6. Public Health - Sanitary Drainage System Design (DS)

This PH-DS design guideline written for DHA healthcare facilities, is a consolidated document listing out the design requirements for all new construction and major renovation healthcare projects, within the Emirate of Dubai, under the licensure of DHA.

A good sanitary disposal system are essential systems for every development where the importance of sanitation are critical especially in new healthcare facilities. This has an impact on infection control parameters, equipment, staff and patients.

The requirements outlined in these guidelines are not intended to conflict with Federal Regulations, Local Municipality Laws, Executive Orders, or the needs of the end users.

This document is intended for the Architect/Engineer (A/E) and others engaged in the design and renovation of DHA facilities. Where direction described in applicable codes are in conflict, the A/E shall comply with the more stringent requirement. The A/E is required to make themselves aware of all applicable codes.

The document should be read in conjunction with other parts of the Health Facility Guidelines (Part A to Part F) & the typical room data sheets and typical room layout sheets.

6.1 Introduction

1. Drainage design will need to ensure a safe, clean and hygienic treatment areas are maintained and unaffected.
2. The drainage system design needs to deal with amount of effluent delivered in the system. The standard drainage principles shall apply as per DM requirements unless specially stated otherwise within these guidelines.
3. For drainage design of healthcare facilities, the following details are important for the best

design of a facility:

- Healthcare facility geographical location
- The ground surface level of where the healthcare facility is located
- The locations of existing drainage network main holes and main connection points (if any)
- The healthcare facility operational hours and times of peak load (if known)
- Type of special drainage that will be discharged from the healthcare facility (radiation, chemical, grease etc.)

4. The drainage connection points for the external network must be as per DM requirements.

6.2 Drainage Strategy

1. The drainage system that must be a gravity drainage system for general drainage systems.
2. Pressure drainage system shall only be used externally to the building or within the basement areas via a sump pump connection.
3. Pressure drainage systems within buildings lead to a number design failures and risk of the healthcare clean environment being jeopardized in case of a leak in the system.
4. The drainage design of the system needs to ensure the following:
    - Prevent any odours emerging from the drainage system via dried traps.
    - Minimise the frequency of blockages.
    - Provide sufficient drainage gradient to discharge waste into main sewer network (or central plant)
    - Drainage discharge to be connected from sanitary fixtures to the main drainage runs and not via a floor trap or any other fixture.

5. The DHA drainage design guidelines for healthcare facilities shall only concentrate on drainage systems within healthcare facilities i.e. above ground installations.

6.3 Types of Drainage Systems

1. In healthcare facilities, there are several different types of drainage systems. It is imperative that these systems are kept separate in healthcare facilities, so that the infection control strategy is not jeopardized, and the system maintenance is easier to maintain.
2. The drainage systems are the following:
    - Waste Water Drainage – Generally drainage from Wash Hand Basins, Showers, Baths, Sinks, Scrub Sinks and Floor Drains. Drainage that does not contain human waste or contaminated water discharge.
    - Soil Water Drainage – Drainage from systems that contain human waste. Such as WC's, Urinals, Dirty Utility Flushing Rims (Slope Hopper) and Baby Washing Rooms.
    - Storm Water Drainage – This is drainage from water precipitation from external conditions such as rain, sprinkler water discharge or bib tap discharge.
    - Chemical Drainage – Drainage from dedicated laboratory areas where systems will need to be neutralised before connecting to the main system.
    - Radiation Drainage – This is drainage from the healthcare facility oncology areas and hot labs and toilet areas. This only applies to low level of radiation and not industrial radiation uses.
3. Some of the above systems maybe combined with other systems to ensure the system operation and function, such as including designing for grease / oil interceptors.

6.4 Vent Pipes

1. All the above systems will be required to be vented to atmosphere via a vent pipe connection

to the drainage runs. The vent pipe can be provided at high level or just above the point of discharge of the sanitary fixture units.

2. For very small facilities, where there are local toilet facilities made up or a WC and WHB, then the system is not required to be vented at high level via vent pipes, but a stub stack shall sufficient for a system to be vented via the drainage system connection.

3. For small rise and small floor area healthcare facilities, an automatic air vent or air admittance valve can be provided at the top of a sanitary drainage system. This scenario is sometimes existing when a facility in a high-rise building is being refurbished on a single floor of a building and a separate drainage system needs to be installed.

