**Joint Committee Interim Report**

**Hon'ble NGT matter- OA No. 121/2024 (WZ) related to incident at M/s.Amudan Chemicals Pvt. Ltd. Dombivli, Dist Thane, Maharashtra**

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1. The Hon'ble NGT (WZ) has constituted a committee in the matter of OA 121/2024 (WZ) vide order dated 24.05.2024 which is registered *suo moto* on the basis of News item titled "Amudan Chemicals Pvt. Ltd. in Dombivli East- 8 killed, 60 injured in boiler blast at Thane Chemical Unit" appearing in The Indian Express dated 24.05.2024.
2. Hon'ble NGT vide aforesaid order directed to the joint committee to visit the site and submit report. The 'Terms of Reference' for the Joint Committee is also provided in the aforesaid order. The Copy of the aforesaid order is given as **Annexure-I.**

The Joint committee comprising following members nominated by the concerned department have carried out the site visit on 31/05/2024, the copy of visit report is enclosed as **Annexure-II.**

- Shri Rajesh Mule, Deputy Engineer, MIDC Dombivali
- Shri Sachin Bhele, Deputy Director, DISH, Kalyan
- Shri Satyajit Chavan, Residential Nayab Tahsildar
- Shri Rajendra D. Patil, Scientist 'E', CPCB RD Pune
- Dr. Rajendra Rajput, Regional Officer, MPCB, Kalyan – Nodal Officer

The pointwise details as per ToR in Hon'ble NGT order are given as below-

## 3. ACCIDENT INVESTIGATION REPORT ALONG WITH CORRECTIVE ACTION PLAN;

3.1. Directorate of Industrial Safety & Health (DISH), Govt of Maharashtra carried out detail investigation of the said industrial accident. DISH has submitted its report to the Govt of Maharashtra. A copy of the report is also provided to the committee for the reference, same is enclosed at **Annexure-III.**

3.2. Following is mentioned about the 'Occurrence of explosion and fire in the factory' in the said investigation report

3.2.1. The said unit was engaged in manufacturing of various organic peroxides such as Methyl Ethyl Ketone Peroxide (MEKP), Di Tertiary Butyl Peroxide (DTBP), Tertiary Butyl Hydro Peroxide (TBHP). The manufacturing process of Tertiary Butyl hydrogen peroxide (TBHP) is a highly exothermic reaction.

3.2.2. On 23/05/2024, the synthesis of Tertiary Butyl hydro peroxide (TBHP) was carried out in Glass Line reactor (GLR) (3 KL), and the settling of Tert- Butyl Peroxybenzoate (TBPB) was carried out in the SS reactor (3 KL).

3.2.3. On 22/05/2024, at night in GLR (3KL), $H_2O_2$ (1200 kg) is charged and the temperature of the reactor was brought to around $17^0$ C. Also, in the SS reactor (3 KL) there was making of TBPB and at night, there was the activity of the stirring of TBPB in SS reactor (3 KL).

3.2.4. On 23/05/2024 at 09 am, operator had cooled the reactor around $17^0$ C and charging of $H_2SO_4$ of around 180 Kg was charged from the $H_2SO_4$ can with help of vacuum pump. The charging of 1 can (63 Kg) of $H_2SO_4$ takes around 15 minutes. Total 180 Kg was charged from the 3 cans taking around 40 to 45 minutes. Then, when the vacuum was released there was an increase in temperature and the temperature was maintained below $25^0$C and the stirring was carried out for around 2 to 2 ½ hours.

3.2.5. Thus, the charging of the remaining 210 Kg $H_2SO_4$ from the 3 & ½ cans was carried out at 11:15 am and the charging was finished at 12:30 pm.

3.2.6. At 12:30 PM there was a lunch break till 1:00 PM. After lunch break TBA of around 100-150 Kg was charged into the reactor, soon after the charging was over by releasing vacuum, the temperature was increased rapidly leading to exothermic reaction at 60 to $70^0$C and to control runaway reaction cooling arrangement was insufficient. As the temperature increased inside the reactor pressure increased beyond bursting pressure of 95 Kg/cm$^2$ leads to bursting of GLR (3KL).

3.2.7. Due to the explosion of the reactor, the shock waves and tremendous heat, the adjacent SS reactor (3KL) containing TBPB was also exploded due to the decomposition reaction of TBPB exceeding the SADT temperature more than $60^0$ C.

3.2.8. Also, the MS tank containing DMP was exploded which leads to the rupture of the tank due to forming explosive mixtures with air on intense heating and the MEK tank was thrown away at a distance of 7 meters from the original position.

3.2.9. Due to the presence of combustible liquid and flammable liquids in the premises, the fire started in the factory and spread rapidly to the adjacent factories. After the explosion followed by fire the workers of the adjacent factory informed the Fire brigade about the incident. The Fire brigade from Dombivili MIDC reached the spot at 1:50 PM and started extinguishing the fire. After some time other Fire brigade from Kalyan Dombivli Municipal Corporation, Navi Mumbai Municipal Corporation, Ulhasnagar Municipal Corporation, Ambernath Municipal Council and NDRF Battalion No. 5 and TDRF had conducted rescue operations and on 25.05.2024 at 3.42 pm the said rescue operations was stopped.

3.3. The said report also quoted the possible responsible reasons.

3.3.1. The workers had neither formal education in the chemistry of reactions and handling of hazardous substances nor had qualifications and experience in handling hazardous substances. They were not competent to supervise such handling within the factory.

3.3.2. On the day of incidence, there was no facility for control addition of sulphuric acid through an addition vessel / glass

flask. Sulphuric acid was directly charged into the reactor from the sulphuric acid carboys through vacuum charging.

3.3.3. A safety relief valve was provided on the SS reactor (3 KL) but the rupture disc was not provided. In the Case of GLR (3 KL) neither a safety relief valve nor a rupture disc was provided on it.

3.3.4. On the reactor system, there was no provision for an alarm and interlock such as a utility failure alarm, agitator failure alarm, High-temperature alarm or Alarm for a High rate of addition of limiting reactant which is added at a controlled rate. Also, there was no control system installed in which the raw material (limiting reactant) addition rate is controlled by the flow control loop. The controlling parameter is reactor temperature.

3.3.5. The flow control valve or on-off valve (interlocked with the reaction mass temperature and agitator tripping) was not installed on the reactor.

## 4. DETAILS OF DECEASED PERSONS – EMPLOYEE/CONTRACT WORKER/OTHER, AGE, LAST DRAWN SALARY, COMPENSATION PAID;

4.1. As per the details provided by the District Administration, total 13 persons were deceased on the spot.

4.2. Compensations of Rs. 5.00 lakh each paid to 2 persons and District Administration is in process to pay the compensation to the remaining deceased persons.

4.3. Details of last salary drawn of permanent and contractual employee/ worker submitted by the industry to MPCB on 02/07/2024 and same is enclosed herewith as **Annexure-IV.**

5. **DETAILS OF INJURED PERSONS – EMPLOYEE/CONTRACT WORKER/OTHER, AGE, LAST DRAWN SALARY, NATURE OF INJURY, PERMANENT DISABLEMENT, IF ANY, DATE OF ADMISSION IN HOSPITAL, DATE OF DISCHARGE, COMPENSATION PAID;**

5.1. A total of 68 people were injured and taken to different hospitals for treatment. Free treatment has been provided by the Government of Maharashtra.

5.2. Out of these 68 injured individuals, two casualties were reported later in addition to the 13 people who died on the spot during the incident.

5.3. The details provided by the District Administration are attached in the **Annexure-V.**

5.4. Details related to the compensation paid are awaited.

6. **DAMAGE TO NEARBY STRUCTURES, IF ANY;**

6.1. After explosion, the raw material finished product being combustible and flammable caught fire. This fire spread into the adjacent factories

as well. Due to the high intensity, many houses and industrial establishments in the surrounding area have been damaged.

6.2. In addition to the unit in question, collapse of the structures was observed in the adjacent units M/s. Mehta Paint and M/s. Saptvarna Colourant having common boundary wall with the unit in question.

6.3. The committee also observed that the structures and manufacturing equipment of other surrounding units has been damaged.

6.4. The committee also noted that some minor structures within an approximately one-kilometre aerial distance were also damaged. According to the information from the Tahsildar Office, a detailed survey was conducted and minor and major damages have been reported upto an approximate distance of 1.5 km.

6.5. As per the report of the Revenue Department, Kalyan Dombivli Municipal Corporation (KDMC) and Revenue Department has jointly conducted a panchnama of the incident site and total 980 residential properties and commercial properties in the surrounding area. Out of 980 properties, 643 residential properties were minorly affected and 337 commercial properties were also affected (298 commercial properties were minorly affected and 39 commercial properties were fully affected).

## 7. ACTIONS TAKEN BY DISH AND MPCB AFTER THE ACCIDENT;

7.1. MPCB has issued Closure Directions vide No. MPCB/ROK/750/24, Dated 23/05/2024 to the said unit M/s. Amudan Chemicals Pvt Ltd and also issued voluntary Closure Directions to the adjacent 8 units.

The copies of the these directions are enclosed herewith as **Annexures-VI.**

7.2. MPCB has carried out survey of Chemical units located in MIDC area Dombivali during 25/05/2024 to 28/05/2024 and issued Closure Directions issued to 36 defaulter units. The list of total 45 units is attached at **Annexure-VII.**

7.3. The DISH carried out detailed investigation and submitted report categorially mentioning about the occurrence of the accidents, possible responsible factors and remedial measures to be taken to consider such accidents in future.

## 8. ENVIRONMENTAL DAMAGE IN TERMS OF AIR/WATER/LAND POLLUTION AND MITIGATION MEASURES;

8.1. During the incident, due to explosion followed by fire, hazardous chemicals/ material burned which resulted into air pollution.

8.2. MPCB informed that around 214.2 MT of contaminated waste has been shifted to CHWTSDF for safe disposal.

8.3. According to CHWTSDF estimation, another 100 to 150 MT of contaminated waste remains at the site and they are in the process of removing it. They have also collected seven residue samples for analysis to confirm the appropriate method of treatment and disposal.

8.4. MPCB conducted Ambient Air Quality Monitoring for 24 hours from 4:00 PM on 23/05/2024. As per monitoring reports the lower and higher concentrations of PM10 level during 24 hours are 187 $\mu g/m^3$ and 314 $\mu g/m^3$ respectively. (Standard of PM10 for 24 hours in

industrial and residential area is 100 µg/m3). The AAQM Results is attached at **Annexure-VIII.**

8.5. The committee observed some liquid spillages at the site however, no significant quantities were noticed.

8.6. The committee was of the opinion that technical services from the reputed institute/organization should be hired to estimate the environmental damage in terms of air, water, and land pollution. The committee opined to engage the services of the suitable technical institute for damage assessment of environment due to said incidence.

## 9. RECORD OF REGULATORY COMPLIANCE BY THE UNIT IN TERMS OF EPA 1986, WATER (PREVENTION AND CONTROL OF POLLUTION) ACT 1974, AIR (PREVENTION AND CONTROL OF POLLUTION) ACT 1981, HAZARDOUS WASTE (MANAGEMENT AND HANDLING) RULES 2016;

9.1. As per the information with MPCB, the unit had provided the following infrastructure to control the environmental pollution,

9.1.1. Effluent Treatment Plant (ETP) of 1.5 CMD capacity comprising primary treatment. Treated effluent was sent to Common Effluent Treatment Plant (CETP) for further treatment.

9.1.2. Stack was provided to LDO fired Thermopack.

9.1.3. Scrubber was provided to process reactor.

9.2. The unit was having Consent to Operate having validity 31/12/2028 under Water Act, Air Act and HW Rule. The Consent copy is attached at **Annexure-IX.**

9.3. Industry has submitted online HW returns for the 2022-23. Industry has disposed HW 3 Kg in 21.09.2023, 21.12.2023, 18.04.2024 and 16.05.2024.

9.4. The unit was also submitted Pollution Audit Report under provision of Environment (Protection) Act, 1986. The report is attached at **Annexure-X.**

10. **UNAUTHORIZED CONSTRUCTION/ EXPANSION/INSTALLATION CARRIED OUT BY THE UNIT, IF ANY;**

10.1. MIDC informed that area of the plot is 700 sq. mtr. and MIDC has permitted built up area 240 sq. mtr.

10.2. As per the records with MIDC, no unauthorized construction/ expansion/installation has been reported.

11. **Record of Regulatory Compliance by the Unit in terms of Manufacture, Storage and Import of Hazardous Chemicals Rules 1989 specifically in the terms of HAZOP Study/ies, Safety Audit/s carried out in past 3 years before the accident;**

11.1. HAZOP study of the unit was carried out in Dec 2020 by DISH certified Safety Auditor Mr Dhananjay Jadhav (Register No.MS/DISH/SA/J-006/2019) M/s. Dtech Engineering.

11.2. In the HAZOP study report the manufacturing activity details, raw material details, process flow and production process of organic peroxide was studies. Also, the studies of activities like mixing of chemical, charging of chemicals, the possible hazards generation of static charged / splash fire, explosion / chemical / vapor explosion are mentioned in the said report. The HAZOP Report is attached at **Annexure-XI.**

## 12. HAZOP STUDY/IES, SAFETY AUDIT/S CONDUCTED AFTER THE ACCIDENT ALONG WITH STATUS OF IMPLEMENTATION OF AUDIT RECOMMENDATIONS AND ALSO IMPLEMENTATION OF RECOMMENDATIONS OF MPCB AND DISH; AND

12.1. DISH have carried out detailed investigation and submitted report categorially mentioning about the occurrence of the accidents, possible responsible factors and remedial measures to be taken to consider such accidents in future. DISH has carried out study after the accident and submitted recommendations.

12.2. To avoid reoccurrence of such incidence in future following remedial measures are suggested by DISH :-

12.2.1. The facility for control addition of sulphuric acid through an additional vessel / glass flask shall be made.

12.2.2. On the rector system provision of alarm and interlock such as utility failure alarm, agitator failure alarm, High temperature alarm for High rate of addition of limiting reactant which is added at controlled rate shall be provided.

12.2.3. Flow control valve and / or On-Off valve for raw material shall be installed such that raw material (limiting reactant) addition rate should be controlled by flow control loop. The controlling parameter is reactor temperature. And FCV and/or On-Off valve should be interlocked with the reaction mass temperature and agitator tripping.

12.2.4. A HAZOP study for the entire process shall be carried out by specialized expert and recommendations thereof shall be complied with.

12.2.5. Workers and the operator shall be trained well-designated Training Programme for operation and working staff regarding handling of hazardous chemical and hazardous associated with it, and the same shall be periodically refreshed with the latest information available within the scope.

## 13. PROFIT AND LOSS STATEMENT FOR THE UNIT FOR PAST 3 YEARS PRIOR TO THE ACCIDENT.

13.1. The profit and loss statements of year 2021-2022 and 2022-2023 are submitted by industry to the MPCB on 01/07/2024 and same are enclosed herewith as **Annexure-XII.**

14. The photographs taken during the visit of the committee are attached herewith as **Annexure-XIII.**

15. The committee humbly submits before Hon'ble NGT to consider this report as interim report and allow time to submit the final report including environmental damage assessment with help of the reputed technical institute/organisation.

Date : 02/07/2024
Place : Kalyan

Dr. Rajendra Rajput,
Regional Officer, MPCB, Kalyan –
Nodal Officer

Annexure-I



(Pune Bench)

**BEFORE THE NATIONAL GREEN TRIBUNAL**
**WESTERN ZONE BENCH, PUNE**

THROUGH PHYSICAL HEARING (WITH HYBRID OPTION)

**Original Application No.121/2024(WZ)**

News item titled "Amudan Chemicals Pvt. Ltd. in Dombivli East- 8 killed, 60 injured in boiler blast at Thane Chemical Unit" appearing in The Indian Express dated 24.05.2024.

Date of hearing: 24.05.2024

**CORAM: HON'BLE MR. JUSTICE DINESH KUMAR SINGH, JUDICIAL MEMBER**
**HON'BLE DR. VIJAY KULKARNI, EXPERT MEMBER**

Respondent : Ms. Manasi Joshi, Advocate for MPCB

**ORDER**

1. We have perused the report of the learned Registrar of this Tribunal dated 24.05.2024 in respect of news item published in The Time of India dated 24.05.2024 titled "8 die, 62 hurt in chemical unit blast in dense Dombivli MIDC".

2. This Original Application is registered *suo-moto* on the basis of above-mentioned report of learned Registrar as well as news item published in The Indian Express dated 24.05.2024 titled "Amudan Chemicals Pvt. Ltd. in Dombivli East 8 killed, 60 injured in boiler blast at Thane chemical unit".

3. As per the newspaper reports, a boiler explosion took place in a chemical industry in Dombivli (East) of Thane District in Maharashtra on Thursday afternoon. The name of the Chemical Industry is recorded as Amudan Chemicals Pvt. Ltd., wherein it is reported by the Officials of Kalyan Dombivli Municipal Corporation (KDMC) that the boiler explosion happened in Phase- 2 of the Dombivli MIDC area around 1.40 pm, affecting adjacent factories and houses. The explosion was heard in a

radius of two kilometers and the window panes of nearby houses in the buildings in 500 mtrs. radius were shattered due to the impact. A smoke cloud could be seen billowing from the factory. A photograph of the same is also given in the newspaper.

4. It is further reported in the newspaper that a fire brigade official said that the Amudan Company, owned by Malay Mehta, is dealing into hardener (chemical) manufacturing, where two-three blasts followed the main blast. The impact was such that four companies nearby were gutted. People working in and around Amudan were thrown off. Due to the presence of chemicals within the premises, there were two more explosions. Metal objects were flung around in a radius of about 500 mtrs.

5. It is further reported in the newspaper that the KDMC had pressed nearly 12 fire engines, 16 water tankers and 50 foam drums for rescue operations. In this occurrence, 8 lives were lost and 60 were injured. As per the preliminary information, those killed were working in neighbouring factories. The cause of the explosion is still not known. In the year, 2016, a similar explosion took place at a company in Dombivli MIDC in which 12 people were killed.

6. It is further reported in the newspaper that the boiler in the factory was not registered under the Indian Boiler Regulations, 1950. Large number of people are feared trapped in the factories around the chemical factory and efforts are made to rescue those people. All most-hazardous industrial units falling under the red category are directed to have been closed down immediately, which would be given option to shift to another location or change the usage (category).

7. Looking to the seriousness of the occurrence, we are inclined to take cognizance of this occurrence *suo moto* and direct the Registry to

implead following parties as respondents in the present Original Application:-

(i). **Maharashtra Pollution Control Board**
through Member Secretary
Kalpataru Point, 2nd floor,Opp. PVR Theatre, Sion (E), Mumbai-400022 ,Maharashtra
Email - ms@mpcb.gov.in

(ii). **Maharashtra Industrial Development Corporation**
through Chief Executive Officer
'Udyog Sarathi", Marol Indl. Area,
Mahakali Caves Road, Andheri (East),
Mumbai – 400 093.
Tel: 022-47488312/47484699/47484679
Email - ceo@midcindia.org

(iii). **District Collector -Thane**
Collector Office, Court Naka,
Thane (West), Pin 400601
Telephone : +91- 22 – 25347444
E-mail: collector.thane@maharashtra.gov.in

(iv). **Central Pollution Control Board**
through Regional Directorate
Survey No. 110, Dhankude Multi Purpose Hall,
Baner Road, Baner, Pune - 411045
Tel: 020-2991 2772 & 020-2991 2773
E-mail - pratik.cpcb@gov.in

(v). **Directorate of Industrial Safety and Health**
Kamgar Bhawan, 5th Floor, C-20, E-Block, Opp R.B.I., Bandra-Kurla Complex, Bandra (E), Mumbai-400 051.
Tel.-+91 22 26572504/ 09 / 22 / 58
E-mail- dirdish.mum-mh@gov.in

(vi). **AMUDAN CHEMICALS PRIVATE LIMITED**
through Directors- Malay Mehta and Sneha Malay Mehta
W-229, MIDC Phase II, Manpada Road,
Dombivli (East), Thane 421203.
E-mail:- amudanchemicals@gmail.com

8. We also deem it appropriate to constitute a Joint Committee comprising one Member each of:-

(i). Maharashtra Pollution Control Board;

(ii). Maharashtra Industrial Development Corporation;

(iii). District Collector –Thane;

(iv). Central Pollution Control Board; and

(v). Directorate of Industrial Safety and Health.

9. The Maharashtra Pollution Control Board (MPCB) shall be the nodal agency for coordination and logistic support.

10. The Committee is directed to visit the site in question within two days positively. Following shall be the Terms of Reference for the Joint Committee along which the report is required to be submitted by the Committee:-

1. Accident Investigation Report along with corrective action plan;
2. Details of deceased persons – employee/contract worker/other, age, last drawn salary, compensation paid;
3. Details of injured persons – employee/contract worker/other, age, last drawn salary, nature of injury, permanent disablement, if any, date of admission in hospital, date of discharge, compensation paid;
4. Damage to nearby structures, if any;
5. Actions taken by DISH and MPCB after the accident;
6. Environmental damage in terms of air/water/land pollution and mitigation measures;
7. Record of Regulatory Compliance by the Unit in terms of EPA 1986, Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981, Hazardous Waste (Management and Handling) Rules 2016;
8. Unauthorized construction/expansion/installation carried out by the unit, if any;
9. Record of Regulatory Compliance by the Unit in terms of Manufacture, Storage and Import of Hazardous Chemicals Rules 1989 specifically in the terms of HAZOP Study/ies, Safety Audit/s carried out in past 3 years before the accident;

10. HAZOP Study/ies, Safety Audit/s conducted after the accident along with status of implementation of Audit recommendations and also implementation of recommendations of MPCB and DISH; and

11. Profit and Loss statement for the unit for past 3 years prior to the accident.

11. The Committee shall submit its report within one month.

12. We further direct that the Member Secretary, MPCB shall ensure that an Officer not below the rank of Regional Officer shall be personally responsible in carrying out the investigation and the said Officer shall appear before this Tribunal on the date fixed by us with action taken report.

13. The report in the matter be submitted by MPCB through e-filing by using portal of NGT in the form of searchable PDF/OCR Support PDF and not in the form of Image PDF.

14. A copy of this order be communicated to the above-mentioned Committee and respondent No.6 forth-with for compliance.

Put up this matter for further consideration on 03.07.2024

Dinesh Kumar Singh, JM

Dr. Vijay Kulkarni, EM

May 24, 2024
Original Application No.121/2024(WZ)
P.Kr

Visi tof the joint committee with reference to Hon'ble NGT Order OA 121/2024 (WZ) related to incident at Amudan Chemicals Pvt. Ltd. Dombivli

The Hon'ble NGT (WZ) has constituted a committee in the matter of OA 121/2024 (WZ) vide order dated 24.05.2024 which is registered suo moto on the basis of News item titled "Amudan Chemicals Pvt. Ltd. in Dombivli East- 8 killed, 60 injured in boiler blast at Thane Chemical Unit" appearing in The Indian Express dated 24.05.2024.

Hon'ble NGT item titled "Amudan Chemical (P) Ltd., Dombivali (E) 8 killed, 60 injured in boiler blast at Thane Chemical unit" appearing in the Indian Express dated 24/05/2024) and directed to the joint committee to visit the site and submit report. The 'Terms of Reference' for the Joint Committee is also provided in the aforesaid order.

The following members, nominated by the concerned department, carried out the site visit on 31/05/2024.

- Rajesh Mule, Deputy Engineer, MIDC Dombivali
- Sachin Bhele, Deputy Director, DISH, Kalyan
- Satyajit Chavan, Residential Nayab Tahsildar
- Rajendra D. Patil, Scientist 'E', CPCB RD Pune Dr. Rajendra
- Dr. Rajendra Rajput, Regional Officer, MPC Board, Kalyan –Nodal Officer

Following is some of the key observations made during visit.

1) It was reported that the explosion began between 1:30 and 2:00 PM on 23/05/2024 and that the fire continued until late at night.

2) The committee observed that the structures of the unit have collapsed at the site and that the debris are spread across the unit area.
3) In addition to the unit in question, collapses of the structures were observed in the adjacent units, M/s. Mehta Paint and M/s. Saptvarna Colourant, which shared their boundary walls with the unit in question.
4) The committee also observed that the structures and manufacturing equipment of other surrounding units have been damaged.
5) According to the information provided by Residential Nayab Tahsildar, total of 15 units sustained damage to their civil/building structures.
6) MPCB officials informed that MPCB issued voluntary closure orders to the 8 adjacent units, immediately after the blast & fire incident.
7) MPCB also informed that 214.2 MT of contaminated waste have been shifted to CHWTSDF for safe disposal and about 100 to 150 MT of contaminated waste remains at the site. CHWTSDF is in the process of removing the waste. Seven residue samples of the waste have collected for analysis to confirm the appropriate method of treatment and disposal.
8) MPCB conducted Ambient Air Quality Monitoring for 24 hours starting from 4:00 PM on 23/05/2024..
9) The committee observed traces of liquid spillages at the site; however, no significant quantities were noticed.
10) The committee also noted that minor structures within an approximately one-kilometre aerial distance were damaged. According to the information provided Residential Nayab Tahsildar, a

detailed survey was carried out, and minor and major damages have been reported up to an approximate distance of 1.5 km.

11) The committee has requested representatives from the concerned department to provide relevant information as per the Terms of Reference mentioned in the 'para 10' of the aforesaid order within 10 days.

12) The committee is also of the opinion that technical services from the national level reputed institute/organization should be hired for the assessment of environmental damage in terms of air, water, and land pollution. The committee requested MPCB to expedite the process as soon as possible.

| Name of the officer | Signature |
|---|---|
| Rajesh Mule, Deputy Engineer, MIDC Dombivali | |
| Sachin Bhele, Deputy Director, DISH, Kalyan | |
| Satyajit Chavan, Residential Nayab Tahsildar | |
| Rajendra D. Patil, Scientist 'E', CPCB RD Pune | |
| Dr. Rajendra Rajput, Regional Officer, MPC Board, Kalyan | |
| Date of visit | May 31, 2024 |

Annexure - III

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OIC

**Government of Maharashtra**
**Directorate of Industrial Safety & Health**
**Office of Joint Director,**

Industrial Safety & Health, 3rd Floor, Gandhi Tower, Near Joker Cinema, Bail Bazar, Kalyan (W). Ph.no:- 0251-2207042, E-mail ID: jdishkalyan@gmail.com

**By RPAD**

No.JDISH/Visit/SGB/3335
Date – 14 JUN 2024

Forwarded the visit remarks dtd. 23/05/2024 to Occupier/Manager of M/s. Amudan Chemicals Pvt Ltd., Plot No. W-229, M.I.D.C. Phase II, Manpada Road, Dombivali (East) Kalyan, Tal – Kalyan & Dist-Thane 421204 pasting in Inspection Book & early compliance.

(S.G. Bhele)
Deputy Director,
Industrial Safety & Health, Kalyan

**M/s. Amudan Chemicals Pvt Ltd.,**
**Plot No. W-229, M.I.D.C. Phase II, Manpada Road,**
**Dombivali (East) Kalyan**
**Tal – Kalyan & Dist-Thane 421204.**

1. On receipt of the telephonic message from the MARG member from Dombivali, I, visited the factory on 23.05.2024 @ 2:00 PM to enquire into the explosion that took place in the factory @ 1:35 PM on the same day which resulted into fire and an offsite emergency.

2. Shri. D.B. Gore, Director, Directorate of Industrial Safety & Health, Maharashtra,Shri. S.S. Joshi, Jt. Director, Kalyan, Shri. L.K. Gorane, Dy. Director, DISH were also present at the accident spot.

3. A total of 13 workers died, and 67 persons were injured in this incident. The injured workers were immediately taken to AIMS Hospital, ICON Hospital, and Shastri Hospital KDMC and other hospitals in Dombivli east in after a rescue operation was launched. A total of 36 nearby industrial establishments have been verified by the Police department in connection with the blast incident, and the following industrial establishment workers were found missing. later, the dead bodies were identified by relatives /DNA sampling. Below is the list of deceased workers due to accident.

| Sr. No | Name of deceased workers | Age | Sex | Name of the factory where the deceased worker was employed | Whether Factory Worker / Contract Worker | Whether Registered under ESIC/WC |
|---|---|---|---|---|---|---|
| 1. | Mrs. Rohini Kadam | 26 | Female | Amudan Chemicals Pvt. Ltd., | Staff | Registered under ESIC. INS.NO – 3417421857 |
| 2. | Mrs. Riddhi Khandwilkar | 38 | Female | Amudan Chemicals Pvt. Ltd., | Staff | Registered under ESIC. INS.NO. – 3417421616 |
| 3. | Mr. Dhaval Vaghani | 29 | Male | Amudan Chemicals Pvt. Ltd., | Staff | Not registered under ESIC. |
| 4. | Mr. Ravi Rajbhar | 45 | Male | Amudan Chemicals Pvt. Ltd., | Factory Worker | Registered under ESIC. INS.NO - |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | 3517457747 |
| 5. | Mr. Satyanarayan Rajbhar | 48 | Male | Amudan Chemicals Pvt. Ltd., | Factory Worker | Registered under ESIC. INS. NO – 3517457791 |
| 6. | Mr. Manoj Jondhale | 54 | Male | Amudan Chemicals Pvt. Ltd., | Contract worker of Disha Enterprises | Registered under ESIC. INS. NO – 3417344667 |
| 7. | Mr. Sirajuddin Ahmed | 24 | Male | Amudan Chemicals Pvt. Ltd., | Contract worker of Kishore Prabhakar Gulhane | Registered under ESIC. INS. NO – 3416976471 |
| 8. | Mr. Bharat Jaiswar | 43 | Male | Amudan Chemicals Pvt. Ltd., | Contract worker of Kishore Prabhakar Gulhane | Registered under ESIC. INS. NO – 3416091051 |
| 9. | Mr. Manoj Chavan | 35 | Male | Amudan Chemicals Pvt. Ltd., | Contract worker of Poonam Enterprises | Registered under ESIC. INS. NO – 3415848558 |
| 10. | Mr. Manish Kumar Das | 22 | Male | Amudan Chemicals Pvt. Ltd., | Contract worker of Poonam Enterprises | Registered under ESIC. INS. NO – 3416802910 |
| 11. | Mr. Rakesh Rajput | 49 | Male | Saptavarna Colors Pvt. Ltd., W - 230, MIDC, Phase - 2, Dombivli, | Contract worker of Colourmax Dyestuff Pvt. Ltd. | Registered under ESIC. INS NO- 5609503478 |
| 12. | Mr. Vishal Poundwall | 42 | Male | Cosmos Company | Factory worker | Registered under ESIC. INS NO- 3417424412 |
| 13. | Mr. Jai Sarkar | 26 | Male | Cosmos Company | Factory worker | Registered under ESIC. INS NO- 3417428289 |

4. Kalyan Dombivli Municipal Corporation, Navi Mumbai Municipal Corporation, Ulhasnagar Municipal Corporation, Ambernath Municipal Council and NDRF Battalion No. 5 and TDRF had conducted rescue operations. On 25.05.2024 at 3.42 pm the said rescue operation was stopped.

