7.1. R & R ACTION PLAN

There is no R & R action plan because proposed expansion of sugar factory of DBRKPSSKL.

7.2. RISK ASSESSMENT

Proposed Expansion of existing sugar manufacturing plant will be implemented by the project proponents in the premises of existing project complex of DBRKPSSKL. Risk assessment and hazard management study was done by **Mr. Vinod Sahasrabuddhe** who is the FAE for RH in respect of EEIPL. Proposed expansion project would be formulated in such a fashion and manner so that utmost care of safety norms and Environment Protection Act shall be taken care of.

- **Objective of the Risk and Hazard Analysis is to -**

1) Identify hazards and nature of hazard in the process, storage and handling of hazardous chemicals.
2) Carry out Qualitative risk analysis for the process and suggest mitigation measures.
3) Carry out Quantitative risk analysis of the storage of hazardous chemicals and estimate the threat zones for Most Credible and Worst case scenarios
4) Suggest mitigation measures to reduce the risk/probability of the accident to the minimum.
5) Incorporate these measures for ensuring safe operations and safe layout and for effective preparation of On-site and Off-site emergency plans
6) Suggest Guidelines for on-site and off - site emergency plan

7.3. HAZARD IDENTIFICATION

Methodology

- Processes description received based
- Identify Hazardous Chemicals handled and stored
- Inventory of Hazardous chemicals

Hazard Assessment

1. By Qualitative Risk Assessment
2. By Quantitative Risk Assessment by Hazard index calculations and estimate threat zones by using ALOHA

Recommendations

- Recommend mitigation measures based upon the above
- Recommending guidelines for the preparation of On-site Emergency Plan

7.4. REVIEW OF THE PROJECT

The management of DBRKPSSKL have planned to go for expansion of sugar factory from **5000 TCD to 10,000 TCD**. **D.B.R.K. Panchganga S.S.K. Ltd.** leased unit of M/s. Shree Renuka Sugars Ltd.

7.5. POTENTIAL AND MAJOR HAZARDS IN SUGAR MANUFACTURING PLANT

Table 7.1 Possible Hazardous Locations onsite

Sr. No	Hazardous Area	Hazard Identified	Mitigation measures	Mitigation measures in place	Comments/ Additional measures
1	Boiler Area	Explosion	IBR rules for design, maintenance and operation of boiler by certified boiler attendants in	These measures are in place as the boiler is in Operation for the existing capacity.	Will be adopted for the additional boiler Capacity
2	All over the plant	Lightening	To design and install adequate number of best available lightening arrestors.	6 Lightening arrestors at critical locations lie bagasse yard, biogas plant are installed. The drawing is available.	If additional are required for increased area of operations these will be installed
3	Electrocution	Lose fitting	Regular maintenance, internal safety audit, and external safety audit at regular intervals.	These are in place for the operation of the existing capacity	---
4	Electrical rooms	Fire and electrocution	Regular maintenance, internal safety audit, and external safety audit at regular intervals.	These are in place for the operation of the existing capacity	---
5	Transformer area	Fire and electrocution	Regular maintenance, internal safety audit, and external safety audit at regular intervals.	These are in place for the operation of the existing capacity	---

Sr. No	Hazardous Area	Hazard Identified	Mitigation measures	Mitigation measures in place	Comments/ Additional measures
6	Cable tunnel	Fire and electrocution	Regular maintenance, internal safety audit, and external safety audit at regular intervals.	These are in place for the operation of the existing capacity	---
8	Bagasse storage area	Fire	Fire hydrant around Bagasse Storage area.	Fire hydrant around the Bagasse storage is in place	Other Detailed measures have been suggested in the report, in the later part.
9	Sulphur Storage	Dust Explosion & Fire	Fire extinguishers, water hose connection	Fire extinguishers in place	Other detailed mitigation measures are suggested in the report.
10	Molasses Storage Tanks	Spillage & Tank Explosion	Dyke walls around the Storage tanks. Temperature Control	Temperature Control in place	Dyke walls will be built around the existing tanks and around the additional tanks installed after expansion.

