

Standard Operating Procedure (SOP) *for* Cleaning of Sewers and Septic Tanks



Central Public Health and Environmental Engineering Organization (CPHEEO)

Ministry of Housing and Urban Affairs
Government of India

www.amrut.gov.in

November 2018



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Message

हरदीप एस पुरी
HARDEEP S PURI



सत्यमेव जयते



Message

आवासन और शहरी कार्य
राज्य मंत्री (स्वतंत्र प्रभार)
भारत सरकार
**MINISTER OF STATE (I/C)
HOUSING AND URBAN AFFAIRS
GOVERNMENT OF INDIA**

For the past many years, Ministry of Housing and Urban Affairs has taken various steps to facilitate States/ UTs to eliminate manual scavenging by providing central assistance to them for switching over to mechanized cleaning of sewers and emptying of septic tanks.

This Standard Operating Procedure (SOP) contains procedures to be followed during mechanical and manual cleaning of sewers and emptying of septic tanks. Efforts have been made to make this SOP easily adoptable by the Urban Local Bodies (ULBs). The SOP will be useful not only for the ULBs across the Country, but also for the individual, contractors, cleaning workers and private stakeholders.

I take this opportunity to congratulate the concerned officers in the Ministry for bringing out this user-friendly SOP.

New Delhi
16 November 2018

(Hardeep S Puri)

Foreword

दुर्गा शंकर मिश्र

सचिव

Durga Shanker Mishra

Secretary



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FOREWORD

As per the 2011 Census, 81.4% households had toilet facilities within their premises. Out of this, 32.7% households had water closets connected to sewer system and 38.2% households were having water closets with septic tank. This percentage of households having water closets with septic tank have increased drastically in the last four years due to conversion of insanitary latrines into sanitary latrines and construction of sanitary toilets for individual and public under Swachh Bharat Mission – Urban (SBM-U).

2. Further, a huge amount of sewerage infrastructure is being developed under Atal Mission for Rejuvenation and Urban Transformation (AMRUT) in the past three years. This SOP together with the Manual on Sewerage and Sewage Treatment Systems, 2013, wherein, the different methods of mechanized & manual cleaning of sewers & septic tanks are discussed, will provide requisite guidance for officials to switch over to mechanized cleaning and eliminate human casualties.

3. I believe that this SOP will go a long way in improving the working condition of all those involved in operation and maintenance of sewers and emptying of septic tanks. I hope Municipalities / Municipal Corporations will make extensive use of this SOP to mitigate the current miseries. I welcome suggestions from stakeholders and experts to further improve it on email: vk.chaurasia@nic.in

(DURGA SHANKER MISHRA)

New Delhi
November 15, 2018

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1 INTRODUCTION

As per the 2011 census, the share of urban population is 31.2% as against 28% of 2001 census of the total population of the country which is expected to be 50% by 2050. This increase in population has created a significantly enhanced demand on urban sanitation, inter alia. As per the 2011 Census, 81.4% households have toilet facilities within their premises. Out of this, 32.7% households have water closets connected to sewer system and 38.2% households are having water closets with septic tank. Remaining 18.6% households do not have toilet facilities within their premises. However, at present under Swachh Bharat Mission (Urban), the toilet facilities have significantly improved at present all the cities and towns are expected to be open defecation free before 2nd October 2019.

Government of India had notified Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 and Rules 2013. As per the Rules, for the purposes for removal of submersible pump sets fixed at the bottom of the suction wells at sewage pumping stations, reconstruction of manhole, rectification of the sewer main, before allowing entry of a person in the sewer, sewage shall be totally emptied.

Working near or in a manhole inherits potential dangers which may result in serious accidents and in some extreme cases, loss of life as well. The common accidents include falls/ slips, fire or explosion, oxygen depletion, gas poisoning, heat stress, drowning, asphyxiation arising from gas, fume, vapour and entrapment by free-flowing solids. Amongst these, dangerous gases are easily overlooked or neglected, leading to serious casualties.

The health and safety of personnel can be safeguarded to a great extent by use of safety equipment and by taking precautions appropriate for each hazard condition. In order to cater the issues of hazardous cleaning, this Standard Operating Procedure (SOP) discusses on the precautionary steps to be followed while cleaning of sewers and desludging of septic tanks. Further, the document also enlightens ideas on various mechanized sewer & septic tank cleaning

procedure and technologies to eradicate hazardous cleaning. This SOP may also be read in conjunction with Act and Rules, in case of any clarification.

2 SCOPE

The scope of the SOP is to impart the knowledge into the stakeholders about the cleaning of sewers and emptying of septic tanks before and after the assignment. This document would be found useful by all Urban Local Bodies (ULBs), Public Health Engineering Departments and other agencies engaged in the process of cleaning of sewers / emptying of septic tanks across the country. Further, the procedures mentioned in SOP shall also be applicable to the contractors who employ person(s) for cleaning of sewers/ emptying of septic tanks and the individuals who hire such person(s) for cleaning their sewers/ emptying of septic tanks in their premises. States/UTs shall publish this SOP in local language for better understanding of the concerned agencies and individual, as per the necessity.

3 OBJECTIVE

The main objective of this SOP is to eliminate hazardous cleaning or at least to avoid the accidents due to improper practice of cleaning of sewers/ emptying of septic tanks, thereby, preventing human casualties. Further, the SOP intends to prevent the risk of acquiring diseases to the concerned person because of following the unhygienic & unscientific working procedures. This SOP also provides information on protective gears, their applicability to sewers /septic tanks cleaning, emergency preparedness, emergency due to toxic gas emission, precaution due to gas hazard & infection, precaution due to vehicular traffic, responding to sewers/ septic tanks overflows by field workers/ employees in case of crisis, responsibility to stakeholders and so on.

4 INITIATIVES TAKEN BY GOVERNMENT OF INDIA

(i) Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

The “Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013” described “hazardous cleaning” by an employee, in

relation to a sewer or septic tank, means its manual cleaning by such employee without the employer fulfilling his obligations to provide protective gear and other cleaning devices and ensuring observance of safety precautions, as may be prescribed or provided in any other law, for the time being in force or rules made thereunder.

Further, the Act defined that a person engaged or employed to clean excreta with the help of such devices and using such protective gear, as the Central Government may notify in this behalf, shall not be deemed to be a 'manual scavenger'. It is the duty of every local authority and other agency to use appropriate technological appliances for cleaning of sewers, septic tanks and other spaces within their control with a view to eliminate the need for the hazardous cleaning.