6.5 Drainage System Design Types

1. A number of international drainage systems from different countries around the world use their local drainage system requirement (System 1, System 2, System 3, System 4 etc). In DHA these same systems can be adapted to be used in the emirate of Dubai. The drainage design will be based upon the requirements of BS EN 12056 unless mentioned otherwise by DM.

6.6 Waste Water Drainage

1. The drainage from sanitary fixture units in the drainage system must be directly connected to the main drainage line (vertical or horizontal main drainage lines).

2. Clean outs must be located behind the sanitary fixture unit or above ceilings or floor access in service areas.

6.7 Floor Drains

1. Floor drains are required as per Part B briefing requirements for areas such as in dirty

utilities, SSU, clean-up areas.

2. Floor drain and clean out shall be a combined fitting with trap to prevent odours in areas requiring floor drains
3. Floor drains located in an environment that will dry out will need to be connected to a primer valve that is connected to the potable water system to ensure that the trap refills with water if the trap dries up due to evaporation.
4. A special floor drains with a special seal can be used in place of a combined trap and primer valve.

6.8 Soil Water Drainage

1. Soil drainage shall be the drainage discharge from Toilets (WC's), dirty utilities and baby washing facilities.
2. These can be S-Trap or P-Trap discharge systems.
3. The type of discharge will depend on the local some parameters limiting the designing of the drainage system. Ceiling space may be restricted, structure may prevent core drilling through below or shaft space may be limited. Figure 6.1 below provides the difference between the two discharge systems.

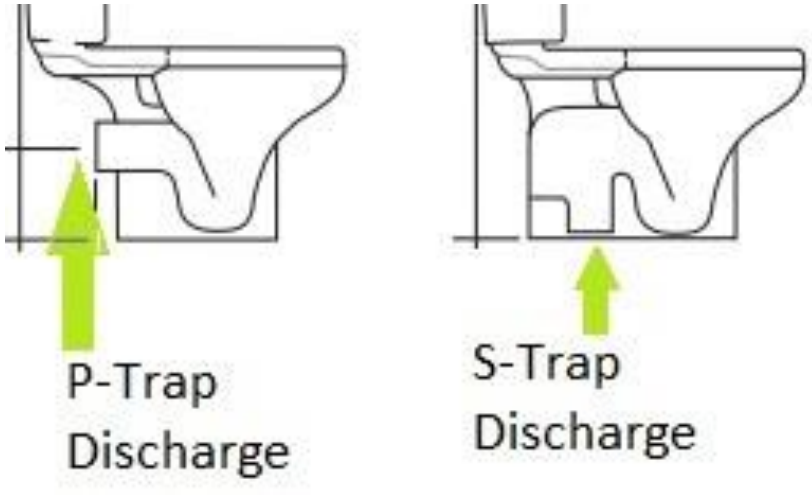

Figure 6.1 – Types of WC Discharge

4. It is highly recommended to install a P-trap system. It is easier to maintain and replace parts of fittings to the WC. Furthermore, it provides the shortest possible drainage route and eliminates any drainage runs over healthcare sensitive areas.
5. The WC drainage connection must be a minimum of 150mm (160mm) if more than 1 No. WC is connected to the system.
6. Bends of 90° must not be installed on soil drainage lines as these are the points of the system that blockage is likely to occur.
7. All bends must be provided with a Rodding Eye (RE) access door for unblocking the soil system if it suffers from blockage.
8. The RE should be located in service areas or behind WC's, never in clinical areas. Figure 6.2 below provides further detail.

