ENVIRONMENTAL IMPACT ASSESSMENT

Final Assessment Report

(Volume 1: Introduction and Summary)

Hong Kong Cement/Concrete Batching Plant
and
Material Storage Facilities
at
North-West Tsing Yi Island

EHS Consultants Limited
Consultants in Environmental Protection, Health and Safety

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ENVIRONMENTAL IMPACT ASSESSMENT

Final Assessment Report

(Volume 1: Introduction and Summary)

Hong Kong Cement/Concrete Batching Plant
and
Material Storage Facilities
at
North-West Tsing Yi Island

Reference : R545-1/0895

Prepared by : EHS Consultants Limited

Date : August 1995

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1. INTRODUCTION

1.1 Background

The existing cement depots and concrete batching plant next to Greenfield Garden at TYTL 124, Tsing Yi Island will be relocated to North -West of Tsing Yi Island at TYTL 119 (Figure 1-1). The proposed site will have an area of 9,000.0m^2 and will accommodate four cement works (Figure 1-2) namely: Hong Kong Cement Manufacturing Co. Limited (HKC), Pioneer Concrete (HK) Limited (PIC), Quon Hing Concrete Co. Limited (QHC) and Shun Shing Fat Limited (SSF).

In order to demonstrate that the proposed cement works will not generate any adverse environmental impacts upon any sensitive receivers in the vicinity during construction and operational phase of the plants, an Environmental Impact Assessment (EIA) is required. EHS Consultants Limited was commissioned by the cement works to conduct the EIA study.

1.2 Purpose of the Environmental Impact Assessment

A Study Brief of the EIA was issued by Environmental Protection Department (EPD) with the purpose to provide information on nature and extent of the environmental impacts arising from the construction and operational phase of the cement works. The objectives of the EIA, which drawn directly from the Study Brief are as follows:

i) to describe the proposed project and associated works together with the requirements for carrying out the proposed project;

ii) to identify and describe the elements of the community and environment likely to be affected by the proposed project, and/or likely to cause adverse impacts upon the proposed project, including both the natural and man-made environment;

iii) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

iv) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction, operation of the project;

v) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and cumulative effects expected to arise during the construction and operation phases of the project in relation to the sensitive receivers and potential affected uses;

vi) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the project which are necessary to mitigate these impacts and reduce them to acceptable levels;

vii) to design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted;

viii)to investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;

ix) to identify constraints associated with the mitigation measures recommended in the study; and

x) to identify any additional studies necessary to fulfill the objectives to the requirements of this Environmental Impact Assessment Study.

In order to satisfy the objectives listed above, the scope of work for this study are as follows:

i) carrying out the necessary background studies to identify, collect and analyze existing information relevant to the EIA study;

ii) carrying out any necessary environmental survey, site investigations and baseline monitoring work to achieve the objectives;

iii) quantifying, by use of models or other predictive methods, the residual and cumulative environmental impacts (specifying whether these are transient, long term and/or irreversible) arising from the construction and operation of the project;

iv) proposing practicable, effective and enforceable methods, measures and standards to effectively mitigate any significant environmental impacts in the short and long term; and

v) outlining a programme by which the environmental impacts of the project can be assessed, monitored and audited.

In further defining the scope of the EIA Study, consideration should be given to beneficial and adverse effects, short and long term effects, secondary and induced effects, cumulative effects, synergistic effects and transboundary effects.

1.3 Approach and Methodology

Frequent meetings have been held with different sections of the Environmental Protection Department to discuss various aspects of the study regarding construction and operational phase of the plants. This includes modification of assessment criteria, revision of modelling methodologies, identification of key issues and answers to comments.

Discussions with the plant operators and project Architect have been held throughout the duration of the study to obtain information on the best practical means of mitigation measures for different stages of the project. This will enable the highest possible mitigation measures to be implemented at the proposed plants.

Hong Kong Environmental Protection Department and United States Environmental Protection Agency (EPA) approved computer programme/models such as Caline4, ISCST and FDM are employed to predict the air pollutant concentrations due to various pollutants generating processes during the construction and operational phase of the plants. Model control parameters and methods for presentation of results have been consulted and agreed with EPD prior to commencing the detailed studies. Discussions have been held with various technical groups of the EPD to agree on parameters to be used in the model and the analysis of results.

Block layout plans of the cement works have prepared and included in this EIA. These plans are used to show the buildings and topography surrounding the premises where the cement works are to be conducted and the location of all dust emission points and their corresponding numbers.

Schematic flow diagrams of the cement works have been prepared and contained in this EIA. These diagrams showed the flow of material and product, in process of storage and distribution. All dust emission points and air pollution control equipment associated with the emission points have been identified and labeled with consistent reference numbers.

1.4 Structure of the Environmental Impact Assessment Report

The full Environmental Impact Assessment study will include the following reports:

- *An Inception Report*

  This report will indicate the approach and methodology for various parts of the EIA, defining the work programmes and detailing the submission of reports.

- *An Initial Assessment Report*

  This report provide an initial assessment of the environmental impacts and cumulative effects arising from the proposed plants. Identify key issues which will be addressed in details in the Key Issues Report.

- *A Key Issue Report*

  The Key Issue Report give an in-depth assessment of the key issue identified in the Initial Assessment Report. The Key Issue Report will cover the air quality impact during construction and operational phase of the plants.

- *Final Assessment Report*

  The report will summarise all the findings and conclusions from the Initial Assessment Report and the Key Issues Report. Any mitigation measures recommended will also be described.

- *An Executive Summary*

  An English and Chinese version of the executive summary highlighting the issues of concern to the community will be provided.

- *An Environmental Monitoring and Audit Programme*

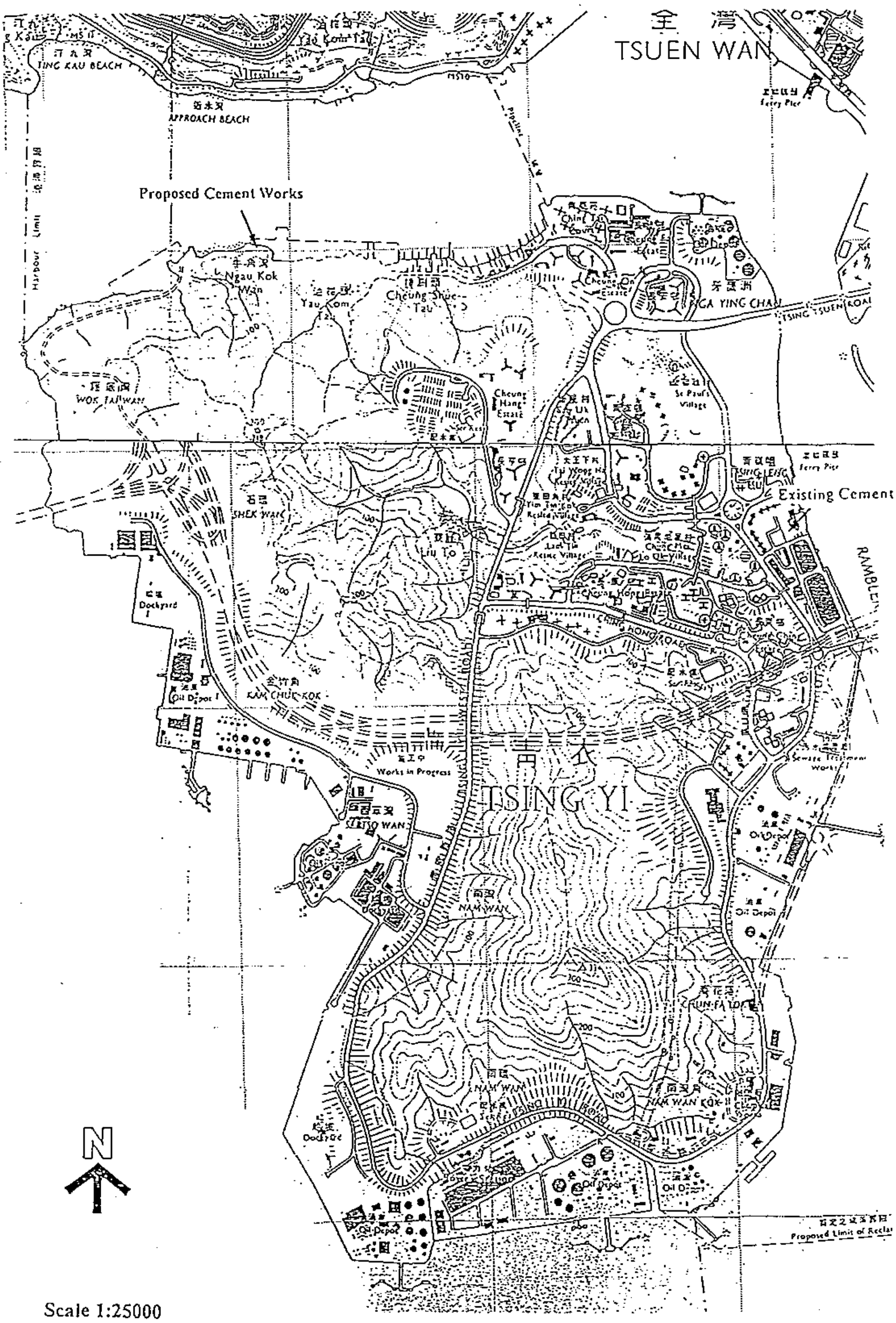
  This report summarises the environmental monitoring requirements and the recommended mitigation measures for operational phase of the plants.

The *Inception Report, Initial Assessment Report, Key Issue Report* of the EIA study has been completed and the final version of these reports have been submitted to the Environmental Study Management Group for comment. All of the Government raised comments have been satisfactorily resolved and, therefore at this stage, a Final Assessment Report is being prepared to summarise all the findings and conclusion in these reports. Government's comments as well as the Consultant's response to these comments regarding the two reports are enclosed in the Appendix for information.

1.5 Scope of the Final Assessment Report

The *Final Assessment Report (FAR)* will summarise the following points:

- fully satisfies the requirements of the Study Brief issued by the EPD in respect to the prediction and assessment of impacts, the identification of environmental impact mitigation measures and the associated residual impacts;
- describes the agreed schedules and programmes for monitoring and audit requirements;
- prescribes the specification for detailed design construction and operation requirements for the proposed cement works;
- provides with the impacts summary, the study findings, conclusions, recommendations and a mechanism for implementation.



TITLE : Location of the Proposed Cement Works at TYTL 119, Tsing Yi Island, N.T.

PROJECT : Cement and Concrete Batching Plants at Tsing Yi Final Assessment Report

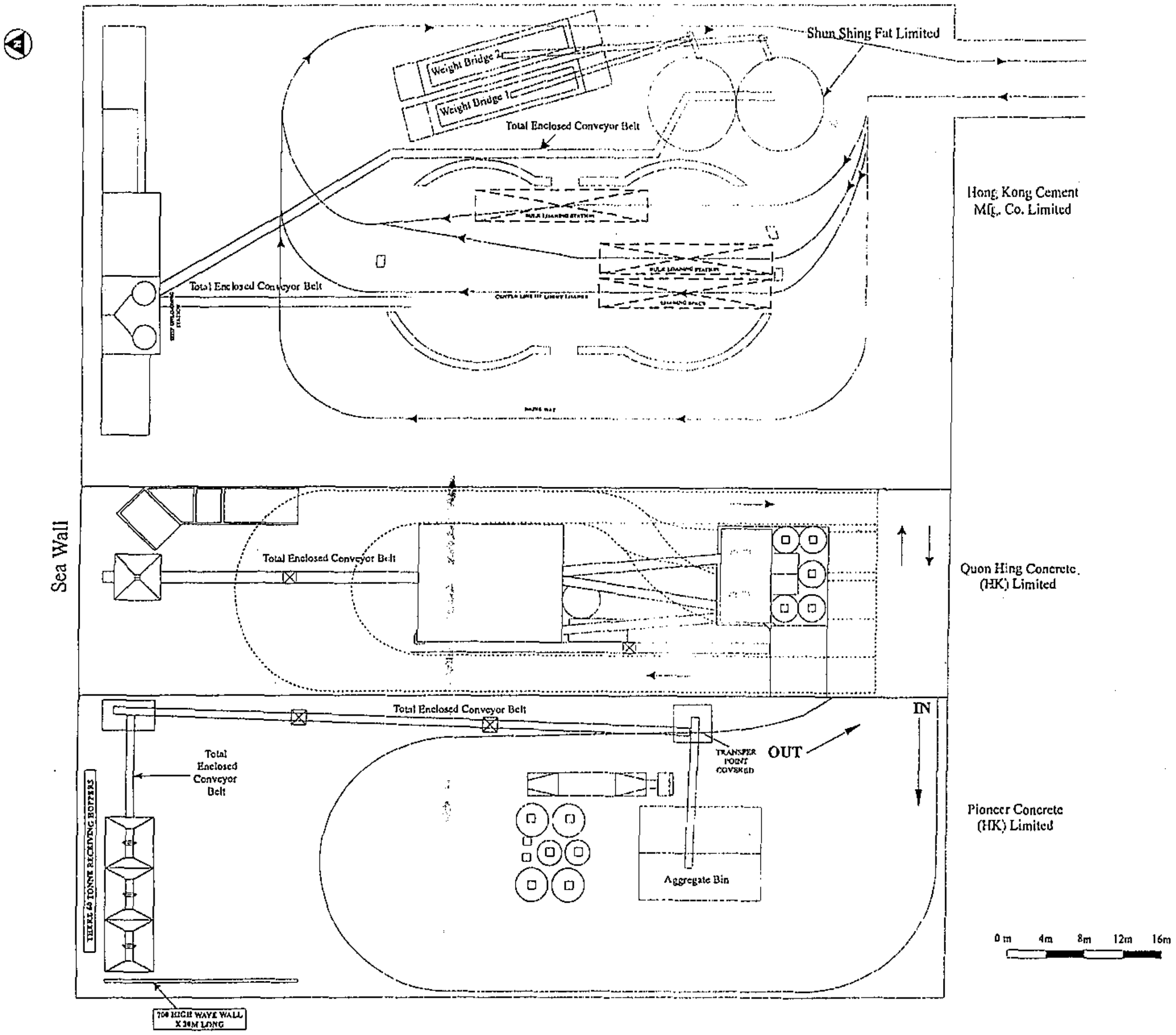
Figure : 1-1

Scale : ---

EHS Consultants Limited

Figure : 1-2

Scale : ---



TITLE :	Block Layout Plan of the Proposed Cement Works at TYTL 119, Tsing Yi Island, N.T.
PROJECT :	Cement and Concrete Batching Plant at Tsing Yi Final Assessment Report

EHS Consultants Limited

2. SUMMARY AND CONCLUSION OF ENVIRONMENTAL IMPACTS

2.1 Construction Phase Impacts

- At the moment of writing of this EIA report, major dust generating construction processes have been completed. Existing on-going construction works will involve only steelworks and superstructure, which are not dust-generating process. Therefore, it will no longer be necessary to address the construction phase dust impact in great detail.

- Construction noise impact has been assessed *(Section 4.4 of the Initial Assessment Report)* and concluded that the predicted noise levels at the NSRs are well below the Acceptable Noise Level of 65dB(A) during the restricted hours (i.e. 1900 to 2300 on normal weekdays and any time on a public holiday including Sunday). It is concluded that construction noise impact should not be a problem.

- During construction phase prevention of soil and construction material from entering the water source will be the main issue (*Section 5.6 of the Initial Assessment Report).* A series of silt removal facilities will be installed to settle out siltation prior to discharge into public foul sewer. Sediment traps, channels and manholes will be properly maintained and deposited silt and grit will be removed regularly by the contractor.

2.2 Operational Phase Impacts

2.2.1 Machinery Noise Impacts

- In the assessment, different operational scenarios of the cement works have been assumed and modelled by a conservative approach (*Section 4.5 of the Initial Assessment Report*). Mitigation measures in form of noise barriers and enclosures have been recommended and aimed at reducing the noise level impact. After implementation of the mitigation measures on-site, total compliance with noise standards shall be achieved.

2.2.2 Traffic Noise Impacts

- Traffic noise along the Tam Kon Shan Road, Tam Kon Shan Interchange and the Tsing Tsuen Road with and without the proposed cement works has been assessed *(Section 4.6 of the Initial Assessment Report*). Three scenarios have been modelled which are as follows:
    - ⇒ Base case scenario 1994 before the relocation of the cement works
    - ⇒ Scenario at 1995 before the commissioning of the cement works
    - ⇒ Scenario at 1995 for the cumulative noise effect after the commissioning of the cement works

- The general exceedance in the noise level above the recommended standard of 70dB(A) was predicted even without the cement works as the noise sensitive receivers are already very close to the major roads. The predicted noise level at various NSRs will only marginal increased by at most 1.5dB(A) after the commissioning of the cement works.

2.2.3 Water Quality Impact

- Water quality impacts during construction and operational phase of the cement works have been assessed. *(Section 5 of the Initial Assessment Report)* Service water generated from operational procedures will be recycled as much practicable as possible and they will be conveyed by properly designed drainage to a drain pit and a series of sedimentation basins.

- Sufficient number of sediment traps will be provided to allow silt removal to the surface runoff prior to discharge into public stormwater drain. This situation will only happen when the service water storage tanks are overflowed during heavy rain fall.

- An effluent discharge licence will be applied and regular water monitoring will be conducted if necessary.

- With the implementation of recommended mitigation measures, the possible impact on water quality shall be minimised to acceptable levels. It is not envisaged that water quality impact arising from the proposed cement works.

2.2.4 Vehicular Emission Impacts

- Emission from the plants related vehicles during the operational phase has been assessed by Caline 4 and compared with the baseline scenario. The assessment concluded that such emissions will be within acceptable level as stipulated in the Air Quality Objectives *(Section 4 of the Key Issue Report).*

2.2.5 Dust Emission Impacts

- Dust emission from various operational processes of the cement works has been considered as key issue of the EIA study and the aspect has been covered by a Key Issue *Report (Section 5 of the Key Issue Report).* With the incorporation of best practicable means of dust control measures and good housekeeping, computer modelling by FDM predicted that dust emitted from the cement works will be within acceptable level and will not create any environmental nuisance to the nearby sensitive receivers.

- The best practicable measures of dust control measures were formulated with referenced to the guidelines issued by the EPD. Additional mitigation measures have been recommended to the plant operators at site specific locations where fugitive dust emission is expected to be serious.

- The best practicable means of dust control measures includes but not limited to the following approaches:
  - ⇒ Dust laden-air generated by dusty processes shall be fully extracted and vented to dust collectors to meet the particulate emission limited of 50mg/m^3.
  - ⇒ All cement silos shall be fitted with audible high level alarm to give early warning of over-filling. The alarm indicator shall be interlocked with the cement filling line such that when the alarm is activated, the cement filling line will be closed within a short time.
  - ⇒ Loading out of cement into bulk cement trucks shall be carried out in a structure enclosed on top and all sides with rigid boards down to ground level. The entrance

opening and exit point of the enclosed structure shall be provided with flexible curtain.

⇒ Double-walled retractable loading head with air extraction between the walls shall be installed and used to loading cement into bulk cement tankers.

⇒ Dust generating processes shall be totally enclosed as far as possible by creating an enclosed structure to house the processes.

⇒ There will not be any open storage of raw materials on site. All aggregates will be stored in totally enclosed storage bin.

⇒ Conveyor systems for material handling shall be enclosed on top and 2 sides by metal sheets with a metal board at the bottom to eliminate any dust emission due to wind-whipping effect.

⇒ Loading of cement and aggregates weigh hoppers will be operated in a totally enclosed system. Dust generated from the processes will be extracted and vented to dust collector to meet the particulate emission standard of 50mg/m^3.

⇒ Sufficient dust suppression system in terms of water sprinklers and water hoses shall be installed throughout the cement works.

⇒ A high standard of housekeeping shall be maintain to prevent emission of fugitive dust emission from its plant operation. And a series of dust monitoring exercise will be carried out by the plant operators to oversee the effectiveness of the dust control measures.

⇒ All spillage or deposits of dusty materials on the plant facilities shall be cleaned up as soon as practicable. The material shall be handled properly to prevent fugitive dust emission. The dusty waste shall be vacuum cleaned or conditioned for dust suppression immediately once generated.

3. IMPLEMENTATION PROGRAM OF THE CEMENT WORKS

The next planning stage of the cement works will be the application of the specified process licence (SPL) pursuant to Section 14 of the Air Pollution Control Ordinance (APCO). Under Section 14a of the APCO, the plant operator is required to submit an Air Pollution Control Plan (APCP) to the Authority (EPD) for approval prior to operation.

In the APCP, details of the best practicable means of dust control measures will be provided by the plant operators. Upon satisfactorily demonstrated to the Authority that the plants will not create an environmental nuisance to the public, a SPL will be issued. Dust control measures as proposed in the APCP, as well as any additional requirements that EPD considered as necessary, will be stated in the SPL as terms and conditions. All these terms and conditions have to be strictly followed by the plant operator under the supervision of the Authority. A series of dust monitoring program will be required to perform by the plant operators under the terms and conditions of the SPL. And the monitoring results as well as plant process/production data have to be submitted in a regularly base to the Authority for comment and information. Such that the effectiveness of the dust control measure can be effectively observed.

In addition before the issue of the SPL, a commissioning trial will be required to demonstrate that the operation of the cement works will not generate any adverse environmental impacts upon the sensitive land users. The commissioning trail will be witnessed by the Authority.

4. CONCLUSION

An Environmental Impact Assessment for four cement works has been conducted. This study concluded that with the incorporation of the best practicable means of duct control measures and effective housekeeping, the level of dust emission from the four specified processes will be within acceptable level and will not create an environmental nuisance to the public. Through the teams and conditions of the specified processes licence, the operation of the cement works will be under the tight supervision of the Authority.

Appendix Ia

Government's Comments
for the
Initial Assessment Report

HK Cement (EIA)

28

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YOUR REF: L265/0395
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TEL. NO.: 2835 1150
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By Fax & Normal Despatch
(Fax No.: 2507 2203)

SL
12/5
12/5

9 May 1995

12 MAY 1995

EHS Consultants Ltd.
22/F, Loyong Court Commercial Building
220 Lockhart Road
Hong Kong

(Attn.: David Yeung)

Dear Mr. Yeung,

EIA for Hong Kong Cement/Concrete Batching Plant and Material Storage Facilities at North-West Tsing Yi Island
Environmental Impact Assessment

Draft Initial Impact Assessment (amended Mar., 95)

We refer to the letter quoted-above and the telecon. (Yeung/undersigned) of 9.5.95 regarding the responses to the members' comments on the above report

As discussed, we have not yet received all of the members' reply and we could only provide you an advanced copy of comments (copy attached) which we have at the moment. We hope these would be useful for you to finalize the report. Should you have any queries, please feel free to contact the undersigned.

Thank you for your attention.

Yours sincerely,

(Felix S. C. LEUNG)
Environmental Protection Officer
for Director of Environmental Protection

..../

<u>c.c.</u>

AC for T/NT
PM/NTW
DO/K&T
DPO/TW & KT

<u>Internal</u>

S(AP)2	(Attn.: E(AP)3)
S(AM)1	
S(NP)5	(Attn.: E(NP)5)
S(WS)5	(Attn.: E(WS)5)
S(LP)4	(Attn.: E(LP)9)

[ID.LTR0905A{AA}]

(Advanced Copy)

Remarks on Responses by Consultants

EIA for Hong Kong Cement/Concrete Batching Plant and Material Storage Facilities at North - West Tsing Yi Island EIA
Initial impact Assessment (amended Mar., 95)

Environmental Protection Department

Water Aspect
(Technical Contact: Mr. Wynn To at 2835 1154)

Sect. 5.6.1 2nd para.

Besides following guidelines from the Civil Engineering Department, the Consultants should also follow EPD guidelines, especially the Practice Note for Professional Persons (ProPECC Notes) and the Environmental Guidelines for Planning in Hong Kong.

Sect. 5.6.2.2 2nd para.

With a maximum of 20 m³ of service per day, there should be some safety margin in the design of the sedimentation basins, a capacity of only 20 m³ solids may be enough.

Project Manager/New Territory West
(Contact: Mr. T W CHAN at 2217 6348)

The Consultants' response to my comments is not all satisfactory. The traffic data used in the assessment should not be the data based on existing operating plants at TYTL 69 and from other similar plants operating elsewhere. It should be the projected traffic based on the maximum output of the operator's proposed plant at TYTL 119.

District Officer/Kwai Tsing
(Contact: Mr. Lawrence CHOW at 2421 2855 ext. 17)

The Consultants should contact Mr. Ray Chiu (tel. 2423 40002 ext. 38) for consultation arrangements

The following members have no adverse comments:

a. Assistant Commissioner for Transport/New Territories.
b. District Planning Officer/Tsuen Wan and Kwai Tsing.

Appendix Ib

Consultants' Responses
to the
Government's Comments

EHS Consultants Limited
22/F Loyong Court Commercial Building,
220 Lockhart Road, Wanchai, Hong Kong
Tel : (852) 2507 2203 Fax : (852) 2507 2293

FAX TRANSMISSION

FAX REF. :	Fax-535/0695	DATE :	June 8 1995
TO (COMPANY) :	Environmental Protection Department		
ATTENTION :	Mr. Wynn To	FAX NO. :	2834 9960
FROM :	David Yeung	PAGES TO FOLLOW :	nil
SUBJECT :	EIA for Hong Kong Cement/Concrete batching plant and material storage facilities at North-West Tsing Yi Island - Initial Assessment Report (March 95)		

MESSAGE :

Dear Mr. To,

I refer to your comment regarding the captioned, which was passed on to us through Mr. Felix Leung of your Department {ref: (48) in EP1/N3/44 II dated 12 May 1995}. We have the following response to your comments:

<u>Section 5.6.1 2nd para.</u>
The consultants shall also follow EPD guidelines, especially the Practice Note for Professional Persons (ProPECC Notes) and the Hong Kong Planning Standards and Guidelines as well as the guidelines from CED

<u>Section 5.6.2.2 2nd para</u>
A capacity of $30m^3$ solid have been considered in our report. During detailed design stage, drainage plans will be submitted by the AP of the project to EPD through Building Department for comment and approved.

I hop this will solve your queries. Please do not hesitate to contact the undersigned should you have nay queries.

Yours sincerely,

ORIGINAL SIGNED

David Yeung
Senior Consultant

c.c. Mr. Felix Leung - EPD

5.6 Proposed Mitigation Measures

5.6.1 During Construction Phase

Construction works will be programmed to minimise soil excavation works in rainy seasons. Erosion from construction sites can be minimised by implementing viable erosion control measures as follows :-

i) Diversion of upstream run-off away from exposed soil surfaces, e.g. by provision of intercepting channels along the crest/edge of excavation;

ii) Minimise the time that soil surfaces is exposed;

iii) Protection of exposed soil surfaces from rainfall, e.g. cover temporarily exposed slope surfaces by tarpaulin and protect temporary access roads by crushed stone or gravel, and

iv) Slow down the run-off flowing across exposed soil surfaces.

A series of silt removal facilities will be installed to settle out siltation prior to discharge into public foul sewer. Such facilities will be properly designed in accordance with guidelines from the Civil Engineering Department, the Practical Note for Professional Persons (ProPECC) as well as the HKPSG to achieve the desired mitigating effect on the water quality. Typically, a detention time not less than 5 minutes for maximum design flow of inlet should achieve adequate sediment removal. Channels or earth bunds or sand bag barriers will be provided on site to properly direct surface runoff to such silt removal facilities. Sediment traps, channels and manholes will be maintained and the deposited silt and grit will be removed regularly by the contractor. A manual penstock will be installed before the final discharge to stop accidental spillage.

Sewage generated from the construction workers will be contained by chemical toilets before connection to public foul sewer can be completed. Chemical toilets will be provided at a rate of about 1 per 50 workers. The facility will be serviced and cleaned by specialist contractor at regular intervals.

To prevent spillage of fuel oils or other polluting fluids at source, it is recommended that all the stocks should be stored inside proper containers and sited on sealed areas, preferably surrounded by bunds.

5.6.2 During Operational Phase

5.6.2.1 Foul Effluent from the Plants

Foul water effluent generated from the offices and toilet facilities will be directed to the government foul sewer without pretreatment. Chemical toilets may be used in places where connection to public sewers are not feasible. If site canteen is erected, properly designed grease traps/ oil interceptors capable of providing a minimum 20 minutes retention during peak flow will be installed to remove excess quantities of grease and oil from wastewater collected from the kitchen basins, sinks and floor drains prior to discharge into the public foul sewer.

5.6.2.2 Service Water from PIC and QHC

Drainage design for the future PIC will be similar to the existing layout which convey all service waters from the concrete loading and the drum washing areas containing high level of solid into a drain pit before entering a series of two sedimentation basins for particle settling. PIC will continue to use all the surplus water for concrete production similar to their existing practice. Such arrangement will allow no service waters with high pH value or carrying high level of solid to be discharged into the public foul sewer network. The drainage layout will be submitted to relevant

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Tel : (852) 2507 2203 Fax : (852) 2507 2293

FAX TRANSMISSION

FAX REF. : Fax-494/0595 DATE : May 22 1995

TO (COMPANY) : Territory Development Department

ATTENTION : Mr. T W Chan (PM/ NTW) FAX NO. : 2412 0358

FROM : David Yeung TOTAL NO. OF PAGE : 1

SUBJECT : EIA for Hong Kong Cement/Concrete Batching Plant and Material; Storage Facilities at North - West Tsing Yi Island Initial Impact Assessment Report (amended March 1995)

MESSAGE

Dear Mr. Chan,

I refer to the telephone conversation between your goodself and the undersigned regarding the captioned. We would like to confirm that the traffic data used in the assessment was provided by the plant operators and was based on the maximum production rate of the plants.

We hope this would clarify your queries. Thank you very much for your attention and please feel free to contact the undersigned if you have any queries.

Yours sincerely,

ORIGINAL SIGNED

David Yeung
Senior Consultant

c.c. Mr. Felix Leung - EPD (2591 0558)

Table 4-12 Noise Sensitive Receivers Along the Route of Concrete Mixer Trucks

NSR	Description
T1	Secondary school of Cheung On Tsuen
T2	One housing estate block of Cheung On Tsuen
T3	One housing estate block of Ching Tai Court
T4	Primary school of Ching Tai Court
T5	Primary school of Cheung On Tsuen
T6	One housing estate block of Cheung On Tsuen
T7	One housing estate block of Cheung On Tsuen
T8	Tsing On THA
T9	One housing estate block of Cheung On Tsuen
T10	Proposed C/R development above the Tsing Yi Station and transport interchange

4.6.5 The Traffic Flow

Existing flow on the Tam Kon Shan Road was counted in-situ before the Interchange and projected to the Year 1995 for the baseline scenario. Additional flows to be generated from the proposed Plants were supplied by the plant operators based on the maximum permitted output of the plants. Flow on the Tsing Tsuen Road was referenced to the Annual Traffic Census.

Table 4-13 1994 Base Case Scenario

Roads	Light vehicles	Heavy vehicles	Total flow (veh/hr)
Tam Kon Shan Road	50 %	50 %	923
Tsing Tsuen Road	49 %	51 %	2,361

Table 4-14 1995 Scenario Without the Cement/Concrete Batching Plants

Roads	Light vehicles	Heavy vehicles	Total flow (veh/hr)
Tam Kon Shan Road	50 %	50 %	969
Tsing Tsuen Road	49 %	51 %	2,479

Table 4-15 1995 Cement Plants Traffic Generation (peak hour)

Plants	Heavy vehicles	Total flow (veh/hr)
HKC	100 %	20
SSF	100 %	27
QHC	100 %	91
PIC	100 %	65
Total		*203*

Appendix IIa

Government's Comments
for the
Key Issue Report

HK Cem
(214)

本署檔號
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134

By Fax & Normal Despatch
(Fax No.: 2507 2203)

16 May 1995

EHS Consultants Ltd.
22/F, Loyong Court Commercial Building
220 Lockhart Road
Hong Kong

18 MAY 1995

(Attn.: David Yeung)

Dear Mr. Yeung,

**EIA for Hong Kong Cement/Concrete
Batching Plant and Material Storage
Facilities at North-West Tsing Yi Island
Environmental Impact Assessment**

**Volume 3: Key Issue Report (Air Quality Impact Assessment)
(amended Mar., 95, Ref. R270/0495)**

We refer to the above amended report submitted in the letter quoted-above.

As there are still outstanding issues which have not been satisfactorily resolved, we are not in a position to endorse the Key Issue Report without our members's agreement. The attached is an advanced copy of members' comments for your early action.

Please note that we have not yet received all of the members' responses and we would let you know their comments, if any, as soon as they are available. Should you have any queries, please feel free to contact the undersigned.

Taking this opportunity, we wish to remind you that the operators of the above facilities should also obtain Specified Process licenses under the Air Pollution Control Ordinance.

Thank you for your attention.

Yours sincerely,

(Felix S. C. LEUNG)
Environmental Protection Officer
for Director of Environmental Protection

....\

(Advanced Copy)
EIA for Hong Kong Cement/Concrete
Batching Plant and Material Storage
Facilities at North-West Tsing Yi Island
Environmental Impact Assessment

Comment on
Volume 3: Key Issue Report (Air Quality Impact Assessment)
(amended Mar., 95, Ref. R270/0495)

Environmental Protection Department
(Technical Contact: Mr. K W Ng at 2594 6313)

We recommend that the transfer of sand and aggregates from barges to receiving hoppers to be placed at a suitable level " below ground" with enclosures and water sprinklers as proposed in the EIA. Would the Consultants please liaise with our Miss Y C Lee at 2417 6138 on the details of the receiving hoppers.

District Planning Officer/Tsuen Wan and Kwai Tsing
(Contact: Mr. Alex KIU at 2417 6257)

General

The Consultants have not addressed my repeated query as to whether users of the District Open Spaces should be regarded as ASRs.

Sect. 5.5. and Figure. 5-13

There is a discrepancy between the description of ASR D 11 and its location on the figure. The Consultants should clarify this.

Sect. 7

I am a little concern about the practicability of limiting the maximum production rate of the 2 concrete batching plants to 125 m^3. Who is going to enforce/monitor this any way ?

The following members have no adverse comments:

a. Chief Engineer/Mainland South, Drainage Services Department
b. Project Manager/New Territory West
c. District Officer/Kwai Tsing
d. Director of Fire Services

The following members have not yet responded

a. District land Officer/Kwai Tsing
b. Assistant Commissioner for Transport/New Territory
c. Director-General of Industry
d. Director of Marine

c.c.

