5. <u>CONDITIONS UNDER HAZARDOUS WASTE:-</u>

5.1 Applicant shall have to comply with provisions of Hazardous & Other Wastes (Management and Transboundary Movement) Rule-2016 as amended from time to time for all the types/categories of the generating hazardous waste.

5.2 The applicant shall obtain membership of common TSDF site for disposal of Hazardous Waste as categorized in Hazardous & Other Wastes (Management and Transboundary Movement) Rule-2016 as amended from time to time.

5.3 The applicant shall obtain membership of common Hazardous Waste incinerator for disposal of incinerable waste.

5.4 The applicant shall provide temporary storage facilities for each type of Haz. Waste as per Hazardous & Other Wastes (Management and Transboundary Movement) Rule-2016 as amended from time to time.

5.5 The applicant shall obtain registration for recycling / reprocessing any hazardous waste before procuring material / starting production from CPCB.

5.6 The applicant shall obtain authorization for recovery/ reuses of any hazardous waste material.

6. <u>GENERAL CONDITOINS:-</u>

6.1 Regular maintenance of the pipeline shall be carried out to avoid any spillage or leakage during conveyance of the effluent.

6.2 Unit shall keep accurate records of their water consumption and wastewater generation, discharge, quantity of each product manufactured, and consumption of electricity on day-to-day basis and shall be required to submit the compiled record for each month to GPCB on or before seventh day of the succeeding month. Separate logbooks shall be maintained for recording all the necessary data.

6.3 Magnetic flow meters shall be installed at the various stages of inlet & outlet of pipeline to measure the quantity of effluent at each stage of conveyance.

6.4 SEZ - GIDC shall constitute a monitoring committee for monitoring of the effluent discharged by its members in the pipeline.

6.5 In case of power failure, separate stand-by D.G. set having power generation capacity equivalent to the requirement of power to run the APCM system shall be installed, so that it shall always be operated round the clock even in case of power failure also. The unit shall not keep any bypass line or system for stack emission.

6.6 Unit shall have only one outlet for the discharge of its effluent and no effluent shall be discharged without requisite treatment and without meeting with the GPCB norms. Convenient easy approach shall be provided at the outlet for ease of sampling. The unit shall not keep any bypass line or system, or loose or flexible pipe for discharging effluent outside or even within the effluent treatment plant. The unit shall not keep dual disposal modes.

6.7 Unit shall submit, to the GPCB, the site plan of the unit indicating the location of the effluent treatment plants, and also a separate plan indicating the channels / pipelines through which water / effluent passes from different stages of effluent treatment process right up to the stage of its final outlet. Such plan shall also be displayed by the unit on a Board of adequate size within its compound and near its effluent treatment plant.

6.8 The company shall have to undertake and implement following measures:

- Water conservations measures to minimize the fresh water consumption. Metering system for water consumption.
- Cleaner production options.
- Reuse / recycle of trade waste, ground (rain) water recharging, electricity conservation.
- Use of solar or wind energy for lighting / heating purpose.
- Control of odour nuisance from the plant premises.

6.9 The company shall have to keep baseline quality data of land, water and air and shall be required to submit to GPCB with CTE / CCA applications.

6.10 The company shall carry out regular monitoring of ground water quality (including for all pesticides) within the premises as well as around the impervious guard ponds. Separate logbook shall be maintained. The data shall be submitted for each month to GPCB on or before 7th day of succeeding month, and shall also comply with the instructions of GPCB in case of deterioration if applicable.

6.11 Handling, manufacturing, storage and transport of hazardous chemicals shall be in accordance with the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989.

6.12 Transportation of effluent, solid waste or any other goods pertaining to treatment activities, shall be carried out as per central Motor Vehicle Rule-1989 & Hazardous & Other Wastes (Management and Transboundary Movement) Rule-2016.