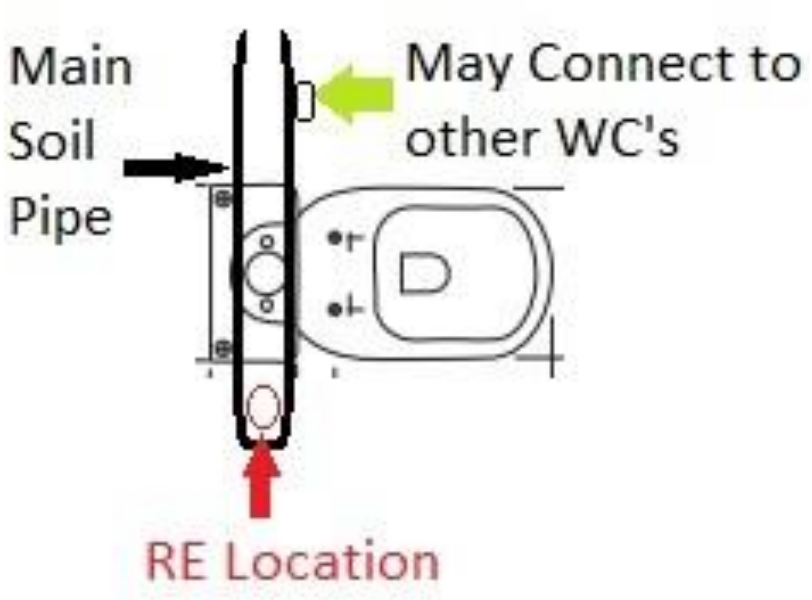

Figure 6.2 – Rodding Eye (RE) location behind WC.

6.9 Soil & Waste Water Drainage Over Critical Areas

1. The opportunity of having a clear drainage route over non-sensitive areas may not always be possible. There are some instances where the drainage will need to be taken over Grade

A and B areas.

2. Where health planning briefing design does not allow for such leisure the drainage design shall be sleeved or double walled completely through the critical area that the pipe is routed through. The end of the pipe sleeve is to be open on both ends to the external areas (that are not critical). This strategy allows for any leaks to be taken out if the critical zones completely.
3. If a double wall pipe solution is not used, then a double ceiling system over the clinical areas must be provided.
4. For Dialysis areas, there should be a dedicated drainage point for each proposed dialysis station. The drainage connection shall be provided below the water supply point and shall be a clean drainage connection with no air gaps. The drainage pipe shall be easy to disconnect between machine and station.

6.10 Rainwater Drainage System

1. Complete rain water drainage system needs to be provided to any healthcare facility.
2. Rainwater Drainage at healthcare facility roof (s) will be collected via a network of horizontal pipes and transferred to a level to connect to the external storm water network or within the facility holding tanks or in some cases into soakaways used to increase the water table level. In DM, the rainwater system will connect into a collection tank or the external storm water network. DM requirements shall be the design that is followed for connection requirements.

6.10.1 Syphonic Rainwater systems

1. It is highly recommended that these items should only be used in areas where there is limited ceiling space for services and thus several bends will be used, or a water seal has been

provided at the rainwater floor gullies/drains to ensure that the symphonic process is enabled.

6.10.2 Pipe Materials for Drainage Systems

1. The drainage system pipe materials shall be as per BS EN 12056 or DM requirements. These requirements shall be as follows:
    - Sanitary Sewer, Storm water and Vent, Above Grade: uPVC (un-plasticized polyvinyl chloride) as per BS EN 1329. Gravity Drainage to UPVC for local to the sanitary fixtures.
    - Force Main Below & Above Grade as well as gravity drainage: HDPE (High Density Polyethylene) as per 12201. Gravity drainage for min stacks to be HDPE.
    - Kitchen Waste: HDPE (High Density Polyethylene)

6.11 Special Drainage Systems

1. Special drainage systems are used in laboratory and in special healthcare departmental areas such as morgues, incinerators etc.
2. Special drainage systems are the following:
    - Acid Waste Drainage
    - Infectious Contaminated Drainage

6.11.1 Acid Waste Drainage

1. An acid waste drainage system deals with drainage liquid discharge of liquids with a PH level lower than 7. Generally, this type of drainage system is provided at high level fully operational teaching healthcare facilities where pharmaceutical drugs are prepared and manufactured.
2. All the drainage from the acid waste drainage must be neutralised to a pH of 4 as minimum before being connected to the external drainage network.

3. Floor drains should be avoided in laboratory areas.
4. Where floor drains are provided in laboratory areas, the floor drain shall be covered with a special odour type seal and the floor drain must have a disinfection capability.
5. Any spillage should be wiped away with aa cloth and that cloth used for wiping be placed in hazardous waste bins.

6.11.2 Acid Waste Drainage Health and Safety Concerns

1. Concentrations of Acid drainage can cause a number of severe damage (eyes, skin etc) to healthcare operators. Emergency showers, eye wash units, drench system shall be provided by exit doors as per Part B healthcare briefing.
2. A floor drain be needed to prevent the flooding of the area where the emergency is being provided.
3. The floor drain shall be connected to a neutralisation plant. If gaseous or fog acid is generated in a facility, fog water nozzles are to be used to prevent the gas from spreading.