DPO/TW & KT
DO/K&T
DFS
PM/NTW
CE/MS, DSD

Internal

S(AP)2 (Attn.: E(AP)3)
S(AM)1
S(UW)1

Appendix IIb

Consultants' Responses
to the
Government's Comments

EHS Consultants Limited
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FAX TRANSMISSION

FAX REF. : Fax-505/0595
DATE : June 29 1995
TO (COMPANY) : EPD (Air Policy Group)
ATTENTION : Mr. K W Ng
FAX NO. : 2827 8040
FROM : David Yeung
TOTAL NO. OF PAGE : 1
SUBJECT : EIA for Hong Kong Cement/Concrete Batching Plant and Material Storage Facilities at Tsing Yi Island, Vol 3 : KIR (Air Quality Impact Assessment)

MESSAGE

Dear Mr. Ng,

I refer to your comment, which has been passed on to us through Mr. Felix Leung of your Department and we would like to have the following response

At this early planning stage, there are some difficulties to determine the exactly design and level of the ground receiving hoppers for the two concrete batching plants. Since the ground receiving hoppers will be fairly close to the sea wall of the premises, the AP and RSE of the project advise that there may be some structural constraints for the lowest possible level that the receiving hoppers can be buried into the ground, without affecting the stability of the sea wall. In addition, the two concrete batching plants are preparing structural plans of the site for submission to Building Department, detailed design of the plants cannot be finalized without approval of the drawings from the Building Department.

In any case, we knowledge EPD has such recommendation for the level of the receiving hopper. In the later detail design stage, the plants operator will take the recommendation into consideration with the advice from the AP.

We hope this will solve your queries. Thank you very much for your attention and please feel free to contact the undersigned if you have any queries.

Yours sincerely,

ORIGINAL SIGNED

David Yeung
Senior Consultant

c.c Mr. Felix Leung - EPD
Mr. Vincent Chan - PIC
Mr. Edmond Pau - QIIC

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FAX TRANSMISSION

FAX REF. : Fax-474/0595 DATE : May 16, 1995

TO (COMPANY) : District Planning Office / Tsuen Wan and Kwai Tsing

ATTENTION : Mr. Alex Kiu FAX NO. : 2412 5435

FROM : David Yeung TOTAL NO. OF PAGE : 2

SUBJECT : EIA for Hong Kong Cement/Concrete Batching Plant and Material; Storage Facilities at North - West Tsing Yi Island Volume 3 Key Issue Report (Air Quality Impact Assessment) (amended March 1995)

MESSAGE

Dear Mr. Kiu

We refer to EPD's letter {(55) in EP1/N3/44 II dated 16th May 1995 } regarding your comment on the captioned. we have the following response:

- District open spaces are generally considered as ASRs. Therefore, we have included the site to the west of Ching Tai Court in our dust emission impact assessment (D5 of our report referred). And the assessment concluded that the site will not have any adverse impact which generated from the proposed cement works in TYTL 119.
- The description of ASR D11 should read "northern side of the proposed district hospital".
- As stated in the said EPD's letter, the operators of the cement works will require to apply for a Specified Process Licence to operate a cement works under the Air Pollution Control Ordinance. Upon approval of the application, the Authority (DEP) will issue the licence with a list of terms and conditions, and all these terms and conditions will have to be strictly followed by the plant operators. One of the terms will be the operational capacity of the plant (pls. see attached licence for information), In additional, the plant operator, as required by the licence, has to submit on a 3-monthly basis information related to its operation. All these conditions will carefully monitor the production rate of the cement works.

We hope this would clarify your queries. Thank you very much for your attention and please feel free to contact the undersigned if you have any queries.

Yours sincerely,

ORIGINAL SIGNED

David Yeung
Senior Consultant

c.c. Mr. Felix Leung - EPD (2591 0558) - w/e

PART B (Process Description):

Hereunder is the brief description of the process to be conducted in the premises mentioned in Part A of this licence. A more exact description of the process is contained in application of registration no. A0111 dated the 25th day of November 1994

1. Classification of specified process: Cement Works
2. ~~Installed~~/Processing* Capacity: 300,000 MT cement per year
3. Silo Capacity (for Cement Works only): 2,000 MT
4. Fuel Usage: Not applicable

Emission Point No.	Fuel to be Used				Consumption Rate	
	Type	Ash Content	Sulphur Content	Other Specifications	Maximum	Normal
Not Applicable						

5. Raw Materials and Products:

Type	Nature or General Composition	Raw Materials Usage			Product Production		
		Consumption Rate		Annual Use	Production Rate		Annual Production
		Normal	Maximum		Normal	Maximum	
Cement	CaO 62.1% SiO_2 21.3%	N.A.	N.A.	300,000 MT	N.A.	N.A.	300,000 MT of cement

6. Other Particulars:

* Delete if not applicable

Table 5-10 Cement Particulates Size Distribution

Dust Diameter (μm)	Frequency Distribution	Cumulative Frequency Distribution
1	0.0363	0.0363
2	0.0311	0.0674
4	0.0622	0.1296
5	0.0363	0.1659
8	0.0881	0.2540
10	0.0518	0.3058
12	0.0674	0.3732
14	0.0466	0.4198
16	0.0311	0.4509
18	0.0518	0.5027
20	0.0518	0.5545
22	0.0311	0.5856
24	0.0312	0.6168
26	0.0311	0.6479
28	0.0415	0.6894
30	0.0207	0.7101
40	0.0933	0.8034
45	0.0518	0.8552
50	0.1451	1.0003

5.5 Air Sensitive Receivers

Fourteen discrete Air Sensitive Receivers (ASRs) D1 to D16 (Figure 5-13), which located around the cement works were selected for the dust emission impact assessment. Dust concentration at each ASR is modelled from ground level up to a vertical height of 50m above ground with 5m interval so that the dispersion of dust concentration at these ASRs can be investigated. In addition, dust concentration at the site boundary of the premises (B1 to B3) were modelled with a similar specification described above. In order to have a better picture of the dust impact of the cement works, ground level dust concentration level within 300m radius from the plant in form of contour was plotted and superimposed onto survey map.

D1 - southern side of Tsing Yan Temporary Housing Area (residential area)
D2 - northern side of Tsing Yi Temporary Housing Area (residential area)
D3 - western side of Cheung On Estate (residential area)
D4 - school site at Cheung On Estate (community area)
D5 - western side of Ching Tai Court (community area)
D6 - northern side of Cheung Hang Estate (residential area)
D7 - western side of Tsing Yi Estate (residential area)
D8 - centre of Cheung Fat Estate (residential area)
D9 - centre of Cheung On Estate (residential estate)
D10 - school site at Lam Tin (community area)
D11 - northern side of the propose district hospital (community area)
D12 - proposed secondary school site (community area)
D13 - proposed secondary school site (community area)
D14 - residential development above the Tsing Yi Railway Station (residential area)
D15 - shipyard next door (open repair yard) (industrial area)
D16 - office building of the shipyard (industrial area)
B1 - eastern site boundary
B2 - southern site boundary
B3 - western site boundary

ENVIRONMENTAL IMPACT ASSESSMENT
Final Assessment report
(Volume 2 : Initial Assessment Report)
Hong Kong Cement/Concrete Batching Plant
and
Material Storage Facilities
at
North-West Tsing Yi Island

Reference : R468-3/0895
:

Prepared by : EHS Consultants Limited

Date : August 1995

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1. INTRODUCTION

1.1 Background

The existing cement and concrete batching plants next to Greenfield Garden will be relocated to North-West of Tsing Yi Island (Figure 1-1). The proposed site will have an area of about 9,000m^2 and will accommodate four factories namely: Hong Kong Cement Manufacturing Company Limited (HKC), Pioneer Concrete (HK) Limited (PIC), Quon Hing Concrete Company Limited (QHC), and Shun Shing Fat Limited (SSF). HKC and SSF are cement storage depot while PIC and QHC are the concrete batching plant. General layout of the site is indicated in Figure 1-2. In order to demonstrate that the proposed plants will not generate any adverse environmental impacts upon any sensitive receivers on the surrounding areas during the construction and operation of the plants, an Environmental Impact Assessment (EIA) was conducted. EHS Consultants Limited (EHS) was appointed by the above plant takers to conduct the EIA in relation to the said development. Information regarding the plants was provided by each individual plant.

1.2 Scope And Objectives Of the EIA

The main objective of the study is to provide information on the nature and extent of the environmental impacts associated with the proposed cement and concrete batching plants. The objectives of the assessment draw directly from the Study Brief for the EIA prepared by the Environmental Protection Department (EPD) and they are as follows :

i) to describe the proposed project and associated works together with the requirements for carrying out the proposed project;

ii) to identify and describe the elements of the community and environment likely to be affected by the proposed project, and/or likely to cause adverse impacts upon the proposed project, including both the natural and man-made environment;

iii) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

iv) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction, operation of the project;

v) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and cumulative effects expected to arise during the construction and operation phases of the project in relation to the sensitive receivers and potential affected uses;

vi) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the project which are necessary to mitigate these impacts and reduce them to acceptable levels;

vii) to design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted;

viii) to investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;

ix) to identify constraints associated with the mitigation measures recommended in the study; and

x) to identify any additional studies necessary to fulfill the objectives to the requirements of this Environmental Impact Assessment Study.

In order to satisfy the objectives listed in section 1.2 above, the scope of work for this study will be as follows:

i) carrying out the necessary background studies to identify, collect and analyze existing information relevant to the EIA study;

ii) carrying out any necessary environmental survey, site investigations and baseline monitoring work to achieve the objectives;

iii) quantifying, by use of models or other predictive methods, the residual and cumulative environmental impacts (specifying whether these are transient, long term and/or irreversible) arising from the construction and operation of the project;

iv) proposing practicable, effective and enforceable methods, measures and standards to effectively mitigate any significant environmental impacts in the short and long term; and

v) outlining a programme by which the environmental impacts of the project can be assessed, monitored and audited.

In further defining the scope of the EIA Study, consideration should be given to beneficial and adverse effects, short and long term effects, secondary and induced effects, cumulative effects, synergistic effects and transboundary effects.

1.3 Project Co-Ordination And Programme

Frequent meetings have been held with different sections of the Environmental Protection Department to discuss various aspects of the study during the construction and operational phase of the plants. This includes modification of assessment criteria, revision of modelling methodologies, identification of key issues and answers to comments.

Discussions with the plants personnel and project Architect have been held throughout the duration of the study to obtain information on the best practical means of mitigation measures for different stages of the project. This will enable the highest possible mitigation measures to be implemented at the proposed plants.

1.4 Structure Of The EIA

This Environmental Impact Assessment will include the following reports:

i) *An Inception Report*

This report will indicate the approach and methodology for various parts of the EIA, defining the work programmes and detailing the submission of reports.

ii) *An Initial Assessment Report*

This report provide an initial assessment of the environmental impacts and cumulative effects arising from the proposed plants. Identify key issues which will be addressed in details in the Key Issues Report.

iii) *A Key Issue Report*

The Key Issue Report give an in-depth assessment of the key issue identified in the Initial Assessment Report. The Key Issue Report will cover the air quality impact during construction and operational phase of the plants.

iv) *Final Assessment Report*

The report will summarise all the findings and conclusions from the Initial Assessment Report and the Key Issues Reports. Any mitigation measures recommended will also be described.

v) *An Executive Summary*

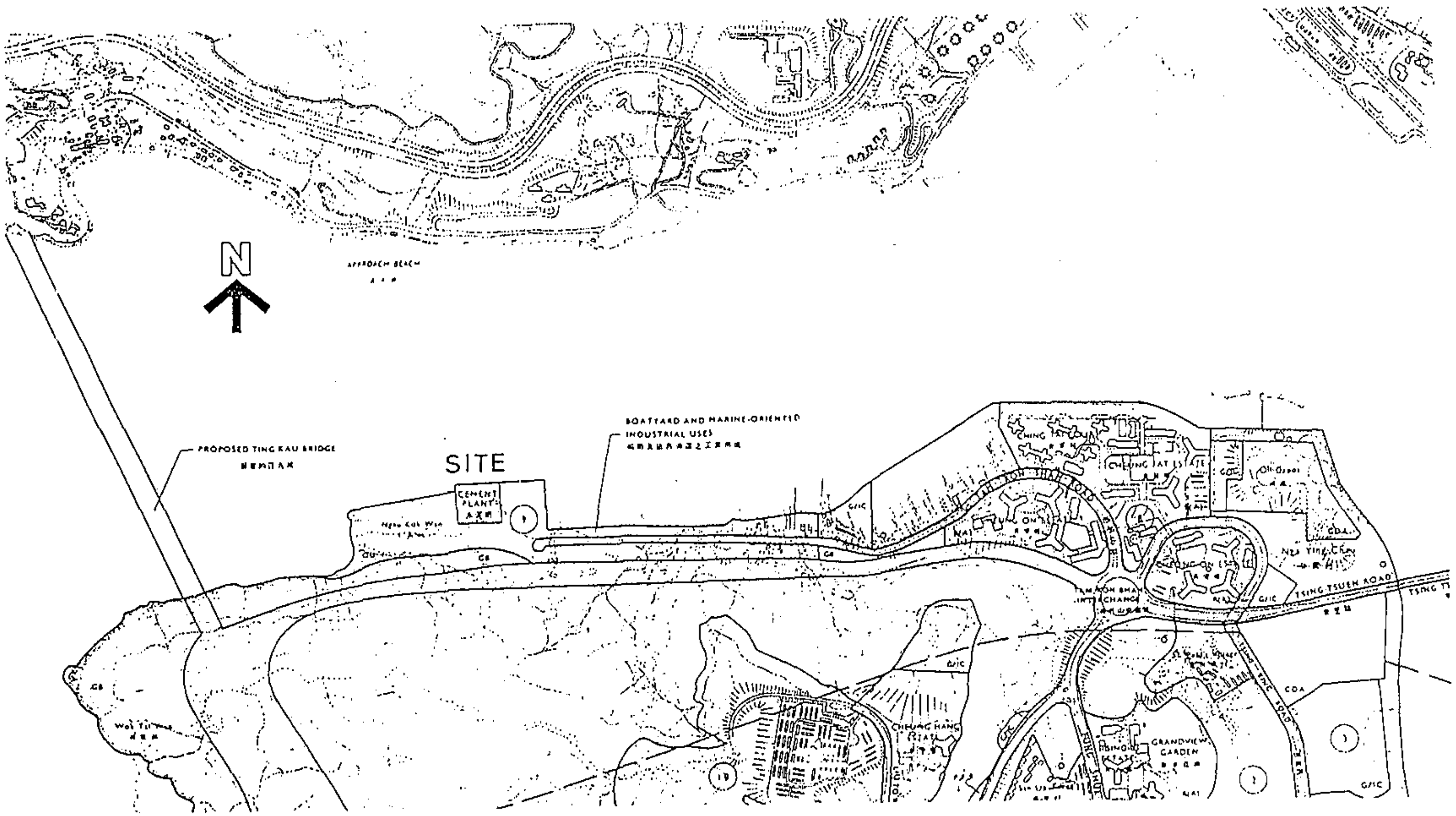
An English and Chinese version of the executive summary highlighting the issues of concern to the community will be provided.

vi) *An Environmental Monitoring and Audit Programme*

This report summarises the environmental monitoring requirements and the recommended mitigation measures for operational phase of the plants.

Figure : 1-1

Scale :



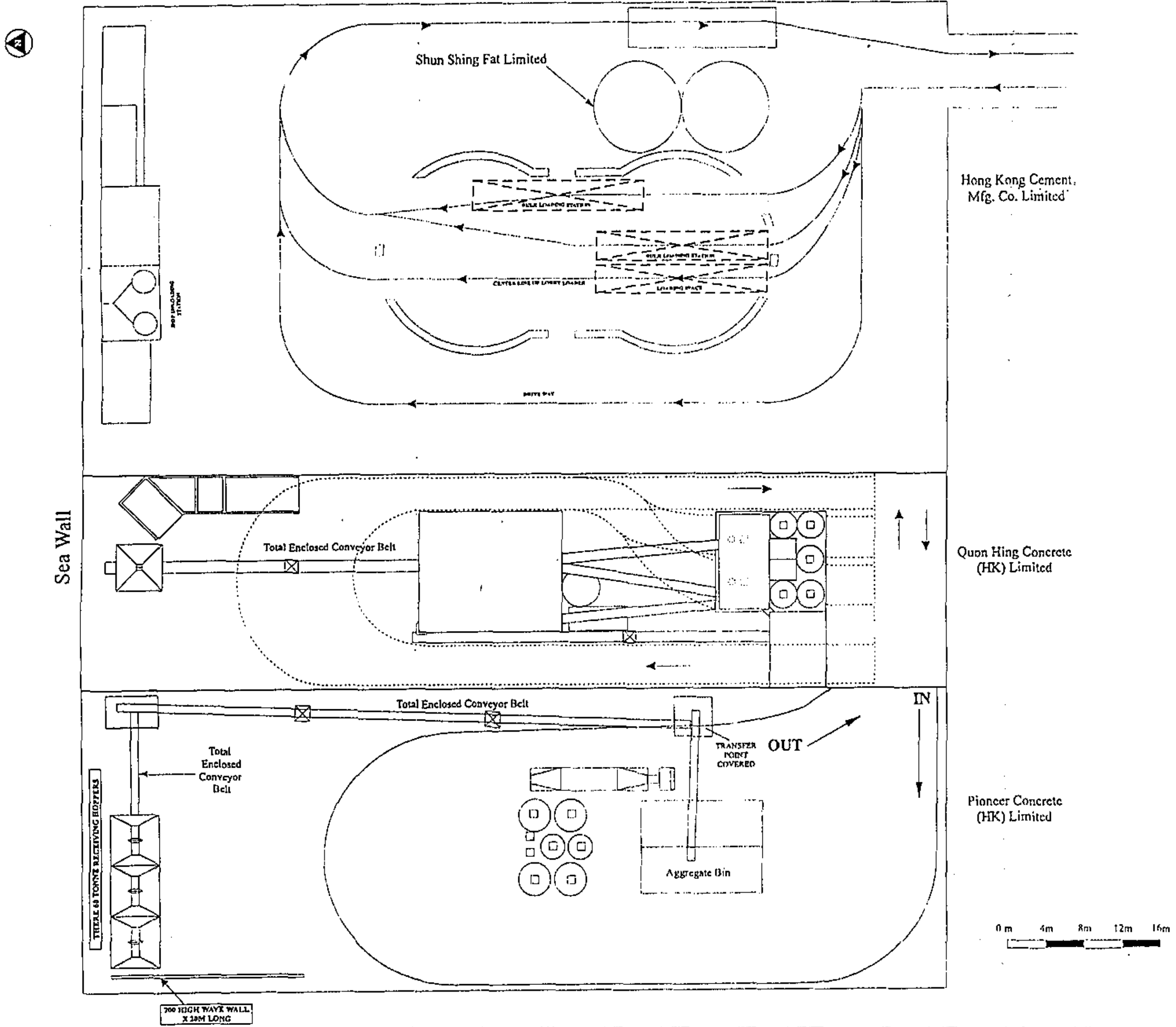
TITLE : **Location of the Proposed Cement and Concrete Batching Plants**

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

EHS Consultants Limited

Figure : 1-2

Scale :



TITLE : General Layout of the Site

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

EHS Consultants Limited

2. PROJECT DESCRIPTION

In order to provide a better understanding of the cumulative environmental impacts arising from the proposed cement and concrete batching plants at the north-west of Tsing Yi Island, site surveys have been conducted together with review of Government survey maps, Planning Department Outline Zoning Plans and existing Environmental Impact Assessment for the area. Three main areas have been identified as show in Figure 2-1, which will be affected by the proposed plants were briefly described in the following sections.

2.1 Existing Environment

2.1.1 Tsing Yi Island

Tsing Yi Island comprises residential areas and industrial areas along the coastal margin of the island. Residential areas are mainly concentrated on the North-East and East side of the Island where two bridges namely, Tsing Yi North Bridge and Tsing Yi South Bridge, are connecting Tsuen Wan Area and Kwai Chung Area respectively. Residential areas consist of private and public housing estates. Industrial developments on the Island include dangerous goods depots, chemical treatment plant, electricity power stations and numerous boatyards and marine-oriented industries located at the northern side. A planned container terminal is to be located at the south-east side of the Island.

The existing cement depots and concrete batching plant are located right next to a residential development named Greenfield Garden as in Figure 2-2. After relocation, the cement and concrete batching plants will be at least 1000m away from the residential areas. The closest sensitive receivers are Tsing Yan Temporary Hosing Area, Cheung On Estate, Ching Tai Court and Cheung Fat Estate.

Along the Tam Kon Shan Road, where the proposed plants will be located, there are numerous operating shipyards with the biggest being located right next to the proposed plants.

2.1.2 Ma Wan Channel and Northern Rambler Channel

Ma Wan Channel and Northern Rambler Channel which are to the north east of the proposed new plants, carry significant amount of marine traffic for ocean going vessels to and fro the Pearl Delta. In addition to ocean going vessels, there are large amount of small vessels and ferries passing through the water. Most of the heavy marine traffic will use the shipping channel between the Tsing Yi and Ma Wan Island but will not affect the northern Rambler Channel unless in cases of emergency of typhoons. A Dangerous Goods Anchorage is presently situated in Rambler Channel south of Tsuen Wan.

2.1.3 Ting Kau and Tsuen Wan

Ting Kau and Tsuen Wan are situated opposite to the proposed site of the plants across the Ma Wan Channel. Both areas have dense residential areas along the Tuen Mun Road and Castle Peak Road. From different residential areas, there are footpaths leading down to the gazetted beaches along the coast. With the channel separating the plants and these residential and recreational areas, the impact of each other is minimal.

2.2 Future Infrastructure In The Area

To the west of the cement plant site, on-going construction works are being undertaken to prepare a platform for the North West Tsing Yi Interchange of the Route 3. Large-scale bulk excavation and removal of rocks and soft materials from North West Tsing Yi are being transported by lorry via unpaved haul roads to an existing barge loading point at Ngau Kok Wan.

Associated with the new airport on Lantau Island, there are a number of strategic transport links which will be completed by 1996/7 on the Island (Figure 2-3). These include:

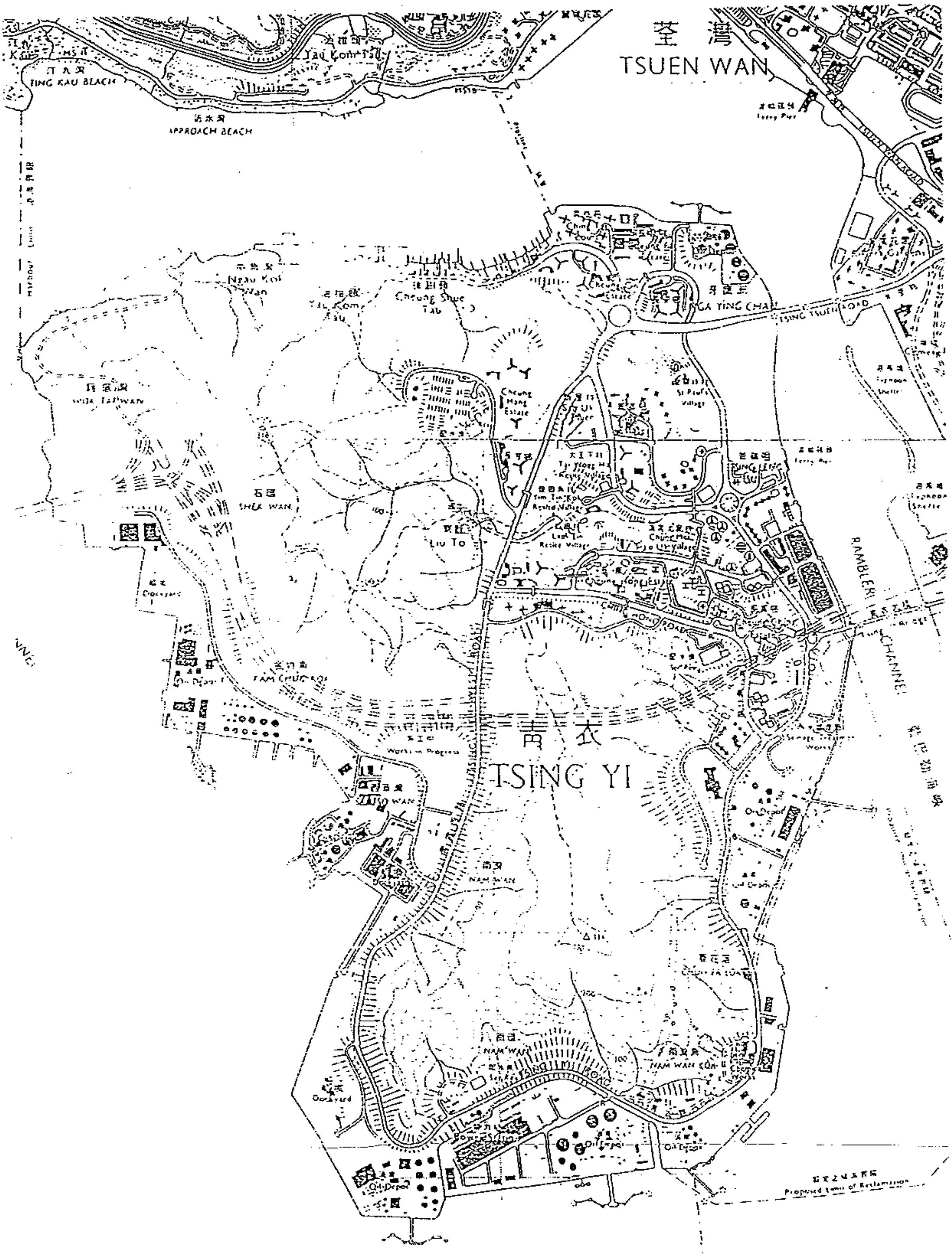
- Route 3
- Lantau Fixed Crossing (Tsing Ma Bridge)
- Duplication of the Tsing Yi South Bridge
- Tsing Yi Road West Improvement
- Airport Rail Link

2.3 Proposed Cement And Concrete Batching Plants

There will be two cement depots and two concrete batching plants located at the proposed site. They are Hong Kong Cement Manufacturing Company Limited (HKC), Pioneer Concrete (HK) Limited (PIC), Quon Hing Concrete Company Limited (QHC), and Shun Shing Fat Limited (SSF). Table 2-1 listed the characteristics of each plant.

Table 2-1 Characteristics of the Cement Depot and Concrete Batching Plant

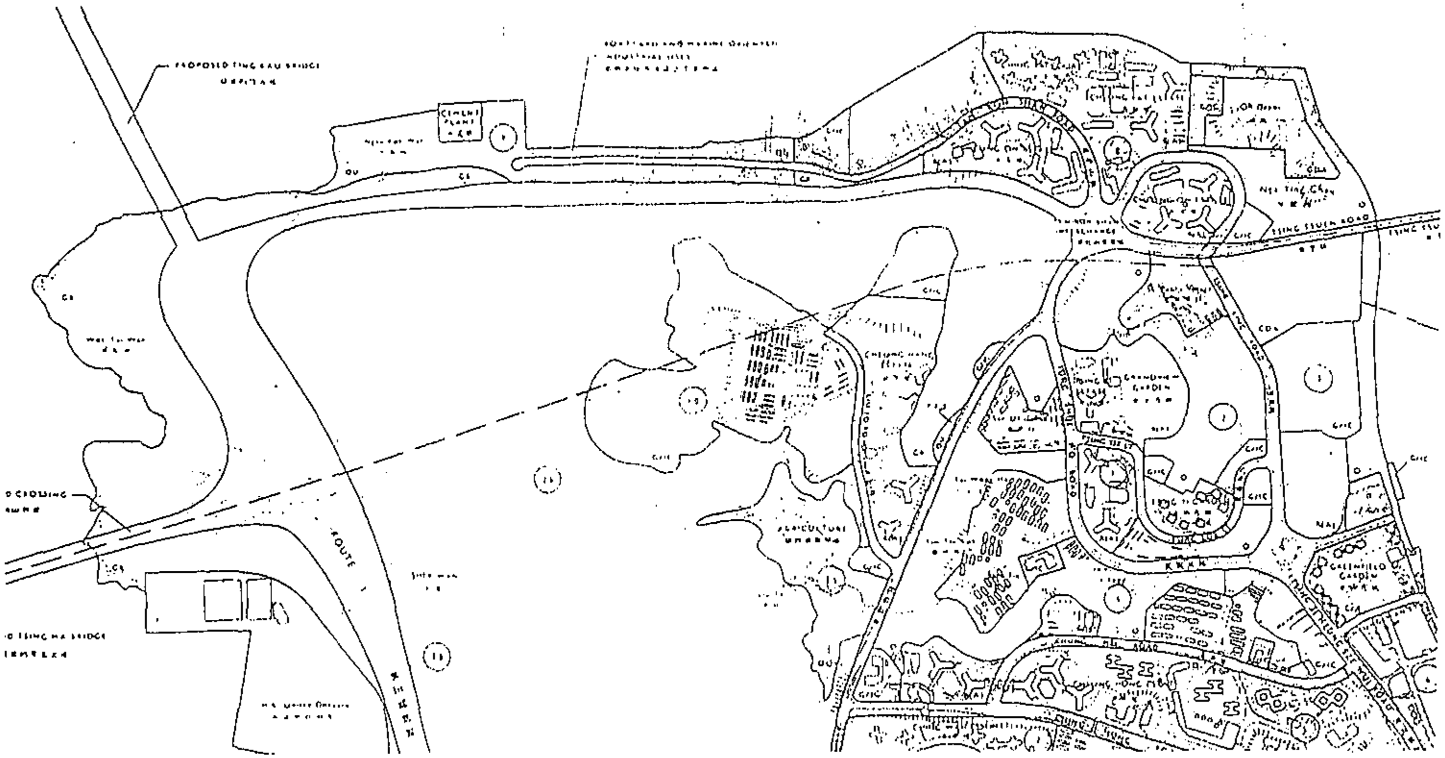
Characteristics	**HKC**	**PIC**	**QHC**	**SSF**
Nature of Business	Cement storage, package and distribution	concrete batching	concrete batching	Cement storage and distribution
Installed Production Rate	50,000MT/month	200m^3/hr	200m^3 /hr	1300MT/month
Cement Silo Capacity	2*10000MT	500MT	500MT	2*1000MT
Workers on Site	15	40	30	20
Operation Hours	24hours/day & 7days/week	7:30 to 20:30 & 7days/week	8:00 to 20:00 & days/week	8:00 to 19:00 & days/week



TITLE :	Environment of the Proposed Cement and Concret Batching Plants		EHS Consultants Limited
PROJECT :	Cement and Concrete Batching Plants at Tsing Yi		
Figure :	2-1	Scale :	

Figure : 2-2

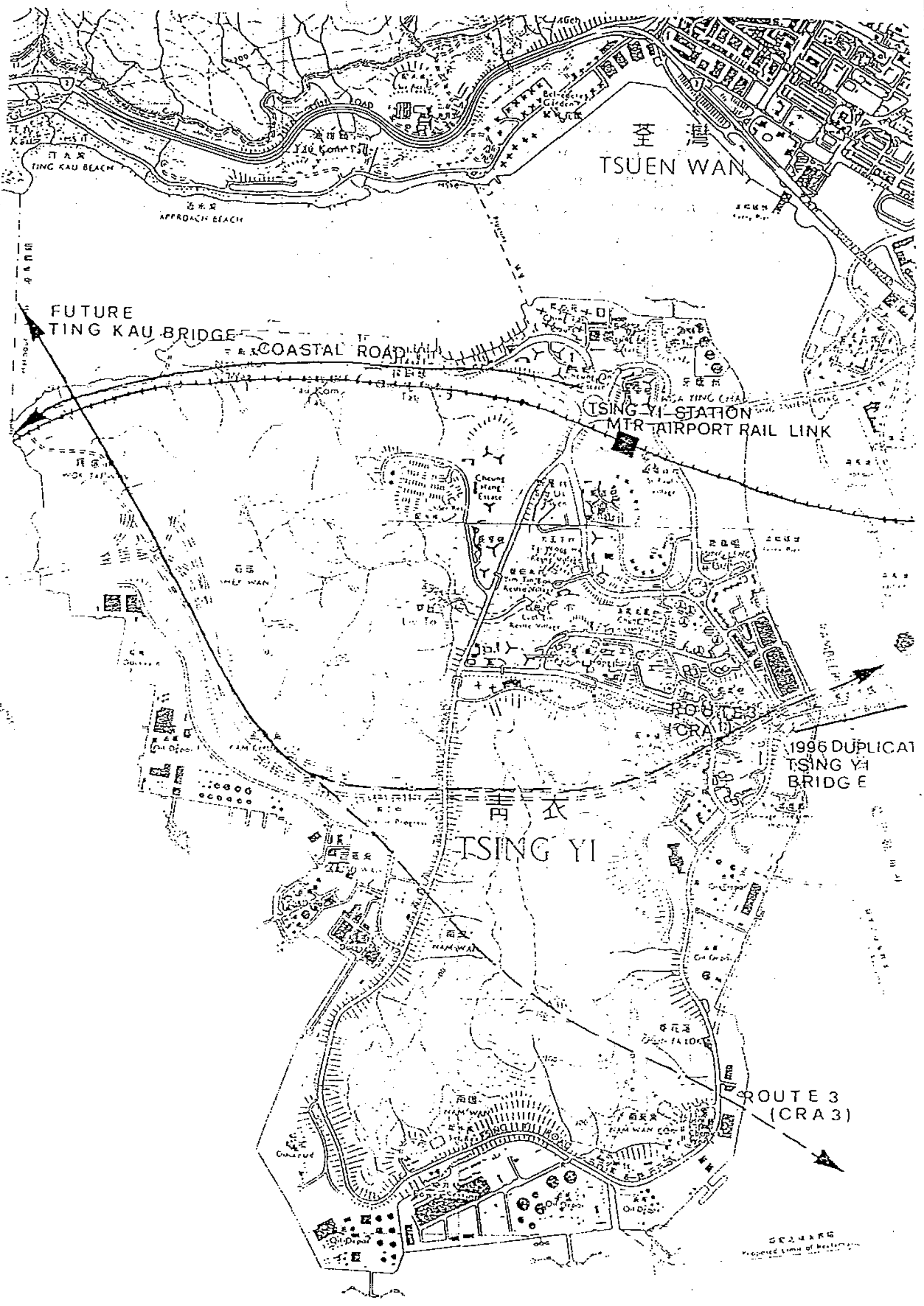
Scale :



TITLE : Location of the Plants at Tsing Yi and its Surroundings

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

EHS Consultants Limited



TITLE : Future Transport Infrastructure on Tsing Yi Island

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

Figure : 2-3 Scale :

EHS Consultants Limited

3. AIR QUALITY IMPACT

3.1 Objectives

Air quality impacts during the construction and operational phase of the cement and concrete batching plants will be one of the key issues to be addressed in this EIA report. Details of the assessment including air quality modelling will be addressed in a separate report namely: *Environmental Impact Assessment - Volume 3 : Key Issue Report (Air Quality Impact Assessment).* The aim of this section is to identify the air quality impacts raised from the proposed plants during construction and operational phase. Appropriate and best practicable means for mitigation will be proposed in accordance with the results obtained in the Key Issue Report.

