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SALE OF SITE
FOR RESIDENTIAL & RESIDENTIAL WITH COMMERCIAL AT 1ST STOREY DEVELOPMENT
LAND PARCEL AT SILAT AVENUE

TECHNICAL CONDITIONS OF TENDER

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TECHNICAL CONDITIONS OF TENDER

PART I

1.0 GENERAL

1.1 The Urban Redevelopment Authority ("the Authority"), acting as agent for and on behalf of the Government of the Republic of Singapore ("the Government"), is inviting offers for lease by tender for the Land Parcel at Silat Avenue ("Land Parcel") for a residential and residential with commercial at 1st storey development. The lease and development of the Land Parcel is subject to these Technical Conditions of Tender and the Conditions of Tender contained in the Developer's Packet. In these Technical Conditions of Tender, where the context so admits, the expression "the Authority" includes the Government.

1.2 The successful tenderer shall in addition to the Conditions of Tender observe and comply with these Technical Conditions of Tender. The Conditions of Tender and these Technical Conditions of Tender are to be read together with the Control Plans of the Land Parcel supplied in the Developer's Packet.

PART II

2.0 PLANNING CONCEPT

2.1 Kampong Silat

Rail Corridor

2.1.1 The Land Parcel is located next to the 24km-long Rail Corridor which will become an inclusive community space and seamless leisure corridor. There is opportunity to capitalize on the mature, lush greenery and recreational offering of the Rail Corridor to create a unique and differentiated development that innovatively and sensitively integrates greenery with high-rise living.

Conserved Buildings

2.2.1 The Land Parcel includes five conserved former Singapore Improvement Trust (SIT) flats ("the Conserved Buildings") which are local landmarks. These familiar blocks are to be restored. The sensitive integration of these blocks into the overall residential development provides the opportunity to deliver a distinctive and delightful product.

2.2.2 These restored blocks are also envisaged to form the backdrop to an inviting yet intimate neighbourhood park in front of the blocks that leads to the Rail Corridor for both immediate residents, as well as Rail Corridor users to enjoy..

2.2 Land Parcel at Silat Avenue

Central Location with Good Accessibility

2.2.1 The Land Parcel is located at the fringe of an established residential estate in the Central Region of Singapore. It is easily accessible from the Central Business District (CBD) and other parts of the City Centre such as Marina Bay and Orchard Road, as well as the Southern Waterfront where VivoCity and Sentosa are located.

Convenient Road and Rail Access

2.2.2 The future development is well served by Kampong Bahru Road and Central Expressway and the nearest MRT stations serving the site are the Outram Interchange and upcoming Cantonment MRT Stations.

PART III

3.0 SUMMARY OF PLANNING AND URBAN DESIGN REQUIREMENTS

3.1 A summary of the planning and urban design requirements is set out in Table 1. The detailed planning and urban design requirements are set out in Part IV.

Table 1 – Summary of Planning & Urban Design Requirements for the Land Parcel

PARAMETERS	**PROVISIONS / REQUIREMENTS**
Site Area	22,851.6 m^2
Land Use / Zoning	Residential and Residential with Commercial at 1st Storey
Type of Proposed Housing Development	The Land Parcel is to be developed for predominantly residential use for: a. Flats; or b. Serviced apartments; or c. A combination of flats and serviced apartments Condominium and strata landed houses will not be allowed.
Permissible Gross Floor Area (GFA)	<u>Overall GFA</u> 84,551 m^2 (maximum) 76,096 m^2 (minimum) The maximum number of dwelling units is to be capped at 1,125. <u>Commercial and Complementary Uses GFA</u> Total Commercial GFA: 1,300 m^2 (maximum, including childcare centre and ORA) [1] Shop and/or Restaurant GFA: 450 m^2 (maximum, including ORA) The proposed development shall include a childcare centre (CCC) of minimum 450 m^2 GFA. The GFA for the CCC is to be computed as part of the permissible GFA for the proposed development. (see Conditions 4.2.10 to 4.2.16) Commercial, CCC and other complementary uses shall only be located within the first storey of three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the basement of the Conserved Building located nearest to the junction of Kampong Bahru Road and Silat Avenue (where applicable)[2].

[1] The estimated total GFA of the 1st storey of three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the basement of the conserved building located nearest to the junction of Kampong Bahru Road and Silat Avenue is about 1,284.4 m^2.

[2] Of the three Conserved Buildings fronting Kampong Bahru Road, one block closest to the junction of Kampong Bahru Road and Silat Avenue has a basement level. Commercial, CCC and complementary uses are allowed within the basement.

PARAMETERS	PROVISIONS / REQUIREMENTS
	If there is any Outdoor Refreshment Areas (ORA), the ORA shall be located in the space between the three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the southern boundary of the Land Parcel. If there is no ORA, the commercial and complementary uses shall only be confined within the first storey of the three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the basement of the Conserved Building located nearest to the junction of Kampong Bahru Road and Silat Avenue.
Allowable Uses in the Conserved Buildings	The Land Parcel includes five existing Conserved Buildings which shall be retained and restored. Three of the Conserved Buildings fronting and nearest to Kampong Bahru Road are zoned Residential with Commercial at 1st Storey and only residential use is allowed from the second storey and above. The first storey and basement (where applicable) of these three Conserved Buildings shall be adapted for one or more of the following uses: a) Office b) Shop and/or Restaurant c) Childcare Centre d) Commercial School e) Commercial Gymnasium and Fitness Centre f) Any other complementary uses as approved by the Competent Authority under the Planning Act. and shall not be used for bar, pub, health centre, amusement centre, private clubhouse and/or any live entertainment uses. The maximum permissible GFA for commercial use and any other complementary uses is 1,300 m^2. Of the maximum permissible GFA for commercial use and any other complementary uses, the total GFA for shop and/or restaurant uses is not to exceed 450 m^2. The minimum size of each commercial unit is 50 m^2. The other two Conserved Buildings are zoned Residential and shall be adapted for residential or private clubhouse use only.
Building Height	The development is subject to the following building height controls:

PARAMETERS	PROVISIONS / REQUIREMENTS
	Low-Rise Zone Up to a maximum of 50.0 m Above Mean Sea Level (AMSL) High-Rise Zone Up to a maximum of 200.0 m[3] Above Mean Sea Level (AMSL) The details are as set out in Part IV (Condition 4.5) and as shown in the Control Plans.

[3] Tenderers are to ensure that all buildings (inclusive of all structures and fixtures above the roof-top such as TV antennas, water tanks, lift motor rooms, cranes, maintenance equipment and lightning conductors), construction equipment and temporary structures, such as cranes, piling rig, etc within the Land Parcel should not exceed 200 m AMSL at all times. The successful tenderer shall seek the Republic of Singapore Airforce (RSAF) clearance for the use of construction equipment and temporary structures above 123 m AMSL. (Email: height_control@defence.gov.sg)

PART IV

4.0 PLANNING AND URBAN DESIGN REQUIREMENTS

4.1 General Guidelines

4.1.1 The Planning and Urban Design Requirements as set out in Part IV are to be read in conjunction with the Control Plans and the Conditions and Requirements of Relevant Competent Authorities & Public Utility Licensees provided in the Developer's Packet.

4.1.2 The successful tenderer shall comply with the Development Control Guidelines issued, or that may be issued from time to time, by the Competent Authority under the Planning Act.

4.1.3 Where applicable, the successful tenderer's Qualified Person shall submit a Development Statement of Intent (DSI) together with the development proposal to be submitted to the Competent Authority under the Planning Act (Cap. 232) at the formal submission stage as per prevailing guidelines and circulars issued by the Competent Authority.

Access into State Land/ MEWR Land/ HDB Land

4.1.4 For the purpose of entering State Land or land under the Ministry of the Environment and Water Resources (MEWR) or the Housing Development Board (HDB) to carry out any works for the purpose of or in relation to the proposed development as may be required under these present Technical Conditions of Tender or Conditions of Tender, the successful tenderer shall obtain a Temporary Occupation Licence (TOL) from the Singapore Land Authority (SLA) for use of the State Land or obtain a TOL from MEWR or HDB. The TOL may be granted on such terms and conditions and subject to the payment of such charges and fees as the SLA/ MEWR/ HDB may determine.

Deviations from Planning Requirements

4.1.5 The planning and urban design requirements relating to location, height, size, area or extent of uses, etc. as set out in this Part are specified with a view of achieving the prevailing planning objectives as outlined or indicated in the provisions in this Part. The successful tenderer may submit alternative proposals to any of such requirements for the Authority's consideration. Where the Authority is satisfied that the alternative proposal will also serve to achieve the planning objective relevant to the requirement, the successful tenderer may be allowed to adopt such alternative proposal instead, in which event the relevant provisions in this Part shall be deemed to be complied with. The Authority, however, reserves the absolute discretion to decide whether or not to allow any alternative proposal to be adopted.

4.2 Land Use and Quantum

4.2.1 The Land Parcel is zoned for Residential and Residential with Commercial at 1st Storey under the Master Plan and is to be developed for a predominantly residential development. The maximum permissible Gross Floor Area (GFA) for the development is 84,551 m^2 and the total GFA to be built is not to be less than 76,096 m^2. The maximum number of dwelling units (DUs) is to be capped at 1,125.

Commercial and Complementary Uses

4.2.2 The maximum permissible GFA for commercial, childcare centre and any other complementary uses as approved by the Competent Authority under the Planning Act (Cap. 232) is 1,300 m^2. Of the maximum permissible GFA for commercial and any other complementary uses, the total GFA for shop and/or restaurant uses, including any proposed Outdoor Refreshment Areas (ORA) is not to exceed 450 m^2. Commercial and complementary uses shall only be located within the first storey and basement (where applicable) of the three blocks of the Conserved Buildings fronting and nearest to Kampong Bahru Road. If there is no ORA, the commercial and complementary uses shall only be confined within the first storey of the three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the basement of the conserved building located nearest to the junction of Kampong Bahru Road and Silat Avenue.

4.2.3 Any ORA, if provided, shall be located in the space between the three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the southern boundary of the Land Parcel. The ORA shall be setback to comply with the 2-metre green buffer along its boundary abutting the park.

4.2.4 The total GFA of the conserved buildings and any ORA shall be computed as part of the maximum permissible GFA of 84,551 m^2.

4.2.5 All tenderers are advised to carry out their own simulation studies to ascertain the achievable GFA for the proposed development, including any additional GFA allowable under the prevailing Development Control Guidelines (e.g. for balconies in residential projects). Such simulation studies should take into account all relevant considerations including the technical height constraint and existing ground conditions of the Land Parcel as well as the possible need to provide basements.

Allowable Uses within the Conserved Buildings

4.2.6 The Land Parcel includes five existing Conserved Buildings which shall be retained and restored.

4.2.7 Three of the Conserved Buildings fronting and nearest to Kampong Bahru Road are zoned Residential with Commercial at 1st Storey and only residential use is allowed from the second storey and above. The first storey and basement (where applicable) of these three Conserved Buildings shall be

adapted for one or more of the following uses to allow the larger community to appreciate our early public housing heritage

a. Office;
b. Shop and/or Restaurant;
c. Childcare Centre;
d. Commercial School;
e. Commercial Gymnasium and Fitness Centre; and
f. Any other complementary uses as approved by the Competent Authority under the Planning Act.

and shall not be used for bar, pub, health centre, amusement centre, private clubhouse and/or any live entertainment uses.

4.2.8 The other two Conserved Buildings are zoned Residential and shall be adapted for residential or private clubhouse use only.

Access to the Conserved Buildings with Commercial Uses

4.2.9 The three Conserved Buildings fronting and nearest to Kampong Bahru Road are zoned Residential with Commercial at 1st storey as the intention is to keep the first storey space within and around the buildings accessible to the public during business operation hours. To complement this, the area in front of the conserved blocks will be developed as a public park which will be accessible to the public.

Childcare Centre (CCC) Facility

4.2.10 The successful tenderer is required to provide a childcare centre[4] (CCC) for infant care and/or childcare services within the proposed development for a minimum of 10 years from the date of issuance of CCC license. The GFA of the CCC shall be a minimum of 450 m^2 and is to be computed as part of the permissible GFA for the proposed development. The CCC is estimated to accommodate a total capacity of 100 children (including infants).

4.2.11 The CCC shall comply with the requirements and guidelines established by the Early Childcare Development Agency (ECDA) for infant and childcare centres. Tenderers may refer to the guideline published by ECDA "Guide on Setting Up a Child Care Centre" which is found on ECDA's website: (http://www.childcarelink.gov.sg.ccls/uploads/CCC_Guide.pdf) to understand the requirements and guidelines for CCCs.

4.2.12 The successful tenderer must inform ECDA when the Certificate of Statutory Completion for the proposed development is obtained and notify ECDA when the MCST is formed. The successful tenderer/MCST is to appoint an operator to run the CCC. The operator shall comply with requirements stipulated under the Child Care Centre Act (Cap 37A) and be licensed accordingly. The

[4] A childcare centre primarily caters to pre-school children below 7 years old. A childcare centre can choose to incorporate infant care into its services. Infant care caters to children aged 2 to 18 months.

successful tenderer/MCST may approach ECDA should they need assistance to identify a child care operator.

4.2.13 The CCC is to be located at the first storey and basement level (where applicable) of the Conserved Buildings zoned Residential with Commercial at 1st storey. The successful tenderer is not allowed to strata subdivide the CCC space. The CCC space shall form part of the common property of the development.

4.2.14 As the demographics of the area may change over time, the CCC space is to be used for a minimum of 10 years from the date of issuance of CCC license for CCC use

4.2.15 After the initial 10 year period, the MCST may convert the CCC space to other community uses, e.g. elder care centre, subject to approval of ECDA, URA and relevant agencies. Only upon the confirmation of ECDA, URA and relevant agencies that the space is no longer suitable or required for other community uses, the space can be converted to commercial use, subject to compliance with the conditions set out in 4.2.2 to 4.2.7.

4.2.16 Sufficient pick-up/drop-off bays equivalent to 10% of the maximum enrolment capacity of the CCC facility shall be provided within the proposed development. There is to be direct access from the pick-up/drop off bays to CCC, to minimise the walking distance between the two areas. All pick-up and drop-off activities of the CCC should be contained within the proposed development and such activities shall not be conducted along the public roads at all time. The appropriate security and amenity measures must be ensured in the overall design of the proposed development to safeguard the resident's privacy and living environment.

Inform Home Buyer of the CCC Facility

4.2.17 The successful tenderer shall also include in all sale brochures, marketing materials, options and agreements for the sale or sublease of the residential units such information as to highlight to the purchasers or sub-lessees the provision of a CCC within the development. The options and agreements for the sale of the residential units shall state that a minimum GFA of 450 m2 comprised in the common property of the development shall be for use only as a CCC.

4.3 Land / Strata Sub-division

4.3.1 The successful tenderer is not allowed to subdivide the Land Parcel, and may strata subdivide the development (including the Conserved Buildings) only in such a manner that the first storey of three of the Conserved Buildings that are fronting and nearest to Kampong Bahru Road and the basement of the Conserved Building located nearest to the junction of Kampong Bahru Road and Silat Avenue shall form part of the common property for the whole of the development, subject to the prevailing Development Control Guidelines issued by the Competent Authority under the Planning Act.

4.4 Building Form and Massing

4.4.1 The overall building form and massing of the development shall be designed to relate sensitively to the conserved buildings within the site and to the surrounding context. Should a landscaped car park deck be proposed to occupy the site, the construction of car parking spaces should be restricted to not more than two storeys above the ground, with the remaining car parking lots to be contained within the basement levels of the development.

4.4.2 The proposed new buildings shall adopt a terracing built form in response to the Rail Corridor, to preserve the signature green experience for users to enjoy.

4.5 Building Height

4.5.1 The development is subject to specific building height controls which are established to guide the development to sensitively relate to the adjacent Rail Corridor. These building height controls are set out below and are shown on the Control Plans:

a. Low-Rise Zone – The part of the development fronting the Rail Corridor may be built up to a maximum of 50.0 m Above Mean Sea Level (AMSL). The intention is to preserve the current 'green oasis' experience for users of the Rail Corridor by having the low-rise zone adjacent to it.

b. High-Rise Zone – The development may be built-up to a maximum of 200.0 m Above Mean Sea Level (AMSL) in this zone.

4.5.2 The general development and all construction equipment and temporary structures, such as cranes, piling rigs, etc., as well as permanent structures, such as water tanks, mechanical and electrical (M&E) equipment, lift motor rooms, TV antennae, lightning conductor, etc., are subject to a maximum allowable technical height control of 200.0 m AMSL, and are to comply with the requirements of the relevant Competent Authorities. The successful tenderer shall seek the Republic of Singapore Airforce (RSAF) clearance for the use of construction equipment and temporary structures above 123 m AMSL. (Email: height_control@defence.gov.sg)

4.6 Building Setback

4.6.1 The development is subject to the following building setbacks as shown in the Control Plans:

a. For the northern and north eastern boundary of the land parcel, the development is to comply with the prevailing Development Control Guidelines and adopt the common boundary setbacks in accordance with the proposed height of the development; and

b. For the western boundary of the land parcel, fronting the Rail Corridor, a minimum setback of 25.0 m from the site boundary shall be adopted; and.
c. All above-ground structures shall have a minimum 10.0 m setback from the conserved buildings.

4.6.2 Basement levels and permanent subterranean structures may be built within the building setback areas. A minimum of 3.0 m setback shall be observed between the basement levels and the conserved blocks. No basement or permanent subterranean structures may be built under the conserved buildings.

4.7 Building Platform Level

4.7.1 The minimum platform level (MPL) for the development on the Land Parcel shall be Reduced Level (RL) 104.0 m or 300 mm above the adjacent road/ ground levels, whichever is the highest. The exception shall apply for the 25.0 m wide strip of land abutting the Rail Corridor (see Control Plan) which shall not be topped up, to protect and conserve seven trees identified within.

4.8 Building Facades

4.8.1 The design of the building form and architectural treatment of the development is to respond to the Rail Corridor and to the tropical climate.

4.8.2 For the main elevation along Kampong Bahru Road, the building facades of the development are to be well-articulated with solid (walls) / void (fenestration) areas that draw upon a combination of different materials (e.g. concrete, brick, steel, glass, greenery, etc.). Full-height glass facades are not allowed.

4.8.3 All elevations facing the Rail Corridor are encouraged to be greened up. Rooftop gardens and sky terraces are also encouraged to be provided.

4.8.4 To create visual interest and to break down the building mass, elements of tropical architecture such as sky terraces, balconies, sun-shading fins/louvres, deep recesses, window ledges, roof terraces, communal planter boxes and vertical green walls are strongly encouraged to be provided as part of the development and integrated with the overall building form and architectural treatment of the development.

4.9 Vehicular and Servicing Access

Vehicular Access

4.9.1 Vehicular access to the development is to be taken from Silat Avenue only, as shown at the approximate position in the Control Plans and as set out in Clauses 7.1 to 7.2 of the Conditions and Requirements of Relevant Competent Authorities and Public Utility Licensees.

4.9.2 The internal driveway within the Land Parcel connecting to Silat Avenue is to extend for a minimum distance of five car lengths from the site boundary / line of Road Reserve of Silat Avenue. Permanent structures, including all gantry / entry barriers and guard houses or passenger drop-offs / pick up points and taxi lay-bys are not allowed to be located along this stretch of the driveway.

4.9.3 Sufficient pick up / drop off bays, taxi stand, vehicle queuing length and adequate turning spaces shall be provided within the development to avoid queuing-up of vehicle onto the main road. Any gantry/barriers to car park access shall be located deep within the development.