6.11.3 Acid Waste Drainage Design Considerations

1. Each sanitary fixture will need to be individually trapped and each unit to be provided with a vent pipe to atmosphere.
2. Drainage from laboratory systems shall be connected to a single acid neutralisation plant unless mixing of the chemicals causes a hazardous or a catalytic reaction, then another drainage system along with another neutralisation plant will need to be provided.

6.11.4 Acid Waste Drainage Pipe Material

1. The following pipes materials are required for acid waste drainage systems:
    - Polypropylene with Electrofusion welding joints
    - Glass with Compression Joints (encased in plastic for protection) – But not Vent pipes.

- High Silicon Cast Iron with Compression Gasket Joints

2. Other materials such as PVC or UPVC or CPVC may be considered but should be avoided as they have a lower chemical compellability and lower temperature rating.
3. Polytetrafluoroethylene (PTFE) seal is the only material that is resistive to a wide range of chemicals as well as having the highest temperature rating.
4. The pipe for the acid waste drainage systems should be supported through the system to prevent drainage spots in the drainage system that could lead to leaks.

6.11.5 Acid Waste Drainage Treatment

1. Acid waste drainage pH levels from healthcare laboratories require to be neutralised to a pH between 4 and 7 before being connected to the main external drainage network. DM may have a more stringent requirement and that does not allow any discharge to the network from the laboratory.
2. Probes will be required after the neutralisation process to ensure that the pH level is correct when connecting to the external drainage network.
3. If drainage cannot be connected to the DM from laboratory waste, then a storage/holding tank system shall be provided for a number of days.
4. The storage/holding tank can only be emptied by a licenced contractor.
5. The type of neutralised system used is the drainage laboratory discharge to be in contact with lime stone chips or a lime stone gel/liquid or chemical faeces or equivalent.
6. The design of the treatment system should be designed for the maximum flow rate foreseen from the laboratory area.
7. In smaller DHA facilities or clinics, a central neutralisation plant or equipment may be too costly. If this is the case, then single isolated sink(s) should be provided.

8. These sinks will need to have an acid neutralising trap as part of the unit. These should be used for discharging acid waste drainage only.

6.11.6 Infectious Contaminated Drainage

1. Drainage that will consist of biohazardous material carrying suspended living organisms which is risk of causing infection to patients, visitors and healthcare operational staff is considered infectious contaminated drainage.
2. The drainage will be from type Q isolation rooms.
3. These systems need to be disposed of correctly and safely to ensure the continuity of the facility clean and safe environmental conditions via discharge to a holding tank.
4. The holding tank will be connected to all the areas of concern where there is a biohazardous material being discharged.
5. The containment is divided into the following parameters:
    - Primary Measures – Particular equipment such as the biological safety cabinet, glove boxes etc.
    - Secondary Measures – Measures used to support primary measures.

6.11.7 Types of Biological Safety Levels

1. CDC/NIH Guidelines for Biosafety in Microbiological and Biomedical Laboratories have provided biosafety level of contaminates for facilities. The range from Biosafety Level (BL) BL1 – BL4. In the majority of healthcare facilities, the safety level is between BL1 and BL2, (BL3 is very rare).

6.11.8 Infectious Contaminated Drainage Treatment

1. The holding which is also known as a 'Kill Tank', is the when the tank is injected with a chemical that attacks the hazardous organisms.

2. Please note that the decontamination process is not an instantaneous process, but the 'Kill Tank' works in stages for the drainage to be neutralised before connecting to the system.

6.11.9 Infectious Contaminated Drainage System Components

1. For healthcare facilities, the drainage system must be closed system and the floor drains (if provided) are to be sealed.
2. Floor drains will need to have valve connections when the system is not in use.
3. In many of these areas the HVAC areas (as discussed in section 2 of these guidelines) will have negative air requirement, therefore the floor trap will need to be 90-100mm deep.
4. The floor trap seal will need to be filled with a disinfectant solution that can prevent the spread of organisms.
5. The pipe system will be a double wall pipe system with leak detection.

6.11.10 Infectious Contaminated Drainage System Pipe Material

1. The proposed drainage materials for such systems are the following:
    - Stainless steel
    - PTFE – For higher temperature systems
    - PVC, CPVC, PP, or lined FRP pipe – For lower temperature systems.