7.5.1. Bagasse Production and Storage:

- At present capacity of 5000 TCD,1400 MT of Bagasse is produced. 60 MT per day is consumed in the boiler as fuel and 1340 MT is stored in a storage yard.At present the factory has two areas reserved for Bagasse. One inside the factory and one outside with area of 3750 Sq. M (50MX 75 M). There is fire hydrant piping laid around the Bagasse storage area and is designed as per IS 1390 code for sizing of fire hydrant piping, number of hydrants, location of alarm points, hose boxes etc. Water provision is as per IS 9668. There is fire hydrant piping of sizes 200 mm NB and 150 NB laid around the area with 30 hydrant points. Copy of fire hydrant layout covering bagasse storage area is enclosed in **Appendix–F.**

- **Mitigation measures:**

After the expansion, Bagasse produced per day will be 2800 MT, out of which only 120 MT will be consumed per day and the storage will be required for 2600 MT per day. It has to be examined that the present area can accommodate the increased quantity of (2600- 1340) 1260

MT excess bagasse can be stored in the same area. Or sale of 1260 MT Bagasse per day will have to be arranged.

- **Additional Mitigation Measures for safe Bagasse Storage:**

Following mitigation measures to eliminate the fire hazard are in place and some additional Measures are suggested as below:

1. It will be ensured while routing high tension voltage lines to avoid storage of bagasse storage below & near high voltage (H.T.) transmission lines.
2. Avoid routing of electric supply cables & cable trenches near to bagasse storage and if unavoidable locate these as far away from stored bagasse or bagasse heaps.
3. Always keep other raw materials & useful material far away from storage of bagasse area.
4. Creating awareness among workers about sudden bagasse fire and emergency action plan will definitely avoid risks of heavy fire. In this way we can save a valuable fuel & life of human being working near bagasse.
5. Posting of proper supervision staff with necessary communication facility.
6. Hot work, like welding, gas cutting will not be carried out near Bagasse storage. Or only after issue of proper work permit and making necessary arrangements.
7. Daily record of Bagasse storage data will be maintained and proper review of storage conditions will be taken by higher authority.
8. Training of all the involved staff in firefighting in normal & emergency operating system will be done.
9. Proper Planning & Maintenance of the fire hydrant system around the bagasse storage yard and not depending exclusively on fire tender for firefighting will be implemented.
10. Creating awareness among workers about sudden bagasse fire and emergency action plan will definitely avoid risks of heavy fire. In this way we can save a valuable fuel & life of human being working near bagasse.

7.5.2. Hazard identification and Mitigation measures: Sulphur Storage

- **Hazard Identification:**

At present Sulphur is stored in a closed shed of area which is of area 4800Sqft.But only a part about 15-20% area of this warehouse is used for the storage of Sulphur and the rest is used for storage of waste, spare parts and all kind of materials, which is not desirable. It is recommended that his warehouse will be compartmentalized by dividing this by constructing a wall. And area reserved for Sulphur should be exclusively used for storing only Sulphur.Sulphur is transferred manually to the SO_2 production unit manually as per the requirement in bags. Following are the hazards in storage and handling Sulphur.

1. Dust Explosion
2. Fire

- **Dust Explosion:**

As Sulphur is stored and handled in granular form, there is always some dust formation, which can lead to dust explosion. A dust explosion occurs when a fine dust in suspension in air is

ignited, resulting in a very rapid burning, and the release of large quantities of gaseous products. This in turn creates a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people. It is generally considered that a dust explosion can only be initiated by dust particles less than 500 microns diameter.

- **Conditions For A Dust Explosion**

Following conditions are necessary before a dust explosion can take place.

- The dust will be combustible.
- The dust cloud will be of explosive concentration, i.e. between the lower and upper explosion limits for the dusts.Sulphur is a flammable substance in both the solid and liquid states.The dust is characterized by a very low ignition point of 190°C compared to other combustible dusts, and dust clouds are readily ignited by weak frictional sparks. Dusts containing 25% or more elemental Sulphur may be almost as explosive as pure sulphur.
- There must be sufficient oxygen in the atmosphere to support and sustain combustion.
- A source of ignition must be present.
- The dust must be fine enough to support an explosion.

- **Mitigation Measures:Explosion Prevention:**

Dust explosions can be prevented by ensuring that the following conditionsare met:

- Formation and Suspensions of Sulphur dust in air are avoided.
- To prevent dust formation during the storage and handling of Sulphur, it is necessary to take necessary precautions to avoid spillage and crushing of granular Sulphur during bulk loading and unloading in the storage area.
- Storage shed should be constructed with a minimum number of horizontal surfaces to avoid dust will accumulation.
- Bulk accumulations of fine Sulphur may also be removed using soft push brooms, having natural bristles and non-sparking scoops or shovels before vacuum cleaning equipment is used.
- The use of compressed air to remove dust from any surface, vigorous sweeping or any other method of cleaning which may raise a dust cloud is prohibited.
- All sources of ignition are excluded.
- Presence of moisture helps in preventing dust explosion.