List of Industrial establishments affected by the explosion & fire at M/s. Amudan Chemicals Pvt. Ltd.,

| Sr. No. | Company Name and Address |
|---|---|
| 1. | Wagjhai Enterprises<br>Plot no. W-233, M.I.D.C. Phase II, Manpada Road,<br>Dombivali (East) Kalyan<br>Tal – Kalyan & Dist-Thane 421204 |
| 2. | Neo orgo Chem LLP ,Plot No. W-222, Phase II,Dombivali PHASE - II MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 3. | Omega Fine Chemicals, Plot No. w-130,Phase II,Dombivali Dist. Thane |
| 4. | Omega Fine Chemicals, Plot No. A-88,Phase II,Dombivali Dist. Thane |
| 5. | Mehta corporation<br>Plot no. W-228, M.I.D.C. Phase II, Manpada Road,<br>Dombivali (East) Kalyan<br>Tal – Kalyan & Dist-Thane 421204 |
| 6. | Auto Car Color & Coating Pvt Ltd,<br>Plot No.734, M.I.D.C. Phase II, Manpada Road,<br>Dombivali (East) Kalyan<br>Tal – Kalyan & Dist-Thane 421204 |
| 7. | S.D.A. Industries Limited<br>Plot no. W-227, M.I.D.C. Phase II, Manpada Road,<br>Dombivali (East) Kalyan<br>Tal – Kalyan & Dist-Thane 421204 |
| 8. | Brisk Chemical,Plot No. W-221, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 9. | Modern Industrial Gases, W-170/1, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 10. | Mr. Vighnahar Chemicals, Plot no. W-225, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 11. | Vinayak Tech Plasticchem Pvt. Ltd.,<br>Plot no. W- 226, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 12. | Deccan Colors & Chemicals Pvt. Ltd.<br>Plot no. W-232, M.I.D.C. Phase II, Manpada Road,<br>Dombivali (East) Kalyan |
| 13. | Saptavarna Colorants Pvt. Ltd.<br>Plot no. W-130, Sonarpada, manpada Road, MIDC phase 2,<br>Dombivali, |
| 14. | Cosmos Engineering, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 15. | Kaushal Chemical, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |
| 16. | Metro godown, Mhatre copmpound, PHASE - II<br>MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane |

5. Due to the high intensity of the said chemical accident, many houses and industrial establishments in the surrounding area have been damaged and lives have been lost. As per the report of the Revenue department, Kalyan Dombivli Municipal Corporation and Revenue Department had jointly conducted a panchnama of the incident site and a total of 980 properties of residents and commercial properties in the surrounding area. Out of 980 properties, 643 residential properties were minorly affected, and 337 commercial properties were also affected (298 commercial properties were minorly affected, 39 commercial properties were fully affected).

6. **Observations at the affected M/s. Amudan Chemicals Pvt. Ltd., :**

**After the incidence following situation was found during the enquiry;**

i. The factory shed, the compound wall, factory building structure having 1 floor with MS platform was completely collapsed due to explosion.

ii. A crater size of around 15 feet diameter & about 7 feet deep is formed due to explosion in the factory.

iii. Due to explosion shock waves, the adjacent factories building, structures, roofs etc. collapsed, Glass window panels & door panels/shutters, etc, of the residential and commercial buildings in the surrounding area got damaged.

iv. The GLR (3 KL) was totally shattered into pieces and the SS reactor (3KL) too was shattered into pieces. The MS platform along with the structure was thrown away from the actual location.

v. The Di Methyl Phalate (DMP) tank exploded and was found ruptured. The MEK tank was thrown away at a distance of 12.8 meters from the actual location.

vi. The SS reactor, which was not in use, located at a distance of 7 meters from the GLR, was thrown away at a distance of 70 meters, and the SS blender was thrown away at a distance of 100 meters from the actual location.

vii. After explosion, the raw material finished product being combustible and flammable caught fire. This fire spread into the adjacent factories,

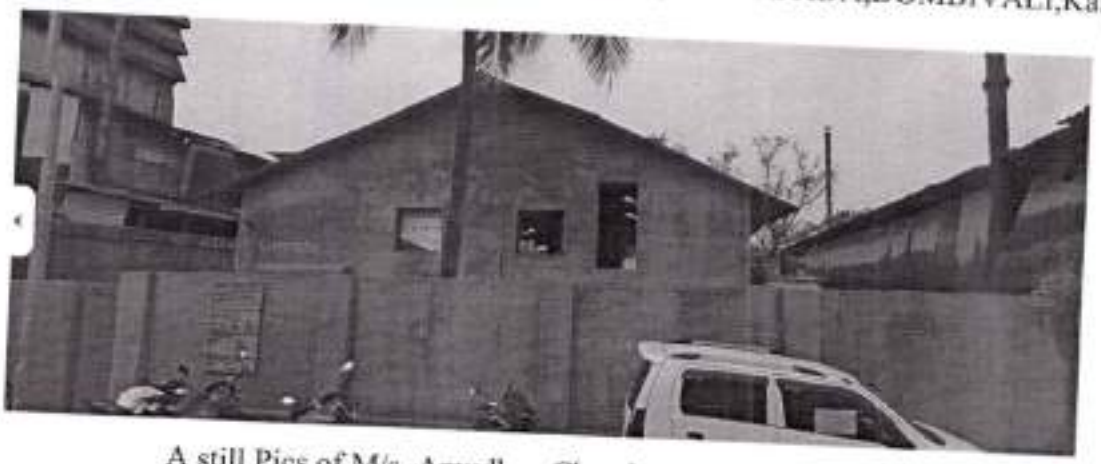
a) Saptavarna Colorants Pvt. Ltd.
Plot no. W-130, Sonarpada, manpada Road, MIDC phase 2, Dombivali,

b) Cosmos Engineering, PHASE - II MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane

c) Kaushal Chemical, PHASE - II MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane

d) K.G Chemicals, PHASE - II MIDC,SONARPADA,DOMBIVALI,Kalyan, Thane

e) Metro Company Godown, PHASE - MIDC,SONARPADA,DOMBIVALI,Kalyan



A still Pics of M/s. Amudhan Chemicals, Before explosion

The devasted factory after explosion and fire

A crater formed due to the explosion of the reactor at the original position of the reactor

Rupture of 20 KL DMP tank

The dislocation MEK Tank from the original position

7. Visited the factory again on 25/05/2024 and 29/05/2024 to carry out further enquiry of incidence. The following activities were carried out during the visit.

i. I obtained the sketch of the actual layout, and machine layout showing the position of the storage tanks, SS reactor, glass line reactor, blender, chilling plant, office on the first floor, storage of raw material, and finished goods. (Annexure-1)

ii. I have collected information about the latest plan approved by my office, which shows that the Plans were revised vide letter no. DISH/PLN/DBD/147/2009/137 dtd. 22/05/2007. The approved plan shows that mixing vessels, reactor vessel, nutch filter, receiver, condenser, flask, baby boiler, oil expansion tank, vacuum pump etc. were installed in the premises. (Annexure- 2)

iii. I have obtained a report of examination of pressure vessel – SS reactor of 3 KL (Eq no. SSR-02 ID NO. PVO2,MOC-SS, installed in 2023), GLR reactor no. 3 KL (Eq no. GLR-01 ID NO. PV03,MOC-MS/GLR installed in 2023), Blending vessel 1.5 KL (Eq no. BV-

01 ID NO. PV04,MOC-SS, installed in 2005), SS reactor KL (Eq no. SSR-01 ID NO. PV01,MOC-SS), in form no-13 obtained from competent person Mr.Dhananjay Jadhav on dated 23/09/2023. The hydarulic examination, ultrasonic test was carried out on 23/09/2023, and it was observed that ultrasonic tests revealed that

| Sr. no | | Shell thickness | Dish thickness |
|---|---|---|---|
| 1 | SS reactor no. 2 | 4.2 mm 4.11 mm | 4.22 mm, 4.30 mm |
| 2 | GLR reactor | 16.02 mm 16.13 mm | 18.22 mm, 18.30 mm |

iv. Risk Assessment& job safety analysis, HAZOP study, Safety Audit was carried out in Dec 2020 by Mr.Dhananjay Jadhav of M/s. Dtech Engineering.

v. I have recorded the statement of Mr. Ganesh Ashok Musale, Supervisor of M/s. Amudan Chemicals Pvt Ltd., Dombivli.

**8. <u>From the above enquiries and the recorded statement it is revealed as follows:-</u>**

a) The factory manufactures various organic peroxides such as Methyl Ethyl Ketone Peroxide (MEKP), Di Tertiary Butyl Peroxide( DTBP), Tertiary Butyl Hydro Peroxide (TBHP).

b) On 23/05/2024, in the factory there was the following raw materials and finished goods were stored in the factory.

| Sr. No. | Name of Chemicals | Mode of storage | Total quantity stored | remarks |
|---|---|---|---|---|
| 1. | Methyl Ethyl Ketone (MEK) | SS tank of 20 KL capacity | 10 MT | Raw Material |
| 2. | Di Methyl Phalate (DMP | SS tank of 20 KL capacity | 20 MT | Raw Material |
| 3. | Hydrogen Per Oxide (H2O2) | 40 Drums | 7 to 8 MT | Raw Material |
| 4. | DEG | 40 Drums | 9.5 MT | Raw Material |
| 5. | TBA | 40 Drums | 6.6. MT | Raw Material |
| 6. | Benzoyl Chloride | 8 Drums | 2 MT | Raw Material |
| 7. | Sulphuric Acid | 14 cans (63 kg each), | 882 Kg | Raw Material |
| 8. | Methanol | 6 Drums | 930 Kg | Raw Material |
| 9. | Di Tertiary Butyl Peroxide( DTBP) | Plastic Cans | 700 Kg | Finished Goods |

| | | | | |
|---|---|---|---|---|
| 10. | TBPB- | Plastic Cans | approx. 30 Kg | Finished Goods |
| 11. | MEKP FG 50 | Plastic Cans | 3 MT | Finished Goods |
| 12. | MEKP FG 40- | Plastic Cans | 1.5 MT | Finished Goods |
| 13. | MEKP LG- 1.5 | Plastic Cans | 1.5 MT | Finished Goods |
| 14. | Cobalt | | around 1.5 MT | Finished Goods |

c) The following equipment were installed and used in manufacturing activity on the ground floor in the shed.

| Sr. No. | Name of equipment | Equipment ID | Installed on |
|---|---|---|---|
| 1. | SS reactor of 3 KL | Eq no. SSR-02 ID NO. PVO2,MOC-SS | 2023 |
| 2. | GLR reactor no. 3 KL | Eq no. GLR-01 ID NO. PV03,MOC-MS/GLR | 2023 |
| 3. | Blending vessel 1.5 KL | Eq no. BV-01 ID NO. PV04,MOC-SS, | 2005 |
| 4. | SS reactor 1 KL | Eq no. SSR-01 ID NO. PV01,MOC-SS | 2005 |
| 5. | Vacuum pump and ejector (7HP & 5 HP) | - | |
| 6. | Chilling Plant | 42 TR | 2023 |
| 7. | Cooling tower | -- | -- |

Also, in front of the main gate inside the factory, there was an office on the first floor; next to the office was a store.

d) The Factory is registered under Section 85 of the Factories Act, 1948 The factory is engaged in manufacturing activity in relation to Chemical Industries – Electrochemicals ( Peroxides) industries listed under Sr. 17 of the First Schedule of the Factories Act, 1948.Hence the factory is carrying out Hazardous process as defined under section 2(cb) of the Factories Act, 1948.

e) The factory license bearing no. 10018373 is found renewed till the year 2025. As per the application for renewal of licence in form No: - 01, it is revealed that Mr. Kirti Gokuldas Mehta, Director is the Occupier of the factory. But, as per letter dtd. 29/05/2024 by Mr Kirti Mehta it was reported that, he had resigned from the position of Director of M/s.

Amudan Chemicals Pvt. Ltd., and the same was accepted by Mr. Malay Mehta. Also, as per the Register of Companies, Mumbai, it is revealed that Mr Malay Pradeep Mehta and Mrs Sneha Malay Mehta are the Directors of the M/s. Amudan Chemicals Pvt. Ltd.. Hence, Mr. Malay Pradeep Mehta and Mrs. Sneha Malay Mehta are the occupiers as per Section 2 (n)(ii) of the Factories Act, 1948

f) It is found from the office records that the occupier had not drawn an on-site emergency plan and detailed disaster control measures for his factory.

g) On the day of incident 23/05/2024, at 1:30 PM, there was the manufacturing of TBHP in Glass Line reactor (3 KL) and the manufacturing of TBPB in the SS reactor (3 KL)

h) On the day of the incident, 23/05/2024, the following workers were working in the factory incidental to the TBHP manufacturing process.

| Sr. No. | Name Of Worker | Nature of work |
|---|---|---|
| 1) | Mr. Ravi Rajbhar | Operator |
| 2) | Mr. Satyanarayan Rajbhar | Operator |
| 3) | Mr. Sirajuddin Ahmed | Helper |
| 4) | Mr. Bharat Jaiswar | Helper |
| 5) | Mr. Manoj Chavan | Helper |
| 6) | Mr. Manish Kumar Das | Helper |

i) The manufacturing process of Tertiary Butyl hydrogen peroxide (TBHP) is a highly exothermic reaction. Exothermic reaction means the release of Heat during the reaction

j) It was revealed from the recorded statement of Mr. Ganesh Musale, that workers were not fully aware of the risks involved in H2O2 and its reaction with sulphuric acid and TBA. Also, the workers, as stated above, had no formal education in the chemistry of reactions and handling of hazardous substances nor had qualifications and experience in handling hazardous substances and were not competent to supervise such handling within the factory.

k) On the day of incidence there was no facility for control addition of sulphuric acid through an addition vessel /glass flask. sulphuric acid was directly charged into the reactor from the sulphuric acid carboys through vacuum charging.

l) A safety relief valve was provided on the SS reactor (3 KL), but the rupture disc was not provided. In the Case of GLR (3 KL), neither a safety relief valve nor a rupture disc was provided on it.

m) On the reactor system, there was no provision for an alarm and interlock such as a Utility failure alarm, agitator failure alarm, High-temperature alarm, or Alarm for a High rate of addition of limiting reactant, which is added at a controlled rate. Also, there was no control system installed in which the Raw material (limiting reactant) addition rate is controlled by the flow control loop. The controlling parameter is reactor temperature. Also, the flow control valve or on-off valve (interlocked with the reaction mass temperature and agitator tripping) was not installed on the reactor.

n) As per the manufacturing process and process flow submitted vide renewal application form no. 100030712015 dtd. 11/09/2020 it was revealed that, the manufacturing process flow is as follows:

Take sulphuric acid in the glass vessel cool it upto 6-10 $^{0}$ C, start addition of TBA over stir for 15-20 deg. Celsius. Start addition of Hydrogen peroxide, and maintain temperature 15 to 30 $^{0}$ C, Stir for 8 hrs. Stop stirring and separate out TBHP as per batch taken.

But on 23/05/2024, it was revealed that, the manufacturing process flow is as follows:

Take Hydrogen peroxide in the reactor cool it upto 17-18 $^{0}$ C, Start addition of sulphuric acid, and maintain temperature 25 to 30 $^{0}$ C, then add TBA into the reactor maintaining the temperature below 25$^{0}$ C Stir for 8-12 hrs. Stop stirring and separate out TBHP as per batch taken.

o) Hydrogen peroxide is a strong oxidant with explosive risk. An increase in the temperature promotes the decomposition as well as a higher pH Value, for optimum stability, the pH range of hydrogen peroxide below 4.5. Above pH 5.0 decomposition increases sharply, for the commercial solution generally pH adjusts under 5.0.The Decomposition will produce a vast amount of gas which increase the pressure of the system, release very high heat. The impurities trigger the decomposition of hydrogen peroxide at low temperatures.

p) Hydrogen peroxide with sulfuric acid to produce peroxy mono sulfuric acid (Piranha solution), Even small amounts of organics could make the piranha solution unstable

q) S, Tert- Butyl Hydro peroxide bearing CAS no75-91-2 is having Flash point 43 $^{0}$C , flammability limit 5%-100%, Auto Ignition 238$^{0}$C, Boiling point 96$^{0}$ C. SADT > 60$^{0}$ C.

r) As per MSDS, Tert- Butyl Peroxybenzoate (TBPB) is a organic peroxide bearing CAS no. 614-45-9 is having Flash point > 93 $^{0}$C , SADT > 60$^{0}$ C. The TBPB batch was in SS reactor (3 KL) adjacent to the GLR reactor.

s) As per MSDS, Solvent MEK is highly flammable liquid, having boiling point 78$^{0}$ C, flash point is -7 $^{0}$C.

t) As per MSDS, Dimethyl phthalate (DMP) is combustible liquid, having boiling point $282^0$ C, flash point is $146^0$ C, auto ignition temperature is $470^0$ C. It forms explosive mixtures with air on intense heating. A range from approx. 15 Kelvin below flash point is rated as critical.

u) As per MSDS, Tert- Butanol bearing CAS no. 75-65-0 is having flash point $11^0$ C, auto ignition temperature is $490^0$ C, Boiling point is $83^0$ C. It is flammable, containers may explode when heated, vapours may form explosive mixtures with air.

v) One chilling plant and one cooling tower were installed in the factory. Temperature was controlled via jacket cooling.

7) **Details of the TBHP Manufacturing Process-**

a. TBHP reaction was carried out in GLR reactor 3 KL (Eq no. GLR-01 ID NO. PV03,MOC-MS/GLR installed in 2023).

b. The brief of reactants added in GLR is $H_2O_2$ (1200 kg) + $H_2SO_4$ (300 Kg) + TBA (1260 Kg).

c. First, H2O2 is added in GLR and chilled up to 17 to $18^0$ C. This addition was done on previous night i.e. on 22/05/2024.

d. On the 23/05/2024, Mr. Ravi Rajbhar, Operator, Mr. Satyanarayan Rajbhar, Operator, Mr. Sirajuddin Ahmed, Helper, Mr. Bharat Jaiswar, Helper, Mr. Manoj Chavan, Helper, Mr. Manish Kumar Das, Helper were present.

e. $H_2SO_4$ is added GLR maintaining the temperature below 25 to $30^0$ C. @ 9 am on 23/05/2024, the addition of 180 Kg of $H_2SO_4$ is completed. After 2 -2 ½ hours, another addition of the remaining 210 Kg of $H_2SO_4$ was made into the GLR (charging of 1 can of 63 Kg takes around 8-10 mins. ) maintaining the temperature below 25 to $30^0$ C. After that TBA addition is started in the reactor maintaining the temperature below $25^0$ C (approximately 100 kg to 150 kg per addition)

f. After completion of the addition of TBA, the reactor is maintained in stirring condition for 10 to 12 hrs.

g. After that it is transferred to the mixing process in the blender and neutralise with Magnesium Carbonate and adjust PH.

h. After Active Oxygen testing, add methanol as per requirement.

**i. It is note that, at one batch around 1500 Kg of TBHP is obtained.**

The manufacturing process flow chart of TBHP is shown in **Figure below**

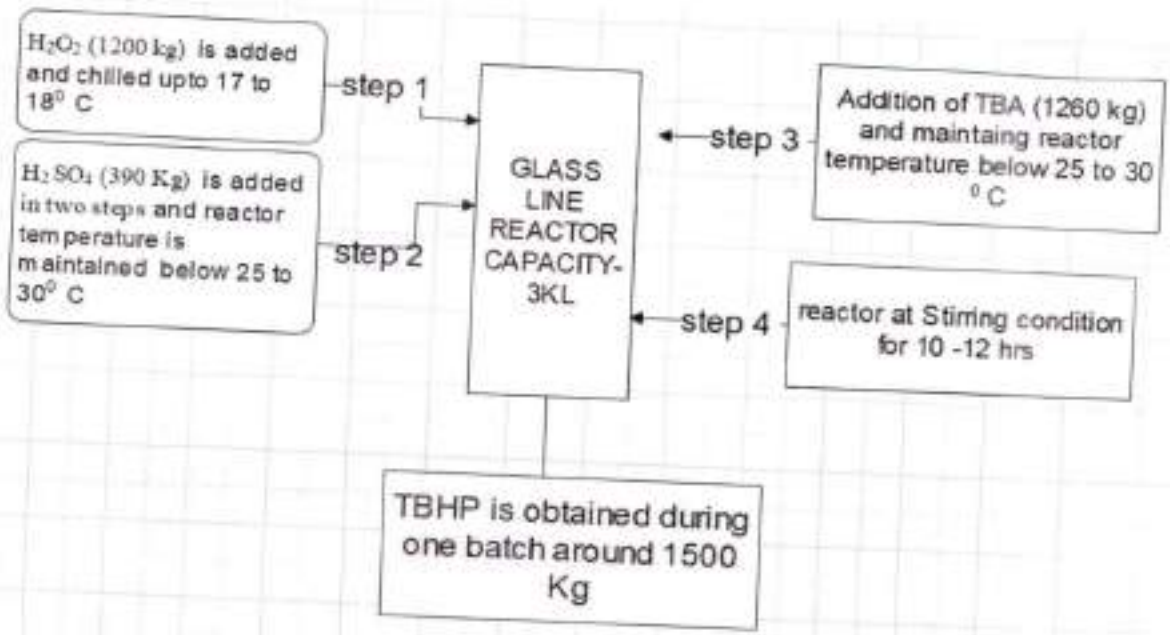



**Figure - Manufacturing Process Flow Chart for TBHP**

8) **Details of the TBPB Manufacturing Process-**

a. TBPB rection was carried out in SS reactor 3 KL (Eq no. SSR-02 ID NO. PVO2,MOC-SS, installed in 2023),

b. The brief of reactants added in SSR is TBHP - N (450 kg) + Caustic Soda Solution + Benzoyl Chloride.

c. Caustic Soda Solution (approx. 200 Kg) as per testing of TBHP -N added in SS reactor and maintain temperature below 20° C.

d. Addition of Benzoyl Chloride. Stir, maintaining the temperature 20-25° C.

e. The reactor is maintained in stirring condition for 9-12 hours. After completion of the reaction separate water from the product by layer separation.

f. Material is transferred in the blender and then add magnesium sulphate for removing water content, After removing the water collect the filtrate via filter in 30 Kg Nutch filter

9) **Occurrence of explosion and fire in the factory:**

On 23/05/2024, The synthesis of Tertiary Butyl hydro peroxide (TBHP) was carried out in GLR (3 KL), and in the SS reactor (3 KL), the settling of TBPB was carried out.

i. On 22/05/2024, at night in GLR (3KL), $H_2O_2$ (1200 kg) is charged and the temperature of the reactor was brought to around 17° C. Also, in the SS reactor(3 KL) there was making of TBPB, and at night, there was the activity of the stirring of TBPB in SS reactor (3 KL),

ii. On 23/05/2024 @ 09 am Mr. Ravi Rajbhar, operator, had cooled the reactor around $17^0$ C and charging of $H_2SO_4$ of around 180 KG was charged from the $H_2SO_4$ can with help of vacuum pump. The charging of 1 can (63 Kg) of $H_2SO_4$ takes around 15 minutes. Total 180 KG was charged from the 3 $H_2SO_4$ Cans taking around 40 to 45 minutes. Then, when the vacuum was released, there was an increase in temperature, and the temperature was maintained below 25 $^0$ C, and the stirring was carried out for around 2 to 2 1/2 hours.

iii. Thus, the charging of the remaining 210 KG H2SO4 from the H2SO4 cans (3& ½ cans) was carried out at 11:15 am, and the charging was finished @ 12:30 pm.

iv. At 12:30 PM there was a lunch break till 1:00 PM. After lunch break TBA of around 100-150 Kg was charged into the reactor, soon after the charging was over by releasing vacuum, the temperature was increased rapidly leading to exothermic reaction @ 60 to 70 $^0$ C and to control runaway reaction cooling arrangement was insufficient. As the temperature increased, also inside the reactor pressure increased beyond bursting pressure of 95 Kg/cm$^2$, leading to the bursting of GLR (3KL).

v. Due to the explosion of the reactor and the shock waves and tremendous heat, the adjacent SS reactor (3KL) containing TBPB also exploded due to the decomposition reaction of TBPB exceeding the SADT temperature of more than $60^0$ C.

vi. Also, the MS tank containing DMP also exploded, leading to the rupture of the tank due to forming explosive mixtures with air on intense heating and the MEK tank was thrown away at a distance of 7 meters from the original position.

vii. Due to the presence of combustible liquid, and flammable liquids at the premises, the fire started in the factory and spread rapidly to the adjacent factories. After the explosion followed by fire the workers of the adjacent factory informed the Fire brigade about the incident. The Fire brigade from Dombivili MIDC @ 1:50 PM reached the spot and started extinguishing the fire. Also, after some time other Fire brigade from Kalyan Dombivli Municipal Corporation, Navi Mumbai Municipal Corporation, Ulhasnagar Municipal Corporation, Ambernath Municipal Council and NDRF Battalion No. 5 and TDRF had conducted rescue operations. On 25.05.2024 at 3.42 pm the said rescue operation was stopped.

viii. The injured workers were immediately taken to AIMS Hospital, ICON Hospital, and Shastri Hospital KDMC and other hospitals in Dombivli east in after a rescue operation was launched. Out of 68 workers. One worker Mr. Jay Sarkar of M/s. Cosmos Engineering

succumbed to the burn injury on 29/05/2024 while treatment at the National Burn Centre, Airoli. A total of 13 workers died, and 67 persons were injured in this incident.

**10) Observation of samplings Raw materials, finished goods of TBA,Hydrogen peroxide and hydrogen peroxide for simulation of accident scenario.**

1. On 28/10/2022, I have collected samples from the thrown away reactor and the crater formed at the site. Also as per reactions carried out in GLR on the date of incidence, reaction mass of containing same raw materials and finished product was sent to the laboratory for examination to M/S GVS Cibatech, Bhandup for DSC analysis on 03/06/24. the result of the same was received at my office on 15/06/2024 **(Annexure -3).**
2. As per thumb rule calculation and ASME , the brust pressure of the reactor is calculated as below:

Burst pressure =2 eSt/D-0.8t

=2 x 0.85x 75000.x 0.75/70.86- 0.8x0.75

=1361PSI

=95 Kg/cm2

e= welding efficiency

S= Tensile Strength

t= thickness of vessel

D= outside diameter of vessel

Even though we are getting, Burst pressure 95 Kg/cm$^2$. Considering vessel condition like life, welding joints, nozzle joints, dish end etc the vessel will burst at pressure exceeding 70 Kg/ cm2..

**Conclusions from the results of collected samples, chemical analysis :**

From the result of DSC test report from M/S. GVS Sebatech, Bhandup it is concluded that, there is violent / exothermic / runway reaction of the carried out GLR up to temperature of 70 deg. cel. Thus, violent/runway/ exothermic reaction at this temperature occurred, leading to an increase in pressure inside the reactor beyond 80 Kg/cm$^2$. Heat generation rate and cooling capacity in the reactor are needed to assess the possibility of a runaway. Also, the additional cooling system was not in place to remove the heat generated during the runaway reaction. There was no controlled addition of sulphuric acid, and the sulphuric acid was charged into the reactor directly from the carboy through vacuum charging.

On the reactor system there was no alarm and interlock such as Utility failure alarm, agitator failure alarm, High temperature alarm, Alarm for High rate of addition of

limiting reactant which is added at controlled rate, Raw material (limiting reactant) addition rate should be controlled by flow control loop and FCV and/or On-Off valve interlocked with the reaction mass temperature and agitator tripping system was not available or installed on the reactor. Hence this accident has occurred

**11) Contraventions:-**

**I) <u>The contraventions of Provisions of Section 7 A- (2) (a) of the Factories Act 1948:-</u>**

On 23/05/2024, The synthesis of Tertiary Butyl hydrogen peroxide (TBHP) was carried out in GLR (3 KL), and in the SS reactor (3 KL), the settling of TBPB was carried out. On 22/05/2024, at night in GLR (3KL), $H_2O_2$ (1200 kg) is charged and the temperature of the reactor was brought to around $17^0$ C. Also, in the SS reactor(3 KL) there was making of TBPB, and at night, there was the activity of the stirring of TBPB in SS reactor (3 KL), On 23/05/2024 @ 09 am Mr. Ravi Rajbhar, operator, had cooled the reactor around $17^0$ C and charging of $H_2SO_4$ of around 180 KG was charged from the $H_2SO_4$ can with help of vacuum pump. The charging of 1 can (63 Kg) of $H_2SO_4$ takes around 15 minutes. Total 180 KG was charged from the 3 $H_2SO_4$ Cans taking around 40 to 45 minutes. Then, when the vacuum was released, there was an increase in temperature, and the temperature was maintained below 25 $^0$C, and the stirring was carried out for around 2 to 2 1/2 hours. Thus, the charging of the remaining 210 KG H2SO4 from the H2SO4 cans (3& ½ cans) was carried out at 11:15 am, and the charging was finished @ 12:30 pm. At 12:30 PM there was a lunch break till 1:00 PM. After lunch break TBA of around 100-150 Kg was charged into the reactor, soon after the charging was over by releasing vacuum, the temperature was increased rapidly leading to exothermic reaction @ 60 to 70 $^0$C and to control runaway reaction cooling arrangement was insufficient. As the temperature increased, also inside the reactor pressure increased beyond 80 Kg/cm$^2$. The inside pressure due to the reaction would have increased beyond 80 Kg/cm$^2$ leading to the bursting of GLR (3KL).

On the 23/05/2024, safety relief valve was provided on the SS reactor (3 KL), but the rupture disc was not provided. In the Case of GLR (3 KL), neither a safety relief valve nor a rupture disc was provided on it. Also, on the reactor system there was no provision of alarm and interlock such as Utility failure alarm, agitator failure alarm, High temperature alarm, Alarm for High rate of addition of limiting reactant which is added at controlled rate, Raw material (limiting reactant) addition rate should be controlled by flow control loop. The controlling parameter is reactor temperature. And FCV and/or On-Off valve should be interlocked with the reaction mass temperature and agitator tripping.

The aforementioned causes contributed to this incident, so it was essential to make the following work system to ensure worker safety and the absence of any health risks. However, in this instance, the occupier failed to ensure safety of the workers and there was risk to their health while they were at work:

a. There was no facility for control addition of sulphuric acid through an addition vessel /glass flask. sulphuric acid was directly charged into the reactor from the sulphuric acid carboys through vacuum charging.

b. By providing alarm and interlock such as Utility failure alarm, agitator failure alarm, High temperature alarm, Alarm for High rate of addition of limiting reactant which is added at controlled rate, Raw material (limiting reactant) addition rate should be controlled by flow control loop.

c. The controlling parameter being the reactor temperature. And FCV and/or On-Off valve should be interlocked with the reaction mass temperature and agitator tripping.

Thus, the occupier had failed to maintain the in safe working order as well as the system without risking the workers' health.

