To,
The Hon'ble Registrar,
National Green Tribunal,
Western Zone Bench, Pune.

Sub: Submission of Additional Affidavit by the Joint Director, Industrial Safety and Health, Kolhapur in Suo-Moto matter O.A. No. 237/2024 (WZ) regarding the incident of toxic gas release at ManmarIndustries, Plot No. A-53, MIDC Shalgaon, Taluka- Kadegaon, District- Sangli, dated 21/11/2024.

Ref: Hon'ble NGT Order dated 03/02/2026.

Respected Sir/Madam,

In compliance with the Order dated 03/02/2026 passed by the Hon'ble National Green Tribunal in the above-referred matter, the undersigned hereby submits the Additional Affidavit on behalf of the Director, Industrial Safety and Health, Mumbai, Maharashtra, for kind consideration of the Hon'ble Tribunal.

Kindly take the same on record.

Yours faithfully,

10/03/2026.

(Dr. A.M. Avasare)
Joint Director,
Industrial Safety & Health, Kolhapur.

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, WESTERN ZONE BENCH PUNE

ORIGINAL APPLICATION NO. 237/2024 (WZ)
EARLIER ORIGINAL APPLICATION NO. 1364/2024 (PB)

IN THE MATTER OF: -

Sub: News item titled "3 dead 9 hospitalized after gas leak blast at fertilizer plant in Maharashtra" appearing in the Times of India dated 22.11.2024.

Additional Affidavit on behalf of the Director of Industrial Safety and Health, Maharashtra. (Regarding Precautionary Measures that the Occupier Ought to Have Taken, and the Current Status of Implementation)

The undersigned, on behalf of Respondent No. 6, Director of Industrial Safety and Health, Maharashtra, respectfully submits this affidavit under the Directorate of Industrial Safety and Health, Maharashtra, in compliance with the directions of the Hon'ble National Green Tribunal –Western Zone Bench, Pune.

Nature of Process and Inherent Hazards

The conversion of Dichloroacetyl Chloride (DCAC) to Dichloroacetic Acid (DCA) is a highly exothermic hydrolysis reaction, classified as a hazardous process involving chemical- halogenated compounds, as specified under Schedule I of the Factories Act, 1948.

The inherent hazards associated with the said process are as under:

a) The hydrolysis of DCAC is strongly exothermic, wherein the rate and quantity of water (reactant) addition are critical safety parameters. Addition of water at a rate exceeding the reactor's heat removal capacity leads to accelerated reaction kinetics and rapid heat release, resulting in a sudden rise in the temperature of the reaction mass. Excess or uncontrolled water addition can therefore cause abrupt temperature escalation. Under normal operating conditions, the reaction is intended to be conducted at a temperature of approximately 30 - 40°C and a pressure of 1- 2 bar.

b) Once the reaction temperature exceeds the established safe operating limit of approximately 60°C, the system becomes increasingly unstable, with a high likelihood of a rapid and uncontrollable temperature rise. Upon crossing the critical

temperature of approximately 100°C, the reaction becomes susceptible to thermal runaway i.e. uncontrollable.

c) Thermal runaway conditions lead to a sudden and steep pressure build-up within the reactor due to intensified reaction rates and rapid generation of gaseous by-products, thereby posing a serious risk of mechanical failure of the containment systems.

d) Elevated temperatures further cause thermal decomposition of DCAC and partially converted reaction intermediates, resulting in the evolution and release of highly toxic and corrosive gases/vapours, including Carbon Monoxide (CO), Chlorine (Cl_2), and Hydrogen Chloride (HCl), posing grave risks to personnel, plant integrity, and the surrounding environment.

Precautionary Measures That Ought to Have Been Taken to Avoid This Accident -

1. Conduct of Risk Assessment Prior to Commencement of the Hazardous Manufacturing Process -

Before commencing the above hazardous exothermic reaction in Glass Lined Reactor - 1 (GLR-1), the occupier was legally and technically required to carry out a systematic Hazard Identification and Risk Assessment of the hazardous process, such as a HAZOP Study (Hazards and Operability Study), as mandated under best industrial safety practices and later reinforced by Rule 73-ZC of the Maharashtra Factories (1st Amendment) Rules, 1963, vide notification dated 13 May 2025.