4.9.4 The successful tenderer shall locate the electrical substation(s) and refuse bin centre within the Land Parcel. Access to these service areas, if required, shall be taken via the ingress/ egress point of the proposed development.

Service Areas

4.9.5 Sufficient service areas, including the refuse bin centre, electrical substation, loading / unloading bays, holding bays, etc., are to be included within the development to meet the needs of the proposed uses. All service areas are encouraged to be located at the basement levels. If located at-grade or above-grade, these service areas are to be located and designed to be fully integrated within the overall building form and architectural treatment of the development and visually well-screened from the top and on all sides. The successful tenderer shall ensure that access to these service areas is taken from within the development site. Service areas are not allowed to be located fronting the conserved buildings within the site.

4.9.6 Other service areas / structures, such as air-conditioning ledges for the individual DUs and ventilation shafts to the basement levels, if provided, are to be fully integrated within the overall envelope of the buildings and are to be visually well-screened.

4.9.7 All service areas will be subject to the requirements and approval of the Authority and the relevant Competent Authorities at the formal submission stage.

Location of Bin Centre

4.9.8 The bin centre for the development shall be sensitively located within the Land Parcel such that it does not become a nuisance to residents in the surrounding developments. The entrance to the bin centre is to be designed to face inwards within the development and the internal driveway leading to it, including any parking space for the refuse trucks, are to be fully located within the Land Parcel. The length of the driveway must be able to accommodate all required service vehicles.

4.9.9 Lush planting and / or physical screening is to be provided to visually screen the bin centre and service areas from the adjacent public spaces and surrounding developments.

Construction Access

4.9.10 A separate construction access driveway shall be constructed parallel to Silat Avenue maintaining a divider of 1.5 m wide (min). The construction access can be taken from Kampong Bahru Road located at least 20 m away from the existing Silat Avenue junction. The details of the construction access and connection to Kampong Bahru Road is subject to the requirements and approval of the LTA, HDB and other relevant Competent Authorities.

4.10 Car, Motorcycle and Bicycle Parking Provision

Car Parking

4.10.1 The successful tenderer shall provide car parks for the proposed development in accordance with the requirements of the prevailing Parking Places (Provision of Parking Places and Parking Spaces) Rules.

4.10.2 The car parking spaces may be located at-grade, above-grade, and / or at basement levels. The car parking spaces (whether at the basement, at-grade and / or above-grade levels) are to be sensitively located within the Land Parcel such that they are not directly fronting onto, or visible from adjacent public spaces or the conserved buildings within the site. Should a landscaped car park deck be proposed, the construction of car parking spaces should be restricted to not more than two storeys above the ground, with the remaining car parking lots to be contained within the basement levels of the development. Basement car parking shall also observe a 3.0m setback from the conserved blocks.

4.10.3 The façade of all at-grade and / or above grade car parking spaces is be fully integrated within the overall building form and architecture treatment of the development.

Motorcycle Parking

4.10.4 The motorcycle parking lots are strongly encouraged to be co-located within the car parking areas. Some of the motorcycle parking facilities are encouraged to be located in accessible areas, such as together with the loading / unloading bays, to provide easy access for short term motorcycle parking for dispatch or delivery activities.

Bicycle Parking

4.10.5 To facilitate cycling as a mode of transportation to major transport nodes and key amenities, the successful tenderer is encouraged to construct and provide bicycle parking(s) based on the recommendations set out in item 9.6.5 Pedestrians & Cyclists of LTA's Code of Practice for Street Work Proposals Relating to Development Works (https://www.lta.gov.sg/content/dam/ltaweb/corp/Industry/files/COP-

Appendices/RT-COP-V1.2.pdf) and Code of Practice for Vehicle Parking Provision in Development Proposals.

4.10.6 The bicycle parking area(s) that fulfil LTA's requirements can be considered for GFA exemption subject to URA's evaluation. Any provision above the minimum requirement will be subject to evaluation. The bicycle parking area(s), once approved, will not be allowed to be converted for other uses without the approval of the Authority and relevant Competent Authorities.

4.10.7 The successful tenderer is encouraged to provide complementary facilities such as showers, lockers and changing rooms in close proximity to the bicycle parking facilities where appropriate. These supporting facilities that fulfil LTA's guidelines may also be considered for GFA exemption subject to URA's evaluation. These area(s), once approved, are not allowed to be converted to other uses without the Competent Authority's approval.

4.10.8 The successful tenderer shall obtain clearance from the Competent Authority on all matters related to the bicycle parking facilities before commencing the construction of the bicycle parking lots.

4.10.9 The successful tenderer shall be responsible for the operation and maintenance of the bicycle parking lots at all times and shall bear all the costs related to the proper functioning of the bicycle parking lots.

Way-finding Signage

4.10.10 The successful tenderer is to provide a comprehensive wayfinding system for the public to easily find their way to any transportation nodes within the vicinity and towards the pedestrian and cyclist related facilities (e.g. bicycle parking) within the development. A guide for Wayfinding signage and related facilities can be found in the Code of Practice for Street Works Proposals relating to Development Works or https://www.lta.gov.sg/content/dam/ltaweb/corp/GreenTransport/2016/Guide%20for%20Wayfinding%20Signage.pdf

4.11 Greenery Replacement, Roofscape and Screening

Greenery Replacement

4.11.1 Within the development, the successful tenderer is required to provide greenery replacement and landscaping equivalent in area to 45% of the site area of the Land Parcel. These landscaped areas shall be used for softscape (permanent planting) and can be in the form of sky terraces, roof gardens, as well as at-grade landscaping, subject to the approval from the Authority and the relevant Competent Authorities.

4.11.2 To achieve the vision of a lushly landscaped development visible from the street level, the successful tenderer is to ensure that minimally 35% of the total landscaped areas provided in the Land Parcel are located within the 1st

storey. The lush landscaping required within the 1st storey is strongly encouraged to front the Rail Corridor, to heighten the sense of greenery along Rail Corridor.

4.11.3 The landscaped areas are to be integrated with the development and the Rail Corridor as usable spaces, well-designed and well-integrated with the overall building form and architectural treatment of the development and as far as possible be free from obstruction by structural elements.

4.11.4 The remaining area can be hardscape, for uses such as footpaths, outdoor seating, water features, and other outdoor recreational uses (tennis courts, swimming pool, etc) and is to be well-integrated with the softscape areas.

4.11.5 Covered walkways, covered linkways, ORAs, car park ramps, vehicular driveways and drop-off points cannot be computed as part of the hardscape.

4.11.6 However, well-designed vehicular driveways and drop-off points can be considered when well-integrated with the landscaping, subject to the approval from the Authority and the relevant Competent Authorities.

4.11.7 The landscaped areas are subject to the following requirements and detailed guidelines as set out in LUSH 3.0:

a. The landscaped areas shall be open to sky, or be in the form of sky terraces or communal landscaped areas on the 1st storey that qualify for GFA exemption under the prevailing Development Control Guidelines issued by the Competent Authority under the Planning Act;

b. The landscaped areas must be communal and accessible to the public or occupants of the building;

c. Within the softscape (permanent planting) areas, there should be a variety of planting comprising trees, shrubs and turfing. The planting bed provision shall comply with the minimum soil depth required for the proposed type of planting:

Type of Planting	Minimum Soil Depth Required
Trees	1,000 mm
Shrubs	500 mm
Turf	300 mm

d. To ensure that the planting is permanently in place within the landscaped area, potted plants will not be counted as part of the minimum 40% softscape area.

The prevailing Development Control Guidelines issued by the Competent Authority under the Planning Act on the GFA exemption of public open spaces, sky terraces and roof gardens will apply.

4.11.8 Given the site's visible location along the Rail Corridor, the development on the Land Parcel is subject to higher greenery requirements. The successful tenderer shall refer to Clauses 8.1 to 8.2 of the Conditions and Requirements of Relevant Competent Authorities and Public Utility Licenses for more information on NParks' requirements for the Land Parcel.

Roofscape

4.11.9 To contribute to the sense of pervasive greenery along the Rail Corridor, the roof areas of the low-rise parts of the development are to be considered as the "fifth" elevation and designed as landscaped roof gardens.

Screening Requirements

4.11.10 To ensure that the roof areas are well-designed and attractive when viewed from the surrounding developments, all service areas, mechanical and electrical (M&E) equipment, water tanks, etc., are to be located within and fully integrated into the building envelope and be visually well-screened from the top and all sides of the development.

4.11.11 The performance requirements for the screening of roof-top services are as follows:

a. To be screened from the top and on all sides;

b. The spacing between the trellis or louver elements is to be equal to or less than their depth;

c. The elements are to be orientated to cut off views from the street level and surrounding buildings; and

d. The openings in perforated panels are to be evenly distributed with porosity (i.e. percentage of void-to-solid) equal to or less than 25%. The width / diameter of the openings shall not exceed 30 mm.

4.12 Perimeter Treatment

4.12.1 To preserve the signature green experience along the Rail Corridor, the boundary treatment of the development fronting the Rail Corridor is to be sensitively designed as part of the overall landscape strategy for the site and is to be visually porous such that the lush landscaping within the 18 m wide landscape area is visible from the Rail Corridor. Solid walls and fences are not permitted.

4.12.2 The boundary treatment along the neighbourhood park shall also be designed as part of the landscape strategy for the park and is to be visually porous. Solid walls are not permitted.

4.13 Landscaping Works to Complement the Rail Corridor and Conserved Buildings

4.13.1 The land parcel is located next to the 24km-long Rail Corridor which will become an inclusive community space and seamless leisure corridor. To strengthen the Rail Corridor's signature green experience, the successful tenderer is required to protect and conserve seven mature trees and develop a landscape plan to enhance the greenery within the 18 m wide strip of land adjacent to the Rail Corridor, as shown in the Control Plan and set out in Clauses 8.2 of the Conditions and Requirements of Relevant Competent Authorities/ Public Utilities Licensees.

4.13.2 The landscape plan should include a suitable planting palette comprising largely native species, and various tiers (understorey, midstorey, canopy), to complement the ecological function of the Rail Corridor. The landscaping should screen off any structures and services (e.g. drains, fences) and be visually aesthetic from the Rail Corridor.

4.13.3 As the Rail Corridor serves as an ecological corridor and habitat for wildlife, the successful tenderer is required to adopt wildlife-sensitive urban design, especially around the area adjacent to the Rail Corridor. Wildlife-sensitive urban design may include, and are not limited to: drain finishes, suitable lighting levels, as well as monkey-proof features (e.g. bin centre and kitchens fully enclosed to prevent stealing of exposed food by monkeys).

4.13.4 The design of the landscaping surrounding the conserved buildings should also be sensitive to the setting and allow the appreciation of the conserved buildings.

4.13.5 The successful tenderer is consult URA and NParks early at the planning and design stage for inputs on the landscape plan for the subject site.

4.14 Development Control Guidelines

4.14.1 The successful tenderer is to comply with the prevailing Development Control Guidelines as issued by the Competent Authority under the Planning Act, and any modifications thereto, as well as the requirements of all relevant Competent Authorities for the development of the Land Parcel.

PART V

5.0 CONSERVATION GUIDELINES

5.1 General Guidelines

5.1.1 The Conservation Guidelines, as set out in Part V, are to be read in conjunction with the accompanying Control Plans Nos. 4 to 7. The Conservation Guidelines set out the general principles for the restoration of the conserved buildings within the Land Parcel. As the objective of these guidelines is to enhance or restore the character or appearance of the conserved buildings, the successful tenderer may submit alternative proposals to any of such guidelines for the Authority's consideration. Where the Authority is satisfied that the alternative proposal will also serve to achieve the conservation objective, the successful tenderer may be allowed to adopt such alternative proposal, in which event the relevant provisions in this Part shall be deemed to be complied with. The Authority, however, reserves the absolute discretion to decide whether or not to allow any alternative proposals to be adopted. Detailed evaluation of the proposals will be carried out at the formal plan submission stage. All proposals are subject to the approval of the Authority and all relevant Competent Authorities.

5.1.2 The successful tenderer is not to commence any work on the conserved buildings or any part or parts thereof without first obtaining the approval of the Authority and all relevant Competent Authorities which shall be granted at their absolute discretion and subject to such terms and conditions as they deem fit.

Architectural Heritage Marker / Storyboard

5.1.3 The five conserved buildings were part of an estate built between 1948 and 1952 by the Singapore Improvement Trust (SIT), the predecessor of the Housing and Development Board (HDB). The buildings embody the spirit of early-day public housing in Singapore, which aimed to provide housing with sanitation and modern amenities for the population. Over time, the buildings have become a local landmark. The successful tenderer is to implement measures to share on the history and heritage of the conserved buildings. The contents proposal shall be submitted to URA, HDB and NHB for approval.

5.2 Conservation Guidelines

5.2.1 In restoring the conserved buildings, the successful tenderer is to retain the character and architectural features of the buildings in accordance with the following guidelines and those shown in the accompanying Control Plans. The fundamental 3Rs principle of maximum Retention, sensitive Restoration and careful Repair, and the "Top-Down" approach are to be applied.

Conservation Best Practice

5.2.2 The successful tenderer is to engage a restoration / conservation consultant who will carry out research and investigation on the buildings (including their

historical, architectural, constructional, technological and material attributes). The consultant shall be engaged early and be part of the project team to ensure that site planning for the development is sensitive to the conserved buildings, and that the conserved buildings are restored and refurbished according to conservation best practice, preserving the special qualities of the building as they take on a new lease of life.

5.2.3 As part of the Development Application, the restoration/ conservation consultant is to submit a conservation report consisting:

a. Documentation and Research
b. Conservation Strategy
c. Conservation Maintenance Guidelines

The following shall be addressed:

a. Documentation and Research
- Detailed research into the site, building typology, architecture, structure, materials and building history which includes physical alterations carried out over time. Sources used in the research are to be cited.
- Detailed documentation of the buildings' physical condition. This includes materials investigation e.g. paint analysis.

b. Conservation Strategy
- Conservation approach taking into consideration the documentation and research and 3R principles.
- Adaptive reuse strategy respecting and enhancing the inherent historic physical, spatial, and environmental qualities of the buildings and their surroundings. This includes appropriate techniques and materials in the restoration and fitting out of the buildings.
- Promotion of the history and significance of the conserved buildings.

c. Conservation Maintenance Guidelines
- Strategies for proper maintenance for extending the lifespan of the building.

<u>Building Profile and Height</u>

5.2.4 The five conserved buildings (Nos. 18, 19, 22, 23 and 24) each comprises 4 storeys of walk-up apartments. The blocks were originally identical except for No. 19 which had an additional chamber for M&E at the lower platform level.

<u>Roof</u>

5.2.5 The original pitched roof profile, height, structure, eaves projection, material and finish are to be retained and restored. The roof cover is to be restored to unglazed, natural-colour, flat interlocking clay roof tiles.

5.2.6 Addition of small skylights on the roof shall be subject to evaluation. Any proposed skylights which require a change in the roof structure is not allowed.

5.2.7 Internally, the roof trusses are to be retained and restored. In the event that their replacement is necessary, the successful tenderer is to reinstate these elements to their original design and materials.

External Facades

5.2.8 The external façade features and elements are to be restored in accordance with the Control Plans Nos. 4 to 7.

Front Facade

5.2.9 The front façade is symmetrical and characterised by two separate entrances each leading to a vertical circulation core. Located within the vertical circulation core is a staircase which opens to two apartments on every floor. Inside the apartments, the layout is adapted to the tropical climate. To promote air movement, recessed balconies and windows line the living room and bedroom respectively.

Front Façade - Recessed Balconies

5.2.10 These balconies shall be kept open and naturally ventilated without enclosures of any kind (Refer to Control Plans Nos. 4 to 7). Additional safety features, if required, may be installed subject to evaluation of the design. They must be unobtrusive (e.g. 'invisible' steel wires) to keep the openness of the balcony.

5.2.11 The inner leaf facade within the building envelope is to be restored in its original location which is in line with the existing column and ceiling beam. Flexibility can be given for the design of the inner leaf façade but it must complement the building's architectural character and be consistent across all five conserved buildings. The use of timber frame for the windows / doors is encouraged as it complements the original timber windows. Glass panel infill is allowed.

Rear Facade

5.2.12 The rear facade is symmetrical and characterised by windows and protruding balconies lining the bedroom and kitchen respectively.

Rear Façade - Protruding Balconies

5.2.13 The protruding balconies are be kept open and naturally ventilated. Additional safety features, if required, may be installed subject to evaluation of the design. They must be unobtrusive (e.g. 'invisible' steel wires) to keep the openness of the balcony. Or, they can be specially designed to complement the architecture of the building.

5.2.14 Alternatively, to keep a sense of porosity and yet provide some enclosure, glass-louver windows may be added above the parapet walls provided that the design treatment is applied consistently across all five conserved buildings. No partition walls, screens or glass are to be inserted within the balconies.

5.2.15 The inner leaf facade within the building envelope is to be restored in its original location which is in line with the existing wall/ column of the adjacent bedroom. Flexibility can be given for the design of the inner leaf façade but it must complement the building's architectural character and be consistent across all five conserved buildings. The use of timber frame for the windows / doors is encouraged as it complements the original timber windows. Glass panel infill is allowed.

1st Storey Facades for Commercial Units and Childcare Centre at Selected Blocks Facing Kampong Bahru Road (Blocks 19, 22 & 23)

5.2.16 Existing door and window openings may be enlarged to facilitate a more visible or accessible frontage facing the main road, or at the original front façade, provided that the new design complements the building's architectural character.

Doors, Windows and Vents

5.2.17 All other doors, windows and vents of the original design are to be retained and restored in accordance with the Control Plans. If replacement of any door, window and vent is necessary, the original design and materials are to be reinstated in accordance with the Control Plans. Windows and doors which are not part of the original design are to be removed and replaced with new ones of original design and materials.

5.2.18 New internal secondary doors and windows, if required, can be added subject to the design being compatible with those of the main doors and windows. The material and frame size of the secondary doors and windows are to match those of the main doors and windows. The frame of the secondary door and windows can be of any material. If metal is used, it is to be anodized or colour coated. However, the use of timber frame is encouraged as it is more compatible with the architecture of the conserved building.

Additional Security for Openings

5.2.19 Additional security features may be installed, subject to evaluation of the design. As far as possible, they must be unobtrusive to keep the openness or porosity of the opening.

Internal Architectural Elements

5.2.20 All original internal structural elements, such as columns and beams, are to be retained. In the event that their replacement is necessary, the successful tenderer is to reinstate the architectural features of these elements to their

original design and materials.

5.2.21 Internal non-load bearing walls, except the inner leaf façade (if any), may be removed for the purposes of reconfiguring the spaces for new uses.

5.2.22 New partitions are to respect the architectural character of the building. They shall not abut any original door or window openings or vents.

Floors and Structure

5.2.23 The existing structural system, including structural elements such as columns and beams, is to be retained and restored. The original structural grids are to be retained. New columns, if required to be added, are to align with and respect the original grids. Provided that the structural integrity of the building is not compromised, flexibility to relocate some of the existing columns to meet the specific operational and functional requirements may be considered on a need-to basis.

5.2.24 The original floor levels are to be retained.

5.2.25 Localised openings in the upper storey floors to create double-volume spaces may be allowed, subject to the merits of the design and provided that it respects the structural grid/ system of the building. The detailed proposal shall be subject to evaluation at the formal submission stage.