- **Fire in Sulphur storage:**

There is a risk of fire in Sulphur storage as ignition temperature is low 190 deg C. Solid and liquid Sulphur will burn to produce Sulphur dioxide gas, which is extremely irritating and toxic. The effects of the fire hazard itself are slight.

- **Mitigation Measures:**

- Smoking and the use of matches shall be prohibited in all areas where Sulphur dust is likely to be present. Prominent NO SMOKING signs shall be placed around such areas.
- Naked flames or lights and the use of gas cutting or welding equipment is prohibited during the normal operation of the plant. Repairs involving the use of flames, heat, or hand or power tools in areas where sulphur may be present shall be made only after getting hot work permit from the authorities.
- Sulphur will be wetted down.
- Always use Self Contained Breathing Apparatus (SCBA). Sulphur fires produce hazardous sulphur dioxide gas. Sulphur dioxide gas is heavier than air and will accumulate in the vapour spaces of the rail car.
- Automatic sprinkler systems which comply with relevant Indian Standards and provide a fine spray or mist are recommended as the most satisfactory extinguishing system for bulk stores. Fire hoses and extinguishers will be fitted with fine spray nozzles to ensure that Sulphur dust clouds are not raised, as these can explode on contact with the fire.
- Small Sulphur fires are easily extinguished by adding moresulphur on top of the burning Sulphur. This depletes the oxygen and smothers the fire.
- For larger Sulphur fires use a light water fog or CO_2 to extinguish. Do not use heavy water streams as this may create Sulphur dust which could potentially explode.

7.5.3. Hazard Identification: Molasses Storage

- There are two areas of concern are:

1. Molasses storage: Heavy leakage of Molasses, total breakage of tank, leading to loss of life and pollution.

Molasses Storage

It is planned to store Molasses in the tanks as given in the table below:

Table 7.2 Storage Details of Molasses

No	Description	Details	
		Existing	After Expansion
1	Storage Area	630 Sq. M	1260 Sq. M
2	Storage Capacity	10850 MT	14000 MT
3	No. of tanks	3	4
4	Dimensions	Diameter = 20 M Height= 7 to 8 M Thickness=12 mm	1 tank ofsame dimension will be added

Storage of Molasses

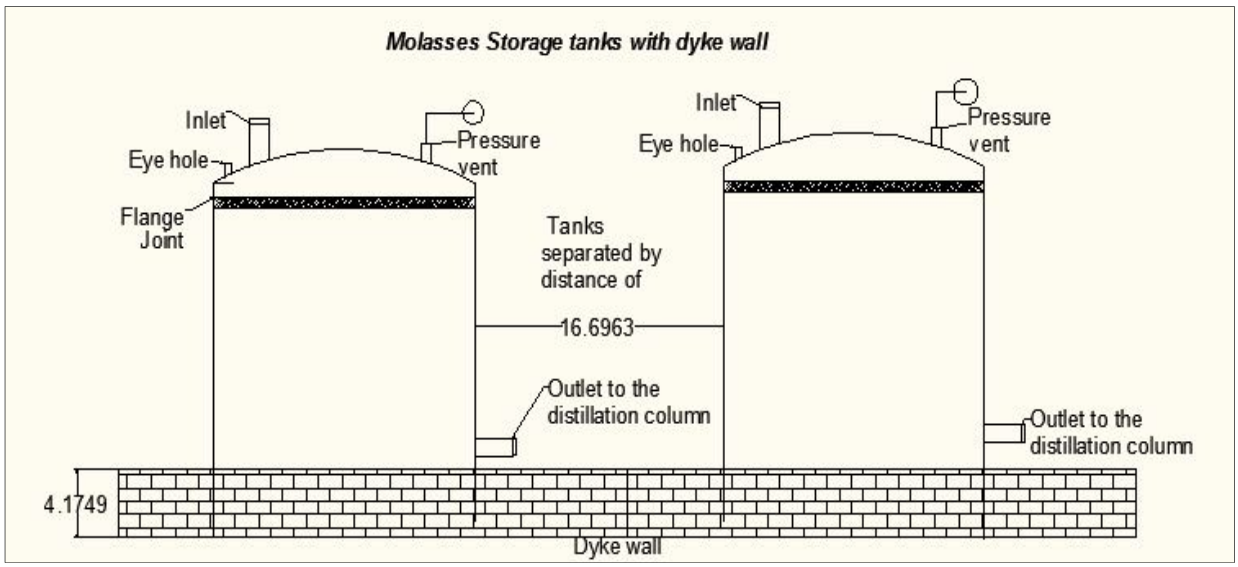
1. Molasses will be stored in good quality and leak proof mild steel tanks.
2. Adequate safety factor will be incorporated into the design of wall thickness considering deterioration that will occur due to corrosion over a period of time.