Main features of the Act are

- a) Definitions of manual scavengers and insanitary latrines widened to cover not only dry latrines but other insanitary latrines as well.
- b) Offences under the Act are cognizable and non-bailable and attract stringent penalties.
- c) Vigilance/Monitoring Committee at sub-Division, District, State and Central Govt. levels.
- d) National Commission for Safai Karamcharis (NCSK) would, inter alia, monitor implementation of the Act and enquire into complaints regarding contravention of the provisions of the Act.
- e) Provision of construction of adequate number of sanitary community latrines in urban areas, within three years from the date of commencement of this Act to eliminate the practice of open defecation.

(ii) Prohibition of Employment as Manual Scavengers and their Rehabilitation Rules, 2013

Prohibition of Employment as Manual Scavengers and their Rehabilitation Rules, 2013 has been notified by Ministry of Social Justice and Empowerment under the provisions of Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013. As per the Rules, no person shall be allowed to clean a sewer manually, with the protective gear and

safety devices except

- a) for the removal of concrete or FRP (Fibre Reinforced Plastic) or damaged manhole door where mechanical equipment's cannot be put into operation;
- b) for inter-linking the newly laid sewer main with the existing sewer main, in case of sewer of size more than 300 mm diameter,
- c) for removal of submersible pump sets fixed at the bottom of the suction wells of sewage pumping stations / STP
- d) for the reconstruction of the manhole or rectification of the sewer main,
- e) Any circumstance, when it is absolutely necessary to have manual sewage cleaning, after Chief Executive Officer (CEO) or Head of the Local Authority has permitted to do so after recording in writing the specific valid reasons for allowing such cleaning;

The Rules requires to monitor and oversee the survey of manual scavengers at District and State level, District Level Survey Committee. It mandates a State Level Survey Committee should be constituted, and to publish final consolidated list of manual scavengers in the State.

(iii) Swachh Bharat Mission – Urban (SBM-U)

Swachh Bharat Mission – Urban (SBM-U) is under implementation in all urban areas with the objective to make urban areas open defecation free by converting the insanitary latrines into sanitary latrines and providing individual household latrines, community and public latrines with urinals. The Mission also includes awareness creation among the various stakeholders through Information, Education & Communication (IEC) & Public Awareness activities.

(iv) Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) a Centrally Sponsored Scheme is under implementation with the development of basic urban infrastructure including sewerage and septage management in 500 cities/towns in the country. Government of India is

providing financial assistance to all States/UTs for creation of infrastructure and mechanized cleaning of sewers and septic tanks.

(v) Manual on Sewerage and Sewage Treatment Systems, 2013

Ministry of Housing and Urban Affairs has published 'Manual on Sewerage and Sewage Treatment Systems, 2013', wherein the different methods for mechanized & manual cleaning of sewers & desludging the septic tank without human interventions are discussed and may be referred to.

(vi) IS 11972 – 2002: Code of Practice For Safety Precautions To Be Taken When Entering A Sewerage System

This standard lays down guidelines for selection of sewer men and safety measures against gas hazard, infection with a view to provide some basic guidance for selection of employees for sewer cleaning and proper job instructions for safe working in a sewerage system.

5 CLEANING OF SEWERS

Mechanical cleaning of sewers is the most preferred method and shall be employed to the extent possible. Manual entry for hazardous cleaning of sewers is completely banned as per the Prohibition of Employment as Manual Scavengers and their Rehabilitation Rules, 2013 & Rules, 2013. To operate and maintain a sewer collection system to function as intended, the maintenance engineer should try to strive towards the objectives to minimize the number of blockages per unit length of sewer, and to minimize the number of odour complaints. For this purpose, sewer-cleaning using hydraulic or mechanical cleaning methods needs to be done on a scheduled basis to remove accumulated debris in the pipe such as sand, silt, grease, roots and rocks.

5.1 Cleaning Frequency

The frequency of cleaning of sewers is based on the prevailing local conditions and determined through field inspections & complaints received from the residents of the area. However, it is desirable to clean the sewer at least once in every 6 months (ideally once just before monsoon season). Inspections and

examinations of the sewers and septic tanks shall be made before to start the cleaning which is explained in SOP.

5.2 Procedures for Cleaning of Sewers

5.2.1 Mechanical

Step 1: Reaching the site

- i. Selection of prospective employees for the sewer cleaning should take into account the duties they will be expected to perform;
- ii. The complete hazard involved in the cleaning activity should be explained clearly to the employees by the supervisor and should get their consent in written before starting cleaning activities;
- iii. A supervisor along with adequate machinery and staff shall reach the designated site, preferably during lean period of sewage flow in sewers;
- iv. The supervisor shall have the names, address and emergency contact information of the staff involved in cleaning the sewers; and
- v. Appropriate protective gears and safety devices shall be worn by the staff before beginning the work of cleaning the sewers.

Step 2: Identification and isolation of the area

- i. Identify the stretch to be cleaned and identify the manholes associated with the stretch;
- ii. Barricade the area where cleaning is to be carried out; and
- iii. A flag man shall be stationed at least 15 m ahead of the site and should be visible to incoming traffic for at least 150 m.
- iv. Cones (similar to the one used by police) shall be placed on the road.

Step 3: Verify the presence of any gases or other hindrances

- i. Ventilate the sewer line by opening 2-3 manholes on both sides of the working stretch for at least 1 hour prior to start of the work to ensure escape of toxic gases; The worker opening the manhole must not bend down into the opened manhole and this may cause his getting overcome by Hydrogen Sulphide and even tripping into the manhole.

- ii. Use gas monitor, detector lamp, wet acetate paper or gas detector masks to detect any residues of poisonous gases like hydrogen sulphide, carbon monoxide, methane and gasoline vapors;
- iii. Insert a long pole with lead acetate paper which will convert to black colour in the presence of hydrogen sulfide. The person shall not try to insert the paper by hand into the manhole.
- iv. If gases are detected, extend waiting period to allow residual gases to escape and to avoid the chance of explosion, in case. Repeat the procedure many times for checking the escape of toxic gases;
- v. Before the start of the cleaning operation, employees shall check for hindrances that may delay the cleaning process; and
- vi. Dummy covers with welded fabric or wire net shall be used to cover the manhole, if required. However, care should be taken to ensure that the cover is strong enough to hold a man's weight.

Step 4: Removal of silt/wax - Mechanical Process

- i. Appropriate machines, at least to the extent specified in this SOP are to be used to remove the silt/wax;
- ii. The operating procedures of these machines shall be strictly followed for cleaning; and
- iii. The manhole cover shall be closed tightly after cleaning.

Step 5: Leaving from the site

- i. All the equipment/machineries along with the protective gears and safety devices that had any direct contact with the sewage shall be cleaned properly as per the cleaning procedure specified by the manufacturer;
- ii. All the equipment, safety gears, barricades etc shall be removed from the working area and the crew shall move to the base or to the next site; and
- iii. The entire operation shall be monitored and documented by the supervisor.