Such assessment ought to have included:

a) Quantification of the heat generation rate during normal and abnormal hydrolysis conditions;
b) Determination of the maximum credible temperature and pressure rise in case of cooling failure, excess water addition, or agitation malfunction;
c) Evaluation of runaway reaction scenarios, decomposition pathways, and toxic gas evolution;
d) Assessment of the safe operating limits, establishing a clear margin between normal operating temperature and the onset of uncontrollable reaction;
e) Verification of reactor design pressure, materials of construction, and weakest points under upset conditions.

During the enquiry of said accident, no HAZOP study, reaction calorimetry data, thermal screening, or documented risk analysis was evident or produced, demonstrating a complete absence of technical safety evaluation prior to undertaking the process.

2. <u>Implementation of Adequate Process Control Systems and Operating Safeguards during Hazardous Manufacturing Process</u> -

During the conduct of the aforesaid hazardous exothermic reaction, the occupier was legally and technically obligated to implement robust process control systems and engineered operating safeguards to prevent temperature rise beyond safe limits, runaway reaction, and release of toxic/hazardous gases.

The occupier was required to ensure the following mandatory safeguards:

a) Provision of an automated and interlocked reactant (water) dosing system, with a scientifically established maximum permissible addition rate based on the reactor's heat removal capacity, in place of manual throttling;
b) Ensuring continuous and proactive cooling, initiated prior to commencement of reactant addition and maintained throughout the reaction, rather than reactive cooling after temperature rise;
c) Provision of temperature and pressure monitoring systems with effective safety interlocking mechanisms to:

- Automatically stop water (reactant) addition,
- Activate emergency cooling systems,
- Interrupt agitation or isolate the system to prevent further acceleration of the reaction.

d) Development and implementation of written and approved Standard Operating Procedures (SOPs) clearly specifying:

- Permissible reactant addition rates,
- Defined safe operating temperature and pressure limits,
- Emergency process deviation management process and emergency response procedures.

However, the detailed departmental enquiry revealed that, the hazardous process was operated predominantly based on manual judgment, without automated interlocks, engineered safeguards, or documented and enforced operating limits. Such absence of structured process control mechanisms rendered the system highly susceptible to human error, delayed intervention, and loss of reaction control under upset conditions.

3. <u>Ensuring Adequate Equipment Design, Structural Integrity, and Pressure Relief Systems for Hazardous Processes</u> -

In hazardous exothermic chemical processes, reactors and associated systems are required to be designed, constructed, and safeguarded to withstand the maximum anticipated temperature and pressure under normal, abnormal, and emergency conditions.

The occupier must ensure that the systems:

a) Be designed to safely withstand maximum credible pressure and temperature, including runaway reaction scenarios;
b) Be equipped with adequately sized pressure relief and emergency venting arrangements;
c) Include scrubbing systems capable of handling maximum credible releases of hazardous/toxic gases;
d) Incorporate fail-safe features to prevent catastrophic rupture and uncontrolled release.

However, it was observed that the vapour line, condenser, water (reactant) addition system, and pressure gauge connections were made of glass, incapable of withstanding sudden pressure surges from runaway reactions. No adequately sized pressure relief devices, rupture discs, or emergency venting systems were provided, and the scrubbing system was not demonstrated to handle the maximum foreseeable release of acidic and chlorinated gases. These deficiencies indicate that the reactor and associated systems were not engineered to tolerate foreseeable process deviations that leads to mechanical failure of weak components of the system and uncontrolled hazardous/ toxic gas release.

4. <u>Provision of Suitable Personal Protective Equipment (PPE) for Workers for Handling Hazardous Chemicals</u> -

The occupier of the factory is obligated to provide and maintain appropriate personal protective equipment (PPE) for all personnel engaged in processes involving hazardous chemicals. Workers handling highly corrosive substances, including Dichloroacetyl Chloride (DCAC), Dichloroacetic Acid (DCA), and Hydrogen Chloride (HCl), must be equipped with adequate PPE and supported by appropriate emergency preparedness measures.

Under runaway or decomposition conditions, this process can generate highly toxic and hazardous gases and vapors, including Carbon Monoxide (CO), Chlorine (Cl_2), and HCl, exposure to which can result in adverse health effects or fatality. It was observed that essential PPE's, most importantly- suitable respirators, chemical resistant gloves, protective footwear, and safety goggles - were not found provided in the factory, resulting in direct exposure of workers to toxic/hazardous gases and vapors, which caused lung injuries to those exposed and ultimately led to the death of three workers.