6.11.11 Infectious Contaminated Drainage System Vent

1. Vents from pipe, fixtures, sealed sump pits, and kill tanks must be filter-sterilized prior to leaving the system using an HEPA (EP1) filter (connected to HVAC system exhaust).

6.12 Radiation Drainage

1. As per international standards (Federal Authority for Nuclear Regulation (FANR – Abu Dhabi)), there is no need for radiation (Contaminated Drainage) holding tanks for drainage from toilets coming from patients who have just used iodine-131 or other low-level

radioactive isotopes as per FANR.

2. If a healthcare facility would like to provide a radiation tank they will need to provide the tank external to the building in a location where there is limited to radiation exposure. The level acceptable radiation levels will be determined by the radiation safety officer.
3. DM may not allow for radiation drainage to be diluted and connected to the external drainage network, therefore a holding tank shall be provided.

6.12.1 Radiation Drainage Strategy

1. Radiation drainage shall be discharged to its own dedicated system. The system may be a diluted type of system or a holding tank system for a licenced contractor to remove the tanks contents.
2. A sample access to the system is to be provided for the radiation safety officer to take periodic samples of the system.
3. Many facilities may wish to hold radiation drainage confined to glove boxes or protected hoods. Radiation drainage in these areas should be shielded.

6.12.2 Radiation Drainage Holding & Decontamination

1. External radiation storage tank shall be a divisional storage tanks to allow for operation and maintenance of the radiation storage tank.
2. Depending on the level radiation used, the tank storage volume can be for 30 to 90 days storage capacity (it may sometimes be less for an oncology dedicated facility).
3. It is highly recommended a second set of holding tanks should be provided to reduce the risk of healthcare operations. This provision should be based on a risk assessment carried outlining the capability of the licenced contractor being available as well as the operational parameters of the facility and oncology department.

6.12.3 Radiation Pipe Material

1. The pipes used for radiation drainage will depend on the level of radiation being discharged or carried in the drainage system. As per the NRC requirements, the pipe material will need to have the following properties:
    - Pipe to be nonporous.
    - Pipe must be easy to clean and decontaminate.
    - Pipe must be acid resistant.
    - Pipe to be nonoxidizing as the oxides of the pipe can become radioactive
    - The pipe joints should not form a crud trap for drainage discharge
    - The pipe joints should not be by radiation exposure such the weakening of gaskets.
2. For healthcare facilities with low levels of radiation drainage levels some materials such as plastic are not acceptable since there is possibility for certain plastics to react to different types of radiation drainage.
3. Stainless Steel pipes (typical 316L) with welded joints is the only pipe that covers the above requirements as well as not allowing crud trap on the pipe joints.
4. Stainless-Steel press fitting pipe fittings with smooth surfaces may also be used instead of welded joints.
5. In bunker areas, where thick concrete is used, the drainage pipe shall be pipe-in-pipe, the pipe, with a Duplex Stainless-Steel pipe to be the exterior pipe that is in contact with concrete.
6. Pipe joints are to be outside the concrete cast (unless its unavoidable).

6.13 Condensate Drainage

1. All condensate drainage from local air conditioning, HVAC main equipment and plant to be

collected or discharged to foul drainage via a trap (i.e. hepVo trap).

2. For water re-use efficiency, condensate should be collected in a single tank and treated prior to use.
3. In line with the Dubai Al-Sa'fat Green Building Code, condensate collected shall be used as irrigation purposes (please refer to irrigation water system in these guidelines).

6.14 Kitchen Grease Drainage

1. Where there is a facility for hot food to be cooked then a grease interceptor is to be provided for all the drainage in that area to be connected to before being discharged to the external drainage network.
2. If the healthcare facility is a small clinic (RDL 1-2), then a local below the kitchen sink grease interceptor is to be provided.
3. In larger facilities (RDL 3-6) the grease interceptor should be provided in an area that is readily accessible by the healthcare maintenance staff.

6.15 Oil or Fuel Drainage

1. Many healthcare facilities may have main electrical equipment that relies on a fuel source. Any drainage around this area is to be provided with an Oil Interceptor as per BS EN 858.
2. Oil Interceptor as per BS EN 858 to be provided car park areas where care washing takes place.
3. For generator areas where a foam extinguishing system has been activated, the drainage from the discharge shall not be directly discharged into the sewer network.
4. Foam systems have a high BOD and therefore will need a storage drainage tank stored below the generator and treated before discharging to the external drainage network via Oil Interceptor as per BS EN 858.