5.2.26 Addition of attic or mezzanine floor may be considered, subject to evaluation. The insertion of these floors should not affect the roof structure of the conserved buildings.

5.2.27 No new basement is allowed below the conserved buildings. Any proposed new basement within the site shall be adequately set back from the conserved buildings to protect its structural integrity.

5.2.28 New staircase, if required, should respect the architectural character of the building and its internal spatial quality. It shall not abut any original door or window opening, or vent.

Addition of Lift

5.2.29 Any lift, if required to be added, is to be fully internalised within the building envelope. Lift overrun must not pop out of the pitched roof.

Paint scheme and finishes

5.2.30 The paint scheme and colours are to complement the architecture of the building. Non-gloss paint shall be used.

Signage

5.2.31 Sensitively-located and well-designed business signs (for the designated

blocks where non-residential uses are allowed at the first storey) may be considered at the facades of the conserved buildings. The architectural features of the conserved buildings should not be obscured or affected. A signage masterplan shall be submitted for evaluation.

Air-conditioning (A/C) Units

5.2.32 A/C units may be mounted on the external walls provided they are located at unobtrusive locations (eg not on original frontage or facing the main road), neatly aligned with the existing window openings, and properly screened.

Exhaust Flue

5.2.33 External exhaust flue is not allowed. To cater for future food and beverage outlets allowed at the 1st storey of selected blocks facing Kampong Bahru Road, vertical stack space should be provided within the existing building envelope for future installation of flues, when required.

Landscaped Area and Covered Walkways

5.2.34 The conserved buildings are laid out in two rows with landscaped area in-between. The open foreground and setting of the conserved buildings shall be retained.

5.2.35 Any covered link ways, if required for connection to the conserved buildings, shall be sensitively planned and designed so as to be least visually obtrusive. They must not detract from the architecture of the buildings or adversely impact the spatial quality of the open landscaped area between the buildings. The Authority is willing to consider sensitively-designed covered walkway within the building envelope provided it is minimally invasive and respectful of the archi tecture of the building.

5.3 Protection of Existing Buildings Against Deterioration and Collapse

5.3.1 The successful tenderer is required to carry out all necessary measures and works to protect and prevent the conserved buildings against deterioration and or collapse, upon site procurement. For this purpose, the successful tenderer is to engage his own Professional Engineers to:

a. Prepare and submit within 3 months from the date of the possession of the site in accordance with Condition 56 of the Conditions of Tender for the site, to the Authority plans for the measures and works that are assessed and determined by the Professional Engineer as being necessary for the protection and prevention of the conserved buildings against deterioration and / or collapse. Prior to the submission of the plans to the Authority, the Architect appointed by the successful tenderer for the proposed conservation on the site is to also declare and certify on the plans that the measures and works to be taken and carried out will not affect the architectural features of the buildings;

b. Ensure that the measures and works for the conserved buildings as shown on the plans are carried out and completed according to the plans either within six (6) months from the date of the possession of the site in accordance with Condition 56 of the Conditions of Tender for the site or before the commencement of the repair works on the buildings whichever is earlier; and

c. Confirm and certify to the Authority in writing within fourteen (14) days upon the completion of the measures and works as shown on the plans and that such measures and works have been taken and carried out in accordance with the plans and to the satisfaction of the Professional Engineer.

5.3.2 The submission of the plans to the Authority is to be solely for the purpose of the record of the Authority and such submission to and receipt by the Authority of the plans are not deemed to be approval or confirmation by the Authority of the adequacy of the measures and works as shown on the plans for the buildings.

5.4 Structural Alterations to the Conserved Buildings

5.4.1 The successful tenderer is required to engage a Professional Engineer to determine the structural loading adequacy of the structure of the existing conserved buildings to support the new use and to design and make the required submission for the proposed conservation and repair of the buildings.

5.4.2 The successful tenderer's Professional Engineer is to adopt strengthening and repair as the basic approach towards the proposed conservation of the buildings. Any recommendation of the Professional Engineer involving partial reconstruction of the conserved buildings is to be submitted to the Authority for approval. Such recommendation must be justified by detailed calculation and sound engineering judgment.

5.4.3 In the event that the Authority and the successful tenderer's Professional Engineer is unable to reach an agreement as to whether this part of the conserved buildings can be restored and repaired, the BCA will be requested to give its assessment. If the BCA concurs with the recommendation of the successful tenderer's Professional Engineer for partial demolition and reconstruction, the request of the successful tenderer for the same will be allowed by the Authority.

PART VI

6.0 OTHER REQUIRED WORKS

6.1 Site Works

6.1.1 The successful tenderer is required to obtain clearance from the Authority, SLA, LTA, NParks and the relevant Competent Authorities prior to commencement of any construction works within or affecting State land. All State land is to be reinstated to the requirements and satisfaction of SLA, LTA, NParks and the relevant Competent Authorities upon completion of the works.

6.1.2 All construction works are to be hoarded up and visually screened at all times.

6.1.3 Measures are to be adopted to minimise any disamenity to the surrounding developments arising from the construction works for the development in accordance to the prevailing guidelines issues by NEA.

6.1.4 The development works and hoarding of the site are to be designed and programmed to allow for a minimum of 1.5 m wide pedestrian route along both Silat Avenue and Kampong Bahru Road.

6.2 Construction of Park Abutting Southern Boundary of Land Parcel

6.2.1 The successful tenderer shall at his own cost and expenses, design and construct a neighbourhood park of approximately 2,069 m^2 abutting the southern boundary of the Land Parcel; as shown indicatively in the Control Plan and as set out in Clauses 8.0 of the Conditions and Requirements of Relevant Competent Authorities/Public Utility Licensees.

6.2.2 The successful tenderer is to pre-consult with NParks, URA and LTA during the early design stage of the park. The proposed layout, design, quality of materials, external fixtures, street furniture, facilities, landscaping and planting palette within the park, shall be mindful of existing views of the conserved buildings from along Kampong Bahru road as well as any existing vegetation on site. The park shall be designed appropriately for various age groups, taking into consideration the demographic profile of Bukit Merah estate. All designs, proposed planting, materials and fittings etc, shall be subject to detailed evaluation and approval by the NParks, URA, LTA and other relevant agencies.

6.2.3 The design of the park shall include a minimum 3.0 m wide footpath, complete with lightings and fittings, for circulation and Barrier-Free Access (BFA) within the park. The footpath network within the park should be easily accessible for park users from the adjacent developments, Rail Corridor, public residential area (Blocks 140-146 Jalan Bukit Merah and Blocks 147- 150 Silat Avenue) and the Nursing Home along Silat Avenue.

6.2.4 To create a wider seamless access point into the park from along Kampong Bahru Road, the successful tenderer is required to top up and re-grade the

park to match the top of the existing retaining wall. The successful tenderer shall study the extent for which the park land shall be topped up and re-graded to achieve a wider access point.

6.2.5 A 1.8 m wide shared ramp and staircase is to be constructed within the park to provide direct connection to the Rail Corridor (indicated in Control Plans). The interface between the landing point of the ramp and the Rail Corridor shall be designed sensitively. The successful tenderer shall also provide a direct path with crossing pad from the end of the ramp to the Rail Corridor earth track (details of the crossing pad to be advised by NParks during the pre-consultation). The proposed ramp and staircase should be designed to comply with BCA"s requirements for BFA and provide safety signage. The proposed ramp and staircase shall be designed to integrate well with the existing terrain such that it is not visually intrusive from the Rail Corridor and park. Should a new retaining wall be required for the construction of the ramp and staircase, it shall be designed to meet LTA's requirements.

6.2.6 The successful tenderer is required to obtain a TOL from the SLA for the area required for construction of the proposed park. The TOL area shall not be used for other purpose and is to be kept free of obstruction, at all times. The successful tenderer shall allow public agencies, including contractors, agents, employees and owners/occupiers of adjacent developments, access and use of the said TOL area at all times if required, without any charge, payment, hindrance, obstruction or restriction whatsoever.

6.2.7 The proposed neighbourhood park shall be completed before the issuance of Temporary Occupation Permit for the residential development.

6.2.8 The completed park (including the new footpath and lightings) is to be maintained at the expense of the successful tenderer and to the satisfaction of the NParks until such time when they are handed over to the NParks for ownership and maintenance.

6.3 Road Improvement Works

6.3.1 For information of tenderers, the successful tenderer shall at his own cost and expense, carry out the road widening, construction and improvement works to the Road Reserves and sidetables along Kampong Bahru Road and Silat Avenue that is required by LTA as shown indicatively in the Control Plan and set out in Clause 7.2 of the "Conditions and Requirements of Relevant Competent Authorities and Public Utility Licensees".

6.4 Potential Presence of Asbestos in Conserved Buildings

6.4.1 The presence of asbestos was detected in the refuse chute areas of 8 nearby demolished SIT blocks. As the 5 conserved SIT blocks within the Land Parcel were constructed during the same period, it is highly likely that asbestos would also be present in the refuse chute area of these conserved buildings. The successful tenderer is required, at their own cost and expense, to carry out their own survey to ascertain the presence of asbestos within these conserved

buildings and prepare a plan to indicate the exact location and extent of the asbestos if any. Please refer to the Workplace Safety and Health Council's guidelines on the survey, management and removal of asbestos (see Annex A).

6.4.2 The successful tenderer is required to completely remove the asbestos if any. In the event that it is assessed to be not technically and structurally feasible to completely remove the asbestos, the successful tenderer may in such situation propose remediation measures (e.g. encapsulation) to be undertaken within 9 months from the date of the Authority's acceptance of tender. The successful tenderer is also be required to completely remove the asbestos or complete the proposed remediation measures, and provide the satisfactory results of the air sampling test on its completion within 15 months from the date of the Authority's acceptance of tender. In the event that the asbestos have not been completely removed from the conserved buildings within the Land Parcel, the plan indicating the location of the asbestos and the remediation measures that had been undertaken to reduce or mitigate its impact will be included as part of the Lease condition in the issuance of the State Lease.

6.4.3 In the event that the asbestos have not been completely removed from the conserved buildings within the Land Parcel, the successful tenderer shall in relation to the sale, sublease or disposition of the units affected by the asbestos, include in the respective options and agreements:

a. Provision(s) informing the purchasers, sublessees or parties accepting from the successful tenderer any disposition of the affected units within the development of the presence of asbestos and the remediation measures that had been undertaken to reduce or mitigate its impact; and

b. The location of the asbestos in the floor plan(s) of each affected unit which the successful tenderer has to provide under rule 10(4) and Form 3 of the Housing Developers Rules.

6.5 Protection of Existing Slope

<u>Rubble Retaining Wall near Northern Boundary</u>

6.5.1 There is an existing retaining wall near the land parcel along the northern boundary, as shown indicatively in the Planimetric and Encroachment Survey Plans.

6.5.2 The existing retaining wall provides structural support to the existing HDB flats and car park within the adjacent land. The successful tenderer shall take all necessary measures to ensure the structural stability of this existing retaining wall when carrying out any development works within the land parcel near it.

6.5.3 The successful tenderer, may at their own cost and expense, carry out their own site verification of the existing retaining wall and other obstructions to ascertain the effect on the proposed development.

6.5.4 The successful tenderer shall indemnify the State against all claims/ or damages which may arise directly or indirectly from any instability rendered to the existing retaining wall by any cause whatsoever or by works carried out by the successful tender or by his servants/ agents.

Retaining Wall along Kampong Bahru Flyover

6.5.5 The successful tenderer shall undertake all necessary measures to ensure the structural stability of the existing retaining wall when carrying out any development works. The successful tenderer is required to obtain clearance from URA and LTA prior to commencement of any demolition or construction works affecting the retaining wall.

6.5.6 The successful tenderer shall indemnify the State against all claims/ or damages which may arise directly or indirectly from any instability rendered to the existing retaining wall by any cause whatsoever or by works carried out by the successful tender or by his servants/ agents.

7 OTHER REQUIREMENTS

7.1 Public Communications Plan

7.1.1 The successful tenderer is required to carry out a public communications plan as part of the efforts to keep the local community informed of the development plans for the Land Parcel.

7.1.2 The local community is defined as the residents and administration of developments within a 100 m radius of the Land Parcel. This includes all residents of HDB flats, private condominiums / flats and landed houses, Management Corporation Strata Title (MCST) of private condominiums, Chairmen of Residents' and Neighbourhood Committees, Constituency Director of the Constituency Office and General Managers of Town Councils, the administration of schools and other institutions.

Stage 1: Prior to submission of application for Written Permission

7.1.3 The successful tenderer is required to submit to the Authority within 2 months from the date of the award of tender a duly completed Form A (as shown in Annex B-1) setting out the public communication plan for the proposed development for the Authority's information.

7.1.4 Prior to the erection of any hoarding or commencement of any clearance and/or tree-felling on the Land Parcel, the successful tenderer shall distribute flyers to the local community containing brief information on the development project, including the road improvement works to be carried out, the implementation of the proposed neighbourhood park, the proposed provision of a childcare centre within the future development and the contact details of the successful tenderer and the hotline numbers of the relevant departments in the Building and Construction Authority (BCA), National Environment Agency (NEA), the Urban Redevelopment Authority and the Ministry of Manpower (MOM).

7.1.5 The successful tenderer shall submit to the Authority after the distribution of flyers to the local community a duly completed Form B (as shown in Annex B-2) verifying that the requirements set out in Condition 7.1.4 have been complied with. Upon confirming that the declaration provided by the successful tenderer is in order, the Authority will give written consent to the successful tenderer to proceed with the submission of an application to the Competent Authority under the Planning Act (Cap. 232) for Written Permission ("development application") for the proposed development on the Land Parcel. The successful tenderer shall not submit any development application for the proposed development on the Land Parcel without the prior written consent of the Authority as mentioned above.

7.1.6 Upon receiving the Authority's written consent, the successful tenderer may proceed with the erection of hoarding, on which the contact details of the successful tenderer and the hotline numbers of the relevant departments in BCA, NEA, URA and MOM shall be prominently displayed.

Stage 2: Prior to resubmission of application subsequent to the grant of Provisional Permission

7.1.7 After the grant of Provisional Permission by the Competent Authority under the Planning Act (Cap. 232) for the proposed development, the successful tenderer shall distribute additional flyers to the local community containing detailed information on the development project. The information to be provided shall include but is not limited to the following:

a. Project information (e.g. type of development, number of units, storey height, vehicle access points);

b. Key milestones in the construction programme [e.g. commencement and duration of piling works, expected date of issuance of Temporary Occupation Permit (TOP)];

c. Schematic site layout showing the location of building blocks and facilities such as the bin centre, electrical substation, BBQ pits, etc.

d. Details of proposed measures to mitigate the impact of development to the surrounding environment and users;

e. Contact details of the successful tenderer for the community to highlight issues such as noise and dust arising from the construction activities, and to provide feedback on the proposal;

f. Indicative timeframe for the community to respond to the proposal, which shall be at least 2 weeks from the date the flyers are distributed; and

g. The hotline numbers of the relevant departments in BCA, NEA, MOM and URA.

7.1.8 At least 2 weeks from the date of distribution of flyers, the successful tenderer shall submit to the Authority a duly completed Form C (as shown in Annex B-3) verifying that the requirements set out in Condition 7.1.7 have been complied with and detailing the preliminary feedback received from the local community for the Authority's information, if any. Upon confirming that the declaration provided by the successful tenderer is in order, the Authority will give written consent to the successful tenderer to proceed with the resubmission of the application subsequent to the Provisional Permission granted by the Competent Authority under the Planning Act (Cap. 232), which shall be made no earlier than 3 weeks from the date the flyers are distributed. The successful tenderer shall not resubmit any application for the proposed development on the Land Parcel without the prior written consent of the Authority as mentioned above.

7.1.9 As part of the resubmission of the application subsequent to the Provisional Permission granted by the Competent Authority under the Planning Act (Cap. 232), the successful tenderer shall submit to the Competent Authority duly

completed Form D (as shown in Annex B-4), which is a final collation of the feedback received on the proposed development, if any. The developer is also to explain how the development proposal seeks to sensitively address the concerns raised by the local community, if any.

7.1.10 The successful tenderer shall not commence structural works until the Authority has given written consent for the successful tenderer to proceed to apply to BCA for the permit to commence structural works, or has granted Written Permission under the Planning Act (Cap. 232).

Approval of flyers prior to distribution

7.1.11 The successful tenderer is required to submit a copy of the flyers mentioned in Conditions 7.1.4 and 7.1.7 to the Authority before the distribution of the said flyers to the local community for the Authority's approval.

7.2 Prefabricated Prefinished Volumetric Construction (PPVC)

7.2.2 For information of tenderers, the successful tenderer is required to adopt the minimum level of use of Prefabricated Prefinished Volumetric Construction (PPVC) as stipulated under the Building Control (Buildability and Productivity) Regulations for the development on the Land Parcel for Residential use as set out in Clause 10.2 of the "Conditions and Requirements of Relevant Competent Authorities & Public Utility Licensees".

7.2.3 For the purpose of adopting the PPVC method of construction, the successful tenderer is required to set aside some space within the Land Parcel for storage and/or holding area for PPVC modules. No additional space/land outside the Land Parcel will be granted on TOL basis for this purpose.

7.3 CONQUAS Assessment of Construction Quality

7.3.1 The successful tenderer shall be required to refer and submit the proposed development to the Building and Construction Authority (BCA) to be assessed for the construction quality of the building works under the Construction Quality Assessment System (CONQUAS).

7.3.2 The successful tenderer shall for the purpose of this Condition comply with all requirements, procedures, directions and request of BCA and shall pay all fees, charges and other amounts payable to BCA for and in relation to the assessment of the construction quality of the proposed development under CONQUAS. The successful tenderer shall also render his full co-operation to BCA, its officers, employees and agents in relation to such assessment under CONQUAS.

7.4 Productive Formats for Shops and Restaurants

7.4.1 The Successful Tenderer is strongly encouraged to work with the tenants/operators of the shops and restaurants to adopt relevant productive formats in the said development. Outlets larger or equal to 200 m^2 should

adopt at least 3 productive formats, while outlets smaller than 200 m^2 should adopt at least 2 productive formats. SPRING Singapore has provided a set of examples of the productive formats in Annex C for reference. For more information on the productive formats, the Successful Tenderer is to contact SPRING Singapore directly via email: food_division@spring.gov.sg or lifestyle_division@spring.gov.sg.

PART VIII

8.0 DESIGN ADVISORY PANEL

8.1 General

8.1.1 To ensure that the development meets the planning and urban design objectives described in Part IV, the proposal for the Land Parcel will be subject to review by a Design Advisory Panel (DAP) and approval from the Authority as part of the development application submission process.

8.1.2 The DAP will be appointed by the Authority and comprise members from the building and real estate industries as well as representatives from related fields, as and when necessary. The DAP will convene necessary meetings to provide inputs and comments on the overall building layout and architectural design, including the appropriate use of building materials, finishes and external lighting. The successful tenderer will have the opportunity to clarify or propose alternatives to address the DAP's concerns through the DAP evaluation process.

8.2 DAP Evaluation Process

8.2.1 The DAP evaluation will be a two-stage process.

Stage 1

8.2.2 At the Provisional Permission (PP) stage, the DAP will address the broader urban design aspects of the development proposal in relation to the form, massing, pedestrian connectivity, vehicular circulation, view corridors and landscaping. This is to ensure major issues affecting the layout of the proposal are addressed by the time that PP is issued for the development.

8.2.3 As part of the PP submission, plans, sections and elevations, as well as a 1:500 scale massing model are required to be submitted to show the proposed development in relation to the adjacent sites and surrounding context.