5.2.2 Manual

Step 1: Reaching the site

- i. Selection of prospective employees for sewer cleaning should take into account the duties they will be expected to perform;

- ii. The complete hazard involved in the cleaning activity should be explained clearly to the employees by the supervisor and should get their consent in written before to start cleaning activities;
- iii. A supervisor along with adequate machinery and staff shall reach the designated site, preferably during lean period of sewage flow in sewers;
- iv. The supervisor shall have the names, address and emergency contact information of the staff involved in cleaning the sewers; and
- v. Appropriate protective gears and safety devices shall be worn by the staff before the start of work on cleaning the sewers.

Step 2: Identification and isolation of the area

- i. Identify the stretch to be cleaned and identify the manholes associated with the stretch;
- ii. Barricade the area where cleaning is to be carried out; and
- iii. A flag man shall be stationed at least 15 m ahead of the site and should be visible to incoming traffic for at least 150 m.
- iv. Cones (similar to the one used by police) shall be placed on the road.

Step 3: Verify the presence of any gases or other hindrances

- i. Ventilate the sewer line by opening 2-3 manholes on both sides of the working stretch for at least 1 hour before to start the work to ensure escape of toxic gases;
- ii. The labour opening the manhole must not bend down into the opened manhole and this may cause his getting overcome by Hydrogen Sulphide and even tripping into the manhole.
- iii. Use gas monitor, detector lamp, wet acetate paper or gas detector masks to detect any residues of poisonous gases like hydrogen sulphide, carbon monoxide, methane and gasoline vapours;
- iv. Insert a long pole with lead acetate paper which will convert to black. The person shall not try to insert the paper by hand into the manhole.
- v. If gases are detected, extend waiting period to allow residual gases to escape and to avoid the chance of casualty, in case. Repeat the procedure many times for checking the escape of toxic gases;

- vi. Before to start the cleaning operation, employees shall check for hindrances that may delay the cleaning process; and
- vii. Dummy covers with welded fabric or wire net shall be used to cover the manhole, if required.

Step 4: Removal of silt/clogs/rocks

- i. Identify and close off or re-route the inlet sewage of the identified stretch, if possible;
- ii. Check the oxygen level in the manhole. If it is less than 19.5% or greater than 21% at any of the three levels (i.e., bottom, middle and top), the staffs (is it staffs or personnel) shall not be allowed to enter the manhole;
- iii. Air should be supplied into the manholes or to make provision of ventilation to achieve the desired oxygen level;
- iv. The staff shall wear full bodysuit if entering manholes of more than 5 ft. depth or partial fishing wade suits if entering manholes of less than 5 ft. depth;
- v. All the staffs entering the sewer shall wear helmet attached with head lamp;
- vi. The staff entering the sewer shall preferably wear full-face mask having escape breathing apparatus with at least 10-minute air supply along with other appropriate protective gears and safety devices;
- vii. Safety belt shall be fastened tightly onto their suit;
- viii. The staff shall have extra flashlights and communication devices such as two-way radios;
- ix. The staff shall check for the stability of the manhole walls visually and the strength of the rope ladder and descend into the manhole carefully after getting the permission of the supervisor;
- x. The persons entering the manhole shall be monitored by CCTV cameras or any other suitable mechanism at the ground;
- xi. Clogs/silt/rocks shall be removed by using appropriate machineries/equipment and brought up to ground level and then shall be suitably disposed of at the designated areas;
- xii. Pull the staff out of the manhole after completion of cleaning activities;
- xiii. Manhole lid shall be closed tightly after cleaning; and



- xiv. At a stretch, a duration not exceeding 90 minute shall be taken for cleaning the sewers and a mandatory interval of 30 minute shall be given to the staff involved in cleaning between two intervals.

Step 5: Leaving from the site

- i. All the equipment/machineries along with the protective gears and safety devices that had any direct contact with the sewage shall be cleaned properly as per the cleaning procedure specified by the manufacturer;
- ii. All the equipment, safety gears, barricades etc shall be removed from the working area and the crew shall move to the base or to the next site; and
- iii. The entire operation shall be monitored and documented by the supervisor.

6 EMPTYING OF SEPTIC TANKS

6.1 Emptying Frequency

Regular emptying of septic tanks through a systematic extraction and collection procedure is essential to check environmental pollution. The frequency of emptying is determined by the local conditions including loading rate and performance of septic tanks. However, it is ideal to clean the septic tanks once in one year or two years based on its design criteria. But in no case the cleaning frequency shall exceed two years.

6.2 Procedures followed for Emptying of Septic Tanks

- (i) Inform the occupant of the pending service and note any concerns or issues;

- (ii) Inspect the site for possible hazards, such as clearing the area of people, or identifying high groundwater that could cause a tank to 'float', if emptied;
- (iii) Park the truck as close to the septic tank as possible. The maximum distance is determined by the length of hose and elevation rise from the bottom of the pit or septic tank to the vacuum truck. This should typically be not more than 25 meters in linear distance and 4 meters in elevation gain. In case, the length and elevation is more than the specified, intermediate pumping may be required;
- (iv) Break the mortar seal of the septic tank lid. Inspect the tank for cracks or damage before and after the emptying of tank;
- (v) Lay out and connect the hoses from the truck to the tank or pit to be emptied and secure the truck using wheel chocks;
- (vi) It is essential to ensure that the hose is in sound condition, and that the hose connections are locked into place prior to using this method;
- (vii) Follow the safety instruction as prescribed in above section of mechanical cleaning of sewers;
- (viii) Open the tank or pit by removing the access ports or covers over the storage system;
- (ix) Engage the vacuum equipment by using a power take-off from the truck's transmission;
- (x) Increase the vacuum to the proper level with the valve closed by watching the vacuum gauge, then lowering the end of the hose into the septic tank, and open the valve sufficiently such that the faecal sludge is drawn out of the tank or pit;
- (xi) Break up faecal sludge that has agglomerated into a solid mass, either by making use of a long handle shovel and adding water when necessary;
- (xii) Operators shall leave behind sludge not less than 25 mm in depth in the bottom of the septic tank as this will act as the seeding material.
- (xiii) Identify any abnormal conditions, such as high concentration of non-biodegradable materials, oils and grease before taking to the treatment plant for final disposal;
- (xiv) If the cover of the tank has been removed, it should be replaced and sealed with cement plaster. If desludging has been carried out through a desludging hatch, the cover of the hatch should be replaced and sealed with cement plaster;
- (xv) Clean up any spillage using proper sorbent materials. The top of the cover and the area around the septic tank is sprayed with 1 % chlorine solution;
- (xvi) Two sets of working clothes will be provided for each worker, which should be dedicated to be used only during the desludging process. Clothes worn during the desludging process should be removed before the workers return home;
- (xvii) Prepare a written report indicating: how much waste was removed; the condition of the tank or pit; any recommendations for repairs or maintenance; any recommendations for proper use of the system;
- (xviii) Inform the client that the work is complete, and give them the final report along with recommendations, if any
- (xix) The final report shall also be entered in the computer in the ULB so as to provide a database and to also know about the next emptying date, etc
- (xx) Remove the wheel chocks and drive the truck to the next site or to the nearest approved disposal Site.