6.13 The hazardous wastes shall be handled as per the Hazardous & Other Wastes (Management and Transboundary Movement) Rule-2016 of the Environment (Protection) Act, 1986

6.14 On site and off site emergency plan as required under the Rules 13 & 14 of handling. manufacturing, storage and import of the Hazardous chemicals Rules, 1989 shall be prepared and approval from the Board shall be obtained.

6.15 Periodic medical checkup of the workers shall be done and records maintained as a measure to provide occupational health protection to the workers.

6.16 Unit shall provide state of the art composite samplers & set up testing laboratory facilities for collection, analysis of samples under the supervision of competent technical personnel.

6.17 The Environmental Management Unit / Cell shall be setup to ensure implementation and monitoring of environmental safe guards and other conditions stipulated by statutory authorities. The Environmental Management Unit / Cell shall directly report to the Chief Executive of the organization and shall works as a focal point for internalizing environmental issues. These Cells /Units shall also coordinate the exercise of the environmental audit and preparation of the environmental statements.

6.18 The Environmental audit shall be carried out yearly and the environmental statements pertaining to the previous year shall be submitted to the GPCB latest by 30th September every year.

6.19 Storm water shall not be mixed with the industrial effluent. Disposal system for storm water shall be provided separately.

6.20 Good housekeeping shall be maintained within the premises. All pipes, valves and drains shall be leak proof. Floor washing shall be admitted in to the effluent collection system for subsequent treatment and disposal.

6.21 The entire pipeline shall be protected from external corrosion/damage.

6.22 Necessary clearances for the adequacy & safety measures shall be obtained from the concerned authority.

6.23 Unit shall comply with the provisions of all the laws of land including safety, disaster management and prevention of eco contamination.

6.24 The applicant shall have to submit the returns in prescribed form regarding water consumption and shall have to make payment of water cess to the Board under the Water Cess Act- 1977.

6.25 In case of change of ownership/management the name and address of the new owners/ partners/ directors/ proprietor shall immediately be intimated to the Board.

6.26 The applicant also comply with the General conditions as per Annexure - I attached herewith (No.1 to 38) (whichever applicable).

6.27 Any change in personnel, equipment or working conditions as mentioned in the consents form/order should immediately be intimated to this Board.

6.28 Adequate plantation shall be carried out all along the periphery of the industrial premises in such a way that the density of plantation is at least 1000 trees per acre of land and a green belt of adequate width is developed. Unit shall comply with CPCB guideline for green belt development.

6.29 The applicant shall however, not without the prior consent of the Board bring into use any new or altered outlet for the discharge of effluent or gaseous emission or sewage waste from the proposed industrial plant. The applicant is required to make applications to this Board for this purpose in the prescribed forms under the provisions of the Water Act-1974, the Air Act-1981 and the Environment (Protection) Act-1986.

6.30 The concentration of Noise in ambient air within the premises of industrial unit shall not exceed following levels:

Between 6 A.M. and 10 P.M.: 75 db(A)
Between 10 P.M. and 6 A.M.: 70 db(A)

For and on behalf of
Gujarat Pollution Control Board

(A.V.Shah)
Sr. Environmental Engineer

Annexure 3

PROCESSORS PRIVATE LIMITED

NO OBJECTION CERTIFICATE

We, **M/s. Radha Madhav Processors Pvt. Ltd.** located at Plot No.D-2/CH/5 & 6, GIDC Industrial Estate, Dahej-II, Taluka: Vagra, Dist.: Bharuch, Gujarat, hereby take oath and solemnly affirm to state as under:-

1. That Environmental Clearance (EC) was granted for the project manufacturing **11,000 MT/Month of Synthetic Organic Chemicals and Pesticides Specific Intermediates** (herein after referred to as "the project") for **M/s. Radha Madhav Processors Pvt. Ltd.** located at **Plot No. D-2 /CH /5 & 6** of GIDC Industrial Estate, Dahej-II, Bharuch, Gujarat by the Ministry of Environment, Forest & Climate Change, Government of India vide its Letter No. IA-J-11011/274/2014-IA-II(I) dated 18th May, 2018 as per EIA Notification, 2006.

