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INTRODUCTION
The Code of Practice on Environmental Health (COPEH) provides the guidelines to address environmental health concerns in the design of buildings. The Code spells out the objectives to be met and stipulates only the minimum basic design criteria. In this way, Qualified Persons (QPs: Architects or Professional Engineers) may exercise flexibility and creativity to meet the stated requirements. So long as design outcomes satisfy the stated objectives, the building plans will be deemed to have complied with the COPEH.

Director General of Public Health
National Environment Agency
Ministry of the Environment
Singapore
1 REFUSE STORAGE AND COLLECTION SYSTEM

1.1 Objective
The refuse storage and collection system shall be mechanised where possible and designed such that there will be minimum nuisance to occupants and neighbouring premises, and no pollution to the environment. All facilities provided shall be adequate in size to meet the anticipated refuse output.

1.2 Refuse Output
(a) The refuse output for the various categories of premises shall be computed as follows:

<table>
<thead>
<tr>
<th>Category of Premises</th>
<th>Refuse Output (litres/day)</th>
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<tbody>
<tr>
<td>Office</td>
<td>15 per 100 sq m gross floor area</td>
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<tr>
<td>Hotel / dormitory</td>
<td>10 per 100 sq m gross floor area</td>
</tr>
<tr>
<td>Shop / trade premises</td>
<td>30 per 100 sq m gross floor area</td>
</tr>
<tr>
<td>Supermarket / market /department store</td>
<td>100 per 100 sq m gross floor area</td>
</tr>
<tr>
<td>Restaurant / eating house /food centre / canteen</td>
<td>200 per 100 sq m gross floor area</td>
</tr>
<tr>
<td>Residential premises</td>
<td>20 per dwelling premises</td>
</tr>
<tr>
<td>Petrol station</td>
<td>300 per premises</td>
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</table>

(b) Where a proposed development has a combination of different types of premises (for example, a shopping complex with offices, residential premises and a food centre), the total refuse output shall be the sum of the outputs for each category of premises.

1.3 Refuse Chute
Refuse chutes shall be provided for buildings taller than 4 storeys so that occupants need not have to bring their refuse into lifts or walk down the stairs with it. Refuse chute shall meet the following requirements:

(a) The cross-sectional area of the chute shall be not less than 0.3 sq m.

(b) The chute shall terminate at the roof of a building. The chute shall be ventilated at the top with at least two openings of not less than 0.1 sq m each. This top section of the refuse chute shall be made accessible from common area to facilitate maintenance.

(c) If the roof is to be used as a roof terrace/garden, particular attention shall be paid to the siting of the refuse chute, the location of its openings and the maintenance requirements so as to minimise any smell nuisance. Ventilation openings shall be located at least 2.1 m above roof level.
(d) There shall be a system to wash and flush the whole length of the chute. The control valve for the flushing system preferably is located at the chamber level.

1.4 Refuse Chute Chamber

A refuse chute chamber is located at the bottom of a chute and houses a bin. Refuse chute and its chamber shall be suitably located to facilitate easy and nuisance-free removal of refuse. The refuse chute chamber shall meet the following requirements:

(a) The chamber shall be large enough to house a wheeled refuse bin with cover, which can contain at least one day of refuse output from all the premises connected to the chute.

(b) The walls shall be lined with tiles or other impervious materials.

(c) The floor shall be recessed at least 100mm below the apron area and graded towards a gully connected to a sewer.

(d) An airtight non-corrosive flap door shall be provided.

1.5 Refuse Room

A refuse room is located at the bottom of a chute and houses a large container or a mechanical refuse handling equipment, e.g. a dust-screw compactor. Refuse collected in the container is conveyed directly into a refuse collection vehicle, which backs up to the refuse room. The refuse room shall meet the following requirements:

(a) The refuse room shall be large enough to accommodate two days of refuse output from all the premises connected or served by the chute.

(b) The access to the refuse room shall be such that a refuse collection vehicle can make a three-point turn to back up into the entrance of the room.

(c) The walls shall be lined with tiles or other impervious materials.

(d) The floor shall be graded towards a gully/floor trap connected to sewer.

(e) A water tap shall be provided.

(f) The refuse room shall be rendered pest-proof against birds and rodents.

1.6 Refuse Bin Centre

A bin centre shall be provided when the amount of refuse output exceeds 1,000 litres/day. The bin centre shall meet the following requirements:

(a) The bin centre shall be so sited as to minimise nuisance to neighbouring premises, and be accessible to a refuse collection vehicle, providing an adequate turning area where necessary.
(b) The bin centre shall be large enough to house the daily output of refuse from the proposed development. The bin centre shall be designed for bulk bin access from within the development.

(c) Where the daily refuse is 4,000 litres or more, a roll-off compactor or dust screw compactor shall be provided. An example of the layout of a bin centre with a roll-off compactor is shown in Appendix 1.

(d) The walls shall be lined with tiles or other impervious materials.

(e) The floor shall be graded towards a gully/floor-trap connected to sewer.

(f) A roof with no gutters shall be provided. The roof shall have adequate gradient to avoid the stagnation of water and prevent mosquito breeding.

(g) The bin centre shall be adequately ventilated and rendered pest-proof against birds and rodents.

(h) The entrance and ventilation openings of the bin centre shall face away from any residential premises in the vicinity. Aesthetic screening shall be provided where practical, to further minimise nuisance.

1.7 Pneumatic Refuse Conveyance System

Where a pneumatic refuse conveyance system (i.e. vacuum station system or vacuum truck system) is adopted, the following requirements shall be complied with:

(a) The ventilation, air intake and air outlet units shall be so sited as to minimise nuisance to neighbouring premises.

(b) The refuse storage capacity shall be two days of refuse output.

(c) Refuse collection and storage facilities shall be accessible to refuse collection vehicle, and be so sited as to minimise nuisance to neighbouring premises.