7 EMERGENCY PREPAREDNESS

- i. Emergency plan to execute the work shall be prepared before arriving at the site
- ii. The supervisor and all the crew members involved in sewer cleaning should be familiarized with the emergency plan;
- iii. A tripod attached with rope & pulley and harness or some other suitable system shall be put in place for retrieving the injured worker
- iv. A first aid kit distinctly marked with a red cross on white back ground shall be readily available at the site which should at least have the items listed in Annexure-I.
- iv. Wash-up material like soap & skin cream for applying on the body shall be adequately available at the site.

- v. A list of medical care centers available near the site may be prepared and made readily available;
- vi. Vehicle preferably an ambulance shall be available at the site for carrying the injured worker(s) to the hospital, in case of any emergency.

8 GAS EMERGENCY

- i. If a gas emergency occurs everyone should immediately put on their escape sets (breathing apparatus) and raise the alarm.
- ii. The men at the ground level are trained rescuers and they shall immediately send down the rescue sets and await the men working in sewer to come out. The men at the ground level shall attempt to rescue the man inside sewer with all the equipment at their disposal.
- iii. If there is a casualty, he (should be propped up out of sewage in a comfortable position. Immediately call the emergency services (ambulance, fire brigade). When the victim has the gas mask on the face and if he is breathing, a rescuer should always be with him because he may vomit thereby choking the supply of oxygen.
- iv. Guidelines for giving first-aid to a gas victim are given below:
 - a. Remove him to fresh air as soon as possible.
 - b. Apply artificial respiration with an oxygen resuscitation if he is not breathing. If one is not available, apply mouth to mouth breathing; and
 - c. Keep him lying down and wait for an ambulance.

9 PRECAUTIONS

9.1 Precautions against Gas Hazards

When a sewer or a manhole is required to be entered for cleaning or clearing an obstruction, where dangerous gas or oxygen deficiencies may be present, the following precautions shall be taken:

- i. The following shall not be allowed, (a) smoking, (b) open flames and (c) spark.
- ii. Erect warning signs.
- iii. Use only safety gas-proof electric lighting equipment or mirror for reflection of light.
- iv. Test the atmosphere for noxious gases and oxygen deficiencies. In case of scum formation the sewage and sediments in the manhole should be agitated with the help of rod or any other suitable instrument for trapped gases and

the manhole should be checked for noxious gases and oxygen deficiencies.

- v. If the atmosphere is normal, workmen may enter with a safety belt attached and with at least two men available at the ground level. For extended jobs, the gas tests shall be repeated every three minutes while men are in the sewer.
- vi. If oxygen deficiency or noxious gas is found, the structure shall be ventilated with pure air by keeping open at least one manhole cover each on upstream and downstream side for quick exit of toxic gases or by forced ventilation using a portable blower. The gas tests shall be repeated before entering. Adequate ventilation shall be maintained during the work and the gas test shall be repeated every three minutes.
- vii. If the gas or oxygen deficiency is present and it is not practicable to ventilate adequately before workers enter, hose masks shall be worn and extreme care shall be taken to avoid all sources of ignition. Workers shall be taught how to use the hose equipment. In these cases, they shall always use permissible safety lights (not ordinary flash lights) rubber boots or non-sparking shoes and non-sparking tools.
- viii. Workmen descending a manhole shaft to inspect or clean sewers shall try each ladder step or rung carefully before putting the full weight on it to guard against insecure fastening due to corrosion of the rung at the manhole wall. When work is going on in deep sewers, at least two men shall be available for lifting workers from the manhole in the event of serious injury, and
- ix. Portable air blowers, for ventilating manhole, are recommended for all tank, pit or manhole work where there is a possibility of presence of noxious gas, vapours or oxygen deficiency. The motor of these air blowers shall be of weatherproof and flameproof type, compression-ignitions-diesel type (without sparking plug). These shall be placed not less than 2m away from the opening and on the leeward side protected from wind so that they will not serve as a source of ignition for any inflammable gas which may be present. Forced type ventilation should be provided by blower located at ground level with suitable flexible ducting to displace the air from the manhole.

9.2 Precautions against Infection

The personnel working in sewerage maintenance systems are prone to infections and hence the following precautions should be taken:

- i. The workers should be educated about the hazards of waterborne diseases such as typhoid and cholera through sewage and tetanus through cuts and wounds. Cuts and grazes should be covered with waterproof plasters. Effective immunization of workers against diseases such as typhoid, cholera, tetanus, etc. should be done by vaccination.
- ii. The importance of personal hygiene should be emphasized and the worker should be instructed to keep finger nails short and well-trimmed, wash hands with soap and hot water before taking food and to keep fingers out of nose, mouth and eyes, because the hands carry most infection.
- iii. Use of rubber gloves shall be insisted so that sewage or sludge does not come in direct contact with hand. Before starting work, skin likely to be exposed to sewage should be covered with barrier cream.
- iv. The worker should be provided with a complete change of work clothes to be worn during working hours. Gum boots should also be provided for the workers.
- v. When the work is completed, thoroughly wash all contaminated parts of the body.

9.3 Precautions to be taken while working near Vehicular Traffic

- i. Workers (on foot) exposed to vehicular traffic must wear fluorescent flagging garments.
- ii. Workers shall not wear any type of headgear that can interfere with hearing back up alarms, warnings, etc.
- iii. When hazards to workers exist because of vehicular traffic, use traffic controls in conformance with the Local Transport Authority.
- iv. Additionally, controls such as detours, warning signs, or barricades shall be used when necessary. Flagmen are required where these controls are ineffective.
- v. Wherever mobile equipment operation encroaches upon a public thoroughfare, a system of traffic controls must be used.

10 PROTECTIVE GEARS AND SAFETY DEVICES

All the protective gears and safety devices shall be checked once in every six months and repaired/replaced as necessary. Proper inventory of all the protective and safety gears to be maintained. The following (refer table 1) are the protective gears and safety devices, but not limited to, as prescribed by Prohibition of Employment as Manual Scavengers and their Rehabilitation Rules, 2013 to prevent any hazardous entry of humans into the sewers.