**Hence Occupier of the factory have been contravened Provisions of section 7 A- (2) (a) of the Factories Act 1948 on the day of incidence.**

II) **The contraventions of Provisions of Section 7 (1) (b) of the Factories Act, 1948** It is reported that Mr Malay Pradeep Mehta and Mrs Sneha Malay Mehta are the Directors of the M/s. Amudan Chemicals Pvt. Ltd... As per Section 7 (1) of the Factories Act, 1948, Whenever Occupier begins to occupy any premises as factory, he shall send a written notice in form no. 1 as stated in Rule 14 of the Maharashtra Factories Rules 1963 at least 15 days before begins to occupy any premises as factory. The Occupier has not sent a written notice in form no. 1 containing the name and address of the Occupier; **hence, the provision of Section 7 (1) (b) of the Factories Act, 1948 is contravened.**

III) **The contraventions of Provisions of Section 41-B (4) of the Factories Act, 1948**

The factory is engaged in manufacturing activity in relation to Chemical Industries – Electrochemicals ( Peroxides) industries listed under Sr. 17 of the First Schedule of the Factories Act, 1948.Hence the factory is carrying out Hazardous process as defined under section 2(cb) of the Factories Act, 1948.

It is revealed from the office records that the occupier had not drawn an on-site emergency plan and detailed disaster control measures for his factory. Thus, the occupier had not drawn an on-site emergency plan and detailed disaster control measures for the factory. **Hence the**

**Occupier had contravened the provisions of Section 41-B (4) of the Factories Act, 1948.**

**IV) The contraventions of Provisions of Section 41-C (b) of the Factories Act, 1948**

The factory is engaged in manufacturing activity in relation to Chemical Industries – Electrochemicals ( Peroxides) industries listed under Sr. 17 of the First Schedule of the Factories Act, 1948.Hence the factory is carrying out Hazardous process as defined under section 2(cb) of the Factories Act, 1948.

It was revealed that workers were not fully aware of the risks involved in H2O2 and its reaction with sulphuric acid and TBA. Also, the workers, as stated above, had no formal education in the chemistry of reactions and handling of hazardous substances nor had qualifications and experience in handling hazardous substances and were not competent to supervise such handling within the factory. Thus, the occupier of a factory involving Hazardous process as stated above, had not appointed persons who possess qualification & experience in handling hazardous substances and are competent for such handling. **Hence the Occupier had contravened the provisions of Section 41-C (b) of the Factories Act, 1948.**

**V) The contraventions of Provisions of Rule 4(2) of Maharashtra Factories Rules 1963**

At the time of my visit it is found that, the plans of the were revised vide letter no. DISH/PLN/DBD/147/2009/137 dtd. 22/05/2007. The approved plan shows that mixing vessels, reactor vessel, nutch filter, receiver, condenser, flask, baby boiler, oil expansion tank, vacuum pump etc. were installed in the premises., The present factory machinery layout are not in conformity with the approved plans, it is seen that, On the ground floor, SS reactor of 3 KL (Eq no. SSR-02 ID NO. PVO2,MOC-SS, installed in 2023), GLR reactor no. 3 KL (Eq no. GLR-01 ID NO. PV03,MOC-MS/GLR installed in 2023) and SS tank of 20 KL capacity used for the storage of Methyl Ethyl Ketone (MEK), SS tank of 20 KL capacity used for the storage of Di Methyl Phalate (DMP) was installed in factory. Thus machinery layout are not in conformity with the earlier approved plans. **Therefore the Occupier has contravened the Provisions of Rule 4(2) of Maharashtra Factories Rules 1963.**

**VI) The contraventions of Provisions of Rule 4(1) (d) of Maharashtra Factories Rules 1963** As per the manufacturing process and process flow submitted vide renewal application form no. 100030712015 dtd. 11/09/2020 it was revealed that, the manufacturing process flow is as follows:

Take sulphuric acid in the glass vessel cool it upto 6-10 0 C, start addition of TBA over stir for 15-20 deg. Celsius. Start addition of Hydrogen peroxide, and maintain temperature 15 to 30 0 C, Stir for 8 hrs. Stop stirring and separate out TBHP as per batch taken.But on 23/05/2024, it was revealed that, the manufacturing process flow is as follows:

Take Hydrogen peroxide in the reactor cool it upto 17-18 0 C, Start addition of sulphuric acid, and maintain temperature 25 to 30 0 C, then add TBA into the reactor maintaining the temperature below 250 C Stir for 8-12 hrs. Stop stirring and separate out TBHP as per batch taken.

Thus, there is change in manufacturing process of TBHP, But the occupier was using the premises as factory without getting plan approval from Jt. Director DISH, Kalyan regarding changes total or partial in manufacturing process. **Therefore, the Occupier has contravened the Provisions of Rule 4(1) (d) of Maharashtra Factories Rules 1963**

**VII) The contraventions of Provisions of 73-N(1) of Maharashtra Factories Rules ,1963**

The factory is engaged in manufacturing activity in relation to Chemical Industries – Electrochemicals ( Peroxides) industries listed under Sr. 17 of the First Schedule of the Factories Act, 1948.Hence the factory is carrying out Hazardous process as defined under section 2(cb) of the Factories Act, 1948.

As per rule 73-N(1) of Maharashtra Factories Rules ,1963 , The occupier of a factory carrying on a 'Hazardous process' ought to be compiled and made known to workers individually through supply of booklets or leaflets the following information in relation to handlings of hazardous materials like methanol,IPA etc. Or any hazardous substances in the manufacture, transportation, storage and other processes of making TBHP,TBBP, MEKP:

a) Information of Hazardous processes carried on in the factory.

b) Location and availability of all materials Safety Data Sheets as per Rule 73-M.

c) Material safety data sheets of raw materials and finished products and intermediates handled in manufacturing process at plant.

d) Physical and health hazards arising out of the exposure to or handling of substance.

e) Measures to be taken by the workers to ensure safe handling, storage and transportation of hazardous substance.

f) Personnel protective equipments required to be used by workers employed in hazardous process or dangerous operation.

g) Sign and symptoms likely to be manifested on exposure to hazardous substances and to whom to report.

h) Measures to be taken by the workers in case of any spillage or leakage of hazardous substance.

But during enquiry it is found that the workers working on manufacturing process of synthesis of TBHP, TBBP, MEKP were not provided with information in relation to handling of hazardous materials like Hydrogen peroxide TBA, Sulphuric Acid, thus occupier of has contravened the provisions of the Rule 73-N(1) of Maharashtra Factories Rules,1963.

**VIII) <u>The contraventions of Provisions of Rule 3 (b) of MaharashtraFactories (Safety Audit) Rules, 2014</u>**

The factory is engaged in manufacturing activity in relation to Chemical Industries – Electrochemicals ( Peroxides) industries listed under Sr. 17 of the First Schedule of the Factories Act, 1948.Hence the factory is carrying out Hazardous process as defined under section 2(cb) of the Factories Act, 1948.

A safety Audit was carried out in Dec 2020 by Safety Auditor Mr Dhananjay Jadhav. In Dec 2022,Safety Audit was not carried out by the occupier of the factory. As per Rule 3 (b) of MaharashtraFactories (Safety Audit) Rules, 2014, The occupier of the factory shall arrange to carry out the safety audit externally, once in two years by the Safety Auditor as a measure for securing the safety of persons employed . But the Occupier had not arranged to carry out a Safety Audit externally once in two years by safety auditor **<u>Therefore, the Occupier has the Provisions of Rule 3 (b) of MaharashtraFactories (Safety Audit) Rules, 2014</u>**

**IX)<u>The contraventions of Provisions of Rule 115 (2) of Maharashtra Factories Rules, 1963</u>**

There was an explosion and fire on 23/05/2024 at 1:30 pm in the factory leading to the accident of 10 workers. I came to know about accident through telephonic message from the MARG member from Dombivali, @ 2:00 PM The notice of an accident should have been confirmed by the manager by sending a written report in form No. 24 within 12 hours of taking place of this accident as per provision of Rule 115 (2) of Maharashtra Factories Rules 1963. However, the written report in form No. 24 has not been submitted till date.

Thus the Manager had not submitted written report in form No. 24 within the prescribed time limit 12 hours, **the provisions of Rule 115 (2) of Maharashtra Factories Rules, 1963 have been contravened by the Manager of the factory.**

**12) Remedial Measures:**

To avoid the reoccurrence of such incidence in future following remedial measures are suggested:-

i. The facility for control addition of sulphuric acid through an addition vessel /glass flask. Shall be made

ii. On the reactor system provision of alarm and interlock such as Utility failure alarm, agitator failure alarm, High temperature alarm, Alarm for High rate of addition of limiting reactant which is added at controlled rate shall be provided.

iii. Flow Control Valve and/or On-Off valve for raw material shall be installed such that raw material (limiting reactant) addition rate should be controlled by flow control loop. The controlling parameter is reactor temperature. And FCV and/or On-Off valve should be interlocked with the reaction mass temperature and agitator tripping.

iv. A HAZOP study for the entire process shall be carried out by specialized expert and recommendations thereof shall be complied with.

v. Workers and the operator shall be trained well-designed Training Program for operators & working staff regarding handling of hazardous chemicals & hazards associated with it, and the same shall be periodically refreshed with the latest information available within the scope.

**13) Payment of Compensation and Ex-gratia:**

The occupier is directed to -

1. Pay legal due compensation to heirs of diseased under intimation to this office.
2. Pay substantial sum of rupees as ex-gratia payment to heirs of diseased under intimation to this office.
3. Adequate Medical treatment shall be extended to the injured. Health progress of injured shall be reported periodically to this Directorate. Injured worker shall be paid their wages during medical leave.

**14) Show Cause Notice :**

The occupier may explain & show causes if any within 7 days that why legal action shall not be considered against him for the above said contraventions.

( S. G. Bhele.)
Deputy Director,
Industrial Safety and Health,
Kalyan

DETAILS OF DECEASED PERSONS PERMANENT STAFF AND WORKERS OF AMUDAN CHEMICALS PVT LTD

| Sr No | NAME | AGE | SALARY/MONTH | ESIC COVERED INS NO. |
|---|---|---|---|---|
| 1 | SATYANARAYAN RAJBHAR | 48 | 14820 | 3517457791 |
| 2 | RAVI RAJBHAR | 45 | 14820 | 3517457747 |
| 3 | DHAVAL WAGHANI | 38 | 55000 | NOT REGISTERED |
| 4 | RIDDHI A KHANVILKAR | 38 | 16000 | 3417421616 |
| 5 | ROHINI C KADAM | 26 | 18000 | 3417421857 |

DETAILS OF DECEASED PERSONS ON CONTRACT BASIS THROUGH CONTRACTOR OF AMUDAN CHEMICALS PVT LTD

| Sr No | NAME | AGE | CONTRACTOR NAME | ESIC COVERED INS NO. |
|---|---|---|---|---|
| 1 | MANOJ JONDHALE | 54 | DISHA ENTERPRISES | 3417344667 |
| 2 | SIRAJUDDIN AHMED | 24 | SAHARA MULTI SERVICES | 3416976471 |
| 3 | BHARAT JAISWAR | 43 | SAHARA MULTI SERVICES | 3416091051 |
| 4 | MANOJ CHAVAN | 35 | POONAM ENTERPRISES | 3415848558 |
| 5 | MANISH KUMAR DAS | 22 | POONAM ENTERPRISES | 3416802910 |

Annexure-V



# उपविभागीय अधिकारी तथा उपविभागीय दंडाधिकारी
# कल्याण उपविभाग कल्याण यांचे कार्यालय

क्र.केडी/टे-३/नै.आ./अमुदान कंपनी/७८५/२०२४

दि.२१/०६/२०२४

प्रति,
प्रादेशिक अधिकारी,
महाराष्ट्र प्रदुषण नियंत्रण मंडळ,
सिध्दीविनायक संकूल, तिसरा माळा
स्टेशन रोड, कल्याण(प)-४२१३०१,
ता.कल्याण, जि.ठाणे

प्राप्तीक कार्यालय
म.प्र.नि. मंडळ, कल्याण.
आवक क्र. 2360
दिनांक : 25/06/24

विषय : मौजे सोनारपाडा येथील अमुदान केमीकल कंपनी मध्ये झालेल्या स्फोटाबाबत...

संदर्भ : १) NGT Western Zone bench,Pune order dated 24.05.2024

२) Minutes Of Joint Committee Visit to Amudan Chemicals Pvt.Ltd.Dombivali

३) तहसिलदार कल्याण यांचेकडील पत्र क्र. जा.क्र./महसूल/नै.आ/टे-४/कावि-३६/२०२४, दि. १४/०६/२०२४

उपरोक्त संदर्भिय विषयाचे अनुषंगाने सादर करणेत येते की, कल्याण तालुक्यातील मौजे सोनारपाडा, डोंबिवली पूर्व, M.I.D.C, Phase II मधील प्लॉट नं.W २२९ ,अमुदान केमिकल्स प्रा.लिमिटेड या कंपनीत दि. २३/०५/२०२४ रोजी दुपारी १.४० वाजता रिॲक्टर केमीकल स्फोट झाल्याने कंपनीमधील अनेक कर्मचारी मयत / जखमी झाले आहेत.

सदरहू घटनेत एकूण ६८ लोक जखमी झाले आहेत. त्यांचा तपशिल खालीलप्रमाणे आहे.

| Sr. No. | Patient Name | Age | Gender | Hospital Name | No. of Patients | Ward Name | Company Name |
|---|---|---|---|---|---|---|---|
| 1. | Ankush Kumbhar | 52 | Male | AIMS HOSPITAl | | P93 | Omega |
| 2. | Janki Nair | 47 | Female | AIMS HOSPITAl | | P93 | Shrinivas Chemical |
| 3. | Ravindra Kumar Ram | 32 | Male | AIMS HOSPITAl | | P93 | Cosmos Company |
| 4. | Akhilesh Mehta | 36 | Male | AIMS HOSPITAl | | P93 | Cosmos Company |
| 5. | Sonu Kumar | 21 | Male | AIMS HOSPITAl | | P93 | Cosmos Company |

SROKT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. | Shirish Talele | 62 | Male | AIMS HOSPITAl | 31 | P93 | Cosmos Company |
| 7. | Shivram Thavale | 43 | Male | AIMS HOSPITAl | | P93 | Dexan Company |
| 8. | Shivam Tiwari | 20 | Male | AIMS HOSPITAl | | P93 | - |
| 9. | Manoj Kumar | - | Male | AIMS HOSPITAl | | ICU 1 | - |
| 10. | IndrapalBhardvaj | 34 | Male | AIMS HOSPITAl | | ICU 1 | - |
| 11. | Reena Kanojia | 27 | Female | AIMS HOSPITAl | | ICU 1 | - |
| 12. | Rahul Pote | 33 | Male | AIMS HOSPITAl | | ICU 2 | - |
| 13. | Sudarshan Mehta | 35 | Male | AIMS HOSPITAl | | ICU 2 | - |
| 14. | Manisha Pokharkar | 46 | Female | AIMS HOSPITAl | | ICU 2 | - |
| 15. | Prince Gupta | 27 | Male | AIMS HOSPITAl | | Ward | |
| 16. | Sanjay Kumar Mahto | 24 | Male | AIMS HOSPITAl | | Ward | Peemco Company |
| 17. | Sagar Dohale | 28 | Male | AIMS HOSPITAl | | Ward | Chaware Industry |
| 18. | Kishor Sawant | 51 | Male | AIMS HOSPITAl | | Ward | Mahal Printing Press |
| 19. | Ravi Kumar | 21 | Male | AIMS HOSPITAl | | Ward | Shakti Enterprises |
| 20. | Tejal Gavit | 23 | Female | AIMS HOSPITAl | | Ward | Model Industry |
| 21. | Vikas Mehta | 35 | Male | AIMS HOSPITAl | | Ward | Shakti Enterprises |
| 22. | Sujata Kanojia | 34 | Male | AIMS HOSPITAl | | Ward | Deccan Color |
| 23. | Sagar Das | 30 | Male | AIMS HOSPITAl | | Ward | Cosmos Company |
| 24. | Ram Chauhan | 70 | Male | AIMS HOSPITAl | | Ward | Raj Sons Industry |
| 25. | Vasudev Yadav | 48 | Male | AIMS HOSPITAl | | ICU 3 | - |
| 26. | Kamlesh Mehta | - | Male | AIMS HOSPITAl | | Casualty | Techo Fiber |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27. | Prachi Ghadi | 44 | Female | AIMS HOSPITAl | | Casualty | - |
| 28. | Rajan Gothankar | 56 | Male | AIMS HOSPITAl | | - | - |
| 29. | Rajendra Mishra | 55 | Male | AIMS HOSPITAl | | - | - |
| 30. | Geema Bharti | 42 | Female | AIMS HOSPITAl | | - | - |
| 31. | Vasudev Yadav | 48 | Male | AIMS HOSPITAl | | - | - |
| 32. | Ravindra Chormare | - | Male | Mamta Hospital | | - | - |
| 33. | Prakash Kambli | - | Male | Mamta Hospital | | - | - |
| 34. | Mansi patil | | Male | Mamta Hospital | 7 | - | - |
| 35. | Ujwal Mankar | | Male | Mamta Hospital | | - | - |
| 36. | Yellappa | | Male | Mamta Hospital | | - | - |
| 37. | Anil Bind | | Male | Mamta Hospital | | - | - |
| 38. | Ramesh Kumar | | Male | Mamta Hospital | | - | - |
| 39. | Pratik Waghmare | | Male | Neptune Hospital | | ICU | |
| 40. | Rajan Ghotankar | 56 | Male | Neptune Hospital | | - | - |
| 41. | Rudyansh Dalvi | 5 | Male | Neptune Hospital | | - | - |
| 42. | Pravin Chavan | 41 | Male | Neptune Hospital | 9 | - | - |
| 43. | Madhura Kulkarni | 37 | Female | Neptune Hospital | | - | - |
| 44. | Hemangi Chouk | 56 | Female | Neptune Hospital | | - | - |
| 45. | Kishor Vichapure | 54 | Male | Neptune Hospital | | ICU | - |
| 46. | Akshat Patil | 24 | Male | Neptune Hospital | | | |
| 47. | Baban Devkar | 45 | Male | Neptune Hospital | | | |
| 48. | Rajendra Mishra | 57 | Male | Aurindam | 5 | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Hospital | | | |
| 49. | Smita Dharve | | Female | Aurindam Hospital | | - | - |
| 50. | Prasad Dhawale | | Male | Aurindam Hospital | | - | - |
| 51. | Bhumi Yadav | 25 | Female | Aurindam Hospital | | - | - |
| 52. | Lalita Mehta | 36 | Female | Aurindam Hospital | | - | - |
| 53. | Reema Vijay Bharti | 38 | Female | Gajanan Hospital | | - | - |
| 54. | Ashwini umesh Bhalerao | 29 | Female | Gajanan Hospital | 3 | - | - |
| 55. | Vinodkumar Anarrlal Das | 63 | Male | Gajanan Hospital | | - | - |
| 56. | Deepak Singh | 22 | Male | Shastri Nagar | | - | - |
| 57. | Rahul Gaikwad | 36 | Male | Shastri Nagar | | - | - |
| 58. | Ehsan Khan | 34 | Male | Shastri Nagar | 3 | - | - |
| 59. | Pratik Waghmare | 35 | Male | Icon Hospital | | - | - |
| 60. | Ramesh Shukla | 45 | Male | Icon Hospital | | - | - |
| 61. | RamsuratPaswani | 52 | Male | Icon Hospital | | - | - |
| 62. | Dinesh Vishwakarma | 30 | Male | Icon Hospital | 4 | - | - |
| 63. | Suresh kothari | 47 | Male | Shivam Hospital | | ICU | - |
| 64. | Jay Sarkar | 27 | Male | Shivam Hospital | 5 | ICU | - |
| 65. | Shailesh Prajapati | 34 | Male | Shivam Hospital | | OPD | - |
| 66. | Ranvijay Mishra | 40 | Male | Shivam Hospital | | Ward | - |
| 67. | Raghunath Shigwan | 37 | Male | Shivam Hospital | | OPD | - |
| 68. | Uttara Nikulse | - | Female | Ashirwad Hospital | 1 | - | - |
| Total | | | | | 68 | | |

तसेच मे.अमुदान केमीकल्स मध्ये झालेल्या स्फोट घटनेच्या अनुषंगाने पोलीस विभागामार्फत जवळच्या एकूण ३६ औदयोगिक आस्थापनांची पडताळणी करण्यात आली असुन खालील आस्थापनांमधील कामगार बेपत्ता आहेत.

१. अमुदान केमिकल्स - १०

वरीलपैकी १० मृतदेहांची ओळख पटविण्यात आलेली आहे.

२. सप्तपर्ण केमिकल्स - १

सदर मृतदेहाची ओळख पटविण्यात आली आहे.

३. कॉसमॉस केमिकल्स - २

वरीलपैकी २ मृतदेहाची ओळख पटविण्यात आली आहे.

वर नमुद केलेप्रमाणे १३ कामगारांची ओळख पटविण्यात आली आहे.

वरिष्ट पोलीस निरीक्षक, गुन्हे शाखा, घटक ४, उल्हासनगर यांनी दिनांक १०.०६.२०२४ रोजी या कार्यालयास अहवाल सादर केलेनुसार, ओळख पटलेल्या मयत व्यक्तींचा तपशिल खालीलप्रमाणे

१. रोहिणी चंद्रकांत कदम - २६ वर्षे, रा.रुम नं.२०९,पांडुरंग अपा.,मातोश्री शाळा,आजदेगाव, डोंबिवली(पूर्व)

२. रिध्दी अमित खानविलकर - ३८ वर्षे, रा.रु.नं.१,नव मारुती सोसायटी,रामचंद्र नगर,डोंबिवली(पूर्व)

३. भरतलाल गोरखनाथ जयस्वाल - ४० वर्षे, रु.नं.२,निर्मलनगर, संदीप पाटील कॉम्प्लेक्स, दावडी, डोंबिवली (पूर्व)

४. मनिष कुमार दिलीप दास - २२ वर्षे,रा.रु.नं.१०३, समर्थ बिल्डींग, नमस्कार ढाबा, आडिवली ढोकळी, कल्याण(पूर्व)

५. राकेश वर्मादिन रजपूत - ४५ वर्षे, रा.वैष्णवी कृपा चाळ,रु.नं.५,सोनारपाडा,डोंबिवली(पूर्व)

६. विशाल सुनिल पौडवाल - ३९ वर्षे, रा.नारायण पॅलेस,रु.नं.१०२,राऊत चाळ जवळ,गॅरेज रोड,बदलापूर(प.)

७. जय सरकार - कॉसमॉस कंपनीमधील कामगार

८. रवी अंबिकाप्रसाद राजभार - २७ वर्षे, रा.रमेश म्हात्रे चाळ,शंकरनगर,सोनारपाडा,डोंबिवली(पूर्व)

९. मनोज अंबिकाप्रसाद जौंधळे - ४५ वर्षे, रा.विठ्ठल कृपासोसायटी,१०१,शंकरनगर,सोनारपाडा,डोंबिवली(पूर्व)

१०. मनोजसोती चौहान - ३५ वर्षे, रा.ओमश्री गुरुलिला,रु.नं.३०२,सोनारपाडा,डोंबिवली (पूर्व)

११. सत्यनारायण विश्वनाथ राजभर - ४० वर्षे, रा.जाईबाई चाळ,मुकेश पाटील यांचे बंगल्याचे मागे,सोनारपाडा,डोंबिवली

१२. सिराजउद्दीन वाहीद अहमद सलमानी - २२ वर्षे, बासगाव, तहसिल मेहनगर, पोलीस ठाणे तर्मा, जि.आजमगढ, उत्तरप्रदेश

१३. धवल जगदीश वाघानी - ३८ वर्षे,रा.२००४,फाल्कन बिल्डींग,एस.एव्हियाना सोसायटी,कासारवडवली,ठाणे

सदरच्या रासयनिक अपघाताची तीव्रता जास्त असल्याने आसपासच्या परिसरातील अनेक घरांचे तसेच औद्योगिक आस्थापनांचे नुकसान झालेले असून जिवीत व वित्तहानी झालेली आहे. त्याअनुषंगाने महसुल विभाग व कल्याण डोंबिवली महानगरपालिका यांनी संयुक्तरित्या घटनास्थळाचे तसेच त्याबाजूच्या परिसरातील रहिवासी व वाणिज्य एकुण ९८३ मालमत्ताचे पंचनामे करण्यात आलेले आहेत. त्यांचा तपशील खालीलप्रमाणे आहे.

| अ.क्र. | मालमत्तेचा प्रकार | एकूण मालमत्तेचे नुकसान | मालमत्तेचे नुकसान अंशत: | मालमत्तेचे नुकसान पूर्णत: | रक्कम |
|---|---|---|---|---|---|
| १. | रहिवासी मालमत्ता | ६४३ | ६४३ | ० | १६६३०१००/- |
| २. | वाणिज्य मालमत्ता | ३३७ | २९८ | ३९ | १२२४४३३१८/- |
| एकूण | | ९८० | ९४१ | ३९ | १३९०७३४१८/- |

तसेच मे.अमुदान केमीकल्स प्रा.लि लगतच्या एकूण १५ औद्योगिक आस्थापनांचे प्रत्यक्ष जागेवर पंचनामे करण्यात आलेले आहेत. त्यांचा तपशिल खालिलप्रमाणे आहे.

| अ.क्र. | कंपनीचे नाव | नुकसान रक्कम |
|---|---|---|
| १. | बी ४८ वाघाजाई इंटरप्राईजेस व विजकेम इंटरप्राईजेस | १३३००००/- |
| २. | NEOORGA CHEM LLP | ३६०००/- |
| ३. | ओमेगा फाईनकेमीकल्स प्रा.लि.W १३० | ३२५००००/- |
| ४. | ओमेगा फाईनकेमीकल्स प्रा.लि.A ८८ | ४१०००००/- |
| ५. | मेहताकॉर्पोरेशन | १५५००००/- |
| ६. | ऑटोकारकलर अॅन्डकोटिंग्स प्रा.लि. | ५०००००/- |
| ७. | पल्लवी इंटरप्रायझेस प्रा.लि | १५२००००/- |
| ८. | SDA INDUSTRIES W २२७ | १८२५०००/- |
| ९. | BRISK CHEMICAL INDUSTRIES | ३०५०००/- |
| १०. | MODERN INDUSTRIAL GASS PVT LTD | १४०००००/- |
| ११. | विघ्नहर्ता केमीकल्स प्रा.लि. | १७०००००/- |
| १२. | VINYLTEK PLASTICHEM PVT LTD | १४००००/- |
| १३. | सप्तवर्ण कलर प्रा.लि. | १०३००००/- |
| १४. | कॉसमॉस इंजिनिअरींगकंपनी | २१८८७०००/- |
| १५. | डेक्कन कलर केमीकल प्रा.लि. | ४४८००००/- |
| | एकूण | २२१८२२०००/- |

प्रस्तुत प्रकरणी दिनांक २३/०५/२०२४ रोजीच्या रिॲक्टर केमीकल स्फोटच्या घटनेत मोठ्या प्रमाणावर जिवीत व वित्तहानी झालेली असल्याने, सदरचा अहवाल आपले मार्फत मा. राष्ट्रीय हरित न्यायाधिकरण यांचेकडे पाठविणेत यावा.

(विश्वास गुजर)
उपविभागीय अधिकारी कल्याण
उपविभाग कल्याण

Annexure VI



# MAHARASHTRA POLLUTION CONTROL BOARD

## REGIONAL OFFICE-KALYAN

Tel. No. (0251) 2310167/2310212
Fax No. (0251) 2310192
Visit us on: http://mpcb.gov.in
E-mail: rokalyan@mpcb.gov.in

"Your Service is our Duty"

Siddhivinayak Sankul,
3rd Floor, Near Oak Baug,
Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 750 /24

Date:- 23 / 05 /2024

To,
M/s. Amudaan Chemicals Pvt Ltd
Plot No. W-229, MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
2) Fire Incidence taken place in your unit on dtd 23.05.2024.
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

**AND WHEREAS,** it is obligatory on your part to obtain Conditional Combined Consent and Authorization to operate your industrial plant to discharge sewage and trade effluent in water pollution prevention area subject to certain terms and conditions more precisely under the provisions of 25/26 of the Water (P&CP) Act, 1974 and section 21 of the Air (P&CP) Act, 1981 and the Ha Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016. AND WHEREAS, it was also obligatory on your part to provide adequate and efficient pollution control devices and take adequate measures to control air & water pollution from all sources so as to achieve the standards prescribed in the Environment (Protection) Act, 1986.

**AND WHEREAS,** fire incidence taken place in your Plot No. W-229 at 1.30 pm on dtd.23/05/2024 due to reactor explosion it has been has noticed that near by area is affected as well as caused pollution and about 6-7 fatalities reported.

**AND WHEREAS,** as per consent condition no. 15 you have not reported to MPC Board about this incidence.

**AND WHEREAS,** the burnt raw material and finished products, spilled contaminated soil, sand, debris found lying in company premises and also drums containing chemicals shall be safely disposed off to CHWTSDF as per the provision of environmental enactment.

...2/-

**NOW THEREFORE,** in exercise of powers conferred upon me by the Board u/s. 33A of the Water (P&CP) Act, 1974 and u/s 31A of the Air (P&CP) Act, 1981. I, The Regional Officer, Kalyan hereby directed you to not to start your manufacturing activity till further order from MPC Board and NOC from DISH Authority.

This is issued with the post facto approval from competent authority of the Board.

**(R. A. Rajput)**
**Regional Officer, Kalyan**

**Copy submitted for information to:**

1. Member Secretary, M.P.C. Board, Mumbai.
2. Joint Director (WPC), M.P.C. Board, Mumbai.
3. Law Officer M.P.C. Board, Mumbai.

**Copy to:**

Sub-Regional Officer, M.P.C. Board, Kalyan-I- It is directed to serve the directions to above industry and submit compliance time to time.

# MAHARASHTRA POLLUTION CONTROL BOARD

## REGIONAL OFFICE-KALYAN

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Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 757/24

Date:- 23 / 05 /2024

To,
M/s. Deccan Colour and Chemical Pvt. Ltd.
Plot No. W- 232, MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -**
1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024.
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

**AND WHEREAS,** it is obligatory on your part to obtain Conditional Combined Consent and Authorization to operate your industrial plant to discharge sewage and trade effluent in water pollution prevention area subject to certain terms and conditions more precisely under the provisions of 25/26 of the Water (P&CP) Act, 1974 and section 21 of the Air (P&CP) Act, 1981 and the Ha Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016. AND WHEREAS, it was also obligatory on your part to provide adequate and efficient pollution control devices and take adequate measures to control air & water pollution from all sources so as to achieve the standards prescribed in the Environment (Protection) Act, 1986.

**AND WHEREAS,** fire incidence taken place in M/s Amudaan Chemicals Pvt Ltd. Plot No. W-229 at 1.30 pm on dtd.23/05/2024 the industry located near to your unit and due to which the machineries and the building structure of your unit is found damaged.