8.2.4 A digital textured model is required to be submitted to show the proposed development in relation to the adjacent sites and surrounding context. The files for the digital 3D model should be in any of the following formats: AutoDesk 3Ds Max file format, version 2016 and below (.max), or a digital 3D model in SketchUp file format, version 8 and below (.skp), geo-referenced to SVY21 coordinates.

Stage 2

8.2.5 At Written Permission (WP) stage, the DAP will focus on the building layout and architectural design aspects of the proposal including the appropriate use of building materials, finishes and external lighting.

8.2.6 As part of the WP submission, 1:50 scale elevations and sections, a 3D digital textured model in any of the formats in Condition 8.2.4,and a 1:200 scale architectural model if necessary, as well as material samples of the facade and roof materials are required to be submitted to show the architectural design of the development.

Annex A

Workplace Safety and Health Guidelines

Management and Removal of Asbestos

WSHCOUNCIL

Year of issue: 2014

Contents

1. Introduction

Asbestos had been widely used in buildings, plants and ships due to its excellent fire, heat and chemical resistance properties. However, exposure to asbestos, such as through inhalation of asbestos fibres, can lead to serious diseases. In response to these health risks, the use of asbestos in buildings was banned in Singapore in 1988 by the Building Control Division (now the Building and Construction Authority [BCA]).

Many old buildings in Singapore still contain asbestos or asbestos-containing materials (ACMs). These asbestos and ACMs can be released into the air when disturbed, affecting building occupants. It is therefore important to manage asbestos in buildings and workplaces to prevent harmful exposure. Precaution and care must be taken when conducting work activities involving ACMs. These activities include building structural works (e.g., repair, dismantling, demolition, renovation, maintenance and alteration) and other related operations (e.g., handling, sawing, cutting, grinding, drilling, lagging and delagging).

This set of guidelines was developed to provide guidance on the proper management of ACMs and how to work with them safely. It is primarily aimed at contractors, occupiers and building owners, especially those in the construction sector, shipyards and petrochemical facilities.

The guidelines will first discuss some health effects of asbestos exposure and list examples of ACMs. It will then elaborate on the management of ACMs and good industry practices. This is followed by a description of the various aspects of asbestos-removal work. Salient points on air monitoring, training and medical surveillance will also be covered.

After reading this guide, contractors, occupiers and building owners should be able to:

- identify ACMs in workplaces;
- understand the health risks of work involving asbestos; and
- manage the risk of ACMs through appropriate controls.

2. Asbestos and Asbestos-containing Materials

Asbestos
Asbestos is a naturally-occurring mineral. Asbestos fibres have excellent physical and chemical properties which made them popular as construction materials and useful for fireproofing, thermal, electrical or sound insulation and heat or chemical resistance.

There are six types of asbestos fibre and they are classified into two groups: amphibole and serpentine (see Table 1). Amphibole is generally more brittle and tends to be straighter, whereas serpentine, that is, chrysotile is more flexible and less likely to be friable. Crocidolite, amosite and chrysotile are the three most common types of asbestos. Crocidolite and amosite are known to be more hazardous than chrysotile.

Types of asbestos	
Amphibole • Crocidolite (blue asbestos) • Amosite (brown asbestos) • Anthophyllite • Tremolite • Actinolite	Serpentine • Chrysotile (white asbestos)

Table 1: Types of asbestos.

Asbestos-containing Materials
ACMs are any material, substance, product or article containing asbestos. ACMs are either friable or non-friable. The degree of friability of an ACM determines its classification and the potential that it will release respirable fibres. To classify whether the ACMs are friable or non-friable, the densities of the materials need to be determined. Established methods to determine density can be found in the *British Standards BS 4624: 1981* and *BS 3536 Part 2: 1974*.

A list of materials that may contain asbestos is provided in **Annex A**.

2.1 Non-friable Asbestos Materials

Generally, non-friable ACMs are less hazardous than friable ACMs. Non-friable asbestos materials are cementitious, resinated, plastic or bituminous. In their dry form, they cannot be crumbled, pulverised or reduced to fine particles by hand, thus it is harder for them to produce the asbestos fibres that constitute a serious health risk. In these materials, asbestos fibres are generally locked or embedded in the base material matrix. Therefore under normal usage conditions or in the course of normal handling, they usually do not release enough asbestos fibres to constitute a health risk.

In a dry state, non-friable asbestos materials usually have a density greater than 1 tonne per cubic metre (1000 kg/m^3). They are hard, light grey and generally contain 10% to 15% asbestos fibres, but occasionally they can contain up to 40% asbestos fibres.

Examples of non-friable asbestos materials include:

- corrugated asbestos roof sheets;
- asbestos wall cladding;
- asbestos floor tiles;
- asbestos vinyl sheets;
- asbestos cement piping; and
- asbestos friction products.

2.2 Friable Asbestos Materials

Friable asbestos materials can be crumbled by hand, and their fibres are readily released into the air when disturbed. To completely contain airborne asbestos fibres, total enclosure for the work area and other strict control measures are necessary.

Any non-friable material in poor condition that has a high probability of being crumbled or pulverised during removal operations should be considered friable (e.g., roof sheets that are damaged or have been infested by mold or algae, and old gaskets that require scraping off during removal).

Examples of friable asbestos materials include:

- asbestos fibrous sprayed-on materials used for fire protection, anti-condensation and acoustic control purposes;
- asbestos thermal insulation on boilers and pipes;
- asbestos ceiling boards or wall panels; and
- cable penetrations.

3. Health Risks of Asbestos Exposure

Asbestos is a confirmed human carcinogen and all types of asbestos can cause cancer. Asbestos fibres can enter a body when inhaled as airborne dust or when contaminated materials are ingested. These fibres are retained in respiratory or digestive tissues, leading to diseases such as asbestosis, mesothelioma and lung cancer. These diseases often have a long latency period, and symptoms generally do not appear until 15 to 50 years after initial exposure.

Asbestosis
Asbestosis is a scarring of the lung tissue which leads to decreased lung volume and increased resistance in the airways. It is normally associated with high levels of exposure for many years. Symptoms include shortness of breath, persistent coughing, tiredness and nausea.

Mesothelioma
Mesothelioma is a cancer of the lining of the lungs (pleura) and abdominal organs (peritoneum). Persons diagnosed with this disease usually have a short survival span. It does not normally require a threshold of exposure before ill effects occur, however the risk of contracting mesothelioma generally increases with the frequency, duration and level of exposure to asbestos. Symptoms include weight loss, fever, night sweats, chest pain and breathlessness on exertion.

Lung Cancer
Lung cancer, which can be caused by a number of inhaled carcinogens, including asbestos, is a malignant tumour in the lungs' air passages. Like mesothelioma, lung cancer does not require a threshold of exposure before ill effects occur. The synergistic effect of asbestos exposure and smoking can increase the risk of lung cancer by at least 50 times. Symptoms include a chronic cough, breathlessness, chest pain, haemoptysis (coughing up blood), hoarseness of the voice and wheezing.

4. Risk Management of Asbestos-containing Materials

Proper risk management of ACMs in buildings and workplaces can protect the safety and health of both occupants and workers. Putting in place a proper asbestos management plan can help prevent exposure to airborne asbestos fibres (see Figure 1) for a flow chart for the managing of ACMs.)

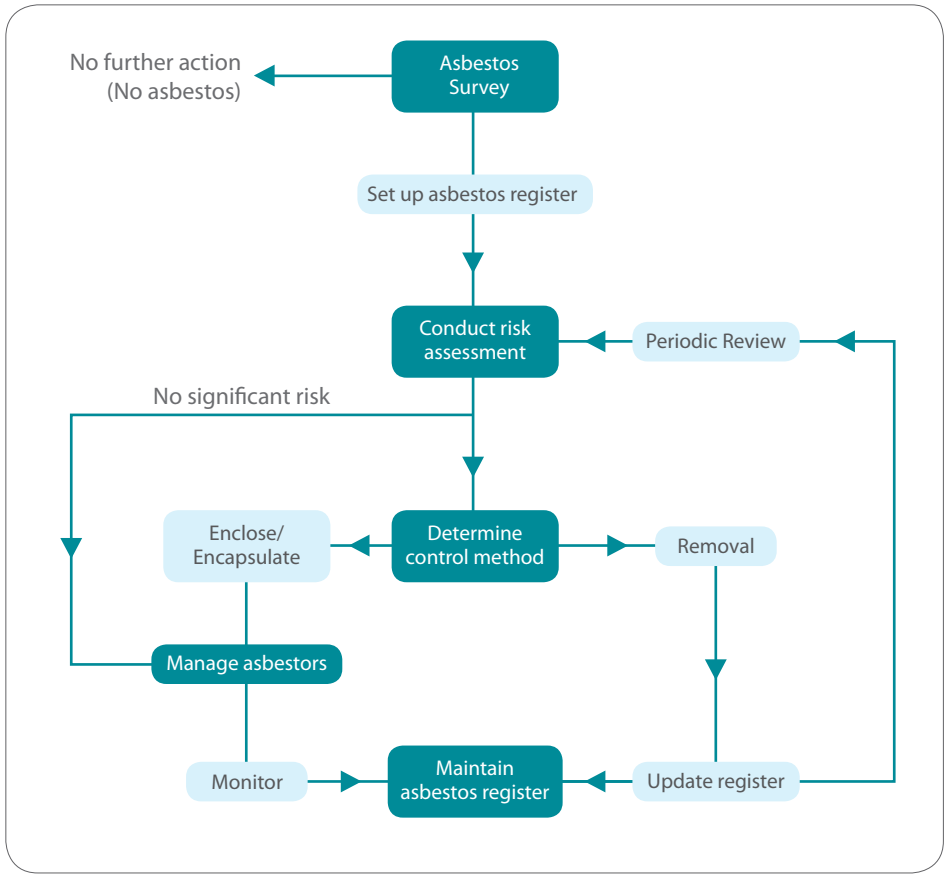

Figure 1: Flow chart for managing ACMs.

4.1 Identification of Asbestos-containing Materials

The first step in managing the risk of asbestos exposure is to determine the presence and location of all ACMs at the workplace, as well as the types and conditions of these ACMs.

Asbestos may be found in numerous building materials, typically for the purposes of fire protection, heat and sound insulation, such as partition walls, refuse chutes, roofing sheets and ceiling boards (see Figure 2).

The type of ACMs which may be found in a typical building include:

- corrugated roof sheets (e.g., roofing, wall cladding);
- insulation boards or tiles (e.g., wall partitions, ceiling boards, fire protection boards);
- flooring materials (e.g., vinyl floor tiles or sheets);
- insulation materials (e.g., fire doors, rubbish chute columns, brake linings); and
- asbestos cement products (e.g., gutters, water tanks, underground pipelines).

ACMs may also be found in ships and plant facilities. They include:

- asbestos sheets, ropes and cloths (e.g., gaskets, insulation, seals, fire blankets);
- spray-on thermal insulation (e.g., fire protection in ducts and structural steelwork, ceilings);
- lagging (e.g., thermal insulation of pipes and boilers; see Figure 3);
- insulation boards or tiles (e.g., wall panels, ceiling boards, fire protection boards, refractory linings); and
- electrical circuits (e.g., panels, wiring insulation, seals, cable penetrations; see Figure 4).

An asbestos survey can be carried out by a competent person to identify all the ACMs in the workplace. (See **Annex B** on how to conduct an asbestos survey.) The competent person must exercise care and diligence in conducting the survey to ascertain the presence of asbestos or ACMs. See below for general steps on how to identify asbestos in buildings.

Figure 2: Asbestos used in building roof sheets and ceiling boards.

1. Roof sheets.
2. Celling panels.

Figure 3: Asbestos cloth wrapping with asbestos lagging of exhaust pipe.

Figure 4: Asbestos-containing cable penetrations used on ships.

Step 1: Check the age of the building.

If the building was constructed before 1991, it is likely to contain asbestos since the use of asbestos in building materials was banned in Singapore in 1988.

Step 2: Check building plans.

Some building plans may indicate the use of ACMs. However, it should not be assumed that the buildings do not contain asbestos just because the building plans do not indicate the presence of ACMs.

Details of any extension, adaptation, renovation or refurbishment to the building in the building plans must be examined.

Step 3: Conduct an asbestos survey.

There are two types of asbestos survey, Asbestos Management Survey and Building Refurbishment or Demolition Survey.

- An Asbestos Management Survey is conducted to locate, as far as reasonably practicable, any materials suspected of containing asbestos and assess their condition. It enables proper management of ACMs by preventing ACMs from being disturbed during building maintenance. Any inaccessible structure or material which may contain asbestos should be clearly indicated in the report.
- A Building Refurbishment or Demolition Survey is required if major renovation (alteration, addition or repair work) or demolition of the building needs to be carried out. This may involve destructive inspections to ensure that all areas are accessed and thoroughly checked. Condition assessment of the ACMs may be unnecessary if ACMs are soon to be removed. The report may indicate areas of damage or locations where asbestos debris may be present.

An asbestos survey must be carried out for buildings due for demolition or renovation if the building was built before 1 Jan 1991 (based on its temporary occupation permit date). A competent person must be appointed to carry out the survey to ascertain the presence of asbestos or ACMs before commencement of the work.

See **Annex A** for examples of materials that may contain asbestos.

All identified ACMs must be removed by an Approved Asbestos-Removal Contractor (AARC) before demolition work is carried out (see Chapter 6 on Removal of Asbestos-containing Materials).

Step 4: Take samples for analysis where appropriate.

Samples of materials suspected to contain asbestos should be sent to an accredited laboratory for analysis. Sample taking must be performed by a competent person and necessary precautionary measures should be taken. Samples should be analysed using the NIOSH 9002 Polarised Light Microscopy (PLM) Method of asbestos fibre identification. The analysis result should report the type of asbestos present in the sample. If any asbestos fibres are found in the sample, the material is taken to contain asbestos.

4.2 Exposure and Risk Evaluation

After ACMs in the building are identified, the risk of exposure to the ACMs is evaluated. The risk of exposure is determined by the potential of release and likelihood of disturbance of the ACMs. Factors to consider when evaluating the exposure risk are illustrated in Figure 5 and further elaborated in the paragraphs that follow.

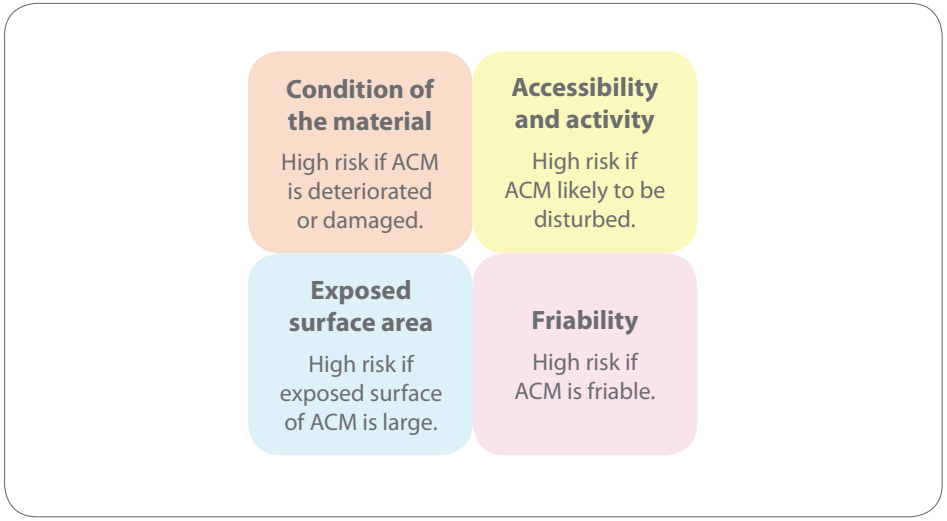

Figure 5: Factors affecting the risk of exposure to ACMs.

Condition of Material
The condition, extent of damage or deterioration of the ACM can influence how fast and how easily it releases asbestos fibres into the immediate environment. This factor is usually associated with the quality of the installation work, the adhesion of the friable material to the underlying surface, and the integrity of the material. Water can also affect the condition of the ACM by dislodging and disturbing the asbestos in the material. Asbestos fibres can be dislodged by water and deposited elsewhere after the water has evaporated.

Exposed Surface Area
The greater the exposed surface area of the friable material, the higher the potential for fibres to be dislodged or released. The release potential and risk of exposure are further increased if the friable material is exposed.

Accessibility and Activity
If a material can be accessed or reached easily, it may be subject to increased contact and hence possible damage. The amount and/ or type of activity or work happening in the vicinity of the ACM, such as vibration and air movement, can also result in potential damage and fibre release.

Friability and Content
Different ACMs have varying degrees of friability – the more friable the material, the greater the potential for asbestos fibres to be released. In addition, a higher asbestos content in a material also increases the likelihood of fibres being released.

4.3 Control Methods

Having evaluated the risk of exposure of ACMs, appropriate control measures need to be put in place. There are four methods of control.

Removal
Removal of ACMs should be considered if ACM damage is extensive and repair is not justifiable. Major changes or remodelling made to the building may also disturb ACMs present and warrant their removal. Asbestos-removal work poses a great risk of fibre release and should only be carried out by an AARC (see Chapter 6 on Removal of Asbestos-containing Materials).

Encapsulation
Encapsulation involves treating the ACM with a sealant that either binds the asbestos fibres together or coats the ACM so that fibres are not released. Encapsulation should be limited to areas where damage due to contact will not occur, so that the ACM will retain its bonding integrity. This method is usually used as an interim measure. It is necessary to ensure that the person carrying out the encapsulation work is adequately protected from exposure to asbestos fibres.

Enclosure
For the enclosure method, a barrier such as a suspended ceiling is usually constructed between the ACM and the building's environment. As the ACMs still remain, asbestos fibres and fallout can accumulate behind the enclosure. However, the accumulated fibres can be released into the building's environment if the enclosure is damaged. It is therefore important to include provision for access to the ACMs during the design and installation of enclosures so they can be inspected regularly.

Leave-in-place
ACMs that are in a good condition should be left undisturbed as they are less likely to release asbestos fibres into the surrounding air. The risk of exposure is normally low or negligible in such instances, and remedial action and assessment can be deferred to a later time when necessary.

The conditions of existing ACMs can change with time, making it necessary to periodically inspect and monitor ACMs. An inspection regime can be established to ensure that the risk of asbestos exposure does not endanger the health of building occupants. It can also indicate the need for further corrective actions such as ACM removal.

5. Good Practices in Managing Exposure to Asbestos-containing Materials

Asbestos Register
Based on the findings of the asbestos survey, an asbestos register can be maintained to keep a record of identified ACMs or those likely to be present.

The asbestos register should indicate the location, type and condition of the ACMs. It should also include inaccessible locations where materials may contain asbestos. The asbestos register has to be maintained, kept up to date, and made available to occupants and any other persons who may be exposed to ACM. The following should be done regularly to help maintain the asbestos register.

Information and Labelling
Wherever possible, ACMs in the workplace should be labelled with warning signs to warn workers or occupants of asbestos hazards. These help prevent people from disturbing the ACMs unknowingly and exposing themselves unnecessarily.

Training and Awareness
Training can be provided for workers or occupants to heighten their awareness of hazards caused by asbestos when working with or near ACMs. Persons who conduct activities in areas with ACMs or who are likely to be exposed to the asbestos in the building must also be informed and educated about the presence of ACMs and their potential hazards.