11 GUIDANCE FOR SELECTION OF SEWER/ SEPTIC TANK CLEANING EMPLOYEES

11.1 Requirements for Duties Not Requiring Entry into Confined Space

No specific requirements except a routine medical examination shall be made. Those with the following disabilities shall not be selected as any of the disease involves risks to the health and safety of both the prospective employee and/or other employees:

- a) History of fits, blackouts, fainting attacks;
- b) Chronic skin disease; and
- c) Meniers disease or diseases involving loss of balance.

11.2 Requirements for Duties Requiring Entry into Confined Space

Persons considered for employment in confined spaces shall be physically fit and capable of understanding training given. Those with the undernoted disabilities shall not be recruited for this type of work and those who contract these should cease to be employed in this capacity:

- a) A history of fits, blackouts or fainting attacks;
- b) A history of heart disease or disorder;
- c) High blood pressure;
- d) Asthma, bronchitis or a shortness of breath on exertion;
- e) Deafness;
- f) Meniers disease or disease involving giddiness or loss of balance;
- g) Claustrophobia or nervous or mental disorder;
- h) Back pain or joint trouble that would limit mobility in confined spaces;

Table 1

S. No.	Protective gears and safety devices	S. No.	Protective gears and safety devices
1.	Air compressor for blower	2.	Airline breathing apparatus
3.	Airline respirator with manually operated air blower	4.	Air purifier gas mask/chin cortege
5.	Artificial respiration/reticulate	6.	Barrier caution tape
7.	Barrier cream	8.	Barrier cone
9.	Blower	10.	Breath mask
11.	Breathing apparatus	12.	Caution board
13.	Chlorine mask	14.	Emergency medical oxygen resuscitator kit
15.	First aid box	16.	Face mask
17.	Gas monitor (4 gases)	18.	Guide pipe set
19.	Full body wader suit	20.	Fishing wader suit attached with boots
21.	Hand gloves	22.	Head lamps
23.	Helmet	24.	Helmet demolishing
25.	Lead acetate paper	26.	Life guard pad
27.	Modular airlines supply trolley system	28.	Normal face mask
29.	Nylon rope ladder – 5 m	30.	Nylon safety belt
31.	Pocket book	32.	Port oxy
33.	Raincoat	34.	Reflecting jacket
35.	Safety belt	36.	Safety body clothing
37.	Safety body harness	38.	Safety goggles
39.	Safety gumboots	40.	Safety helmets
41.	Safety showers	42.	Safety torch
43.	Safety tripod set	44.	Search light

- i) Deformity or disease of the lower limbs limiting movement;
- j) Chronic skin disease;
- k) Serious defects in eyesight; and
- l) Lack of sense of smell.

Employees should be medically re-examined at reasonable intervals, taking into account the person's age and duties.

12 TYPE OF INSPECTIONS AND EXAMINATIONS OF SEWERS

Inspection and examination are the techniques used to gather information to develop operation and maintenance programs to ensure that new and existing collection systems serve their intended

purposes on a continuing basis. Inspection and testing are necessary to identify existing or potential problem areas in the collection system, evaluate the seriousness of detected problems, locate the position of problems, and provide clear, concise, and meaningful reports to supervisors regarding problems. There are two basic types of inspection and examination i.e., direct and indirect described below

12.1 Direct Method

Direct method is performed through direct visual inspection by the inspector who enters into the manhole with proper safety gear as prescribed. This shall never be done once a sewer has been put into service.

12.2 Indirect Method

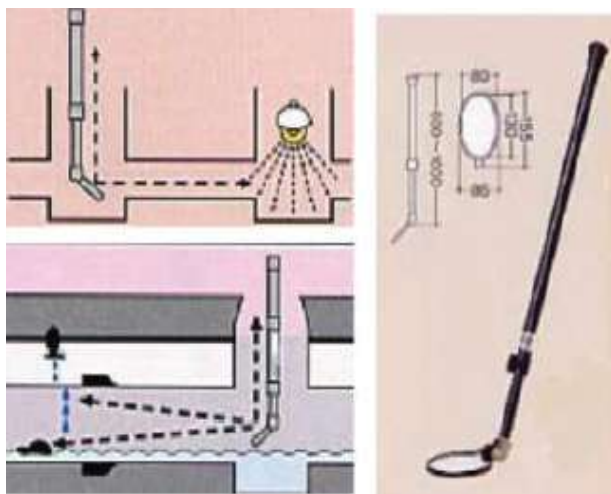
CPHEEO’s Manual on Sewerage and Sewage Treatment Systems, 2013 prescribes various methods of indirect inspection of sewer lines. Sewer system inspection technologies that are considered applicable to Indian conditions by the Manual are as follows:

Table 2

S. No.	Technology	Applicability	
		Sewer size	Sewer condition
1	Light and Mirror	Up to 300 mm	Empty
2	Closed Circuit Camera	Any Size	Empty
3	Sonar Systems	Any Size	Full Flowing

12.2.1 Light and Mirror Method

Two successive manholes are opened and vented sufficiently for about an hour. Thereafter, a long hand-held mirror secured at 45 degrees to the handle is lowered into the bottom of the manhole and a torch light is focused on the mirror from above so that the light beam is deflected by 90 degrees to travel horizontally through the sewer pipe and the light is seen in the opposite manhole. This is easier at dusk. This can tell whether the bore of the pipe is choked or clear or laid straight.



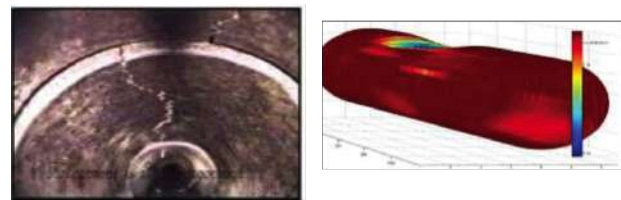
12.2.2 Closed Conduit Camera Method

The closed circuit camera is propelled through the sewer by a remote controlled wired power supply from a van and travels through the sewer and relays the picture of the inside to a TV in the van. The CCTV

inspection can be used for sewer lines as small as 100 mm. Above 900 mm diameter there are limitations due to lighting problems and camera line angles. The traction of the cameras is provided either by pulling winches, by pushing or self-traction. The former two are not used much at present. However, self-traction is suitable for use in sewers above 225 mm diameter.