**AND WHEREAS,** the burnt raw material and finished products, spilled contaminated soil, sand, debris noticed in your company premises and drums containing chemicals shall be safely disposed off to CHWTSDF as per the provision of environmental enactment.

...2/-

**NOW THEREFORE,** in exercise of powers conferred upon me by the Board u/s. 33A of the Water (P&CP) Act, 1974 and u/s 31A of the Air (P&CP) Act, 1981. I The Regional Officer, Kalyan hereby directed you to voluntary safely closed down your manufacturing activity as precautionary measures and safety purpose in order avoid further mishap.

**AND WHEREAS**, you shall not start manufacturing activity till further order from MPC Board and NOC from DISH Authority.

This is issued with the post facto approval from competent authority of the Board.

**(R. A. Rajput)**
**Regional Officer, Kalyan**

**Copy submitted for information to:**
1. Member Secretary, M.P.C. Board, Mumbai.
2. Joint Director (WPC), M.P.C. Board, Mumbai.
3. Law Officer M.P.C. Board, Mumbai.

**Copy to:**
Sub-Regional Officer, M.P.C. Board, Kalyan-I- It is directed to serve the directions to above industr and submit compliance time to time.

# MAHARASHTRA POLLUTION CONTROL BOARD

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3rd Floor, Near Oak Baug,
Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 756 /24 Date:- 23 / 05 /2024

To,
M/s. MEHTA PAINTS INDUSTRIES
Plot No. W- 227, MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024.
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

**AND WHEREAS,** it is obligatory on your part to obtain Conditional Combined Consent and Authorization to operate your industrial plant to discharge sewage and trade effluent in water pollution prevention area subject to certain terms and conditions more precisely under the provisions of 25/26 of the Water (P&CP) Act, 1974 and section 21 of the Air (P&CP) Act, 1981 and the Ha Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016. AND WHEREAS, it was also obligatory on your part to provide adequate and efficient pollution control devices and take adequate measures to control air & water pollution from all sources so as to achieve the standards prescribed in the Environment (Protection) Act, 1986.

**AND WHEREAS,** fire incidence taken place in M/s Amudaan Chemicals Pvt Ltd. Plot No. W-229 at 1.30 pm on dtd.23/05/2024 the industry located near to your unit and due to which the machineries and the building structure of your unit is found damaged.

**AND WHEREAS,** the burnt raw material and finished products, spilled contaminated soil, sand, debris noticed in your company premises and drums containing chemicals shall be safely disposed off to CHWTSDF as per the provision of environmental enactment.

...2/-

**NOW THEREFORE,** in exercise of powers conferred upon me by the Board u/s. 33A of Water (P&CP) Act, 1974 and u/s 31A of the Air (P&CP) Act, 1981. I The Regional Officer, Kal hereby directed you to voluntary safely closed down your manufacturing activity as precaution measures and safety purpose in order avoid further mishap.

**AND WHEREAS**, you shall not start manufacturing activity till further order from MI Board and NOC from DISH Authority.

This is issued with the post facto approval from competent authority of the Board.

**(R. A. Rajput)**
**Regional Officer, Kalyan**

**Copy submitted for information to:**

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3. Law Officer M.P.C. Board, Mumbai.

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# MAHARASHTRA POLLUTION CONTROL BOARD

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Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 749/24

Date:- 23 / 05 /2024

To,
M/s. OMEGA FINE CHEMICALS
Plot No. W-231/D,, MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -**
1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

**AND WHEREAS,** it is obligatory on your part to obtain Conditional Combined Consent and Authorization to operate your industrial plant to discharge sewage and trade effluent in water pollution prevention area subject to certain terms and conditions more precisely under the provisions of 25/26 of the Water (P&CP) Act, 1974 and section 21 of the Air (P&CP) Act, 1981 and the Ha Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016. AND WHEREAS, it was also obligatory on your part to provide adequate and efficient pollution control devices and take adequate measures to control air & water pollution from all sources so as to achieve the standards prescribed in the Environment (Protection) Act, 1986.

**AND WHEREAS,** fire incidence taken place in M/s Amudaan Chemicals Pvt Ltd. Plot No. W-229 at 1.30 pm on dtd.23/05/2024 the industry located near to your unit and due to which the machineries and the building structure of your unit is found damaged.

**AND WHEREAS,** the burnt raw material and finished products, spilled contaminated soil, sand, debris noticed in your company premises and drums containing chemicals shall be safely disposed off to CHWTSDF as per the provision of environmental enactment.

...2/-

**NOW THEREFORE,** in exercise of powers conferred upon me by the Board u/s. 33A of the Water (P&CP) Act, 1974 and u/s 31A of the Air (P&CP) Act, 1981, I The Regional Officer, Kalyan hereby directed you to voluntary safely closed down your manufacturing activity as precautionary measures and safety purpose in order avoid further mishap.

**AND WHEREAS**, your shall not start manufacturing activity till further order from MPC Board and NOC from DISH Authority.

This is issued with the post facto approval from competent authority of the Board.

(R. A. Rajput)
**Regional Officer, Kalyan**

**Copy submitted for information to:**

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No.: MPCB/ROK/ 751/24

Date:- 23 / 05 /2024

To,
M/s. OMEGA FINE CHEMICALS
Plot No. W-130,, MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

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**AND WHEREAS,** fire incidence taken place in M/s Amudaan Chemicals Pvt Ltd. Plot No. W-229 at 1.30 pm on dtd.23/05/2024 the industry located near to your unit and due to which the machineries and the building structure of your unit is found damaged.

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3rd Floor, Near Oak Baug,
Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 753/24 Date:- 23 / 05 /2024

To,
M/s. Saptavarna Colourants Private Limited
Plot No. W-230 MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

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**AND WHEREAS,** fire incidence taken place in M/s Amudaan Chemicals Pvt Ltd. Plot No. W-229 at 1.30 pm on dtd.23/05/2024 the industry located near to your unit and due to which the machineries and the building structure of your unit is found damaged.

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**(R. A. Rajput)**
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**Copy submitted for information to:**
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**Copy to:**
Sub-Regional Officer, M.P.C. Board, Kalyan-I- It is directed to serve the directions to above industry and submit compliance time to time.

# MAHARASHTRA POLLUTION CONTROL BOARD

## REGIONAL OFFICE-KALYAN

Tel. No. (0251) 2310167/2310212
Fax No. (0251) 2310192
Visit us on: http://mpcb.gov.in
E-mail: rokalyan@mpcb.gov.in

"Your Service is our Duty"

Siddhivinayak Sankul,
3rd Floor, Near Oak Baug,
Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 7541 24 Date:- 23 / 05 /2024

To,
M/s. SEAGULL CHEMICALS PVT LTD
Plot No. W-127 MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

**WHEREAS,** you are operating the industry in the pollution prevention area declared under the Provisions of the Water (P&CP) Act, 1974 and the Air (P&CP) Act, 1981 and the Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016.

**AND WHEREAS,** it is obligatory on your part to obtain Conditional Combined Consent and Authorization to operate your industrial plant to discharge sewage and trade effluent in water pollution prevention area subject to certain terms and conditions more precisely under the provisions of 25/26 of the Water (P&CP) Act, 1974 and section 21 of the Air (P&CP) Act, 1981 and the Ha Hazardous & Other Wastes (Management & Transboundary Movement) Rules, 2016. AND WHEREAS, it was also obligatory on your part to provide adequate and efficient pollution control devices and take adequate measures to control air & water pollution from all sources so as to achieve the standards prescribed in the Environment (Protection) Act, 1986.

**AND WHEREAS,** fire incidence taken place in M/s Amudaan Chemicals Pvt Ltd. Plot No. W-229 at 1.30 pm on dtd.23/05/2024 the industry located near to your unit and due to which the machineries and the building structure of your unit is found damaged.

**AND WHEREAS,** the burnt raw material and finished products, spilled contaminated soil, sand, debris noticed in your company premises and drums containing chemicals shall be safely disposed off to CHWTSDF as per the provision of environmental enactment.

...2/-

**NOW THEREFORE,** in exercise of powers conferred upon me by the Board u/s. 33A of the Water (P&CP) Act, 1974 and u/s 31A of the Air (P&CP) Act, 1981. I The Regional Officer, Kalyan hereby directed you to voluntary safely closed down your manufacturing activity as precautionary measures and safety purpose in order avoid further mishap.

**AND WHEREAS**, you shall not start manufacturing activity till further order from MPC Board and NOC from DISH Authority.

This is issued with the post facto approval from competent authority of the Board.

**(R. A. Rajput)**
**Regional Officer, Kalyan**

**Copy submitted for information to:**
1. Member Secretary, M.P.C. Board, Mumbai.
2. Joint Director (WPC), M.P.C. Board, Mumbai.
3. Law Officer M.P.C. Board, Mumbai.

**Copy to:**
Sub-Regional Officer, M.P.C. Board, Kalyan-I- It is directed to serve the directions to above industry and submit compliance time to time.

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Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 752/24 Date:- 23 / 05 /2024

To,
M/s. SOHAN DYECHEM PVT LTD
Plot No. W-124, W-131 , W-124 MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
2) Fire Incidence occurred in M/s Amudan Chemicals Pvt Ltd on dtd.23.5.2024
3) Visit of Board Official on 23/05/2024.
4) Legal action proposal received from SRO Kalyan-1.

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**(R. A. Rajput)**
**Regional Officer, Kalyan**

**Copy submitted for information to:**

1. Member Secretary, M.P.C. Board, Mumbai.
2. Joint Director (WPC), M.P.C. Board, Mumbai.
3. Law Officer M.P.C. Board, Mumbai.

**Copy to:**

Sub-Regional Officer, M.P.C. Board, Kalyan-I- It is directed to serve the directions to above industry and submit compliance time to time.

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3rd Floor, Near Oak Baug,
Station Road,
Kalyan (West) – 421 301.

No.: MPCB/ROK/ 755/24

Date:- 23 / 05 /2024

To,
M/s. Supra Chemicals.
Plot No. W-129, MIDC Phase-II,
Dombivali, Dist. Thane

**Sub:-** Closure Directions u/s 33A of the Water (P&CP) Act, 1974 and u/s 31 A of the Air (P&CP) Act, 1981.

**Ref: -** 1) Consent granted by MPC Board
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**Regional Officer, Kalyan**

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**Copy to:**

Sub-Regional Officer, M.P.C. Board, Kalyan-I- It is directed to serve the directions to above industry and submit compliance time to time.

Annexure – VII



## Regional Office, Kalyan

| Sr. No. | Name and Address of the industry | Closure Direction Issued on |
|---|---|---|
| 1 | M/s Amudan Chemicals Pvt. Ltd.<br>Plot No. W-229, MANPADA RD, PH - II, MIDC Dombivali, Dist. Thane | 23.5.2024 |
| 2 | Peroxy chem (INDIA)<br>PRERANA BUNGLOW, V P ROAD, Dombivli,Thane, Tal. Kalyan, Dist. Thane | 28.5.2024 |
| 3 | Astec LifeSciences Limited<br>F-39, MIDC, Phase-II, Sonarpada, Dombivli (East), Tal. KALYAN, Dist. Thane | 28.5.2024 |
| 4 | SURFCHEM ORANICS PVT LTD<br>W-148, M.I.D.C. Phase II, Dombivli (E.), Tal. KALYAN, Dist. Thane | 28.5.2024 |
| 5 | Altra Pharma Chem p.Ltd.<br>W-31, Sonarpada, MIDC, Phase-II, Dombivali | 28.5.2024 |
| 6 | Sunbeam Monochem Pvt. Ltd.<br>A-72, MIDC, Phase- I, Dombivali, Kalyan, Dist- Thane. | 29.5.2024 |
| 7 | Pliogrip Resins and Chemicals Pvt. Ltd.<br>W-78 MIDC Phase-II, Dombivali | 29.5.2024 |
| 8 | Hindustan Monomers (Unit No.II) Pvt. Ltd.<br>Plot no. D-7/4, MIDC Phase-I, Dombivali. | 29.5.2024 |
| 9 | Western Chemical Industries<br>B-31 , MIDC Phase-I, Dombivali | 29.5.2024 |
| 10 | Aarti Industries Limited<br>Plot No D-55, 56,57, 59 & 60, MIDC, Phase-II Dombivali | 29.5.2024 |
| 11 | MOORE DYE-CHEM PVT.LTD.,<br>W-165, , M.I.D.C., PH-II,DOMBIVLI - 421 204. | 30.5.2024 |
| 12 | AKSHAY CHEMICALS<br>D-33, MIDC, PHASE II, SAGAON, DOMBIVLI EAST-421203, Tal. KALYAN, Dist. Thane | 30.5.2024 |
| 13 | CHEMORG,<br>W 122 , PHASE II DOMBIVLI | 30.5.2024 |
| 14 | Neelam Ayurchem India Pvt. Ltd.<br>Plot No. A-43, MIDC Phase-I, Dombivali | 30.5.2024 |
| 15 | DREAMLAND DYES PVT LTD<br>Plot No. W-133, MIDC Phase-II, Dombivali (E) | 30.5.2024 |
| 16 | S.A.I. Products.<br>W-54, Phase II, MIDC Area, Dombivli(E), Tal. Kalyan, Dist. Thane | 03-06-2024 |
| 17 | Jaishil Sulphur and Chemical Industries,<br>Plot No.B-11/2, M.I.D.C., Phase-I, Dombivli (East), Dist.-Thane | 03-06-2024 |
| 18 | ZEN CHEMICALS PVT LTD<br>PLOT NO. D-5, M.I.D.C., PHASE - II, OPP PIMPALESHWAR MANDIR, DOMBIVLI (E), Tal. KALYAN, Dist. Thane | 03-06-2024 |
| 19 | Furia Chemicals,<br>Plot No. A/35, MIDC, Ph-II, Dombivali (E) | 03-06-2024 |
| 20 | Chemstar,<br>TS-5, Sagoan, MIDC , Dombivli(E), Tal. KALYAN, Dist. Thane | 03-06-2024 |
| 21 | SAMUH CHEMICALS<br>W-101, PHASE-II, MIDC, DOMBIVALI | 03-06-2024 |
| 22 | Nirmal Chemicals<br>A-73, PHASE I, MIDC, DOMBIVLI, 421203, Tal. DOMBIVLI, Dist. Thane | 03-06-2024 |
| 23 | M/s. Neoloba Specialty Pvt. Ltd.<br>Plot No.A-19,A-19(Part) & C-10/1, MIDC,Phase-I, Dombivli (East),Dist.Thane | 03-06-2024 |

| | | |
|---|---|---|
| 24 | VCM Polyurethanes Pvt. Ltd.<br>W- 134 , MIDC, Phase - II, Dombivali, Thane, Tal. Kalyan, Dist. Thane | 03-06-2024 |
| 25 | M/S SUYOJIT CHEMICALS WORKS PVT LTD,<br>A-25, MIDC, Phase-1, Dombivli-E, Tal. Kalyan, Dist. Thane | 03-06-2024 |
| 26 | B R Sons<br>Sagaon, MIDC Phase II | 03-06-2024 |
| 27 | M/s. Ambrosia Chemicals (Formerly Known as Amber Chemicals)<br>W-84, PHASE II, MIDC, DOMBIVLI, 421203, Tal. DOMBIVLI, Dist. Thane | 04-06-2024 |
| 28 | Mr. H.R. Badodkar<br>Plot No. : W-32, M.I.D.C., Phase-II, Sagaon, Dombivli (E), Tal. KALYAN, Dist. Thane | 04-06-2024 |
| 29 | Durvesh Rasayan Pvt Ltd<br>W-60, Phase II, MIDC, Dombivili (E) | 04-06-2024 |
| 30 | Dhanwantary Laboratories Pvt. Ltd.<br>Plot No. W-140, MIDC Dombivali, Tal. Kalyan, Dist, Kalyan. | 04-06-2024 |
| 31 | M/S. Indian Dyestuff & Chemicals Mfg.Co<br>Plot No W-25, MIDC Phase II, Dombivali, Tal: Kalyan, Dist : Thane | 04-06-2024 |
| 32 | HYPOPHOSPHITES AND CO.<br>PLOT NO. A-78, MIDC, PH -I , DOMBIVALI WEST, Tal. KALYAN, Dist. Thane | 04-06-2024 |
| 33 | AUCHTEL PRODUCTS LTD PLOT NO A/85-86 AND C-22 MIDC PHASE I DOMBIVLI (E) DIST THANE | 11-06-2024 |
| 34 | Alu Fin,<br>W-153 , MIDC, Phase II | 13-06-2024 |
| 35 | CRYSTAL INDIA<br>W-114, MIDC, PHASE II, DOMBIVLI(E) | 13-06-2024 |
| 36 | Crystal India<br>W-111 & W-112,MIDC Phase II Manpada Dombivali | 13-06-2024 |
| **Sr. No.** | **Name and Address of the industry** | **Voluntary Closure Direction Issued on** |
| 37 | M/s. OMEGA FINE CHEMICALS,<br>Plot No. W-231/D, MIDC, Phase -II, Sonarpada Village, Dombivali (E), Dist. Thane | 23.5.2024 |
| 38 | M/s. SOHAN DYECHEM PVT LTD<br>Plot No. W-124, W-131 , W-124, MIDC, Phase-II Dombivali | 23.5.2024 |
| 39 | M/s. OMEGA FINE CHEMICALS,<br>UNIT NO 2, PLOT NO W-130, PHASE II, DOMBIVALI ( EAST ) , DIST: THANE | 23.5.2024 |
| 40 | M/s. Deccan Colour and Chemical Pvt. Ltd.<br>Plot No. W-232, MIDC Phase II, Dombivali, Dist Thane | 23.5.2024 |
| 41 | M/s. Saptavarna Colourants Private Limited<br>Plot No. W-230, Phase-II, MIDC, Dombivali, Dist. Thane | 23.5.2024 |
| 42 | M/s. MEHTA PAINTS INDUSTRIES,<br>Plot No. W-227, MIDC Phase-II, Dombvli East, Dist.-Thane | 23.5.2024 |
| 43 | M/s. SEAGULL CHEMICALS PVT LTD<br>Plot No. W-127, MIDC PHASE-II, DOMBIVLI, Dist Thane. | 23.5.2024 |
| 44 | M/s. Supra Chemicals.<br>Plot No. W-129, MIDC, PH-II, Dombivali, Dist. Thane | 23.5.2024 |
| 45 | M/s. UNILAB CHEMICALS & PHARMACEUTICALS PVT. LTD<br>Plot No. : W-32, M.I.D.C., Phase-II, Sagaon, Dombivli (E), Tal. KALYAN, Dist. Thane | 03-06-2024 |

# MAHARASHTRA POLLUTION CONTROL BOARD

Phone : 022-67195031
Email : icclab@mpcb.gov.in
Website : http://mpcb.gov.in

"Your Service is our Duty"

**Central Laboratory**
Central Laboratory, Maharashtra Pollution Control Board, P-3, "Nirmal Bhavan", MIDC Industrial Area, Mahape, Navi Mumbai- 400 710

Repot Outward No.: MPCB/CLab/Ambient/24-25/06/34
Date: 25/06/2024 06:01 PM

## Analysis Report-Air (Ambient)

| Client/Industry/location Name & Address |
|---|
| amudan chemicals pvt ltd<br>R25 Basic chemicals and electro chemicals and its derivatives including manufacturing of acid |

| Sample Details | |
|---|---|
| **Field Sample ID :** | BR-0073178 |
| **Laboratory Sample Code :** | MPCB/CLab/AMB/24-25/142 |
| **Sample Details (Water/Air/HW) :** | Air |
| **Sample Volume Received :** | |
| **Sample Collected By :** | SRO-Kalyan I (Shri. Upendra Kulkarni) (SRO-Kalyan I) |
| **Seal No. :** | 128 |
| **Type of Industry / Location details :** | Red |
| **Sample Collected On :** | May 23 2024 04:00:00:000PM |

| Sr.No | Parameter | Starting Time | Closing Time | Result | Unit | Method of analysis |
|---|---|---|---|---|---|---|
| 1 | PM10 | 23-05-2024 16:00 | 24-05-2024 00:00 | 314 | $\mu g/m^3$ | |
| 2 | PM10 | 24-05-2024 00:00 | 24-05-2024 08:00 | 237 | $\mu g/m^3$ | |
| 3 | PM10 | 24-05-2024 08:00 | 24-05-2024 16:00 | 187 | $\mu g/m^3$ | |
| 4 | SO2 | 23-05-2024 16:00 | 23-05-2024 20:00 | 5 | $\mu g/m^3$ | |
| 5 | SO2 | 23-05-2024 20:00 | 24-05-2024 00:00 | 5 | $\mu g/m^3$ | |
| 6 | SO2 | 24-05-2024 00:00 | 24-05-2024 04:00 | 4 | $\mu g/m^3$ | |
| 7 | SO2 | 24-05-2024 04:00 | 24-05-2024 08:00 | 5 | $\mu g/m^3$ | |
| 8 | SO2 | 24-05-2024 08:00 | 24-05-2024 12:00 | 6 | $\mu g/m^3$ | |
| 9 | SO2 | 24-05-2024 12:00 | 24-05-2024 16:00 | 4 | $\mu g/m^3$ | |
| 10 | NOx | 23-05-2024 16:00 | 23-05-2024 20:00 | 15 | $\mu g/m^3$ | |
| 11 | NOx | 23-05-2024 20:00 | 24-05-2024 00:00 | 14 | $\mu g/m^3$ | |
| 12 | NOx | 24-05-2024 00:00 | 24-05-2024 04:00 | 13 | $\mu g/m^3$ | |
| 13 | NOx | 24-05-2024 04:00 | 24-05-2024 08:00 | 14 | $\mu g/m^3$ | |
| 14 | NOx | 24-05-2024 08:00 | 24-05-2024 12:00 | 13 | $\mu g/m^3$ | |
| 15 | NOx | 24-05-2024 12:00 | 24-05-2024 16:00 | 14 | $\mu g/m^3$ | |

**Report Type:** final

**Report generated on:** 25/06/2024 06:00 PM

**Complied by:** Archana Lendait

**Approved by:** Dr P D Khadkikar

**Reviewed on Date:** 25/06/2024 06:01 PM

**Reviewed by:** Dr P D Khadkikar

**Dr P D Khadkikar**
Senior Scientific Officer,
I/c Central Laboratory,
MPCB, Navi Mumbai.

* Electronic report does not require signature

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Note :
1. The results refer to the samples and parameters requested for analysis.
2. Abbreviations: - BDL=Below Detectable limit, N.D.=Not Detected, N.A.= Not Analyzed
3. The Contents of this Report shall not be reproduced in part or in full without written approval of laboratory.

*** End of the Report ***

# MAHARASHTRA POLLUTION CONTROL BOARD

Tel: 0251-2310212
0251-2310167
Fax: 0251-2310192
Website: http://mpcb.gov.in
Email: rokalyan@mpcb.gov.in

Maharashtra Pollution Control Board, Sidhivinayak Sankul,3rd and 4th Floor, Station Road,Kalyan(West)

RED/S.S.I ()
No:- Format1.0/RO/UAN
No.0000173336/CR/2312002013

Date: 20/12/2023

To,
M/s. Amudan Chemicals Pvt. Ltd.
Plot No. W-229, MIDC PHASE -II, Manpada Road,
Dombivli (East), Dist -Thane

LiFE Lifestyle for Environment
Your Service is Our Duty

**Sub:** **Consent to Operate**

**Ref:** Board has granted Consent to Operate vide Consent No: MPCB/19/464/1908001014 dtd. 31.08.2019.

Your application No.MPCB-CONSENT-0000173336 Dated 10.06.2023

For: grant of Consent to Operate under Section 26 of the Water (Prevention & Control of Pollution) Act, 1974 & under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Rule 6 and Rule 18(7) of the Hazardous & Other Wastes (Management & Transboundary Movement) Rules 2016 is considered and the consent is hereby granted subject to the following terms and conditions and as detailed in the schedule I, II, III & IV annexed to this order:

1. **The consent to renewal is granted for a period up to 31/12/2028**
2. **The capital investment of the project is Rs.0.3757 Crs. (As per C.A Certificate submitted by industry )**
3. **Consent is valid for the manufacture of:**

| Sr No | Product | Maximum Quantity | UOM |
|---|---|---|---|
| Products | | | |
| 1 | Tertiary Buthy Pivolate | 1 | MT/M |
| 2 | Cummene Hydro Peroxide | 1 | MT/M |
| 3 | Benzoyl Peroxide | 1 | MT/M |
| 4 | Tertiary Butyl Octate | 1 | MT/M |
| 5 | Aluminum Isopropoxide | 1 | Ton/M |
| 6 | Di tertiary Butyl Peroxide | 2 | Ton/M |
| 7 | Tertiary Butyl Per Benzoate | 2 | Ton/M |
| 8 | Di Methyl phthalate | 2 | Ton/M |
| 9 | Tertiary Butyl Hydro Peroxide | 1 | Ton/M |
| 10 | Methyl Ethyl Ketone Peroxide | 20 | Ton/M |

4. **Conditions under Water (P&CP), 1974 Act for discharge of effluent:**

| Sr No | Description | Permitted (in CMD) | Standards to | Disposal Path |
|---|---|---|---|---|
| 1. | Trade effluent | 1.2 | As per Schedule-I | CETP |
| 2. | Domestic effluent | 0.4 | As per Schedule-I | Soaked in soak pit |

5. **Conditions under Air (P& CP) Act, 1981 for air emissions:**

| Sr No. | Stack No. | Description of stack / source | Number of Stack | Standards to be achieved |
|---|---|---|---|---|
| 1 | S-1 | Thermopack | 0 | As per Schedule -II |

6. **Non-Hazardous Wastes:**

| Sr No | Type of Waste | Quantity | UoM | Treatment | Disposal |
|---|---|---|---|---|---|
| 1 | N. A. | 0 | --NA-- | N. A. | N. A. |

7. **Conditions under Hazardous & Other Wastes (M & T M) Rules 2016 for Collection, Segregation, Storage, Transportation, Treatment and Disposal of hazardous waste:**

| Sr No | Category No./ Type | Quantity | UoM | Treatment | Disposal |
|---|---|---|---|---|---|
| 1 | 35.3 Chemical sludge from waste water treatment | 50 | Kg/M | Landfill | CHWTSDF |

8. The Board reserves the right to review, amend, suspend, revoke this consent and the same shall be binding on the industry.
9. This consent should not be construed as exemption from obtaining necessary NOC/ permission from any other Government authorities.
10. The industry shall not carry expansion / additional investment / modernization / upgradation / additional construction without prior permission of the Board.
11. Industry shall obtain necessary permission from the Directorate of Industrial Safety & Health (DISH) & Fire Department NOC time to time.
12. The Public Liability Insurance (PLI) Act 1991 referred to PLI Act 1981 provides a mandatory Public Liability Insurance for an owner, industry or Installation handling its liability arising out of accident involving Hazardous Chemicals.
13. Applicant shall obtain permission from Central Ground Water Authority (CGWA) for use of bore-well water for industrial purpose.
14. Applicant shall not carry any activities which require prior environmental clearance as per EIA notification 2006 & as amended thereafter.

15. If CETP does not work for achieving standards and problem of pollution occurs, industry shall voluntarily stop the production or total effluent shall be reused.

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474a077b
262adb05
c7e2171c
0e33c220
714eb719

Signed by: R. A. Rajput
Regional Officer
For and on behalf of
Maharashtra Pollution Control Board
rokalyan3@mpcb.gov.in
2023-12-20 14:26:04 IST

**Received Consent fee of -**

| Sr.No | Amount(Rs.) | Transaction/DR.No. | Date | Transaction Type |
|---|---|---|---|---|
| 1 | 7500.00 | TXN2309001982 | 12/09/2023 | Online Payment |
| 2 | 1500.00 | TXN2311003906 | 28/11/2023 | Online Payment |
| 3 | 10869.86 | TXN2311003907 | 28/11/2023 | Online Payment |

**Copy to:**

1. Sub-Regional Officer, MPCB, Kalyan I
   - They are directed to ensure the compliance of the consent conditions.
2. Chief Accounts Officer, MPCB,Sion, Mumbai

## SCHEDULE-I

**Terms & conditions for compliance of Water Pollution Control:**

1. A] As per your application, you have provided Effluent Treatment Plant (ETP) of designed capacity of 1.50 CMD consisting of Primary (Collection tank, Neutralization tank), Tertiary (Pressure sand filter), Sludge treatment (Sludge drying bed) for the treatment of 1.2 CMD of trade effluent.

   B] The Applicant shall operate the effluent treatment plant (ETP) to treat the trade effluent so as to achieve the following standards prescribed by the Board or under EP Act, 1986 and Rules made there under from time to time, whichever is stringent:

| Sr.No | Parameters | Limiting concentration not to exceed in mg/l, except for pH |
|---|---|---|
| (1) | pH | 6.0 -8.5 |
| (2) | BOD (3 days 27°C) | 30 |
| (3) | COD | 250 |
| (4) | TSS | 100 |
| (5) | Oil & Grease | 10 |
| (6) | ***Benzene | 0.1 |
| (7) | Sulphides as S | 2 |
| (8) | Phenolic Compounds | 1 |
| (9) | Sulphate | 1000 |
| (10) | Chloride | 600 |

   C] The Industry shall ensure connectivity online monitoring system to the MPCB server including separate energy meter for pollution control system.

   D] The treated effluent shall be sent to CETP for further treatment. In no case, effluent shall find its way for gardening / outside factory premises.

2. A] As per your application, you have provided Septic Tank followed by Soak pit for the treatment of 0.4 CMD of sewage.

   B] The Applicant shall operate the sewage treatment system to treat the sewage so as to achieve the following standards.

| Sr.No | Parameters | Standards (mg/l) | |
|---|---|---|---|
| 1 | Suspended Solids | Not to exceed | 100 |
| 2 | BOD 3 days 27°C | Not to exceed | 30 |
| 3 | COD | Not to exceed | 100 |

C] The treated sewage shall be recycled for secondary purposes to the maximum extent and remaining shall be discharged on land for gardening within premise after confirming above standards. In no case, sewage shall find its way for gardening / outside factory premises.

3. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification there of & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or an extension or addition thereto.

4. The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.

5. The Applicant shall comply with the provisions of the Water (Prevention & Control of Pollution) Act, 1974 and as amended, by installing water meters and other provisions as contained in the said act:

| Sr. No. | Purpose for water consumed | Water consumption quantity (CMD) |
|---|---|---|
| 1. | Industrial Cooling, spraying in mine pits or boiler feed | 0.00 |
| 2. | Domestic purpose | 0.50 |
| 3. | Processing whereby water gets polluted & pollutants are easily biodegradable | 1.70 |
| 4. | Processing whereby water gets polluted & pollutants are not easily biodegradable and are toxic | 0.00 |
| 5. | Gardening | 0.3 |

6. The Applicant shall provide Specific Water Pollution control system as per the conditions of EP Act, 1986 and rule made there under from time to time/ Environmental Clearance/ CREP guidelines.