(d) Adequate measures shall be taken to minimise noise nuisance resulting from the operation of the system.

(e) Adequate measures shall be provided to remove dust and smell from the air used for refuse conveyance before it is discharged into the atmosphere. The discharge point shall be away from the neighbouring premises.
2 PUBLIC TOILET

2.1 Objective
Premises patronised primarily by the members of the public shall have adequate provision of toilets. The public toilets shall be designed to withstand heavy usage. Ventilation is therefore important. The design shall also take into consideration ease of maintenance and should facilitate proper toilet use and personal toilet hygiene.

Note: Publications such as <A Guide to Better Public Toilet Design & Maintenance> may also be used for further reference.

2.2 Definition Of Public Toilet
2.2.1 A public toilet is defined as a toilet that the general public has free access, regardless of payment/ non-payment to access the premises. The general public is free to access the public toilet without having to be a resident, student, staff, member or a guest, or a regular client. Toilets in following places are classified as public toilets:

- shopping mall or centre, including the floor in commercial buildings with shops;
- supermarket and wet market;
- eating establishment and food centre (restaurant, coffeeshop, hawker centre, food court)/ bar/ nightclub/ discotheque/ pub;
- conference hall/ cinema/ theatre;
- park/ tourist site/;
- bus terminal/ interchange;
- petrol station;
- community centre/ community clubs;
- exhibition hall/ convention hall;
- MRT station;
- stadium;
- public swimming pool.

Although toilets within premises which the general public does not have free access (e.g. condominiums, terraced workshops, places of worship, etc) are not covered under this code of practice, QPs are encouraged to adopt the guidelines stipulated here.

2.2.2 Although construction sites are not freely accessible to the public, sanitary facilities in a construction site shall be provided in accordance with the requirements stipulated in Appendix 2.
2.3 General Design Criteria

The general design requirements for public toilet shall be as follows:
(a) The walls shall be lined with smooth wall tiles or other impervious materials.
(b) The design of the toilet’s main entrance shall preferably be such that it can do away with a door, and the cubicles, urinals and mirrors shall be sited away from the line of sight from the main entrance.
(c) The minimum lighting level shall be 300 lux.

2.4 Sanitary Fittings Required In Public Toilet

Sanitary appliances and fittings installed in public toilets shall be of heavy-duty classification and quality.

Where sanitary provisions are to be made for wheelchair users, such provisions shall be in accordance with the requirements stipulated in BCA’s “Code on Barrier-Free Accessibility in Buildings”.

A glossary of the terms used in this section is given in Appendix 8.

2.4.1 Number of sanitary fittings

The number of public toilets and sanitary fittings to be provided in a building, which the general public is expected to patronise, is given in Appendix 2.

2.4.2 Water closets and urinals

(1) Water closet pans shall be the pedestal type. Where there is more than one cubicle, at least one squatting type WC pan is to be provided.

(2) Each urinal shall be fitted with a sensor-operated flush valve with manual override feature, with the exception of waterless urinals approved by the Public Utilities Board (PUB). Waterless urinals installed shall be maintained in accordance to manufacturer’s instructions and not cause any odour nuisance.

(3) Each water closet shall be fitted with a sensor-operated flush valve and coupled with manual by-pass and manual override.

(4) For volume of water per flush in urinals and water closets, please refer to the latest Public Utilities (Water Supply) Regulations.

(5) A water tap point coupled with spring nozzle shall be provided within every cubicle where a squatting WC pan is provided.

(6) The cubicle, where a squatting WC pan is provided, should be kerbed such that water will not flow out of the boundary of the cubicle. The cubicle floor shall be properly graded towards the gully trap within the cubicle.
2.4.3 Wash hand basins and taps

Wash-hand basins shall be under-counter. Other designs are allowed provided that they can minimise the problem of water spilling over from the basin to the counter. For basins that sit on top of the counter or are stand-alone, these shall be deep enough to prevent water splashing out of the basins when in use.

(1) All wash hand basin taps shall have their flow rate suitably adjusted to minimise splashing and shall be self-closing delayed-action taps (mechanical or sensor type) taps. Care shall be taken to position the tap such that it prevents splashing of water outside the basin.

2.5 Accessories To Be Provided

(1) Liquid soap or foam soap dispenser
One soap dispenser shall be provided for every two wash hand basins, subject to a minimum of one. The dispenser shall be positioned near to the basins. The dispenser shall have a transparent window so that the level of soap in the dispenser is clearly visible.

(2) Hand-dryer blower or paper towel dispenser
A minimum of one hand-dryer blower and/or paper towel dispenser shall be provided near the wash hand basin area.

(3) Litterbins
A minimum of one litterbin shall be provided near the wash hand basin area. A sanitary bin for the disposal of sanitary pads shall be provided in each WC cubicle in the female toilet.

(4) Toilet paper holder
A jumbo toilet paper roll holder or a toilet tissue sheet dispenser of similar capacity shall be installed in each WC cubicle.

2.6 Ventilation

(a) The toilet shall preferably be naturally ventilated.

(b) If mechanically ventilated, the air exchange rate shall have a minimum of 15 air changes per hour. Service access ducts, if fully enclosed, shall be connected to the mechanical ventilation system. Suitable fresh air inlet grilles shall be provided to ensure an air exchange rate of 5 air changes per hour.

(c) The exhaust system shall disperse the air directly outdoors without causing any nuisance to neighbouring premises.
3 FOOD RETAIL OUTLET

3.1 Objective

Food retail outlets, such as restaurants, food courts, etc. (also known as “food shops”) shall be designed to ensure that the layout can support an efficient workflow. The size of the kitchen and store to be provided shall be sufficient to meet the operator’s needs. The floors shall be graded to drain off the wash-water during cleaning, and to keep the kitchen dry. A good layout will help the operator attain a high standard of food hygiene and cleanliness in the premises.