3.2 Assessment Criteria

Assessment Criteria are based on the Air Quality Objectives (AQOs) for criteria pollutants presented in Chapter 9, "Environment", of the Hong Kong Planning Standards and Guidelines (HKPSG) for air pollution control. The standards used throughout the assessment are given in Table 3-1.

Table 3-1 Hong Kong Air Quality Objectives

Averaging Time	**Pollutant Concentration Level (µg/m^3)**				
	Sulphur Dioxide	**Nitrogen Dioxide**	**Carbon Monoxide**	**Total Suspended Particulate**	**Respirable Suspended Particulate**
1 Hour^1	800	300	30,000	N.A.	N.A.
24 Hours^2	350	150	10,000	260	180
1 Year^3	80	80	N.A.	80	55
Emission Level*		-	-	50mg/m^3	-

(1) Not to be exceeded more than three times per year.

(2) Not to be exceeded more than once per year.

(3) Arithmetic means.

N.A. Not Available

* Best practicable Means requirement

3.3 Construction Phase Impact

On the air quality aspect, the major pollutant would be dust particulate from the construction works. The only air pollutant concerned under this section is Total Suspended Particulate and Respirable Suspended Particulate which becomes air-borne by wind during the construction activities of the proposed plants. Other pollutants such as carbon monoxide, carbon dioxide, nitrogen dioxide and sulphur dioxide generated by powered mechanical equipment fuelled by diesel and vehicle exhaust on site are not taken into consideration since only minute quantities will be produced and their impacts upon nearby sensitive receivers are unlikely to be significant. Dust emission is most likely to arise from the following construction activities:-

- site investigation;
- earth moving and grading;
- transport of material on site;
- site formation and preparation;
- wind effect on material stockpiles;
- vehicle movements on unpaved roads and over construction site;
- loading and unloading of construction materials and excavated debris.

Parameters required for the construction dust assessment including site area, nature of construction activities, quantities of stockpiled materials, particle size multiplier, material silt content, particle size of different soil types, mean wind speed, material drop height, material moisture content, dumping device capacity, mean number of wheels of the vehicles, rainfall data, work methods and sequence of different types of work areas. At the moment, the site for the proposed cement and concrete batching plants has been completely formed, the outstanding constructed works to be completed are erection of cement silos, factory buildings and assemble of mechanises. Most of these construction works only comprise steelworks and no dust generating sources are involved. Therefore, at this stage the site will not have any adverse impacts upon any nearby sensitive receivers.

3.4 Operational Phase Impact

During operational phase of the four plants, fugitive dust emission from various processing procedures is expected. However, the site is located over 1,000m away and at the downwind direction with respect to the public housing developments, e.g. Cheung On Estate, Ching Tai Court and Cheung Fat Estate, the dust impacts should not be significant. Moreover, the operation of the new plants will be subject to stringent environmental control imposed by specified process licensing conditions and with the incorporation of the best practicable means of dust mitigation measures, good site management and effective operational procedures, the impact for fugitive dust can be reduced down to acceptable level. The emission of the dust will be kept at a minimum level and most of them will be suppressed on site at short distance of the sources. Only minute percentage will be carried out of the site boundary. The provision of effective dust mitigation measures can markedly reduce the potential of adverse impacts on the surrounding areas, improve occupational health of the site workforce as well as achieving the AQO at sensitive receivers.

In addition to fixed emission sources, mobile source emissions impact including the cement trucks and cement barges have also been assessed. All these issues will be as assessed in the Key Issue Report (Air Quality Impact Assessment).

3.5 The Best Practicable Means Of Dust Mitigation Measures

This section describes briefly the dust mitigation measures to be incorporated into each individual process by the plants operators. As a general rule, loading, unloading, handling and storage of raw materials, products, wastes or by-product shall be carried out in a manner acceptable to the Government and avoid creating any dust nuisance to the public. Dust mitigation measures for the plants will be designed specially for suppressing each emission source.

3.5.1 Cement and Other Dusty Materials

- The loading, unloading, handling, transfer or storage of cement, and/or other equally dusty materials shall be carried in a totally enclosed system acceptable to the EPD. All dust-laden air or waste gas generated by the process operations should be properly extracted and vented to fabric filtering system to meet the emission limits stipulated in section 3.2.
- Cement and/or other equally dusty materials shall be stored in storage silo fitted with audible high level alarms to warn of over-filling. The high-level alarm indicators shall be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed.
- Vents of all silos shall be fitted with fabric filtering system to meet the emission limits stipulated in section 3.2.
- Vents of cement weighing scale shall be fitted with fabric filtering system to meet the emission limits stipulated in section 3.2.
- Seating of pressure relief valves of all silos shall be checked, and the valves can be reseated if necessary, before each delivery.

3.5.2 Other Raw Materials

- The loading, unloading, handling, transfer or storage of other raw materials which may generate airborne dust emissions such as crushed rock, sand and stone aggregate shall be carried out in such a manner to prevent or minimise dust emissions.
- The materials mentioned above shall be adequately wetted prior to and during the loading, unloading and handling operations. Manual or automatic water spraying system shall be provided at all unloading areas, stock piles and material discharge points.
- All receiving hoppers for material unloading operations mentioned above shall be enclosed on three sides up to 3 metres above the unloading point. In no case shall these hoppers be used as the material storage devices.
- The belt conveyor for material handling operations mentioned above shall be enclosed on top and 2 sides with a metal board at the bottom to eliminate any dust emission due to wind-whipping effect. Other type of enclosure will also be accepted by the Government if it can be demonstrated that the proposed enclosure can achieve a same performance.
- All conveyor transfer points shall be totally enclosed. Openings for the passage of conveyors shall be fitted with adequate flexible seals.
- Scrapers shall be provided at the turning points of all conveyors to remove dust adhered to the belt surface.
- Conveyors discharged to stockpiles of materials mentioned above shall be arranged to minimise free fall as far as practicable. All free falling transfer points from conveyors to stockpiles shall be enclosed with chute(s) and water sprayed.

- Aggregates with a nominal size less than or equal to 5 millimeters should be stored in totally enclosed structure such as storage bin and should not be handled in open area. Where there is sufficient buffer area surrounding the concrete batching plant, ground stockpiling may be used.
- The stockpile shall be enclosed at least on top and 3 sides and with flexible curtain to cover the entrance side.
- Aggregates with a nominal size greater than 5 millimeters should preferably be stored in totally enclosed structure. If open stockpiling is used, the stockpile shall be enclosed on 3 sides with the enclosure wall sufficiently higher than the top of the stockpile to prevent wind whipping.
- The opening between the storage bin and weighing scale of the materials mentioned above shall be fully enclosed.

3.5.3 Loading of Materials for Concrete Batching

- Concrete truck shall be loaded in such a way as to minimise airborne dust emissions. Without prejudice to the generality of this requirement, the following control measures shall be implemented
    i. Pre-mixing the materials in a totally enclosed concrete mixer before loading the materials into the concrete truck is recommended. All dust-laden air generated by the pre-mixing process as well as the loading process shall be totally vented to fabric filtering system to meet the emission limits stipulated in section 3.2.

    ii. If truck mixing batching or other types of batching method is used, effective dust control measures acceptable to the Government shall be adopted. The dust control measures must have been demonstrated to the Authority that they are capable to collect and vent all dust-laden air generated by the material loading/mixing to dust arrestment plant to meet the emission limit stipulated in section 3.2.

- The loading bay shall be totally enclosed during the loading process.

3.5.4 Vehicles

- All practicable measures shall be taken to prevent or minimise the dust emission caused by vehicle movement.
- All access and route roads within the premises shall be paved and adequately wetted.
- Vehicle cleaning facilities shall be provided and used by all vehicles after loading and other vehicles leaving the premises to wash off any dust and/or mud deposited on the wheels and/or vehicle body.

3.5.5 Housekeeping

- A high standard of housekeeping shall be maintained. All spillage or deposits of materials on ground, support structures or roofs shall be cleaned up promptly by a cleaning method acceptable to the Authority. Any dumping of materials at open area shall be prohibited

3.5.6 Dust Mitigation Equipment

The dust mitigation equipment for air quality control to be used in the plants can be divided into the following types:

- suppression at individual electronic dust collector with polyester filter cloth of 99% designed efficiency for dust emission points;
- total enclosure of material transport conveyors of about 99.9% dust suppression efficiency for line emission sources;
- water spray and with(out) enclosure for material handling equipment of about 90% dust control efficiency for volume emission points;
- water sprinklers for open area, route roads within the premises with about 85% dust control efficiency.

3.6 Monitoring Requirements

In order to review the effectiveness of the on site dust control equipment a series of dust monitoring station will be set up at appropriate locations. Monitoring locations will be included at site boundary and/or any nearby air sensitive receivers. The exact monitoring location(s) will be determined upon the completion of the *EIA Volume 3 : Key Issue Report (Air Quality Impact Assessment*) and will be operated under the licensing conditions. Relevant parameters related to the operation process (total raw materials input, raw material storage, product rate, malfunctioning and breakdown of air pollution control equipment) will be reported to the Government on a regular interval if requested by the Authority. The format of the information will be agreed with the Government prior to the commissioning of the plants. Details of the monitoring programme will be addressed in the Environmental Monitoring and Audit Manual.

4. NOISE IMPACT

4.1 Introduction

The relocation of the existing cement/concrete plants near the Greenfield Garden to the northwestern coast of the Tsing Yi Island at TYTL 119 warrants an environmental impact assessment to study the acceptability of possible impacts upon sensitive receivers in the surroundings. One of the issues relates to the noise impact during the construction and operational phase of the plant. Besides, the traffic noise due to increased concrete trucks on the Tam Kon Shan Road and the Tsing Tsuen Road will be assessed.

The noise assessment presented in this section identified the principal noise sources, predicted the likely impact and checked with the relevant noise standards. Mitigation measures were recommended to reduce the noise generated so as to provide an acceptable environment for existing and future developments in the surroundings.

4.2 Scope Of Work And Objectives

The scope of work and objectives of the noise assessment are as follows : -

- address of the background information and the existing noise levels;
- identification of noise sensitive receivers and/or potentially affected uses;
- provision of emission inventory of noise generating processes;
- analysis of construction and operational activities;
- presentation of predicted future noise levels; and
- evaluation of impact and proposal for noise control and/or noise mitigation measures should the impact exceed the relevant standard.

4.3 The Proposed Plant And The Environs

As described in the previous sections, the proposed cement and concrete batching plant will be situated near Ngau Kok Wan which is more than 1000m from the nearest temporary residential area at the Tsing Yan Temporary Housing Area(THA) and 1.2 km from the Cheung On Estate. The site was formed from cutting slopes and is topographically shielded to the south and west. Further east along the coast are numerous shipyards and jetties which dominate the existing noise environment by various activities such as metalwork, marine engine testing etc.

Existing and potentially affected noise sensitive uses are identified in the northeastern part of the Island where the Cheung On Estate and the Ching Tai Court are. The Tsing Yan THA to the south of the shipyards is nearer to the Plant but is topographically shielded by slopes around. However, the Cheung Hang Estate will be expected to have direct view of the Plant due to higher building height.

In the selection of noise sensitive receivers for construction and operational noise assessments, those having direct view of the Plant were picked. Other factors such as the distance from the Plant and the sensitivity of the uses were also considered.

4.4 Construction Phase Noise Impact

4.4.1 Introduction

This section identifies and assesses the potential impact of construction noise arising from the proposed cement/concrete batching plant on noise sensitive receivers (NSRs) in the vicinity. It also gives recommendations on how such impacts could be reduced to a practicable minimum.

4.4.2 Methodology

The technical memoranda issued pursuant to the Noise Control Ordinance viz., the "Technical Memorandum on Noise From Construction Works Other Than Percussive Piling and Technical Memorandum on Noise From Percussive Piling", laid down detailed procedures for predicting noise levels at NSRs with particular emphasis on work within restricted hours for regulatory purposes.

The methodology outlined were used as the basis for predicting noise levels from construction activities at the proposed new plant. The procedures used in this assessment are summarized as follows:-

(a) Based on the assumption of a construction program, various items of Powered Mechanical Equipment (PME) to be used and their numbers for each of the construction activities are identified;

(b) Each items of PME is assigned a Sound Power Level (SWL) based on values given in the TMs;

(c) Predicted Noise Level (PNL) for all the activities are calculated at the NSR assuming 100% on time of the PME; and

(d) Noise levels at each NSR are then corrected for distance attenuation, shielding and the effect of reflection to give a Corrected Noise Level (CNL) at the NSR.

Steps (a) to (d) should give the worst case scenario for noise levels at the NSRs. It should be noted the assumption of 100% on time of the PME is a conservative approach and should represent the worst gross impact.

4.4.3 Noise Sensitive Receivers

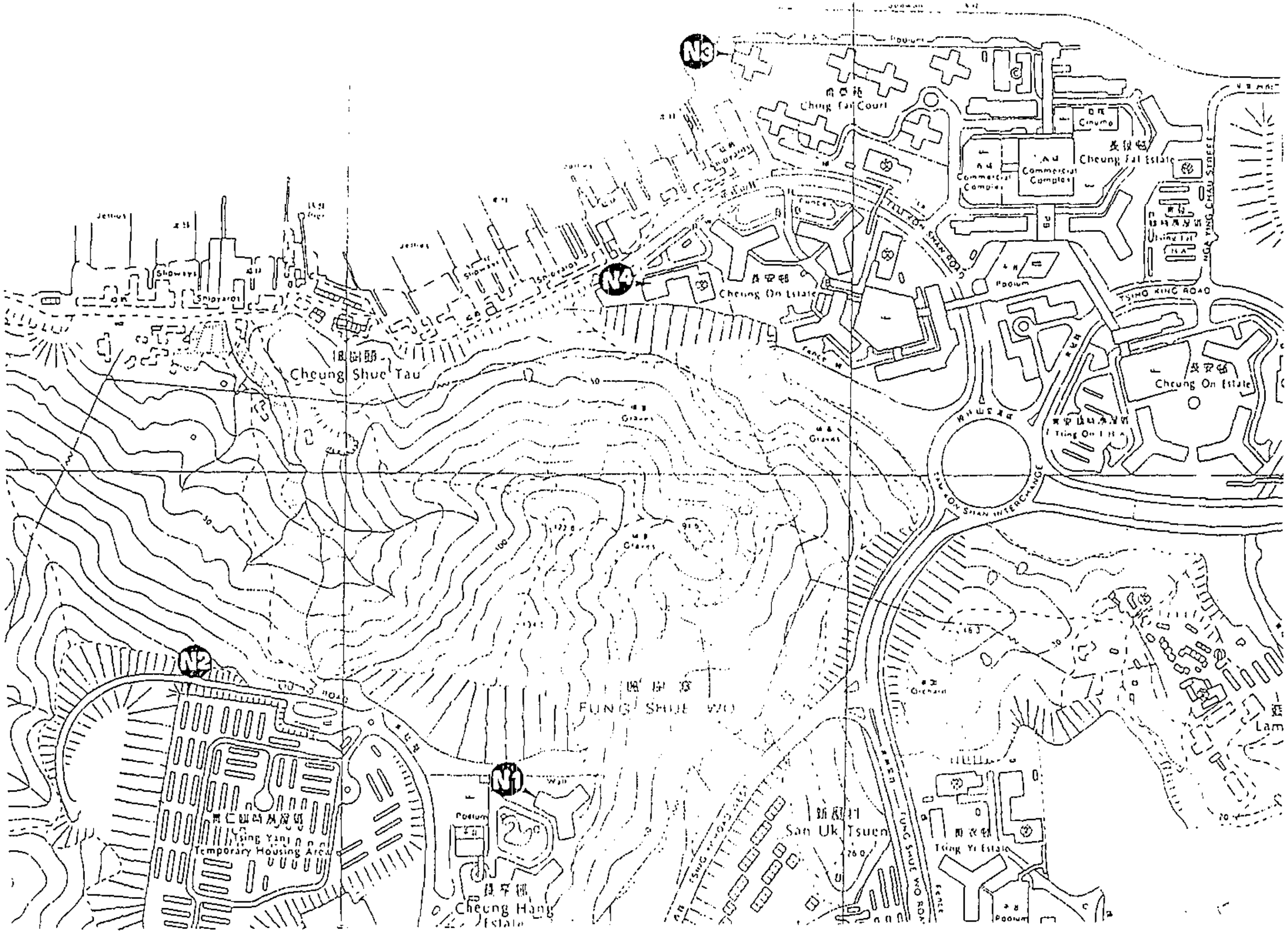
The construction site is remote from residential areas at the northeastern part of the Tsing YI Island. The closest would be the Tsing Yan Temporary Housing Area, the Ching Tai Court and the Cheung On Estate. All of the NSRs will have direct view of the proposed new plant except the THA and are therefore chosen for the assessment. Table 4-1 lists out the approximate distance from the centroid of the Plant to the various NSRs identified below. Location of such NSRs are shown in Figure 4-3.

Table 4-1 Distance of NSRs from Centroid of the Construction Site.

Noise Sensitive Receivers	Horizontal Distance (m)
N1 Cheung Hang Estate	1,175
N2 Tsing Yan THA	820
N3 Ching Tai Court	1,225
N4 Cheung On Estate (secondary school)	1,125

Figure : 4-1

Scale :



TITLE : Location of NSRs for Construction Noise Impact Assessment

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

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4.4.4 The Criteria

Construction noise is controlled under the Noise Control Ordinance (NCO). Under the Ordinance, it is an offence in law to undertake work using powered mechanical equipment (PME) during restricted hours which includes the hours of 7 p.m. to 7 a.m. on normal weekdays and any time on a public holiday (including Sundays) without any Construction Noise Permit (CNP) from the Authority. The criteria and procedures for issuing such permits are specified in the "Technical Memorandum on Noise From Construction Works Other than Percussive Piling".

Noise criteria during the restricted hours (19:00-23:00) for construction activities not involving percussive piling will be the ANL. In determining the ANL for that area, Area Sensitivity Rating (ASR) of B mentioned in the said TM is chosen in view of the urban nature of the area where the NSRs are situated. The ANL thus selected is 65dB(A).

Since no percussive piling will be needed, the noise standard (the ANL) will be governed by construction noise involving PME only. There is however no statutory control of construction noise outside the restricted hours, the general guideline of 75 dB(A) which is in line with most infrastructure developments in the Territory is adopted.

To summarize, the ANL [$L_{A,eq}$ (5 min)] for activities not involving percussive piling is : -

during 19:00-23:00 each day, Sundays and Public Holidays	=	65 dB(A)
during the night-time (2300 to 0700 hours)	=	50 dB(A)
outside restricted hours	=	75 dB(A)

In general, noisy construction activities such as concrete pouring will only be carried out in the non-restricted hours. For the hours 19:00-23:00, it will only restrict to less noisy activities such as bar cutting, bending, welding and other steel structure assembly work etc. There will be no construction works during the night-time (2300 to 0700 hours) and hence the impact will not be evaluated.

4.4.5 Potential Sources of Impact

It is expected that major construction activities can be divided into 3 phases as follows : -

Phase I	site formation and building of sea wall	(completed)
Phase II	foundation works	(to be completed before end of 94)
Phase III	building work, steelworks	(to be completed before June 95)

As the first phase has been completed at the time of writing, the construction noise impact for this phase will not be addressed in this study.

The second phase will involve foundation works for the concrete silos, pump house, workshop and laboratories etc. for HK Cement. A concrete platform will be made afterwards to cover the whole site and ready for the construction of buildings and steel superstructure in the third phase. It is expected that the erection and welding of steel structure will not be noisy as the steel beams will be pre-fabricated elsewhere for assembly on-site.

As the actual types and number of PME to be used are not certain at this stage, typical items are assumed for each phases. Reference was made to the TM for the sound power level (SWL) for each assumed PME and tabulated in Table 4-2. It should be noted that the assessment is conservative as it is unlikely that all the equipment will be used at the same time.

Table 4-2 Typical PME to be used in various construction phase

<table>
<tr><th colspan="4">Phase II Foundation Works</th></tr>
<tr><th>I.D. Code</th><th>PME used</th><th>SWL, dB(A)</th><th>Nos. to be used</th></tr>
<tr><td>CNP 021</td><td>Bar Benders</td><td>90</td><td>1</td></tr>
<tr><td>CNP 044</td><td>Concrete Lorry Mixer</td><td>109</td><td>2</td></tr>
<tr><td>CNP 047</td><td>Concrete Pump</td><td>109</td><td>1</td></tr>
<tr><td>CNP 081</td><td>Excavator</td><td>112</td><td>1</td></tr>
<tr><td>CNP 141</td><td>Lorry</td><td>112</td><td>2</td></tr>
<tr><td>CNP 170</td><td>Poker</td><td>113</td><td>2</td></tr>
<tr><td>CNP 201</td><td>Saw</td><td>108</td><td>1</td></tr>
<tr><td>CNP 281</td><td>Water Pumps</td><td>88</td><td>2</td></tr>
<tr><td colspan="4"></td></tr>
<tr><th colspan="4">Phase III Building & Steel Works</th></tr>
<tr><th>I.D. Code</th><th>PME used</th><th>SWL, dB(A)</th><th>Nos. to be used</th></tr>
<tr><td>CNP 021</td><td>Bar Benders</td><td>90</td><td>2</td></tr>
<tr><td>CNP 044</td><td>Concrete Lorry Mixer</td><td>109</td><td>2</td></tr>
<tr><td>CNP 047</td><td>Concrete Pump</td><td>109</td><td>1</td></tr>
<tr><td>CNP 048</td><td>Crane, mobile</td><td>112</td><td>1</td></tr>
<tr><td>CNP 065</td><td>Drill/grinder</td><td>98</td><td>5</td></tr>
<tr><td>CNP 141</td><td>Lorry</td><td>112</td><td>2</td></tr>
<tr><td>CNP 170</td><td>Poker</td><td>113</td><td>2</td></tr>
<tr><td>CNP 201</td><td>Saw</td><td>108</td><td>2</td></tr>
</table>

4.4.6 Significance of Impacts

The Tsing Yan THA, which is closest to the Plant, is exemplified in the following construction noise calculation : -

Table 4-3 Construction noise impact at the Tsing Yan THA (N2) for phase II and III

Phase II Foundation Works					
I.D. Code	**PME used**	**Nos. used**	**SWL, dB(A)**	**Dist. attenuation, dB(A)**	**SPL at NSR, dB(A)**
CNP 021	Bar Benders	1	90	66.3	23.7
CNP 044	Concrete Lorry Mixer	2	109	66.3	45.7
CNP 047	Concrete Pump	1	109	66.3	42.7
CNP 081	Excavator	1	112	66.3	45.7
CNP 141	Lorry	2	112	66.3	48.7
CNP 170	Poker	2	113	66.3	49.7
CNP 201	Saw	1	108	66.3	41.7
CNP 281	Water Pumps	2	88	66.3	24.7
	Cumulative PNL =	54.4	dB(A)		
	Correction for reflection =	3.0	dB(A)		
	Correction for screening =	-5.0	dB(A)		
	CNL =	**52.4**	**dB(A)**		
Phase III Building & Steel Works					
I.D. Code	**PME used**	**Nos. used**	**SWL, dB(A)**	**Dist. attenuation, dB(A)**	**SPL at NSR, dB(A)**
CNP 021	Bar Benders	2	90	66.3	26.7
CNP 044	Concrete Lorry Mixer	2	109	66.3	45.7
CNP 047	Concrete Pump	1	109	66.3	42.7
CNP 048	Crane, mobile	1	112	66.3	45.7
CNP 065	Drill/grinder	5	98	66.3	38.7
CNP 141	Lorry	2	112	66.3	48.7
CNP 170	Poker	2	113	66.3	49.7
CNP 201	Saw	2	108	66.3	44.7
	Cumulative PNL =	54.7	dB(A)		
	Correction for reflection =	3.0	dB(A)		
	Correction for screening =	-5.0	dB(A)		
	CNL =	**52.7**	**dB(A)**		

Similarly, the corresponding impact on various NSRs are summarized as follows : -

Table 4-4 Construction noise levels predicted at various NSRs during Phase II and III

Noise Sensitive Receivers	Phase II	Phase III
N1 Cheung Hang Estate	54.3 dB(A)	54.6 dB(A)
N2 Tsing Yan THA	52.4 dB(A)	52.7 dB(A)
N3 Ching Tai Court	54.0 dB(A)	54.3 dB(A)
N4 Cheung On Estate (secondary school)	54.7 dB(A)	55.0 dB(A)

4.4.7 Conclusion

It is expected that the possible construction noise impact will be acceptable temporary. Most construction works involving noisy operations will be completed before June 95. In fact, the site formation work has been completed at the time of writing this report. The rest of the construction works will mainly be the building of the concrete silos and office buildings for the Hong Kong Cement Manufacturing Co. Ltd. and steelworks assembly for the remaining three.

Results obtained in the last section showed that the predicted noise levels at various NSRs are well below the ANL of 65 dB(A) during the restricted hours. (i.e. 1900 to 2300 on normal weekdays and any time on a public holiday including Sunday) It is therefore unlikely that construction noise impact should be a problem and it is well within the Acceptable Noise Level of 65 dB(A) during the restricted hours and the 75 dB(A) during the unrestricted hours.

4.5 Machinery Noise Impact

4.5.1 Introduction

This section presents a more detailed assessment of the operational noise impact against the relevant standard to allow impact identification and the suggestion of mitigation measures. Recommendations were given by the Consultants in the general plant layout design to minimize the gross noise impact and to take advantage of the site location, orientation and the screening effect due to interposition of buildings. (e.g. the two main silos of HK Cement)

Major noise sources will be expected to come from the operation of machines on-site, the idling concrete and cement trucks, and the unloading of aggregates and cement from barges etc. The increase of traffic noise over the existing levels due to increased concrete trucks along the Tam Kon Shan Road and the Tsing Tsuen Road will also be addressed.

4.5.2 Inventory of Noise Sources

Through review of noise surveys, noisy equipment and operations, SPL for various sources and operations have been measured, estimated, and ranked as far as practicable. Minor sources have been discarded to keep the noise assessment concise and manageable. In the course of inventory collection, neither the user nor supplier of the machines have been able to provide the noise specifications. Further, it is also impossible and unnecessary to analyse or measure the noise characteristics for every single equipment that has been assembled together.

As such, the noise assessment has been based on individual noisy operations. This approach has the advantage of addressing machines modules that will always be working as a group and is unlikely to be separately working. In the case where the machine noise cannot be measured with confidence due to specific site environment, generic data of sound power levels will be used.

Principal noisy operations of the existing cement/concrete batching plants which have been targets of major complaints from the Greenfield Garden and potential nuisance, are identified below. It is expected that the noise characteristics of these operations will repeat themselves as most of the machines will be retained and re-installed after the relocation. New machines to be purchased will have roughly the same power or scale of operation.

Principal noisy activities identified are: -

S1- Unloading of aggregates from barges;

S2- Unloading of cement from barges into silos;

S3- Filling of cement, aggregates and additives into concrete lorry mixers;

S4- Queuing of concrete trucks for filling;

S5- In-plant circulation of materials

S6- Loading of materials into aggregate bins

S7- Cement truck moving inside plants

Source sound power level (SWL), which is a parameter specific to the source characteristic and is unaffected by the background noise levels and physical dimension of the equipment, is calculated from the SPL measured at a particular distance using the following standard acoustical equation for point sources : -

$$SWL = SPL + 10 \log 4\pi r^2 - DI$$

where DI is the directivity index which takes the value of 0 dB for source in free field, 3 dB for source on ground and 6 dB when bounded by two surfaces. Table 4-5 below shows the machines involved in each noisy operations and the estimated SWL.

Table 4-5 Inventory of SWL for Various Noisy Activities

Code	**Description of operation**	**Machines involved**	**Nos. involved**	**Estimated SWL for each machine, dB(A)**	**Estimated SWL for each operation, dB(A)**
S1	Unloading of aggregates from barge	winch	1	120	120
S2	Unloading of cement from barge into silos	vacuum pump compressor blower	1 2 1	103 109 103	113
S3	Filling of cement, aggregates and admixtures into concrete lorry mixer	mixer and concrete lorry mixer	1 pair	110	110
S4	Queuing of concrete trucks for filling	concrete lorry mixer	1	109	109
S5	In-plant circulation of materials	conveyor belt	different for each plant	90	90
S6	Loading of materials into aggregate bins	loader	1	112	112
S7	Cement truck moving inside plants	cement truck	1	112	112

4.5.3 Inventory of noise sources operating simultaneously

In consideration of the worst case scenario, all of the identified noise sources and activities are assumed to operate simultaneously. The four users of the plants have indicated that their working time will start roughly after 0800 hours and will last up to 2300 hours each day. Extra overtime work beyond 2300 hours will be very unlikely except the case of unloading of cement from barges by Hong Kong Cement. This will happen 3 to 4 times each month and the whole process of unloading will take about 30 to 65 hours continuously depending on the size of barge and the quantity of cement to be unloaded.

The table below shows the maximum possible number of machines and operations for the four plants altogether.

Table 4-6 Estimated Maximum Number of Noise Sources and Activities for Each Plants

Noisy operations	HKC	SSF	PIC	QHC	Total
S1	0	0	1	1	2
S2	1	0	0	0	1
S3	0	0	2	2	4
S4	0	0	4	4	8
S5	4	4	7	11	26
S6	0	0	0	1	1
S7	2	2	0	0	4

4.5.4 Noise Sensitive Receivers

For the prediction of off-site environmental noise after the commissioning of the cement/concrete batching plants, the following groups of potentially affected NSRs have been chosen. The NSRs are grouped and expected to be subject to the same background noise and similar future operational noise of the plants. Please refer to Figure 4-2 for their locations.

Group A : Tsing Yan THA , Cheung Hang Estate and proposed school sites; and

Group B : Exiting school at Cheung On Estate and Ching Tai Court

In the assessment, the following representative points have been chosen for various NSRs of each the group.

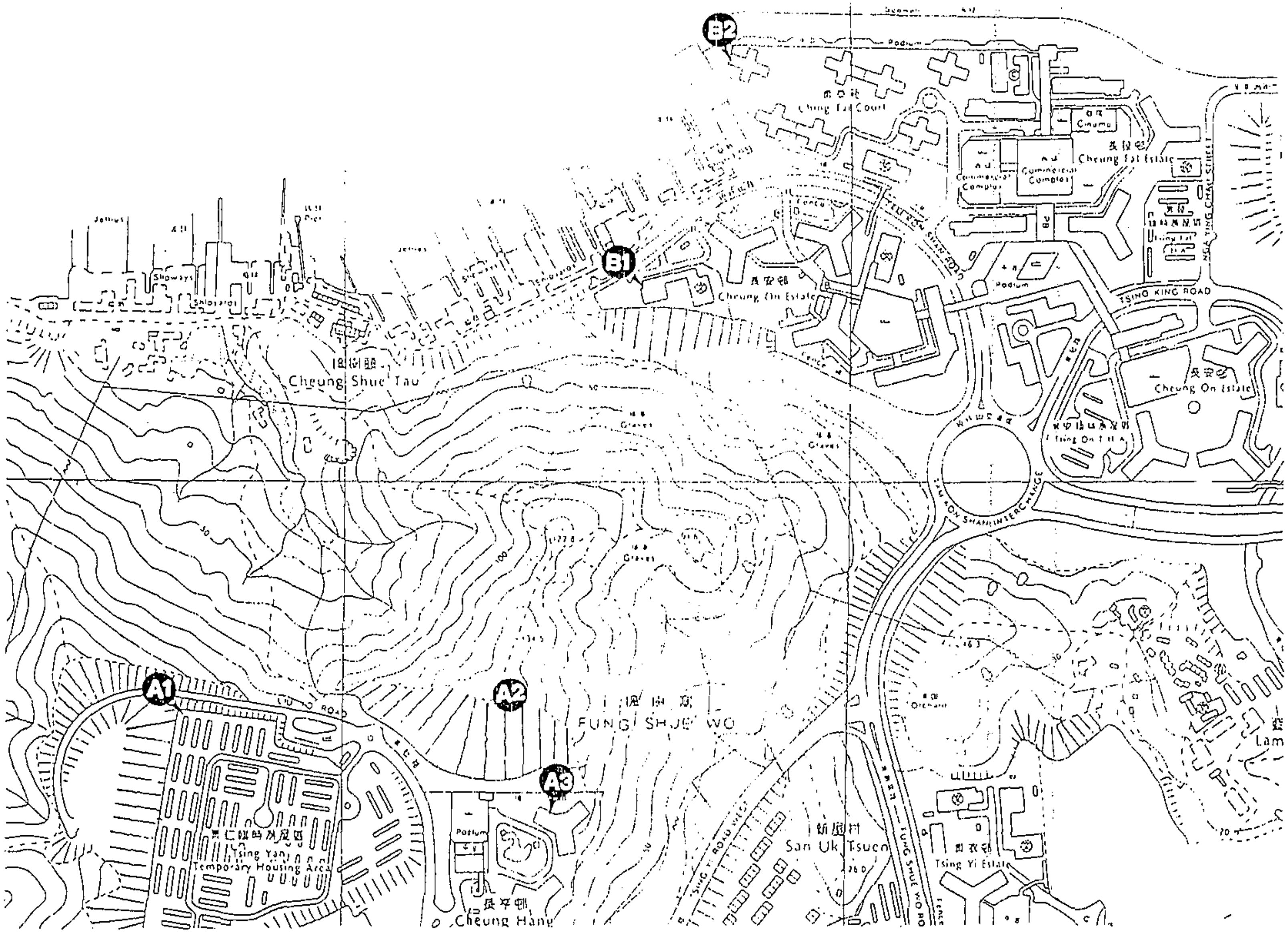
Table 4-7 Location of Various NSRs for Operational Noise Assessment

NSR	Location
A1	Tsing Yan THA or the future district hospital
A2	two sites reserved for secondary school development near Cheung Hang Estate
A3	1/F level of Cheung Hang Estate #
B1	Existing secondary at Cheung On Estate
B2	1/F level of a building block at Ching Tai Court

\# 1/F of the Cheung Hang Estate was chosen for the worst scenario. No screening effect from the hills has been taken into consideration

Figure : 4-2

Scale :



TITLE : Location of NSRs for Operational Noise Impact Assessment

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

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4.5.5 Assessment Criteria

Noise standards applicable to the NSRs identified are recommended in the HKPSG which specifies a noise level of 5dB(A) below the Acceptable Noise Level (ANL) prescribed in the Technical Memorandum for the Assessment of Noise From Places other than Domestic Premises, Public Places or Construction Sites. (TM). It is also recommended that the prevailing background noise level is to be preserved if it is 5dB(A) below the ANL mentioned above.