Isolate or Restrict Access
Restrict and control access to areas where ACMs may pose a risk. Only authorised persons wearing proper personal protective equipment (PPE) should be allowed access to these areas.

Asbestos Monitoring Programme
A programme can be implemented to inspect ACMs periodically (e.g., every six or 12 months depending on the condition of the ACMs) and monitor the concentration of asbestos in the air when necessary.

Reporting Procedures
Procedures can be established for workers or occupants to report any damage or deterioration of the ACMs so that timely and appropriate corrective actions can be implemented to minimise the risk of exposure.

Some Do's and Don'ts

- In areas with damaged ACMs, do keep activities to a minimum if unable to avoid the areas completely.
- Do wear appropriate PPE when working in areas where ACMs may be disturbed.
- Don't dust, sweep, or vacuum debris that may contain asbestos.
- Don't saw, sand, scrape, or drill holes in ACMs.

6. Removal of Asbestos-containing Materials

The Workplace Safety and Health (WSH) (Asbestos) Regulations define asbestos-removal work as any work that entails the removal of asbestos or ACMs that are fixed or installed in a building, plant, ship, machine, equipment or workplace, so that the asbestos or ACMs are no longer fixed or installed in that building, plant, ship, machine, equipment or workplace.

Asbestos-removal work is a high risk activity, and should only be carried out by AARCs. It is important to properly plan, effectively communicate and adequately prepare the site before starting asbestos-removal work.

Asbestos-removal work includes total or partial removal of any type of ACM. Examples of asbestos-removal work include:

- removing asbestos corrugated roof sheets or ceiling boards from buildings or factories;
- removing asbestos insulation or laggings from pipelines or boilers;
- removing asbestos gaskets from piping, flanges, boilers or heat exchangers;
- removing part of damaged asbestos roof sheets, ceiling boards or pipe insulations;
- cutting an opening in asbestos roof sheets or ceiling boards for installation of exhaust fans or pipelines; and
- cleaning up asbestos debris, including decontamination of the worksite or workplace.

6.1 Roles and Responsibilities

The occupier of a workplace should ensure that asbestos-removal work is carried out by an AARC.

An AARC should:

- Submit a notification of asbestos-removal work at least seven calendar days before commencement of the work;
- Appoint a competent person to supervise the asbestos-removal work;
- Ensure that the work is carried out under the immediate supervision of the competent person;
- Ensure that the asbestos-removal plan of work prepared by the competent person is implemented; and
- Ensure that asbestos-removal work is carried out in accordance with the requirements in the WSH (Asbestos) Regulations.

The competent person for asbestos-removal work should:

- Prepare an asbestos-removal plan of work and ensure that it is adequate, suitable and effective;
- Advise on all methods and measures related to asbestos-removal work;
- Ensure that the asbestos-removal work is carried out in accordance with the asbestos-removal plan of work;

- Coordinate or manage asbestos-removal work activities;
- Supervise the entire asbestos-removal work; and
- Ensure that only trained persons carry out asbestos-removal work.

6.2 Notification of Asbestos-removal Work

Under the WSH (Asbestos) Regulations, AARCs carrying out asbestos-removal work must notify the Commissioner for Workplace Safety and Health (WSH) at least seven calendar days prior to the commencement of work. This notification should be submitted through the e-service portal available on MOM's website.

AARCs have to update any change to the notification submitted. A copy of the notification should also be made available at the workplace and must be produced upon request by MOM inspectors.

6.3 WSH Risk Assessment

A proper and thorough WSH risk assessment (RA) must be conducted prior to the start of asbestos-removal work. The RA should identify all potential hazards, establish all the risks associated with asbestos-removal work (e.g., working at height, working in confined spaces), and propose measures to prevent or minimise these risks. Available asbestos registers and survey reports should be referred to when conducting the RA.

For more information about WSH risk assessment, see *Approved Code of Practice for WSH Risk Management*.

6.3.1 Other Hazards Associated with Asbestos-removal Work

Working at Heights

Contractors should avoid working on top of asbestos roofs or ceiling boards. As much as possible, asbestos-removal should be carried out from underneath the roof using suitable work platforms such as mobile elevated work platforms and scaffold platforms. Work platforms must be of safe design, sound material, good construction and adequate strength.

If working on a roof cannot be avoided, safety harnesses, lifelines and anchorage points have to be adequately provided to ensure that the work can be carried out safely. A proper fall prevention plan has to be developed and implemented for working at heights.

For more information on working at height, refer to the following:

- *WSH (Work at Heights) Regulations;*
- *Code of Practice for Working Safely at Heights;*
- *WSH guidelines: Working safely on roofs;*
- *WSH guidelines: Anchorage, lifelines and temporary edge protection*; and
- *Technical advisory for scaffolds*.

Working in Confined Spaces

For asbestos-removal work carried out in confined spaces, entry permits must be obtained prior to entry into the confined space(s). All requirements for work in confined spaces apply.

For more information on work in confined space, refer to the following:

- *WSH (Confined Spaces) Regulations;*
- *SS 568:2011 Code of Practice for confined spaces; and*
- *Technical advisory on working safely in confined spaces.*

Working in a Hot Environment

Outdoor asbestos work causes heat exhaustion due to the hot and humid environment, heavy physical work and non-breathable protective clothing. Heat-related hazards also result from working in enclosures and confined spaces.

However, heat-related disorders can be prevented by:

- ensuring workers are acclimatised;
- ensuring that workers drink plenty of water;
- ventilating the work area; and
- implementing a work-rest schedule.

Removal of asbestos from hot pipelines or machinery should be scheduled to take place during shutdowns, thus allowing sufficient time for the pipelines or machinery to cool. If this cannot be avoided, the plan of work has to take into consideration additional heat stress hazards arising from the pipelines or machinery. Appropriate PPE and control measures have to be put in place to ensure that the work can be carried out safely.

For more information on working in hot environment, refer to *WSH guidelines: Managing heat stress at the workplace*.

6.4 Plan of Work

Before undertaking any asbestos-removal work, it is important to develop a proper plan of work. A written plan of work will guide and establish details on how asbestos-removal work is to be carried out. The plan will vary according to the nature of the task, and the type, location, quantity and condition of the ACM to be removed. Other work activities in the vicinity should also be considered when developing the plan.

The plan of work must be readily available on site. A copy should be made available upon request by MOM inspectors and to others who may be affected by the work. Any change to the plan of work should be documented and updated.

The plan of work shall include, but should not be limited to, the following:

a) Scope of work:
   - nature of work;
   - estimated duration of work;

- date of work commencement;
- type(s) of asbestos fibres involved;
- type of ACM(s) involved (attach photos if possible);
- quantity of ACM(s) involved (estimated amount); and
- the condition of the ACM(s).

b) Location and address of asbestos-removal work.

c) Particulars of person(s) involved in the work:
- stakeholders involved in the project (e.g., developer, main contractor, sub-contractors, consultants, AARCs);
- competent person(s):
  - who advises on the establishment of the plan of work; and
  - who supervises the asbestos-removal work.
- workers:
  - total number of workers involved in the project;
  - workers register;
  - summary reports for medical examinations;
  - fit testing records of respiratory protection devices; and
  - safety orientation course certificates of workers (in the relevant industries).

d) Method(s) of removal and measures to minimise the release or spread of asbestos:
- method statement (see Chapter 6.6 on Removal Methods);
- details of enclosures (see Chapter 6.5.3 on Enclosure):
  - size and dimensions;
  - structure and materials used for construction; and
  - calculations of air extraction flow rate requirements.
- tools and equipment (including PPE) used:
  - specifications of equipment; and
  - checking and maintenance records of equipment.

e) Decontamination facilities (see Chapter 6.5.4 on Decontamination Facilities):
- size, structure and material used (if it is to be constructed); and
- manufacturer specifications (if the facility is a purchased unit).

f) Site layout:
- demarcation of asbestos work area;
- location of air extraction units;
- location of the hygiene facility;
- location of the asbestos waste storage area;
- transit route; and
- waste route.

g) Decontamination procedures (where applicable, see Chapter 6.5.4 on Decontamination Facilities for more information) for:
- the workplace;
- tools and equipment;
- personnel; and
- soil.

h) Disposal arrangement (see Chapter 6.9 on Waste Disposal):
- procedures for waste handling;
- National Environment Agency (NEA) approved asbestos disposal contractor; and
- certificate of waste disposal receipt.

i) Monitoring of asbestos levels (where applicable; see Chapter 6.10 on Air Monitoring):
- background level (before starting work);
- workers' exposure level (during work);
- check for spread of asbestos outside work area;
- air clearance check (after completion of work); and
- monitoring or test reports (where applicable).

j) Emergency procedures (where applicable):
- breaches in integrity of enclosure during removal work;
- unplanned ACM disturbance;
- fire emergencies; and
- rescue of personnel.

k) Other hazards (where present, see Chapter 6.3 on WSH Risk Assessment).

6.5 Site Preparation

A visual inspection should be carried out to verify that the area is not contaminated before setting up the site for asbestos-removal work. If necessary, air monitoring can be conducted to establish the level of asbestos concentration in the air to determine if respiratory protection is necessary during site preparation.

Prior to covering the asbestos work area with a polyethylene sheet, the area should be pre-cleaned using a high efficiency particulate air (HEPA)-filtered vacuum cleaner or wet wiped. Dry sweeping must never be used to collect asbestos debris under any circumstances. All movable objects such as furniture should be removed from the work area to prevent them from being

contaminated with asbestos. Non-movable objects which are to remain within the work area such as circuit boxes and switch gears should be pre-cleaned thoroughly with an industrial vacuum cleaner equipped with a HEPA filter, or wet-wiped. They should then be sealed with two layers of polyethylene sheets and securely taped down to protect them from contamination. Any ventilation system serving or connected to the asbestos work area should be disabled and the ventilation ducts leading to and from the work area should be sealed for the whole duration of the asbestos-removal work.

6.5.1 Site Control and Arrangement

No person is allowed to enter the asbestos work area, except for those involved in the asbestos-removal work or authorised to enter the work area. The owner, occupants and employees in the workplace and anyone who may be affected by the asbestos-removal work should be advised to stay away from the asbestos work area during the period of work. Barriers or barricades should be erected to control the entry and exit of persons in the asbestos work area. Arrangement for alternate walking path is necessary to prevent unauthorised people or the public from going through or near the asbestos work area.

Signs should be put up at all entry and exit points of the work area to warn the occupants and public of the hazards of asbestos work (see Figure 6). The warning or hazard statements on the signs must be in languages that any person who may be exposed to the hazard can understand. The signs should also be weatherproof and secured in place until the asbestos-removal work is completed. Other signs should enforce site disciplinary rules such as mandatory PPE and no eating, drinking or smoking in the work area.

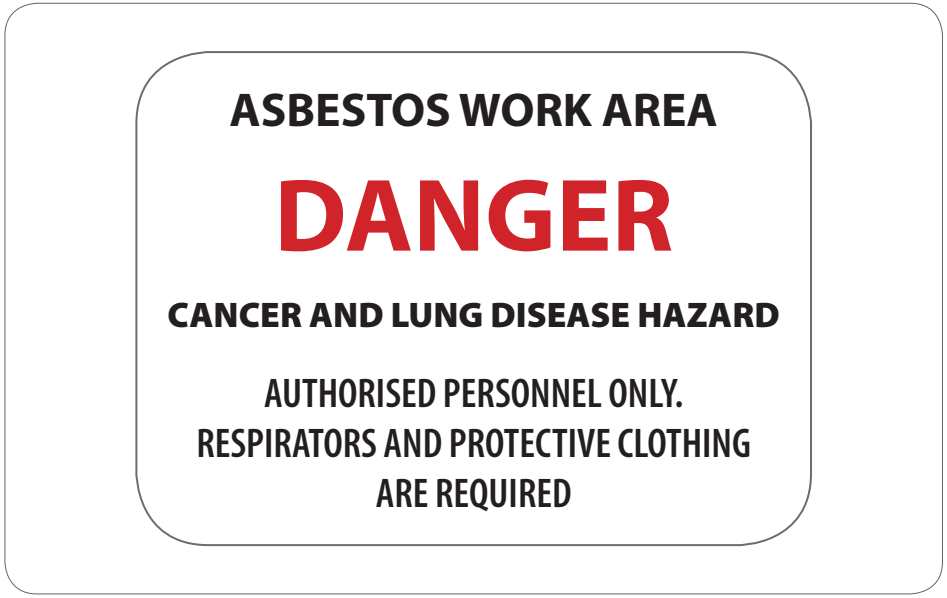

Figure 6: Example of a warning sign.

Scaffolds, lifelines and other work equipment required for asbestos-removal work have to be arranged and set up. During equipment installations, the ACMs should not be disturbed, to prevent unnecessary asbestos exposure. Workers performing the installations must wear appropriate PPE and be able to recognise work hazards such as falling through asbestos roofs or ceilings.

Arrangements should be made for other operations or work to stop during asbestos-removal work. Where possible, avoid work activity in the vicinity of the asbestos work area.

6.5.2 Tools, Materials and Equipment

The following are some tools, materials and equipment that may be required for asbestos-removal work:

- Polyethylene Sheets

  Polyethylene sheets of 0.20 mm (or 8 mils) thickness should be used to enclose and seal the asbestos work area. These sheets are impermeable and impervious and can prevent asbestos dust and waste from spreading to the surrounding environment.

- Wetting Agent

  ACMs need to be properly wetted with a suitable wetting agent to suppress asbestos fibres. Water can be used as the wetting agent for ACMs that contain hydrophilic chrysotile fibres, but is less effective for hydrophobic asbestos fibres such as amosite or crocidolite. For the latter, surfactants (e.g., detergent) will be a more effective wetting agent. Whenever possible, surfactants should be used for all types of asbestos-removal work. Surfactants used should be diluted to a specific concentration based on the manufacturer's instructions. For example, a wetting solution can be applied by an airless type portable water spray.

- Water-based Polyvinyl Acetate Adhesives

  Water-based polyvinyl acetate (PVA) adhesives may be sprayed onto exposed surfaces to bind traces of asbestos that may still be around during the clean-up of the work area. The adhesives should be dyed to indicate where (and whether) they have been applied to facilitate cross-checking at a later stage. Such adhesives can also be used during decontamination work, by spraying them onto asbestos debris to minimise the release of asbestos fibres.

- Industrial Vacuum Cleaner

  An industrial vacuum cleaner can collect asbestos dust and debris during the clean-up of the asbestos work area. The vacuum cleaner used should be of Type H or equivalent, fitted with a HEPA filter. Unless the vacuum cleaner is designed for wet application, it should not be used to vacuum wet materials as this will damage the HEPA filter. Domestic or general purpose vacuum cleaners should not be used as they do not meet the requirements needed to remove asbestos dust which is hazardous to health.

6.5.3 Enclosure

Depending on the type of ACMs to be removed, a partial or total enclosure needs to be provided.

Non-friable ACM Removal

Partial enclosures are required for non-friable ACMs removal. If the precautionary measures to suppress dust release during the removal work are found to be inadequate after assessment, total enclosures may be necessary. It is advisable to use polyethylene sheets to cover all openings to the asbestos work area as the sheets act as a barrier to prevent the spread of asbestos fibres to other areas in the workplace.

At the asbestos work area, the floor should be covered with polyethylene sheets extending up to at least 1.5m away from the work activity area. The edges of the polyethylene sheets should extend at least 30cm upwards, and should be sealed to the wall with adhesive tapes (see Figure 7). All wall openings such as windows should be covered and sealed with two layers of polyethylene sheets.

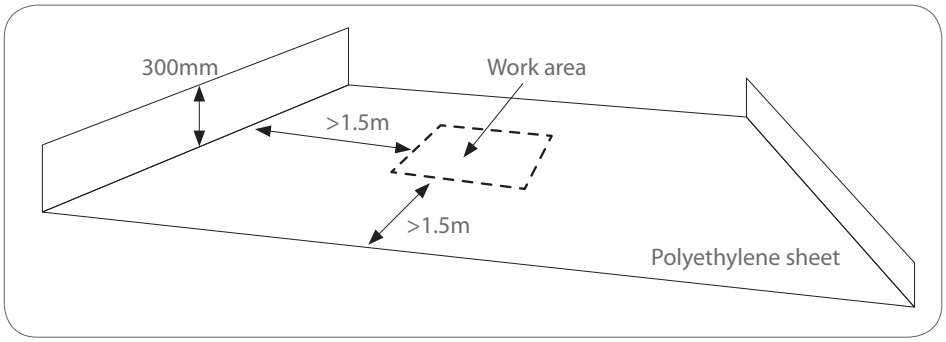

Figure 7: **Flooring to be covered with polyethylene sheets at the asbestos work area.**

For asbestos-removal work on roofs, a barricade at least 2m high should be erected 5m around the work area to prevent unauthorised entry (see Figure 8). If the minimal distance of 5m is not possible, the barricade should be high enough to prevent any ACMs or debris from falling out.

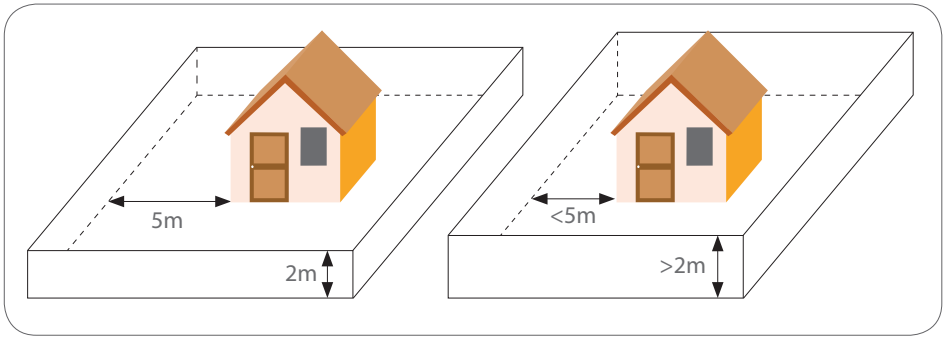

Figure 8: **Example of how barricades for non-friable ACM removal work can be set up.**

Friable ACM Removal

For removal of friable ACMs, the concentration of airborne asbestos fibres is expected to be high and total enclosure is necessary to prevent the spread of asbestos beyond the asbestos work area. Some factors to consider when designing the enclosure include location, size and shape of the work area, number of workers involved and the use of an air extraction unit to maintain sufficient negative pressure.

Enclosure Design

The enclosure should be of a suitable size based on the work requirements. (An oversized enclosure may not be practical as it increases the amount of ventilation required.) A common type of enclosure used is a self-supporting temporary unit built to accommodate the work area (see Figure 9). It consists of a frame to which polyethylene sheets are securely fixed.

Figure 9: **Example of a self-supporting temporary enclosure.**

The choice of materials for the construction of the enclosure is determined by a number of factors, including duration and location of the work. The sheets used must be thick enough to withstand wear and tear. In situations where fire hazards are a concern, fire-retardant polyethylene sheets must be used. Wherever possible, operating processes should not be enclosed as this may introduce additional hazards such as plant overheating, heat stress and fire hazards.

The construction of an enclosure may either make use of parts of the existing building structure or self-supporting temporary structures built around the asbestos working area. Where existing walls, ceilings and floors are used to form part of an enclosure, they should have smooth impervious surfaces that can be thoroughly cleaned after the asbestos-removal work. If any part of the surface is rough, damaged or friable, it should be lined with polyethylene sheets, after pre-cleaning has been done. Any openings (e.g., doors, vents, windows, holes) should be sealed using tape or proprietary sealing compounds and/or covered with two layers of polyethylene sheets. Care should also be taken to ensure that openings through which pipes or ducts pass are properly sealed. All the joints in the polyethylene sheeting need to be adequately sealed using adhesive tape.