3.2 General Design Criteria

The general design criteria for a food retail outlet (also referred to as “food shop”) shall be as follows:

(a) The minimum kitchen area shall be 8 sq metres (excluding the servery area).

(b) The floor of the kitchen shall be graded towards floor traps.

(c) The walls of the preparation and servery area shall be lined with glazed tiles or other suitable impervious materials of not less than 1.5 m, to facilitate cleaning.

(d) No manhole or overhead sanitary wastepipe shall be sited in the area where food is prepared or cooked. No inspection chamber or grease trap shall be sited within the areas where food is prepared, cooked, stored or served; or other areas where they are likely to give rise to nuisance, health or hygiene hazards during maintenance.

(e) At least one sink with a draining board shall be provided in the kitchen or food preparation area. For a large kitchen, additional sinks may be required for the washing of soiled crockery. The numbers to be provided shall be according to the operator’s needs.

(f) At least one wash hand basin shall be provided for workers in the kitchen. The tap of the wash hand basin shall preferably be sensor-operated.

(g) All stores and storage cabinets provided shall be pest-proof and rodent-proof.

(h) A storage cabinet shall be provided for cleaning tools, brooms, cleaning materials, etc.

(i) A storage room or cabinet shall be provided, where necessary, for the workers’ personal belongings.

(j) A storage room shall be provided, where practical, for the storage of large equipment such as additional chairs, tables etc.

(k) Where there are public toilets within the building where the food shop is located, the provision of a toilet within the food shop is not necessary.
Otherwise, the number of toilets and sanitary fittings provided shall be in accordance with the requirements in Section 2 of the COPEH.

(l) For a foodshop with individual foodstalls, each individual foodstall shall have a minimum kitchen area of 8 sq m and a servery area of 5 sq m. A wall or partition shall be provided between the kitchen and servery area.

(m) Every food shop with individual food stalls shall have a centralised wash area for the washing of soiled crockery. The centralised wash area shall be located in a well-ventilated room or an enclosure, and the walls shall be lined with glazed tiles or other suitable impervious materials. The provision of a commercial dishwashing machine in the centralised wash area is encouraged. Steam generated from the dishwashing machine shall be exhausted out by an extractor fan.

(n) Where there are 6 or more individual stalls, a minimum of one hand-washing basin in the refreshment area with liquid soap dispenser and paper towel dispenser/hand dryer shall be provided. A minimum of one litterbin shall be provided at the wash hand basin area. Taps shall be suitably adjusted to minimise splashing and shall be delayed-action type or auto-sensor operated type.

(o) All kitchen appliances and equipment such as oven, etc, and piping shall be kept at least 15 cm above the finished floor level.

(p) All mist generating systems and fans installed shall be in accordance with the requirements stated in Appendix 3.

3.3 Ventilation And Air Exhaust Systems

The ventilation and air exhaust systems in a food shop, including the kitchen, shall be designed and operated in accordance to the requirements set out here:

(a) All fumes from the cooking range shall be extracted immediately and treated with an air cleaning system. The air cleaning system shall capture particulate matters, grease, oil, water vapour and smell causing compounds such that there is:
   i. No visible black smoke and fumes (white or otherwise) from the exhaust;
   ii. No emission of grease or oil from the exhaust as evident by the deposition on the grating or in the surrounding area of the exhaust;
   iii. No intense/ irritating smell of frying, charbroiling, roasting and such other cooking in the vicinity of exhaust.

(b) The air cleaning system shall not cause noise nuisance.

(c) The cleaned air shall be exhausted outdoors by a hood and flue or other extractor fan system at or above the roof, facing away and aesthetically screened from the immediate neighbouring premises, such that it will not cause smell or other public health nuisance. Where it is not practical to exhaust the fumes at or above the roof, an alternate location of the discharge point in the outdoors may be selected, facing
away and aesthetically screened from the immediate neighbouring premises.

(d) Consideration shall be given to aesthetic aspect of the exhaust outlets if it is sited near residential premises.

(e) There shall be regular cleaning and maintenance of the exhausts.

(f) The food shop shall be well ventilated. Where mechanical ventilation is employed, there shall be at least 20 air changes per hour in the kitchen.

(g) Sufficient make-up air shall be provided and negative pressure shall be maintained when the kitchen hood is in operation.

(h) All air ducts (incoming and outgoing) in the kitchen shall be made of non-combustible materials and of smooth texture, and easy to clean. Inspection openings shall also be provided in the air ducting.

(i) For approval of building plans for premises with foodshop(s), a qualified person shall ensure that the exhaust and ventilation system complies with the above requirements and all applicable guidelines stipulated under Section 6.2 of the latest edition of Singapore Standard CP 13.
4 SUPERMARKET

4.1 Objective
Supermarket is the final point where a large variety of food is sold to consumers. Supermarkets shall be so designed to ensure that the layout can support an efficient workflow. The size of the food preparation and storage area shall be sufficient to meet needs of the supermarket. The floor shall be properly graded and drained so that the preparation area can be kept dry. If the preparation area is not air-conditioned, it must be well ventilated. A good layout will help the supermarket prevent cross contamination and attain a high standard of food hygiene and cleanliness.

4.2 Design Criteria
The design criteria for a supermarket shall be as follows:

(a) The walls of the preparation and servery area shall be lined with glazed tiles or other suitable impervious materials of not less than 1.5 m, to facilitate cleaning.

(b) Floor of the preparation and servery area shall be paved with non-slip heavy-duty homogenous quarry/ ceramic tiles and graded towards floor traps.

(c) No manhole, overhead sanitary wastepipe, inspection chamber or grease trap shall be sited inside the preparation area; or other areas where they are likely to give rise to nuisance, health or hygiene hazards during maintenance.

(d) All over-hanging sanitary/ waste/ drain pipes within the premises shall be boxed-in/ concealed.