From the said TM, the suitable Area Sensitivity Ratings (ASR) for all of the NSRs is B and hence the ANL should be 65dB(A) during the day (0700-2300) and 55 dB(A) during the night (2300-0700). Thus, ANL-5 should be 60 and 50 dB(A) for the two time periods respectively.

The prevailing background noise levels at the NSRs were measured for each time period and tabulated below : -

Table 4-8 Prevailing Background Noise Levels at the Selected NSRs

Time Period	Tsing Yan THA (Group A)		Ching Tai Court (Group B)	
	Leq, dB(A)	L90, dB(A)	Leq, dB(A)	L90, dB(A)
Day (07:00 - 19:00)	62.4	55.0	59.7	56.5
Evening (19: 00 - 23:00)	53.2	51.7	58.0	56.0
Night (23:00 - 07:00)	51.6	51.0	55.7	54.0

As a result, the applicable criteria (the target noise level, TNL) are evaluated as the ANL-5 or the prevailing background noise levels whichever is lower for each time period as below : -

Table 4-9 Target Noise Levels for the NSRs

Time Period	Tsing Yan THA (Group A)	Ching Tai Court (Group B)
TNL (0700-2300), $L_{A,eq}$ (30 min)	53.3	56.3
TNL (2300-0700), $L_{A,eq}$ (30 min)	50.0	50.0

Please note that the background noise level for the period 0700-2300 has been taken as the arithmetic mean of those in the day-time and evening period.

4.5.6 Modelling of Operational Noise

The SPL estimated for various noisy operations are converted into their respective SWL. The off-site noise levels, SPL at various NSRs are then predicted and adjusted for some correction factors using the following standard acoustic equation by

$$SPL = \log \Sigma (SWL + DI - K1 - K2 - K3 - K4 - K5 - K6 - K7)$$

where DI = Directivity Index, taken as 3 dB for point sources and 6 dB for vertical plane sources;
K1 = Geometric spreading, for point source is 10 log ($4\pi r^2$);
K2 = Atmospheric absorption;
K3 = Ground effect attenuation;
K4 = Meteorological attenuation, takes into account the effect of wind and vertical temperature gradient on noise propagation;
K5 = Source height correction, to be applied to adjust for ground effect attenuation;
K6 = Barrier attenuation based on Maekawa's empirical chart that relate with path difference between the direct and screened path, and the frequency;
K7 = In-plant screening

Of all the correction factors listed above, only K1 and K7 will be considered as the others are comparatively minor or cannot be determined with certainty. All the noisy operations are considered to happen at the centroid of the site and behave as point sources owing to the great distance to the various NSRs.

4.5.7 Cumulative Machinery Noise Impact

SPL at various NSRs are predicted using procedures described in Section 4.5.6. Table 4-10 below shows the predicted gross noise impact (SPL) at various NSRs and the comparison with the relevant noise criteria during that period.

Table 4-10 Cumulative Noise Impact on Various NSRs (without mitigation)

Code	Quantity	SPL at individual NSRs (unmitigated)				
		A1	A2	A3	B1	B2
S1	2	48	51	50	51	50
S2	1	41	44	43	44	43
S3	4	44	47	46	47	46
S4	8	46	49	48	49	48
S5	26	32	35	34	35	34
S6	1	40	43	42	43	42
S7	4	46	49	48	49	48
Cumulative noise (0700-2300)=		**52.9**	**55.5**	**54.8**	**55.5**	**54.8**
TNL(0700-2300) =		53.3	53.3	53.3	56.0	56.0
Exceedence =		-0.4	(2.2)	(1.5)	-0.8	-1.5
Cumulative noise (2300-0700))=		**41**	**44**	**43**	**44**	**43**
TNL(2300-0700) =		50.0	50.0	50.0	50.0	50.0
Exceedence =		-8.9	-6.4	-7.0	-6.4	-7.0

It can be noticed that there are exceedance of 2.2 and 1.5 dB(A) in the noise criterion during the period 0700-2300 for NSRs A2 and A3 where the site has been reserved for two secondary schools and an existing tower of the Cheung Hang Estate is. As evident from the above table, activities S1, S2 and S3 are responsible for much of the exceedance in the noise criteria, mitigation measures are therefore needed for these activities and is much easier since only stationary machines are involved.

N.B. Only activity S2 will carry overnight and is so assessed

4.5.8 Mitigation Measures

As revealed in the last section, mitigation measures have to be incorporated to machines involved in operations S1, S2, S3 and S4 as follows : -

(i). S1 - Unloading of aggregates from barge

In this case, noise is mainly emanating from the engine-driven winch on board of the barge. It is recommended that a barrier of sufficient size and mass can be placed by the engines to screen the noise and to cut the direct view of the engine from noise sensitive receivers to the east and southeast of the site. However, this will not introduce any management difficulties since the cement/concrete companies use their own barges. With this barrier, an attenuation of 5 dB(A) can generally be achieved.

(ii). S2 - Unloading of cement from barge into silos using compressors, vacuum pump and blower

It is this noisy operation that will last overnight and hence requires more stringent noise control. It is suggested that machines should preferably be separated from one another by partitions or in individual rooms. The doors of each room should be facing north. Ventilation or air-intake openings of such rooms should have louvered sound attenuators and intake and outlet silencers for the compressors as well. With this design, an attenuation of 10 dB(A) is achievable.

(iii). S3, S4 - Filling of cement, into concrete trucks and those waiting to be filled

The engine noise in this case dominates. A concrete wall of at least 5 m can be built adjacent to the filling points to screen the noise from reaching the NSRs to the east and southeast. With this barrier, an attenuation of 5 dB(A) can be achieved. These mitigation measures are depicted in Figure 4-3.

4.5.9 Residual Impact after the implementation of mitigation measures

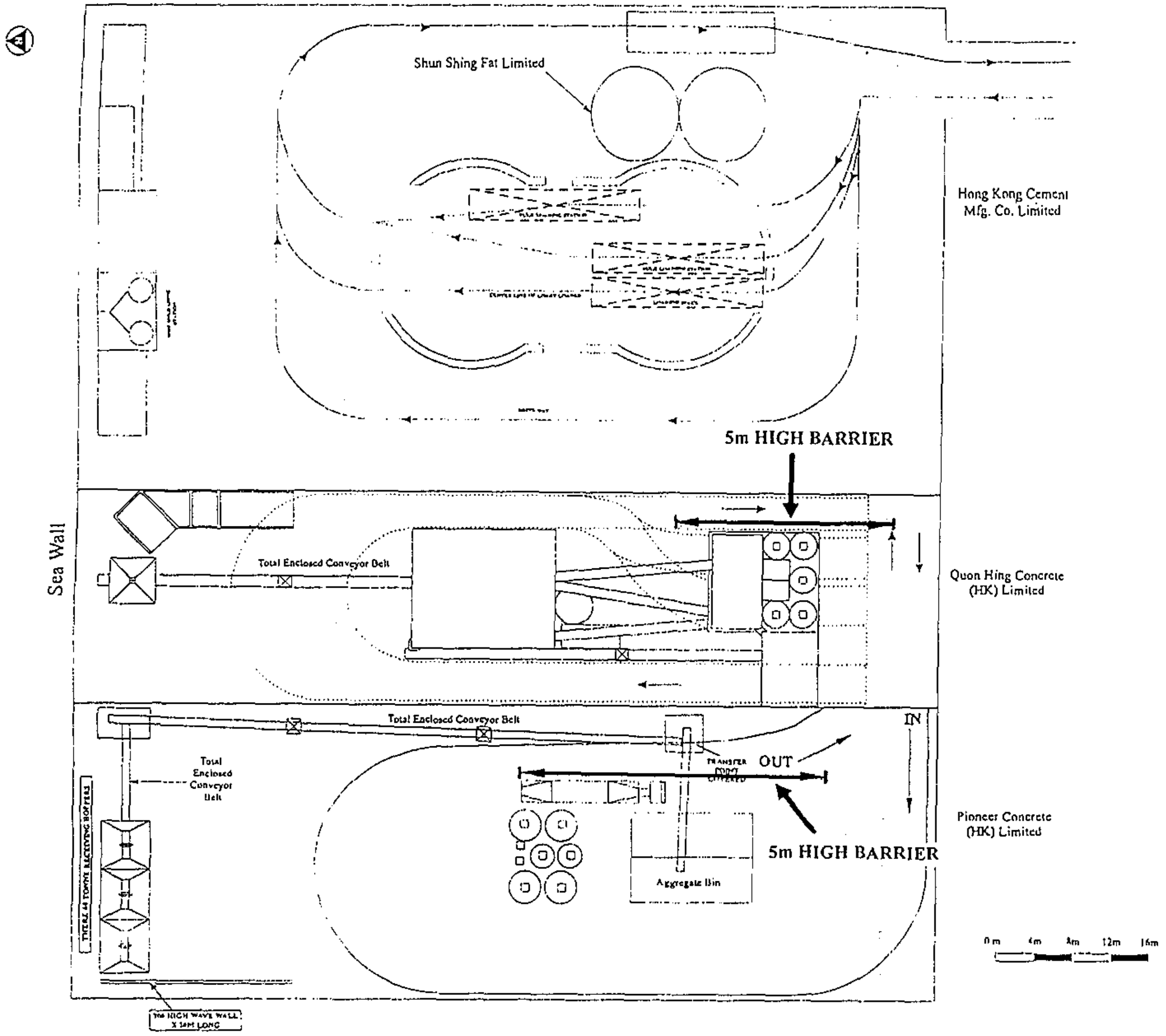
With mitigation measures suggested in the last sections, the residual impacts are calculated with the results shown below. Full compliance can now be achieved at all time periods.

Table 4-11 Residual Noise Impact on Various NSRs (with mitigation)

Code	Quantity	SPL at individual NSRs (mitigated)				
		A1	A2	A3	B1	B2
S1	2	43	46	45	46	45
S2	1	31	34	33	34	33
S3	4	39	42	41	42	41
S4	8	46	49	48	49	48
S5	26	32	35	34	35	34
S6	1	40	43	42	43	42
S7	4	46	49	48	49	48
Cumulative noise (0700-2300) =		**50.9**	**53.4**	**52.8**	**53.4**	**52.8**
TNL(0700-2300) =		53.3	53.3	53.3	56.3	56.3
Exceedence =		-2.4	0.0	-0.5	-2.9	-3.5
Cumulative noise (2300-0700) =		**31**	**34**	**33**	**34**	**33**
TNL(2300-0700) =		50.0	50.0	50.0	50.0	50.0
Exceedence =		-18.9	-16.4	-17.0	-16.4	-17.0

Figure : 4-3

Scale : ---



TITLE : Barrier Wall Recommended On-Site

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

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4.5.10 Conclusion

A conservative assessment on the operational noise has indicated exceedance of the noise criterion at NSRs A2 and A3 without any noise mitigation measures. This is due to their relatively closer distance to the cement /concrete batching plants and is not topographically shielded as in the case of A1. Mitigation measure in the form of barriers and enclosures are recommended and aimed at reducing the noise exposure to the main noisy operations. In fact, the screening effect of the two giant silos of HK Cement have not been taken into account in the assessment. Others factors such as atmospheric absorption and ground absorption are also ignored as a conservation approach at this stage. After the implementation of mitigation measures on-site as described in the last sections, total compliance with the noise standard should be achieved.

It is expected that the completion of the Tsing Yi Northern Coastal Road after 1997 should increase the overall noise level in the surroundings. However, the cement /concrete batching plants should not be a cause of unacceptable noise impact arising from on-site operations.

4.6 Traffic Noise Impact

4.6.1 Introduction

The increase of traffic noise over the existing due to increased concrete trucks along the Tam Kon Shan Road, Tam Kon Shan Interchange and the Tsing Tsuen Road will be addressed in this section.

4.6.2 Assessment Criteria

Noise standards are recommended in the HKPSG for planning against noise impact from sources such as road traffic, railway and aircraft etc. According to the guidelines, the maximum noise level from road traffic, measured in terms of L_{10}(1-hr.) is recommended to be 70 dB(A) at new dwellings and 65 dB(A) at schools.

4.6.3 Modelling of Road Traffic Noise

The methodology involved the prediction of the hourly L_{10} noise levels at NSRs identified along the route of the concrete trucks (i.e Tam Kon Shan Road and Tsing Tsuen Road) for the year 1994 and 1995 with or without the Plants.

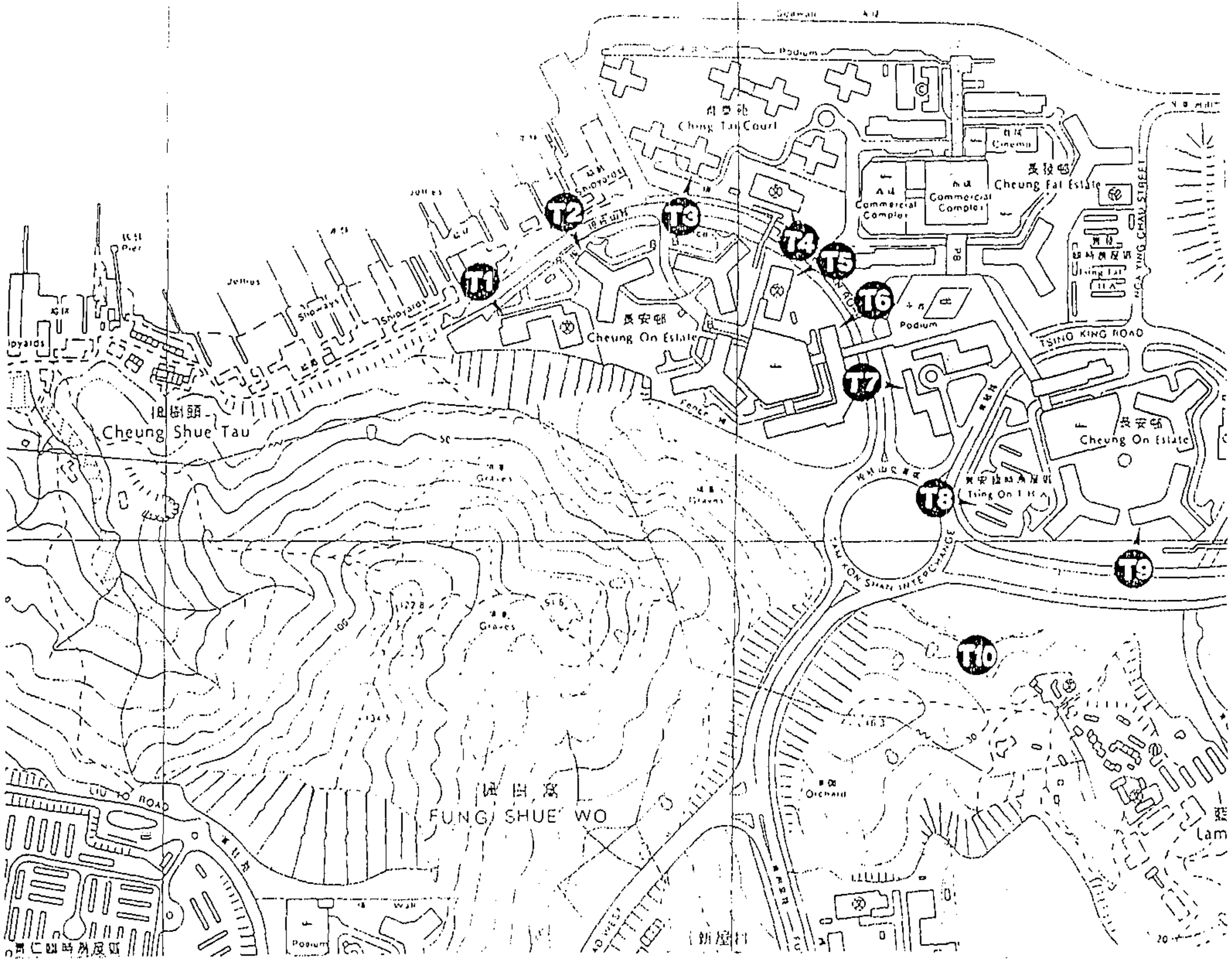
The predicted noise levels were compared with the relevant noise criteria for assessing the impact. The U.K. Department of Transport's procedure "Calculation of Road Traffic Noise" was used to predict the hourly L_{10} generated from traffic on the road at typical facades of selected NSRs of the residential development.

4.6.4 Noise Sensitive Receivers

Noise sensitive receivers were identified along the Tam Kon Shan Road and the Tsing Tsuen Road is described in Table 4-12 and shown in Figure 4-4

Figure : 4-4

Scale :



TITLE : Location of NSRs for Traffic Noise Impact Assessment

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

EHS Consultants Limited

Table 4-12 Noise Sensitive Receivers Along the Route of Concrete Mixer Trucks

NSR	Description
T1	Secondary school of Cheung On Tsuen
T2	One housing estate block of Cheung On Tsuen
T3	One housing estate block of Ching Tai Court
T4	Primary school of Ching Tai Court
T5	Primary school of Cheung On Tsuen
T6	One housing estate block of Cheung On Tsuen
T7	One housing estate block of Cheung On Tsuen
T8	Tsing On THA
T9	One housing estate block of Cheung On Tsuen
T10	Proposed C/R development above the Tsing Yi Station and transport interchange

4.6.5 The Traffic Flow

Existing flow on the Tam Kon Shan Road was counted in-situ before the Interchange and projected to the Year 1995 for the baseline scenario. Additional flows to be generated from the proposed Plants were supplied by the plant operators based on the maximum permitted output of the plants. Flow on the Tsing Tsuen Road was referenced to the Annual Traffic Census.

Table 4-13 1994 Base Case Scenario

Roads	Light vehicles	Heavy vehicles	Total flow (veh/hr)
Tam Kon Shan Road	50 %	50 %	923
Tsing Tsuen Road	49 %	51 %	2,361

Table 4-14 1995 Scenario Without the Cement/Concrete Batching Plants

Roads	Light vehicles	Heavy vehicles	Total flow (veh/hr)
Tam Kon Shan Road	50 %	50 %	969
Tsing Tsuen Road	49 %	51 %	2,479

Table 4-15 1995 Cement Plants Traffic Generation (peak hour)

Plants	Heavy vehicles	Total flow (veh/hr)
HKC	100 %	20
SSF	100 %	27
QHC	100 %	91
PIC	100 %	65
Total		***203***

Table 4-16 1995 Scenario After the Commissioning of the Cement/Concrete Batching Plants

Roads	Light vehicles	Heavy vehicles	Total flow (veh/hr)
Tam Kon Shan Road	41 %	59 %	1,172
Tsing Tsuen Road	45 %	55 %	2,682

4.6.6 Traffic noise impact along the route

The noise impact arising from the transportation of cement and concrete on trucks were predicted and compared with the existing scenario. Table 4-16 below shows the existing traffic noise level and the predicted ones in 1995 before and after the relocation of the Plants.

Table 4-17 Results of traffic noise prediction for various NSRs with and without the plant, dB(A)

NSR	1/F			5/F			10/F		
	1994	1995	1995+	1994	1995	1995+	1994	1995	1995+
T1	75.1	75.3	76.8	74.6	74.8	76.2	73.2	73.4	74.9
T2	80.6	80.8	82.2	77.9	78.1	79.5	75.1	75.3	76.7
T3	74.1	74.3	75.8	73.5	73.7	75.2	72.4	72.6	74.0
T4	75.5	75.7	77.1	74.8	75.0	76.5	73.4	73.6	75.0
T5	77.4	77.6	79.0	76.2	76.4	77.9	74.3	74.5	75.9
T6	76.9	77.1	78.6	76.2	76.4	77.8	74.6	74.8	76.3
T7	76.4	76.6	78.1	75.7	75.9	77.3	74.2	74.4	75.8
T8	80.6	80.8	81.5	79.7	79.9	80.6	78.1	78.3	79.1
T9	78.2	78.4	79.0	78.0	78.2	78.8	77.3	77.5	78.2
T10	75.0	75.2	75.9	74.8	75.1	75.8	74.5	74.7	75.4

where 1994 = Base case scenario at 1994 before the relocation of the Plants
1995 = Scenario at 1995 before the commissioning of the Plants
1995+ = Scenario at 1995 after the commissioning of the Plants

The general exceedance in the noise level above the recommended standard of 70 dB(A) is expected even without the Plants as the housing blocks are already very close to the roads. The noise level at various NSRs will only be marginally increased by at most 1.5 dB(A) in 1995 after the commissioning of the concrete/cement plants. Therefore, the consequential increase in noise impact upon NSRs along the roads would be insignificant.

4.7 Conclusion And Recommendation

A noise assessment for the construction and operational phase has been completed and revealed no insurmountable impact upon existing and future noise sensitive uses.

It is predicted that construction noise receivable at the nearest noise sensitive uses (the Tsing Yan THA) will be around 55 dB(A) in all phases and is be more than 10 dB(A) below the noise standard during the hours 1900 to 2300 each day, Sundays and public holidays. Further, there will be no construction work after 2300 hour to 0700 hour the following day. Though there is no statutory control of construction noise during day-time, the assessment has predicted that the noise level will be well below the recommended standard of 75 dB(A).

In fact, site formation work has been completed at time of writing this report. Most of construction works involving noisy operations will be completed before June 95. The rest of the construction works will mainly be the erection of cement silos, office buildings and steelworks assembly.

For operational noise, the assessment has revealed some exceedance near the Cheung Hang Estate if no mitigation measures are to be incorporated. The exceedance is mainly attributed to the unloading of cement and aggregates from barges and the filling of concrete and cement trucks on-site.

It is therefore recommended to house the pumps, compressors and blowers in acoustically enclosed rooms and add barriers to screen the engine-driven winch on board of barges. Trucks queuing for filling will be screened by barrier wall of at least 5 m high. With all the mitigation measures incorporated, full compliance of noise standard at all the sensitive uses will be expected.

For the traffic noise, sensitive uses along the Tam Kon Shan Road and Tsing Tsuen Road are currently subject to noise in excess of the standard of 70 dB(A). The commissioning of the Plants will only marginally increase the noise level by 1.5 dB(A) by the additional concrete/cement trucks visiting and leaving the Plants.

In conclusion, the environmental noise at various existing and future sensitive uses arising from the proposed relocation of the cement and concrete batching plants should be acceptable after the implementation of suitable noise mitigation measures.

5. WATER QUALITY IMPACT

5.1 Objectives

Water-related impact are likely to arise from both the construction and operational phase of the cement depots and concrete batching plants. The objective of this water quality impact assessment is to identify the sources of wastewater and recommend practicable treatment/disposal methods and/or mitigation measures with an aim to satisfy all required standards as well as the water policies of the area.

5.2 Legislation

The proposed cement and concrete batching plants falls within the Western Buffer Water Control Zone (WBWCZ). All discharges into any drainage or sewerage systems within the WCZ are controlled under the Water Pollution Control Ordinance (Cap. 358), except the discharge of domestic sewage into foul sewers or the discharge of unpolluted water into storm drains or into the waters of Hong Kong. As there are public (foul and storm) sewers available in the vicinity to the subject site, all effluent generated will be discharged into the sewerage network for central treatment. The quality of discharge has to meet the standards for effluents discharged into foul sewers leading into Government sewage treatment plants presented in Table 1 of the Technical Memorandum (TM) "Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" as given in Table 5-1. According to the TM, there is a list of prohibited substances for discharging into foul sewers which include:

- polychlorinated biphenyls (PCB);
- polyaromatic hydrocarbons (PAH);
- fumigant, pesticide, or toxicant;
- radioactive substances;
- chlorinated hydrocarbons;
- flammable or toxic solvents;
- petroleum oil or tar;
- calcium carbide;
- wastes liable to form scum or deposits in any part of the public sewer; and
- any substance of a nature and quantity likely to damage the sewer or to interfere with any of the treatment processes.

Table 5-1 Standards for Effluents Discharged into Foul Sewers Leading into Government Sewage Treatment Plants

Flow rate (m^3/day) Determinand	≤10	>10 and ≤100	>100 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (°C)	43	43	43	43	43	43	43	43	43	43	43	43	43
Suspended solids	1200	1000	900	800	800	800	800	800	800	800	800	800	800
Settleable solids	100	100	100	100	100	100	100	100	100	100	100	100	100
BOD	1200	1000	900	800	800	800	800	800	800	800	800	800	800
COD	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Oil & Grease	100	100	50	50	50	40	30	20	20	20	20	20	20
Iron	30	25	25	25	15	12.5	10	7.5	5	3.5	2.5	2	1.5
Boron	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Barium	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Mercury	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper	4	4	4	3	1.5	1.5	1	1	1	1	1	1	1
Nickel	4	3	3	2	1.5	1	1	0.8	0.7	0.7	0.6	0.6	0.6
Chromium	2	2	2	2	1	0.7	0.5	0.4	0.3	0.2	0.1	0.1	0.1
Zinc	5	5	4	3	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Silver	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Other toxic metals individually	2.5	2.2	2	1.5	1	0.7	0.6	0.4	0.3	0.2	0.15	0.12	0.1
Total toxic metals	10	10	8	7	3	2	2	1.6	1.4	1.2	1.2	1.2	1
Cyanide	2	2	2	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.08	0.06
Phenols	1	1	1	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.1	0.1
Sulphide	10	10	10	10	5	5	4	2	2	2	1	1	1
Sulphate	1000	1000	1000	1000	1000	1000	1000	900	800	600	600	600	600
Total nitrogen	200	200	200	200	200	200	200	100	100	100	100	100	100
Total phosphorus	50	50	50	50	50	50	50	25	25	25	25	25	25
Surfactants (total)	200	150	50	40	30	25	25	25	25	25	25	25	25

5.3 Source Of Wastewater

5.3.1 During Construction Phase

Site construction activities will inevitably have the potential to cause water pollution. The subject site has already completed all site formation works which minimise the intensity of soil erosion. The contractor should, nonetheless, carry out the works in such a manner as to minimise adverse impacts on the water quality. Activities that are likely to cause water pollution include:

i) Construction runoff and drainage;

ii) Sewage effluent from the site; and

iii) Liquid spillage, e.g. oil, diesel, solvents etc.

Construction runoff contains increased loads of sediments, other suspended solids and contaminants. Potential sources of pollution include runoff and erosion from the site surfaces, drainage channels; bentonite slurries and other grouting materials; concrete batching plant washout and drainage from dust suppression sprays; fuel, oil and lubricants from construction vehicles and other equipment. No dredging or reclamation is required for the proposed development.

5.3.2 During Operational Phase

Wastewater generated from the operational phase of the cement and concrete batching plants include sewage and service waters. Service water arises mainly from the two concrete batching plants which include water sprayed onto road surface, handling equipment, and mixer trucks for dust suppression and cleaning purposes. As the cleaning practice does not involve any use of chemical or detergent, the wastewater is unlikely to contain any prohibited or toxic substances listed in the previous Section 5.2.

Water consumption records of existing PIC batching plant at TYTL 124 from March to August 1994 suggest an average usage of 275 m^3 per day. By adopting a typical water requirement of 195 litres per 1 m^3 of concrete and an average daily concrete production of 1,300 m^3, a total of 254 m^3 of water is being used for concrete mixing per day. The remaining 21 m^3 of water is consumed by the workers and other cleaning facilities. Dry mixing technique is currently adopted by PIC which involves loading of all ingredients into concrete mixer truck before adding water for concrete production. Such technique requires continuously water spray to wash down all dusts prior to leaving the works. The adoption of wet mix batching technique in the proposed plant at TYTL 119, i.e. mixing of concrete in total enclosure silos prior to filling into the mixer truck, should markedly reduce the water demand for truck and equipment cleaning.

Water consumption records of Quon Hing Concrete (QHC) Batching Plant from May to August 1993 suggest an average usage of 192 m^3 per day. By adopting an average daily concrete production of 950 m^3 which requires 185 m^3 of water, approximately 7 m^3 of water is being used for other activities each day. QHC has planned to double its production capacity in the new plant which would proportionally increase its water consumption, i.e. up to 384 m^3 per day. Wet mix batching technique will be adopted in the new plant as the current practice.

The number of workers from the four plants are expected to be 15, 40, 30, and 20 for HKC, PIC, QHC, and SSF respectively. By adopting the unit flow of 0.06 m^3 per employee per day as provided in Part 1 of the "Sewage Strategy Study 1989" prepared by EPD, the daily sewage flows are estimated to be 0.9 m^3, 2.4 m^3, 1.8 m^3, and 1.2 m^3 for HKC, PIC, QHC, and SSF respectively. The total sewage flow from the 105 workers is estimated to be 6.3 m^3 per day.

5.4 Existing Wastewater Treatment System

Foul water effluent from the offices and toilets of the four existing plants are discharged into public foul sewer without treatment. The quality of such effluent, which is of domestic in nature, should be within the required discharge standards as given in Table 5-1.

The existing PIC and QHC have drainage designed to convey all surface runoff from cement loading and truck washing areas which contains high levels of solids to a sedimentation basin. The sedimentation basin consists of a series of four compartments which allows solids to settle. The settled solids are removed every two to three days to restore the tank capacity. PIC currently uses the surplus water in conjunction with fresh water for concrete mixing which consumes all the cleaning effluents. QHC currently recirculates the surplus water for floor and mixers cleaning.

The existing drainage arrangements of both plants do not convey any service water to public sewers.

5.5 Wastewater Characteristics

Water samples were collected from the existing PIC and QHC plants at locations before and after final sedimentation for analysis of pH and Suspended Solids (SS) content. The sampling at PIC was conducted on 29 July 1994 at 10:00 a.m. while that for QHC was conducted on 28 August 1994 at 4:30 p.m. when the plants were operated under their normal conditions. Cleaning of mixer trucks and equipment were observed at both plants. The SS determinations was performed in accordance with the Standard Method APHA 18ed 2540D by the Consultant. The pH determination was conducted *in situ* by a properly calibrated digital pH meter (Schott Geräte CG818) in accordance with the Standard Method APHA 18ed 4500-H^+ B. Results of the analysis are summarised in Table 5-2.

Table 5-2 Wastewater Analysis of the Existing PIC and QHC Plants

Sampling Location	PIC		QHC	
	pH	SS (mg/L)	pH	SS (mg/L)
Before Sedimentation	10.1	2,569	10.6	2,614
After Sedimentation	11.6	73	11.1	92

5.6 Proposed Mitigation Measures

5.6.1 During Construction Phase

Construction works will be programmed to minimise soil excavation works in rainy seasons. Erosion from construction sites can be minimised by implementing viable erosion control measures as follows :-

i) Diversion of upstream run-off away from exposed soil surfaces, e.g. by provision of intercepting channels along the crest/edge of excavation;

ii) Minimise the time that soil surfaces is exposed;

iii) Protection of exposed soil surfaces from rainfall, e.g. cover temporarily exposed slope surfaces by tarpaulin and protect temporary access roads by crushed stone or gravel, and

iv) Slow down the run-off flowing across exposed soil surfaces.

A series of silt removal facilities will be installed to settle out siltation prior to discharge into public foul sewer. Such facilities will be properly designed in accordance with guidelines from the Civil Engineering Department, the Practical Note for Professional Persons (ProPECC) as well as the HKPSG to achieve the desired mitigating effect on the water quality. Typically, a detention time not less than 5 minutes for maximum design flow of inlet should achieve adequate sediment removal. Channels or earth bunds or sand bag barriers will be provided on site to properly direct surface runoff to such silt removal facilities. Sediment traps, channels and manholes will be maintained and the deposited silt and grit will be removed regularly by the contractor. A manual penstock will be installed before the final discharge to stop accidental spillage.

Sewage generated from the construction workers will be contained by chemical toilets before connection to public foul sewer can be completed. Chemical toilets will be provided at a rate of about 1 per 50 workers. The facility will be serviced and cleaned by specialist contractor at regular intervals.

To prevent spillage of fuel oils or other polluting fluids at source, it is recommended that all the stocks should be stored inside proper containers and sited on sealed areas, preferably surrounded by bunds.

5.6.2 During Operational Phase

5.6.2.1 *Foul Effluent from the Plants*

Foul water effluent generated from the offices and toilet facilities will be directed to the government foul sewer without pretreatment. Chemical toilets may be used in places where connection to public sewers are not feasible. If site canteen is erected, properly designed grease traps/ oil interceptors capable of providing a minimum 20 minutes retention during peak flow will be installed to remove excess quantities of grease and oil from wastewater collected from the kitchen basins, sinks and floor drains prior to discharge into the public foul sewer.

5.6.2.2 *Service Water from PIC and QHC*

Drainage design for the future PIC will be similar to the existing layout which convey all service waters from the concrete loading and the drum washing areas containing high level of solid into a drain pit before entering a series of two sedimentation basins for particle settling. PIC will continue to use all the surplus water for concrete production similar to their existing practice. Such arrangement will allow no service waters with high pH value or carrying high level of solid to be discharged into the public foul sewer network. The drainage layout will be submitted to relevant

Government departments for approval in the later designed stage. The future PIC will adopt the wet mix batching technique which minimise water consumption for dust suppressing purposes.

QHC is also planning to recirculate the service water. The drainage layout will convey all high solid contented service waters into a drain pit before entering a series of sedimentation basins. Based on the existing water consumption records, it is estimated the future production will generate a maximum of 20 m^3 of service water per day. QHC will build sedimentation basins capable to contain 20 m^3 of water and 30 m^3 of solid deposition which should provide sufficient capacity for the collected service waters. The surplus water will be used for floor and conveyor belt cleaning purposes; as well as for concrete production. The drainage layout will be submitted to relevant Government departments for approval in the later designed stage.