## SCHEDULE-II

## Terms & conditions for compliance of Air Pollution Control:

1. As per your application, you have provided the Air pollution control (APC) system and erected following stack (s) to observe the following fuel pattern:

| Stack No. | Source | APC System provided/proposed | Stack Height(in mtr) | Type of Fuel | Sulphur Content(in %) | Pollutant | Standard |
|---|---|---|---|---|---|---|---|
| S-1 | Thermopack | Stack | 10.00 | LDO 400 Ltr/M | - | SO2 | 2.0 Kg/Day |
| S-2 | Reactor | Scrubber | | 0 0 Ltr/M | - | Acid Mist | 35 $Mg/Nm^3$ |

•Industry shall provide adequate capacity of air pollution control system to all gases/dust pollutants generating sources to control the emissions. •Industry shall ensure that there shall not be any type of fugitive emission due to said activity.

2. The Applicant shall provide Specific Air Pollution control equipments as per the conditions of EP Act, 1986 and rule made there under from time to time/ Environmental Clearance / CREP guidelines.

3. The applicant shall operate and maintain above mentioned air pollution control system, so as to achieve the level of pollutants to the following standards:

| Parameters | Standards (unit) | |
|---|---|---|
| Total Particulate Matter | Not to exceed | 50 mg/ Nm3 |
| Acid Mist | Not to exceed | 35 mg/ Nm3 |

4. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof or alteration or replacement/alteration well before its life come to an end or erection of new pollution control equipment.

5. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).

## SCHEDULE-III

## Details of Bank Guarantees:

| Sr. No. | Consent (C2E/ C2O /C2R) | Amt of BG Imposed | Submission Period | Purpose of BG | Compliance Period | Validity Date |
|---|---|---|---|---|---|---|
| 1 | C to R | 25000 | 15 days | towards O & M of pollution control system and compliance of consent condition | 31.12.2028 | 31.03.2029 |

**The above Bank Guarantee(s) shall be submitted by the applicant in favour of Regional Officer at the respective Regional Office within 15 days from the date of issue of Consent.**

### BG Forfeiture History

| Srno. | Consent (C2E/C2O/C2R) | Amount of BG imposed | Submission Period | Purpose of BG | Amount of BG Forfeiture | Reason of BG Forfeiture |
|---|---|---|---|---|---|---|
| NA | | | | | | |

### BG Return details

| Srno. | Consent (C2E/C2O/C2R) | BG imposed | Purpose of BG | Amount of BG Returned |
|---|---|---|---|---|
| NA | | | | |

## SCHEDULE-IV
## General Conditions:

1. The Energy source for lighting purpose shall preferably be LED based
2. The PP shall harvest rainwater from roof tops of the buildings and storm water drains to recharge the ground water and utilize the same for different industrial applications within the plant
3. Conditions for D.G. Set
   a) Noise from the D.G. Set should be controlled by providing an acoustic enclosure or by treating the room acoustically.
   b) Industry should provide acoustic enclosure for control of noise. The acoustic enclosure/ acoustic treatment of the room should be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on higher side. A suitable exhaust muffler with insertion loss of 25 dB (A) shall also be provided. The measurement of insertion loss will be done at different points at 0.5 meters from acoustic enclosure/room and then average.
   c) Industry should make efforts to bring down noise level due to DG set, outside industrial premises, within ambient noise requirements by proper sitting and control measures.
   d) Installation of DG Set must be strictly in compliance with recommendations of DG Set manufacturer.
   e) A proper routine and preventive maintenance procedure for DG set should be set and followed in consultation with the DG manufacturer which would help to prevent noise levels of DG set from deteriorating with use.
   f) D.G. Set shall be operated only in case of power failure.
   g) The applicant should not cause any nuisance in the surrounding area due to operation of D.G. Set.
   h) The applicant shall comply with the notification of MoEFCC, India on Environment (Protection) second Amendment Rules vide GSR 371(E) dated 17.05.2002 and its amendments regarding noise limit for generator sets run with diesel.
4. The applicant shall maintain good housekeeping.
5. The non-hazardous solid waste arising in the factory premises, sweepings, etc. be disposed of scientifically so as not to cause any nuisance / pollution. The applicant shall take necessary permissions from civic authorities for disposal of solid waste.
6. The applicant shall not change or alter the quantity, quality, the rate of discharge, temperature or the mode of the effluent/emissions or hazardous wastes or control equipments provided for without previous written permission of the Board. The industry will not carry out any activity, for which this consent has not been granted/without prior consent of the Board.
7. The Board reserves the right to review, amend, suspend, revoke this consent and the same shall be binding upon you.
8. The industry shall submit quarterly statement in respect of industries obligation towards consent and pollution control compliance's duly supported with documentary evidences (format can downloaded from MPCB official site).
9. The industry shall submit official e-mail address and any change will be duly informed to the MPCB.
10. The industry shall achieve the National Ambient Air Quality standards prescribed vide Government of India, Notification No. B-29016/20/90/PCI-L dated. 18.11.2009 as amended.
11. This consent should not be construed as exemption from obtaining necessary NOC/ permission from any other Government authorities.

12. The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.
13. You shall operate OCEMS installed for source emission round 'O' clock and transmit data online to CPCB and MPCB server. You shall also monitor effluent quality, stack emissions and ambient air quality monthly/quarterly. You shall conduct Dioxin Furan monitoring by third party NABL Accredited agency once in year and submit report to Sub Regional Officer.
14. You shall ensure collection, and segregation of BMW regularly to treat and dispose Off within 48 hrs from generation.
15. Whenever due to any accident or other unforeseen act or even, such emissions occur or is apprehended to occur in excess of standards laid down, such information shall be forthwith Reported to Board, concerned Police Station, office of Directorate of Health Services, Department of Explosives, Inspectorate of Factories and Local Body. In case of failure of pollution control equipments, the production process connected to it shall be stopped.
16. The applicant shall provide an alternate electric power source sufficient to operate all pollution control facilities installed to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by terms and conditions of this consent.
17. The industry shall recycle/reprocess/reuse/recover Hazardous Waste as per the provision contain in the Hazardous and Other Wastes (M & TM) Rules 2016, which can be recycled /processed /reused /recovered and only waste which has to be incinerated shall go to incineration and waste which can be used for land filling and cannot be recycled/reprocessed etc. should go for that purpose, in order to reduce load on incineration and landfill site/environment.
18. An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.
19. You shall not Rent, Lend, Sell, Transfer or Close Down the facility or otherwise transport the Bio Medical waste for any other purpose without obtaining prior written permission of the MPC Board.
20. Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of the collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipes/sewers downstream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system.
21. Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.
22. The industry should not cause any nuisance in surrounding area.
23. The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standard in respect of noise to less than 75 dB (A) during day time and 70 dB (A) during night time. Day time is reckoned in between 6 a.m. and 10 p.m. and night time is reckoned between 10 p.m. and 6 a.m.
24. You shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the facility premises.

25. The applicant shall provide ports in the chimney/(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.
26. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or an extension or addition thereto
27. The applicant shall install a separate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained.
28. The applicant shall bring minimum 33% of the available open land under green coverage/ plantation. The applicant shall submit a yearly statement by 30th September every year on available open plot area, number of trees surviving as on 31st March of the year and number of trees planted by September end.
29. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions.
30. The firm shall submit to this office, the 30th day of September every year, the Environment Statement Report for the financial year ending 31st March in the prescribed FORM-V as per the provisions of Rule 14 of the Environment (Protection) (second Amendment) Rules, 1992.
31. You should monitor effluent quality, stack emissions and ambient air quality monthly/quarterly. You shall conduct Dioxin Furan monitoring by third party NABL Accredited agency once in every year and submit report to Sub Regional Officer.
32. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).
33. The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous waste to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.
34. You shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof or alteration or shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.
35. You shall strictly comply with the Water (P&CP) Act, 1974, Air (P&CP) Act, 1981 and Environmental Protection Act, 1986 and industry specific standard under EP Rules 1986 which are available on MPCB website (www.mpcb.gov.in).
36. You shall create the Environmental Cell by appointing an Environmental Engineer and Chemist for looking after day-to-day activities related to compliance of CCA.

37. You should comply with the Hazardous and Other Wastes (M & TM) Rules, 2016 , Bio Medical Waste Management Rules,2016 and submit the Annual Returns as per Rule 6(5) & 20(2) of Hazardous and Other Wastes (M & TM) Rules, 2016 for the preceding year in Form-IV by 30th June of every year

This certificate is digitally & electronically signed.

## The Pollution Audit Report submission to MPCB

To,
Member Secretary
Maharashtra Pollution Control Board,
Kalpataru Point, Sion Circle,
Mumbai 400 072

(Period from **01-04-2023** To **31-03-2024**)

| (A) | GENERAL |
|---|---|
| 1 | Name of the Industry: **Amudan Chemicals Pvt. Ltd** |
| | UAN No. of Consent to Operate issued by MPCB-<br>**MPCB-CONSENT-0000173336**<br>Validity of Consent to Operate: **31-12-2028** |
| 2 | Location (Address) of the Industry:<br>**Plot No. W-229, MIDC PHASE –II, Manpada Road, Dombivli (East), Dist –Thane**<br>Latitude and longitude of location:<br>Latitude- **19.2059**<br>Longitude- **73.1003** |
| 3 | Registered Office Address:<br>**Plot No. W-229, MIDC PHASE –II, Manpada Road, Dombivli (East), Dist –Thane** |
| 4 | Month & Year of establishment: **01-04-1995** |
| 5 | Details of consents/authorization and its validity: **31-12-2028** |
| 6 | - No. of workers employed : **3** |
| 7 | - No. of electrical connections with service numbers:<br>- Total connected load: **98.99 hp**<br>- Electric consumption per tones of product manufactured:<br>- Percentage enhancement in energy:<br>- Saving as compared to previous year: |
| 8 | Number of D.G. Set & their capacity : **NA** |
| 9 | Name/Residential address of all directors/partners:<br>**Mr. Malay Mehta**<br>**Ms. Sneha Mehta** |
| 10 | Telephone Nos: **9833525588**<br>(Residential &Industrial)Fax<br>No:<br>E-mail of Industry : **amudanchemicals@gmail.com**<br>E-mail of Partners/Directors: **NA** |

| | |
|---|---|
| 11 | No. of shifts & timings: **1 shift of 8 hrs.** |
| 12 | Name & Address of the in charge of Environment/Safety Division/Cell/Unit: **Mr. Malay Mehta** |
| 13 | No. of days during which production activities were in operation during the Audit period covered: **280 days** |

| | |
|---|---|
| 14 | Has the industry obtained ISO 9000/ISO 14000/OSHAS 18000/Any other EM Accreditation/Certification recognition? (If yes, please mention the year of certificationand validity) |

| (B) | PRODUCT DETAILS |
|---|---|

1 Name of products(s) & installed capacity with Yield/purity per day:

| Products | Maximum Quantity | UOM |
|---|---|---|
| Tertiary Buthy Pivolate | 1 | MT/M |
| Cummene Hydro Peroxide | 1 | MT/M |
| Benzoyl Peroxide | 1 | MT/M |
| Tertiary Butyl Octate | 1 | MT/M |
| Aluminum Isopropoxide | 1 | Ton/M |
| Di tertiary Butyl Peroxide | 2 | Ton/M |
| Tertiary Butyl Per Benzoate | 2 | Ton/M |
| Di Methyl phthalate | 2 | Ton/M |
| Tertiary Butyl Hydro Peroxide | 1 | Ton/M |
| Methyl Ethyl Ketone Peroxide | 20 | Ton/M |

2 Name of all by products and its quantity per day: **NA**

3 Date of commencement of production for each product. Whether production is as per consented quantity: **01-04-1995**

4 Give details of last three years of actual production quantity (It should be min and max per day or min and max per month, whichever mentioned in the consent) along with total Quantity produced during the years.
**NA**

5 All raw materials required per kg of the product(s) (It should be related with the by-products and hazardous waste also):

| Raw Materials | Quantity | UOM |
|---|---|---|
| Aluminum | 2500 | Kg/M |
| Isopropyl Alcohol | 13350 | Kg/M |
| Dimethyl Pthalate | 15600 | Kg/M |
| Sulphuric Acid | 880 | Kg/M |
| M. E. K | 14800 | Kg/M |
| Hydrogen Peroxide | 21600 | Kg/M |
| sulphuric acid | 200 | Kg/M |
| Caustic soda | 920 | Kg/M |
| Diethylen Glycol | 11000 | Kg/M |
| T. Butyl Alcohol | 1980 | Kg/M |
| sulphuric acid | 300 | Kg/M |
| T. Butyl Alcohol | 1300 | Kg/M |
| Hydrogen Peroxide | 1280 | Kg/M |

| | |
|---|---|
| 6 | -Whether the manufacturing process is continuous or batch wise: **Batch wise**<br>-Indicate the batch capacity: **21 KL/M**<br>-If the process is in batch operation, no. of batches/month along with the duration of the completion of each batch: **7 batches per month**<br>Duration of completion of each batch – **3 days** |
| 7 | -Detailed manufacturing process with schematic flow diagram:-<br>-List of unit operation & processes & with all chemical reactions along with the time required (in hrs) for completion of each unit operation/process and the total time for completion of the entire batch: **3 days**<br>-Mass balance in respect of the quantity of water, input of raw materials and waste water Generation. (Attach separate sheet)<br><br>**Attached** |
| **(C)** | **WATER** |
| 1 | -The quantity of water consumed per day as well as per tones of product manufactured:<br>-(Attach water balance diagram)* over the last three years (Source with qty and permission for water supply/usage): |

| Purpose for water consumed | Water consumption quantity (CMD) |
|---|---|
| Domestic purpose | 0.50 |
| Processing whereby water gets polluted & pollutants are easily biodegradable | 1.70 |
| Gardening | 0.3 |

| | |
|---|---|
| 2 | The quantity of waste water (trade effluent) generated per tones of each product per day, as well as per batch* over the last three years: |

| Trade Effluent | 1.2 CMD |
|---|---|

| | |
|---|---|
| 3 | -The particulars of effluent treatment plant (Attach separate sheets):- **NA**<br>-Name and Size of each unit: |

| Treatment unit | Size (mxm) | Retention time (hr) |
|---|---|---|
| Collection Tank | 5 | 48 |
| Neutralization Tank | 1 | 2 |
| Chemical Dozing Tanks | 0.2 | 2 |
| Settling Tank | 2 | 4 |
| Sludge Drying Bed | 0.5 | 1 |

- Capacity of ETP: **1.5 m3/day**
- Flow diagram & Hydraulic diagram, of ETP to be submitted: **NA**
- Whether lighting arrangement around ETP is provided: **NA**
- Whether separate energy meter is installed for effluent treatment plant. If yes, readings of the meter for consumption every month: **NA**
- Whether flow meters are provided at the inlet and outlet of the ETP. Please indicate the type of the flow meter: **NA**
- Comments about adequacy of ETP, considering inlet effluent quality and quantity: **NA**
- Whether OCEMS is mandated? If yes, details of parameters along with connectivity

| | |
|---|---|
| | status to MPCB and CPCB server.<br>- If ZLD (Zero liquid discharge mandated? If yes, then if camera is installed?<br>- If the industry is discharging to CETP? If yes, give following details –<br>- 1. Positive discharge,<br>- 2. Separation of high COD and low COD stream<br>- 3. Provision of auto sampler<br>- 4. Provision of non-return valve (NRV) with a two-way SCADA attached to CETP |
| 4 | The method of disposal of final treated effluent and the point of disposal (Please attach sketch): **NA** |
| 5 | The quality of trade effluent at the inlet and outlet of ETP and at various stages of treatment (Attach separate sheets): **NA** |
| 6 | The quantity and quality of sewage and its method of treatment and disposal (Attach separate sheets):<br>a) As per norms : **NA**<br>b) Total pollution load*: **NA** |
| 7 | The open area available for disposal of the treated effluent: **NA** |
| 8 | -Whether the quality of treated effluent meets the specified norms: **NA**<br>-If no, the extent of deviation and reasons thereof: **NA** |
| 9 | Give comments on adequacy of STP: **NA** |
| 10 | -Improvement in effluent quality and quantity since previous environmental audit based on performance evaluation of effluent management systems: **NA**<br>-If yes, provide details (Attach separate sheets): **NA** |
| 11 | -Retrofitting undertaken to improve performance of ETP: **NA**<br>-If yes, provide details: **NA** |
| 12 | Major problems encountered during operation of effluent treatment facilities, if any and reasons thereof: **NA** |
| 13 | The details about the operator/chemist responsible for operation & maintenance of effluent treatment plant: **NA**<br>- Name of the operators/employees: **NA**<br>- Qualification & Experience of each Operator/employee whether trained in such operation or not: **NA**<br>-Total cost incurred for treatment of effluent for last three years (Average cost per day): **NA** |
| 14 | Quantity of electricity and chemical consumption: **NA** |
| 15 | Whether environment monitoring cell exist? If yes, provide details- manpower, educational background etc.: **NA** |
| 16 | If CETP has done the industry's monitoring? - If yes, provide details: **NA** |

| (D) | AIR |
|---|---|

| | | |
|---|---|---|
| 1 | No. of the flue gas stacks, their height (from ground level) nature & consumption of fuel: **NA** | |
| 2 | Source of emission, fuel consumption, expected pollutants, control systems provided, stack height? | |
| | **Source of emission** | **Boiler (Not in Use)** |
| | **Fuel consumption** | **Diesel – 2.0 Ltr/hr** |
| | **Expected pollutant** | **TPM** |
| | **Control system provided** | **Chimney of 10.0 mtrs height has been provided** |
| | **Stack Height** | **10 M (above ground level)** |
| 3 | The details pertaining to the stack monitoring facilities: **NA** | |
| 4 | Number of process stacks, their height (from ground level) source, expected pollutants (emission) & the details pertaining to the provisions of stack monitoring facilities, control measures provided? | |
| | **Source of emission** | **Boiler (Not in Use)** |
| | **Fuel consumption** | **Diesel – 2.0 Ltr/hr** |
| | **Expected pollutant** | **TPM** |
| | **Control system provided** | **Chimney of 10.0 mtrs height has been provided** |
| | **Stack Height** | **10 M (above ground level)** |
| 5 | The quality/ concentration of emission from each flue gas stack & the process stack & the extent of deviation from them: **NA**<br>If OCEMS installed as per CPCB guidelines or not (17 categories)? **NA** | |
| 6 | If CAAQMS are provided in neighboring area? (wherever applicable): **NA** | |
| 7 | The ambient air quality within the factory premises, along with the number of ambient air quality monitoring stations outside the industry: **NA** | |
| 8 | If buffer zone is provided? If yes, give details. If green zone is provided? If yes, givedetails: **NA** | |
| 9 | Fugitive/ secondary emissions (VOC)- Source and control measures adopted? Suggestif any improvement needed: **NA** | |
| 10 | The details of air pollution control measures for all process & flue gas stacks, along with adequacy report: **NA** | |

| | |
|---|---|
| 11 | -Improvement in emission quality since previous environmental audit based on performance evaluation of air pollution management system: **NA**<br>-If yes, provide details. (Attach separate sheets)<br>- average of last three years emissions quality: **NA** |
| 12 | Retrofitting undertaken to improve emission quality. If yes, provide details: **NA** |
| 13 | Major problems encountered during operation of control device, if any and reasons thereof: **NA** |
| NOTE : Total pollution load each for air, water and hazardous waste should have mentioned along with the quality of effluent, emission or solid waste as the case may be. Whether measures taken for reduction of pollution load. | |
| **(E) HAZARDOUS (SOLID) WASTE:** | |
| 1 | -The quantity, sources & characteristics of hazardous waste/solid waste from each process/source over the last three years. (Total sludge generation per ton of product): **3 Kg/M**<br>- Whether it is as per the consented quantity: **NA**<br>Remarks about the quantity of hazardous waste generation: **NA** (It should be compared withgeneration of the category as well as quantity of the similar nature of industry) |

| | | | | |
|---|---|---|---|---|
| 2 | a) The method of storage, treatment & disposal of hazardous/solid waste:<br>- The details should include area of storage and disposal and whether storage and disposal system is covered and made impervious (pucca) :<br>- **Disposal to CHWTSDF**<br>- The quantity of Hazardous waste sent to TSDF/ (authorized) recyclers : **0.80 Kg/M**<br>- Please also indicate how the quantity of hazardous /solid shall be reduced in next three months: **NA**<br>c) The data/information about leachate generation, quantity & characteristics and treatment facility: **NA**<br>d) Preferred treatment mechanism depending upon characteristics of Hazardous waste (landfillable/incineration/processing/recycling) and actual treatment quantity by mode of treatment<br>(1998 HW Rules have it) | | | |
| 3 | The status of authorization under the Hazardous and Other Waste (Management and Trans boundary Movement) Rules 2016, for hazardous and other waste: | | | |
| | **35.3 Chemical sludge from waste water treatment** | **50 Kg/M** | | |
| | Statutory submissions/ records maintenance at plant site- such as Records of form III, annual returns in form IV | | | |
| 4 | Plan, if any to reduce hazardous waste generation or its recycling: **NA** | | | |
| **(F) Non-Hazardous Waste:** | | | | |
| | Quantity of non-hazardous waste generation in last three years: **NA**<br>Disposal of the non-hazardous waste and mode of disposal: **NA** | | | |
| **(G) ACCIDENTS** | | | | |
| 1 | The details of accidents (including fire) in the factory if any, root cause analysis & remedial measures taken to avoid such type of accidents in future<br>-- Incidents of spillages, leakages etc. and remedial measures thereof: **NA** | | | |
| **(H) SAFETY MEASURES** | | | | |
| 1 | General Environment of the factory. Please tick ( ) the appropriate column | | | |
| | a. House Keeping | **Good** | Fair | Poor |
| | b. Dustiness | High | Medium | **Low** |
| | c. Lighting | **Good** | Fair | Poor |
| | d. Ventilation | **Good** | Fair ✓ | Poor |
| 2 | Whether the following protective appliances are provided to all the persons | | | |
| | Goggles | Yes/No (Utilization level) | | 10 |
| | Gloves | Yes/No (Utilization level) | | 10 |
| | Gumboot | Yes/No (Utilization level) | | 10 |
| | Helmet | Yes/No (Utilization level) | | 10 |
| | Skin Cream | Yes/No (Utilization level) | | 10 |

| | | | |
|---|---|---|---|
| | Soap | Yes/No (Utilization level) | 10 |
| | Ear Plug | Yes/No (Utilization level) | 10 |

| | | | |
|---|---|---|---|
| | Face Masks | Yes/No (Utilization level) | 10 |
| | Clothing | Yes/No (Utilization level) | 10 |
| 3 | The details of facilities for disaster management/gas leakage: **NA** | | |
| 4 | Whether on site/off site emergency plans are prepared (if applicable) and are being implemented/upgraded regularly; please give details<br>If safety plan is prepared? Name of responsible officer, Whether safety mock drills conducted?<br>**NA** | | |
| 5 | Whether records of occupational hazards are maintained?<br>**NA** | | |
| 6 | Preventive measures adopted to minimize occupational hazard: **NA** | | |

| | |
|---|---|
| **(I) REMEDIAL MEASURES** | |
| 1 | The details of sources; monitoring & measures taken for control of noise pollution in & around the industrial premises: **NA** |
| 2 | The measures taken for prevention treatment & control of odor nuisance in & around the industrial premises: **NA** |
| 3 | The details in respect of legal actions initiated in last three years, under the Water Act-1974, the Air Act-1981 & the EPA-1986: **NA**<br>a) Details of compliances of directions (SCN/PD/ID) issued by the SPCB: **NA**<br>b) Whether closure directions issued in last three years? If yes, compliance status of conditions mentioned in restart directions: **NA** |
| 4 | The compliance report with respect to all the conditions of NOC/Consent(Under all the Acts)/ Bank Guarantee: **NA** |
| 6 | -Whether insurance policy obtained under PLI Act (if applicable): Yes/No<br>-If yes, provide details: **NA** |
| **(J) The name and address of the Consultant engaged by the Company/Industry, if any:** | |

**It is hereby declared that all the information submitted in and with respect to this format is correct and we will be responsible for any lapse regarding incorrect or incomplete information.**

| (A) | | | (B) | | |
|---|---|---|---|---|---|
| Name & Signature of responsible persons of industry/organization/institute/CETP/TSDF with stamp. | | | Name & Signature of all the members of Audit Team | | |
| Sr. No | Name | Sign. | Sr.No | Name | Sign. |
| | | | | | |
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| | | | | | |

# HAZOP STUDY REPORT

***For***

## M/s. AMUDAN CHEMICALS PVT LTD.

**Plot No. 229, MIDC, Phase II, Manpada, Dombivli (E),**

**Dist: Thane-421 204.**

## DEC -2020

Prepared by

**Mr. Dhananjay Jadhav**

**(DME/B. Tech (Mech)/ADIS)**

**DISH Certified Safety Auditor Register No.MS/DISH/SA/J-006/2019**

M/s. DTECH ENGINEERING

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# HAZOP STUDY REPORT

## INDEX

# HAZOP STUDY REPORT

## Introduction on HAZOP Study

A hazard and operability study (HAZOP) is a structured and systematic examination of a complex planned or existing process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment.

HAZOP addresses single failures, or multiple failures with a common cause leading to a deviation, but does not consider multiple, independent, coincident failures. These lower frequency events are outside the direct experience of most people and are better addressed by a risk analysis study, if warranted by the extent of the potential consequences.

### 1. What is 'HAZOP'?

"HAZOP" (hazard and operability) study of an operation is defined as follows

The application of the formal, systematic critical examination to the process of engineering intentions of a facility to aces the hazard potential of mal-operation or malfunctioning of individual items of equipment and the consequential effects on the facility as a whole." Incidentally, a "HAZOP" is defined as a physical situation with a potential for-

1. Human injury
2. Property damage
3. Damage to Environment
4. Lessening the ability to perform a prescribed function.

### 2. THE METHODOLOGY

**HAZOP** study is a procedure used to review the design and operations of a hazardous process facility. It is used to identify all possible causes of deviation from normal safe operation that could lead to any hazard/ environmental risk/operability problems etc. some of the causes may be unrealistic and so the desired consequences will be some deviations with both, causes that are conceivable and consequences that are potentially hazardous. These potential hazards are then noted for recommendations/ actions.

Having examined a part of the design, materials of construction, safety arrangements and recorded potential hazards associated with it, the attempts to find out the suitable modifications, improvements, measures, etc. which may be adopted to prevent deviations from the processes and engineering intentions and

# HAZOP STUDY REPORT

consequent hazard and operability problems. After finalizing the recommendations, the study progresses to focus on the next part of the design.
The examination is repeated until the whole plant has been studied.

HAZOP is a systematic and highly structured study with a critical approach to examine the process and engineering intentions of the process design. The most important of these terms are:

| TERM | MEANING |
|---|---|
| Intention | The intention defines how the selected section / unit is Expected To Operate. |
| Deviation | These are departures from the intention which are discovered by systematically applying the guide words. |
| Causes | These are the reasons why deviations might occur. Once a deviation has been shown to have a conceivable or realistic cause, it can be treated as meaningful. |
| consequences | They are the results of deviations, should they occur. |
| Hazards | The consequences, which can cause damage, injury or loss. |
| Guide words | These are simple words, which are used to quality the intentions in order to guide and stimulate the thinking process and to discover deviations. A list of guide words along with the likely causes is given in the table, on the preceding pages. |

## 3. THE AIMS

The primary aims of HAZOP are:
1. To identify the cause of all deviations of changes from the design intent.
2. To determine all major hazard and operability problems associated with these deviations.
3. To decide whether action is required to control the hazard or operability problem.
4. To ensure that the actions decided upon are implemented and documented.

# HAZOP STUDY REPORT

## 4. THE PROCEDURE ADOPTED

The complete process studied is divided into discrete nodes. For each node, every parameter or guideword deviation is considered; for each cause, consequence, recommendations for actions are made, if the remaining level of risk is considered unacceptable.

## 5. THE STEPS USED

- The sequence of steps used to conduct the HAZOP is as follows:
  1. Select and confirm the scope of node.
  2. Explain the general design intentions and operating conditions of the node.
  3. Specify the node's process parameters.
  4. Select a process parameter (flow, Pressure etc.) and specify the design intention relating to this parameter.
  5. Apply a deviation (more, less etc.) to the parameter and develop meaningful causes, hazards of the deviations from the intension.
  6. Identify all scenarios, causes / hazards of the deviation from the intention.
  7. Identify all major consequences associated with each cause without regard to safeguards.
  8. Specify predominant safeguard against each consequence.
  9. Make recommendations to mitigate the consequences if the severity is unacceptable.
  10. Reiterate the above steps for other guidewords.
  11. Reiterate the above steps for all other nodes in review.
- The team should document all recommendations submitted during the study.
- When a study team decides that major redesign of a plant / Section is necessary, it records the parameters for the redesigning and a HAZOP review is required, when the redesign is complete.
- When the information data base contains a questionable fact, it is best to assume that it is correct and note that appropriate action with a rider to the effect that the data should be verified first.
- If the leader or any team member believes that a particular system of P & I diagram should not be studied by team either because it is identical to the system already studied or because it involves no additional hazards, this must be agreed upon by the team and the reasons recorded in the report.

# HAZOP STUDY REPORT

## ➢ Hazop guide words & parameters:

| Guide Word | Explanation |
|---|---|
| No or Not or More | Negation of the design intent |
| More | Quantitative increase |
| Less | Quantitative decrease |
| As well As | Qualitative increase, extra activity occurs |
| Part of | Qualitative decrease |
| Reverse | Opposite of the intention |
| Other than | Substitution |

| Parameter | Guide Words |
|---|---|
| **FLOW** | More |
| | Less / None |
| | Reverse |
| | Other than |
| **Pressure / Vacuum** | High |
| | Low |
| **Temperature** | High |
| | Low |
| **Level** | High |
| | Low |
| **Composition (Quality)** | Part of (something Missing) |
| | As well as (something Extra) |
| | Other than (something Different) |
| **Others** | Maintenance |
| | Corrosion/ Erosion |
| | Engineering issues / Drawing errors |
| | Static electricity |
| | Startup |
| | Shout down |
| | Sampling |
| | Fire Engulfment |
| | Spillage |
| | No agitation |
| | Power failure |

# HAZOP STUDY REPORT

## ACKNOWLEDGMENT

The facility of M/s. Amudan Chemicals Pvt. Ltd. situated at Plot No.W-229, MIDC Phase-II, Dombivali, Tal. Kalyan, Dist- Thane. M/s Amudan Chemicals Pvt. Ltd. is a rising company and manufacturer of Organic Peroxides.

The Management is committed to the safety and health of its organization people and protection of environment and has taken adequate measures to ensure the same. However, as part of continual improvement of the prevailing EHS system the management felt the need to conduct Hazop – Risk Assessment from an external independent source and accordingly the audit was conducted by M/s Dtech Engineering.