(e) Adequate number of commercial sinks with drying benches shall be provided in the preparation area.

(f) Adequate number of NEA approved wheeled refuse bins shall be provided to contain the refuse. The wheeled bins must be placed inside the premise at all times and can only be brought outside the premise during collection.

(g) Toilets shall be provided in accordance with Section 2 of the COPEH.

(h) All food stores and cabinets provided shall be rendered pest-proof and rodent-proof.

(i) A cabinet shall be provided for the storage of cleaning tools, brooms, cleaning materials, etc.

(j) A room or cabinet shall be provided for the storage of workers’ personal belongings.

(k) Cold stores, if provided, shall be designed to take into account the intended food products, storage time and the optimal temperature requirements. The walls of the stores shall be effectively insulated to prevent condensation on the other side of the walls. The loading and
unloading bays shall be so designed to allow the transfer of frozen/chilled products from the refrigerated trucks to the cold store with minimal exposure to ambient temperature and with the least possible handling.

(l) All mist generating systems and fans installed shall be in accordance with the requirements stated in Appendix 3.

(m) The preparation of cooked/ready to eat food and raw food shall be done in distinctly separated areas to prevent cross contamination.

(n) All food retail outlets located within premises of the supermarket, shall comply with Section 3 of the COPEH.
5 FOOD CATERING OUTLET

5.1 Objective
A food catering outlet shall be designed to ensure that the layout can support an efficient workflow. This is to reduce the risk of cross-contamination during the preparation process. Separate storage areas shall be provided for raw materials, final products, chilled or frozen products, packing materials and cleaning equipment, etc. A good layout will enhance hygiene during food preparation.

5.2 Design Criteria
The following design criteria are applicable to food catering outlets:

(a) The minimum kitchen area shall be 16 sq meters.
(b) The floors shall be graded towards floor traps or internal drains.
(c) The walls of the kitchen shall be lined with glazed tiles or other suitable impervious materials to facilitate cleaning. All internal wall partitions separating the work areas shall be erected up to the height of the ceiling to eliminate cross-contamination of food products.
(d) No manhole, overhead sanitary wastepipe, inspection chamber or grease trap shall be sited inside the preparation area; or other areas where they are likely to give rise to nuisance, health or hygiene hazards during maintenance.
(e) Ventilation and air exhaust systems installed, shall comply with Section 3.3 of the COPEH.
(f) Adequate lighting shall be provided at all working areas.
(g) Washing facilities shall be provided in the preparation area. Hands-free taps for wash-hand basins/sinks complete with liquid soap dispensers and hand dryers shall be provided.
(h) Toilets, if provided, shall be located away from the food preparation area. Toilets and sanitary fittings provided shall preferably be in accordance with the requirements in Sections 2.4, 2.5 and 2.6 of the COPEH.
(i) Cold stores, if provided, shall be designed to take into account the intended food products, storage time and the optimal temperature requirements. The walls of the stores shall be effectively insulated to prevent condensation on the other side of the walls. The loading and unloading bays shall be designed to allow transfer of products between the cold store and the refrigerated vehicle with the least exposure to ambient temperature and with the least possible handling.
(j) All stores and storage cabinets provided shall be pest-proof and rodent-proof.
(j) A storage cabinet shall be provided for cleaning tools, brooms, cleaning materials etc.
(k) A storage room or cabinet shall be provided, where necessary, for the workers’ belonging.

(l) A storage room, where practical, shall be provided for the storage of items such as tables, skirtings, buffet utensils etc.

(m) All kitchen appliances and equipment such as oven, etc, and piping shall be kept at least 15 cm above the finished floor level.

(n) The loading bay for the transfer of food from the premises to the vehicle shall be covered and designed to allow transfer of food with the least exposure to the ambient temperature and with the least possible handling.

(o) The entrance to the loading bay shall be equipped with a door, which shall be kept closed except for loading and unloading.
6 MARKET

6.1 Objective
A market shall be designed such that the premises can be kept dry and clean at all times with an effective built-in internal drainage system for each stall. The market shall be well ventilated and adequately lighted with sufficient protection against rain splashing and sunlight penetration.

6.2 Design Criteria
The design criteria for a market shall be as follows:
(a) The floors shall be graded towards floor sumps, such that during washing, water do not flow into the surrounding apron area.
(b) A common service corridor shall be provided for access into the back of each stall.
(c) Waste sumps shall be sited at service corridors and away from main public area. Inspection Chamber shall be sited outside the market proper.
(d) Floor sumps shall be provided at service corridor.
(e) Tap points shall be provided at strategic locations for the washing of the market.
(f) Market stalls shall preferably be designed with a service counter that stretches across the front of the stall. The service counter shall be designed with entrance, if necessary. A low wall shall be provided to segregate the stalls.
(g) The minimum stall area shall be 8 sq metres.
   The floor level of the stall and common passageway shall be designed such that, during washing, water from the common passageways do not enter the stalls and vice versa.
(h) Each stall shall be provided with a tap point and a commercial sink, unless stall space does not permit.
(i) The floor of each stall shall be graded and drained towards either a floor sump or an open scupper drain covered with a grating. The width of the scupper drain shall be at least 150 mm and the depth shall be at least 75 mm at the shallowest end.
(j) Common passageways for customers shall have a width of at least 2.5 m. Other connecting passageways shall have a width of at least 1.5 m.
(k) The floor of the common passageway shall be graded and drained away from the stalls, towards the floor sumps.
(l) All scupper drains within the stalls, at the service corridors, and the common passageways shall be provided with floor sumps.
(m) The floor sumps within the stalls and at the service corridors, as well as floor sumps at the common passageways, shall be connected by drainlines to waste sumps.

(n) The sanitary piping and details of floor sumps, waste sumps, etc., shall be in accordance with the requirements stated in Appendix 4.