Both the concrete filling and truck washing activities are located within roofed areas such that additional flow from rain water can be minimised. A schematic flow diagram illustrating water consumption of the two concrete batching plants is given in Figure 5-1.

A wheel washing facility will be installed at the main exit of the cement and concrete plants to wash off any dust and/or mud deposited on the wheels. Such facility will be located within roofed areas and will contain a sedimentation basin to settle out the deposited particles as illustrated in Figure 5-2. The facility is designed to recirculate the wash water to minimise water consumption.

5.6.2.3 *Surface Water*

Surface runoff outside the cement loading and truck washing areas which contains relatively low levels of solids will be discharged into storm drains via adequately designed sand/silt removal facilities. Typically, a detention time not less than 5 minutes for maximum design flow of inlet should achieve adequate sediment removal. Properly designed surface channels will be provided to direct stormwater to such silt removal facilities. Regular cleaning and maintenance will be conducted especially before and during the rainy season to maintain the designed performance.

Regular monitoring on the suspended solids content and the pH will be conducted to ensure the discharge is within acceptable standards. pH adjustment will be made to the supernatant liqor should non-compliance is recorded. Further treatment with settling agents will be given should settlement alone is found insufficient to settle colloidal materials.

5.7 Wastewater Discharge Location

Foul water effluent generated from the offices and toilet facilities will be discharged into the government foul sewer drains underneath the Tam Kon Shan Road (Road TY 18), which conveys to the Tsing Yi Sewage Disposal Plant. The treatment works provide primary treatment and the effluent is discharge via submarine outfall pipelines in Rambler Channel. Surface runoff will be discharged into the stormwater drain underneath the same road. Details of the connection will be submitted to relevant Government departments by the project engineering consultant.

5.8 Water Quality Monitoring

Regular water quality monitoring will be conducted to ensure the discharges are within acceptable levels. Such monitoring shall include surface water discharged into the stormwater system; as well as service water (if any) discharged into the foul sewer system. Measurement of Suspended Solids (SS) content and pH shall be conducted in accordance with the Standard Methods as stipulated in the TM as described in the following sections.

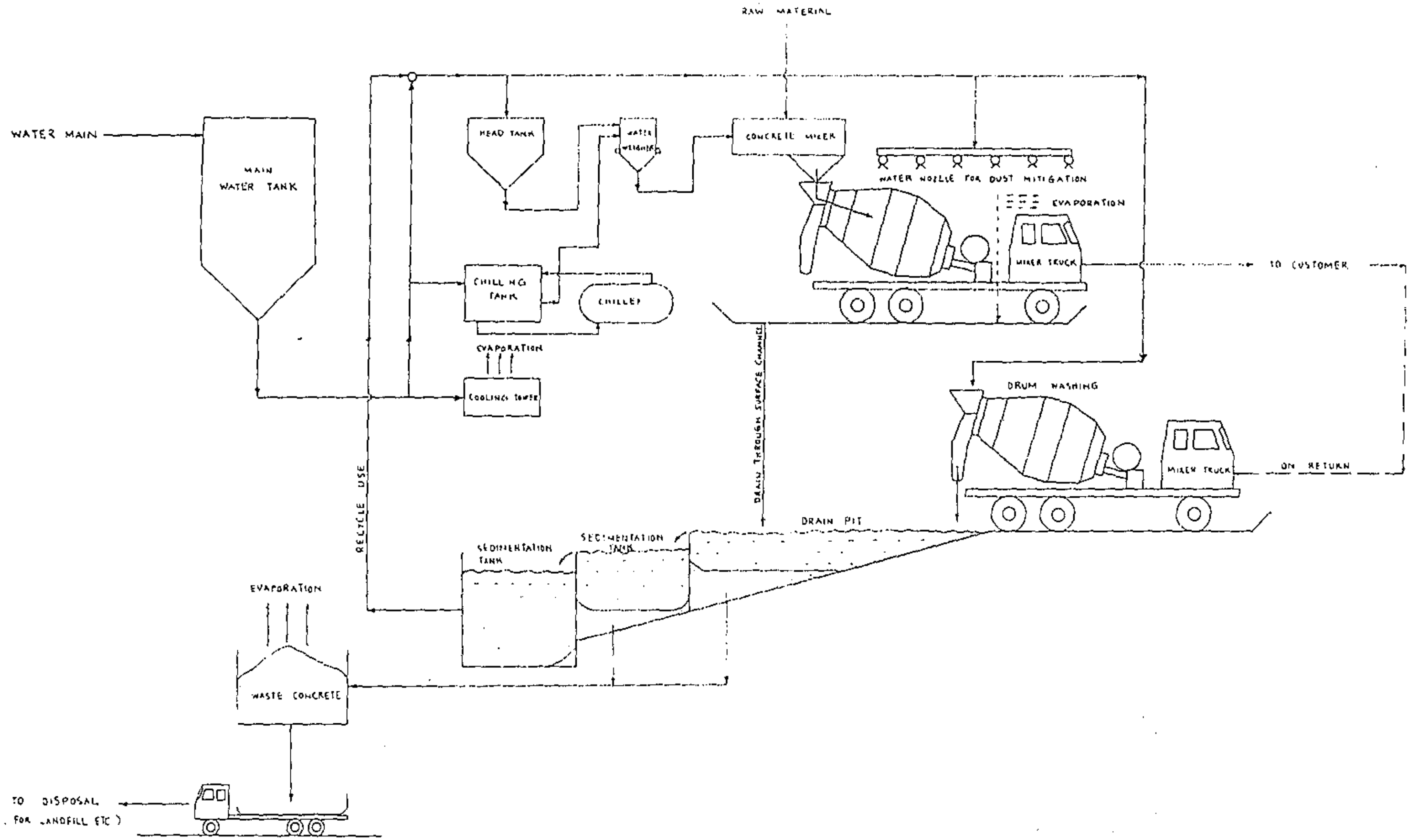


Figure : 5-1

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TITLE : Schematic Flow Diagram of Water Consumption Cycle of the Concrete Batching Plants

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

EHS Consultants Limited

Figure : 5-2

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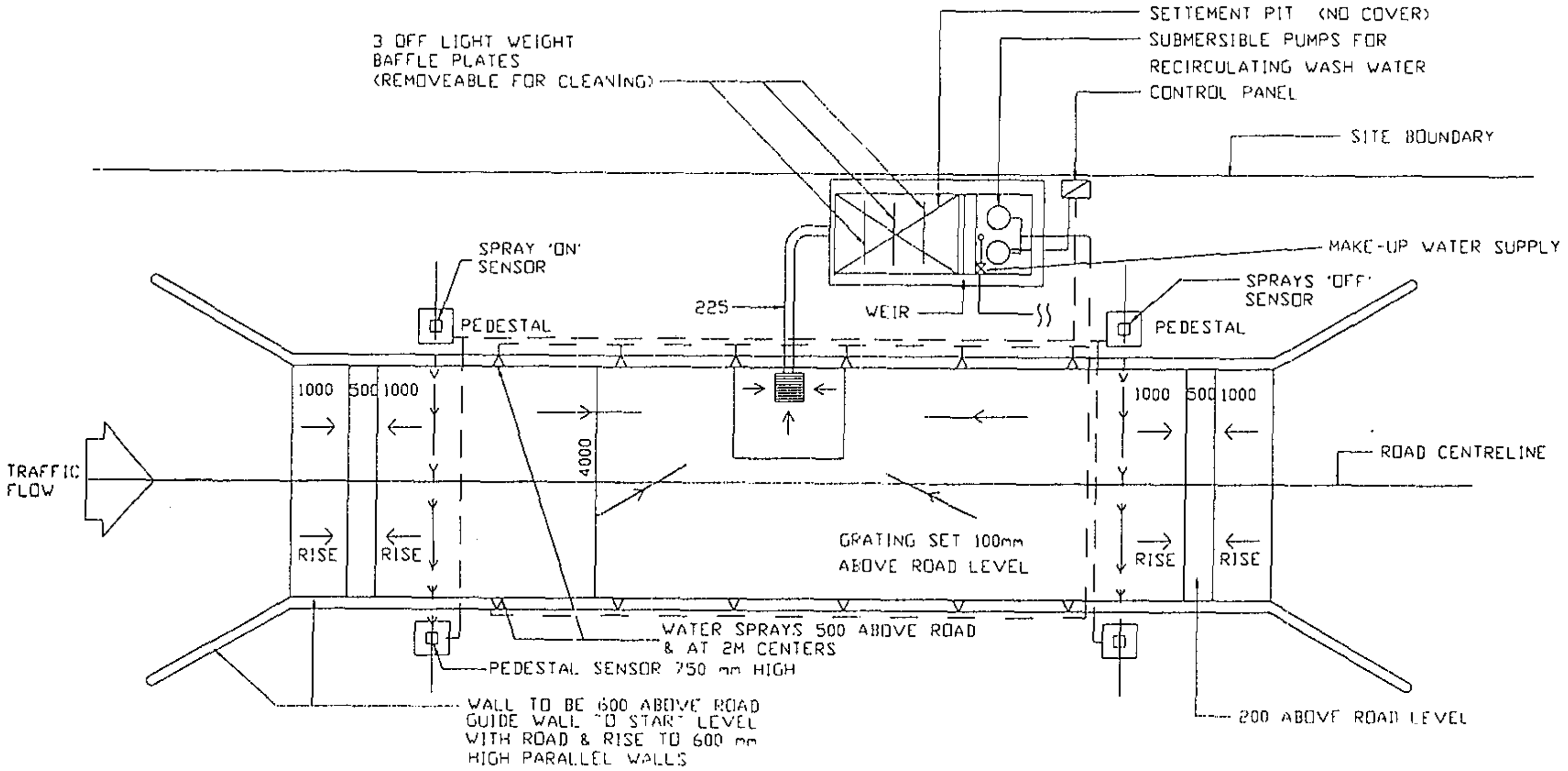

TITLE : Schematic Diagram of the Wheel Washing Facility

PROJECT : Cement and Concrete Batching Plants at Tsing Yi

EHS Consultants Limited

5.8.1 Suspended Solids Determination

The SS determinations will follow the method 2540D of Standard Methods for the Examination of Water and Wastewater (APHA.AWWA.WPCF 18th ed., 1992). Water samples shall be collected in high density polythene bottles, packed in ice (cooled to 5°C without being frozen), and delivered to the laboratory as soon as possible after collection. Upon arrival at the laboratory, samples shall be well mixed and filtered (with a vacuum of less than 381 mmHg) through pre-weighed Whatman GF/C filters immediately. A Millipore hand-operated filtration assembly shall be used to filter the water samples. Particulates collected on the filter paper shall be stored at 5°C and be dried within 48 hours in a drying oven at 103°C until constant weight is reached on two consecutive weighings. Filter papers taken from the drying oven shall be cooled to room temperature in a desiccator prior to being weighed. An accurate electronic balance shall be used to give a precision level of 0.1 mg.

5.8.2 pH Determination

The pH determination will follow the method of APHA 18ed 4500-H^+ B for *in-situ* measurement by the electrometric method. The pH meter consisting of potentiometer, a glass electrode, a reference electrode, and a temperature-compensating device shall be used. The pH meter shall be accurate and reproducible to 0.1 pH unit with a range of 0 to 14.

5.9 Conclusions

Water quality impact during all stages of the four cement and concrete batching plants has been assessed. Foul water effluent generated from the offices and toilet facilities will be either contained by chemical toilets or be directed to public foul sewer for treatment in the Tsing Yi Sewage Disposal Plant. Service water arising from PIC and QHC, including water sprayed in the concrete loading area for dust suppression purpose and the drum/vehicle washing water, will be conveyed by properly designed drainage to a drain pit and a series of two sedimentation basins. The surplus water will be for concrete mixing or for floor/conveyor belt cleaning purposes.

Wastewater arising from the wheel washing facility at the vehicular exit of the concrete and cement plants will be settled and recirculated. Sufficient number of sediment traps will be provided to allow silt removal to the surface runoff prior to discharge into the public stormwater drain. Regular water monitoring will be conducted as necessary.

With the implementation of recommended mitigation measures, the possible impact on water quality shall be minimised to acceptable levels. It is not envisaged that water quality impact arising from the new cement and concrete batching plants will be considered as an key environmental issue in the EIA brief.

6. WASTE MANAGEMENT

6.1 Construction Phase

Site formation for the proposed plants has finished at the time of writing, there will be no further dredging or reclamation to be conducted. The quantities of the other miscellaneous construction wastes cannot be estimated at this stage but they are unlikely to be large The wastes would include mainly wood and metal scraps. The major waste production sources are:

- residues from construction materials/processes;
- plant and vehicle maintenance and servicing; and
- workforce generated wastes.

If the construction processes produce chemical wastes then the Contractor will be required to register with EPD as a Chemical Waste Proceducer and provided relevant information. All wastes which fall within the definition of chemical waste as described in the Waste Disposal (Chemical Waste) (General) Regulation will be disposed at the Chemical Waste Treatment Centre at Tsing Yi Island and will notify EPD prior to disposal.

It will be the contractor's responsibility to identify suitable site for disposal of the mentioned construction wastes. Construction wastes should be recycled wherever possible. Only when recycling is not feasible on technical and/or economic grounds, should the contractor dispose the waste of at an approved landfill site.

6.2 Operational Phase

The solid waste generated during the operational phase should be of limited quantity. The main sources will be from plant and vehicle maintenance, and workforce generated waste.

6.2.1 Plant and Vehicle Maintenance

Trucks and cement/concrete plants will require regular maintenance and servicing for efficiency as well as minimising noise and air pollution emission nuisance. This will generate limited amount of used lubricant, air filter bags and other consumable materials. Each plant will produce no more than one 50 gallon drum of chemical waste every month. All the chemical waste container will be properly labelled. Chemical wastes will be treated as described in the section above while other wastes which are relatively inert and solid materials are suitable for landfill disposal and can be disposed of via the normal waste stream.

6.2.2 Workforce Generated Wastes

Waste from workforce will consist of general refuse such as food scraps, paper and empty containers and also sewage. The general refuse will be of only minimal quantities and therefore is insignificant and they will be disposed either by RSD through lease conditions or by specialist contractor employed by the plants. Sewage issues has been addressed in the previous section and will not be an impact.

7. CONCLUSION

This Initial Assessment Report summaries a preliminary evaluation on the air quality, noise impact, water quality and waste issues of the proposed cement depot and concrete batching plants and the Tsing Yi Island

7.1 Air Impact

Of the above identified environmental issues, only the air quality will be considered as a key issue and will be addressed in details in a separate report namely; *EIA Volume 3: Environmental Impact Assessment Key Issue Report (Air Quality Impact Assessment)*, which will be submitted in a later stage. All other issues, which are not considered as key issues, have been addressed in the report and summarised in the following sections.

7.2 Noise Impact

With suitable and effective noise mitigation measures discussed in Section 4, the operational noise impact at the noise sensitive receivers will be within acceptable level. although the noise impact due to the construction works is temporary, works procedures will not be a nuisance to the surrounding environment.

7.3 Water Impact

Since all the site preparation for the proposed plants has been completed, there will not be any dredging or reclamation on site. Sufficient amount of chemical toilets will be provided on site for the workforces during the construction phase of the plants

Sewage from the workers on site will be discharged into Government's foul sewer during operational phase of the plants. Water generated from the dust suppression processes will be treated prior to discharge into public foul sewer.

7.4 Waste Management

Chemical wastes generated during the operational phase of the plants will be properly disposed by specialists contractors. Domestic waste generated by the workforce will be of only minimal qualities and will not create an environmental impacts.

ENVIRONMENTAL IMPACT ASSESSMENT
Final Assessment Report
Volume 3 : Key Issue Report (Air Quality Impact Assessment)

Hong Kong Cement/Concrete Batching Plant
and
Material Storage Facilities
at
North-West Tsing Yi Island

Reference : **R675/0895**

Prepared by : **EHS Consultants Limited**

Date : **August 1995**

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1. INTRODUCTION

1.1 Objective

Air quality impacts during the construction and operational phase of the cement and concrete batching plants (the plants) at North-West Tsing Yi Island will be the key issue to be addressed in this *Environmental Impact Assessment (EIA) Volume 3 : Key Issue Report (Air Quality Impact Assessment).* Location of the plants is shown in Figure 1-1 and their layout within the site is indicated in Figure 1-2. In order to demonstrate that the proposed plants will not generate any adverse air quality impact upon the nearby sensitive receivers, an air quality impact assessment was conducted.

This assessment provides detailed evaluation and assessment of air quality impacts arising from the construction and operational phase of the plants by computer modellings. Appropriate and best practicable means of dust mitigation measures will be proposed in accordance with the results obtained in the assessments.

1.2 Scope of Works

This Key Issue Report for the air quality impact assessment will address the following issues:

- measure existing and background air quality in the study area for the purpose of evaluating the cumulative air quality impacts of the proposed project;
- identification of representative sensitive receptors and/or potential affected uses;
- provision of an emission inventory of the air pollution sources;
- analysis of construction activities and related adverse air quality impact;
- analysis of on-site and off-site operational activities (after commissioning), their related air quality impact and characterization;
- assessment and evaluation of the net and cumulative air quality impacts of the air emissions identified above at the receptors identified;
- presentation of the predicted residual air quality impacts in the form of pollution contours, whenever practicable, for the examination of the land use implications of these impacts;
- proposals of effective mitigation measures to reduce the cumulative air pollution impacts to acceptable levels; and
- presentation of an Environmental Monitoring and Audit (EM&A) programme of dust monitoring during the operational phase of the cement and concrete batching plants.

1.3 Methodology

Hong Kong Environmental Protection Department (EPD) and United States Environmental Protection Agency (EPA) approved computer programme/models such as ISCST, FDM and Caline4 will be employed to predict the air pollutant concentrations due to various processes during the construction and operational phase of the plants.

Model control parameters and methods for presentation of results have been consulted and agreed with EPD prior to commencing the detailed studies. Discussions have been held with various technical groups of the EPD to agree on parameters to be used in the model and the analysis of results.

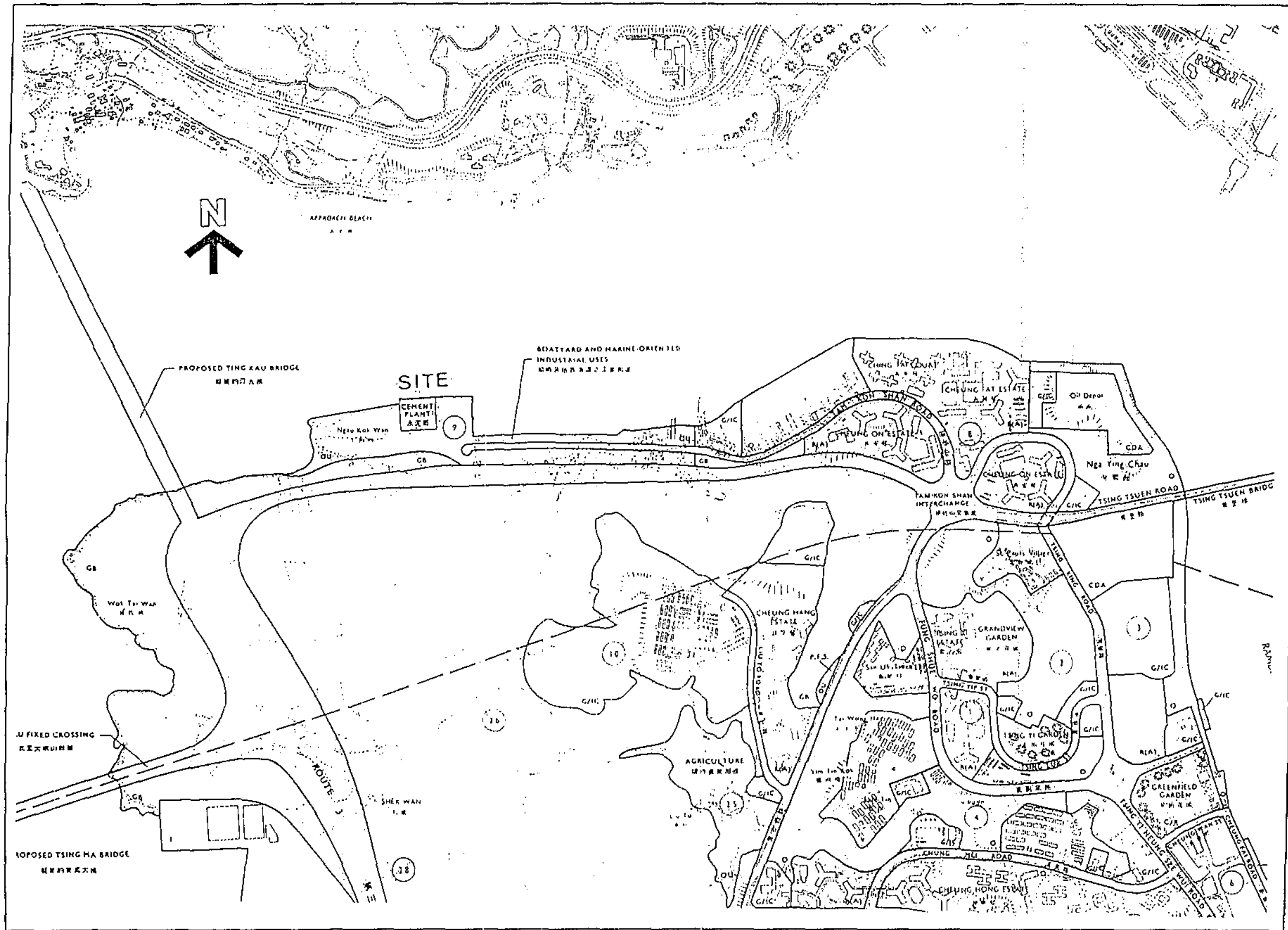

Figure :	1-1
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TITLE : Location of the Cement and Concrete Batching Plants at North-West Tsing Yi Island

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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Figure : 1-2

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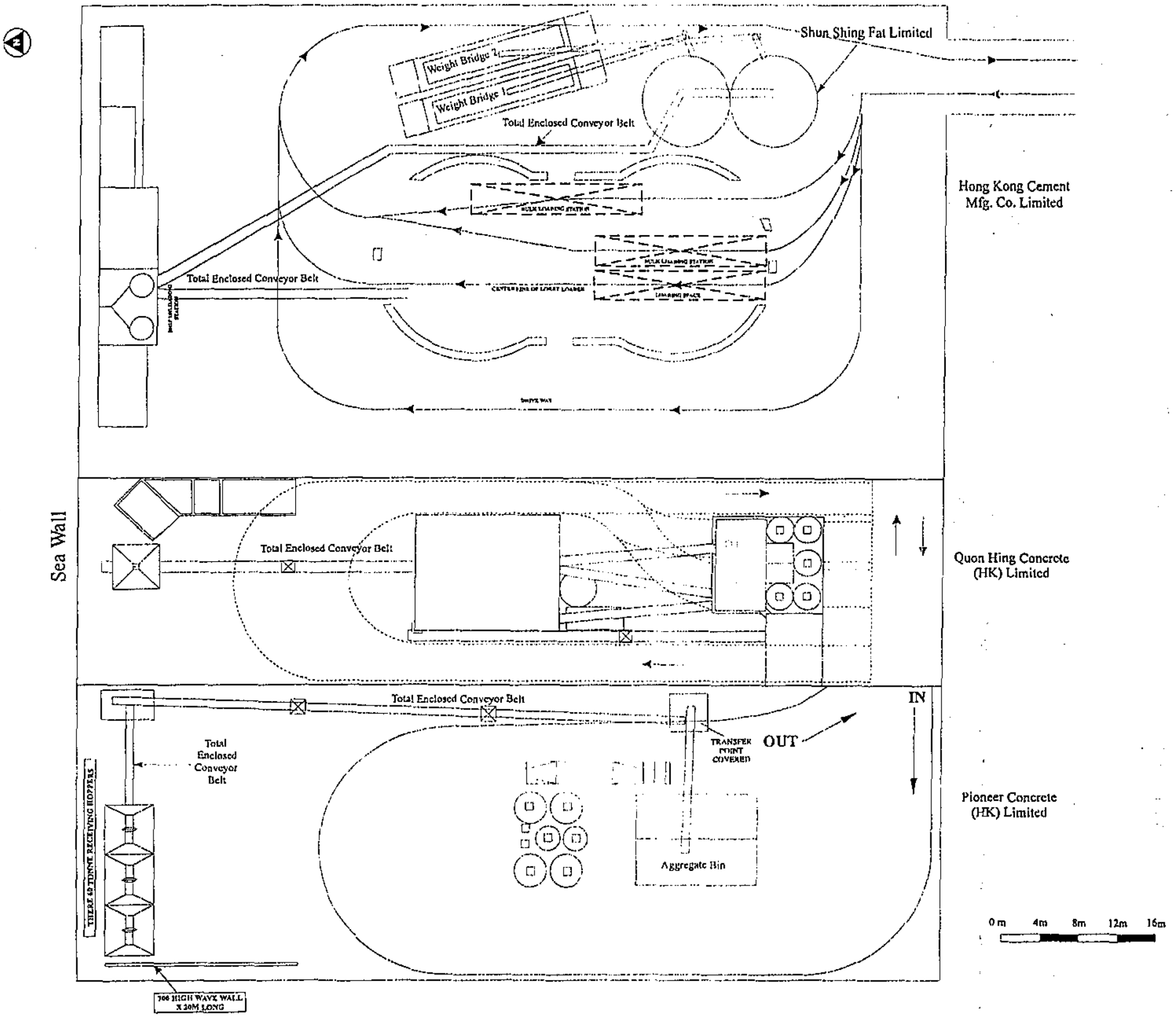

TITLE : Block Layout Plan of the Four Specified Processes Within the Site

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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2. ASSESSMENT CRITERIA

2.1 Emission Limits

With reference to the "*Best Practicable Means Requirements for Cement Works (Cement Depot and Concrete Batching Plant)*" issued by the Environmental Protection Department, all emission to air, other than steam or water vapour, shall be colourless and free from persistent mist or smoke. The maximum particulates emission limit from any point should not be more than 50 mg/m^3. The introduction of dilution air to achieve the emission concentration shall not be permitted.

2.2 Ambient Fugitive Emission Standards .

Assessment Criteria are based on the Air Quality Objectives (AQOs) for criteria pollutants presented in Chapter 9, "*Environment*", of the *Hong Kong Planning Standards and Guidelines* (HKPSG) for air pollution control. The standards used throughout the assessment are given in Table 3-1.

Table 2-1 Hong Kong Air Quality Objectives

Averaging Time	Pollutant Concentration Level (µg/m^3)				
	Sulphur Dioxide	Nitrogen Dioxide	Carbon Monoxide	Total Suspended Particulate	Respirable Suspended Particulate
1 Hour^1	800	300	30,000	N.A.	N.A.
8 Hours^2	N.A.	N.A.	10,000	N.A.	N.A.
24 Hours^2	350	150	N.A.	260	180
1 Year^3	80	80	N.A.	80	55
Emission Level*		-	-	50mg/m^3	-

(1) Not to be exceeded more than three times per year.

(2) Not to be exceeded more than once per year.

(3) Arithmetic means.

N.A. Not Available

* Best practicable Means requirement

3. CONSTRUCTION PHASE IMPACT

During construction phase, the major pollutant would be dust particulate from the construction works. The only air pollutant concerned under this section are Total Suspended Particulate and Respirable Suspended Particulate which become air-borne by wind erosion during the construction phase of the proposed plants. Other pollutants such as carbon monoxide, carbon dioxide, nitrogen dioxide and sulphur dioxide generated by powered mechanical equipment fueled by diesel and vehicle exhaust on site are not taken into consideration since only minute quantities will be produced and their impacts upon nearby sensitive receivers are unlikely to be significant. Dust emission is most likely to arise from the following construction activities:-

- site investigation;
- earth moving and grading;
- transport of material on site;
- site formation and preparation;
- wind effect on material stockpiles;
- vehicle movements on unpaved roads and over construction site;
- loading and unloading of construction materials and excavated debris.

Parameters required for the construction dust emission assessment include site area, nature of construction activities, quantities of stockpiled materials, particle size multiplier, material silt content, particle size of different soil types, mean wind speed, material drop height, material moisture content, dumping device capacity, mean number of wheels of the vehicles, rainfall data, work methods and sequence of different types of work areas.

At the moment, the site formation which is the most dust generating process for the proposed cement and concrete batching plants has been completed. The outstanding construction works to be commenced will be the erection of cement and concrete batching silos, factory buildings and installation of machineries. All these activities involve mainly steelworks or machineries assembly. Since minimum dust emitting sources will be involved at this stage of the construction phase, fugitive dust emission from the site would be minimal. Given the large buffer distance between the site and the nearest sensitive receiver, construction phase dust impact shall be within acceptable level. Good site management procedures will be implemented by the site engineer in order to minimise dust emission. As a result, it will no longer be necessary to address the construction phase dust impact upon any nearby sensitive receivers since this stage of the construction phase will not generate any adverse air quality impacts

4. VEHICULAR EMISSION IMPACT ASSESSMENT

4.1 Source Types and Emission Strength

Typical air pollutants related to vehicular emissions including Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), and Respirable Suspended Particulates (RSP) are considered in this section. The concentration levels of these pollutants are related to the engine operational mode, vehicle type and age, road characteristics, and the distance to allow dispersion of the emitted pollutants. Hence the total emission depend on the vehicle speed, predicted flow rate and traffic mix. However, the rate of emission control strategy in Hong Kong depends on the technological advance in vehicle emission control.

Projected traffic flows during the morning peak hour on the Tam Kon Shan Road before and after the plants being relocated were prepared by SPB Hong Kong Limited and summarised in Table 4-1 and 4-2 respectively. In addition, the traffic flow for the two scenarios at Tam Kon Shan Interchanged has also been estimated and shown in Table 4-3 and 4-4. Traffic forecast of the year 1995 is used when the plants will be commenced for operation.

Table 4-1 Estimated Traffic Flow On Tam Kon Shan Road before Plant Relocation

	Percentage				**Veh/hr**
	Petrol Vehicles	*Buses*	*Light Goods Diesel Vehicles*	*Heavy Goods Diesel Vehicles*	*Two-way Traffic Flows*
AM Peak Hour	50	8	8	34	220
PM Peak Hour	56	8	15	21	200

Table 4-2 Estimated Traffic Flow on Tam Kon Shan Road after Plant Relocation

	Percentage				**Veh/hr**
	Petrol Vehicles	*Buses*	*Light Goods Diesel Vehicles*	*Heavy Goods Diesel Vehicles*	*Two-way Traffic Flows*
AM Peak Hour	38	5	5	52	350
PM Peak Hour	37	5	8	50	360

Table 4-3 Estimated Traffic Flow at Tam Kon Shan Interchange before Plants Relocation

	Percentage			**Veh/hr**
	Petrol Vehicles	*Light Goods Diesel Vehicles*	*Heavy Goods Diesel Vehicles*	*Two-way Traffic Flows*
AM Peak Hour	25	52	23	969
PM Peak Hour	25	54	21	947

Table 4-4 Estimated Traffic Flow at Tam Kon Shan Interchange after Plant Relocation

	Percentage			**Veh/hr**
	Petrol Vehicles	*Light Goods Diesel Vehicles*	*Heavy Goods Diesel Vehicles*	*Two-way Traffic Flows*
AM Peak Hour	23	47	30	1089
PM Peak Hour	23	46	31	1107

Vehicle fleet average emission factor of the pollutants were provided by Vehicular Emission Control Section of the Environmental Protection Department (EPD) and reference were made to United State Environmental Protection Agency "*Compilation of Air Pollutant Emission Factor (AP-42), 1991*". The emission factor of the pollutants are listed Table 4-5.

Table 4-5 Emission Factor of the Vehicular Pollutants

Vehicle Type	**Year 1995 Emission Factor (g/km) - EURO1 Model**		
	CO	**RSP**	**NOx**
Passenger Car (petrol)	16.415	0.041	1.981
Light Diesel Vehicle	0.988	0.740	1.707
Heavy Diesel Vehicle	8.401	1.440	12.214

Vehicular modification factor was not applied to the EPD's pollutant emission factors during modelling. The emission factors for NOx was based on the assumption that NOx is a mixture of NO and NO_2 and a 20% conversion rate of NOx to NO_2 was adopted. NOx was modelled as "Inert Gas" with a molecular weight of 46g while RSP was modelled as "Particulate".

4.2 Vehicular Emission Dispersion Model

The pollutant level of vehicular emissions were evaluated by Caline4 - a computer dispersion model approved by the USEPA and the EPD. Modelling included traffic flow on Tam Kon Shan Road and Tam Kon Shan Interchange, relevant sections of the roads are sub-divided into segments together with information such as meteorological data, peak traffic volume and emission factors for the calculation of the pollutants. A typical Caline4 .LST file which contains all the control parameters, input data and the calculated pollutants concentration is given in Appendix I for reference.

4.3 Meteorological Data and Conditions

The most commonly occurred Pasquill class D with a wind speed of 2m/s (D2) was used as day-time weather condition, while F1 was used as night-time weather condition. A mixing height of 500m was used in the model. Wind direction standard derivation of 5° and 12° was applied to stability class F and D respectively. The worst case wind direction was predicted automatically by the model.

4.4 Air Sensitive Receivers

Concentrations of vehicular related pollutants were predicted along the edge of the Tam Kon Shan Road. Locations of the Air Sensitive Receivers (ASRs) are indicated in Figure 4-1. These ASRs includes the public housing areas, school sites and community facilities along the Tam Kon Shon Road.