12.2.3 Sonar System

The sonar system is similar. A robot is sent through the sewer and it emits high frequency sound waves, which impinge on the pipe surfaces and returns to the emitter as a reflection. By knowing the material of construction of the sewer pipe walls, this can be programmed to verify the structural condition of the wall of the sewers.



Photographs showing Structural Damage and Longitudinal cracked condition of the Sewer

13 METHODS OF CLEANING SEWERS AND SEPTIC TANKS

Mechanical means of cleaning sewers is most preferred method and shall be employed wherever possible. Manual entry into the sewers shall be avoided as far as possible and shall be employed only in inevitable cases, that too with proper protective gears & other cleaning devices and ensuring observance of safety precautions. In no case hazardous cleaning of sewers shall be entertained by the ULBs or by private contractors as Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 completely ban of hazardous cleaning of sewers.

Most often de-silting machines and jetting/suction machines are employed by larger ULBs in the Country for cleaning their sewers. Various sewer cleaning methods are described in the CPHEEO Manual on Sewerage and Sewage Treatment Systems, 2013. Some of them are described below. However, the Manual may be referred for further information in this regard.

13.1 Manual Methods

13.1.1 Manila Rope and Cloth Ball

The most common way of cleaning small diameter sewers up to 300 mm diameter is by the use of a manila rope and cloth ball. Flexible bamboo strips tied together are inserted in the sewer line by a person on top. If necessary, another person inside the manhole with full safety gears, precautionary measures and safety equipment help in pushing the rod through the sewer line. When the front end of the bamboo strip reaches the next manhole, a thick manila rope, with cloth ball at one end, is tied to the rear end of the bamboo splits. The bamboo splits are then pulled by another person in the downstream manhole and pushed through the sewer line. As the rope is pulled, the ball sweeps the sewer line and the accumulated grit is carried to the next manhole where it is removed out by means of buckets. This operation is repeated between the next manholes until the stretch of sewer line is cleaned. This action requires careful supervision.

13.1.2 Sectional Sewer Rods

These rods are used for cleaning small sewers. The sewer rods may be of bamboo or teak wood or light metal usually about one-meter-long at the end of which is a coupling, which remains intact in the sewer but can be easily disjointed in the manhole. Sections of the rods are pushed down the sewer.

The front or the advancing end of the sewer rod is generally fitted with a brush, a rubber ring for cleaning or a cutting edge to cut and dislodge the obstructions. These rods are also useful to locate the obstruction from either manhole in case a particular portion of the sewer has to be exposed for attending to the problem.

13.1.3 Scraper

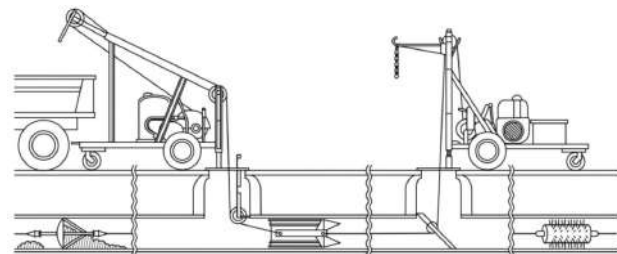
The scraper is an assembly of wooden planks of slightly smaller size than the sewer to be cleaned. The scraper chains, attached to a control chain in the manhole into which it is lowered, are then connected to a winch in the next downstream manhole by means of chains. The winch is then operated to push the debris ahead of the scraper. The upward flow behind the scraper and the water dropping from the

top of the scraper will also assist in pushing it in the forward direction. This ensures that the bottom and the sides of the sewer are cleaned thoroughly. The scraped debris are removed manually.

13.2 Mechanical Methods

13.2.1 Sewer Cleaning Bucket Machine

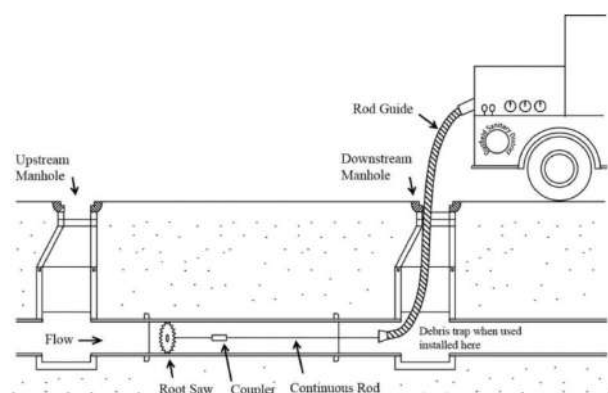
The bucket machine consists of two powered winches with cables in between. For cleaning a section of sewer; the winches are centered over two adjacent manholes. To get the cable from one winch to the other, it is necessary to thread the cable through the sewer line by means of sewer rods or flexible split-bamboo rods. The cable from the drum of each winch is fastened to the barrel on each end of an expansion sewer bucket fitted with closing device, so that the bucket can be pulled in either direction by the machine on the appropriate end. The bucket is pulled into the loosened material to clean the sewer.



Source: EPA, 2003

Power bucket machine setup

13.2.2 Rodding Machine with Flexible Sewer Rods



Power rodding operation

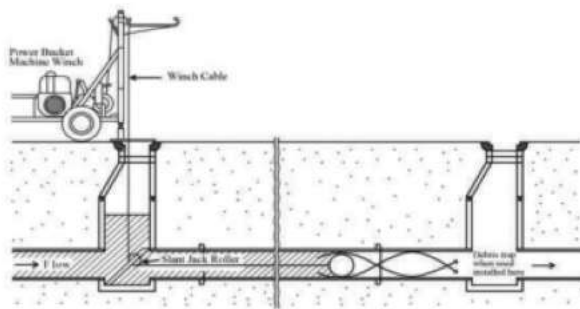
This consists of a machine, which rotates a flexible rod to which is attached a cleaning tool such as auger, corkscrew or hedgehog and sand cups. The flexible

rod is guided through the manhole by a bent pipe. The machine propels the rod with the tool attached to one end, the other end being fixed to the machine. The rod is pulled in and out in quick succession when the tool is engaging the obstruction, so as to dislodge or loosen it. When the obstruction is cleared, the rod is pulled out by means of clamps keeping the rod propelled to facilitate quick and easy removal.