(o) A loading/unloading bay shall be provided.

(p) A common storage (for chillers/freezers) and sorting area shall be considered, if needed.

(q) A common storage area for general cleansing equipment shall preferably be provided.

(r) Toilets shall be provided in accordance with Section 2 of the COPEH.
7  SWIMMING POOL

7.1  Objective

This section addresses specifically the design criteria for swimming pools from the consideration of public health. The pool shall be so designed that the water quality will always remain safe for the public during its operation. Whilst landscaping to enhance the appearance of the pool is encouraged, it shall not be done in such a way or to such an extent that it can contaminate the water in the pool or create a problem for the maintenance of the pool.

A good pool design shall also take into consideration the physical safety of swimmers, the expected user load and the regulatory requirements outlined in the Environmental Public Health (Swimming Pools) Regulations, including the requirements for licensing of swimming pools.

7.2  Design Criteria

The design criteria for swimming pool shall be as follows:

(a) A water-circulation system consisting of pumps, piping, perimeter overflow system, return inlets, filters and other necessary equipment shall be provided for complete circulation of the water through all parts of the pool. The water-circulation pumps and motors shall be of adequate sizes to turn over the entire pool water capacity at least once every 6 hours for the main pool and not more than 2 hours for standalone wading pool.

(b) Overflow weirs shall be provided for at least 50% of the perimeter of the pool. It is advised that ease of maintenance be considered in the design of the overflow weir. A deck level channel design can be adopted for the overflow weir drainage system. Drawings of an example of deck level channel can be found in Appendix 5.

(c) There shall be at least one standby pump unit and motor to supplement the duty pump provided in the filtration system.

(d) Flow meters shall be installed on all re-circulation systems and shall be capable of measuring water flows of 1.5 times the designed flow rate.

(e) The filtration plant shall be the rapid sand, diatomaceous earth or any other acceptable filtration system.

(f) Sampling taps shall be provided at the inlet and outlet pipes of the filter.

(g) Filter backwash water shall be discharged into the sewer via a backwash water holding tank.

(h) The swimming pool shall be equipped with automatic disinfectant and chemical feeders to maintain the bacteriological and chemical characteristics of the water within the water quality limits stipulated in Appendix 6.

(i) Materials used for landscaping of pool edge shall be of smooth surface to facilitate easy cleaning.
The design of planting strip(s) close to the pool edge shall incorporate measures to ensure no overflow of water from the planting strip(s)/area(s) into the pool water.

(j) Linkways and bridges across the pool are allowed. Care must be taken in the design to ensure no overflow of runoff from planting strips on the linkways and bridges into the pool water.

(k) If a submerged bar is provided in the pool, a sink connected to a sewer shall be provided.

(l) At least two showers shall be provided around the swimming pool.

(m) Design of indoor swimming pools shall address the issue of adequate ventilation.

(n) The Qualified Person may refer to Appendix 7 for suggested guidelines on safety features in pool design and landscaping.
8 DORMITORY

8.1 Design Criteria

The following guidelines shall be used for stand-alone dormitories:


(b) The room shall be adequately ventilated and lighted.

(c) Adequate number of toilets and sanitary fittings shall be provided in accordance with Section 2 of the COPEH.

(d) Where cooking area is to be provided in the dormitories, such provisions shall be in accordance with the requirements stipulated under Section 3.4 of the latest edition of Singapore Standard SS 547:2009.
9 ANTI–MOSQUITO BREEDING

9.1 Objective
During the design of any building or structures, the QP shall take into consideration and avoid features that may result in water stagnation and become potential breeding habitat for mosquitoes. Any part of a building where water stagnation may occur shall be provided with permanent and safe access for maintenance purpose.

9.2 Roof Gutter
With effect from 1 Nov 2005, no roof gutters shall be installed for any new developments.

9.3 Air–Conditioning Tray
No tray or receptacle shall be placed beneath and/or on top of any air-conditioning unit so as to avoid creating a condition favourable for mosquito breeding.
10 PREMISES WITH CATTLE

10.1 Design Criteria

Living quarters or dormitories shall not be sited in stables, cattle-sheds, or any building used or intended to be used for the keeping of buffaloes, cows, oxen, sheep, goats and horses, etc.
11 STORAGE AND COLLECTION SYSTEM FOR RECYCLABLES AT STRATA-TITLED PROPERTIES WITH RESIDENTIAL UNITS

11.1 Objective

The recyclables storage and collection system shall be designed for strata-titled properties with residential units to provide residents with convenient access to recycling, without polluting the environment and creating nuisance to residents and neighbouring premises. A recyclables storage and collection system can be a designated main recycling point for recycling receptacles and/or recyclables chute system. The design for the recyclables storage and collection system shall be adequate in size to meet the anticipated recyclables output without compromising the design for the refuse storage and collection system.

11.2 Recyclables Output

(a) “Recyclables” is defined under the Second Schedule of Environmental Public Health (General Waste Collection) Regulations as follows:-

<table>
<thead>
<tr>
<th>Recyclables</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper products</td>
<td>Newspaper, computer printouts, writing paper, envelopes, car park coupons, brochures/pamphlets, magazines, books, cardboard and paper packaging (such as cereal boxes and drink cartons) and other paper products but excluding tissue paper and paper food wrappers</td>
</tr>
<tr>
<td>Metal products</td>
<td>Cans or containers made of metal such as soft drink cans, beer cans, milk powder tins and food cans.</td>
</tr>
<tr>
<td>Plastic products</td>
<td>Bottles or containers made of plastic such as detergent containers, milk containers, mineral water bottles, soft drink bottles, juice bottles, plastic bags, plastic packaging and other plastic products but excluding styrofoam, disposable cutleries and crockeries.</td>
</tr>
<tr>
<td>Glass products</td>
<td>Jars, wine bottles and beer bottles but excluding light bulbs, window glass, porcelain, ceramic and fish tanks.</td>
</tr>
</tbody>
</table>

(b) The daily recyclables output shall be computed to be either an additional 30% by volume of the daily refuse output estimated under section 1.2 or 240L/d of recyclables, whichever is higher.
11.3 Designated main recycling point for recycling receptacles

A designated main recycling point for placement of recycling receptacles shall be provided for the deposit, consolidation and storage of recyclables collected from the development. The designated main recycling point for recycling receptacles shall meet the following requirements:

(a) The designated main recycling point shall allow placement of bulk bin(s) or container(s) to accommodate collection and storage of the minimum daily recyclables output specified in section 11.2.