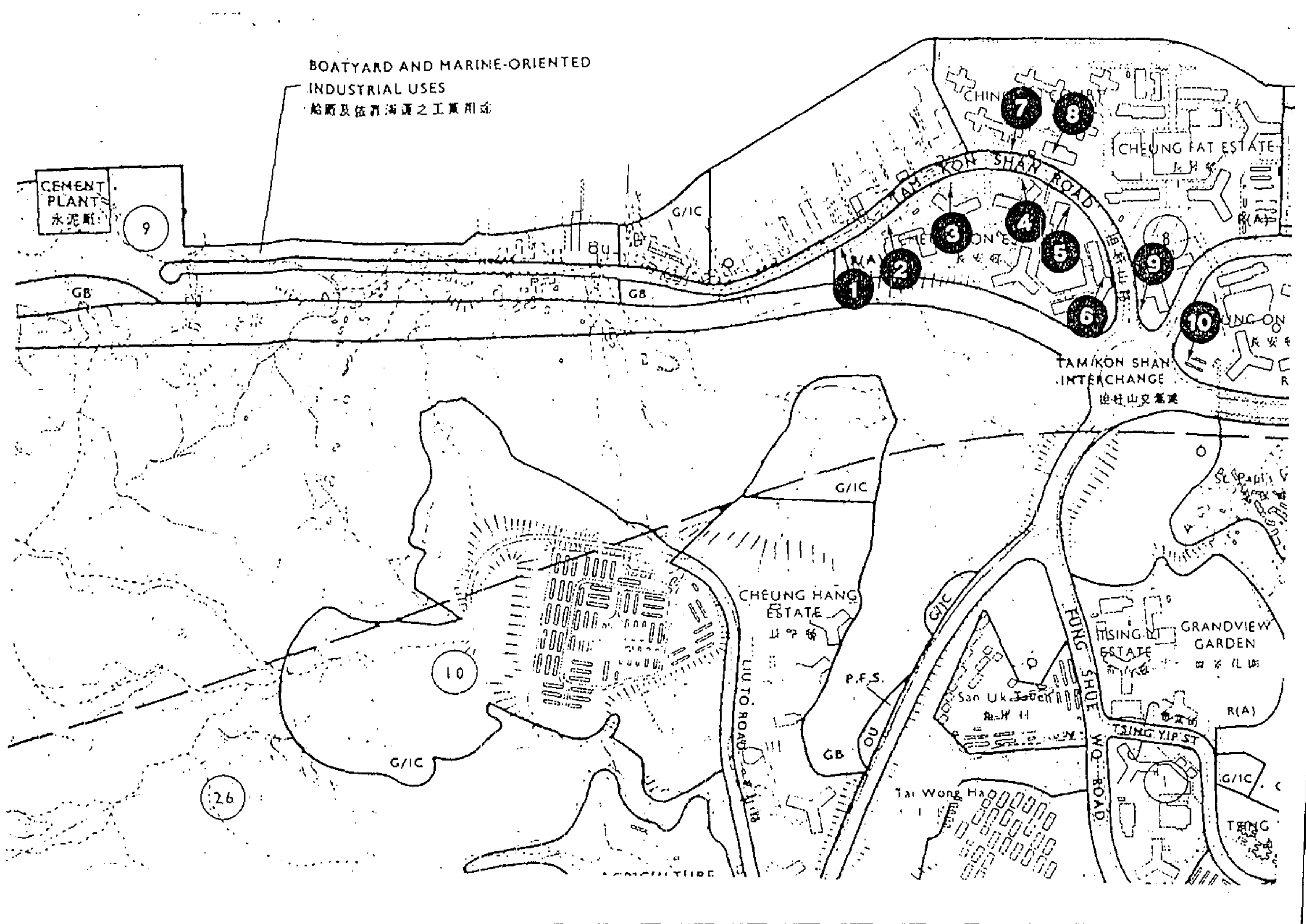
4.5 Caline4 Modelling Results

4.5.1 Vehicular Emission Levels Before Plants Relocation

The predicted highest 1-hour CO, NO_2 and RSP levels at ASRs along the Tam Kon Shan Road are presented in Table 4-6. The results indicated that the background vehicular related pollutants levels at all the ASRs locations are comfortably within the AQO standards.

Table 4-6 Predicted background Vehicular Emission Levels at the ASRs

ASR	Pollutants Concentration ($\mu g/m^3$)				
	CO	NO_2	RSP (1 Hr) (night-time)	RSP (1 hr) (day-time)	RSP (24 Hr)
C1	114.5	56.4	14.9	7.1	12.3
C2	114.5	37.6	11.4	5.0	9.3
C3	228.9	37.6	25.3	13.4	21.3
C4	228.9	37.6	22.2	11.7	18.7
C5	228.9	37.6	39.0	21.0	33.0
C6	457.9	37.6	113.3	49.3	92.0
C7	228.9	37.6	38.2	16.5	31.0
C8	228.9	37.6	53.0	22.5	42.8
C9	572.4	75.2	142.5	61.9	115.6
C10	343.4	37.6	95.5	38.2	76.4
AQO	*30,000.0*	*300.0*	-	-	*180.0*



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TITLE : Locations of ASRs for Caline4 Modelling

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4.5.2 Vehicular Emissions Levels After Plants Relocation

The predicted pollutants concentrations at all the ASRs after the relocation of the plants are shown in Table 4-7. The results are also compared with the AQO.

Table 4-7 Predicted Vehicular Emission Levels at the ASRs after Plants Relocated

ASR	Pollutants Concentration ($\mu g/m^3$)				
	CO	NO_2	RSP (1 Hr) (night-time)	RSP (1 hr) (day-time)	RSP (24 Hr)
C1	228.9	56.4	35.2	14.1	28.2
C2	114.5	37.6	27.6	9.9	21.7
C3	343.4	37.6	60.8	26.8	49.5
C4	343.4	37.6	46.2	23.6	38.7
C5	228.9	37.6	50.2	25.5	42.0
C6	457.9	75.2	146.1	59.8	117.3
C7	343.4	37.6	67.5	26.3	53.8
C8	343.4	37.6	80.9	32.6	64.8
C9	686.8	112.8	183.9	75.2	147.7
C10	457.9	75.2	126.0	47.1	99.7
AQO	*30,000.0*	*300.0*	-	-	*180.0*

The predicted CO concentration are within a narrow range of about 115 to 687μ/m^3, which is only about 2% of the AQO.

The predicted highest 1-hour RSP levels at the ASRs are in the range of 9.9 to 183.9μg/m^3. Taking a 24-hours average by assuming two third of the day is in D2 weather condition and the remaining one-third in F1 weather condition, the time weighted RSP levels were in the range of 22 to 117μg/m^3, which is 12 to 65% of the 180μg/m^3 AQO standard.

The predicted highest 1-hour NO_2 levels at all the ASRs are less than 113μg/m^3. The result is only about 37% of the 300μg/m^3 AQO standard.

4.6 Conclusion

The vehicular emission levels at the Tam Kon Shan Road and Tam Kon Shan Interchange before and after the plants relocation have been predicted.

The traffic volume of the Tam Kon Shan Road for the year 1995 is light Even added on the traffic generated from the plants, the pollutants concentration at the ASRs are still well below the AQO Standards. Whereas at the Tam Kon Shan Interchange, the traffic volume is already heavy and congested, and resulted a much higher background pollutants levels than that of the Tan Kon Shan Road. Nevertheless, after the relocation of the plants, the pollutants levels of the ASRs near the Tam Kon Shan Interchange have increased slightly but not significantly worse, and the level is still within the AQO.

Therefore, the assessment can concluded that after the relocation of the cement and concrete batching plants, the cumulative vehicular emission level will be within acceptable level and will not generate any adverse air quality impacts upon the ASRs. The results indicated that the vehicular emission at ground level ASRs along the Tam Kon Shan Road and Tam Kon Shan Interchange will be easily within the AQO standards. Large margin is still available for traffic expansion in that area before the vehicular emission reaches the AQO standards.

5. DUST EMISSION IMPACT ASSESSMENT

The only air pollutants concerned in this section are Total Suspended Particulate (TSP) and Respirable Suspended Particulates (RSP) which are resulted from various plant operational processes. Other pollutants such as carbon monoxide, carbon dioxide, nitrogen dioxide and sulphur dioxide generated by the plants on site are not considered since only minute quantities will be produced and their impacts are unlikely to be significant. Block layout plan of the four cement works is shown in Figure 5-1.

5.1 Source Types and Processes

During the operational phase of the cement and concrete batching plants, dust can be raised from the following activities and processes:

- aggregate stockpiles;
- transport of raw materials on site;
- engine exhaust from cement barges;
- loading of cement and concrete trucks;
- ventilation form dust filtration treatments;
- loading and unloading of aggregates and other raw materials; and
- vehicle movements on paved roads within the plants' boundary;

Parameters required for the dust emission assessment include site area, nature of operational processes of the four plants, sequence of different types of work, quantities of stockpiled materials, dust suppression method and their efficiency, material silt content, dust particle size distribution, wind speed, materials drop height , materials moisture content, on site vehicle speed, vehicle movement on and off-site, and rainfall data.

5.1.1 Hong Kong Cement Manufacturing Co. Limited

Hong Kong Cement Manufacturing Co. Limited (HKC) is a cement storage and distribution plant with an annual processing capacity of 600,000MT. Specifications of the plant are listed in Table 5-1. Block layout plan and schematic flow diagram of the plant is shown in Figure 5-2 and 5-3 respectively.

Cement is stored in enclosed compartments and transported to the sea front of the plant by company barges. The cement is off-loaded to the cement storage silos by enclosed pneumatic conveying system. Distribution route of the plant is mainly to the concrete batching plants next door. In addition, cement will be transported to other users by bulk cement trucks or in bagged form. Dust emission points of the plant and the control equipment used to serve the dust emission points are listed in Table 5-2 and 5-3.

5.1.2 Shun Shing Fat Limited

Shun Shing Fat Limited (SSF) is another cement work at the premises with its operational scale much smaller than HKC. Plant details are shown in Table 5-1. Its location is indicated in Figure 5-1. Block layout plant and schematic flow diagram of the plant is shown in Figure 5-4 and 5-5 respectively. Dust emission points of the plant and the control equipment used to serve the emission points are listed in Table 5-4 and Table 5-5.

5.1.3 Pioneer Concrete (HK) Limited

Pioneer Concrete (HK) Limited (PI) operates a concrete batching plant with an installed hourly production rate of about 200m^3 of concrete per hour. The processing capacity of the plant will be 125m^3/hr. The plant is located at western side of the premise as indicated in Figure 5-1. In order to reduce any potential environmental nuisances to the public, the best practicable means of dust control measures will be implemented at various dust emission points of the plant. Block layout plan and schematic flow diagram of the plant is shown in Figure 5-6 and 5-7, respectively. Dust mitigation measures for each emission point are listed in Table 5-6 and 5-7.

5.1.4 Quon Hing Concrete Co. Limited

Quon Hing Concrete Co. Limited will operate a concrete batching plant at the premises with an installed hourly concrete output of about 200m^3/hr. The maximum production rate of the plant will be 125m^3/hr. Location of the plant is shown in Figure 5-1. Block layout plan and schematic flow diagram of the plant is presented in Figure 5-8 and 5-9 respectively. The best practical measures of dust control measures will be designed and built into various operational processes and these measures are detailed in Table 5-8 and Table 5-9.

Table 5-1 Details of the Proposed Existing Cement Works at North-West Tsing Yi Island

	Hong Kong Cement	**Shun Shing Fat**	**Pioneer**	**Quon Hing**
Cement silo capacity	2x 10000MT	2 x 1000MT	500MT	500MT
Processing capacity	600,000MT/year	300,000MT/year	200m^3/hr of concrete *(installed capacity)*	200m^3/hr of concrete *(installed capacity)*
Product	cement	cement	ready mixed concrete	ready mixed concrete
Operating hour	08:00 to 24:00	08:00 to 24:00	08:00 to 20:00	08:00 to 20:00
Distribution route	to the plants next door • *600MT/day* by bulk cement trucks • *300MT/day* • *7.5 trucks per hour* by bagged cement trucks • *200MT/day, 4500bags* • *one truck per hour*	by bulk cement trucks • *600MT/day* • *5 trucks per hour*	by mixer trucks to users • *max. 33 mixer trucks per hour*	by mixer trucks to users • *max. 33 mixer trucks per hour*

Figure : 5-1

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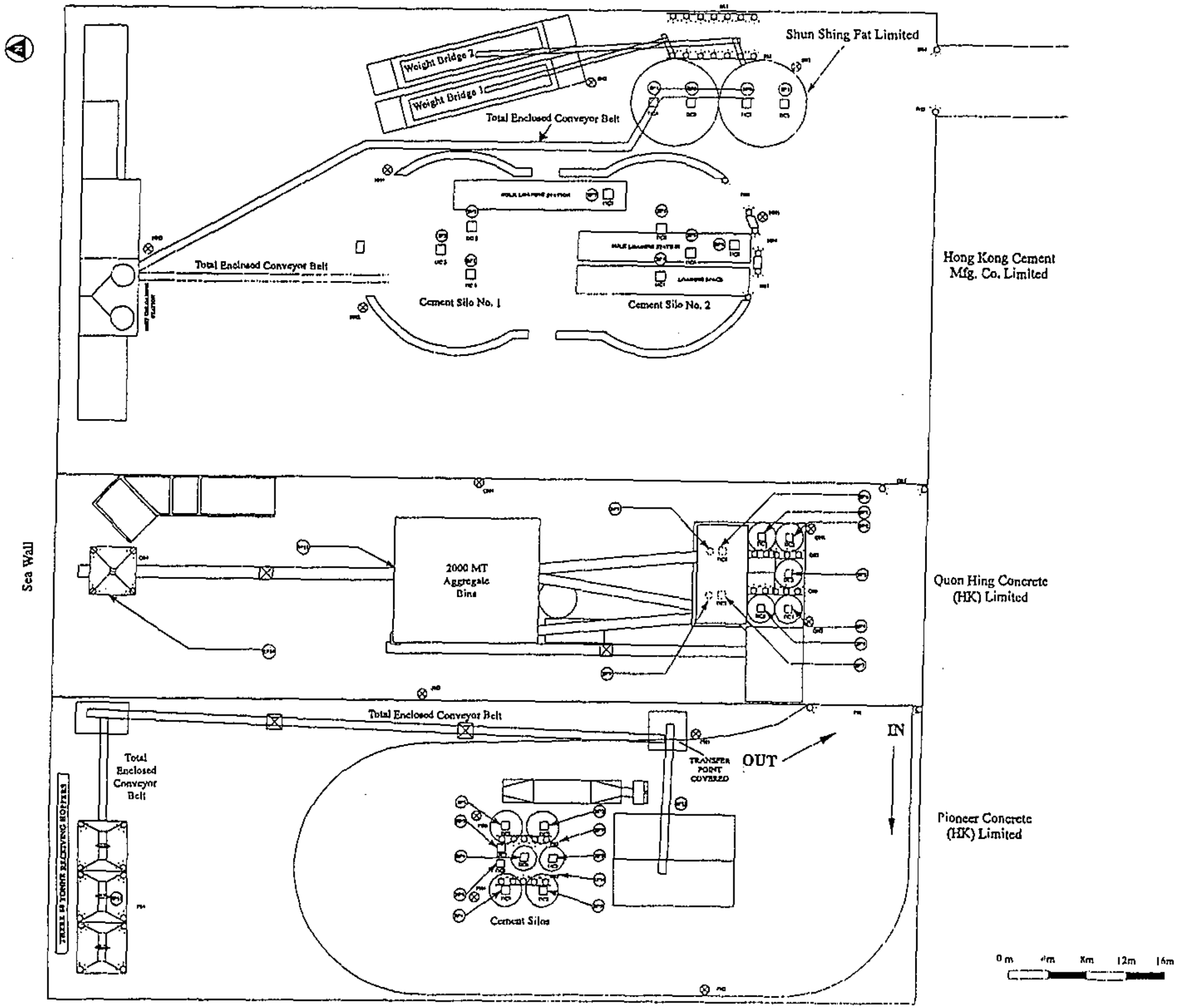

TITLE :	Block Layout Plan of the Cement Works at North-West Tsing Yi Island	PROJECT :	Cement and Concrete Batching Plant at Tsing Yi EIA Volume 3 : Key Issue Report (Air)	**EHS Consultants Limited**

Figure : 5-2

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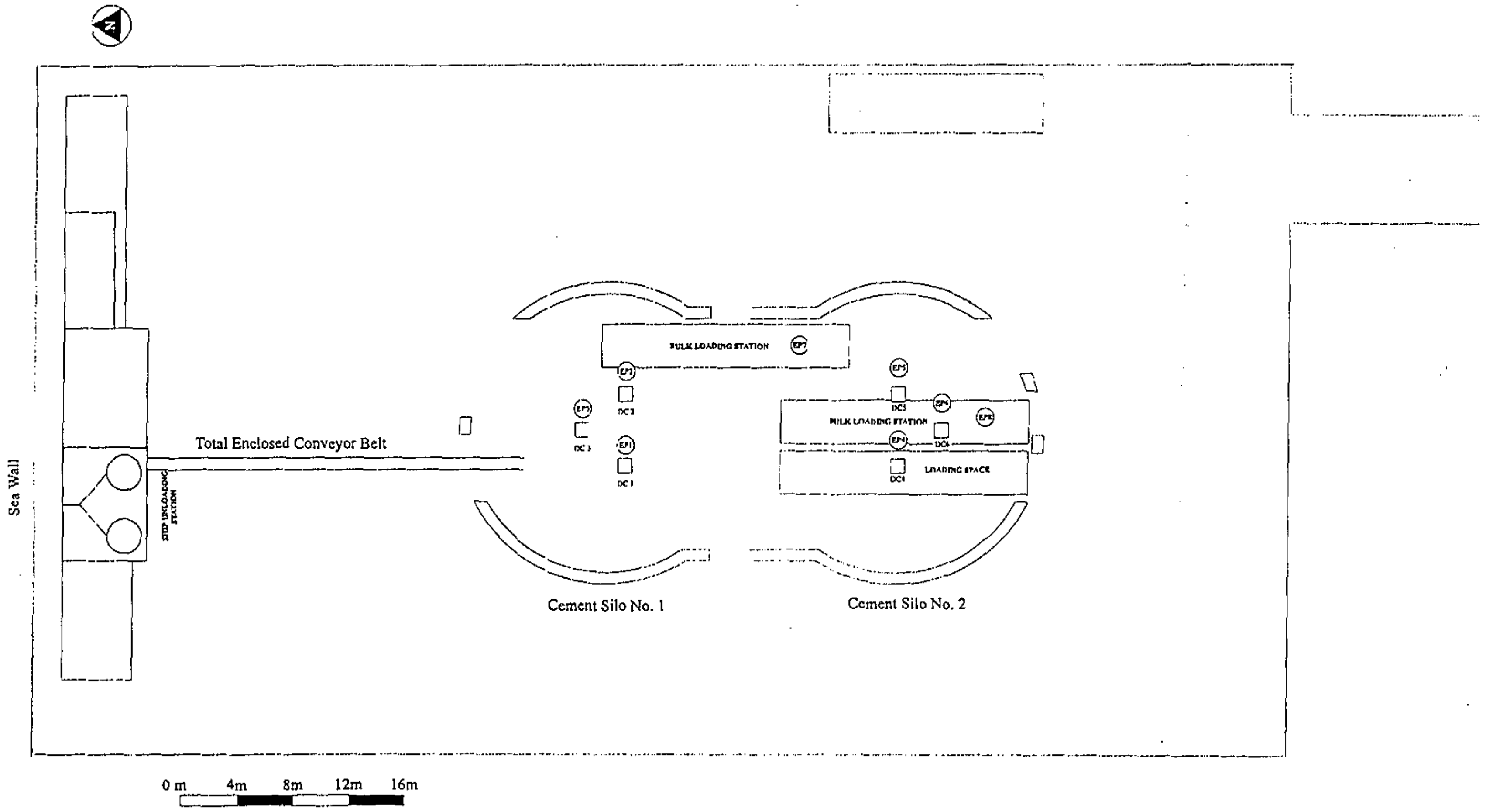

TITLE : Block Layout Plan of Hong Kong Cement Mfg. Co. Limited

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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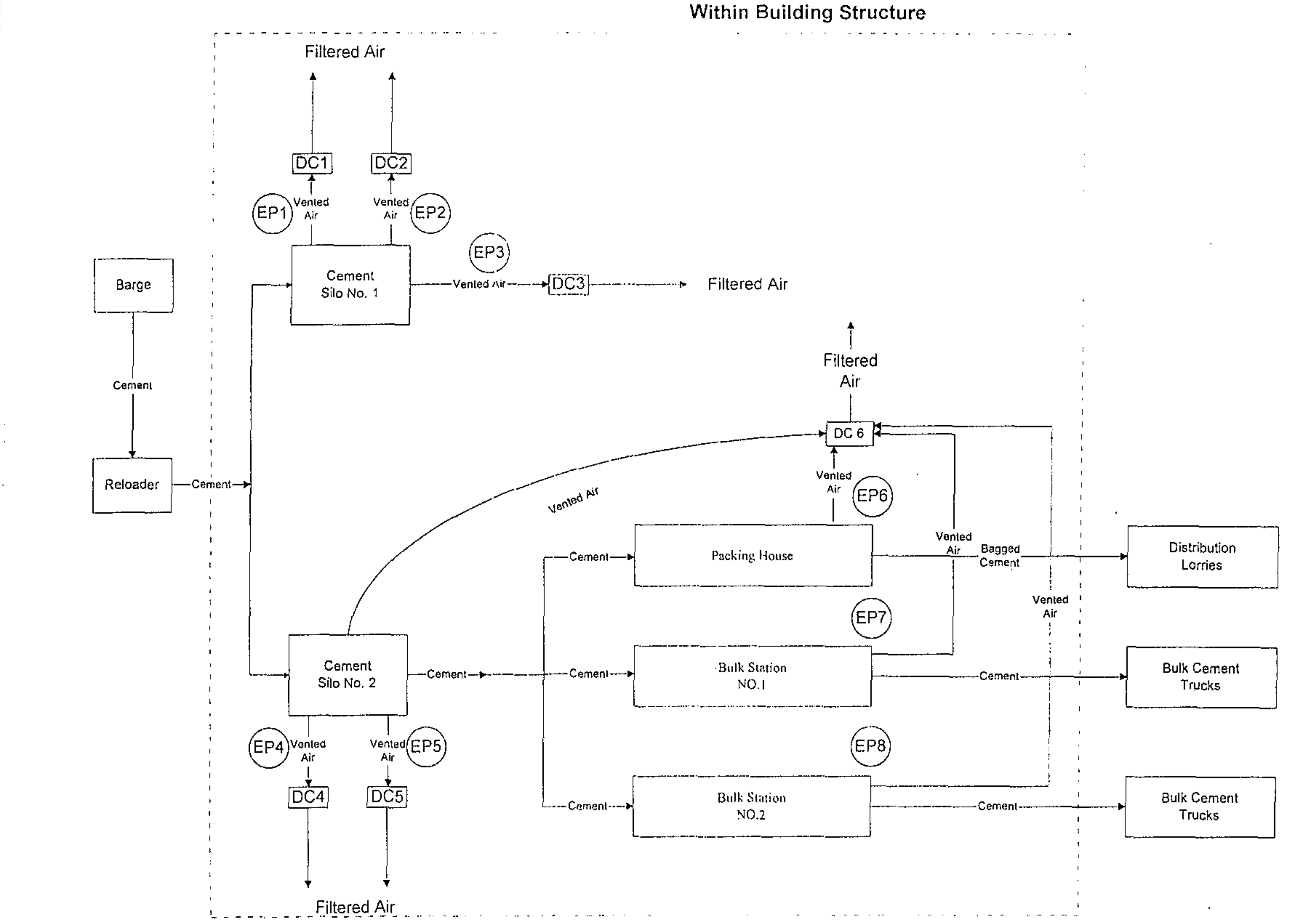

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TITLE : Schematic Flow Diagram of Hong Kong Cement Mfg. Co. Limited

PROJECT : Cement and Concrete Batching Plant at Tsing Yi EIA Volume 3 : Key Issue Report (Air)

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Table 5-2 Dust Control Equipment to be installed at Hong Kong Cement Mfg. Co. Limited

DUST CONTROL EQUIPMENT									
Emission Point	**Label**	**Type**	**Exhaust Fan Capacity (Kw)**	**Filter Media**	**Filter Area (m^2)**	**Exit Size dia. (m)**	**Filter Capacity (m^3/hr)**	**Efficiency (%)**	**Filter Bag Cleaning**
EP1	DC1	dust collector high level alarm	5.5	polyester felt	52.2	0.52	5100	99	pulse jet self-cleaning system
EP2	DC2	dust collector high level alarm	2.2	polyester felt	55.3	0.52	5100	99	pulse jet self-cleaning system
EP3	DC3	dust collector high level alarm	2.2	polyester felt	209	0.52	15000	99	pulse jet self-cleaning system
EP4	DC4	dust collector high level alarm	2.2	polyester felt	55.3	0.52	5100	99	pulse jet self-cleaning system
EP5	DC5	dust collector high level alarm	2.2	polyester felt	55.3	0.52	5100	99	pulse jet self-cleaning system
EP6	DC6	dust collector high level alarm	2.2	polyester felt	104	0.65	16200	99	pulse jet self-cleaning system
EP7	DC6	dust collector	2.2	polyester felt	104	0.65	16200	99	pulse jet self-cleaning system
EP8	DC6	dust collector	2.2	polyester felt	104	0.65	16200	99	pulse jet self-cleaning system

Table 5-3 Dust Emission Points and Mitigation Measures of Hong Kong Cement Mfg. Co. Limited

Emission Process and Label	Technical Particulars	Dust Mitigation Measures
Cement barge	• Emission from compressor engines used to transfer of cement to storage silos • Emission of cement from the transfer process	• Periodic maintenance will be performed to ensure no excess air pollutants would be emitted from the compressor engine • Connection joint will be total enclosed to prevent any fugitive cement emission
Cement storage silos (EP1, EP2, EP4 & EP5)	• Loading of the cement silos by means of compressed air. • Cement dust emission may be caused due to venting of waste air inside the silo	• Fabric dust collectors will be installed on top of the cement silos for venting of waste air. High level alarms will be installed to warn of over-filling. • Details of the fabric dust collector is listed in Table 5-2
Cement loading heads (EP7 & EP8)	• Loading of cement into bulk tankers	• The loading bays are total enclosed with fabric dust collectors fitted on top • The loading spout will be inserted completed into the cement truck and connected to a fabric duct collector • The loading system is fitted with a high level alarm to warn over-filling • Hatch cover of the bulk cement trucks will be firstly closed before the trucks move out of the loading area • Details of the fabric dust collector is listed Table 5-2
Cement packing station (EP6)	• packing cement into bags	• The packer is installed in an enclosed area. Fabric dust collector is installed on top of the packing station. • Details of the fabric dust collector is listed Table 5-2
Distribution lorries	• Loading bagged cement	• The loading area is within an enclosed environment. Lorries are covered with clean tarpaulin sheet. The tarpaulin shall be properly secured.
Traffic movement on site	• Dust emission due to traffic movement	• All access roads within the premises will be paved and adequately wetted during operational hours. • Traffic movement on site will be restricted to 5kph. Public roads close to the premises will be wetted frequently by the plant operator.

Figure : 5-4

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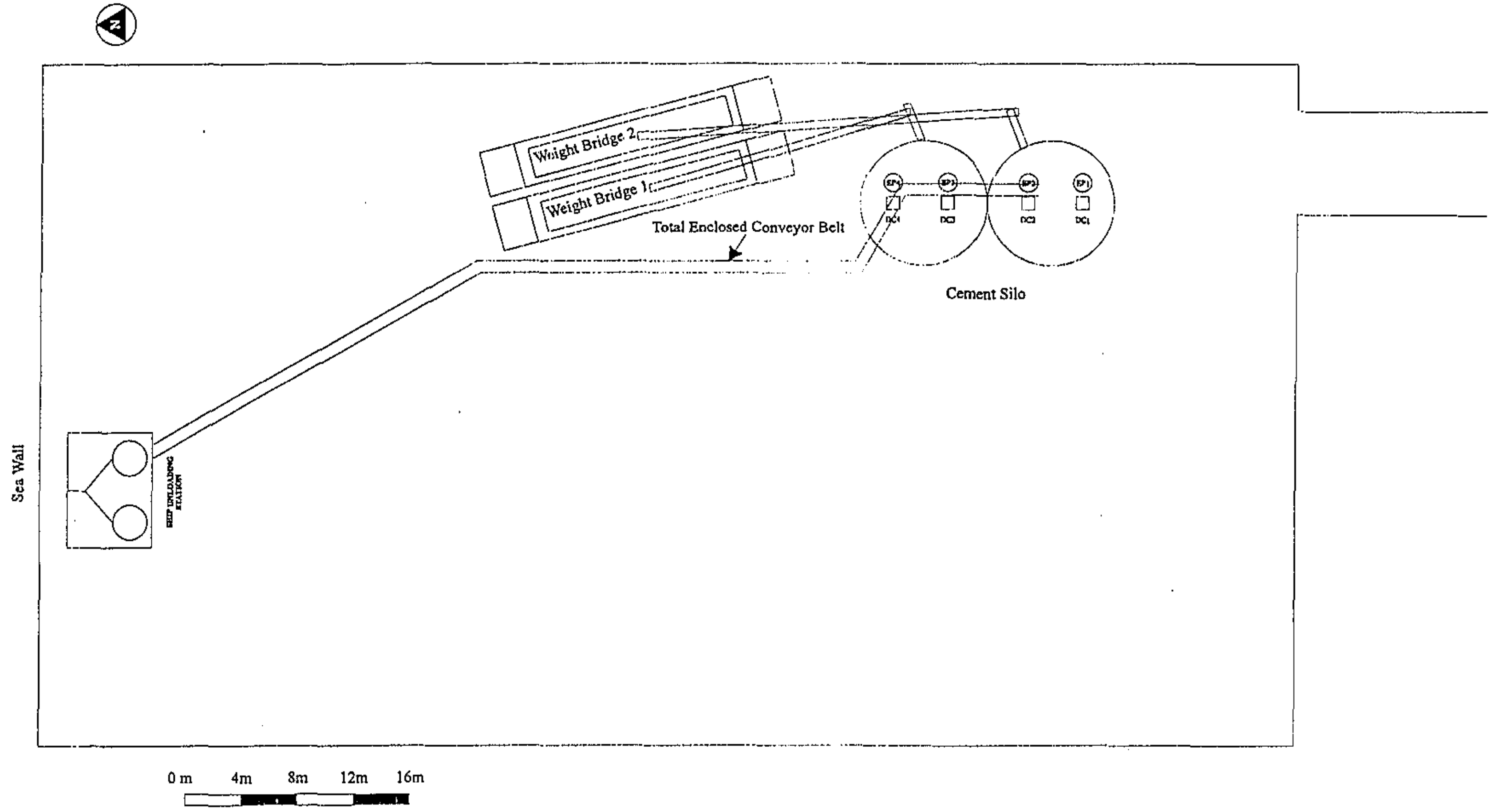

TITLE : Block Layout Plan of Shun Shing Fat Limited

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Figure : 5-5

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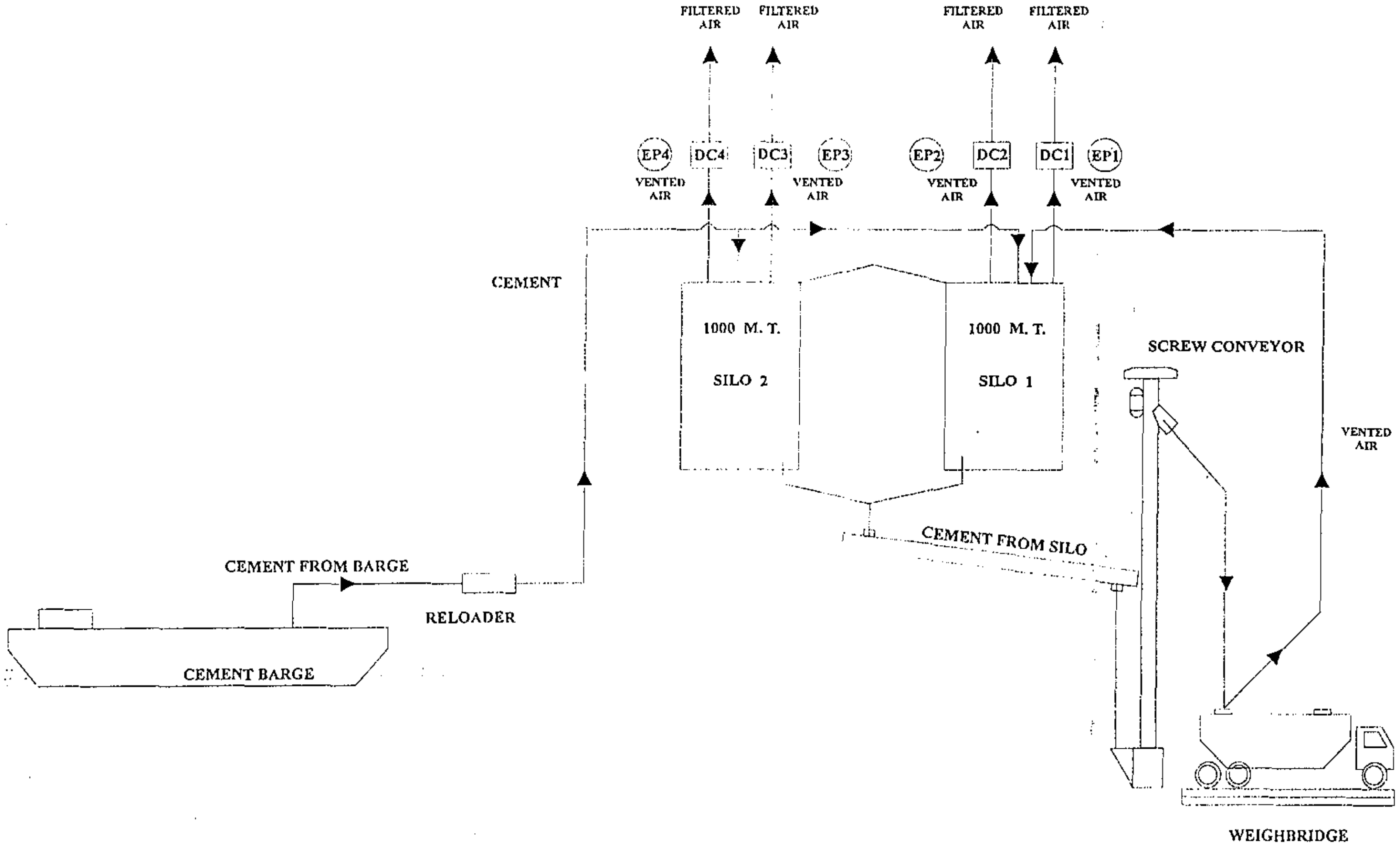

TITLE : Schematic Flow Diagram of Shun Shing Fat Limited

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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Table 5-4 Dust Control Equipment to be Installed at Shun Shing Fat Limited

DUST CONTROL EQUIPMENT									
Emission Point	**Label**	**Type**	**Fan Size Diameter (mm)**	**Filter Media**	**Filter Area (m^2)**	**Exit Size (m)**	**Filter Capacity (m^3/hr)**	**Efficiency (%)**	**Filter Bag Cleaning**
EP1	DC1	dust collector high level alarm	630	polyester felt	16.9	dia. 0.2	2400	99	pulse jet self-cleaning system
EP2	DC2	dust collector high level alarm	430	polyester felt	16.9	0.075 x 0.15	2400	99	pulse jet self-cleaning system
EP3	DC3	dust collector high level alarm	846	polyester felt	26.4	0.15 x 0.2	2400	99	pulse jet self-cleaning system
EP4	DC4	dust collector high level alarm	630	polyester felt	16.9	dia 0.2	2400	99	pulse jet self-cleaning system

Table 5-5 Dust Emission Points and Mitigation Measures of Shun Shing Fat Limited

Emission Process and Label	Technical Particulars	Dust Mitigation Measures
Cement barge	• Emission from compressor engines used to transfer of cement to storage silos • Emission of cement from the transfer process	• Periodic maintenance will be performed to ensure no excess air pollutants would be emitted from the compressor engine • Connection joint will be total enclosed to prevent any fugitive cement emission
Cement storage silos (EP1, EP2, EP3, EP4)	• Loading of the cement silos by means of compressed air. • Cement dust emission may be caused due to venting of waste air inside the silo	• Fabric dust collectors will be installed on top of the cement silos for venting of waste air. High level alarms will be installed to warn of over-filling. • Details of the fabric dust collector is listed in Table 5-4
Cement loading heads	• Loading of cement into bulk tankers	• The loading bay is total enclosed with fabric dust collector fitted on top • The loading spout will be inserted completed into the cement truck and connected to a fabric duct collector • The loading system is fitted with a high level alarm to warn over-filling • Hatch cover of the bulk cement trucks will be firstly closed before the trucks move out of the loading area • Details of the fabric dust collector is listed Table 5-4
Traffic movement on site	• Dust emission due to traffic movement	• All access roads within the premises will be paved and adequately wetted during operational hours. • Traffic movement on site will be restricted to 5kph. Public roads close to the premises will be wetted frequently by the plant operator.