The enclosure should be provided with a negative pressure unit (NPU) to prevent asbestos fibres from escaping. Airlocks should be constructed to allow a one-directional air flow between compartments (see Figure 10).

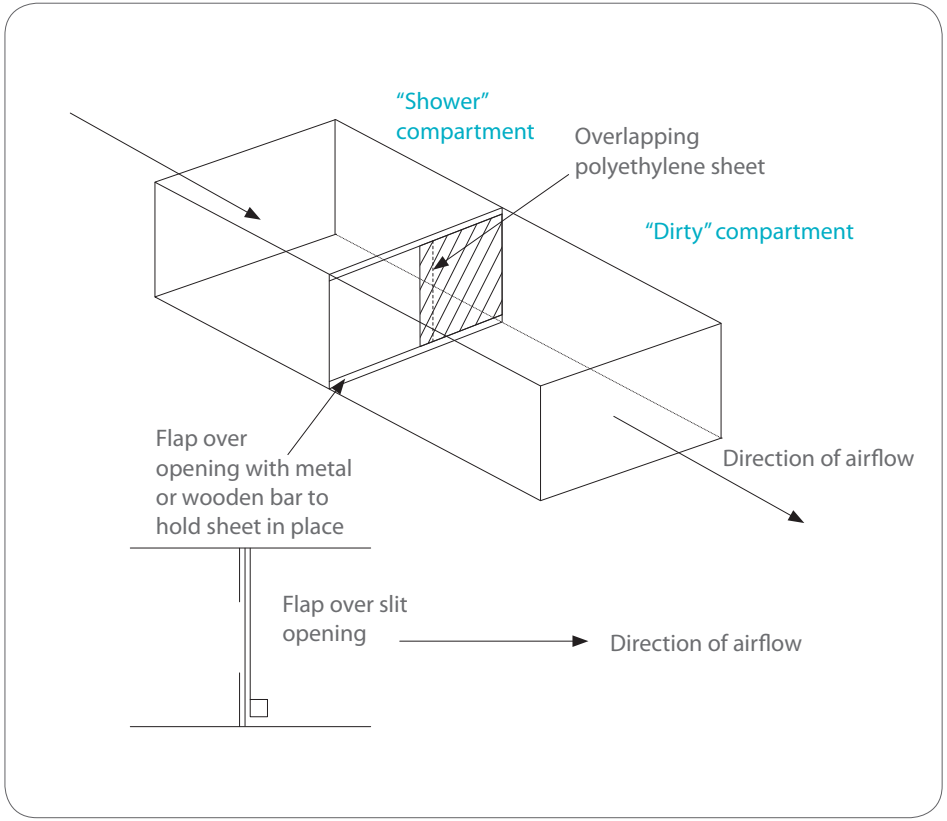

Figure 10: **Air locks between compartments allow one-directional air flow.**

Where a large plant such as a power station is to be stripped of asbestos, it is recommended that the whole area be compartmentalised into multiple smaller enclosed work areas for easier management of the asbestos-removal work. Suitable clear plastic "viewing panels" can be provided so that work activities can be supervised from outside the enclosure.

The enclosure must not obstruct any fire exits. (Where this is unavoidable, alternative arrangements should be made and clearly communicated to the occupants and workers in the premises.)

Air extraction equipment

Air extraction equipment such as an NPU is used to ensure that any asbestos released during the removal work is contained within the enclosure by maintaining the enclosure at negative pressure relative to the surrounding air (5 pascals or 0.5 mm water gauge). The integrity of the negative pressure system can be gauged from the effect of pressure on the plastic sheet. Negative pressure will pull the plastic sheet inwards. This indicates that air flow through any leaks is inwards rather than outwards, preventing asbestos fibres from spreading to the outside of the enclosure. This allows a supply of clean air to the enclosure.

The type of job, layout of the building, and enclosure size and volume need to be considered when determining ventilation requirements. The air extraction unit should be located where it can provide an effective airflow throughout the enclosure. The unit should be placed opposite of or furthest from the entrance to the enclosure so that air can be purged through the entire enclosure (see Figure 11). For large enclosures or those with complex shapes, more than one air extraction unit may be needed to achieve effective airflow.

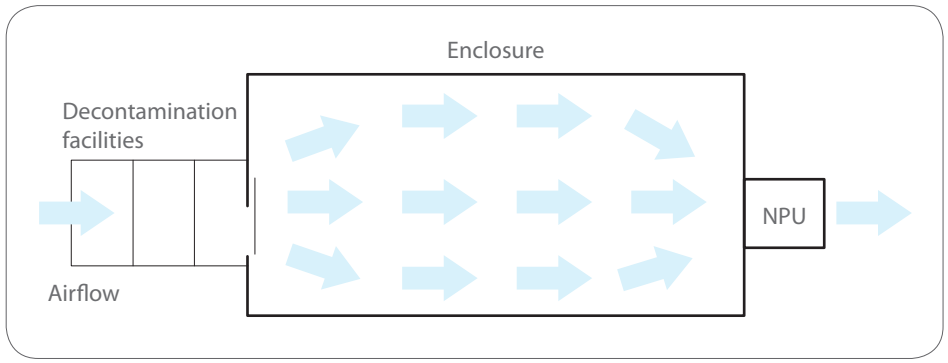

Figure 11: **Illustration of an enclosure with an NPU.**

It is recommended that the extraction flow rates should result in eight air changes per hour in the enclosure. The air extraction unit must be fitted with a HEPA filter of at least 99.97% efficiency. The air extraction unit should be located outside the enclosure where possible.

The following formula is used to determine the capacity of the NPU required:

(Required NPU capacity (m^3/hr) = Volume of enclosure (m^3) x no. of air changes per hour)

Example: For an enclosure that is 10m x 5m x 3m; the
NPU capacity required = 10m x 5m x 3m x 8 air changes per hour
= 1200 m^3/hr

The air extraction unit must be correctly installed and checked by a competent person before use. Safe work procedures for changing of filters should be put in place where there is potential for exposure to asbestos. The air extraction unit should be examined and maintained at least once every six months to ensure that it is in good working condition and operating at its specified efficiency. The maintenance record must be kept updated and available for inspection.

- Inspection and Testing of Enclosure
  A thorough visual inspection of the enclosure is required to check for any leakage prior to the start of each shift. Smoke testing by releasing smoke from a smoke generator inside the enclosure can be done to detect leakages. All air extraction units should be switched off during the smoke testing. Leakages can be detected by observing the smoke flow patterns from outside the enclosure. Any leakage detected must be rectified before work starts.

Additional testing can be performed externally using smoke tubes with the air extraction units running. Smoke tube testing should be carried out at around particular seals and joints to ensure they are effective. Smoke should be drawn into the enclosure during smoke tube testing.

The enclosure must also be maintained in negative pressure during work. Differential pressure monitors can be used to provide a continuous indication of whether or not the enclosure is in negative pressure. A pressure difference of about 5 pascals (0.5 mm water gauge) or above should be maintained. The pressure gauge on the air extraction unit should also be checked to ensure that sufficient airflow is maintained at all times during the work.

6.5.4 Decontamination Facilities

Decontamination or hygiene facilities should be provided to enable workers to:

- change into protective clothing and wear safety equipment such as respirators before entering the asbestos work area; and
- decontaminate themselves before leaving the work area.

The decontamination facility should be positioned adjacent to the work area as shown in Figure 12. Where it is not possible to provide the facilities adjacent to the work area, an alternative known as "transit facilities" should be provided. These transit facilities allow workers to decontaminate themselves partially before moving to the main decontamination facilities for complete decontamination. The route that connects the transit facilities to the decontamination facilities should not pass through occupied areas and allow public access.

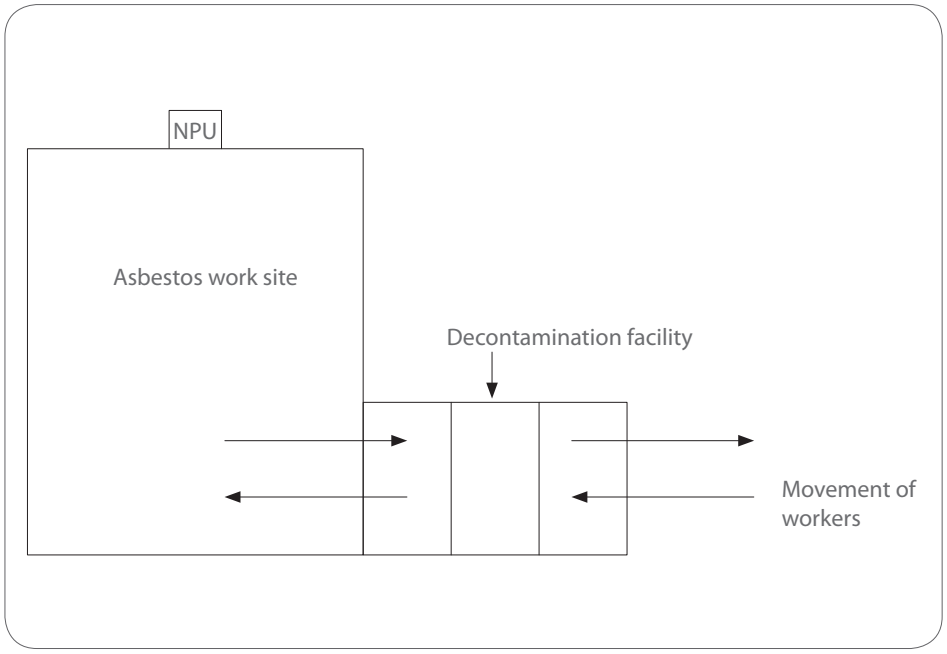

Figure 12: Illustration of a decontamination facility.

The size of the facilities is dependent on the number of workers who will be using them. These facilities should only be used by workers involved in asbestos work.

Design and Construction

Decontamination facilities consist of three separate compartments. They are clean, shower and dirty areas (see Figure 13). At minimum, each compartment should be 1m x 1m x 2m in dimension.

- Clean Area

  There should be provisions for hanging workers' clothing and safe keeping their personal belongings. Decontaminated PPE are to be stored in the clean area. Battery charging points can also be provided in this area.
- Shower Area

  Proper showers should be provided for friable asbestos-removal. The shower area should be between the clean and dirty areas.
- Dirty Area

  There should be storage and disposal bags available in the dirty area for contaminated clothing and asbestos waste respectively. The disposal bags should be labelled to indicate that they contain asbestos waste.

Figure 13: A decontamination facility consisting of three separate compartments (clean, shower and dirty areas).

Decontamination facilities should be constructed such that the facilities can be easily cleaned and no accumulation of asbestos dust in inaccessible areas is possible. Some features and considerations for the facilities include:

- impervious surfaces for all internal walls and ceilings;
- floors completely covered with impervious floor coverings;
- avoiding ledges and grooves;
- covering all corners for easy cleaning;
- providing drainage holes on the floor; and
- capping all poles or tubing used for structure construction.

Two or more overlapping polyethylene sheets between the compartments should be used to ensure that an airlock is maintained as the worker passes through the decontamination facility or unit.

An air extraction unit is needed in the dirty compartment to ensure proper airflow and supply replacement air. Waste water from the decontamination facility should pass through a high efficiency particulate filter (less than 5 microns) before the water can be discharged into the sewer mains (see Figure 14).

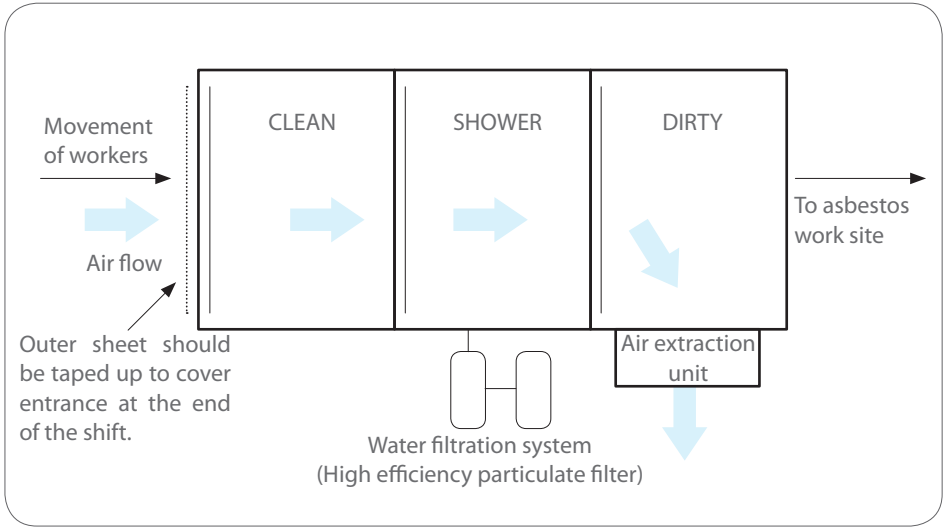

Figure 14: **Illustration of a decontamination facility equipped with a high efficiency particulate filter and air extraction unit.**

Cleaning and Maintenance

Decontamination facilities should be cleaned at the end of each working day. The daily cleaning regime should include the vacuuming of the entire facility followed by a thorough washing down of any exposed surfaces. The water filtration system should also be drained, and debris traps in the shower area emptied. Debris and asbestos waste collected should be put in labelled disposal bags for subsequent disposal. Maintenance workers cleaning the decontamination facilities should wear the appropriate respirator and PPE.

6.6 Removal Methods

The removal technique chosen for asbestos-removal work is usually determined by the nature of the ACMs and their location. Regardless of the technique chosen, the release of asbestos fibres during removal must always be kept to a minimum. Care must be exercised when handling ACMs to minimise breakage. Only non-powered hand tools should be used during the removal process, as the vibration from powered tools will cause more asbestos fibres to be released. Local exhaust ventilation or shadow vacuuming[1] may be used to control asbestos release.

The removal procedures for the different types of ACMs are provided in **Annex C**.

To select the appropriate asbestos-removal method, the following factors should be considered:

- the need to minimise the amount of asbestos fibres generated at the point where ACM is being stripped;
- the type of ACM present (e.g., impervious cement layer on pipe lagging resists wetting whereas lagging such as blankets is better wetted using sprays rather than injection);

[1] Shadow vacuuming applies local exhaust by placing the hose opening of a vacuum cleaner close to the task. The hose opening may be held by a second worker or directly attached to a tool.

- the presence of live electrical equipment that will prevent or restrict the use of controlled wet stripping (wet method);
- the presence of chemicals may present a direct risk to workers or prevent the use of controlled wet stripping methods; and
- the use of wetting agents can result in slips and falls. This is especially important when workers are working at heights.

6.6.1 Wet Method

The wet method refers to water or another wetting agent being used to minimise the release of asbestos. This method is suitable for ACMs that are not covered with other materials (e.g., metal cladding, coated with paint). The wetting agent is sprayed onto the ACM, and sufficient time is given to allow the agent to be absorbed into the material. Over-wetting would result in excess agent seeping out, causing a slip hazard and creating a runoff that may be difficult to handle. The wet ACMs should be removed and placed in a disposal bag, labelled and sealed.

6.6.2 Glove Bag Method

The glove bag is made of strong clear plastic material and can be used in the removal of asbestos-containing gaskets. Generally, the top of the glove bag fits around the material to be removed while the bottom keeps tools and asbestos waste (see Figure 15). The glove bag should have an entry port to allow a spray nozzle to wet the ACM before removal. The bag must not be reused. Procedures to remove the tools and asbestos waste from the glove bag after the removal work have to be established.

Figure 15: **Glove bag containing asbestos waste.**

6.6.3 Injection

Injection methods can be used when the outer surface of the ACM is sealed, covered or coated with impervious material. Where lagging is covered by a cement-like layer, holes can be drilled to allow access for injection heads. The holes should be 10 to 15 cm apart so that the wetting agent is able to reach all areas.

6.6.4 Other Methods

Asbestos can be found in vinyl floor tiles or mastic used to glue tiles to the floor. Hand tools such as scrapers should be used to remove such ACMs. Power tools or abrasive methods such as sanding must not be used during the removal process.

6.7 Personal Protective Equipment

Workers whose work involves asbestos should always put on the appropriate PPE such as disposable protective clothing and respirators.

6.7.1 Disposable Protective Clothing

Workers carrying out asbestos-removal work should use disposable protective clothing. The protective clothing should not have pockets, to prevent asbestos fibres from collecting in them. Also, it should not readily retain or allow the penetration of asbestos fibres. Clothing made of wool or other materials can attract fibrous dusts and must not be worn in the asbestos work area. A Type 5 (BS EN ISO 13982-121) disposable coverall is the appropriate clothing for asbestos work.

The disposable protective clothing must be removed upon leaving the work area (e.g., when the worker goes for meal breaks). It has to be stored in sealed labelled containers to prevent asbestos fibres from getting into the surrounding environment. The worker should refrain from blowing or shaking dust and debris off the clothing as this can dislodge the asbestos fibres. At the end of each shift, the clothing must be disposed of in sealed impermeable bags that are properly labelled.

6.7.2 Respirator

For friable ACM removal work where the exposure is likely to exceed the Permissible Exposure Level (PEL) of 0.1fibre/cc, workers should be provided with powered air-purifying respirators or other high performance equipment (self-contained breathing apparatus or airline respirators). Full-facepiece air-purifying respirators may be used if the exposure is not likely to be above the PEL. On the other hand, for non-friable ACMs removal work and low risk ancillary tasks (e.g., scaffold erection, site set-up, enclosure dismantling, waste handling outside enclosure), provisions should be made for half-facepiece air-purifying respirators equipped with HEPA filters.

Workers should be issued with personal respirators, and they have to ensure that their respirators are regularly cleaned and properly maintained. Fit tests for respirators must be conducted for all users to determine their suitability. Users should also be advised to have their faces clean-shaven to ensure a good fit.

The filter cartridges of the respirators should be replaced when damaged or clogged with dust (e.g., when breathing resistance increases). Workers are reminded to wash their faces and respirators when they leave the work area. The selection, use and maintenance of respiratory protective devices (RPDs), should be in accordance with *SS 548:2009*.

See **Annex D** for the selection and use of RPDs and filter cartridges, and fit test requirements.

6.8 Decontamination

Decontamination is an important step in minimising workers' exposure to residual asbestos fibres during asbestos-removal work processes. The asbestos work area, tools, equipment and PPE need to be decontaminated. Workers should carry out personal decontamination.

Work Area

Decontamination of the work area should be carried out after the asbestos-removal work. The wet-wiping method (e.g., using damp rags to clean the contaminated area[s]) can be used. This is followed by vacuuming to remove asbestos dust. The rags used must be disposed of properly after cleaning. Where wet-wiping is not feasible, sealing agents such as PVA may be used to bind asbestos fibres or dust. After decontamination, a visual inspection should be carried out to ensure that the area has been thoroughly cleaned.

Areas to be decontaminated should include the following, as asbestos debris or residue can be deposited in these areas:

- window sills, ledges, shelves;
- any rough or porous surface;
- support brackets, clamps and pipe hangers;
- nuts and bolts of flanges and hatches of vessels;
- backs of pipes and vessels;
- round conduits and inside cable trays, especially when they are made of metal mesh;
- holes in walls or partitions where pipes, cables or ducts pass through;
- undersides of boilers and tanks;
- folds or overlaps in the polyethylene sheets used to construct the enclosure; and
- electrical installations such as fuse and switch boxes and the inside of light-fitting enclosures.