(b) The designated main recycling point shall be so sited at one location as to minimise nuisance to estate occupants and neighbouring premises and be accessible to a recyclables collection vehicle, using the same road access as that used by the refuse collection vehicle.

(c) The designated main recycling point shall be accessible by residents.

(d) The design of the designated main recycling point shall be independent of and not compromise the design for the refuse storage and collection system.

(e) An estate may opt to provide intermediate recycling points to enable residents to recycle more conveniently. The capacity of the intermediate recycling receptacles at intermediate recycling points shall not result in any reduction in the required capacity (as calculated under 11.3(a)) of the recycling receptacles to be placed at the designated main recycling point.

11.4 Recyclables chute system

For estate that opts to have a recyclables chute system for collection and storage of recyclables, the system shall meet the following requirements:

(a) The recyclables chute shall comply with the same requirements for refuse chutes stated in section 1.3.

(b) A recyclables chute chamber is connected to a recyclables chute and houses a recycling bin. The recyclables chute and its chamber shall be suitably located to facilitate easy and nuisance-free removal of recyclables and shall comply with the same requirements for refuse chute chamber stated in section 1.4 with the capacity to contain at least one day of recyclables output from all the premises connected to the recyclables chute. Recyclables collected in the recyclables chute chamber shall be transferred to the receptacles for recycling at the designated main recycling point.

(c) A recyclables collection room is located at the bottom of a centralised recyclables chute and houses a large container. Recyclables collected in the container are transferred to the recyclables collection vehicle. The recyclables collection room shall comply with the same requirements for
refuse room stated in section 1.5 with a minimum capacity to accommodate 2 days of recyclables output.

(d) A pneumatic recyclables chute collection infrastructure shall comply with the same requirements for pneumatic refuse conveyance system stated in section 1.7 with capacity to accommodate a minimum of 2 days of recyclables output.

(e) The complete recyclables chute system shall be designed to minimise pilferage and/or damage of recyclables.
APPENDIX 1:

EXAMPLE OF THE LAYOUT OF BIN CENTRE FOR THE OPERATION OF ROLL-ON ROLL-OFF REFUSE COMPACTOR

NOTE:
- NO ENCLOSED ROOM WITHIN BIN CENTRE
- ONLY CRITICAL DIMENSIONS ARE INDICATED ON THE DRAWINGS
* R4000 IF THE ACCESS ROAD IS 5m IN WIDTH OR ABOVE
APPENDIX 2: PROVISION OF SANITARY FACILITIES

Sanitary facilities shall be provided in accordance with the requirements listed below. The floor area refers to the **gross floor area**

### Categories of Places

#### (1) SHOPPING PLACE/ SUPERMARKET/ WET MARKET

<table>
<thead>
<tr>
<th>Number of Sanitary Facilities</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>WHB</td>
<td>WC</td>
</tr>
</tbody>
</table>

- Not more than 350 sq m
- 351 sq m to 700 sq m
- 701 sq m to 1,000 sq m
- 1,001 sq m to 1,500 sq m
- 1,501 sq m to 3,000 sq m
- 3,001 sq m to 5,000 sq m
- Every additional 2,000 sq m or less in excess of 5,000 sq m

#### (2) EATING ESTABLISHMENT/ FOOD CENTRE/ BAR/ NIGHTCLUB

<table>
<thead>
<tr>
<th>Number of Sanitary Facilities</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>WHB</td>
<td>WC</td>
</tr>
</tbody>
</table>

- Not more than 250 sq m
- 251 sq m to 500 sq m
- 501 sq m to 750 sq m
- 751 sq m to 1,000 sq m
- 1,001 sq m to 1,500 sq m
- 1,501 sq m to 2,000 sq m
- 2,001 sq m to 3,000 sq m
- 3,001 sq m to 4,500 sq m
- Every additional 1,500 sq m or less in excess of 4,500 sq m
## Categories of Places

### Number of Sanitary Facilities

<table>
<thead>
<tr>
<th>(3) CONFERENCE HALL/ CINEMA/ THEATRE (seating capacity)</th>
<th>(4) PARK/ TOURIST SITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5) CONFERENCE HALL/ EXHIBITION HALL (capacity)</td>
<td>Note: 2 nos of shower rooms each shall be provided for the female and male public toilet block when the Park is abutting a beach.</td>
</tr>
<tr>
<td>(6) PETROL STATIONS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Categories of Places</th>
<th>Number of Sanitary Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>WC</td>
</tr>
<tr>
<td>CONFERENCE HALL/ CINEMA/ THEATRE</td>
<td></td>
</tr>
<tr>
<td>(3) CONVENTION HALL/ EXHIBITION HALL</td>
<td></td>
</tr>
<tr>
<td>Not more than 150 persons</td>
<td>3</td>
</tr>
<tr>
<td>151 to 300 persons</td>
<td>6</td>
</tr>
<tr>
<td>301 to 450 persons</td>
<td>9</td>
</tr>
<tr>
<td>451 to 600 persons</td>
<td>12</td>
</tr>
<tr>
<td>601 to 900 persons</td>
<td>14</td>
</tr>
<tr>
<td>Every additional 100 persons or less in excess of 900 persons</td>
<td>1</td>
</tr>
<tr>
<td>Every additional 150 persons or less in excess of 900 persons</td>
<td>-</td>
</tr>
<tr>
<td>PARK/ TOURIST SITE</td>
<td>2</td>
</tr>
<tr>
<td>BUS TERMINAL/ INTERCHANGE</td>
<td></td>
</tr>
<tr>
<td>Not more than 20 bus bays</td>
<td>3</td>
</tr>
<tr>
<td>21 to 50</td>
<td>6</td>
</tr>
<tr>
<td>51 to 100</td>
<td>9</td>
</tr>
<tr>
<td>More than 100</td>
<td>11</td>
</tr>
<tr>
<td>PETROL STATIONS</td>
<td>1</td>
</tr>
</tbody>
</table>
Categories of Places