Figure : 5-6

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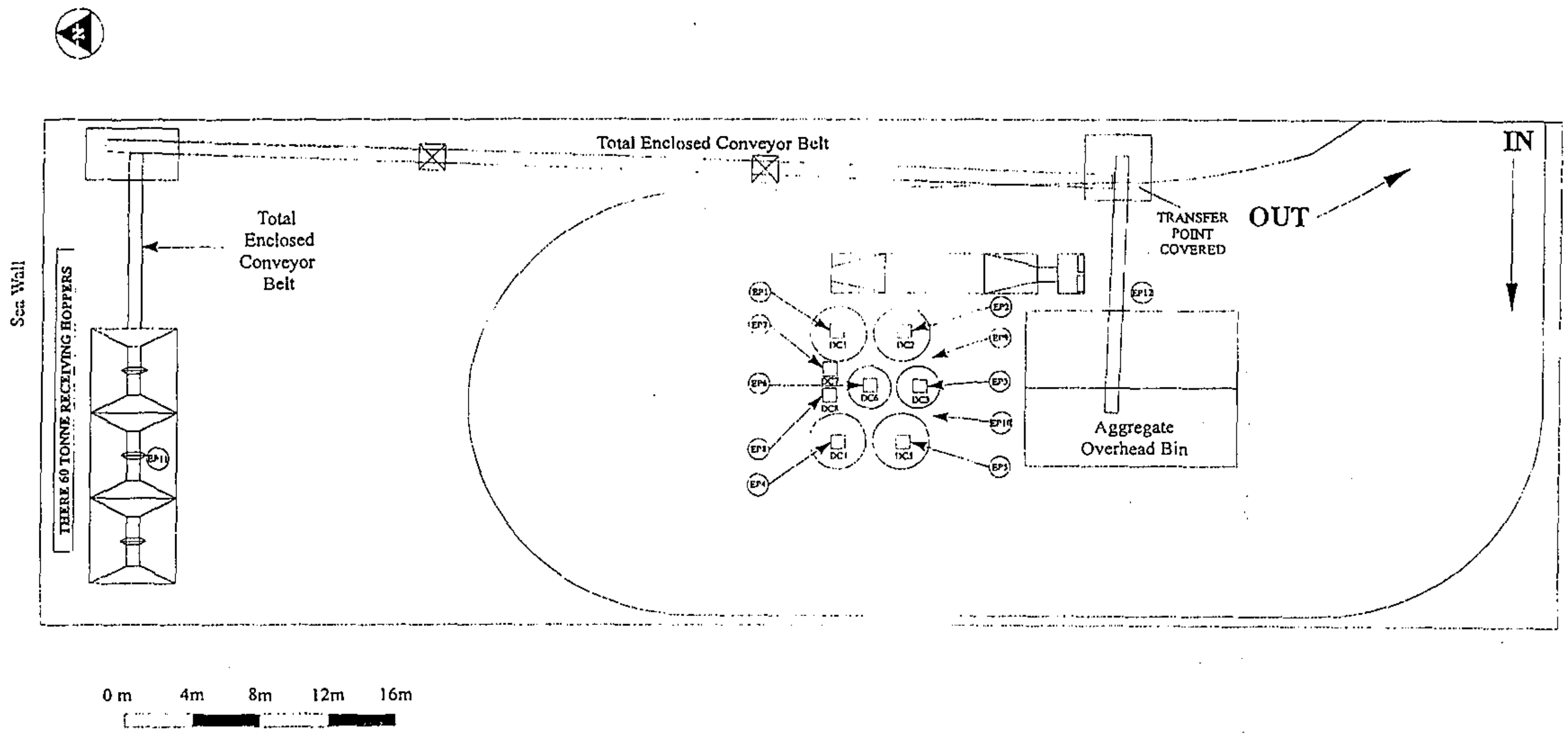

TITLE : Block Layout Plan of Pioneer Concrete (HK) Limited

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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Figure : 5-7

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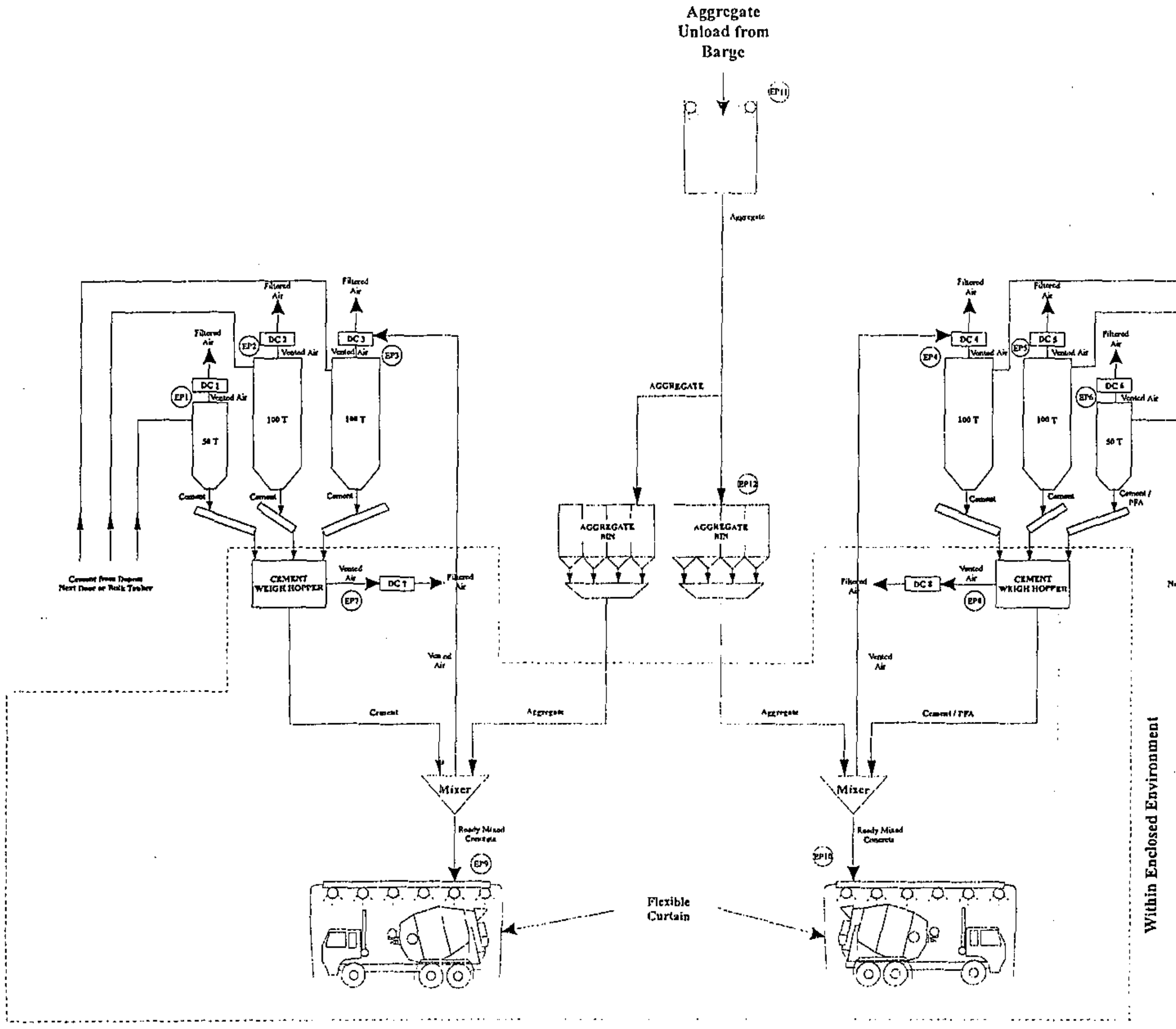

TITLE : Schematic Flow Diagram of Pioneer Concrete (HK) Limited

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
EIA Volume 3 : Key Issue Report (Air)

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Table 5-6 Dust Control Equipment to be Installed at Pioneer Concrete (HK) Limited

Dust Control Equipment										
Emission Point	**Label**	**Type**	**Exhaust Fan Capacity (Kw)**	**Fan Size Diameter (mm)**	**Filter Media**	**Filter Area (m^2)**	**Exit Size (mm)**	**Filter Capacity (m^3/hr)**	**Efficiency (%)**	**Filter Bag Cleaning**
EP1	DC1	dust collector high level alarm	2.2	450	polyester felt	10	250*100	1700	99	pulse jet self-cleaning system
EP2	DC2	dust collector high level alarm	2.2	450	polyester felt	10	250*100	1700	99	pulse jet self-cleaning system
EP3	DC3	dust collector high level alarm	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP4	DC4	dust collector high level alarm	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP5	DC5	dust collector high level alarm	2.2	450	polyester felt	10	250*100	1700	99	pulse jet self-cleaning system
EP6	DC6	dust collector high level alarm	2.2	450	polyester felt	10	250*100	1700	99	pulse jet self-cleaning system
EP7	DC7	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP8	DC8	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP9	DC3	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP10	DC4	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system

Table 5-7 Dust Emission Points and Mitigation Measures of Pioneer Concrete (HK) Limited

Emission Process and Label	Technical Particulars	Dust Mitigation Measures
Aggregate unloading from barge (EP11))	• Discharges aggregate to the receiving hoppers	• The receiving hoppers to be enclosed on top and 3 sides up to 3m above the unloading point and equipped with water spraying system
Belt conveyors	• Transports aggregate from the receiving hopper to the multiple chute	• Conveyors and transfer points are totally enclosed
Multiple chute (EP12)	• Aggregate delivered by the belt conveyor fall into the selected aggregate bin through the multiple chute	• Area around the multiple chute to be totally enclosed.
Aggregate weigh hoppers (EP7 & EP8)	• Aggregates discharged into the concrete mixer	• Area around the aggregate weigh hoppers are totally enclosed • A dust collector will be installed. Details of the dust collector is listed in Table 5-6
Cement / PFA silos (EP1 to EP6)	• Loading cement / PFA from bulk tanker by means of compressed air flow • Dust emission may be caused due to venting of waste air inside the silo.	• Fabric dust collectors will be installed on top of the cement silos for venting of waste air. High level alarm will be installed to warn of over-filling • Details of the dust collectors are listed in Table 5-6
Cement weigh hoppers (EP7 & EP8)	• Cement discharged into the cement weigh-hopper, dust may be emitted through the venting pipe.	• Venting pipes of the cement weigh-hoppers will be connected to a fabric filter. Area around the cement weigh-hopper to be totally enclosed Details of the dust collectors are listed in Table 5-6
Concrete mixer (EP9 & EP10)	• Aggregates and cement discharged into the concrete mixer for mixing	• the area to be vented by a duct connecting to a fabric duct collector. Details of the dust collectors are listed in Table 5-6 • Area around the concrete mixer to be totally enclosed and with adequately wetted. Entrance and exit covered with flexible curtain.

Figure : 5-8

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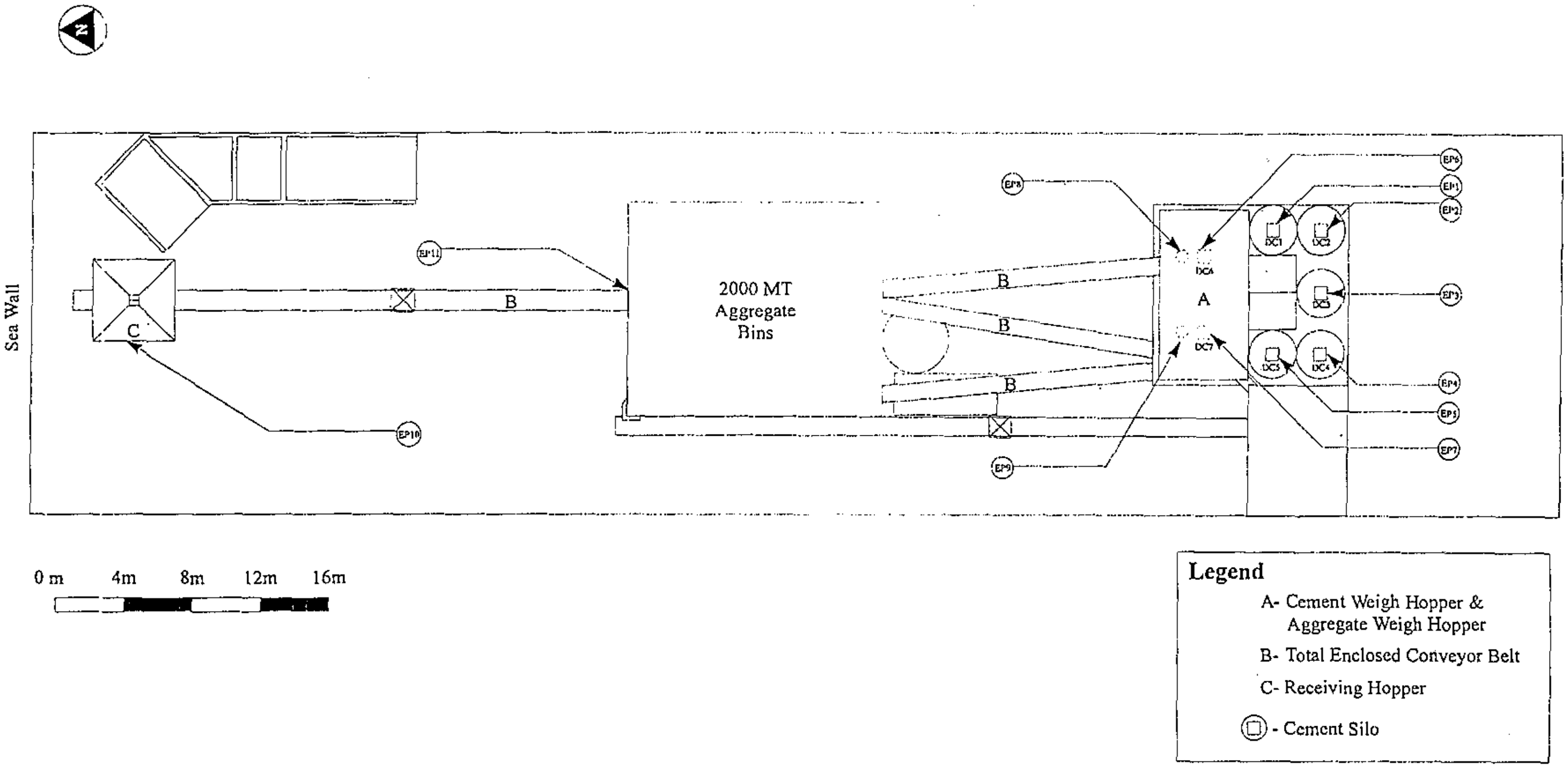

TITLE :	Block Layout Plan of Quon Hing Concrete Co. Limited	PROJECT :	Cement and Concrete Batching Plant at Tsing Yi EIA Volume 3 : Key Issue Report (Air)	**EHS Consultants Limited**

Figure : 5-9

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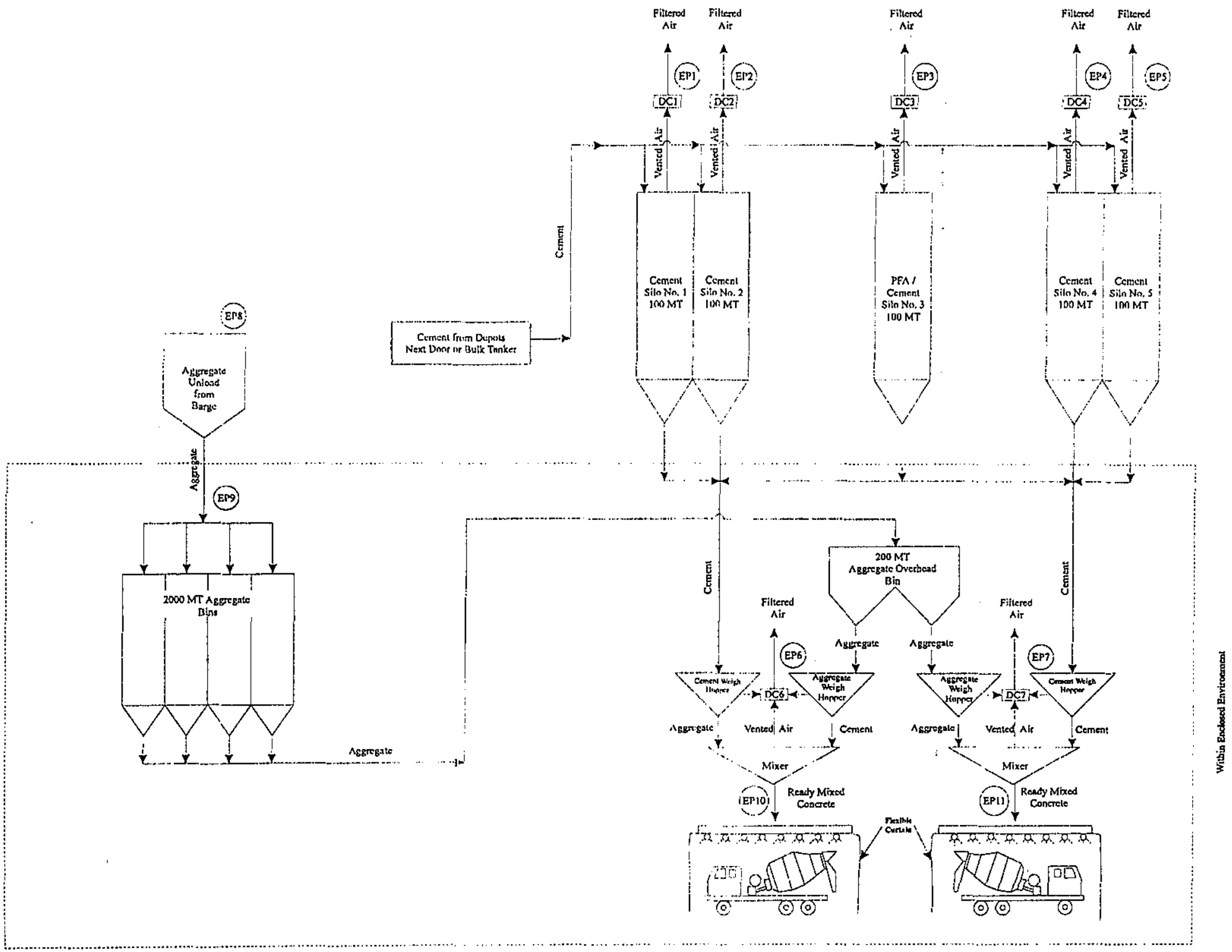

TITLE : Schematic Flow Diagram of Quon Hing Concrete Co. Limited

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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Table 5-8 Dust Control Equipment to be installed at Quon Hing Concrete Co. Limited

Dust Control Equipment										
Emission Point	**Label**	**Type**	**Exhaust Fan Capacity (Kw)**	**Fan Size Diameter (mm)**	**Filter Media**	**Filter Area (m^2)**	**Exit Size (mm)**	**Filter Capacity (m^3/hr)**	**Efficiency (%)**	**Filter Bag Cleaning**
EP1	DC1	dust collector high level alarm	2.2	450	polyester felt	10	110*240	1700	99	pulse jet self-cleaning system
EP2	DC2	dust collector high level alarm	2.2	450	polyester felt	10	110*240	1700	99	pulse jet self-cleaning system
EP3	DC3	dust collector high level alarm	2.2	450	polyester felt	10	110*240	1700	99	pulse jet self-cleaning system
EP4	DC4	dust collector high level alarm	2.2	450	polyester felt	10	110*240	1700	99	pulse jet self-cleaning system
EP5	DC5	dust collector high level alarm	2.2	450	polyester felt	10	110*240	1700	99	pulse jet self-cleaning system
EP6	DC6	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP7	DC7	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP8	DC6	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system
EP9	DC7	dust collector	15	800	polyester felt	10	510*320	10,000	99	pulse jet self-cleaning system

Table 5-9 Dust Emission Points and Mitigation Measures of Quon Hing Concrete Co. Limited

Emission Process and Label	Technical Particulars	Dust Mitigation Measures
Aggregate unloading from barge (EP8)	• Discharges aggregate from barge	• The receiving hoppers are 3-sides and top enclosed up to 3m above the unloading points total and equipped with water spraying system
Belt conveyors	• Transports aggregate from the receiving hopper to the multiple chute	• Conveyors and transfer points are totally enclosed
Multiple chute (EP9)	• Aggregate delivered by the belt conveyor fall into the selected aggregate bin through the multiple chute	• Area around the multiple chute to be totally enclosed.
Aggregate weigh hoppers (EP6 & EP7)	• Aggregates discharged into the concrete mixer	• Area around the aggregate weigh hoppers are totally enclosed. • An additional dust collector will be installed. Details of the dust collector is listed in Table 5-9
Cement / PFA silos (EP1 to EP5)	• Loading cement / PFA from bulk tanker by means of compressed air flow • Dust emission may be caused due to venting of waste air inside the silo.	• Fabric dust collectors will be installed on top of the cement silos for venting of waste air. High level alarm will be installed to warn of over-filling • Details of the dust collectors are listed in Table 5-8
Cement weigh hoppers (EP6 & EP7)	• Cement discharged into the cement weigh-hopper, dust may be emitted through the venting pipe.	• Venting pipes of the cement weigh-hoppers will be connected to a fabric filter. Area around the cement weigh-hopper to be totally enclosed. Details of the dust collectors are listed in Table 5-8
Concrete mixer (EP10 & EP11)	• Aggregates and cement discharged into the concrete mixer for mixing	• The area to be vented by a duct connecting to a fabric duct collector Details of the dust collectors are listed in Table 5-8. • Area around the concrete mixer to be totally enclosed and with adequately wetted. Entrance covered with flexible curtain.

5.2 Meteorological Conditions

The level of emission depends upon the way in which the nature and location of the emission sources interacts with a number of key hourly meteorological elements such as wind speed and direction, temperature, rainfall, Pasquill stability classes, and cloud cover. With increasing wind speeds, emitted pollutants are mixed to a greater extent with the ambient air, leading to higher dilution. However, higher wind speed coupled with ground surface turbulence can increase the rate of dust generated from various processes. For the purpose of modelling, it was assumed that the high wind speeds would coincide with a dry period. This represents a worst case condition in dust generation.

Apart from the mixing heights, hourly meteorological data of the year 1992 and 1993 from the Ching Pak House Weather Station on the Tsing Yi Island was obtained from the Royal Observatory of the Hong Kong Government and used in the modelling. Parameters used included:

- hourly wind direction;
- hourly wind speed with minimum assumed as 1m/s;
- hourly Pasquill stability class (A to F);
- hourly ambient air temperature (K); and
- twice daily mixing height (m) at King's Park Royal Observatory Weather Station.

The two concrete batching plants are only operated for approximately 10 hours a day. The daily dust level will be overestimated if all 24-hourly meteorological data are used in the model. Therefore, meteorological data only related to the operating hours of the plant was used. Figure 5-10 and 5-11 indicates that the prevailing wind directions recorded at Ching Pak House for year 1992 and 1993 on the Tsing Yi Island ranged from NNE to ENE.

5.3 Air Dispersion Model

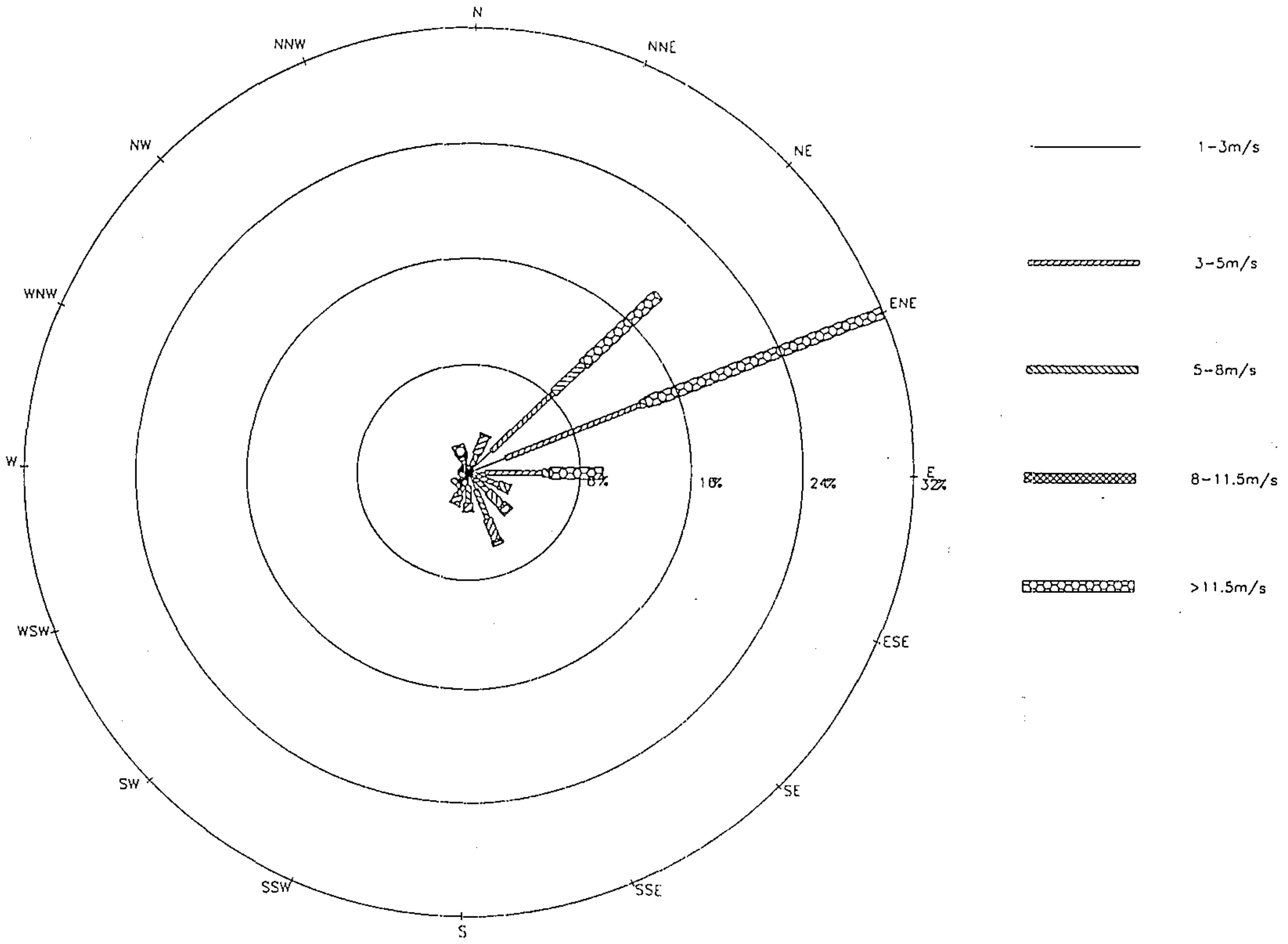
The dispersion of dust from the cement plants and concrete batching plant was studied and modelled using the computer softwares "*Industrial Source Complex Short Term (ISCST)*" and "*Fugitive Dust Model (FDM)*" developed by Trinity Consultants Incorporated. The models are based on the principle of Gaussian dispersion and is widely acceptable to Authorities worldwide including the United States Environmental Protection Agency (USEPA) and the Hong Kong Environmental Protection Department (EPD). The models are designed to predict both concentration and deposition from point, area, line and volume fugitive dust sources. Emission from the concrete batching plant was considered as point source, while site access roads are considered as line source, and dust concentration from these two sources were modelled by FDM. Due to the source emission height restriction of the FDM model, dust emission from the two cement plants were modelled by ISCST.