5. <u>Provision of Additional Staircases for Emergency Exit Arrangements:</u>

The occupier of a factory carrying out hazardous chemical processes shall ensure that workers have immediate and unobstructed means of evacuation in the event of emergencies such as toxic gas release, fire, explosion, or sudden process failure. The occupier is required to provide adequate emergency exits, escape routes, and

staircases in accordance with the safety provisions prescribed under the Factories Act, 1948 and the rules made thereunder.

Emergency exit arrangements shall include at least two independent and adequately sized staircases or exit routes from each floor or operational level where hazardous processes are conducted. Such staircases shall be as remote from each other as possible and arranged to provide access in separate directions, so that workers can safely evacuate if one escape route becomes inaccessible due to gas leakage, fire, or structural obstruction. All emergency exits shall be clearly marked, adequately illuminated, kept free from obstruction, and designed to open outward leading directly to a safe assembly area.

However, during the detailed accident enquiry conducted by the department, it was observed that the operational floor area where the reactors were installed for carrying out the hazardous process did not have independent staircases arranged in separate directions or clearly designated emergency escape routes. This deficiency significantly delayed evacuation during the gas release incident. The absence of such critical emergency infrastructure increased workers' exposure to toxic gases and adversely affected their ability to exit the affected area promptly.

Statutory Approvals

Also, It is respectfully submitted that, prior to commencement of the hazardous manufacturing process, the occupier was mandatorily required to obtain statutory Plan Approval and a valid Factory License from the Directorate of Industrial Safety and Health (DISH) under the Factories Act, 1948 and the Maharashtra Factories Rules, 1963.This approval constitutes a substantive pre-operational safety scrutiny mechanism.

The regulatory approval framework administered by DISH, involves a comprehensive and systematic technical appraisal of the proposed hazardous manufacturing process, including pre-operational risk assessment of hazards associated with process, evaluation of process control systems together with preventive and mitigative safeguards, verification of reactor safety systems and Layers of Process Control. The scrutiny further extends to critical safety parameters such as hazard zoning and facility siting, adequacy of ventilation, provision of emergency exits, safe placement of reactors and storage areas, compatibility and segregation of stored chemicals, and the engineering design and adequacy of piping, venting, pressure relief, and containment systems.