M/s Dtech Engineering have conducted HAZOP Study on the information provided by the management and collected during the site round on 5th December, 2020.

We express our sincere thanks to Mr. Kirti Mehta (Occupier) Mr. Malay Mehta (Factory Manager), and other concerned section in-charges associated with the team for the help and co-operation extended during the Safety Audit, all relevant documents, and records were made accessible for scrutiny during HAZOP Study.

M/s Dtech Engineering wishes to thank the management of M/s. Amudan Chemicals Pvt. Ltd. for giving them an opportunity to carry out the HAZOP Study.

# HAZOP STUDY REPORT

## ➢ TEAM INVOLVED IN THE HAZOP STUDY

- **M/s. Amudan Chemicals Pvt. Ltd.**

| | |
|---|---|
| Mr. Kirti Mehta | Occupier |
| Mr. Malay Mehta | Factory Manager |
| Mr. Swapnil Shelavale | Production |

- **M/s Dtech Engineering**

| | |
|---|---|
| Mr. Dhananjay K. Jadhav | Safety Auditor |
| Mr. Avinash Suryavanshi | Safety Professional |

# HAZOP STUDY REPORT

## MANUFACTURING ACTIVITY DETAILS

The facility of M/s. Amudan Chemicals Pvt. Ltd situated at Plot No W-229, MIDC Phase-II, Dombivali, Tal. Kalyan, Dist- Thane Pin – 421204.

M/s. Amudan Chemicals Pvt. Ltd was established in 1995. They are one of the India's leading manufacturer of Fiber Reinforced Polymer (FRP) catalysts. They manufactures chemicals which are used by their customers as key ingredients to make the products that they can use every day. Their manufacturing facility provides an optimum quality goods. With their advanced research and development facility, they provide unmatched quality products to customers. M/s Amudan Chemicals Pvt Ltd make sure that only optimum quality products are been delivered to their valued customers. This approach has helped them to maintain and enhance reputation in FRP industry.

In an endeavor to take this objective to next level M/s. Amudan Chemicals Pvt. Ltd. has errected venture into the manufacturing of Organic Peroxides, which are used to initiate a process called polymerization, which creates plastic polymers. Organic peroxides are essential in the manufacture of plastics like polystyrene, polyvinyl chloride and composite products like fiberglass.

# HAZOP STUDY REPORT

## PLANT CAPABILITIES

### Salient features of manufacturing site

All the operations of M/s Amudan Chemicals Pvt. Ltd. are approved and certified MPCB and structure has been approved and is in accordance with MIDC.

- M/s. Amudan Chemicals Pvt. Ltd.holds all necessary licenses for handle, transport, store and treat hazardous materials.
- Membership of CETP & Mumbai Waste Management
- 1.5 KL reactor.
- 1.0 KL reactor.
- 2 glass lined reactor of capacity 200 L & 2 Glass Lined Reactors with 100 L Capacity
- Water jet vacuum pump
- Ice chilled water tank having capacity of 1.0 KL for effective cooling
- Thermic fluid Thermo pack boiler

# HAZOP STUDY REPORT

- **List of Raw Materials**

1. Di Methyl Phthalate
2. Hydrogen Peroxide
3. Methyl Ethyl Ketone
4. Catalyst
5. Tertiary Butanol
6. Cyclo Hexanone
7. Acetyl Acetone
8. Diacetone Alcohol

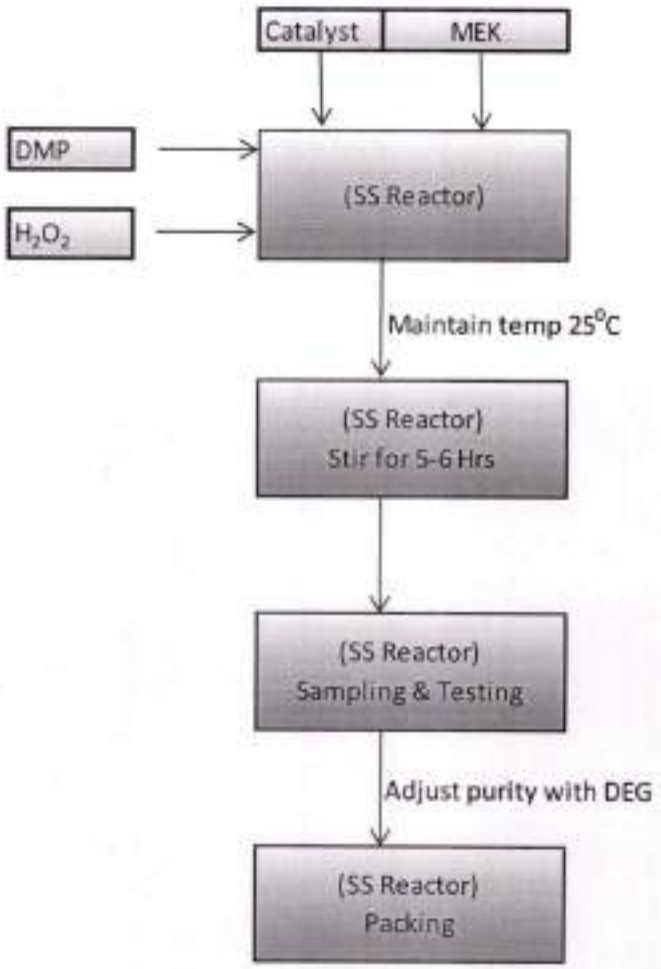
- **List of Finished Products**

1. Methyl Ethyl Ketone Peroxide (MEKP)
2. Di Tertiary Butyl Peroxide (DTBP)
3. Tertiary Butyl Hydrogen Peroxide (TBHP)
4. Acetyl Acetone Peroxide

# HAZOP STUDY REPORT

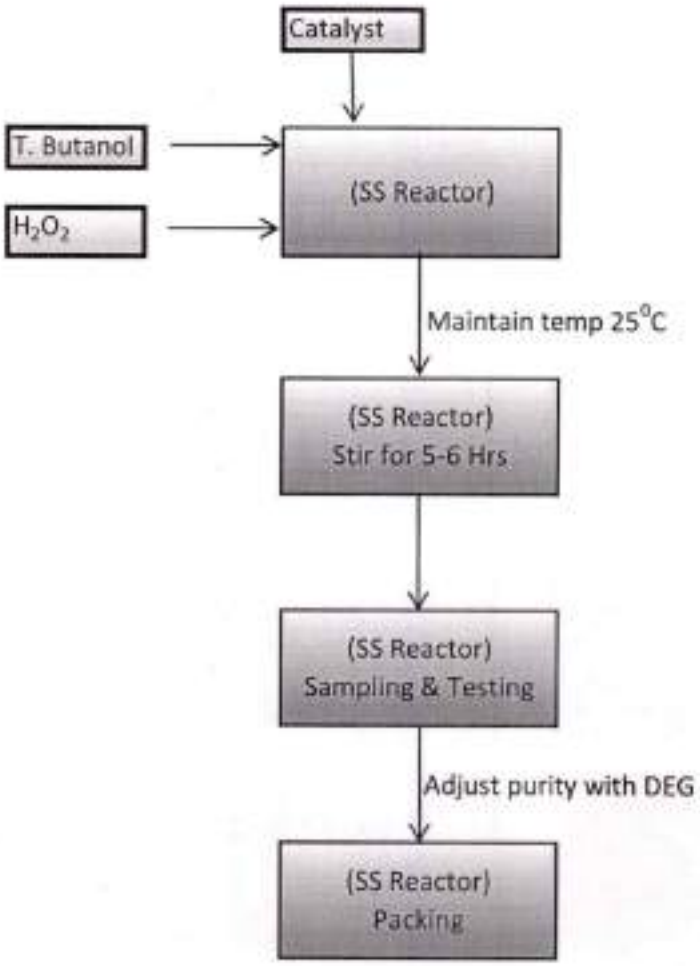
- **Process Flow Chart:**

**1.Manufacturing of Methyl Ethyl Ketone Peroxide (MEKP)**



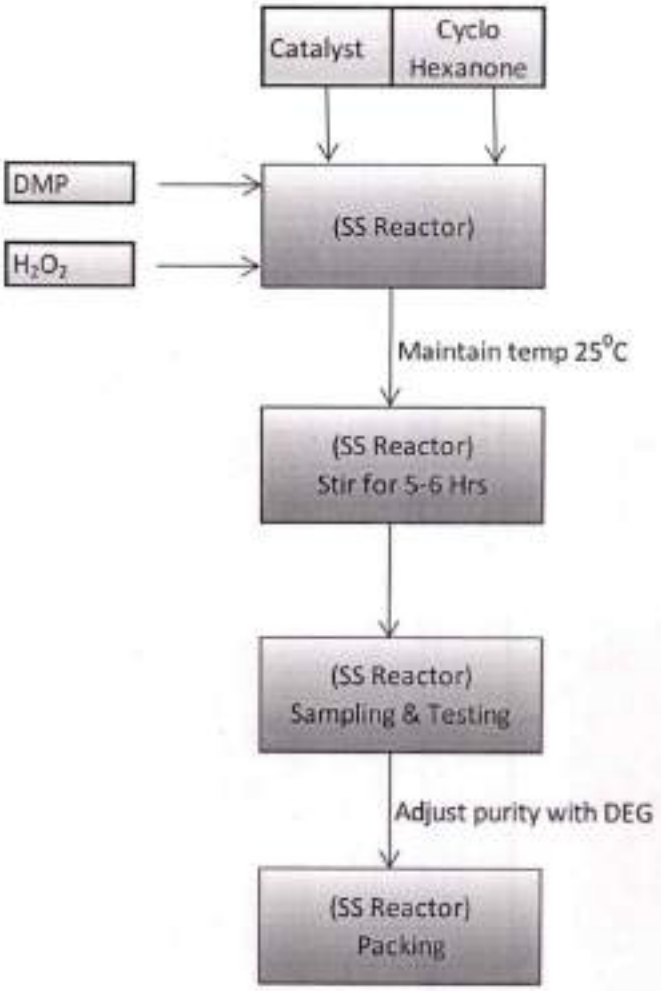
# HAZOP STUDY REPORT

**2. Manufacturing of Di Tertiary Butyl Peroxide (DTBP) / Tertiary Butyl Hydro Peroxide (TBHP)**



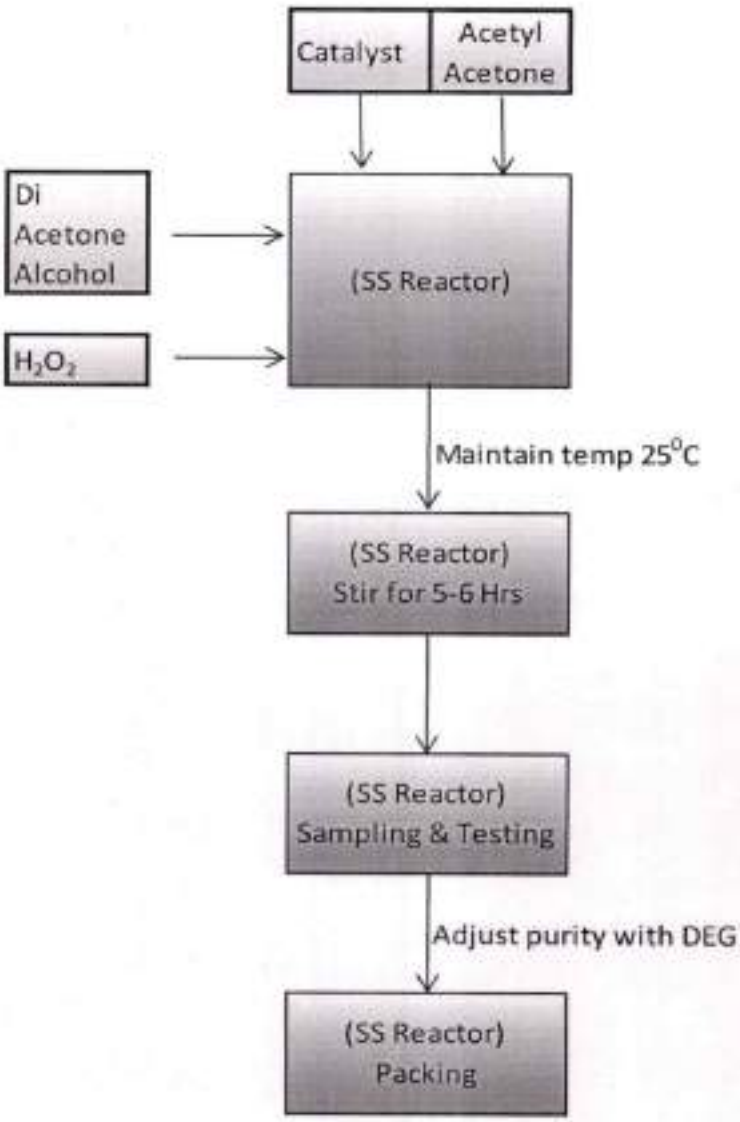
# HAZOP STUDY REPORT

## 4.Manufacturing of Cyclo Hexanone Peroxide



# HAZOP STUDY REPORT

## 5.Manufacturing of Acetyl Acetone Peroxide



# HAZOP STUDY REPORT

## HAZOP STUDY

| | |
|---|---|
| **DEPARTMENT: Production** | **DATE: 05.12.2020** |
| **LOCATION: MIDC, Phase II Dombivali (E), Dist-Thane.** | **REFERENCE NO.:00** |
| **MAIN ACTIVITY/PROCESS:** | |
| **BRIEF PROCESS: Production process for Organic Peroxides** | |
| **HAZOP TEAM: -** | |
| **M/s. Amudan Chemicals Pvt. Ltd.**<br>1. Mr. Kirti Mehta – Occupier<br>2. Mr. Malay Mehta – Factory Manager<br>3. Mr. Swapnil Shelawale –Production In Charge | |
| **M/s. Dtech Engineering:**<br>Mr. Dhananjay K. Jadhav<br>Mr. Avinash Suryavanshi | |

# HAZOP STUDY REPORT

- **Manufacturing of Methyl Ethyl Ketone Peroxide**

**1. Activity: - Charging of Di Ethyl Phthalate to Reactor under vacuum from drum**

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| **None/ No/ Not** | No transfer of Di Ethyl Phthalate | 1. Human error<br>2.Wrong line up | 1. Trained operator | 1. No raw material will transfer | 1. To check material is ready before transfer<br>2.Line trial shall be taken before charging |
| | | 3. Vacuum failure | 1.Periodic PPM schedule for pump | 1. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer<br>2. Line trial shall be taken before charging |
| | | 3. No electricity while charging | 2.Nil | 1. No transfer without electricity | 1. DG back up within five minutes |
| **More** | More quantity of Di Ethyl Phthalate addition | 1. More Di Ethyl Phthalate will transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2.Continuous supervision and quantity | 1.More material addition over flow reactor<br><br>2 Material will buff in reactor and overflow outside area. | 1. Level marking can be done inside the reactors on baffles<br>2.View glass with lamp provision<br>3. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>4.Records filled and maintained by authorized personnel |

| | | | | | |
|---|---|---|---|---|---|
| | | | verification /labeling system | | |
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Trained operators to monitor addition rate. | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for charging DEP<br>4. Double body earthing provision to process piping to reactor<br>5. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>6. Define checking frequency of earthing continuity and records shall be maintained<br>7. SS dip rod with earthing shall be provided to drum while charging ,Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Trained Operators & Supervision | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 3. Ensure Double body earthing provision to process piping to reactor<br>4. Ensure use of conductive hoses while charging flammable chemicals<br>5. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>6. Define checking frequency of earthing continuity and records shall be maintained<br>7. SS dip rod with earthing shall be provided to drum while charging Di Ethyl Phthalate<br>8. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>9. Keep ready spill control kit.<br>10. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>11. Ensure use of flameproof tools while doing any type of maintenance work<br>12. Avoid hammering / mechanical impact<br>13. Provision of Flameproof electrical fixtures<br>14. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing | Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | procedure in place | | 3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of using ice water |
| **More** | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operator & Supervision | 1. Spillage/ Overflow / Fire / Explosion / Chemical/vapour Exposure | 1. Spillage Control Kit required at each floor<br>2. Awareness Training on Spillage Control shall be provided.<br>3. Ensure proper use of PPE's like Safety shoes, Helmet, Hand Gloves and Safety Goggle, Organic vapour mask and flash fire suit etc. |
| **Less** | Less material will transfer | 1. Less flow for transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2. Periodic PPM schedule for pump<br>3. Appropriate Quantity of raw material dispensing process. | 1. Delay in batch<br>2. Delay in batch<br>3. Quality of product disturbs. | 1. Trained persons should be performed all activities.<br>2. Take preventive maintenance of transfer pump.<br>3. Before transfer check quantity of material. |
| | | 2.Pump failure | 1. Periodic PPM schedule for pump | 1. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer<br>2. Line shall be taken before charging |

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# HAZOP STUDY REPORT

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|---|---|---|---|---|---|
| | | 3. Transfer line damaged while transfer | 1. Proper assessment for line design & MOC | 1. Fire & explosion<br>2. No transfer due to transfer line fractured.<br>3. Raw material to be spilled.<br>4. Raw material splashes on operator | 1. Conductive hoses shall be used for charging flammable chemicals<br>2. Line trial shall taken before charging / transfer<br>3. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>4. Define checking frequency of earthing continuity<br>5. SS dip rod with earthing shall be provided while charging DEP to Reactor<br>6. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Keep ready safety shower and eye wash assembly near transfer of material |
| | | 4. 200 lit drums leaked or torn while transfer or tilt and spill of raw material | 1.Inspection of packing material prior to acceptance | 1. Delay for batch<br>2. Spill of raw material<br>3. Fire and Explosion | 1. Secondary Containment provision shall be made to avoid spillage<br>2. Spill control kit shall be kept ready |

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# HAZOP STUDY REPORT

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|---|---|---|---|---|---|
| **Reverse** | 1.Reverse flow of material raw material from Reactor to drum | 1. Failure of Isolation valve. | 1. Only Isolation valve provided. | 1. Delay transfer | 1. Trained Personnel |
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolating transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorised person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | Other raw material charged | Human Error (wrong selection of raw material). | Unknown consequences incoming stage | 1.Labeling procedure is in place.<br>2.Done by and checked by provision in BMR. | 1.No Recommendation |
| **Others** | Inadequate Inertisation | Impure Nitrogen | Fire Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 2.Oxygen Analyzer provision can be made after Nitrogen receiver<br>3.Use of PPE's - (Flash fire suit,Safety goggle, face shield, helmet, safety shoes)<br>4.Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty $N_2$ Flow meter | Fire Hazard | NA | 1.Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | Non dissipation of Static charge | Improper Earthing and bonding | Fire Hazard | 1. Double Earthing provided to Reactor and vessel.<br>2. Spill control kit is available.<br>3. PPEs (Safety goggle, face shield, helmet, safety shoes) | 1. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions). |
| | Inadequate Maintenance / Mechanical Disintegrity | Clamp failure / improper fitting. | DEP get leaked, resulted into spillage | 1.Trained operator performs the activity.<br>2. View glass is available on charging line after | 1.Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | valve<br>3.Spill control kit is available.<br>4.PPE's (Safety goggle, face shield, helmet, safety shoes) | |

# HAZOP STUDY REPORT

## 2. Activity: - Charging of Hydrogen Peroxide to Reactor under vacuum from drum

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| None/ No/ Not | No transfer of Hydrogen Peroxide | 1. Human error 2.Wrong line up | 1. Trained operator | 1. No raw material will transfer | 1. To check material is ready before transfer 2.Line trial shall be taken before charging |
| | | 3. Vacuum failure | 3.Periodic PPM schedule for pump | 2. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer 2. Line trial shall be taken before charging |
| | | 3. No electricity while charging | 4.Nil | 1. No transfer without electricity | 1. DG back up within five minutes |
| More | More quantity of Hydrogen Peroxide addition | 1. More Hydrogen Peroxide will transfer (Fast addition ) | 1. Appropriate Quantity of raw material dispensing process. 2.Continuous supervision and quantity verification /labeling system | 1.Exothermic Reaction 2.More material addition over flow reactor 3. Material will buff in reactor and overflow outside area. | 1. Ensure suitable utility media arrangement for effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system. 2. Audio-visual alarm provision in case of rise in temperature. 3. Level marking can be done inside the reactors on baffles 4. View glass with lamp provision |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 5. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>6. Records filled and maintained by authorized personnel<br>7. All process equipment vent shall be outside plant and flame arrestors shall be provided at end of vent line.<br>8. All pressure vessels and process equipments shall be tested through Competent person<br>9. All indicative type instruments like Pressure Gauge, Temperature indicators shall be calibrated at regular intervals |
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Proper Flow and head parameter designed.<br>2.Double body earthing provision to process piping toreactor | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for charging $H_2O_2$<br>4. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging ,Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>7. Keep ready spill control kit. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Ensure use of flameproof tools while doing any type of maintenance work<br>10. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Double body earthing provision to transferring pump and Reactor | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure use of conductive hoses while charging flammable chemicals<br>4. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging $H_2O_2$<br>7. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact<br>12. Provision of Flameproof electrical fixtures |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 13. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | 1. Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of ice water |
| **More** | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operator & Supervision | 2. Spillage/ Overflow / Fire / Explosion / Chemical/vapour Exposure | 1. Spillage Control Kit required at each floor<br>2. Awareness Training on Spillage Control shall be provided.<br>3. Ensure proper use of PPE's like Safety shoes, Helmet, Hand Gloves and Safety Goggle, Organic vapour mask and flash fire suit etc. |
| **Less** | Less material will transfer | 1. Less flow for transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2. Periodic PPM schedule for pump<br>3. Appropriate Quantity of raw material | 1. Delay in batch<br>2. Delay in batch<br>3. Quality of product disturbs. | 1. Trained persons should be performed all activities.<br>2. Take preventive maintenance of transfer pump.<br>3. Before transfer check quantity of material. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | dispensing process. | | |
| | | 2.Pump failure | 2. Periodic PPM schedule for pump | 2. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer<br>2. Line shall be taken before charging |
| | | 3. Transfer line damaged while transfer | 1. Proper assessment for line design & MOC | 1. Fire & explosion<br>2. No transfer due to transfer line fractured.<br>3. Raw material to be spilled.<br>4. Raw material splashes on operator | 1. Conductive hoses shall be used for charging flammable chemicals<br>2. Line trial shall taken before charging / transfer<br>3. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>4. Define checking frequency of earthing continuity<br>5. SS dip rod with earthing shall be provided while charging $H_2O_2$ to Reactor<br>6. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Keep ready safety shower and eye wash assembly near transfer of material |
| | | 4. 200 lit drums leaked or torn while transfer or tilt and | 1.Inspection of packing material prior to acceptance | 1. Delay for batch<br>2. Spill of raw material<br>3. Fire and Explosion | 1. Secondary Containment provision shall be made to avoid spillage<br>2. Spill control kit shall be kept ready |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | spill of raw material | | | |
| **Reverse** | 1.Reverse flow of material raw material from Reactor to drum | 1. Failure of Isolation valve. | 1. Only Isolation valve provided. | 1. Delay transfer | 1. Trained Personnel |
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolating transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorised person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | Unknown consequences incoming stage | 1.Labeling procedure is in place.<br>2.Done by and checked by provision in BMR. | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Others** | **Inadequate Inertisation** | Impure Nitrogen | Fire / Explosion Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2. Oxygen Analyzer provision can be made after Nitrogen receiver<br>3. Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes)<br>4. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty N2 Flow meter | Fire / Explosion Hazard | NA | 1. Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | **Non dissipation of Static charge** | Improper Earthing and bonding | Fire / Explosion Hazard | 1. Trained Operator | 1. Ensure Double Earthing provided to Reactor and vessel.<br>2. Ensure use of conductive hose while charging and or unloading of flammables<br>3. Ensure FLP electrical fixtures at processing areas<br>4. Proper Nitrogen inertization before charging $H_2O_2$<br>5. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions). |

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# HAZOP STUDY REPORT

| | | | | |
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| | | | | 6. Ensure provision of Earthing jumpers and Earthing continuity shall be checked at regular intervals<br>7. Spill control kit is available.<br>8. PPEs (Safety goggle, face shield, helmet, safety shoes) |
| **Inadequate Maintenance / Mechanical Disintegrity** | Clamp failure / improper fitting. | Hydrogen Peroxide get leaked, resulted into spillage/ Fire Hazard | 1. Trained operator performs the activity.<br>2.View glass is available on charging line after valve<br>3.Spill control kit is available. | 1. Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring<br>3.Use of FLP spanners for maintenance / any mechanical purpose<br>4. PPE's (Chemical protective clothing like chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes) |
| **Human Error** | Un skill / Lack of Knowledge / Experience | Fire / Explosion / Splashing Hazard | 1. Trained operator performs the activity. | 1.Ensure skilled and qualified operator deputed for the work activity<br>2.Training shall be provided to employees about hazards and consequences and trouble shooting<br>3.Training records shall be maintained<br>4.Ensure continuous supervision for critical operations like Nitrogen inertisation, addition of critical raw materials in case of exothermic reactions<br>5. Training on Emergency Handling shall be provided |

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# HAZOP STUDY REPORT

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| | | | | | 6.Suitable fire extinguishers like Mechanical Foam type fire extinguishers for liquid fire (Class-B) shall be provided at workplace<br>7.Peroxides are corrosives and may cause severe injuries / burns in case of exposure so ensure use of PPE's like Chemical protective clothing - chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes etc.<br>8.Ensure provision of Safety Shower and Eye wash at workplace |
| | | Improper storage / Housekeeping | 1.Pressurization of Drum / can due to exposure to direct sunlight<br>2.Fire / Explosion Hazard | 1. Trained operator performs the activity. | 1.Hydrogen Peroxide shall be stored in cool, dry and well ventilated area and away from flammables/ combustible substances, avoid direct exposure to sunlight<br>2.Ensure continuous supervision and qualified operator/ staff for monitoring reactions<br>3.Ensure FLP tools for any maintenance work<br>4.Ensure proper earthing and bonding while handling flammables<br>5.Ensure proper housekeeping at workplace |

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# HAZOP STUDY REPORT

**3. Activity: - Addition of Methyl Ethyl Ketone (MEK) from receiver to reactor by maintaining temperature 25°C**

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No temperature | No meaningful deviation | | | |
| Less | Less (Low) Temperature | Malfunction of utility (Cooling water) | Trained operators and supervision | 1.Exothermic Reaction<br>2 Material will buff in reactor and overflow outside area. | 1.Ensure suitable utility media available effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system.<br>2.Audio-visual alarm provision in case of rise in temperature. |
| | | Temperature sensor failure | Trained operators and supervision | 1.Exothermic Reaction<br>2.Fire / Explosion Hazard | 1. Audio visual Alarm interlock to be provided for set temperature.<br>2. Calibration of Temperature sensor by Competent person<br>3. Reactor jacket provided with pressure gauge & temperature sensor |
| **More** | More quantity of MEK addition | 1. More MEK will transfer (Fast addition ) | 1. Appropriate Quantity of raw material dispensing process.<br>2.Continuous supervision and quantity verification /labeling system | 1.Exothermic Reaction<br>2.More material addition over flow reactor<br>3. Material will buff in reactor and overflow outside area. | 1. Ensure suitable utility media arrangement for effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system.<br>2. Audio-visual alarm provision in case of rise in temperature.<br>3. Level marking can be done inside the reactors on baffles<br>4. View glass with lamp provision |

# HAZOP STUDY REPORT

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| | | | | | 5. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>6. Records filled and maintained by authorized personnel<br>7. To know decomposition temperature, Differential Scanning Colorimetry (DSC) study shall be done<br>8. Safety Valve and Rupture Disc shall be provided to the reactors and to heat exchanger (If provided) to avoid any incident due to rise in temp, pressure or thermal decomposition<br>9. All process equipment vent shall be outside plant and flame arrestors shall be provided at end of vent line.<br>10. All pressure vessels and process equipments shall be tested through Competent person<br>11. All indicative type instruments like Pressure Gauge, Temperature indicators shall be calibrated at regular intervals<br>12. Audio visual Alarm, interlock to be provided in case process temp exceeds above operation temp.<br>13. Reactor jacket provided with pressure gauge & temperature sensor |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Proper Flow and head parameter designed.<br>2.Double body earthing provision to process piping to reactor | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for addition of MEK<br>4. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging<br>7. Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Double body earthing provision to transferring pump and Reactor | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure use of conductive hoses while charging flammable chemicals |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 4. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging MEK<br>7. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact<br>12. Provision of Flameproof electrical fixtures<br>13. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | 5. Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of ice water |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolated transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | Unknown consequences incoming stage depends on chemical compatibity of material | 1. Labeling procedure is in place.<br>2. Done by and checked by provision in BMR. | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |
| **Others** | **Inadequate Inertisation** | Impure Nitrogen | Fire / Explosion Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2. Oxygen Analyzer provision can be made at the top of reactor |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 3. Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes)<br>4. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty N2 Flow meter | Fire / Explosion Hazard | NA | 1. Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | **Non dissipation of Static charge** | Improper Earthing and bonding | Fire / Explosion Hazard | 1. Trained Operator | 1. Ensure Double Earthing provided to Reactor and vessel.<br>2. Ensure use of conductive hose while charging and or unloading of flammables<br>3. Ensure FLP electrical fixtures at processing areas<br>4. Proper Nitrogen inertization before addition MEK<br>5. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions).<br>6. Ensure provision of Earthing jumpers and Earthing continuity shall be checked at regular intervals<br>7. Spill control kit is available.<br>8. PPEs (Safety goggle, face shield, helmet, safety shoes) |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | **Inadequate Maintenance/ Mechanical Disintegrity** | Clamp failure / improper fitting. | Hydrogen Peroxide get leaked, resulted into spillage/ Fire Hazard | 1. Trained operator performs the activity.<br>2.View glass is available on charging line after valve<br>3.Spill control kit is available. | 1. Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring<br>3. Use of FLP spanners for maintenance / any mechanical purpose<br>4. PPE's (Chemical protective clothing like chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes) |
| | **Human Error** | Un skill / Lack of Knowledge / Experience | Fire / Explosion / Splashing Hazard | 1. Trained operator performs the activity. | 1. Ensure skilled and qualified operator deputed for the work activity<br>2.Training shall be provided to employees about hazards and consequences and trouble shooting<br>3.Training records shall be maintained<br>4.Ensure continuous supervision for critical operations like Nitrogen inertisation, addition of critical raw materials in case of exothermic reactions<br>5. Training on Emergency Handling shall be provided<br>6.Suitable fire extinguishers like Mechanical Foam type fire extinguishers for liquid fire (Class-B) shall be provided at workplace<br>7.Ensure use of PPE's like Chemical protective clothing - chemical resistant suits, Full body |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes etc.<br>8.Ensure provision of Safety Shower and Eye wash at workplace |
| | | Improper storage / Housekeeping | 1.Pressurization of Drum / can due to exposure to direct sunlight<br>2.Fire / Explosion Hazard | 1. Trained operator performs the activity. | 1.MEK shall be stored in cool, dry and well ventilated area and away from flammables/ combustible substances, avoid direct exposure to sunlight<br>2.Ensure continuous supervision and qualified operator/ staff for monitoring reactions<br>3.Ensure FLP tools for any maintenance work<br>4.Ensure proper earthing and bonding while handling flammables<br>5.Ensure proper housekeeping at workplace |