2. That transferor **M/s. Radha Madhav Processors Pvt. Ltd.**, is a private limited company incorporated under the Companies Act, 2013 having its registered office at 11th Floor, JMC House, Opp. Parimal Garden, Ambawadi, Ellis Bridge Ahmedabad – 380 006, Gujarat (herein after referred to as **"Transferor Company"**).

3. That the first transferee **M/s. Meghmani LLP (Unit-3) and** second transferee **M/s. Amulis Finechem Pvt. Ltd.** are a limited liability partnership and a private limited company respectively. **M/s. Meghmani LLP (Unit-3)** and **M/s. Amulis Finechem Pvt. Ltd.** are incorporated under the LLP Act, 2008 and the Companies Act, 2013 respectively & both having its registered office at 11th Floor, JMC House, Opp. Parimal Garden, Ambawadi, Ellis Bridge Ahmedabad – 380 006, Gujarat (herein after referred to as **"Transferee Company"**).

4. That the Board of Directors of **M/s. Radha Madhav Processors Pvt. Ltd.** has approved the transfer of a Synthetic Organic Chemicals manufacturing plant **(3,500 MT/Month)** located at **Plot no. D-2 /CH /5** and a Synthetic Organic Chemicals and Pesticides Specific Intermediates manufacturing plant **(7,500 MT/Month)** located at **Plot no. D-2 /CH /6** of GIDC Industrial Estate, Dahej-II, Bharuch, Gujarat and all other assets/property for acquisition of the same by **M/s. Meghmani LLP (Unit-3)** and **M/s. Amulis Finechem Pvt. Ltd.** respectively.

5. That the Transferor Company has transferred the project to the Transferee Companies and the Transferor Company is no more associated with the project.

6. That it is certified and confirmed that **M/s. Radha Madhav Processors Pvt. Ltd. has "No Objection" to transfer of the Environmental Clearance granted** by the Ministry of Environment, Forest & Climate Change, Government of India vide its letter No. IA-J-11011/274/2014-IA-II(I) dated 18th May, 2018 to

   M/s. Meghmani LLP (Unit-3)

   &

   M/s. Amulis Finechem Pvt. Ltd.

   as per the provisions laid down under Paragraph 11, EIA Notification, 2006 issued under Environmental (Protection) Act, 1986.

Sincerely,

For, **M/s. Radha Madhav Processors Pvt. Ltd.**

[Maulik J. Patel - Director]

Place: Ahmedabad

Date: 15/09/2020

S. No. 5036/2020

VIJAY C. SHAH
NOTARY
GOVT. OF INDIA
17 SEP 2020

Annexure 4

NOTARIZED UNDERTAKING

September 17, 2020

To,
The Director (IA-II Section)
Ministry of Environment, Forests & Climate Change (MoEF&CC),
Government of India,
Indira Paryavaran Bhavan,
Jorbagh Road,
New Delhi – 110 003.

Dear Sir :

Sub : a. Environmental Clearance related to the manufacture of products at plot No. D-2/ CH/ 5 & 6, GIDC Industrial Estate, Dahej – II, Tehsil : Vagra, Dist.: Bharuch (Gujarat) granted to M/s. Radha Madhav Processors Pvt. Ltd.

b. Transfer of the above stated Environmental Clearance and our acceptance with respect to all the terms and conditions of the original Environmental Clearance and the new split Environmental Clearance that may be issued to us in our name.

Ref. : i. Environmental Clearance letter no. IA-J-11011/274/2014-IA-II(I) dated 18-05-2018.

ii. NOC from M/s. Radha Madhav Processors Pvt. Ltd addressed to your office *(Annexure-I)*

This has reference to the No Objection Certificate from M/s. Radha Madhav Processors Pvt. Ltd. addressed to your office (attached as Annexure – I). In this connection, we take this opportunity to confirm that we accept the split and transfer of Environmental Clearance with all the terms and conditions.