3. Regular internal and external inspection will be scheduled for checking wall thickness of the tanks.
4. At present there is no dyke wall around Molasses storage tanks. After expansion, dyke/bund walls should be constructed around the tank or tanks.
5. It be ensured while finalizing the dyke dimensions and that thickness that clear volume inside the dyke walls is equal or more than 1.2 x volume of tank storage capacity.
6. Continuous mixing of molasses through external pump circulation will be done.
7. If there is increase in temperature beyond 30^0C external cooling of tanks will be provided by heat exchanger in the circulation line.
8. Frequent Temperature monitoring, manually or by recorder is strongly advised.

If there is leakage following measures will be followed-

a. Leakage will be washed out and diluted and should be recycled as far as possible or will be properly treated in Effluent treatment plant.
b. Replacing of leaky gaskets, joints, will be done strictly by following work permit system.
c. Leakage of pipelines, welding repairs will be carried out outside the plant. The necessary hot work permit should be issued after taking necessary precautions and fire fighting measures for onsite hot work, by the concerned authority before any hot work in undertaken
d. Leakage through pump gland will be reduced to the minimum by installing mechanical seals.
e. To attend all major leakage in tanks the following procedure will be followed.
   (i) Transfer the material to other tank.
   (ii) Prepare the tank for welding repairs by making sure that it is positively isolated with blinds from other vessels and ensuring that it is free of the chemicals and gases by purging air and carrying out air analysis before any hot work is undertaken and this should be done by skilled workers. For this purpose safety permit should be given.

Figure 7.1 Molasses Tank



- **Mitigation Measures:**

It is necessary to take following mitigation measures to prevent bursting of tanks, and heavy leakage and loss of life.

7.5.4. Hazard Identification: Sulphur dioxide(SO_2) production and handling:

The plant has standard Sulphur dioxide (SO_2) production unit. It was confirmed that the existing production capacity is adequate to cater to the additional requirement of Sulphur di oxide (SO_2) for increased production. However, if this is found not adequate, the capacity will have to be increased. The unit produces required amount of Sulphur dioxide (SO_2) at the required rate by changing sulphur feed to the unit.

- **Procedure for (SO2) production**

Firstly Solid Sulphur is fed to melter&it's melted by 7 kg /cm^2steam. This melted sulphur are taken to feeder. Both vessel jacketed by steam & removed condensate formed a trap & drain is provided. Charging & feeder Valve are gun metal & both valve are not open at a time for avoided accident.
Burner / Furnace: - Melted sulphur are taken combustion chamber. It is made by Iron Vessel & it having water jacked & then compressed air inlet inside chamber & generating SO_2 Gas withdrawing other end vessel its having 400-450 ^{O}Ctemperature to be maintain temperature by water jacket water its having suitable baffle for preventing Short-circuiting .
After Burner: - Sulphur Dioxide (SO_2) having temperature 400-450^{O}Cis taken in this Chamber It having Cooling Pipe it decreased temperature up to 250-300 ^{O}C. That Pipe having CI.
Scrubber: - it is water jacket cylindrical C.I tank,it's having refractory bricks at bottom side hot gas inlet from bottom side & raising from layer of bricks & sublimed sulphur & ash are removed & filtrate gas introduced to sulphitor. Final temperature of SO_2 Gas is 65-70 ^{O}C.
Air Compressor: - Dry air supplied to the compressor is compressed about 0.6 to 0.7 Kg/cm^2 pressure this compressed air supplied to the air Receiver.
Air Receiver: - this Compressed air supplied to this vessel is under Pressure it's having relief Valve. Pressure relief is set at 1 kg pressure Maximum. A drain is also provided to drain the oil etc. This 0.6 to 0.7 kg /cm2 compressed air is supplied to burner.
Electronic Control: - Temperature of melter& feeder, temperature of furnace, After Burner & Final SO_2 Gas Pipe

Major hazard is leakage; being toxic it can lead to serious injuries and health concerns.

- **Mitigation Measures suggested and measures which are in place:**

1) SOP for the unit operation is available.
2) Emergency Shutdown procedure is available.
3) Operators are trained.
4) Emergency Shutdown procedure, in local language is to be displayed.