After decontamination of the work area, an air clearance test should be carried out (see Section 6.10 Air Monitoring for details). The enclosure at the asbestos work area can be dismantled once satisfactory air sampling results are obtained. The sheeting materials used should be taken down, folded inwards, placed and sealed in appropriate disposal bags. The materials used in the construction of the enclosure may be contaminated and they may have to be disposed of as asbestos waste unless they can be effectively cleaned or sealed. All contaminated materials, including cleaning rags, plastic sheeting, timber scaffolds, and PPE must be disposed of properly as asbestos waste.

Tools and Equipment

All tools and equipment used during asbestos-removal work should be properly cleaned and decontaminated before they are removed from the asbestos work area. Otherwise, they would have to be disposed of as asbestos waste depending on the level of decontamination and ease of replacement. Tools and equipment can be cleaned by wet-wiping followed by vacuuming (where practicable) to ensure that all asbestos dust has been removed. Tools that cannot be completely decontaminated or are to be reused should be put in appropriate containers or bags, sealed and labelled.

Personnel

Workers have to carry out personal decontamination in the decontamination facilities at the asbestos work area. They must be trained in decontamination procedures, and adhere to the procedures for using the facilities to avoid contaminating the facilities and creating a health risk to themselves and others.

See **Annex E** for procedures for entering and leaving the asbestos work area.

Soil
In situations where the soil is contaminated with asbestos, for example, due to accidental breakage of ACMs or improper removal of ACMs, the contaminated area should be cordoned off and appropriate steps taken to mitigate the situation.

Decontamination can take the following steps:

- Wet the top layer of soil to minimise generating dust;
- Pick up all visible pieces of ACM debris;
- Remove contaminated topsoil to a depth that has no contamination or asbestos debris (a depth of 10cm is usually sufficient for most cases); and
- Dispose of the contaminated soil as asbestos waste.

6.9 Waste Disposal

Asbestos-containing waste, debris and contaminated clothing should be collected in sealed and impermeable bags or closed containers. The outer surface of these bags or containers should be wet-wiped or vacuumed before they are transported out of the asbestos work area. Bulky asbestos waste such as cement sheets, pipes or insulating boards should be wrapped twice in heavy duty plastic. All asbestos waste should be double-bagged, preferably using a coloured bag on the inside and a clear transparent bag outside. Asbestos waste must be sealed and affixed with labels that clearly indicate the presence of asbestos wastes.

All bags or containers used for asbestos-containing waste should be stored in a designated asbestos waste area. This area should be distinguished from other areas with warning signs. If waste bins or skips are used, wastes must be packed and sealed so that when bins and skips are emptied, there is no residual asbestos contamination.

All asbestos waste should be removed and disposed of accordingly by an approved asbestos disposal contractor regulated by NEA. An application for written permission to dispose of the asbestos waste should be made to NEA. A copy of the receipt issued by the NEA when asbestos waste is disposed off at a landfill should also be kept.

For more information on disposal of asbestos waste, visit www.nea.gov.sg

6.10 Air Monitoring

Air monitoring is conducted to ascertain:

- the airborne concentrations of asbestos fibres so that the correct choice of respirators has been made;
- that there is no measurable spread of airborne fibres to areas adjacent to the asbestos work area; and
- that the work area was adequately cleaned before it was returned to normal use.

Air monitoring is important when:

- large quantities of ACMs have been handled;
- work involves the use of abrasive power or pneumatic tools, and/ or breaking ACMs; and
- significant contamination has occurred.

Air samples collected should only be sent to accredited laboratories for analysis. See **Annex F** for information on air sampling.

6.10.1 Initial Exposure Assessment

To ascertain initial air exposure concentration, air monitoring can be done for friable asbestos before asbestos-removal work starts. The initial exposure assessment can help establish the condition of the work site and ensure that adequate preventive measures have been put in place to protect workers.

6.10.2 Exposure Assessment During Operation

For friable asbestos-removal work, contractors or employers must carry out exposure assessment for workers working in the asbestos work area unless there is:

- reliable data showing that the removal activity will not release airborne fibres in excess of the PEL; and
- historical data from prior monitoring for similar asbestos jobs conducted under similar conditions.

For non-friable asbestos-removal work conducted indoors, contractors or employers must carry out exposure assessment for workers working in the asbestos work area unless the contractor is using the control methods and removal methods recommended in the guidelines. If the contractor uses other control methods, the assessment must be carried out even when workers use supplied-air respirators.

The assessment can be terminated if the results show that the exposure is less than the PEL and there is no change in the conditions, for example, in the work method or equipment used.

6.10.3 Post-operation Assessment

Air or clearance monitoring is necessary after asbestos-removal work is completed for friable ACMs and non-friable ACMs indoors. The monitoring should only be carried out when the area has been cleaned and dried after a visual inspection of the work area.

When the results from the monitoring and visual inspection are satisfactory, the enclosure can then be removed. If any contamination is found during the dismantling of the enclosure, further cleaning must be carried out and the process of visual inspection and air monitoring repeated. For clearance monitoring, the concentration of airborne asbestos fibres in the air should not exceed 0.01 fibres/cc.

7. Training of Workers

Workers involved in asbestos work must be adequately trained not earlier than 12 months before they start any asbestos work and retrained once every 12 months after the completion of the last training.

The training programme must include instructions on the following:

- the harmful properties of asbestos and their hazardous effects on health;
- materials, substances, products and articles which contain or are likely to contain asbestos;
- work, processes or operations which may result in exposure to asbestos and preventive measures to minimise such exposure;
- safe work procedures and use of PPE;
- proper use, maintenance and limitations of respiratory protective equipment;
- asbestos decontamination procedures;
- asbestos waste handling procedures; and
- purpose and requirements of medical examinations as specified in the WSH (Medical Examinations) Regulations.

Training programmes must be reviewed periodically to take into account any significant changes in the type of work and/ or work methods used. The training record shall include information on the syllabus and content of the training programme and the start and end dates of the training programme. The training record must be updated, made readily available and kept for at least two years.

8. Medical Surveillance

Under the WSH (Medical Examinations) Regulations, workers involved in asbestos work must be sent for a pre-placement medical examination not later than three months after their employment commences, and every three years thereafter for regular medical examinations.

The medical examination includes a clinical examination and a large-size chest X-ray, and must be conducted by a designated workplace doctor, The contractor or employer is required to submit a register of all workers involved in asbestos work together with their medical summary reports to MOM. The contractor or employer is also required to update MOM if any asbestos worker has resigned or left employment.

The medical examination reports should be kept by the contractor or employer for at least five years, and should be made available upon request by MOM inspectors. It is recommended that these medical records should be retained as long as possible due to the long latency period of asbestos-related illnesses. Employees could also be given a copy of their medical report.

9. Annexes

Annex A – Materials That May Contain Asbestos

The following are materials that may contain asbestos. The list is not exhaustive.

- Bituminous adhesive or sealant
- Boiler insulation
- Brake disc pad
- Brake or clutch lining
- Caulking or putty
- Ceiling board or panel
- Cement board or panel
- Cement pipe
- Corrugated roof sheet
- Corrugated wall cladding
- Electric wiring insulation
- Electrical cloth
- Electrical panel partition
- Elevator brake shoes
- Fire blanket
- Fire curtain
- Fire door insulation
- Fire proofing cloth
- Fire proofing gloves
- Fire-rated wall
- Fire-resistant board
- Floor vinyl sheet
- Floor vinyl tile
- Gasket
- Gland packing
- Insulation block
- Joint sheet or compound
- Mastic
- Millboard
- Pipe cladding
- Pipe insulation
- Plaster (acoustical or decorative)
- Refractory lining or tile
- Roof gutter
- Roofing felt
- Rubbish or refute chute
- Sprayed insulation
- Textured paint or coating
- Thermal insulation lining
- Thermal paper product
- Ventilation panel or pigeon hole ventilation block

Annex B – How to Conduct an Asbestos Survey

Below are general guidelines on asbestos surveys.

a. Survey Planning

Information you need before conducting an asbestos survey:

- number of buildings to be surveyed;
- description and use of building(s);
- age, type and construction details of building(s);
- details on any extension or refurbishment carried out after the building(s) was completed;
- building plans, floor layout or drawings of the site (to record location of samples taken and indications of ACM presence);
- safety and health hazards on site; and
- the location of heating and ventilation ducts, plant rooms, riser shafts, lift shafts, and so on.

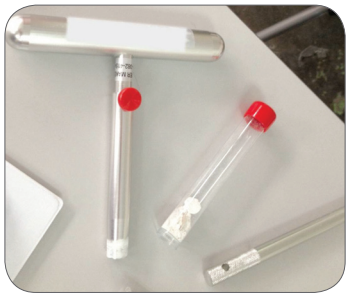

Figure 17: A core sampler.

A list of equipment for asbestos survey work:

Equipment for taking samples	Other ancillary/ auxiliary items	PPE
• Pliers • Screwdrivers • Hammer • Core samplers (see Figure 17) • Tapes • Penknife • Fillers • Hand-spray containing PVA or surfactant • Sampling bags	• Site plan • Step ladder • Camera • Torch • Sampling labels • Type H vacuum cleaner • Asbestos waste bags • Wet wipes • Polythene sheeting	• Disposable clothing • Disposable shoe covers • Disposable gloves • Respirators (where appropriate)

b. Bulk Sampling

Surveys should be carried out systematically to ensure that all areas are inspected and no ACMs are missed out. Each area and room should be thoroughly examined to identify the materials and locations to be selected for sampling.

Below are some good sampling practices:

- Materials should be inspected for apparent differences and variation in appearance;
- Samples of approximately 3 to 5 cm^2 surface area and covering the entire depth of the ACM should be taken;
- For homogenous materials, one or two samples will normally be sufficient. For non-homogenous materials, more samples may be required;
- Repaired or patched materials should be sampled in addition to the original material;
- Materials should be wetted with suitable wetting agent to control any release of airborne asbestos during sampling, and if necessary, shadow vacuuming[2] should be adopted;
- Sampling points, or locations where samples are taken, should be sealed with tapes or fillers to prevent the release of asbestos fibres after sampling; and
- The sampling area should be thoroughly clean, leaving no evidence of debris from the sampling operation.

c. Survey Report

The asbestos survey report should follow the format below:

- Executive summary:
  - brief description of scope and type of survey; and
  - summary of findings and conclusion.

- Introduction:
  - scope, purpose and objectives of survey;
  - type of survey (e.g., management, refurbishment or demolition survey);
  - number of buildings involved in survey; and
  - type and age of building(s).

- Site information:
  - details of surveyor (name of survey company, address, name of surveyor, contact email or number, etc.);
  - details of client (name of company, address, contact person, contact email or number, etc.);
  - name and address of premises surveyed;
  - date of survey;

[2] Shadow vacuuming applies local exhaust by placing the hose opening of a vacuum cleaner close to the task. The hose opening may be held by a second worker or directly attached to a tool.

- date of report;
- areas accessed/ included in the survey;
- inaccessible areas and the reasons why access is not permitted; and
- survey method used.

- Survey results:
  - sample number;
  - location description;
  - product type;
  - photographs of ACM;
  - quantity;
  - test result (asbestos type);
  - condition[3];
  - surface treatment[4]; and
  - building plans indicating the location of ACMs.

- Conclusions and recommendations:
  - summary of findings (list samples that contain asbestos and type of asbestos found); and
  - recommendations and actions to be taken.

- Appendix:
  - bulk analysis results of the samples tested (provided by the laboratory);
  - building plans or floor layout indicating sample locations and areas that contain ACMs; and
  - photographs of the site.

[3] not needed for Demolishment Survey.

[4] not needed for Demolishment Survey.

Examples of ACMs and their locations that could be provided in the survey report:

Sample no	Location	Product type	Quantity	Photo	Test result (asbestos type)
1.	Living room	Ceiling board	Whole ceiling		Amosite
2.	Roof	Corrugated roof sheets	Entire roof		Chrysotile
3.	Backyard roof	Corrugated roof sheets	50m^2		Chrysotile

Annex C – Removal Procedures for Asbestos-containing Materials

Removal Procedures of Non-friable ACMs

- **Manual Dismantling Method**

  If asbestos cement sheets are in a good condition and it is reasonably practicable to provide safe access, they should be taken down in their entirety without breakage. It is best to:

  – Remove them intact;
  – Use wet methods where possible;
  – Immediately vacuum all loose dust along the cut;
  – Lower the roof sheets to the ground as soon as possible or by the end of the work shift;
  – Wrap or bag the removed material before hoisting;
  – Transfer unwrapped materials to a closed receptacle to prevent dispersion of the dust when lowered; and
  – Isolate roof-level ventilation air intakes or shut down the ventilation system.

  Roof sheets should preferably be removed from underneath with mobile elevating work platforms such as scissor lifts or cherry pickers. When using this method, the sheets should not be dropped or damaged. The equipment used should be thoroughly cleaned.

- **Remote Dismantling Method**

  If the sheets are disintegrating or the risk of falls is too great, remote dismantling or demolition methods such as deliberate controlled collapse should be used. Remote demolition could expose equipment operators or waste disposal workers to asbestos fibres.

  When the remote method is used, the work area must be continually sprayed with water to suppress the release of asbestos fibres. The roof sheets should be dismantled in a controlled manner, for example, using excavators fitted with suitable demolition attachments. The area should be cleared of other materials before work commences. The work should be designed to minimise breakage of sheets. Before and while loading the broken sheets onto lorries, keep the sheets damp by spraying them with water. Lorries should be securely covered to prevent the asbestos waste from drying out and dispersing during transportation.

  In some cases, the public may be alarmed by the remote method of demolition as it can be noisy, dusty, or appear uncontrolled, and potentially spread dangerous fibres from asbestos roofing and/ or roof sheets. To alleviate these concerns, contractors can keep members of the public informed about the work and carry out background air sampling at the perimeters of the site.

- **Removal of Floor Tiles**

  To remove asbestos-containing floor tiles, such as vinyl floor tiles, individual tiles should be lifted by scraping manually at their bases. As underlying mastic adhesives may also contain asbestos, any adhering remnant of tiles should be completely removed from the floor slab by manual scraping and wetting.

  To remove asbestos floor coverings, a continuous 1 m high dust barrier sealed to the floor around the work area is required, and mechanical chipping should not be carried out unless in a negative pressure enclosure. Dry sweeping and sand flooring are not allowed.

- **Removal of Gaskets**

  When removing asbestos-containing gaskets, contractors or employers must ensure the following are carried out:

  – Enclose gaskets in glove bags before removal if they are visibly deteriorated and unlikely to be removed intact;
  – Thoroughly wet the gaskets with wetting solutions or water prior to removal;
  – Immediately place the wet gaskets in a disposal container; and
  – Scrape using wet methods to remove residue.

- **Removal of Cement Pipes**

  In most cases, asbestos-containing pipes are considered non-friable. They should not be shattered, crumbled, and/ or pulverised as they will release asbestos fibers. Asbestos-containing pipes should not be sanded, sawed, ground and/ or chipped under any circumstances, such as when using power tools.

  When removing the asbestos containing pipes, contractors or employers must ensure the following are carried out:

  – Excavate the soil to expose the pipes;
  – Use manual tools to clear away the soil surrounding the pipes;
  – Wet the material during removal using a water hose, garden sprayer, spray bottles, or any method that keeps the material wet;
  – Cut the pipe using hand-operated blade cutters or snap cutters and pull the pipe up out of the ground in easy to handle lengths (1 to 1.5 m or 3 to 5 feet); and
  – Do not use compressed air, dry sweep, or vacuum with a non-HEPA rated vacuum cleaner.

Removal Procedures for Friable Asbestos-containing Materials

- **Removal of Lagging and Sprayed Coating**

  If the material is thick (greater than 1 cm), and covered with a coating which can be punctured by injection heads, low-pressure injection can be used.

  If the material is unsealed and relatively thin (less than 1 cm), controlled low-pressure sprays can be used to wet the materials. If there is an impermeable layer which cannot be punctured by injection heads, such as a pipe lagging with a hard cement coating, injection holes can be made by drilling.

  When pipework is redundant, wrap and cut can be applied.

- **Removal of Boards**

  For surfaces which are painted and accessible, shadow vacuuming must be applied while unscrewing the board. Controlled low-pressure sprays should be used on unpainted surfaces, followed by surface vacuuming while unscrewing the boards.

- **Soaking Method (Controlled Wetting Using Injections)**

  If the ACM is so thick that the spray method will not suppress the dust significantly, the soaking method should be used to ensure the material is completely saturated. First, the insulation is soaked in water or another wetting agent through an appropriate applicator which feeds the wetting agent to the insulation via numerous side holes or outlets. To facilitate rapid wetting of the insulation material, holes or cuts should be made in the outer covering to enable water or wetting agents to be injected. It is important to note that the ACM should be saturated with the wetting agent, not just washed out through a liquid passage.

  Where access to ACM is obstructed by coating or cladding, the coating or cladding should be removed carefully to avoid dust generation. Before removal, the surfaces should be vacuum cleaned or where practicable, sprayed with water. The quantity of water or wetting agent and soaking time will depend on the thickness of material, access and location of holes. Water or wetting agent application should be controlled to prevent slurries and/ or surface run off. The saturated ACM should be removed in sections and placed in properly labelled and sealed containers before it is disposed of as asbestos waste.

  The most useful technique for achieving good control of asbestos fibres at the point of removal is multi-point injections, using injection heads which penetrate the outer layer of ACM such as sprayed coatings or lagging. Injection heads with holes only at the tip allow thin layers (1 cm or less) of sealed sprayed coatings to be injected. Alternatively, angled injection heads which help the lateral movement of the wetting agent can be used. However, injection methods may not be appropriate for unsealed sprayed coatings where the injection heads can dislodge asbestos during application.

- **Spray Method**

  The spray method should be used on ACM which is not covered or coated by other materials such as paint and/ or cladding which requires prior removal. The water spray should be applied so that the entire surface of ACM is wet while also minimising runoff. A manually controlled low-pressure water spray could be used. The spray should be both copious and fine so that the water droplets do not generate dust on the surface of the insulation material upon impact. The ACM should be wet through the entire cross section of the ACM.

  The spray should be directed at the cutting-up operation in progress and the wet material removed. The wet ACM should be removed in sections and placed in labelled containers, then suitably sealed. All removed ACM should be properly wet and small sections which may be dislodged should be properly disposed of. Suitable respiratory protection is still necessary when using a water spray method because asbestos dust may not be fully suppressed or eliminated.

Annex D – Selection and Use of Respiratory Protective Devices

Respiratory Protective Devices must be adequate (i.e., provide the level of protection required) and suitable (i.e., matched to the user, job and working environment).

- **Selection**

  The selection of RPD for asbestos work should take into consideration:

  – Expected Level of Exposure

    The expected level of exposure should be established during risk assessment. Results from pre-job or previous air monitoring may be used as a guide in determining expected exposure levels.

  – Protection Factor

    Protective factor determines the effectiveness of the respirator in reducing the concentration of asbestos particles in breathing air.

    See *SS 548: 2009 Code of practice for selection, use and maintenance of respiratory protective devices* for more information on the protection factor of the different RPDs available.

- **Fitting**

  Users must undergo fit testing to ensure they have been outfitted with the right respirator in the right size for their job. A good facial seal is important to ensure optimal respirator performance. Fit testing should be conducted by the manufacturer or manufacturer-accredited representatives.