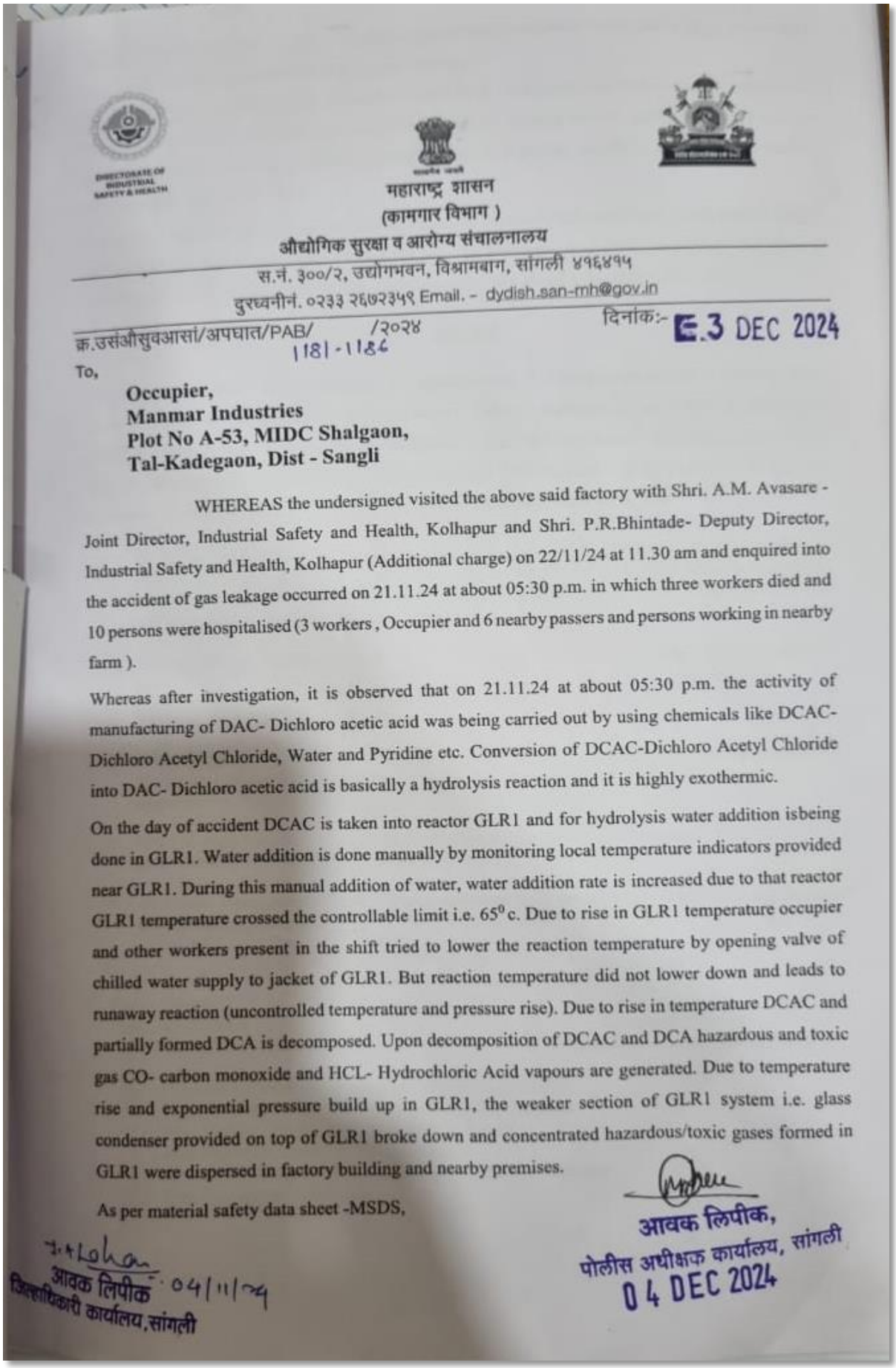
In the present case, the occupier commenced operations without obtaining the requisite statutory approvals, thereby bypassing this essential regulatory mechanism of technical oversight. The absence of such mandatory scrutiny deprived the process of a fundamental preventive control layer intended to ensure incorporation of robust

engineering controls, interlocks, pressure relief arrangements, containment measures, and emergency preparedness systems prior to commencement of production activities. The failure to secure the mandatory approvals consequently undermined the implementation of legally required safety safeguards and materially contributed to the uncontrolled reaction, accidental release of hazardous and toxic gases, and the resulting injuries and fatalities.

In response to the query concerning the implementation of precautionary measures, it is respectfully submitted that the factory management has been prohibited from operating the factory premises till the completion of remedial measures suggested herewith. A closure order has been issued under Section 40(2) of the Factories Act, 1948, directing the occupier/manager not to commence the aforesaid hazardous process in the plant/factory or to resume any manufacturing operations until full compliance with all conditions stipulated in the said order, including adherence to statutory safety requirements, is ensured and duly verified by the Directorate of Industrial Safety and Health (DISH). A copy of the said order dated 03.12.2024 is annexed herewith and marked as Annexure–1.

It is further submitted that, as on date, no response or compliance report has been received from the occupier or the management of the factory with regard to the fulfillment of the conditions prescribed in the closure order. As reported, the factory remains closed and no manufacturing activities are being carried out in the premises from the date of accident to till yet. The closure order for stopping manufacturing activity is enclosed herewith.

Annexure



महाराष्ट्र शासन
(कामगार विभाग)
औद्योगिक सुरक्षा व आरोग्य संचालनालय
स.नं. ३००/२, उद्योगभवन, विश्रामबाग, सांगली ४१६४१५
दुरध्वनीनं. ०२३३ २६७२३५९ Email. - dydish.san-mh@gov.in

क्र.उसंऔसुवआसां/अपघात/PAB/ /२०२४ 1181-1184 दिनांक:- 03 DEC 2024

To,

Occupier,
Manmar Industries
Plot No A-53, MIDC Shalgaon,
Tal-Kadegaon, Dist - Sangli

WHEREAS the undersigned visited the above said factory with Shri. A.M. Avasare - Joint Director, Industrial Safety and Health, Kolhapur and Shri. P.R.Bhintade- Deputy Director, Industrial Safety and Health, Kolhapur (Additional charge) on 22/11/24 at 11.30 am and enquired into the accident of gas leakage occurred on 21.11.24 at about 05:30 p.m. in which three workers died and 10 persons were hospitalised (3 workers , Occupier and 6 nearby passers and persons working in nearby farm).