Following are the toxic properties of SO_2

NFPA rating N (H) =3, N (F)=0 and N(R)=0, TLV= 2 ppm

Toxicity Index:

Toxicity Number: The toxicity number (Th) is derived from the NFPA health factor Nh. Nh is an integer number ranging from 0 to 4.

Table 7.3 Values of NH and TH

Nh	Th
0	0
1	50
2	125
3	250
4	350

Penalty Factor:

The Penalty Factor (Ts) is the second toxicity parameter used to determine the TI. The Ts value is derived from the 'Threshold Limit Values (TLV)'.The TLV-values are drawn up by the American Conference of Governmental Industrial Hygienists. TLV represents a time weighted average (TWA) air concentration to which workers can be exposed during a normal working week of 6 days at 8 hrs per day, without ill effects. The penalty factor is determined from the table below:

Table 7.4 Values of TLV

TLV	Penalty factor Ts
<5	125
5-50	75
>50	5

Toxicity Index TI= Th+Ts/100 X (1+1.75+2.4) TI= 250+125/100 (5,15) = 3.75X 5.15, which is equal to 19.3

The resulting TI values are ranked into three categories:

1-5 Light
6-9 Moderate
10-up High

Hence Toxicity index is in HIGH range.

Sulphur dioxide is produced by oxidation of molten Sulphur in situ in a standard readymade unit as described above and is used in Sulfitation of Sugar cane juice. There is no storage of Sulphur dioxide, as it is produced at the consumption rate and when required. The maximum inventory in the plant is the quantity of Sulphur dioxide is in the pipe line of 80 mm Diameter and approximately 40 to 50 meters long at a pressure of 01.7 kg/cm sq. (g) at around 40 deg C temperature. This unit is situated at 10 meter elevation platform open on all three sides.

For worst case scenario mapping refer**Appendix – G.**

7.5.5. Mitigation Measures suggested based on Quantitative Risk Analysis (QRA):

1. Before the plant start up and every six months, pressure test and thickness test of all the equipments and piping carrying Sulphur di oxide will be carried out to avoid leakage. Alarm system, in case, SO_2 leakage is suspected and detected by smell, to warn all workers of the leakage has already been installed in existing plant the same will be followed for expansion.
2. SO_2 leak detectors shall be installed.
3. All operators will be aware of Emergency Shutdown procedure and action to be taken to warn authorities to sound alarm.
4. Emergency Shutdown procedure and action to be taken should be displayed in the SO_2 production area in the local language.
5. Regular mock drills and training for workers working in this section are being carried out and shall be followed during expansion.
6. In case of leakage as envisaged in MCA of flange joint leakage, area around SO_2 production unit and part of the main plant shall be vacated immediately.
7. In case of major leakage as envisaged in first case, area around 120 meters to 300 meters will be heavily affected and full onsite emergency plan for the entire plant will have to put in action and if necessary population around 1 to 1.5 km will have to be warned.

7.7 POTENTIAL AND MAJOR HAZARDS IN CO-GENERATION PLANT

The DBRKPSSKL has existing 30 MW Co-gen plant has been fully automated with interlocks, alarms and will have following standard safety features.

1. Turbine will be interlocked with high and low steam inlet pressure and relative range of high and low outlet pressure.
2. Turbine will be interlocked for high vibration of any bearing of turbine, gear box, and alternator.
3. Turbine will be interlocked for any bearing high temperature.
4. High axial displacement of the rotor will be installed.
5. Turbine will be interlocked with high lube oil temperature.
6. Separate turbine over speed protection and interlock will be provided for turbine to trip on high speed.
7. For reduction of noise, all steam outlets will be provided with silencers.
8. Pressure safety reliefs valves will be provided on steam drum and steam lines.
9. In addition to mechanical SRV's electrometric safety relief valve is provided.
10. Smoke leak detector alarm will be provided.

7.8 FIRE TRIANGLE

The triangle illustrates the three elements a fire needs to ignite: Fuel, Heat, and an oxidizing agent (usually oxygen) A fire naturally occurs when the elements are present and combined in the right mixture, Meaning that fire is actually an event rather than a thing.

Figure 7.2 Fire Triangle

A fire can be prevented or extinguished by removing any one of the elements in the fire triangle. For example, covering a fire with fire blanket removes the oxygen part of the triangle and can extinguish a fire.Thistype of representation will be displayed in the fire prone areas.