  A qualitative or quantitative fit test method may be employed to determine if a satisfactory fit has been achieved. A fit test shall not be conducted if there is any hair growth between the face and sealing surface of the respirator, such as a beard or moustache.

  See *SS 548: 2009 Code of practice for selection, use and maintenance of respiratory protective devices* for more information on the fit test procedures.

  A fit test must be conducted before the first use of a respirator and subsequently at least once every 12 months, or whenever there is a change in the user's facial characteristics. Records of fit testing must be kept for at least two years.

- **Maintenance and Storage**

  All respirators must be inspected for defects before each use. Fit checks must be done every time a respirator is used to ensure that the respirator is in good condition and that it is a good fit. Both a negative and positive pressure check should be performed. Respirators must be placed in a clean, sealable plastic bag when not in use.

- **Filter Cartridge**

  For asbestos-removal work, a HEPA filter should be used.

  Under the AS/NZS 1715:2009 and BS EN 143:2000 classification, the Type P3 particulate filter should be selected as it has a 99.95% efficiency.

  Under National Institute of Occupational Safety and Health (NIOSH) classification, a P100 particulate filter should be used where 99.97% filtering efficiency is expected.

Annex E – Procedures for Entering and Leaving Asbestos Work Area

i. Procedure for entering the work area with decontamination facility:

- Enter the "clean area" of the decontamination facility.

- Inspect the respirator to ensure that it is in good working condition.
- Replace filter if/ when necessary.
- For positive pressure powered respirators, ensure that a fully charged battery has been fitted.

- Remove all personal clothing.
- Put on clean protective clothing if provided[5].
- Put on the respirator and carry out a fit check.

- Pass through the "shower area" (without showering) into the "dirty area".

- Enter work area.

[5] If protective clothing was left in the "dirty area" from a previous shift, put it on there.

ii. Procedure for leaving the work area with a decontamination facility:

- Before entering the decontamination facility, while still in the work area, remove all visible dust and fibres from protective clothing, respirator and footwear using vacuum cleaning equipment fitted with a HEPA filter.
- A shoe bath can be provided where there is contamination by wet materials.

- Enter the "dirty area" of the decontamination facility.
- Remove protective clothing and place them in the storage region orplastic bags for disposal.
- Do not remove the respirator.

- Enter the "shower area".
- Shower thoroughly while wearing the respirator.
- Remove the respirator and continue showering.

- Remove filter from respirator and place it into a plastic bag, then leave the bag in the "shower area" for disposal later.
- Ensure that the inside and outside of the respirator is clean.

- Enter the "clean area".
- Dry and change into personal clothing.

- Leave the respirator in the "clean area".
- Charge the battery (if necessary).

- Exit the decontamination facility.

iii. Procedure for entering a work area that uses a transit facility:

- Put on protective clothing and respirator in the "clean area" of the decontamination facility.

- Pass through the "shower area" (without showering) into the "dirty area".
- Wear transit coveralls and foot covers.

- Exit the "dirty area" and walk to the transit facility via designated route.

- Enter the transit facility.
- Remove transit coveralls and foot covers.
- Containers or hooks can be provided in the transit facility for coveralls and foot covers.

- Enter work area.

iv. Procedure for leaving the work area that uses a transit facility:

- While still in the work area, remove all visible dust and fibres from protective clothing, respirator and footwear using vacuum cleaning equipment fitted with a HEPA filter before entering the transit facility.
- A shoe bath can be provided where there is contamination by wet materials.

- Enter the transit facility.
- Remove protective clothing and place them in the storage region or plastic bags for disposal.
- Do not remove the respirator.

- Put on transit overalls and foot covers.

- Exit the transit facility and walk to the decontamination facility via designated route.

- Enter the "dirty area" of the decontamination facility.
- Remove transit overalls and foot covers and place them in plastic bags for disposal.
- Do not remove the respirator.
- Follow **Annex E**: Procedure for leaving work area (main decontamination facility) from showering onwards.

Annex F – Air Sampling

Air sampling involves collecting airborne particles, including asbestos fibers and other fibres by drawing air though a filter using a sampling pump operating at a known flow rate for a measured period of time.

Static sampling is undertaken with the filter holder positioned between one to two meters above ground. The points of measurement should cover likely sources of fibres and places where many people gather.

For personal sampling, the sampling pump should be light and portable so that the worker can wear it on his/ her belt. The filter holder should be positioned within the breathing zone. If the worker is wearing a respirator, he/ she should take care to position the filter holder facing away from the filtered air exhaust outlet of the respirator.

Application	Sampling flow rates (litres/min)	Sample volume (litres)	Graticule areas examined	Limit of quantification (fibres/cm^3)
Compliance sampling	1 – 4	240	100	0.04
Assessment of respiratory protection	1 – 4	240	100	0.04
Clearance sampling	2 – 16	480	200	0.01
Background	2 – 16	480	200	0.01
Leak and reassurance	2 – 16	480	200	0.01

Figure 18: **Recommended flow rates, volumes and limits of quantification.**

The sampling flow rate should be adjusted to produce a fibre density of 100 to 1300 f/mm^2 on the filter. For clearance or background leak sampling, the number of graticule areas inspected may be reduced if the collected air volume is increased. In relatively clean atmosphere where targeted fibre concentrations are much lower than 0.1fibre/cc, larger sample volumes are needed to achieve quantifiable loadings. A minimum sample volume of 1200 litres is recommended for air clearance sampling.

Details of the sampling should include the:

- date of sampling;
- type of sampling carried out (e.g., personal, leak, background);
- sampling location;
- details of the worker and type of work he/ she undertook at the time (only applicable for personal sampling);
- identification numbers of equipment used (e.g., sampling pumps, flow measurement devices, filters and sampling heads);
- individual sample details of each sample in the form of:
  - unique identifier;
  - specific sample position; and
  - start and finish time for each sample.

Analytical Methods

NIOSH 7400 Phase Contrast Microscopy Method

The air sample should be analysed using Phase Contrast Microscopy (PCM) to determine the asbestos fibre concentration in the air. However, PCM does not differentiate between asbestos and other types of fibres. All fibres are counted and assumed to be asbestos. Results are expressed in fibres per cubic centimeter (f/cc).

NIOSH 7402 Transmission Electron Microscopy Method

The air sample can be analysed using Transmission Electron Microscopy (TEM). TEM is able to distinguish asbestos from other fibres, expressing results as an asbestos fibre count with the type of asbestos present also reported. The air sample can be analysed using TEM if the analysis result using PCM method exceeds PEL. This method is intended to complement the results obtained by PCM.

10. Further Information

Workplace Safety and Health (WSH) Act

WSH (Asbestos) Regulations

WSH (General Provisions) Regulations

WSH (Risk Management) Regulations

WSH (Medical Examinations) Regulations

WSH Council Code of Practice for WSH Risk Management

WSH Council Code of Practice for Working Safely at Heights

Singapore Standard SS 548: 2009 – Code of Practice for selection, use and maintenance of respiratory protective devices

UK Health and Safety Executive (HSE). Asbestos health and safety.

Published in July 2014 by the Workplace Safety and Health Council in collaboration with the Ministry of Manpower.

This publication is available on the
Workplace Safety and Health Council
Website: www.wshc.sg
Email: contact@wshc.sg

ANNEX B-1

FORM A
PUBLIC COMMUNICATIONS PLAN

Details of Developer	**To:**	**INSTRUCTION:**
Company Name: Address: Tel no: Email:	Group Director Land Sales & Administration Urban Redevelopment Authority 45 Maxwell Road The URA Centre Singapore 069118	This form is to be duly completed and submitted to the Authority within 2 months from the date of the award of tender.

Parcel Reference Number: _____

Proposed Development: _____

_____

Lot/Parcel Reference: _____ TS/MK: _____

	Key milestones **(Refer to Condition 7.1 of the Technical Conditions of Tender)**	**Proposed date of commencement***
1.	Distribution of flyers containing brief project information and contact details of parties specified (Condition 7.1.4)	(dd/mm/yy)
2.	Submission of Form B (Condition 7.1.5)	
3.	First submission of development proposal (Condition 7.1.5)	
4.	Erection of hoarding and site clearance (Condition 7.1.6)	
5.	Obtain grant of Provisional Permission (Condition 7.1.7)	
6.	Distribution of flyers containing detailed project information (Condition 7.1.7)	
7.	Submission of Form C (Condition 7.1.8)	
8.	Submission of Form D (Condition 7.1.9)	
9.	Construction schedule a) Piling b) Sub-structure c) Superstructure d) M&E works e) Finishes	

Name, Designation & Signature of Developer's representative

** The Authority shall be kept informed of any changes to the public communications plan.*

ANNEX B-2

FORM B

DECLARATION BY THE DEVELOPER (PRIOR TO APPLICATION FOR WRITTEN PERMISSION)

INSTRUCTION:

This form is to be duly completed and submitted to the Authority prior to submission of an application to the Competent Authority under the Planning Act (Cap. 232) for Written Permission. If the written consent of the Authority is not submitted together with the development application to the Competent Authority, the development application will be returned.

Details of Developer	**To:**
Company Name:	Group Director Land Sales & Administration
Address:	Urban Redevelopment Authority 45 Maxwell Road
Tel no:	The URA Centre
Email:	Singapore 069118

Parcel Reference Number:

_____

Proposed Development:

_____

_____

_

Lot/Parcel Reference: _____ TS/MK: _____

I, _____ (Name), _____ (Designation), hereby declare on behalf of the developer that in accordance with Condition 7.1.4 of the Technical Conditions of Tender, flyers containing brief information on the project and the contact details of the parties specified in the said Condition have been distributed to the local community* on _____ (Date).

We have enclosed supporting documents to show that the flyers have been distributed.

Signature: Date:

**Local community is defined and includes the parties specified in Condition 7.1.2 of the Technical Conditions of Tender*

ANNEX B-3

FORM C
DECLARATION BY THE DEVELOPER
(FOR RESUBMISSION OF APPLICATION SUBSEQUENT TO THE PROVISIONAL PERMISSION)

INSTRUCTION:

This form is to be duly completed and submitted to the Authority prior to resubmission of development application and no later than 2 months after the grant of Provisional Permission. Upon confirming that the form is in order, the Authority will give written consent for you to proceed with the resubmission of the development application, which shall be made no earlier than 3 weeks from the date the flyers were distributed. If the written consent of the Authority is not submitted together with the resubmission of the development application, the development application will be returned.

Details of Developer	**To:**
Company Name:	Group Director Land Sales & Administration
Address:	Urban Redevelopment Authority 45 Maxwell Road
Tel no:	The URA Centre
Email:	Singapore 069118

Parcel Reference Number:

_____

Proposed Development:

_____

_____

Lot/Parcel Reference: _____ TS/MK: _____

I, _____ (Name), _____ (Designation), hereby declare on behalf of the developer that in accordance with Condition 7.1.7 of the Technical Conditions of Tender, flyers containing detailed information on the development project and the contact details of the parties specified in the said Condition have been distributed to the local community* on _____ (Date).

We have enclosed supporting documents to show that the flyers have been distributed.

ANNEX B-4

FORM D
CONSOLIDATED FEEDBACK ON PROPOSED DEVELOPMENT
(FOR RESUBMISSION OF APPLICATION SUBSEQUENT TO THE PROVISIONAL PERMISSION)

INSTRUCTION:

This form is to be duly completed and submitted to the Competent Authority as part of the resubmission of the development application subsequent to the grant of the Provisional Permission.

Details of Developer	**To:**
Company Name: Address: Tel no: Email:	Group Director Development Control Urban Redevelopment Authority 45 Maxwell Road The URA Centre Singapore 069118

DC Reference: _____

Submission Number: _____

Proposed Development: _____

_____

Lot Number: _____

I, _____ (Name), _____ (Designation), hereby declare on behalf of the developer that in accordance with Condition 7.1.9 of the Technical Conditions of Tender, the table below has included all feedback that has been received from the local community, up to the date of this resubmission of the development application.

Feedback received from the local community and how the development proposal has sensitively addressed the feedback raised**:

Feedback Received from Local Community	**Proposed Measures to Address the Feedback**
1)	1)
2)	2)
3)	3)
4)	4)
Signature:	Date:

** Local community is defined and includes the parties specified under Condition 7.1.2 of the Technical Conditions of Tender*

*** This must include all feedback received up to the point of this resubmission of the development application. If this space is insufficient, additional information should be provided on a separate page and submitted as part of Form D.*

Details of preliminary feedback received from the local community (if any):**

1)

2)

3)

4)

Signature: Date:

* *Local community is defined and includes the parties specified under Condition 7.1.2 of the Technical Conditions of Tender*

***This should include all feedback received up to the point of the submission of this form. If this space is insufficient, additional information should be provided on a separate page and submitted as part of Form C.*

Annex C

The successful tenderer is strongly encouraged to work with the tenants/operators of the shops and restaurants to adopt relevant productive formats in the proposed development. Outlets larger or equal to 200 sqm should adopt at least 3 productive formats, while outlets smaller than 200 sqm should adopt at least 2 productive formats. Below is the list of initiatives suggested by SPRING Singapore to raise productivity for Food Services and Retail Outlets:

Suggested Initiatives to Raise Productivity (Food Services)

Initiative	Functions	Manpower savings / Manpower needed
Digital Service E.g. Digital Kiosks, Mobile App, e-Menu, e-Waiter	Digital service technologies enable ordering and payment to be automated, with orders transmitted directly in real-time to kitchens and payment done wirelessly. For instance, self-ordering or payment kiosks enable patrons to order and pay via a kiosk system.	Reduces about 5 headcounts /outlet
Kitchen Automation	Investing in process automation through machinery and equipment to replace labour-intensive food preparation processes improves productivity.	Reduces about 4 headcounts/outlet
Centralised Dishwashing (shared basis)	Outsourcing dishwashing to an on-site or off-site third-party centralised dishwashing provider reduces food services operators' costs.	Reduces 1 headcounts/outlet
Central Kitchen	Central kitchens enable economies of scale and comprises the following: ▪ Kitchen Automation: Purchase automation equipment or processing line ▪ Workflow Redesign: Streamline work processes to maximise efficiency ▪ 5S Housekeeping: Methodology to improve operational efficiency and space utilization ▪ Enterprise Resource Planning (ERP)	Reduces about 4 - 6 headcounts/outlet

Initiative	Functions	Manpower savings / Manpower needed
Meal Replacement Vending Machines	Meal replacement vending machines are machines which dispense meals to customers automatically after the consumer makes his/her purchase. These vending machines typically have microwave-enabled capabilities for further heating of meals. Some machines are able to prepare food within the machine.	Requires 1 - 3 headcount
Grab and Go Kiosks Retailing Ready Meals	Grab and Go kiosks facilitate takeaway orders. Minimal on-site food preparation is needed due to the usage of ready meals.	Requires 4 – 6 headcount
Productive Food Court/ Coffee Shop	Productive food courts/coffee shops are food courts/coffee shops that are equipped with two or more of the following productivity initiatives: 1. Digital service 2. Centralised dishwashing 3. Kitchen automation 4. Tray return (customised self-return counters, conveyor belt or RFID) 5. Supported by a central kitchen The productive food court/coffee shop model could also include the following: 1. Shared kitchen space 2. Self-service model like IKEA or Marche 3. Retailing of ready meals 4. Incorporation of vending machines and grab and go kiosks 5. Other amenities not necessarily confined to food services, such as click-and-collect services The productive food court/coffee shop model is more manpower-lean.	For a food court with 10 stalls, this requires about 15 - 18 headcount

Suggested Initiatives to Raise Productivity (Retail)

Initiative	Functions	Suggested Trades	Manpower savings/ Manpower needed
Self-Checkout (SCO) System	A SCO system allows customers to scan, pack and pay for their purchases without a cashier's assistance. SCO is typically used for single basket purchases in a grocery store. By using SCO, retailers can redeploy cashiers to other value-adding roles and alleviate long queues along traditional cashier counters.	Grocery and any other high-volume retail trades (e.g. bookstores, pharmacies, convenience stores)	Reduces 8 headcount/ outlet
Cash Management (CM) System	A CM system automates manual cash handling processes, from the point-of-sales to cash-in-transit pick up. With CM, the preparation of cash floats, collection and dispensation of cash payment and reconciliation of cash notes can be done with minimal human intervention. CM is typically used amongst retailers with high cash transactions. By using CM, a retailer can benefit from faster checkouts, higher accuracy in cash dispensation, man-hour savings from the elimination of manual cash counting and increase security.	Grocery and any other retail trades that has high cash transactions (e.g. stationery shops, pharmacies, convenience stores)	Reduces 1 headcount/ outlet
Electronic shelf labelling	Electronic shelf labels can be automatically updated from a centralized pricing system, reducing time spent by staff to print updated prices on price labels and reducing errors in tagging the right products.	Grocery and any other retail trades that has high cash transaction (e.g. stationery, pharmacies, convenience stores)	Reduces 1 headcount/ outlet

Initiative	Functions	Suggested Trades	Manpower savings/ Manpower needed
Radio Frequency Identification (RFID) technology	With remote scanners to read RFID tags placed on individual products, an RFID system enables retailers to record a variety of information, including quantities of various stock items and their precise locations. Retailers can effectively identify and manage items by decreasing time spent on stock count.	All retail trades, especially those that carry a large number of stock-keeping-units (SKUs)	Reduces 2 headcount/ outlet
Digital catalogue	A digital catalogue will allow customers to browse through a large inventory base without sales assistants having to physically locate the products. The catalogue can be integrated with retailers' inventory or content management system, allowing retailers to streamline their product updating processes and eliminate manual price lists.	All retail trades, especially those that carry a large number of stock-keeping-units (SKUs)	Reduces 3 headcount/ outlet
Vending machine	Vending machines, or automated retail systems (ARS), bring together internet, robotics, cashless payment and digital media technologies to sell products round-the-clock without relying on manpower. By using ARS, retailers can increase efficiency and enhance customer experience through self-service.	All retail trades	1-3 headcount required/ outlet
Point-of-Sales (POS) System	A POS system automates real-time tracking of inventory and sales transactions. It is able to generate sales reports and provide insights on customer behaviour and product popularity. The system's API (Application Programmable Interface) should	All retail trades	Reduces 1 headcount/ outlet

Initiative	Functions	Suggested Trades	Manpower savings/ Manpower needed
	be able to integrate with existing accounting and inventory management system.		
Appointment Scheduling and Booking (ASB) System	An ASB system automates appointment scheduling and booking processes, helping companies to save manpower and time. It can also customise and send booking notifications, reminders and confirmation emails to staff and/or customers.	All retail trades, especially those that are service-related (e.g. beauty and hair services)	Reduces 1 headcount/ outlet
Urban Logistics (UL)	Improve the productivity of last mile deliveries through the use of infocomm technologies to optimize deliveries via analytics, technology and automation. In-mall distribution: Retailers can skip the long queues at unloading bays. The UL operator manages the loading bay of the mall, receiving goods on behalf of the tenants and re-distributing them at scheduled times. Offsite Consolidation: Instead of delivering direct to a mall, retailers' delivery vehicles are diverted to an offsite warehouse, where the UL operator will consolidate the goods and make a full truckload delivery to the mall.	All retail trades	

For more information on these productivity initiatives, please contact food_division@spring.gov.sg or lifestyle_division@spring.gov.sg

You can also visit http://www.spring.gov.sg/Growing-Business/Grant/Pages/capability-development-grant.aspx for more information on how SPRING can support your capability upgrading initiatives.