(7) MRT STATIONS
TOILET (CONCOURSE)
(a) Station without Retail Shops, or with retail space not more than 1,000 sq m

<table>
<thead>
<tr>
<th>Female</th>
<th>WC</th>
<th>WHB</th>
<th>Male</th>
<th>WC</th>
<th>UR</th>
<th>WHB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

(b) Station with Retail Shops, retail space of
1,001 to 1,500 sq m

|        | 7  | 4   | 3    | 4  | 4  |      |

exceeding 1,500 sq m

|        | 10 | 6   | 4    | 6  | 5  |      |

(8) STADIUM
Spectators
Not more than 2,000 persons

|        | 10 | 6   | 3    | 7  | 6  |      |

2,001 to 5,000 persons

|        | 15 | 8   | 5    | 10 | 8  |      |

5,001 to 10,000 persons

|        | 26 | 14  | 8    | 18 | 14 |      |

10,001 to 20,000 persons

|        | 40 | 20  | 12   | 28 | 20 |      |

20,001 to 50,000 persons

|        | 60 | 32  | 18   | 42 | 32 |      |

50,001 to 100,000 persons

|        | 100| 46  | 30   | 70 | 46 |      |

Sanitary facilities within the stadium shall be uniformly distributed.
### Categories of Places

<table>
<thead>
<tr>
<th>Number of Sanitary Facilities</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>WHB</td>
<td>BR</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>PUBLIC SWIMMING POOL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 250 sq m</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>251 sq m to 500 sq m</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>501 sq m to 1,000 sq m</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>1,001 sq m to 1,500 sq m</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Exceeding 1,500 sq m</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td><strong>CONSTRUCTION SITE/ DORMITORY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Construction site with living quarters/ dormitories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Every 15 male workers or less</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Every 15 female workers or less</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>(b) Construction site without living quarters,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Every 25 male workers or less, up to 500 male workers</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Every 25 female workers or less, up to 500 female workers</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Notation:**
- *: To be used by both male and female
- WC: Water Closet
- WHB: Wash Hand Basin
- UR: Urinal
- BH: Bench with Hanger
- BR: Bathroom with bench
APPENDIX 3: MIST GENERATING SYSTEM AND FAN

Legionella bacteria can be found naturally in water sources in the environment. They may colonise poorly designed or maintained water systems such as mist generating systems and misting fans (or devices). When people, especially those with weak immunity, are exposed to the mist or water aerosols containing legionella bacteria, they may acquire legionnaires’ disease or Pontiac fever, which are collectively known as legionellosis. To reduce the risk to public health due inhalation of legionella bacteria, it is important to minimise the conditions favouring bacteria proliferation in such water systems and thereby reduce the human exposure to contaminated mist or water aerosols.

The owner(s) and operator(s) of the mist generating systems or misting fans shall ensure that:

(a) The system shall be made from corrosion resistant materials that can withstand the pressure of the water aerosolized.

(b) The design of the system shall be such that the water is drained off during the standby conditions to avoid proliferation of bacteria in stagnant water.

(c) Misting fans shall be installed at such a height or in a manner that the intense stream of mist (as it leaves the nozzle) is not blown directly at a person’s face.

(d) The water used to produce the mist shall be of drinking water quality.

(e) The system shall be equipped with a UV lamp or such other antimicrobial device after the filter, to disinfect the water and minimize the proliferation of microbiological growth.

(f) All chokages (at nozzles or spray heads) shall be cleared promptly. The entire system (including interior piping, nozzles, pump, antimicrobial device, etc.) shall be cleaned and disinfected by a competent person, at least once every three months (or more frequently if recommended by the manufacturer) and kept in a good working condition.

(g) When a system is switched on, care shall be taken to avoid exposure of initial mist stream to any person. For systems that have been shut down for five days or more, cleaning and disinfection of the entire system shall be carried out before switching the system on.

(h) Records of any remedial or maintenance work, inspection or test carried out shall be kept and made available for inspection.
APPENDIX 4: PLUMBING DETAILS FOR MARKET

An example of the layout of the drain lines for the stalls, the common service corridor, and the common passageway is shown in Drawing 1.

(a) The floor sumps from an upper storey shall be connected to a vertical discharge stack of cast iron or UPVC of at least 250 mm in diameter. The discharge stack shall be connected to a waste sump.

(b) Provision of floor sump to be in accordance with Drawing No. 3-13 of Code of Practice on Sewerage & Sanitary Works

(c) Provision of waste sump to be in accordance with Drawing No. 3-10 and Section 3.1.3.11(b) of Code of Practice on Sewerage & Sanitary Works

(d) The inspection chamber shall measure 900 mm x 700 mm in dimensions [Please made reference to Drawing No. 3-7 Of Code of Practice on Sewerage and Sanitary Works]

(e) The last inspection chamber before the sewer manhole shall be provided with an overflow pipe of at least 225 mm in diameter. The overflow pipe shall have a flap valve.

(f) The main drain-lines shall be at least 200 mm in diameter with a minimum gradient of 1:150 but not exceeding 1:40. The main drain-line connected to the last inspection chamber shall have a gully trap.