13.2.3 Hydraulically Propelled Devices

The hydraulically propelled devices take advantage of the force of impounded water to effectively clear sewers. The efficiency depends on the hydraulic principle that an increase in velocity in a moving stream is accompanied by a greatly increased ability to move entrained material. The transporting capacity of water varies as the sixth power of its velocity. The common hydraulically propelled devices are as follows:

- (i) Flush Bags
- (ii) Sewer Balls
- (iii) Sewer Scooters



Typical Setup for Hydraulic cleaning using Sewer Ball

13.2.4 Velocity Cleaners (Jetting Machines)

The high velocity sewer-cleaner makes use of high velocity water-jets to remove and dislodge obstructions. It combines the functions of a rodding machine and gully emptier machine. It includes a high-pressure hydraulic pump capable of delivering water at variable pressure up to about 8 MPa through a flexible hose to a sewer cleaning nozzle. The nozzle has one forward facing jet and a number of peripheral rearward facing jets. The high-pressure water coming out of the holes with a high velocity, breaks up, dislodges the obstructions and flushes the materials down the sewer. Moreover, by varying the pressure suitably, the nozzle itself acts as a jack-hammer and

breaks up stubborn obstructions. A separate suction pump or airflow device may also be used to suck the dislodged material. The entire equipment is usually mounted on a heavy truck chassis with either a separate prime mover or a power take off for the suction device. The truck carries secondary treated sewage, if available, and if not untreated fresh water for the hydraulic jet. The truck also has a tank for the removed sludge and various controls grouped together for easy operation during sewer cleaning.

Now-a-days, Mini jetting machines are also available in the market which can travel into narrow lanes and clean the sewer lines up to a length of 200 feet (60 meters).

13.2.5 Dredger (Clam-shell) - for manhole cleaning

It consists of a grab bucket on a wire rope, which is lowered into the manhole in an open condition with the help of a crane and pulley. On reaching the bottom of the manhole, the segments are closed, and the accumulated silt is picked up. The bucket can be closed by wire ropes or by a pneumatically operated cylinder.

13.2.6 Gully Emptier (Suction Units)

Suction units create the vacuum required for siphoning of mud, slurry, grit and other materials. The vacuum elevated is such as to siphon the materials from the deep manholes catch-pits etc, having depth ranging from 1m to 8m in normal cases with an option to suck an additional 4m with the help of special accessories for the purpose. The unit can be vehicle or trolley mounted. Silt and heavy particles settled at the bottom can be agitated and loosened by pressurized air with the help of the pump and then sucked in a tank.

14 ROLES & RESPONSIBILITIES

14.1 Urban Local Bodies (ULBs)

- i. ULBs shall authorize the Agencies for providing the cleaning of sewers and septic tanks by mechanical means or by manual means, in case, for private as well as public sewerage systems including pumping wells;

- ii. A list of registered agencies along with full contact details, trained manpower, availability of equipments, and others shall be made available on public domain;
 - iii. ULBs must conduct survey to identify manual scavengers/ sanitation workers (hazardous cleaning) in their jurisdiction and frame a mechanism to rehabilitate or integrate them to the system formally;
 - iv. The supervisor of the sewer cleaning activity shall be properly trained on the first aid and cardiopulmonary resuscitation procedures by the ULB;
 - v. All the workers involved in cleaning shall be familiarized with the operating procedures of cleaning equipment and emergency procedures by the ULBs;
 - vi. Sewerage system may be mapped on Global Positioning System (GPS) so as to identify and reach the complaint area and perform the activities at the earliest;
 - vii. Training programs on the technique, equipment operation and emergency procedures shall be conducted for them once in every two years;
 - viii. Sufficient copies of the operating procedures of the cleaning machines/ equipment shall be maintained by the ULBs in local language and the copies of the same shall be made available to the field staffs;
 - ix. ULBs shall ensure that all cleaning staff undergoes regular medical checkups and administered vaccinations as deemed appropriate, and shall maintain proper records of the same;
 - x. ULBs shall ensure the staffs assigned for cleaning sewers/septic tanks has a life insurance policy for at least Rs. 10 lakhs, for which the premium shall be paid by the employer;
 - xi. ULBs shall maintain the complete contact details of the owners of cleaning machines/vehicles operating in their jurisdiction and ensure all the septage collected by them is emptied only at the designated sites;
 - xii. ULBs shall also be responsible for any negligence of the Registered Agencies/ Contractor/ Employers;
 - xiii. ULBs are responsible for providing proper equipment, in case of direct involvement of ULBs in cleaning process;
 - xiv. ULBs shall coordinate emergency activity with local authorities, in case of any emergencies to the crew members while cleaning sewers/septic tanks; and
 - xv. ULBs shall develop and put forth a mechanism to receive/register the grievances/concerns of the cleaning staffs and resolve them as soon as possible.
- 14.2 Registered Agencies/Contractors/Employers**
- i. Registered Agencies/Contractors/Employers shall provide adequate safety gears and cleaning devices as prescribed in the SOP and the Rules;
 - ii. Registered Agencies/Contractors/Employers are responsible for paying premium for life insurance of the staffs assigned with him/her for cleaning of sewers/septic tanks;
 - iii. In consultation with ULBs, registered agencies/contractors shall ensure that all cleaning staffs undergoes regular medical checkups and administered vaccinations as deemed appropriate; and
 - iv. Registered Agencies/Contractors/Employers shall ensure that all cleaning staffs are adequately trained and familiarized with the operating procedures of cleaning equipment and emergency procedures.
- 14.3 Employees**
- i. Employees must familiarize them with the SOP and follow the procedures to ensure the personal safety and the safety of others.
 - ii. In case of any doubt in the operating procedures of cleaning equipment and emergency procedures or inadequate training, the employee shall report the same to the concerned authorities.
 - iii. Employees should, despite their discomfort, use all the necessary safety gears and cleaning devices when employed in cleaning sewers/septic tanks.
 - iv. Employees without the knowledge and consent of the competent authority shall not involve in cleaning of sewers/septic tanks.

14.4 Individuals

- i. Any individual person shall not engage person for cleaning of sewers/ septic tank in their premises on their own;
- ii. Individual shall always hire/employ the cleaning workers only through their ULBs or Authorized Agencies/designated agencies by ULB.
- iii. Individual shall inform to the ULBs officials in case of any casualty.
- iv. Individual shall keep the site free from any hazard, which can injure the workforce.

Terminology

Act: The Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act, 2013.

Cleaning Device: This includes but not limited to the equipment referred to in Rule 5 whether manually or mechanically propelled which can be used to:

- (i) clean or enable the transport or flow of sewage in sewers or septage from septic tanks; and
- (ii) avoid direct manual contact with such sewage or material.

Faecal Sludge: The accumulated semi-solid or solid portion that settled at the bottom of the septic tank which comprising 20% - 50% of the total septic tank volume is termed as faecal sludge.