A) Mitigation Measures for Leakages And Fire

- Approval from Chief Controller of Explosives CCOE' will be procured in addition to regular factory inspector's approval and other statutory approvals.
- With respect to the Petroleum Act, Petroleum rules, 2002 following important measures with respect to tank layout and factory layout will be followed though these are recommended for storage above 5000 $M^{3.}$
- Minimum Clear distance between two tanks will be 0.5 D or d or 15 meters D= tank diameter in meters, d= diameter of small tank in meters. Or (D+d)/4
- Tanker vehicle loading/unloading center of the bay area will be minimum 15 meters away from the tanks storage periphery.
- Boundary fencing will be minimum 20 meters away from periphery
- All the tanks will be placed within the area surrounded by dyke wall, constructed as per standard design and construction norms.
- Volume of the within the dyke wall will be more than the largest storage tank inside the dyke wall.
- Provision will be made for spare tank of for pumping large alcohol spillage or leakage by proving sump and pump connection.
- In case, spare tank is not provided pump piping will be provided such that large leakage can be pumped to a suitable process tank.
- All pump motors and other electrical fittings will be flame proof of suitable class.
- Suitable and proper safety measures shall be installed on the tanks.
- Tanks will be provided with level indicating instruments with high and low alarms.

Table 7.5 Details of Fire Extinguishing Equipment

Sr. No.	Types of Extinguisher	Capacity	Quantity Nos.
1.	Dry Chemical Powder	10 Kg	2
2.	CO2	6.5 Kg	8
		5 Kg	12
		3.2 Kg	12
		2 Kg	12
3.	CO_2 Water	9 Liter	7
4.	ABC Type	10 Kg	21
		9 Kg	30
		2 Kg	2

Table 7.6 Details of Hydrant Point

Sr. No.	Particulars	Capacity
1.	Water Reservoir Capacity	1000 KL
2.	Main Pump	150 HP
3.	Jockey Pump	20 HP
4.	Diesel Pump	150 HP

Figure 7.3 Fire Hydrant System

B) Preventive Measures for Electricity Hazard:

- All electrical equipment is to be provided with proper earthing. Earthed electrode are periodically tested and maintained.
- Emergency lighting is to be available at all critical locations including the operator's room to carry out safe shut down of the plant.
- Easy accessibility of fire fighting facilities such as fire water pumps and fire alarm stations is considered.
- All electrical equipments to be free from carbon dust, oil deposits, and grease.
- Use of approved insulated tools, rubber mats, shockproof gloves and boots, tester, fuse tongs, discharge rod, safety belt, hand lamp, wooden or insulated ladder and not wearing metal ring and chain.
- Flame and shock detectors and central fire announcement system for fire safety are to be provided.
- Temperature sensitive alarm and protective relays to make alert and disconnect equipment before overheating is to be considered
- Danger from excess current due to overload or short circuit is to be prevented by providing fuses, circuit breakers, thermal protection

7.9 OCCUPATIONAL HEALTH ASPECTS AND MEDICAL PROVISION IN THE FACTORY

7.9.1OCCUPATIONAL HEALTH CENTER (OHC)

Standard medical facilities as required by Factories Act, 1948 have been provided in the OHC for the existing plant, important ones are illustrated below:

1. Well equipped First Aid Boxes are provided in each Section of the factory.
2. In case of need, factory will have dispensary to give effective medical facility to workers. In dispensary, sufficient stock of medicines will be available to provide to workers in case of any major emergent situation.
3. A vehicle is always available to shift the sick/injured person to District Hospital.
4. Ambulance is available 24x7 in the factory to deal with injured workers and to take themtothe district hospital.
5. DBRKPSSKLwill continue the facility for expansion activities.

7.9.2 Medical check-up

Medical check-up of the permanent as well as seasonal workers are carried out on regular basis.

The following tests for each worker are conducted regularly.

- Pulmonary Function Test
- Audiometric Test
- Blood Pressure
- Blood Test
- Vision Test.

Refer **Appendix –H** for Health Check-up Report

7.9.3 EHS POLICY:

The company has EHS policy in place. The company has tie-up with 3 near-by hospitals as-

1. Niramay Hospital- Ichalkaranji
2. KLE Hospital- Belagaum
3. Deshmukh Hospital- Ichalkaranji

7.10 ON-SITE EMERGENCY PLAN:

At present, the company has On-site Emergency Plan, prepared in March 2017. The same On-Site –Emergency Plan will be revised, after the expansion. Refer **Appendix – I f**or Onsite emergency plan.