(g) The branch drain-lines connecting the floor sumps within the stalls and at the service corridors to the waste sumps shall be at least 225 mm in diameter. The other branch drain-lines shall be at least 150 mm in diameter. All branch drain-lines shall have a minimum gradient of 1:90 but not exceeding 1:30.

(h) Layout of drainlines to be in accordance with Drawing No. 3-12a of Code of Practice on Sewerage & Sanitary Works.
DRAWING 1 - LAYOUT OF DRAINLINES FOR MARKET
APPENDIX 5: DETAILS OF DECK LEVEL CHANNEL
APPENDIX 6: WATER QUALITY STANDARDS FOR SWIMMING POOL

The water in swimming pools shall be maintained at the following water quality standards at all times.

(I) Physical Quality

(a) The pool water shall be clear and clean. No scum or floating impurities shall be allowed to accumulate. The colour of the water shall not exceed 5 Hazen units and the turbidity shall not exceed 5 NTU.

(II) Bacteriological Quality

(a) *E. Coli* shall not be present in any 100 ml sample of water taken from the pool.

(b) Not more than 10 coliform organisms shall be present in any 100 ml of water taken from the pool.

(c) Not more than one out of five consecutive samples of the water, taken monthly, shall contain any coliform organisms in 100 ml of the water sample.

(d) No sample shall contain more than 200 bacteria per ml as determined by the 24-hour plate count at 37°C or by the membrane filter method.

(III) Chemical

(a) A free chlorine residual of not less than 1.0 mg per litre and not more than 3.0 mg per litre shall be maintained in the pool.

(b) If copper sulphate is used as an algicidal agent, copper sulphate concentration of the water determined as copper shall not exceed 0.2 mg per litre.

(c) The pool water shall have a pH value of between 7.2 and 7.8.

(d) If cyanuric acid is used as a stabilizer for chlorine (either separately or in combined form), its maximum concentration shall not exceed 100 mg/litre in the swimming pool water.
APPENDIX 7: SUGGESTED GUIDELINES ON SAFETY FEATURES IN POOL DESIGN AND LANDSCAPING

The suggested guidelines below are recommendations for QPs’ consideration when designing pool facilities and surrounding landscaping. They do not form part of the design criteria stipulated for Building Plan submission.

(a) The pool bottom of the shallow area and steps of the swimming pool shall be of non-slip finish. Grip tiles used along the edges of the pools shall also be non slippery and smooth to avoid injuries to users.

(b) At any part of the swimming pool with water depth less than 1.5m, the slope of the floor shall be uniform and not steeper than 1:12.

(c) The pool shall have at least two means of exit located so as to serve both ends of the pool. The distance from any point in the pool to an exit shall not be more than 15 m.

(d) The depth of water in metres shall be marked plainly in numerals of at least 100 mm in height embedded into the edge of the pool wall and the corresponding pool deck. Depth markings shall be provided at the shallow and deep ends of the pool and the transition point.

(e) The depth of water in the wading pool shall not exceed 500 mm.

(f) At least 5 m of unobstructed headroom above the diving board shall be provided.

(g) The diving board shall not be placed more than 1 m above the surface of the water for a depth of 2.5 m of water in the swimming pool.

(h) A horizontal separation of 3 m shall be provided between adjacent diving boards and between any diving board and the sidewall.

(i) Where the pool bottom transits to a steeper slope, the transition shall be marked on the bottom and walls of the pool by a stripe of dark contrasting colour at least 15cm wide.
APPENDIX 8: GLOSSARY OF TERMS

The definitions of the following terms apply in this document:

1. Manual override

A built-in feature in the urinal sensor-operated flush valve to allow the user to manually actuate an immediate flushing of the urinal by pressing a button. The sensor and the manual override will not function in the event of a power supply failure.

When the override button is used, the manual override feature overrides the sensor operation and discharges only a preset volume of water (not more than 2.5 liters of water per flush) even if the button continues to be held actuated. No second flush shall be activated when the user leaves the urinal.

2. Manual override cum by-pass

A built-in feature in the WC sensor-operated flush valve to allow the user to manually actuate an immediate flushing of the WC by pressing a button. The sensor and the manual override will not function in the event of a power supply failure. The manual by-pass feature will enable the flush valve to continue to function manually in the event of a power supply failure.

When the override cum by-pass button is used, the manual override and by-pass features overrides the sensor operation and discharge only a preset volume of water (not more than 4.5 litres of water per flush) even if the button continues to be held actuated. No second flush shall be activated when the user leaves the WC.

3. Sensor-operated flush valves

A valve with an electronic control device that is automatically actuated to supply a predetermined quantity of water (not more than 4.5 and 2.5 litres of water per flush for WC and urinal respectively) to a WC or urinal for the purpose of flushing after each use.

4. Waterless Urinals

A urinal made of urine repellent vitreous china or acrylic and requiring no flush valves (i.e. water free). The fixture’s drain outlet includes an immiscible liquid sealant that floats on top of the urine layer. This combination seal blocks out sewer gases, and blocks out urine odors.
Addresses of Environmental Health Department and Environmental Health Regional Offices

(a) Central Regional Office
   4545 Jalan Bukit Merah
   Singapore 159466
   Tel: 6272 4266

(b) South-East Regional Office
    70 Tannery Lane
    Singapore 347810
    Tel: 6747 4811

(c) South-West Regional Office
    335 Clementi Road 14.5 km
    Singapore 129786
    Tel: 6466 0544

(d) North-East Regional Office
    174 Sin Ming Drive
    Singapore 575715
    Tel: 6455 3177

(e) North-West Regional Office
    No.18 Attap Valley Road
    Singapore 759910
    Tel: 6756 7678

(f) Environmental Health Department
    National Environment Agency
    21st Storey Environment Building
    40 Scotts Road
    Singapore 228231