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# HAZOP STUDY REPORT

**4. Activity: - Stir the reaction mass for 5-6 Hrs at 20-30 °C**

| Guide Word | Type of Deviation | Typical Cause | Consequence | Existing controls (safe guards) | Action required (Recommendation) |
|---|---|---|---|---|---|
| No | No Stirring(RPM) | Human Error /Agitator tripped | 1. Reactor may get pressurized. 2. Poor heat transfer. | 1. Continuous Supervision. 2. View glass is available on the reactor. 3. Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |
| Less | Less Stirring(RPM) | Human Error (Wrong RPM selected) | 1.Hot spot may generated. 2.Poor heat transfer. | 1. Continuous Supervision. 2. View glass is available on the reactor. 3. Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |
| More | More Stirring (RPM) | Human Error (Wrong RPM selected) | Reaction mass may decompose or may have quality impact | 1. Continuous Supervision. 2. View glass is available on the reactor. 3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |

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# HAZOP STUDY REPORT

## 5. Activity: - After testing, adjust purity with DEG

| Guide Word | Type of Deviation | Typical Causes | Consequences | Existing controls (safe guards) | Action Required /Recommendation |
|---|---|---|---|---|---|
| **No** | **No Quantity** | Reactor charging valve closed | No EHS consequences | 1.Trained Operators<br>2.Continuous supervision | Ensure Valve operation and proper line up cross verified physically |
| | | Reactor bottom valve opened / dismantled | Spillage of DEG | 1.Trained Operators<br>2. Continuous supervision | 1. Reactor shall have double bottom valve with view glass<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| **More** | **More Qty** | Not possible | | | |
| **Less** | **Less Qty** | Leakage in charging line | Spillage may cause exposure | 1.Trained Operators<br>2. Continuous supervision | 1.Ensure line trail before addition of reaction mass<br>2. Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| **As well As** | **As well as Qty** | Not possible | | | |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Part of** | **Part of Qty** | Not possible | | | |
| **Reverse** | **Reverse Qty** | Not possible | | | |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | EHS Consequences based on compatibility or properties of raw materials | 1.Trained Operators<br>2.Continuous supervision | 1.Ensure permanent piping arrangement with correct tagging to avoid wrong line up<br>2.Ensure proper labeling and arrow marking on permanent piping |
| **Others** | **Inadequate Maintenance/ Mechanical Disintegrity** | Improper maintenance of transferring pump, flange fittings etc | Spillage, leakage or Splash Hazard, Exposure of Caustic | 1.Trained Operators<br>2.Continuous supervision | 1.Ensure Planned Preventive Maintenance as per schedule and record shall be maintained<br>2.Ensure line trail before transferring/charging activities |
| | | Improper machine guarding | Physical injury | Not Available | All moving parts of machineries – Motor pulley guards, reactor and transferring pump shaft guards and other moving parts shall be properly guarded |

# HAZOP STUDY REPORT

## 6. Collection of clear filtrate in to Drums

| Guide Word | Type of Deviation | Typical Causes | Consequences | Existing controls (safe guards) | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No Qty | Reactor / Filtration vessel bottom valve malfunctioning | 1. Hose pipe may get pressurized.<br>2. Spillage of reaction mass,<br>3.Fire and Health Hazard,<br>4. Property loss.<br>5. Drum may get over flow. | 1. Trained operators<br>2. Calibrated SS vessel,<br>3.Standby vessels are available. | 1.Ensure continuous supervision<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| | | Bottom valve closed | 1.Hose pipe may get pressurized<br>2.Spillage of reaction mass<br>3.Fire and Health Hazard<br>4.Property loss. | 1.Trained operators<br>2.Calibrated SS vessel<br>3.Standby vessels are available. | 1.Ensure continuous supervision<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| | | Nutsch Filter outlet valve closed | May impact on quality and yield | 1.Trained operators, | |
| | | Vacuum pump failure | 1.Negative pressure may build up inside Nutsch filter | 1.Trained operators, | 1. Ensure PPM of vacuum pump is done and records are maintained |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | 2. Impact on quality and yield | 2.Continuous supervision | 2.Ensure Compound gauge is provided on Nutsch filter and is periodically calibrated through Competent person and records maintained |
| | | Nutsch filter bottom valve opened. | 1.Spillage/Leakage of finished product<br>2.Product loss | 1.Trained operators,<br>2.Continuous supervision | Spill control kit shall be made available at workplace<br>Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| Less | Less Qty | Hose pipe leakage | 1.Spillage of finished product<br>2.Property loss. | 1.Trained operators,<br>2.Continuous supervision | Fixed SS piping is to be used for filtration<br>Spill control kit shall be made available at workplace<br>Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| Less | Less Qty | Human Error | 1.Hose pipe may get pressurized<br>2.Spillage of finished product<br>3.property loss | 1.Trained operators,<br>2.Continuous supervision | Fixed SS piping is to be used for filtration<br>Spill control kit shall be made available at workplace<br>Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| More | More Qty | Human Error | Overflow of drums | 1.Trained operators, 2.Continuous supervision | Spill control kit shall be made available at workplace Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| As well As | As well as qty | Not Applicable | Not Applicable | Not Applicable | |
| Part of | Not possible | | | | |
| Reverse | Reverse Qty | Not possible | | | |
| Other than | Other solvent charged | Human Error | Hazards depends on compatibility or property of solvents, Impact on Quality and Yield incoming stages | 1. Trained operators, 2.Done by check by procedure is in place. | Spill control kit shall be made available at workplace Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |

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# HAZOP STUDY REPORT

- **Manufacturing of Di Tertiary Butanol Peroxide / Tertiary Butanol Hydro Peroxide**

**1. Activity: - Charging of Tertiary Butanol to Reactor under vacuum from drum**

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| None/ No/ Not | No transfer of Tertiary Butanol | 1. Human error<br>2.Wrong line up | 1. Trained operator | 1. No raw material will transfer | 1. To check material is ready before transfer<br>2.Line trial shall be taken before charging |
| | | 3. Vacuum failure | 5.Periodic PPM schedule for pump | 3. No transfer due to pump under maintenance / breakdown | 3. To check pump is ready for transfer<br>4. Line trial shall be taken before charging |
| | | 3. No electricity while charging | 6.Nil | 2. No transfer without electricity | 2. DG back up within five minutes |
| More | More quantity of Tertiary Butanol addition | 1. More Tertiary Butanol will transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2.Continuous supervision and quantity | 1.More material addition over flow reactor<br><br>2 Material will buff in reactor and overflow outside area. | 1. Level marking can be done inside the reactors on baffles<br>2.View glass with lamp provision<br>3. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>4.Records filled and maintained by authorized personnel |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | verification /labeling system | | |
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Trained operators to monitor addition rate. | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for charging TERTIARY BUTANOL<br>4. Double body earthing provision to process piping to reactor<br>5. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>6. Define checking frequency of earthing continuity and records shall be maintained<br>7. SS dip rod with earthing shall be provided to drum while charging ,Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Trained Operators & Supervision | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 3. Ensure Double body earthing provision to process piping to reactor<br>4. Ensure use of conductive hoses while charging flammable chemicals<br>5. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>6. Define checking frequency of earthing continuity and records shall be maintained<br>7. SS dip rod with earthing shall be provided to drum while charging Tertiary Butanol<br>8. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>9. Keep ready spill control kit.<br>10. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>11. Ensure use of flameproof tools while doing any type of maintenance work<br>12. Avoid hammering / mechanical impact<br>13. Provision of Flameproof electrical fixtures<br>14. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing | Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | procedure in place | | 3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of using ice water |
| **More** | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operator & Supervision | 3. Spillage/ Overflow / Fire / Explosion / Chemical/vapour Exposure | 1. Spillage Control Kit required at each floor<br>2. Awareness Training on Spillage Control shall be provided.<br>3. Ensure proper use of PPE's like Safety shoes, Helmet, Hand Gloves and Safety Goggle, Organic vapour mask and flash fire suit etc. |
| **Less** | Less material will transfer | 1. Less flow for transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2. Periodic PPM schedule for pump<br>3. Appropriate Quantity of raw material dispensing process. | 1. Delay in batch<br>2. Delay in batch<br>3. Quality of product disturbs. | 1. Trained persons should be performed all activities.<br>2. Take preventive maintenance of transfer pump.<br>3. Before transfer check quantity of material. |
| | | 2.Pump failure | 3. Periodic PPM schedule for pump | 3. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer<br>2. Line shall be taken before charging |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | 3. Transfer line damaged while transfer | 2. Proper assessment for line design & MOC | 1. Fire & explosion<br>2. No transfer due to transfer line fractured.<br>3. Raw material to be spilled.<br>4. Raw material splashes on operator | 1. Conductive hoses shall be used for charging flammable chemicals<br>2. Line trial shall taken before charging / transfer<br>3. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>4. Define checking frequency of earthing continuity<br>5. SS dip rod with earthing shall be provided while charging Tertiary Butanol to Reactor<br>6. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Keep ready safety shower and eye wash assembly near transfer of material |
| | | 4. 200 lit drums leaked or torn while transfer or tilt and spill of raw material | 2.Inspection of packing material prior to acceptance | 4. Delay for batch<br>5. Spill of raw material<br>6. Fire and Explosion | 3. Secondary Containment provision shall be made to avoid spillage<br>4. Spill control kit shall be kept ready |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Reverse** | 1.Reverse flow of material raw material from Reactor to drum | 1. Failure of Isolation valve. | 1. Only Isolation valve provided. | 1. Delay transfer | 1. Trained Personnel |
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolating transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorised person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | Other raw material charged | Human Error (wrong selection of raw material). | Unknown consequences incoming stage | 1.Labeling procedure is in place.<br>2.Done by and checked by provision in BMR. | 3.No Recommendation |
| **Others** | Inadequate Inertisation | Impure Nitrogen | Fire Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR. |

# HAZOP STUDY REPORT

| | | | | | |
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| | | | | | 2.Oxygen Analyzer provision can be made after Nitrogen receiver<br>3.Use of PPE's - (Flash fire suit,Safety goggle, face shield, helmet, safety shoes)<br>4.Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty $N_2$ Flow meter | Fire Hazard | NA | 1.Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | Non dissipation of Static charge | Improper Earthing and bonding | Fire Hazard | 1. Double Earthing provided to Reactor and vessel.<br>2. Spill control kit is available.<br>3. PPEs (Safety goggle, face shield, helmet, safety shoes) | 1. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions). |
| | Inadequate Maintenance / Mechanical Disintegrity | Clamp failure / improper fitting. | Tertiary Butanol get leaked, resulted into spillage | 1.Trained operator performs the activity.<br>2. View glass is available on charging line after | 1.Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring |

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| | | | | valve<br>3.Spill control kit is available.<br>4.PPE's (Safety goggle, face shield, helmet, safety shoes) | |

# HAZOP STUDY REPORT

## 2. Activity: - Charging of Hydrogen Peroxide to Reactor under vacuum from drum

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| None/ No/ Not | No transfer of Hydrogen Peroxide | 1. Human error 2.Wrong line up | 1. Trained operator | 1. No raw material will transfer | 1. To check material is ready before transfer 2.Line trial shall be taken before charging |
| | | 3. Vacuum failure | 7.Periodic PPM schedule for pump | 4. No transfer due to pump under maintenance / breakdown | 3. To check pump is ready for transfer 4. Line trial shall be taken before charging |
| | | 3. No electricity while charging | 8.Nil | 2. No transfer without electricity | 2. DG back up within five minutes |
| More | More quantity of Hydrogen Peroxide addition | 1. More Hydrogen Peroxide will transfer (Fast addition ) | 1. Appropriate Quantity of raw material dispensing process. 2.Continuous supervision and quantity verification /labeling system | 1.Exothermic Reaction 2.More material addition over flow reactor 3. Material will buff in reactor and overflow outside area. | 1. Ensure suitable utility media arrangement for effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system. 2. Audio-visual alarm provision in case of rise in temperature. 3. Level marking can be done inside the reactors on baffles 4. View glass with lamp provision |

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# HAZOP STUDY REPORT

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| | | | | | 5. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>6. Records filled and maintained by authorized personnel<br>7. All process equipment vent shall be outside plant and flame arrestors shall be provided at end of vent line.<br>8. All pressure vessels and process equipments shall be tested through Competent person<br>9. All indicative type instruments like Pressure Gauge, Temperature indicators shall be calibrated at regular intervals |
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Proper Flow and head parameter designed.<br>2.Double body earthing provision to process piping toreactor | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for charging $H_2O_2$<br>4. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging ,Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>7. Keep ready spill control kit. |

# HAZOP STUDY REPORT

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| | | | | | 8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Ensure use of flameproof tools while doing any type of maintenance work<br>10. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Double body earthing provision to transferring pump and Reactor | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure use of conductive hoses while charging flammable chemicals<br>4. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging $H_2O_2$<br>7. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact<br>12. Provision of Flameproof electrical fixtures |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 13. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | 6. Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of ice water |
| **More** | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operator & Supervision | 4. Spillage/ Overflow / Fire / Explosion / Chemical/vapour Exposure | 1. Spillage Control Kit required at each floor<br>2. Awareness Training on Spillage Control shall be provided.<br>3. Ensure proper use of PPE's like Safety shoes, Helmet, Hand Gloves and Safety Goggle, Organic vapour mask and flash fire suit etc. |
| **Less** | Less material will transfer | 1. Less flow for transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2. Periodic PPM schedule for pump<br>3. Appropriate Quantity of raw material | 1. Delay in batch<br>2. Delay in batch<br>3. Quality of product disturbs. | 1. Trained persons should be performed all activities.<br>2. Take preventive maintenance of transfer pump.<br>3. Before transfer check quantity of material. |

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# HAZOP STUDY REPORT

| | | | | | |
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| | | | dispensing process. | | |
| | | 2.Pump failure | 4. Periodic PPM schedule for pump | 4. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer<br>2. Line shall be taken before charging |
| | | 3. Transfer line damaged while transfer | 2. Proper assessment for line design & MOC | 5. Fire & explosion<br>6. No transfer due to transfer line fractured.<br>7. Raw material to be spilled.<br>8. Raw material splashes on operator | 1. Conductive hoses shall be used for charging flammable chemicals<br>2. Line trial shall taken before charging / transfer<br>3. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>4. Define checking frequency of earthing continuity<br>5. SS dip rod with earthing shall be provided while charging $H_2O_2$ to Reactor<br>6. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Keep ready safety shower and eye wash assembly near transfer of material |
| | | 4. 200 lit drums leaked or torn while transfer or tilt and | 2.Inspection of packing material prior to acceptance | 4. Delay for batch<br>5. Spill of raw material<br>6. Fire and Explosion | 1. Secondary Containment provision shall be made to avoid spillage<br>2. Spill control kit shall be kept ready |

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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | spill of raw material | | | |
| **Reverse** | 1.Reverse flow of material raw material from Reactor to drum | 1. Failure of Isolation valve. | 1. Only Isolation valve provided. | 1. Delay transfer | 1. Trained Personnel |
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolating transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorised person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | Unknown consequences incoming stage | 1.Labeling procedure is in place.<br>2.Done by and checked by provision in BMR. | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Others** | **Inadequate Inertisation** | Impure Nitrogen | Fire / Explosion Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2. Oxygen Analyzer provision can be made after Nitrogen receiver<br>3. Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes)<br>4. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty N2 Flow meter | Fire / Explosion Hazard | NA | 1. Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | **Non dissipation of Static charge** | Improper Earthing and bonding | Fire / Explosion Hazard | 1. Trained Operator | 1. Ensure Double Earthing provided to Reactor and vessel.<br>2. Ensure use of conductive hose while charging and or unloading of flammables<br>3. Ensure FLP electrical fixtures at processing areas<br>4. Proper Nitrogen inertization before charging $H_2O_2$<br>5. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions). |

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# HAZOP STUDY REPORT

| | | | | |
|---|---|---|---|---|
| | | | | 6. Ensure provision of Earthing jumpers and Earthing continuity shall be checked at regular intervals<br>7. Spill control kit is available.<br>8. PPEs (Safety goggle, face shield, helmet, safety shoes) |
| **Inadequate Maintenance / Mechanical Disintegrity** | Clamp failure / improper fitting. | Hydrogen Peroxide get leaked, resulted into spillage/ Fire Hazard | 1. Trained operator performs the activity.<br>2.View glass is available on charging line after valve<br>3.Spill control kit is available. | 1. Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring<br>3.Use of FLP spanners for maintenance / any mechanical purpose<br>4. PPE's (Chemical protective clothing like chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes) |
| **Human Error** | Un skill / Lack of Knowledge / Experience | Fire / Explosion / Splashing Hazard | 1. Trained operator performs the activity. | 1. Ensure skilled and qualified operator deputed for the work activity<br>2. Training shall be provided to employees about hazards and consequences and trouble shooting<br>3. Training records shall be maintained<br>4. Ensure continuous supervision for critical operations like Nitrogen inertisation, addition of critical raw materials in case of exothermic reactions<br>5. Training on Emergency Handling shall be provided |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 6. Suitable fire extinguishers like Mechanical Foam type fire extinguishers for liquid fire (Class-B) shall be provided at workplace<br>7. Peroxides are corrosives and may cause severe injuries / burns in case of exposure so ensure use of PPE's like Chemical protective clothing - chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes etc.<br>8. Ensure provision of Safety Shower and Eye wash at workplace |
| | | Improper storage / Housekeeping | 1.Pressurization of Drum / can due to exposure to direct sunlight<br>2.Fire / Explosion Hazard | 1. Trained operator performs the activity. | 1. Hydrogen Peroxide shall be stored in cool, dry and well ventilated area and away from flammables/ combustible substances, avoid direct exposure to sunlight<br>2.Ensure continuous supervision and qualified operator/ staff for monitoring reactions<br>3.Ensure FLP tools for any maintenance work<br>4.Ensure proper earthing and bonding while handling flammables<br>5.Ensure proper housekeeping at workplace |

# HAZOP STUDY REPORT

### 3. Activity: - Addition of Catalyst from receiver to reactor by maintaining temperature 25°C

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No temperature | No meaningful deviation | | | |
| Less | Less (Low) Temperature | Malfunction of utility (Cooling water) | Trained operators and supervision | 1.Exothermic Reaction<br>2 Material will buff in reactor and overflow outside area. | 1. Ensure suitable utility media available effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system.<br>2.Audio-visual alarm provision in case of rise in temperature. |
| | | Temperature sensor failure | Trained operators and supervision | 1.Exothermic Reaction<br>2.Fire / Explosion Hazard | 1. Audio visual Alarm interlock to be provided for set temperature.<br>2. Calibration of Temperature sensor by Competent person<br>3. Reactor jacket provided with pressure gauge & temperature sensor |
| **More** | More quantity of Catalyst addition | 1. More Catalyst will transfer (Fast addition ) | 1. Appropriate Quantity of raw material dispensing process.<br>2.Continuous supervision and | 1.Exothermic Reaction<br>2.More material addition over flow reactor | 1. Ensure suitable utility media arrangement for effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system.<br>2. Audio-visual alarm provision in case of rise in temperature.<br>3. Level marking can be done inside the reactors on baffles<br>4. View glass with lamp provision |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | quantity verification /labeling system | 3. Material will buff in reactor and overflow outside area. | 5. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>6. Records filled and maintained by authorized personnel<br>7. To know decomposition temperature, Differential Scanning Colorimetry (DSC) study shall be done<br>8. Safety Valve and Rupture Disc shall be provided to the reactors and to heat exchanger (If provided) to avoid any incident due to rise in temp, pressure or thermal decomposition<br>9. All process equipment vent shall be outside plant and flame arrestors shall be provided at end of vent line.<br>10. All pressure vessels and process equipments shall be tested through Competent person<br>11. All indicative type instruments like Pressure Gauge, Temperature indicators shall be calibrated at regular intervals<br>12. Audio visual Alarm, interlock to be provided in case process temp exceeds above operation temp.<br>13. Reactor jacket provided with pressure gauge & temperature sensor |
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material | 1. Proper Flow and head parameter designed.<br>2.Double body earthing provision to process piping to reactor | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for addition of Catalyst<br>4. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | inside the reactor while charging | | | 6. SS dip rod with earthing shall be provided to drum while charging<br>7. Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Double body earthing provision to transferring pump and Reactor | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure use of conductive hoses while charging flammable chemicals<br>4. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging Catalyst<br>7. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact<br>12. Provision of Flameproof electrical fixtures<br>13. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | 5. Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of ice water |
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolated transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | Unknown consequences incoming stage depends on chemical compatibity of material | 1. Labeling procedure is in place.<br>2. Done by and checked by provision in BMR. | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |
| **Others** | **Inadequate Inertisation** | Impure Nitrogen<br><br>Faulty $N_2$ Flow meter | Fire / Explosion Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2. Oxygen Analyzer provision can be made at the top of reactor<br>3. Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes)<br>4. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations<br>5. Visual Inspection shall be done before use<br>6. Ensure availability of Portable Fire Extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | **Non dissipation of Static charge** | Improper Earthing and bonding | Fire / Explosion Hazard | 1. Trained Operator | 1. Ensure Double Earthing provided to Reactor and vessel.<br>2. Ensure use of conductive hose while charging and or unloading of flammables<br>3. Ensure FLP electrical fixtures at processing areas<br>4. Proper Nitrogen inertization before addition Catalyst |



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# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 5. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions).<br>6. Ensure provision of Earthing jumpers and Earthing continuity shall be checked at regular intervals<br>7. Spill control kit is available.<br>8. PPEs (Safety goggle, face shield, helmet, safety shoes) |
| | **Inadequate Maintenance/ Mechanical Disintegrity** | Clamp failure / improper fitting. | Hydrogen Peroxide get leaked, resulted into spillage/ Fire Hazard | 1. Trained operator performs the activity.<br>2.View glass is available on charging line after valve<br>3.Spill control kit is available. | 1. Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring<br>3. Use of FLP spanners for maintenance / any mechanical purpose<br>4. PPE's (Chemical protective clothing like chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes) |
| | **Human Error** | Un skill / Lack of Knowledge / Experience | Fire / Explosion / Splashing Hazard | 1. Trained operator performs the activity. | 1. Ensure skilled and qualified operator deputed for the work activity<br>2.Training shall be provided to employees about hazards and consequences and trouble shooting<br>3.Training records shall be maintained<br>4.Ensure continuous supervision for critical operations like Nitrogen inertisation, addition of critical raw materials in case of exothermic reactions<br>5. Training on Emergency Handling shall be provided |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 6. Suitable fire extinguishers like Mechanical Foam type fire extinguishers for liquid fire (Class-B) shall be provided at workplace<br>7. Ensure use of PPE's like Chemical protective clothing - chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes etc.<br>8. Ensure provision of Safety Shower and Eye wash at workplace |
| | | Improper storage / Housekeeping | 1.Pressurization of Drum / can due to exposure to direct sunlight<br>2.Fire / Explosion Hazard | 1. Trained operator performs the activity. | 1. Catalyst shall be stored in cool, dry and well ventilated area and away from flammables/ combustible substances, avoid direct exposure to sunlight<br>2. Ensure continuous supervision and qualified operator/ staff for monitoring reactions<br>3. Ensure FLP tools for any maintenance work<br>4. Ensure proper earthing and bonding while handling flammables<br>5. Ensure proper housekeeping at workplace |

# HAZOP STUDY REPORT

**4. Activity: - Stir the reaction mass for 5-6 Hrs at 20-30 °C**

| Guide Word | Type of Deviation | Typical Cause | Consequence | Existing controls (safe guards) | Action required (Recommendation) |
|---|---|---|---|---|---|
| **No** | **No Stirring(RPM)** | Human Error /Agitator tripped | 1. Reactor may get pressurized.<br>2. Poor heat transfer. | 1. Continuous Supervision.<br>2. View glass is available on the reactor.<br>3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |
| **Less** | **Less Stirring(RPM)** | Human Error (Wrong RPM selected) | 1.Hot spot may generated.<br>2.Poor heat transfer. | 1. Continuous Supervision.<br>2. View glass is available on the reactor.<br>3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |
| **More** | **More Stirring (RPM)** | Human Error (Wrong RPM selected) | Reaction mass may decompose or may have quality impact | 1. Continuous Supervision.<br>2. View glass is available on the reactor.<br>3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |

# HAZOP STUDY REPORT

## 5. Activity: - After testing, adjust purity with DEG

| Guide Word | Type of Deviation | Typical Causes | Consequences | Existing controls (safe guards) | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No Quantity | Reactor charging valve closed | No EHS consequences | 1.Trained Operators<br>2.Continuous supervision | Ensure Valve operation and proper line up cross verified physically |
| | | Reactor bottom valve opened / dismantled | Spillage of DEG | 1.Trained Operators<br>2. Continuous supervision | 1. Reactor shall have double bottom valve with view glass<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| More | More Qty | Not possible | | | |
| Less | Less Qty | Leakage in charging line | Spillage may cause exposure | 1.Trained Operators<br>2. Continuous supervision | 1.Ensure line trail before addition of reaction mass<br>2. Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| As well As | As well as Qty | Not possible | | | |
| Part of | Part of Qty | Not possible | | | |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Reverse** | **Reverse Qty** | Not possible | | | |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | EHS Consequences based on compatibility or properties of raw materials | 1.Trained Operators<br>2.Continuous supervision | 1.Ensure permanent piping arrangement with correct tagging to avoid wrong line up<br>2.Ensure proper labeling and arrow marking on permanent piping |
| **Others** | **Inadequate Maintenance/ Mechanical Disintegrity** | Improper maintenance of transferring pump, flange fittings etc | Spillage, leakage or Splash Hazard, Exposure of Caustic | 1.Trained Operators<br>2.Continuous supervision | 1.Ensure Planned Preventive Maintenance as per schedule and record shall be maintained<br>2.Ensure line trail before transferring/charging activities |
| | | Improper machine guarding | Physical injury | Not Available | All moving parts of machineries – Motor pulley guards, reactor and transferring pump shaft guards and other moving parts shall be properly guarded |

# HAZOP STUDY REPORT

## 6. Collection of clear filtrate in to Drums

| Guide Word | Type of Deviation | Typical Causes | Consequences | Existing controls (safe guards) | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No Qty | Reactor / Filtration vessel bottom valve malfunctioning | 1. Hose pipe may get pressurized.<br>2. Spillage of reaction mass,<br>3.Fire and Health Hazard,<br>4. Property loss.<br>5. Drum may get over flow. | 1. Trained operators<br>2. Calibrated SS vessel,<br>3.Standby vessels are available. | 1.Ensure continuous supervision<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| | | Bottom valve closed | 1.Hose pipe may get pressurized<br>2.Spillage of reaction mass<br>3.Fire and Health Hazard<br>4.Property loss. | 1.Trained operators<br>2.Calibrated SS vessel<br>3.Standby vessels are available. | 1.Ensure continuous supervision<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| | | Nutsch Filter outlet valve closed | May impact on quality and yield | 1.Trained operators, | No Recommendations |
| | | Vacuum pump failure | 1.Negative pressure may build up inside Nutsch filter | 1.Trained operators,<br>2.Continuous supervision | 1. Ensure PPM of vacuum pump is done and records are maintained<br>2.Ensure Compound gauge is provided on Nutsch filter and is |

# HAZOP STUDY REPORT

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|---|---|---|---|---|---|
| | | | 2. Impact on quality and yield | | periodically calibrated through Competent person and records maintained |
| | | Nutsch filter bottom valve opened. | 1.Spillage/Leakage of finished product<br>2.Product loss | 1.Trained operators,<br>2.Continuous supervision | 1. Spill control kit shall be made available at workplace<br>2. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| Less | Less Qty | Hose pipe leakage | 1.Spillage of finished product<br>2.Property loss. | 1.Trained operators,<br>2.Continuous supervision | 1. Fixed SS piping is to be used for filtration<br>2. Spill control kit shall be made available at workplace<br>3. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| Less | Less Qty | Human Error | 1.Hose pipe may get pressurized<br>2.Spillage of finished product<br>3.property loss | 1.Trained operators,<br>2.Continuous supervision | 1. Fixed SS piping is to be used for filtration<br>2. Spill control kit shall be made available at workplace<br>3. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| More | More Qty | Human Error | Overflow of drums | 1.Trained operators, 2.Continuous supervision | 1. Spill control kit shall be made available at workplace<br>2. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| As well As | As well as qty | Not Applicable | Not Applicable | Not Applicable | |
| Part of | Not possible | | | | |
| Reverse | Reverse Qty | Not possible | | | |
| Other than | Other solvent charged | Human Error | Hazards depends on compatibility or property of solvents,Impact on Quality and Yield incoming stages | 1.Trained operators, 2.Done by check by procedure is in place. | 1. Spill control kit shall be made available at workplace<br>2. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |

# HAZOP STUDY REPORT

- **Manufacturing of Acetyl Acetone Peroxide**

**1. Activity: - Charging of Di Acetone Alcohol to Reactor under vacuum from drum**

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| None/ No/ Not | No transfer of Di Acetone Alcohol | 1. Human error<br>2.Wrong line up | 1. Trained operator | 1. No raw material will transfer | 1. To check material is ready before transfer<br>2.Line trial shall be taken before charging |
| | | 3. Vacuum failure | 9.Periodic PPM schedule for pump | 5. No transfer due to pump under maintenance / breakdown | 5. To check pump is ready for transfer<br>6. Line trial shall be taken before charging |
| | | 3. No electricity while charging | 10. Nil | 3. No transfer without electricity | 3. DG back up within five minutes |
| More | More quantity of Di Acetone Alcohol addition | 1. More Di Acetone Alcohol will transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2.Continuous supervision and quantity verification /labeling system | 1.More material addition over flow reactor<br>2 Material will buff in reactor and overflow outside area. | 1. Level marking can be done inside the reactors on baffles<br>2.View glass with lamp provision<br>3. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>4.Records filled and maintained by authorized personnel |

# HAZOP STUDY REPORT

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|---|---|---|---|---|---|
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Trained operators to monitor addition rate. | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for charging Di Acetone Alcohol<br>4. Double body earthing provision to process piping to reactor<br>5. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>6. Define checking frequency of earthing continuity and records shall be maintained<br>7. SS dip rod with earthing shall be provided to drum while charging ,Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Trained Operators & Supervision | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure Double body earthing provision to process piping to reactor |