This is to confirm that we agree to all the terms and conditions of the prior Environmental Clearance and support the same, we have prepared this letter, provided with a franked stamp of Rs. 300/- and have got it duly notarized.

We request you to consider the above request and to grant us the split Environmental Clearance accordingly.

Thanking you,

Sincerely,

For, **M/s. AMULIS FINECHEM PVT. LTD.**

[AUTHORISED SIGNATORY]

EXECUTANT/PARTIES
SIGNED BEFORE ME

VIJAY C. SHAH
NOTARY
GOVT. OF INDIA
17 SEP 2020

NOTARY
VIJAY C. SHAH
AHMEDABAD
GUJARAT STATE
REGD.NO. 2260
GOVT. OF INDIA

NUTAN NAGRIK SAHKARI BANK LTD.
LAW GARDEN BRANCH,
AHMEDABAD
GUJ/SO/AUTH/A/17/2005
INDIA भारत
STAMP DUTY
SPECIAL ADHESIVE
Rs.≈0000300≈ 17.9.2020
363095 GUJARAT
Zero*Zero*Zero*Zero*Three*Zero*Zero*
8650 1222705

Annexure 5

सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF CORPORATE AFFAIRS

Central Registration Centre

Certificate of Incorporation

[Pursuant to sub-section (2) of section 7 and sub-section (1) of section 8 of the Companies Act, 2013 (18 of 2013) and rule 18 of the Companies (Incorporation) Rules, 2014]

I hereby certify that AMULIS FINECHEM PRIVATE LIMITED is incorporated on this Thirty first day of August Two thousand twenty under the Companies Act, 2013 (18 of 2013) and that the company is limited by shares.

The Corporate Identity Number of the company is U24299GJ2020PTC115993.

The Permanent Account Number (PAN) of the company is **AATCA9490J** *

The Tax Deduction and Collection Account Number (TAN) of the company is **AHMA21831F** *

Given under my hand at Manesar this Sixth day of September Two thousand twenty .

DS MINISTRY OF CORPORATE AFFAIRS 6

Digital Signature Certificate
Mr Parvinder Singh
DEPUTY REGISTRAR OF COMPANIES
For and on behalf of the Jurisdictional Registrar of Companies
Registrar of Companies
Central Registration Centre

Disclaimer: This certificate only evidences incorporation of the company on the basis of documents and declarations of the applicant(s). This certificate is neither a license nor permission to conduct business or solicit deposits or funds from public. Permission of sector regulator is necessary wherever required. Registration status and other details of the company can be verified on www.mca.gov.in

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Mailing Address as per record available in Registrar of Companies office:

AMULIS FINECHEM PRIVATE LIMITED
111, JMC HOUSE, R SULABHSHANTI APT,OPP., CHHADAWAD
CHOWKI, PARIMALGARDEN,AMBAWADI, AHMEDABAD,
Ahmedabad, Gujarat, India, 380009

* as issued by the Income Tax Department

Annexure 6

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

Anand Environmental Consultants Pvt. Ltd, Ahmedabad

16, Everest Tower, B/h. Jain Temple, Nr. Ankur Society,Naranpura,Ahmedabad-380013

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

Sl. No.	Sector Description	Sector (as per) NABET	Sector (as per) MoEFCC	Cat.
1	Thermal power plants	4	1 (d)	A
2	Cement Plant	9	3(b)	A
3	Chlor-alkali industry	13	4 (d)	A
4	Pesticides industry and pesticide specific intermediates (excluding formulations)	17	5 (b)	A
5	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
6	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of Schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	28	-	B
7	Ports, harbors, break waters and dredging	33	7(e)	A
8	Building and construction projects	38	8 (a)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated March 06, 2020 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions as per the Scheme. The accreditation needs to be renewed before the expiry date by Anand Environmental Consultants Pvt. Ltd, Ahmedabad following due process of assessment.

Sd/-
Sr. Director, NABET
Dated: June 30, 2020

Certificate No.
NABET/EIA/1922/RA 0167

Valid till
Sept 26, 2022

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.