Whereas after investigation, it is observed that on 21.11.24 at about 05:30 p.m. the activity of manufacturing of DAC- Dichloro acetic acid was being carried out by using chemicals like DCAC-Dichloro Acetyl Chloride, Water and Pyridine etc. Conversion of DCAC-Dichloro Acetyl Chloride into DAC- Dichloro acetic acid is basically a hydrolysis reaction and it is highly exothermic.

On the day of accident DCAC is taken into reactor GLR1 and for hydrolysis water addition isbeing done in GLR1. Water addition is done manually by monitoring local temperature indicators provided near GLR1. During this manual addition of water, water addition rate is increased due to that reactor GLR1 temperature crossed the controllable limit i.e. 65^0 c. Due to rise in GLR1 temperature occupier and other workers present in the shift tried to lower the reaction temperature by opening valve of chilled water supply to jacket of GLR1. But reaction temperature did not lower down and leads to runaway reaction (uncontrolled temperature and pressure rise). Due to rise in temperature DCAC and partially formed DCA is decomposed. Upon decomposition of DCAC and DCA hazardous and toxic gas CO- carbon monoxide and HCL- Hydrochloric Acid vapours are generated. Due to temperature rise and exponential pressure build up in GLR1, the weaker section of GLR1 system i.e. glass condenser provided on top of GLR1 broke down and concentrated hazardous/toxic gases formed in GLR1 were dispersed in factory building and nearby premises.

As per material safety data sheet -MSDS,

आवक लिपीक,
पोलीस अधीक्षक कार्यालय, सांगली
04 DEC 2024

आवक लिपीक
जिल्हाधिकारी कार्यालय,सांगली
04/11/24

DCAC chemical can cause severe skin burns and eye damage and may cause cancer. DCA is corrosive chemical can cause severe skin burns and eye damage.

DCAC and DCA are hazardous & toxic Chemicals & hydrolysis reaction is highly exothermic reaction. So it is an imminent danger to the life of workers working there if special safety precautions are not taken while carrying out manufacturing process & if DCAC and DCA leaked or decomposed and workers get exposed to that.

In a view of above I, Shri. Pravin A. Bondar, Assistant Director- Industrial Safety and Health, Sangli and an Inspector appointed under section 8(1) of The Factories Act, 1948. in exercise the powers vested to me under section 40(2) of The Factories Act, 1948 passing the following order:

ORDER

With immediate effect, the all activities of manufacturing of Dichloro Acetic Acid and any other processes involving use of DCAC –Dichloro Acetyl Chloride shall not carried out in the building and plants of above factory. The activity of manufacturing of Dichloro Acetic Acid using the and any other process involving use of DCAC –Dichloro Acetyl Chloride shall not be started in the building and plants of above mentioned factory unless following measures are compiled: -

- A valid Factory licence is obtained from Directorate of Industrial safety and health, by submitting the details of the raw materials, intermediate products, finished products, quantities, methods of storages, hazards, safety measures, and arrangements for trade- waste and effluents, the likely hazards and the methods to disposal etc.
- For reactors used in factory proper reaction parameters (Pressure and level) monitoring devices provided.
- Effective scrubbing system provided.
- Safety Audit shall be carried out through Certified Safety Auditor as per provisions of The Maharashtra Factories (Safety Audit) Rules, 2014 and recommendations there of shall be implemented. Report of same shall be submitted to this Office.
- HAZOP study for every process carrying out in the factory shall be carried out by expert and recommendations thereof shall be complied with.
- An Onsite Emergency Plan for various scenarios shall be carried out and recommendations thereof shall be complied with.

(P.A.Bondar)
Assistant Director
Industrial Safety and Health ,Sangli

Place : Sangli
Date : 03/12/2024
Time : 05:30 P.M

Copy submitted for kind information and necessary action to:-
1 .Hon. Director- Industrial Safety and Health , Mumbai
2. Hon. District Magistrate and Collector , Sangli
3. Hon. Superintendent of Police, Sangli
4. Hon. Joint Director, Industrial Safety and Health, Kolhapur
5. Police Inspector- Kadegaon