# HAZOP STUDY REPORT

| | | | | | |
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| | | | | | 4. Ensure use of conductive hoses while charging flammable chemicals<br>5. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>6. Define checking frequency of earthing continuity and records shall be maintained<br>7. SS dip rod with earthing shall be provided to drum while charging Di Acetone Alcohol<br>8. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>9. Keep ready spill control kit.<br>10. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>11. Ensure use of flameproof tools while doing any type of maintenance work<br>12. Avoid hammering / mechanical impact<br>13. Provision of Flameproof electrical fixtures<br>14. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of using ice water |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **More** | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operator & Supervision | 5. Spillage/ Overflow / Fire / Explosion / Chemical/vapour Exposure | 1. Spillage Control Kit required at each floor<br>2. Awareness Training on Spillage Control shall be provided.<br>3. Ensure proper use of PPE's like Safety shoes, Helmet, Hand Gloves and Safety Goggle, Organic vapour mask and flash fire suit etc. |
| **Less** | Less material will transfer | 1. Less flow for transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2. Periodic PPM schedule for pump<br>3. Appropriate Quantity of raw material dispensing process. | 1. Delay in batch<br>2. Delay in batch<br>3. Quality of product disturbs. | 1. Trained persons should be performed all activities.<br>2. Take preventive maintenance of transfer pump.<br>3. Before transfer check quantity of material. |
| | | 2.Pump failure | 5. Periodic PPM schedule for pump | 5. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer<br>2. Line shall be taken before charging |
| | | 3. Transfer line damaged while transfer | 3. Proper assessment for line design & MOC | 5. Fire & explosion<br>6. No transfer due to transfer line fractured.<br>7. Raw material to be spilled. | 1. Conductive hoses shall be used for charging flammable chemicals<br>2. Line trial shall taken before charging / transfer<br>3. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>4. Define checking frequency of earthing continuity |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | 8. Raw material splashes on operator | 5. SS dip rod with earthing shall be provided while charging DI ACETONE ALCOHOL to Reactor<br>6. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Keep ready safety shower and eye wash assembly near transfer of material |
| | | 4. 200 lit drums leaked or torn while transfer or tilt and spill of raw material | 3.Inspection of packing material prior to acceptance | 7. Delay for batch<br>8. Spill of raw material<br>9. Fire and Explosion | 1. Secondary Containment provision shall be made to avoid spillage<br>2. Spill control kit shall be kept ready |
| **Reverse** | 1.Reverse flow of material raw material from Reactor to drum | 1. Failure of Isolation valve. | 1. Only Isolation valve provided. | 1. Delay transfer | 1. Trained Personnel |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolating transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorised person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | Other raw material charged | Human Error (wrong selection of raw material). | Unknown consequences incoming stage | 1.Labeling procedure is in place.<br>2.Done by and checked by provision in BMR. | No Recommendation |
| **Others** | Inadequate Inertisation | Impure Nitrogen | Fire Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2.Oxygen Analyzer provision can be made after Nitrogen receiver<br>3.Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes) |

# HAZOP STUDY REPORT

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|---|---|---|---|---|---|
| | | | | | 4.Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty $N_2$ Flow meter | Fire Hazard | NA | 1.Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | Non dissipation of Static charge | Improper Earthing and bonding | Fire Hazard | 1. Double Earthing provided to Reactor and vessel.<br>2. Spill control kit is available.<br>3. PPEs (Safety goggle, face shield, helmet, safety shoes) | 1. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions). |
| | Inadequate Maintenance/ Mechanical Disintegrity | Clamp failure / improper fitting. | DI ACETONE ALCOHOL get leaked, resulted into spillage | 1.Trained operator performs the activity.<br>2. View glass is available on charging line after valve<br>3.Spill control kit is available.<br>4.PPE's (helmet, safety shoes) | 1.Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring |

# HAZOP STUDY REPORT

## 2. Activity: - Charging of Hydrogen Peroxide to Reactor under vacuum from drum

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| None/ No/ Not | No transfer of Hydrogen Peroxide | 1. Human error 2.Wrong line up | 1. Trained operator | 1. No raw material will transfer | 1. To check material is ready before transfer 2.Line trial shall be taken before charging |
| | | 3. Vacuum failure | 11. Periodic PPM schedule for pump | 6. No transfer due to pump under maintenance / breakdown | 1. To check pump is ready for transfer 2. Line trial shall be taken before charging |
| | | 3. No electricity while charging | 12. Nil | 3. No transfer without electricity | 3. DG back up within five minutes |
| More | More quantity of Hydrogen Peroxide addition | 1. More Hydrogen Peroxide will transfer (Fast addition ) | 1. Appropriate Quantity of raw material dispensing process. 2.Continuous supervision and quantity verification /labeling system | 1.Exothermic Reaction 2.More material addition over flow reactor 3. Material will buff in reactor and overflow outside area. | 1. Ensure suitable utility media arrangement for effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system. 2. Audio-visual alarm provision in case of rise in temperature. 3. Level marking can be done inside the reactors on baffles 4. View glass with lamp provision 5. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 6. Records filled and maintained by authorized personnel<br>7. All process equipment vent shall be outside plant and flame arrestors shall be provided at end of vent line.<br>8. All pressure vessels and process equipments shall be tested through Competent person<br>9. All indicative type instruments like Pressure Gauge, Temperature indicators shall be calibrated at regular intervals |
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Proper Flow and head parameter designed.<br>2.Double body earthing provision to process piping toreactor | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for charging $H_2O_2$<br>4. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging ,Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 9. Ensure use of flameproof tools while doing any type of maintenance work<br>10. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Double body earthing provision to transferring pump and Reactor | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure use of conductive hoses while charging flammable chemicals<br>4. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging $H_2O_2$<br>7. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact<br>12. Provision of Flameproof electrical fixtures<br>13. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | 6. Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of ice water |
| **More** | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operator & Supervision | 6. Spillage/ Overflow / Fire / Explosion / Chemical/vapour Exposure | 1. Spillage Control Kit required at each floor<br>2. Awareness Training on Spillage Control shall be provided.<br>3. Ensure proper use of PPE's like Safety shoes, Helmet, Hand Gloves and Safety Goggle, Organic vapour mask and flash fire suit etc. |
| **Less** | Less material will transfer | 1. Less flow for transfer | 1. Appropriate Quantity of raw material dispensing process.<br>2. Periodic PPM schedule for pump<br>3. Appropriate Quantity of raw material dispensing process. | 1. Delay in batch<br>2. Delay in batch<br>3. Quality of product disturbs. | 1. Trained persons should be performed all activities.<br>2. Take preventive maintenance of transfer pump.<br>3. Before transfer check quantity of material. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | 2.Pump failure | 6. Periodic PPM schedule for pump | 6. No transfer due to pump under maintenance / breakdown | 1.To check pump is ready for transfer<br>2. Line shall be taken before charging |
| | | 3. Transfer line damaged while transfer | 3. Proper assessment for line design & MOC | 9. Fire & explosion<br>10. No transfer due to transfer line fractured.<br>11. Raw material to be spilled.<br>12. Raw material splashes on operator | 1. Conductive hoses shall be used for charging flammable chemicals<br>2. Line trial shall taken before charging / transfer<br>3. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>4. Define checking frequency of earthing continuity<br>5. SS dip rod with earthing shall be provided while charging $H_2O_2$ to Reactor<br>6. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>7. Keep ready spill control kit.<br>8. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>9. Keep ready safety shower and eye wash assembly near transfer of material |
| | | 4. 200 lit drums leaked or torn while transfer or tilt and spill of raw material | 3.Inspection of packing material prior to acceptance | 7. Delay for batch<br>8. Spill of raw material<br>9. Fire and Explosion | 1. Secondary Containment provision shall be made to avoid spillage<br>2. Spill control kit shall be kept ready |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Reverse** | 1.Reverse flow of material raw material from Reactor to drum | 1. Failure of Isolation valve. | 1. Only Isolation valve provided. | 1. Delay transfer | 1. Trained Personnel |
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolating transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorised person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | Unknown consequences incoming stage | 1.Labeling procedure is in place.<br>2.Done by and checked by provision in BMR. | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Others** | **Inadequate Inertisation** | Impure Nitrogen | Fire / Explosion Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2. Oxygen Analyzer provision can be made after Nitrogen receiver<br>3. Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes)<br>4. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty N2 Flow meter | Fire / Explosion Hazard | NA | 1. Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | **Non dissipation of Static charge** | Improper Earthing and bonding | Fire / Explosion Hazard | 1. Trained Operator | 1. Ensure Double Earthing provided to Reactor and vessel.<br>2. Ensure use of conductive hose while charging and or unloading of flammables<br>3. Ensure FLP electrical fixtures at processing areas<br>4. Proper Nitrogen inertization before charging $H_2O_2$<br>5. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions). |

# HAZOP STUDY REPORT

| | | | | |
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| | | | | 6. Ensure provision of Earthing jumpers and Earthing continuity shall be checked at regular intervals<br>7. Spill control kit is available.<br>8. PPEs (Safety goggle, face shield, helmet, safety shoes) |
| **Inadequate Maintenance / Mechanical Disintegrity** | Clamp failure / improper fitting. | Hydrogen Peroxide get leaked, resulted into spillage/ Fire Hazard | 1. Trained operator performs the activity.<br>2.View glass is available on charging line after valve<br>3.Spill control kit is available. | 1. Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring<br>3.Use of FLP spanners for maintenance / any mechanical purpose<br>4. PPE's (Chemical protective clothing like chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes) |
| **Human Error** | Un skill / Lack of Knowledge / Experience | Fire / Explosion / Splashing Hazard | 1. Trained operator performs the activity. | 1. Ensure skilled and qualified operator deputed for the work activity<br>2.Training shall be provided to employees about hazards and consequences and trouble shooting<br>3.Training records shall be maintained<br>4.Ensure continuous supervision for critical operations like Nitrogen inertisation, addition of critical raw materials in case of exothermic reactions<br>5. Training on Emergency Handling shall be provided |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 6.Suitable fire extinguishers like Mechanical Foam type fire extinguishers for liquid fire (Class-B) shall be provided at workplace<br>7.Peroxides are corrosives and may cause severe injuries / burns in case of exposure so ensure use of PPE's like Chemical protective clothing - chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes etc.<br>8.Ensure provision of Safety Shower and Eye wash at workplace |
| | | Improper storage / Housekeeping | 1.Pressurization of Drum / can due to exposure to direct sunlight<br>2.Fire / Explosion Hazard | 1. Trained operator performs the activity. | 1. Hydrogen Peroxide shall be stored in cool, dry and well ventilated area and away from flammables/ combustible substances, avoid direct exposure to sunlight<br>2.Ensure continuous supervision and qualified operator/ staff for monitoring reactions<br>3.Ensure FLP tools for any maintenance work<br>4.Ensure proper earthing and bonding while handling flammables<br>5.Ensure proper housekeeping at workplace |

# HAZOP STUDY REPORT

**3. Activity: - Addition of Acetyl Acetone from receiver to reactor by maintaining temperature 25°C**

| Guide Word | Type of Deviation | Typical Causes | Existing controls (safe guards) | Consequences | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No temperature | No meaningful deviation | | | |
| Less | Less (Low) Temperature | Malfunction of utility (Cooling water) | Trained operators and supervision | 1.Exothermic Reaction<br>2 Material will buff in reactor and overflow outside area. | 3.Ensure suitable utility media available effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system.<br>4.Audio-visual alarm provision in case of rise in temperature. |
| | | Temperature sensor failure | Trained operators and supervision | 1.Exothermic Reaction<br>2.Fire / Explosion Hazard | 1. Audio visual Alarm interlock to be provided for set temperature.<br>2. Calibration of Temperature sensor by Competent person<br>3. Reactor jacket provided with pressure gauge & temperature sensor |
| **More** | More quantity of Acetyl Acetone addition | 1. More Acetyl Acetone will transfer (Fast addition ) | 1. Appropriate Quantity of raw material dispensing process.<br>2.Continuous supervision and quantity verification /labeling system | 1.Exothermic Reaction<br>2.More material addition over flow reactor<br>3. Material will buff in reactor and overflow outside area. | 1. Ensure suitable utility media arrangement for effective cooling. It is recommended to use cooling tower / Chilled water plant instead of Ice cooling system.<br>2. Audio-visual alarm provision in case of rise in temperature.<br>3. Level marking can be done inside the reactors on baffles<br>4. View glass with lamp provision |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 5. Batching Meter / Bar coding system can be implemented for dispensing of exact quantity and correct raw material.<br>6. Records filled and maintained by authorized personnel<br>7. To know decomposition temperature, Differential Scanning Colorimetry (DSC) study shall be done<br>8. Safety Valve and Rupture Disc shall be provided to the reactors and to heat exchanger (If provided) to avoid any incident due to rise in temp, pressure or thermal decomposition<br>9. All process equipment vent shall be outside plant and flame arrestors shall be provided at end of vent line.<br>10. All pressure vessels and process equipments shall be tested through Competent person<br>11. All indicative type instruments like Pressure Gauge, Temperature indicators shall be calibrated at regular intervals<br>12. Audio visual Alarm, interlock to be provided in case process temp exceeds above operation temp.<br>13. Reactor jacket provided with pressure gauge & temperature sensor |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | 2. More flow (Free flow leads to friction and resulted in to static charge generation) of raw material inside the reactor while charging | 1. Proper Flow and head parameter designed.<br>2.Double body earthing provision to process piping to reactor | 1. Generation of static charge / splash fire | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards reactors wall side to charging line<br>3. Conductive Hoses shall be used for addition of Acetyl Acetone<br>4. Ensure provision of earthing jumpers on each flange of reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging<br>7. Flange guards shall be provided on each flange of reactor and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact |
| | | 3.Static electricity | 1. Double body earthing provision to transferring pump and Reactor | 3. Fire and Explosion | 1. Line trial shall be taken before charging / transfer<br>2. J-bend provision towards Reactors wall side to charging line<br>3. Ensure use of conductive hoses while charging flammable chemicals |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 4. Ensure provision of earthing jumpers on each flange of Reactor and process piping<br>5. Define checking frequency of earthing continuity and records shall be maintained<br>6. SS dip rod with earthing shall be provided to drum while charging Acetyl Acetone<br>7. Flange guards shall be provided on each flange of Reactors and process piping to avoid splashing hazard<br>8. Keep ready spill control kit.<br>9. Use of PPE's (Personal protective equipment) like Safety Google, Hand Gloves, Organic Vapour mask, safety shoes etc.<br>10. Ensure use of flameproof tools while doing any type of maintenance work<br>11. Avoid hammering / mechanical impact<br>12. Provision of Flameproof electrical fixtures<br>13. Provision of Fire Alarm Detection System / Fire Hydrant System/ Auto Sprinkler system as per local statutory regulations |
| | Human Error (In case of Manual charging) | 1.Lack of Awareness/ Knowledge / skill / Experience | 1.Trained Operators & Supervision<br>2.Proper Labeling and dispensing procedure in place | 5. Exotherm may occur due to chemical incompatibility | 1. BMR (Batch Manufacturing Record) shall be maintained with continuous supervision<br>2. Chemicals shall be stored as per chemical compatibility<br>3. High temperature / pressure alarm with hooter shall be provided<br>4. Ensure effective cooling system (Cooling Tower) provided instead of ice water |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **As well as** | Other material will transfer | 1.Human error<br>2.Other raw material kept near to transfer area | 1.Trained personnel<br>2. Isolated transfer area. | 1. Incompatibility | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |
| **Part off** | One of Material Missed | 1.Human error | 1. Appropriate Quantity and List of raw material Charging process | 1. Batch Failure | 1. Proper Supervision required while transfer of raw material |
| **Other than** | Other material will transfer | 1.Human error | 1.Trained personnel | 1. Incompatibility | 1.Trained personnel |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | Unknown consequences incoming stage, depends on chemical compatibity of material | 1. Labeling procedure is in place.<br>2. Done by and checked by provision in BMR. | 1.Trained personnel<br>2.Raw material shall be stored at Designated place only, marked properly to avoid mix up and dispensing shall be done through Authorized person only |
| **Others** | **Inadequate Inertisation** | Impure Nitrogen | Fire / Explosion Hazard | NA | 1. Before charging raw material into Reactor Inertisation instruction to be incorporated in BMR.<br>2. Oxygen Analyzer provision can be made at the top of reactor |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | 3. Use of PPE's - (Flash fire suit, Safety goggle, face shield, helmet, safety shoes)<br>4. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, or Sprinkler system as per Local regulations |
| | | Faulty N2 Flow meter | Fire / Explosion Hazard | NA | 1. Visually Inspection done before use.<br>2. Ensure availability of Portable fire extinguishers, Fire Hydrant System, Smoke detectors, PA system, Sprinkler system as per Local regulations |
| | **Non dissipation of Static charge** | Improper Earthing and bonding | Fire / Explosion Hazard | 1. Trained Operator | 1. Ensure Double Earthing provided to Reactor and vessel.<br>2. Ensure use of conductive hose while charging and or unloading of flammables<br>3. Ensure FLP electrical fixtures at processing areas<br>4. Proper Nitrogen inertization before addition ACETYL ACETONE<br>5. Earthing & Bonding to be checked before charging raw materials" instructions shall be added in BMR (General Instructions).<br>6. Ensure provision of Earthing jumpers and Earthing continuity shall be checked at regular intervals<br>7. Spill control kit is available.<br>8. PPEs (Safety goggle, face shield, helmet, safety shoes) |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | **Inadequate Maintenance/ Mechanical Disintegrity** | Clamp failure / improper fitting. | Hydrogen Peroxide get leaked, resulted into spillage/ Fire Hazard | 1. Trained operator performs the activity.<br>2.View glass is available on charging line after valve<br>3.Spill control kit is available. | 1. Fixed or permanent piping arrangement is recommended for raw material transferring and dispensing activity.<br>2. Ensure line Trial before charging / transferring<br>3. Use of FLP spanners for maintenance / any mechanical purpose<br>4. PPE's (Chemical protective clothing like chemical resistant suits, Full body pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes) |
| | **Human Error** | Un skill / Lack of Knowledge / Experience | Fire / Explosion / Splashing Hazard | 1. Trained operator performs the activity. | 1. Ensure skilled and qualified operator Di Acetone Alcohol deputed for the work activity<br>2.Training shall be provided to employees about hazards and consequences and trouble shooting<br>3.Training records shall be maintained<br>4.Ensure continuous supervision for critical operations like Nitrogen inertisation, addition of critical raw materials in case of exothermic reactions<br>5. Training on Emergency Handling shall be provided<br>6.Suitable fire extinguishers like Mechanical Foam type fire extinguishers for liquid fire (Class-B) shall be provided at workplace<br>7.Ensure use of PPE's like Chemical protective clothing - chemical resistant suits, Full body |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | | | pressure suit, Safety goggle, Organic vapour mask,Face shield, helmet, safety shoes etc.<br>8.Ensure provision of Safety Shower and Eye wash at workplace |
| | | Improper storage / Housekeeping | 1.Pressurization of Drum / can due to exposure to direct sunlight<br>2.Fire / Explosion Hazard | 1. Trained operator performs the activity. | 1. Acetyl Acetone shall be stored in cool, dry and well ventilated area and away from flammables/ combustible substances, avoid direct exposure to sunlight<br>2.Ensure continuous supervision and qualified operator/ staff for monitoring reactions<br>3.Ensure FLP tools for any maintenance work<br>4.Ensure proper earthing and bonding while handling flammables<br>5.Ensure proper housekeeping at workplace |

# HAZOP STUDY REPORT

**4. Activity: - Stir the reaction mass for 5-6 Hrs at 20-30 °C**

| Guide Word | Type of Deviation | Typical Cause | Consequence | Existing controls (safe guards) | Action required (Recommendation) |
|---|---|---|---|---|---|
| No | No Stirring(RPM) | Human Error /Agitator tripped | 1. Reactor may get pressurized. 2. Poor heat transfer. | 1. Continuous Supervision. 2. View glass is available on the reactor. 3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |
| Less | Less Stirring(RPM) | Human Error (Wrong RPM selected) | 1.Hot spot may generated. 2.Poor heat transfer. | 1. Continuous Supervision. 2. View glass is available on the reactor. 3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |
| More | More Stirring (RPM) | Human Error (Wrong RPM selected) | Reaction mass may decompose or may have quality impact | 1. Continuous Supervision. 2. View glass is available on the reactor. 3.Activity is checked by second person. | 1.Provision can be made for audio – visual alarm in case of tripping of reactor agitator |

# HAZOP STUDY REPORT

## 5. Activity: - After testing, adjust purity with DEG

| Guide Word | Type of Deviation | Typical Causes | Consequences | Existing controls (safe guards) | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No Quantity | Reactor charging valve closed | No EHS consequences | 1.Trained Operators<br>2.Continuous supervision | Ensure Valve operation and proper line up cross verified physically |
| | | Reactor bottom valve opened / dismantled | Spillage of DEG | 1.Trained Operators<br>2. Continuous supervision | 1. Reactor shall have double bottom valve with view glass<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| More | More Qty | Not possible | | | |
| Less | Less Qty | Leakage in charging line | Spillage may cause exposure | 1.Trained Operators<br>2. Continuous supervision | 1.Ensure line trail before addition of reaction mass<br>2. Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| As well As | As well as Qty | Not possible | | | |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| **Part of** | **Part of Qty** | Not possible | | | |
| **Revers e** | **Reverse Qty** | Not possible | | | |
| **Other than** | **Other raw material charged** | Human Error (wrong selection of raw material). | EHS Consequences based on compatibility or properties of raw materials | 1.Trained Operators 2.Continuous supervision | 1.Ensure permanent piping arrangement with correct tagging to avoid wrong line up 2.Ensure proper labeling and arrow marking on permanent piping |
| **Others** | **Inadequate Maintenance / Mechanical Disintegrity** | Improper maintenance of transferring pump, flange fittings etc | Spillage, leakage or Splash Hazard, Exposure of Caustic | 1.Trained Operators 2.Continuous supervision | 1.Ensure Planned Preventive Maintenance as per schedule and record shall be maintained 2.Ensure line trail before transferring/charging activities |
| | | Improper machine guarding | Physical injury | Not Available | All moving parts of machineries – Motor pulley guards, reactor and transferring pump shaft guards and other moving parts shall be properly guarded |

# HAZOP STUDY REPORT

## 6. Collection of clear filtrate in to Drums

| Guide Word | Type of Deviation | Typical Causes | Consequences | Existing controls (safe guards) | Action Required /Recommendation |
|---|---|---|---|---|---|
| No | No Qty | Reactor / Filtration vessel bottom valve malfunctioning | 1. Hose pipe may get pressurized.<br>2. Spillage of reaction mass,<br>3.Fire and Health Hazard,<br>4. Property loss.<br>5. Drum may get over flow. | 1. Trained operators<br>2. Calibrated SS vessel,<br>3.Standby vessels are available. | 1.Ensure continuous supervision<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| | | Bottom valve closed | 1.Hose pipe may get pressurized<br>2.Spillage of reaction mass<br>3.Fire and Health Hazard<br>4.Property loss. | 1.Trained operators<br>2.Calibrated SS vessel<br>3.Standby vessels are available. | 1.Ensure continuous supervision<br>2.Spill control kit shall be made available at workplace<br>3.Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| | | Nutsch Filter outlet valve closed | May impact on quality and yield | 1.Trained operators, | No Recommendations |
| | | Vacuum pump failure | 1.Negative pressure may build up inside Nutsch filter | 1.Trained operators, | 1. Ensure PPM of vacuum pump is done and records are maintained |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| | | | 2. Impact on quality and yield | 2.Continuous supervision | 2.Ensure Compound gauge is provided on Nutsch filter and is periodically calibrated through Competent person and records maintained |
| | | Nutsch filter bottom valve opened. | 1.Spillage/Leakage of finished product<br>2.Product loss | 1.Trained operators,<br>2.Continuous supervision | 1. Spill control kit shall be made available at workplace<br>2. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| Less | Less Qty | Hose pipe leakage | 1. Spillage of finished product<br>2.Property loss. | 1.Trained operators,<br>2.Continuous supervision | 1. Fixed SS piping is to be used for filtration<br>2. Spill control kit shall be made available at workplace<br>3. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| Less | Less Qty | Human Error | 1.Hose pipe may get pressurized<br>2.Spillage of finished product<br>3.property loss | 1.Trained operators,<br>2.Continuous supervision | 1. Fixed SS piping is to be used for filtration<br>2. Spill control kit shall be made available at workplace<br>3. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |

# HAZOP STUDY REPORT

| | | | | | |
|---|---|---|---|---|---|
| More | More Qty | Human Error | Overflow of drums | 1.Trained operators, 2.Continuous supervision | 1. Spill control kit shall be made available at workplace<br>2. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |
| As well As | As well as qty | Not Applicable | Not Applicable | Not Applicable | |
| Part of | Not possible | | | | |
| Reverse | Reverse Qty | Not possible | | | |
| Other than | Other solvent charged | Human Error | Hazards depends on compatibility or property of solvents, Impact on Quality and Yield incoming stages | 1. Trained operators, 2.Done by check by procedure is in place. | 1. Spill control kit shall be made available at workplace<br>2. Ensure Use of PPEs : Chemical splash proof apron / suit, Safety goggle/ Acid-alkali proof hand gloves ,safety shoes etc. |

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# AMUDAN CHEMICALS PRIVATE LIMITED

## STATEMENT OF PROFIT AND LOSS FOR THE YEAR ENDED 31ST MARCH 2022

| | Particulars | Note No. | March 31, 2022 | | March 31, 2021 | |
|---|---|---|---|---|---|---|
| | | | (Rs."00") | (Rs."00") | (Rs."00") | (Rs."00") |
| I | Revenue from operations | 22 | | 31,951 | | 1,81,831 |
| II | Other income | 23 | | 982 | | 24 |
| III | Total Income (I + II) | | | 32,933 | | 1,81,854 |
| IV | Expenses: | | | | | |
| | Cost of materials consumed | 24 | - | | 1,43,916 | |
| | Changes in the inventories | 25 | 241 | | 688 | |
| | Employee benefits expense | 26 | 4,270 | | 9,678 | |
| | Finance costs | 27 | 15 | | 37 | |
| | Depreciation and amortization expense | 10 | 2,549 | | 2,588 | |
| | Other expenses | 28 | 19,618 | | 16,966 | |
| | Total expenses | | | 26,693 | | 1,73,872 |
| V | Profit before exceptional and extraordinary items and tax (III-IV) | | | 6,241 | | 7,983 |
| VI | Exceptional items | | | - | | - |
| VII | Profit before extraordinary items and tax (V - VI) | | | 6,241 | | 7,983 |
| VIII | Extraordinary Items | | | - | | - |
| IX | Profit before tax (VII- VIII) | | | 6,241 | | 7,983 |
| X | Tax expense: | | | | | |
| | (1) Current tax | | 1,450 | | 1,250 | |
| | (2) Deferred tax | | (56) | | (332) | |
| | (3) Prior Period Tax | | (518) | 877 | - | 918 |
| XI | Profit (Loss) for the period from continuing operations (VII-VIII) | | | 5,364 | | 7,065 |
| XII | Profit/(loss) from discontinuing operations | | | - | | - |
| XIII | Tax expense of discontinuing operations | | | - | | - |
| XIV | Profit/(loss) from Discontinuing operations (after tax) (XII-XIII) | | | - | | - |
| XV | Profit (Loss) for the period (XI + XIV) | | | 5,364 | | 7,065 |
| XVI | Earnings per equity share: | | | | | |
| | (1) Basic | | | 357.60 | | 470.97 |
| | (2) Diluted | | | 357.60 | | 470.97 |

SIGNIFICANT ACCOUNTING POLICIES
NOTES ON FINANCIAL STATEMENT
For and on behalf of
PARY & COMPANY
CHARTERED ACCOUNTANTS
FRN NO.007268C

M.P.Pasad

Manish P. Pasad - PARTNER
MEMBERSHIP NO.102006
Date :- 12/08/2022
Place :- Mumbai

FOR AND ON BEHALF OF THE BOARD OF
AMUDAN CHEMICALS PRIVATE LIMITED

Malay

MALAY PRADIP MEHTA - Director ( Din No. 07035609 )

SNMehta

SNEHA MALAY MEHTA - Director ( Din No. 09169193 )

# AMUDAN CHEMICALS PRIVATE LIMITED

## STATEMENT OF PROFIT AND LOSS FOR THE YEAR ENDED 31ST MARCH 2023

| | Particulars | Note No. | March 31, 2023 | | March 31, 2022 | |
|---|---|---|---|---|---|---|
| | | | Rs. in '00 | Rs. in '00 | Rs. in '00 | Rs. in '00 |
| I | Revenue from operations | 22 | | 48,760 | | 31,951 |
| II | Other income | 23 | | 866 | | 982 |
| III | Total Income (I + II) | | | 49,625 | | 32,933 |
| IV | Expenses: | | | | | |
| | Cost of Trading Goods | 24 | 525 | | - | |
| | Changes in the inventories | 25 | - | | 241 | |
| | Employee benefits expense | 26 | 8,986 | | 4,270 | |
| | Finance costs | 27 | 514 | | 15 | |
| | Depreciation and amortization expense | 10 | 2,112 | | 2,549 | |
| | Other expenses | 28 | 25,966 | | 19,618 | |
| | Total expenses | | | 38,102 | | 26,693 |
| V | Profit before exceptional and extraordinary items and tax (III-IV) | | | 11,524 | | 6,241 |
| VI | Exceptional items | | | - | | - |
| VII | Profit before extraordinary items and tax (V - VI) | | | 11,524 | | 6,241 |
| VIII | Extraordinary Items | | | - | | - |
| IX | Profit before tax (VII- VIII) | | | 11,524 | | 6,241 |
| X | Tax expense: | | | | | |
| | (1) Current tax | | 2,950 | | 1,450 | |
| | (2) Deferred tax | | 95 | | (56) | |
| | (3) Prior Period Tax | | 436 | 3,481 | (518) | 877 |
| XI | Profit (Loss) for the period from continuing operations (VII-VIII) | | | 8,043 | | 5,364 |
| XII | Profit/(loss) from discontinuing operations | | | - | | - |
| XIII | Tax expense of discontinuing operations | | | - | | - |
| XIV | Profit/(loss) from Discontinuing operations (after tax) (XII-XIII) | | | - | | - |
| XV | Profit (Loss) for the period (XI + XIV) | | | 8,043 | | 5,364 |
| XVI | Earnings per equity share: | | | | | |
| | (1) Basic | | | 536.17 | | 357.60 |
| | (2) Diluted | | | 536.17 | | 357.60 |

SIGNIFICANT ACCOUNTING POLICIES — 29

NOTES ON FINANCIAL STATEMENT

For and on behalf of
PARY & COMPANY
CHARTERED ACCOUNTANTS
FRN NO.007288C

M.P.Pasad

Manish P. Pasad - PARTNER
MEMBERSHIP NO.102006
Date :- 20/05/2023
Place :- Mumbai

FOR AND ON BEHALF OF THE BOARD OF
AMUDAN CHEMICALS PRIVATE LIMITED

MALAY PRADIP MEHTA - Director ( Din No. 07035609 )

SNEHA MALAY MEHTA - Director ( Din No. 09169193 )