Hazardous Cleaning: Hazardous cleaning by an employee, in relation to a sewer or septic tank, means its manual cleaning by such employee without the employer fulfilling his obligations to provide protective gear and other cleaning devices and ensuring observance of safety precautions, as may be prescribed or provided in any other law, for the time being in force or rules made thereunder;

Local Authority: Local Authority means, (i) a Municipality or a Panchayat, as defined in clause (e) and clause (f) of article 243P of the Constitution, which is responsible for sanitation in its area of jurisdiction; (ii) a Cantonment Board constituted under section 10 of the Cantonments Act, 2006; and a railway authority;

Manual Scavenger: Manual scavenger means a person engaged or employed, at the commencement of this Act or at any time thereafter, by an individual or a local authority or an agency or a contractor, for manually cleaning, carrying, disposing of, or otherwise handling in any manner, human excreta in an insanitary latrine or in an open drain or pit into which the human excreta from the insanitary latrines is disposed of, or on a railway track or in such other spaces or

premises, as the Central Government or a State Government may notify, before the excreta fully decomposes in such manner as may be prescribed, and the expression “manual scavenging” shall be construed accordingly.

Protective Gear: These are the personal safety gear and safety devices that are to be provided, worn or used by safai karamcharis or sanitary workers in respect of cleaning of sewers and septic tanks that may be necessary for the specific nature of work to be carried out, as including and not limited to the materials referred to in Rule 4 to -

- (i) avoid any exposure of human skin to substances which can lead to diseases, along with all breathing equipment which prevents inhalation of gases which can lead to diseases, and also includes any sensory equipment for detection of gases present inside the sewers or septic tanks;
- (ii) avoid any injuries while carrying out cleaning work.

Rule: Prohibition of Employment as Manual Scavengers and their Rehabilitation Rules, 2013.

Safety Precautions: The precautions shall include but not be limited to the precautions referred to in Rule 6 and are all steps necessary to reduce the risk to the person and to avoid contraction of diseases and injuries by the persons engaged in cleaning of sewers and emptying of septic tanks due to exposure to sewage or any other material in any physical state (solid, liquid or gas) inside the sewers or septic tanks and while entering sewers or septic tanks.

Septage: Septage is the liquid and solid material that is pumped from a septic tank, cesspool, or such on-site treatment facility after it has accumulated over a period of time. Septage is the combination of scum, sludge, and liquid that accumulates in septic tanks. Offensive odour and appearance are the most prom-

inent characteristics of Septage. It is a host of many disease-causing organisms along with the contamination of significant level of grease, grit, hair, and debris.

Septic Tank: Septic tank means a water-tight settling tank or chamber, normally located underground, which is used to receive and hold human excreta, allowing it to decompose through bacterial activity.

Sewage: Sewage is defined as the wastewater containing human body waste matter (faeces and urine etc), either dissolved or undissolved, discharged from toilets and other receptacles intended to receive or retain such human body wastes.

Sewer: Sewer means an underground conduit or pipe for carrying off human excreta, besides other waste matter and drainage wastes.

Sewerage System: The underground conduit for the collection of sewage is called Sewer. A network of sewer appurtenances intended for the collection and conveyance of sewage generated from each of the properties to a sewage pumping station for pumping to sewage treatment plant for further treatment and disposal is called sewerage system.

**Unless otherwise specified the above terminologies shall stand valid in this SOP.*

Annexure-I

Checklist for Minimum constituents of the first aid kit that shall be made readily available to the staffs employed in sewer cleaning at the site.

S. No.	Checklist	Minimum constituents	Yes
1	Small sterilized dressings.	6	<input type="checkbox"/>
2	Medium size sterilized dressings	3	<input type="checkbox"/>
3	Large size sterilized dressings	3	<input type="checkbox"/>
4	Large sterilized burn dressings	3	<input type="checkbox"/>
5	Bottle (30ml) containing a two percent alcoholic solution iodine	1	<input type="checkbox"/>
6	Bottle (30 ml) containing Salvolatile having the dose & mode of administration indicated on the label..	1	<input type="checkbox"/>
7	Snakebite lancet	1	<input type="checkbox"/>
8	Bottle (30 gm) of potassium permanganate crystals	1	<input type="checkbox"/>
9	Pair scissors	1	<input type="checkbox"/>
10	Copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour institutes Government of India.	1	<input type="checkbox"/>
11	Bottle containing 100 tablets (each of 5 gm) of aspirin	1	<input type="checkbox"/>
12	Ointment for burns		<input type="checkbox"/>
13	Bottle of suitable surgical antiseptic solution	1	<input type="checkbox"/>

Annexure-II

Checklist for Prerequisites					
1	Did you barricade the area of work?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
2	Have you opened upstream and downstream manholes?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
3	Is there a regular overflow?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
4	What kind of area is it?	Commercial	<input type="checkbox"/>	Residential	<input type="checkbox"/>
5	Does the worker have the safety equipments?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
6	Has the worker applied oil?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
7	Is the sewage cleaning machine available?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
8	Is the suction of the cleaning machine verified?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
9	If yes, is it in good condition?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
10	Has the stagnant sewage water been cleared from the overflowing manhole?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
11	Is the health condition of the worker acceptable?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
12	Are the pipelines silted?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
13	Where is the chockage?	Manhole	<input type="checkbox"/>	Pipeline	<input type="checkbox"/>
14	Is there an Oxygen Cylinder?	Small Cylinder	<input type="checkbox"/>	External Cylinder	<input type="checkbox"/>
	If yes, choose the appropriate option:	Pipe leading to Manhole	<input type="checkbox"/>	No	<input type="checkbox"/>

Annexure-III

Checklist for Entering Manhole			
Depth < 2m		Depth > 2m	
Checklist	Yes/No	Checklist	Yes/No
1. Personal Safety Kit		1. Personal Safety	
Helmet with headlight		Helmet with headlight	
Gum Boots		Gum Boots	
Waterproof Clothing		Waterproof Clothing	
Gloves		Gloves	
Safety Belt		Safety Belt	
Oxygen Mask		Oxygen Mask	
Chemical Cartridge Mask		Chemical Cartridge Mask	
Oil		Oil	
Soap		Soap	
Towel		Towel	
Oxygen Cylinder		Oxygen Cylinders	
2. Gang Kit		2. Gang Kit	
Barricade		Barricade	
Rope Ladder/Tripod with Chain Pulley		Tripod with Chain Pulley	
Silt Grabber		Silt Grabber	
Chromo-flexible Steel Rod		Chromo-flexible Steel Rod	
Bucket with Rope		Bucket with Rope	
Spade with long handle		Spade with long handle	
Crowbar		Crowbar	
Trolley		Trolley	
First Aid Kit		First Aid Kit	
Manhole Key Rod		Manhole Key Rod	

Notes

A series of horizontal dotted lines for taking notes.





Ministry of Housing and Urban Affairs
Government of India