5.4 Particle Size Distribution

The potential drift distance of dust particulate is governed by the emission height, the particulate terminal settling velocity and the degree of atmospheric turbulence. The particle size distribution parameters for the FDM and ISCST modelling listed in Table 5-10 are based on the best available information and a cement fineness of $3500cm^2/g$,. Figure 5-12 illustrates a typical cement dust particle size distribution and cumulative size distribution, the information was extracted from *"Concrete Technology by A.M. Neville & J. J. Brooks, Longman Scientific & Technical"*

Figure : 5-10

Scale : ---



TITLE : Wind Rose of 1992 Ching Pak House Weather Station

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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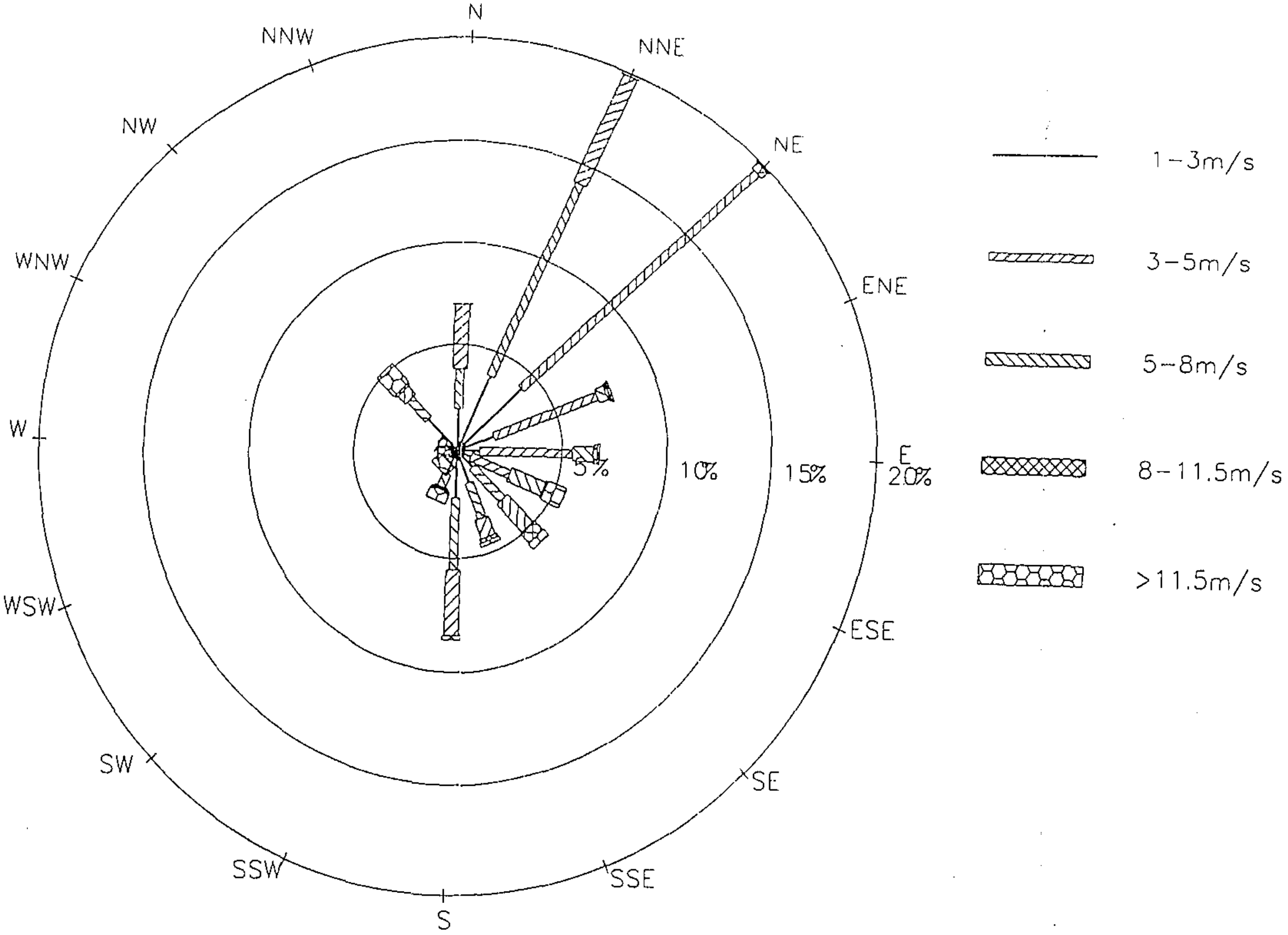

Figure : 5-11

Scale : ---

TITLE : Wind Rose of 1993 Ching Pak House Weather Station

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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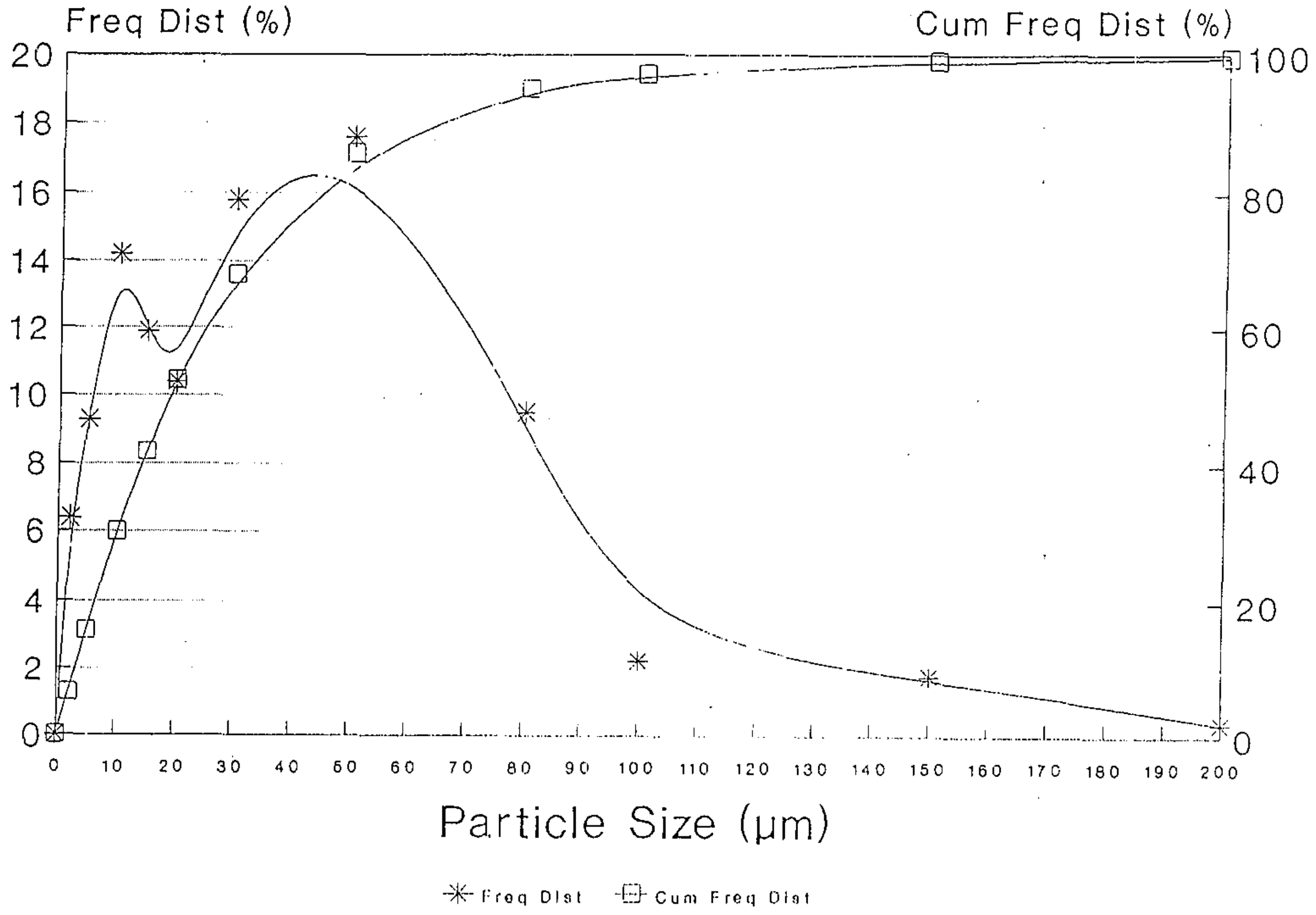
Figure : 5-12

Scale : ---



TITLE :	Particle Size Distribution of Cement	PROJECT :	Cement and Concrete Batching Plant at Tsing Yi EIA Volume 3 : Key Issue Report (Air)

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Table 5-10 Cement Particulates Size Distribution

Dust Diameter (μm)	Frequency Distribution	Cumulative Frequency Distribution
1	0.0363	0.0363
2	0.0311	0.0674
4	0.0622	0.1296
5	0.0363	0.1659
8	0.0881	0.2540
10	0.0518	0.3058
12	0.0674	0.3732
14	0.0466	0.4198
16	0.0311	0.4509
18	0.0518	0.5027
20	0.0518	0.5545
22	0.0311	0.5856
24	0.0312	0.6168
26	0.0311	0.6479
28	0.0415	0.6894
30	0.0207	0.7101
40	0.0933	0.8034
45	0.0518	0.8552
50	0.1451	1.0003

5.5 Air Sensitive Receivers

Sixteen discrete Air Sensitive Receivers (ASRs) D1 to D16 (Figure 5-13), which located around the cement works were selected for the dust emission impact assessment. Dust concentration at each ASR is modelled from ground level up to a vertical height of 50m above ground with 5m interval so that the dispersion of dust concentration at these ASRs can be investigated. In addition, dust concentration at the site boundary of the premises (B1 to B3) were modelled with a similar specification described above. In order to have a better picture of the dust impact of the cement works, ground level dust concentration level within 300m radius from the plant in form of contour was plotted and superimposed onto survey map.

D1 - southern side of Tsing Yan Temporary Housing Area (residential area)
D2 - northern side of Tsing Yi Temporary Housing Area (residential area)
D3 - western side of Cheung On Estate (residential area)
D4 - school site at Cheung On Estate (community area)
D5 - western side of Ching Tai Court (community area)
D6 - northern side of Cheung Hang Estate (residential area)
D7 - western side of Tsing Yi Estate (residential area)
D8 - centre of Cheung Fat Estate (residential area)
D9 - centre of Cheung On Estate (residential estate)
D10 - school site at Lam Tin (community area)
D11 - northern side of the propose district hospital (community area)
D12 - proposed secondary school site (community area)
D13 - proposed secondary school site (community area)
D14 - residential development above the Tsing Yi Railway Station (residential area)
D15 - shipyard next door (open repair yard) (industrial area)
D16 - office building of the shipyard (industrial area)
B1 - eastern site boundary
B2 - southern site boundary
B3 - western site boundary

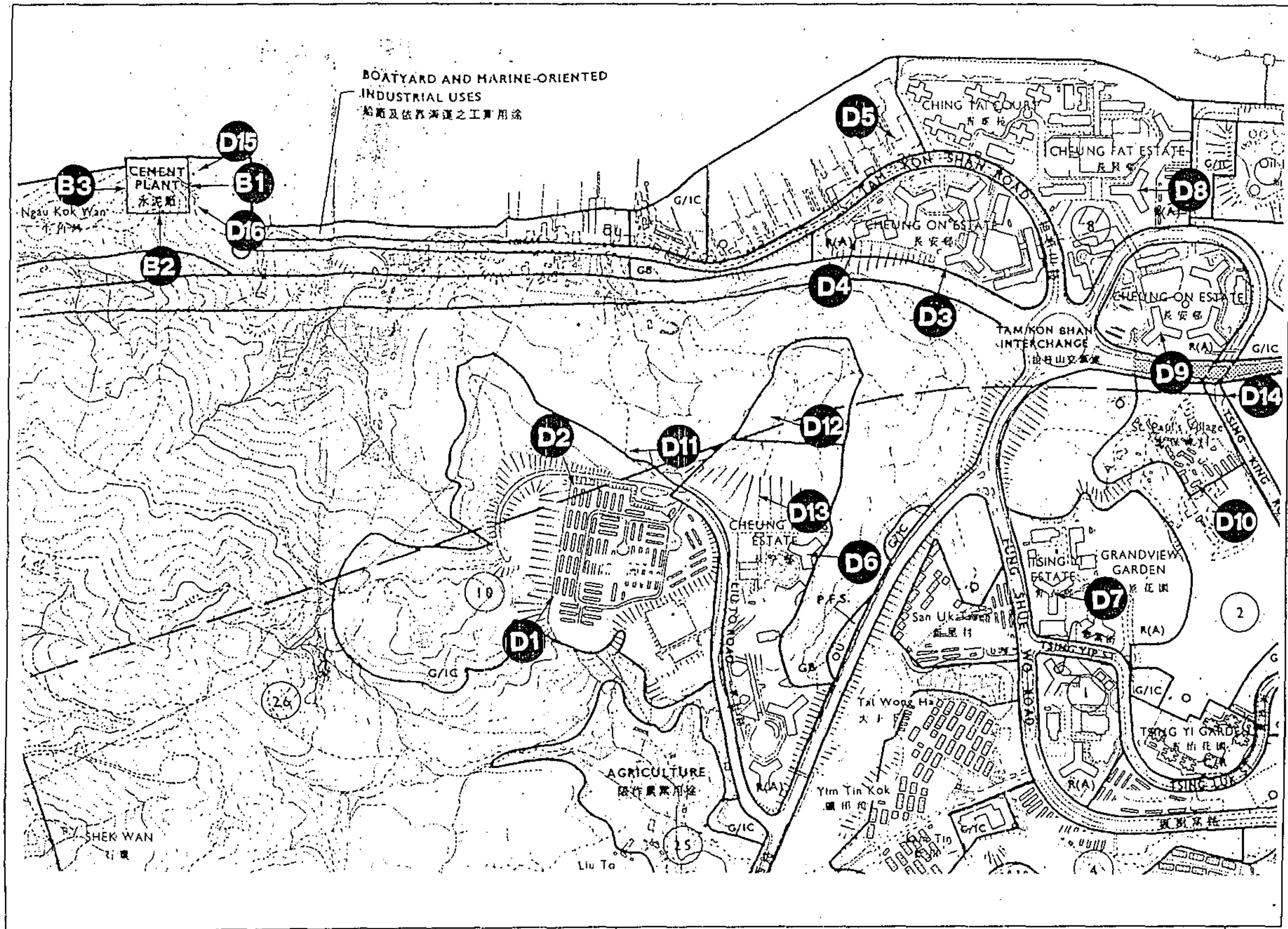

Figure : 5-13

Scale : ---

TITLE : Location of the Air Sensitive Receivers for the Dust Emission Impact Assessment

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
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5.6 Background Dust Concentration

Due to technical difficulties and on-going construction works for the North West Tsing Yi Interchange, dust background concentration at the northern part of Tsing Yi Island cannot be measured for this study. In view of these difficulties and the EPD does not operate an air quality monitoring station in the region, the background dust level in the area was made reference to EPD's ambient monitoring stations throughout the Territory, specially those areas with a lot of industrial emissions. EPD recorded an ambient dust level of about 100μg/m^3, 103μg/m^3, 91μg/m^3 and 90μg/m^3 for Kwun Tong, Sham Shui Po, Tusen Wan and Kwai Chung respectively, with an average of about 96μg/m^3. The ambient dust level at Tsing Yi Island at this stage may be higher than normal average due to various on-going construction works for strategic and PADS projects. Nevertheless, once these projects finished, the ambient dust level at Tsing Yi area in any case will not be higher than that recorded in heavily polluted industrial area in Hong Kong. In conclusion, the background dust concentrations for this study will be 100μg/m^3.

5.7 Emission from Paved Access Roads

Dust emission may be created from the paved access road within the site. Emission strength from this activity was referenced to *USEPA AP-42, "Section 11.2.6: Industrial Paved Roads"*. The quality of dust emission from a given segment of paved road proportional to the volume of traffic , silt content of the raid surface, mean vehicle speed, mean vehicle weight and mean number of wheels of the vehicles. The number of vehicles for the cement and concrete batching plants are listed in Table 5-11. The calculated emission strength from each segment of the site paved access road is enclosed in Appendix 2.

Sufficient number of automatic water sprinklers will be installed throughout the premise in order to keep the ground wet enough to prevent any dust emitting from the site paved roads due to traffic movement. The locations will be at the main entrance to the plants and common access roads to be used by the four plants. Manual water hoses will be installed at convenient locations, where drivers and plant operators can be easily accessible. These water hose can be used to wash off any dust deposited at the vehicle body where cannot be easily cleaned by any other means apart from direct spraying. Wheel washing facilities shall be provided and used by all vehicles after loading and leaving the premises to wash off any dust deposited on the wheels or vehicle body. Moreover, water blowers will be used frequently to spray the public roads in close vicinity to the premises so that no fugitive dust is emitting from the roads due the traffic movement.

Table 5-11 Vehicle Movement of the four Specified Processes

(based on maximum output of the plants)

Vehicle Type	No. of Vehicles per Hour			
	HKC	SSF	QH	PI
aggregate dump truck	0	0	0	0
bulk cement truck	7.5	5	0	0
bagged cement truck	1	0	0	0
concrete mixer truck	0	0	33	33

5.8 Stationary Source Emissions

5.8.1 Hong Kong Cement Manufacturing Co. Limited

5.8.1.1 Loading from Cement Barge

The main dust emission sources from HKC are from the cement storage silos (EP1 to EP5), loading of bulk cement trucks (EP7 & EP8) and packing cement into bags (EP6). Cement is off-loaded to the storage silos through enclosed pneumatic conveying system from company cement barges berthing at the sea front. Dust emitting from such loading process is negligible since the cement is carried in a totally enclosed environment. The connection and disconnection of the delivery hose of cement barge and the filling line of all cement silos shall be carried to minimize dust emissions. The dipping hole on all cement silos shall be maintained in good condition such that there shall be no fugitive dust emissions. These barges will undergo constant maintenance and regular check up to reduce any unpleasant emission from the barge engine. The compressor engines used to transfer cement into the storage silo is located in a totally enclosed environment, dust emission from the compressor engines is minimal.

5.8.1.2 Handling and Storage of Cement

Cement is stored in dust tight silos with dust control equipment (DC1 to DC6) installed on top of the silos. Dust laden-air from the cement silos shall be extracted and vented to the dust collectors to meet the particulate emission limited of 50mg/m^3 . These dust collector can have a dust control efficiency of at least 99% with proper and regular maintenance {Labahn 1983 & ASHARE 1979}. All the maintenance works will be handled by in-house professional personal. In additional, high level alarm will be installed to the silos to warn of over-filling. The high-level alarm indicators will be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed. This is the best practicable means of dust prevention methods for cement storage and dust emitted from such process is minimal.

5.8.1.3 Loadout of Cement

Cement loading to the bulk trucks will be undergone below the storage silos. Automatically drawn one-piece flexible curtain will be provided at the entrance and exit points of the loading area. Before cement is loading into the trucks, all the flexible curtains will be closed and the process is proceeded in a totally enclosed area. The bulk loading unit comprises the inlet casting with dust extraction points, the double-bellows loading spout, the conically tapered nozzle which fits into the inlet opening of the bulk cement tanker to form an air tight seal, and the filling level monitor. The dust-laded air displaced from the interior of the bulk tanker during the loading operation escapes through the annular space between the inner and the outer tubes of the double-bellows spout and extracted by suction connecting to a dust collector (DC6). A cut-off switch in the loading spout prevents overfilling. In this way any dust pollution of the environment is obviated. Except for the hatch opening which is receiving cement, all other hatch covers of the cement tanker shall be fully closed. Sufficient time shall be allowed for the loading unit to extract the dust-laden air inside the tanker before the loading unit is retracted from the hatch opening after delivery of cement. The hatch opening shall be closed before the cement truck it is moving out of the loading area.

5.8.1.4 Packaging of Cement into Sacks

Packing of cement in bags is operated in the packer which is housed below the cement silo within a building structure and with dust control equipment (DC6) installed on top to filter dust laden-air. Paper valve sack is employed for the packing of cement. The paper valve sack is closed on all sides except for a small opening at one corner through which the cement is introduced into the sack. On completion of filling operation, this opening automatically closes (in the manner of a non-return valve) as a result of excess pressure that develops inside the sack and the possibilities of overfilling would be significantly reduced. As a result, fugitive dust emission due to the filling process would be decreased down to an acceptable level. The sacks are generally at least two-ply construction, consisting of kraft paper capable of rough handling.

The packing machine will be located in a purposely built area to achieve total enclosure. Dust generated from the packing process will be vented to a dust collector (DC6). After filling, the sack is dropped by gravity to a flat belt conveyor and transferred, by the shortest possible route. Any dust attached onto the bag surface due to the filling process will be swept off and extracted. Dust laden air from the bag cleaning process will be vented to a dust collector (DC6). All the belt conveyors for handling the bagged cement will be enclosed on four sides by using metal sheets to eliminate any fugitive dust emission. All conveyor transfer points will be totally enclosed and with spillage collecting hoppers installed below the points to collect any accidental spillage. Cement collected from these hoppers will be returned to the packing circuit. The number of transfer points from one belt conveyor to another will be as few as possible. Opening for the passage of conveyors shall be fitted with adequate flexible seals. The whole conveying process will not have any free fall of bagged cement to avoid any fugitive dust emission. To eliminate dust nuisance, dust extraction intakes will be provided with suitable distance. All dust-laden air from the extraction points will be properly vented to a dust collector (DC6) with the aim that the filtered air will meet the particulate emission limited of 50mg/m^3.

The bagged cement is transferred onto a truck by a railcar loading machine. The loading area will be totally enclosed on all sides. The entrance to the loading area will be covered with an automatically drawn one piece flexible curtain such that the loading area is totally separated from the outside environment. When the truck moved into the loading area, the curtain will be closed before the bagged cement is loaded onto the truck from the railcar loading machine. Once loaded onto the truck, any disturbance to the bagged cement will be kept to a minimum, to avoid any accident spillage. All trucks shall have side and tail boards and shall be covered by tarpaulin extending at least 300 mm over the edges of the side and boards. Washing facilities have been installed at the exit of the loading area to wash off any dust attached to the truck body. In addition, water hoses will be installed at appropriate locations. Through manual spraying, any area inaccessible by the wash facilities can be cleaned.

Locations of the all emission sources and their control equipment are identified in Figure 5-3 and Table 5-2. Calculation of the emission strength of the different dust emitting sources from HKC are listed in Appendix 3.

5.8.2 Shun Shing Fat Limited

5.8.2.1 Handling and Storage of Cement

Shun Shing Fat Limited is located at the entrance of the premise. Dust is mainly emitting from the dust collectors installed on top of the cement silos (EP1, EP2, EP3 & EP4). Cement is off-loaded from barges and carried to the dust tight storage silos through the same pneumatic conveying system described above. This is the best solution to handle the cement without creating any dust nuisance to the public. All dust-laden air generated by the process operations shall be fully extracted and vented to fabric filtration systems (DC1, DC2, DC3 & DC4) which will be installed on top of all the storage silos. All the silos are equipped with high level alarm indicators to prevent overfilling. The high-level alarm indicators will be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed. The connection and disconnection of the delivery hose of cement barge and the filling line of all cement silos shall be carried to minimize dust emissions. The dipping hole on all cement silos shall be maintained in good condition such that there shall be no fugitive dust emissions.

5.8.2.2 Loadout of Cement

In order to prevent any fugitive dust emission during the loading of cement to bulk cement trucks, the process will be carried out in a enclosed area, where one piece automatically drawn flexible curtain will be installed at the entrance and exit of the loading area. All the curtains will be drawn before the loading process. Cement loading units are installed with high level alarm and dust extraction mechanism. All dust-laded air from the loading head will be returned to the cement silos where dust collectors (DC3 & DC4) will be installed. Control efficiency of these dust collector can be as high as 99% if the dust collectors are properly and regularly maintained. Except for the hatch opening which is receiving cement, all other hatch covers of the cement tanker shall be fully closed. Sufficient time shall be allowed for the loading unit to extract the dust-laden air inside the tanker before the loading unit is retracted from the hatch opening after delivery of cement. The hatch opening shall be closed before the cement truck it is moving out of the loading area.

Locations of the dust emission sources and their duct control equipment for SSF are shown in Figure 5-5 and Table 5-4. Calculation of the emission strength from different dust emitting sources of SSF are listed in Appendix 4.

5.8.3 Pioneer Concrete (HK) Limited

Pioneer Concrete (HK) Limited is located at the western side of the premises and the best practicable means of dust mitigation measures will be installed at all the dust emitting sources of the plant. Such mitigation measures can effectively reduce the dust generating from different processes of the plant down to an acceptable level. These dust control measures includes total enclosure of dust emitting process, adequate wetting of raw materials before handling, and connecting dust laden- air to dust collectors to filter dust particles.

During the operation of the plant, dust is generating from various activities. These include handling of raw materials, sand and aggregate transferring to elevated storage bin by conveyor belts, unloading of cement to elevated storage silos, aggregates and cement weigh hopper loading, concrete mixer truck loading and wind erosion from sand and aggregates storage piles. Emission factor for these activities were referenced to *USEPA AP-42, "Table 8.10-1: Uncontrolled Particulate Emission Factors for Concrete Batching in Section 8.10 Concrete batching and Section 11.2.3 Aggregate Handling and Storage Piles*" and enclosed in Appendix 5 for information.

5.8.3.1 Loading of Aggregates

In order to reduce the dust generating sources of the plant, there will not be any open storage of raw materials on site. Sand and aggregates will be transported to the plant by barges and unloaded to the ground receiving hoppers at the northern side of the plant (EP11). The raw materials will be adequately wetted in the barge before they are being transferred to the receiving hopper. These receiving hoppers shall be enclosed on three sides up to 3 metre above the unloading points. In no case shall these hoppers be used as the material storage devices. In addition, automatic water sprinklers will be installed at suitable locations of the shed to further suppress fugitive dust emission during the loading process. Through the totally enclosed conveyor belts, the aggregates are transported to an overhead storage bin (EP12). All conveyor transfer points shall be enclosed on top and two sides with a metal board at the bottom to elimate any dust emission due to wind-whipping effect. Openings for passage of conveyors shall be fitted with flexible seals so that minimal dust emission is occurring during the aggregate fill in. Scrapers will be provided at the turning points of all the conveyor belts to remove dust adhered to the belt surface.

5.8.3.2 Handling and Storage of Cement

Cement will be transferred to the elevated storage silos (EP1 to EP6) by totally enclosed pneumatic conveying system from the cement depots next door or by bulk tankers. PFA/cement is carried to the plant by bulk tankers and discharged into the storage silos by compressed air. The cement/PFA will be stored in the silos which will be fitted with fabric filtration system (DC1 to DC6) to vent dust laden-air, and high level alarm has also been installed to avoid over-filling. These dust collectors can have a dust control efficiency as high as 99% with proper and regular maintenance {Labahn 1983 & ASHARE 1979}. The high level alarm indicators shall be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed. Under such best practicable dust mitigation measures, dust emitted from such process will be minimal. Fabric collection systems (DC7 & DC8) will be installed for the process of loading the aggregate weigh hopper from the elevation storage bin and loading the cement weigh hopper from the cement silos (EP7 & EP8). All dust laden-air generated from these loading processes will be connected to the dust collector (DC7 & DC8). In order to achieve a better dust collection efficiency, the filter capacity will be increased from its original of 1700m^3/hr up to 10,000m^3/hr. An improvement of almost 6 times will be achieved.

5.8.3.3 Concrete Batching Process

Combined with water all the raw materials will be mixed together at a mixer and unloading through a serve hopper (EP9 & EP10) directly into a mixer truck. The loading process is undergoing in an enclosed environment with flexible curtain covering the entrance and exit point. All dust-laden air generated by the concrete loading process shall be vented to a fabric filtering system (DC3 & DC4) so that the dust emitting from such process can be reduced down to an acceptable level. Similar to DC7 & DC8, the filter capacities of these dust collectors will be increased to 10,000m^3/hr During the concrete is loading into the mixer truck, water sprinklers will be used to suppress any dust emission. Vehicle cleaning facilities will be provided and used by all vehicles after loading and other vehicles leaving the premises to wash off any dust and/or mud deposited on the wheels and/or vehicle body.

With the incorporation of best practicable means of dust control measures, all dust-laden air generated by the process operations shall be fully extracted and vented to dust collectors to meeting the particulate emission limited of 50 mg/m^3. Location of all the dust emission points are shown in Figure 5-7 and Table 5-6. Calculation of the emission strength for different dust emitting sources of PIC are listed in Appendix 5.

5.8.4 Quon Hing Concrete Co. Limited

Quon Hing Concrete Co. Limited is located between Pioneer Concrete (HK) Limited and Hong Kong Cement Mfg. Co. Limited. The best practicable means of dust mitigation measures will be installed at all the dust emitting sources of the plant. Such mitigation measures can effectively reduce the dust generating from different processes of the plant down to an acceptable level. These dust control measures includes total enclosure of dust emitting process, adequate wetting of raw material before handling, and connecting vented air to dust collectors to filter dust particles. During operation of the plant, dust is generating from various activities. These include handling of raw materials, sand and aggregate transferring to elevated storage bin by conveyor belts, unloading of cement to elevated storage silo, aggregates and cement weigh hopper loading, concrete mixer truck loading and wind erosion from sand and aggregates storage piles. Emission factor for these activities were referenced to *USEPA AP-42, "Table 8.10-1: Uncontrolled Particulate Emission Factors for Concrete Batching in Section 8.10 and Section 11.2.3 Aggregate Handling and Storage Piles*" and enclosed in Appendix 5 for information.

5.8.4.1 Loading of Aggregates

In order to reduce the dust generating sources of the plant, there will not be any open storage of raw materials on site. Sand and aggregates will be transported to the plant by barges and unloaded to the ground receiving hoppers (EP8). Begin unloading into the ground receiving hopper, the aggregates will be adequately wetted. These receiving hoppers shall be enclosed on three sides up to 3 metre above the unloading points. In no case shall these hoppers be used as the material storage devices. Automatic water sprinklers will be installed at the shed to further suppress fugitive dust emission generated from the process if necessary. Through the total enclosed conveyor belts, the aggregates are transported to an overhead storage bin (EP9). All conveyor transfer points shall be total enclosed on top and two sides. The bottom side will be covered by a metal board to eliminate any dust emission due to wind-whipping effect. Opening for passage of conveyors shall be fitted with flexible seals so that minimal dust emission is occurring during the aggregates fill in. Scrapers will be provided at the turning points of all conveyors to remove dust adhered to the belt surface.

5.8.4.2 Storage of Cement

Cement will be transferred to the elevated storage silos (EP1 to EP5) by totally enclosed pneumatic conveying system from the cement depots next door or bulk tanker. PFA/cement is carried to the plant by bulk tankers and discharged into the storage silos by compressed air. The cement/PFA will be stored in the silos which will be fitted with fabric filtration system (DC1 to DC5) to vent all the dust laden-air, and high level alarm will has also be installed to avoid over-filling. These dust collectors can have a dust control efficiency as high as 99% with proper and regular maintenance {Labahn 1983 & ASHARE 1979}. The high level alarm indicators shall be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed. Under such best practicable dust mitigation measures, dust emitted from such process will be minimal. Fabric collection systems (DC6 & DC7) will be installed for the process of loading the aggregate weigh hopper from the elevation storage bin and loading the cement weigh hopper from the cement silos (EP6 & EP7).

5.8.4.3 Concrete Batching Process

Combined with water, all the raw materials will be mixed together in the concrete mixer and unloading through a serve hopper (EP10 & EP11) directly into a mixer truck. The loading process is undergoing in an enclosed environment with flexible curtain covering all the entrance and exit point. All dust-laden air generated by the loading process shall be totally vented to a fabric filtering system (DC 6 & DC7) so that the dust emitting from such process can be reduced down to acceptable level. The filter capacity of the dust collectors DC6 and DC7 will be increased up to 10,000m^3 /hr, so that a high collection efficiency can be achieved. During the concrete is loading into the mixer truck, water sprinklers will be used to suppress any dust emission. Vehicle cleaning facilities will be provided and used by all vehicles after loading and other vehicles leaving the premises to wash off any dust and/or mud deposited on the wheels and/or vehicle body.

With the incorporation of best practicable means of dust control measures, all dust laden-air generated by the process operational shall be fully extracted and vented to dust collectors to meeting the particulate emission limited of 50 mg/m^3. Location of all the dust emission points are shown in Figure 5-9 and Table 5-8. Calculation of the emission strength for different dust emitting sources of QHC are listed in Appendix 5.

5.9 Dust Emission Impact Assessment

5.9.1 Emission from HKC and SSF

The predicted highest daily average dust concentration from HKC and SSF at various heights of the ASRs are listed in Table 5-12. Typical ISCST result file from the cement works are enclosed in Appendix 6 for reference. Best practical means of dust control measures were assumed for the operational procedures of HKC and SSF.

5.9.2 Emission from PI and QH

Apart from the two cement depots, PI and QH will also emit dust from various processes of their operation. The predicted highest daily dust concentration at various heights of the ASRs are listed in Table 5-13. Typical ISCST result file from the cement works are enclosed in Appendix 7 for reference. Best practical means of dust control measures were assumed for the operational procedures of PI and QH.

5.9.3 Cumulative Dust Impact

The cumulative highest daily average dust concentration generated from all the specified process at the premises at different floor levels of the various ASRs are shown in Table 5-14. The result is only a summation of all the predicted dust concentration at each individual ASRs modelled by ISCST and FDM. This cumulative dust presented the worst possible case scenario of the highest daily concentration at each ASRs.

Table 5-12 Predicted Highest Daily Average Dust Concentration ($\mu g/m^3$) from the two Cement Depots

Height	***Air Sensitive Receivers***																		
(m)	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**	**D11**	**D12**	**D13**	**D14**	**D15**	**D16**	**B1**	**B2**	**B3**
5	2.78	2.20	0.32	0.68	0.69	1.51	0.87	0.45	0.45	0.39	2.28	0.95	1.71	0.45	0.92	0.54	0.54	3.72	2.78
10	2.68	2.12	0.32	0.66	0.67	1.47	0.85	0.44	0.44	0.38	2.19	0.93	1.66	0.44	1.74	1.41	1.51	4.04	2.68
15	2.59	2.04	0.31	0.64	0.64	1.42	0.83	0.43	0.43	0.37	2.11	0.90	1.60	0.43	4.64	3.71	5.43	5.28	2.59
20	2.49	1.96	0.31	0.63	0.61	1.37	0.81	0.42	0.42	0.37	2.03	0.88	1.54	0.42	9.58	9.44	17.7	7.63	2.49
25	2.40	1.89	0.30	0.61	0.58	1.33	0.78	0.41	0.41	0.37	1.95	0.86	1.49	0.41	14.1	19.3	49.5	10.0	2.40
AQO	*260.0*																		

The results in Table 5-12 indicated that the predicted highest daily average dust concentration at the various ASRs will be well below the AQOs standard. Hong Kong Cement Mfg. Co. Limited and Shun Shing Fat Limited will not create any nuisance to the sensitive land users nearby because the best practicable means of dust mitigation measures have already been incorporated in the operational procedures of the cement plants. As a result, dust emission from them would be significantly reduced down to a level well below the AQO even at the boundary of the premises

The dust concentration from the cement works were also presented in a form of contour map as shown in Figure 5-14. The figure indicated that the sensitive land users within 150m radius from the two cement plants will not expose to unacceptable dust level.

Table 5-13 Predicted Highest Daily Average Dust Concentration ($\mu g/m^3$) from the two Concrete Batching Plants and Site Access Roads

Height (m)	***Air Sensitive Receivers***																		
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**	**D11**	**D12**	**D13**	**D14**	**D15**	**D16**	**B1**	**B2**	**B3**
5	2.73	4.72	1.14	1.43	0.98	2.58	1.05	0.80	0.73	0.81	4.43	2.87	2.64	0.68	48.9	50.7	36.7	151	139
10	2.56	4.41	1.07	1.33	0.96	2.48	1.03	0.76	0.69	0.77	4.17	2.60	0.52	0.65	13.7	17.7	15.9	55.7	60.0
15	2.29	3.93	0.95	1.16	0.93	2.31	0.98	0.69	0.63	0.71	3.74	2.21	0.18	0.60	8.6	13.2	11.4	23.6	13.6
20	1.97	3.35	0.81	0.97	0.89	2.09	0.91	0.60	0.55	0.63	3.23	1.78	0.17	0.54	11.5	16.3	17.9	51.5	47.4
25	1.62	2.75	0.66	0.78	0.84	1.83	0.83	0.51	0.47	0.55	2.68	1.37	0.16	0.47	1.32	3.18	36.8	1.55	1.73
AQO	*260.0*																		

The table above indicated that the dust emission from various process of the concrete batching plant will not above the AQOs standards with the implementation of the best practicable means of dust control methods. The predicted highest daily average dust level will be below the AQO and the dust emission from the two concrete batching plants and site access roads will not create any unacceptable air impact upon the ASRs. The dust level, generated from the two concrete batching plants and Site Access Roads in form of a contour covering 150m radius from the premises is shown in Figure 5-15.

The predicted cumulative annual average dust level with the implementation of the best practicable means of dust control measures at the worst hit ASRs (B2, B3, D15 & D16) are listed in the Table 5-14.

Table 5-14 Predicted Cumulative Annual Dust Concentration at the ASRs

Dust Sources	**Concentration ($\mu g/m^3$)**			
	B2	**B3**	**D15**	**D16**
Concrete batching plants and paved roads	28.1	51.0	4.4	8.9
Cement depots	0.03	0.41	0.04	0.02
Total dust level	28.13	51.41	4.44	8.92
Air Quality Objective	80.0			

Table 5-15 Cumulative Predicted Highest Daily Average Dust Concentration ($\mu g/m^3$) at the ASRs

Height	*Air Sensitive receivers*																		
(m)	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**	**D11**	**D12**	**D13**	**D14**	**D15**	**D16**	**B1**	**B2**	**B3**
5	5.51	6.92	1.47	2.11	1.67	4.09	1.92	1.25	1.17	1.20	6.71	3.82	4.35	1.13	49.8	51.3	37.2	155	143
10	5.24	6.53	1.39	1.99	1.63	3.95	1.88	1.20	1.13	1.15	6.36	3.53	2.18	1.09	15.5	19.1	17.4	59.4	62.7
15	4.88	5.97	1.26	1.80	1.57	3.73	1.81	1.12	1.06	1.09	5.85	3.12	1.78	1.03	13.2	16.9	16.4	28.9	16.9
20	4.46	5.32	1.12	1.60	1.50	3.46	1.72	1.02	0.97	1.00	5.25	2.66	1.72	0.96	21.1	25.7	25.6	59.1	49.9
25	4.02	4.64	0.96	1.39	1.43	3.16	1.61	0.92	0.88	0.92	4.62	2.23	1.65	0.88	15.4	22.5	86.3	11.6	4.13
AQO	*260.0*																		

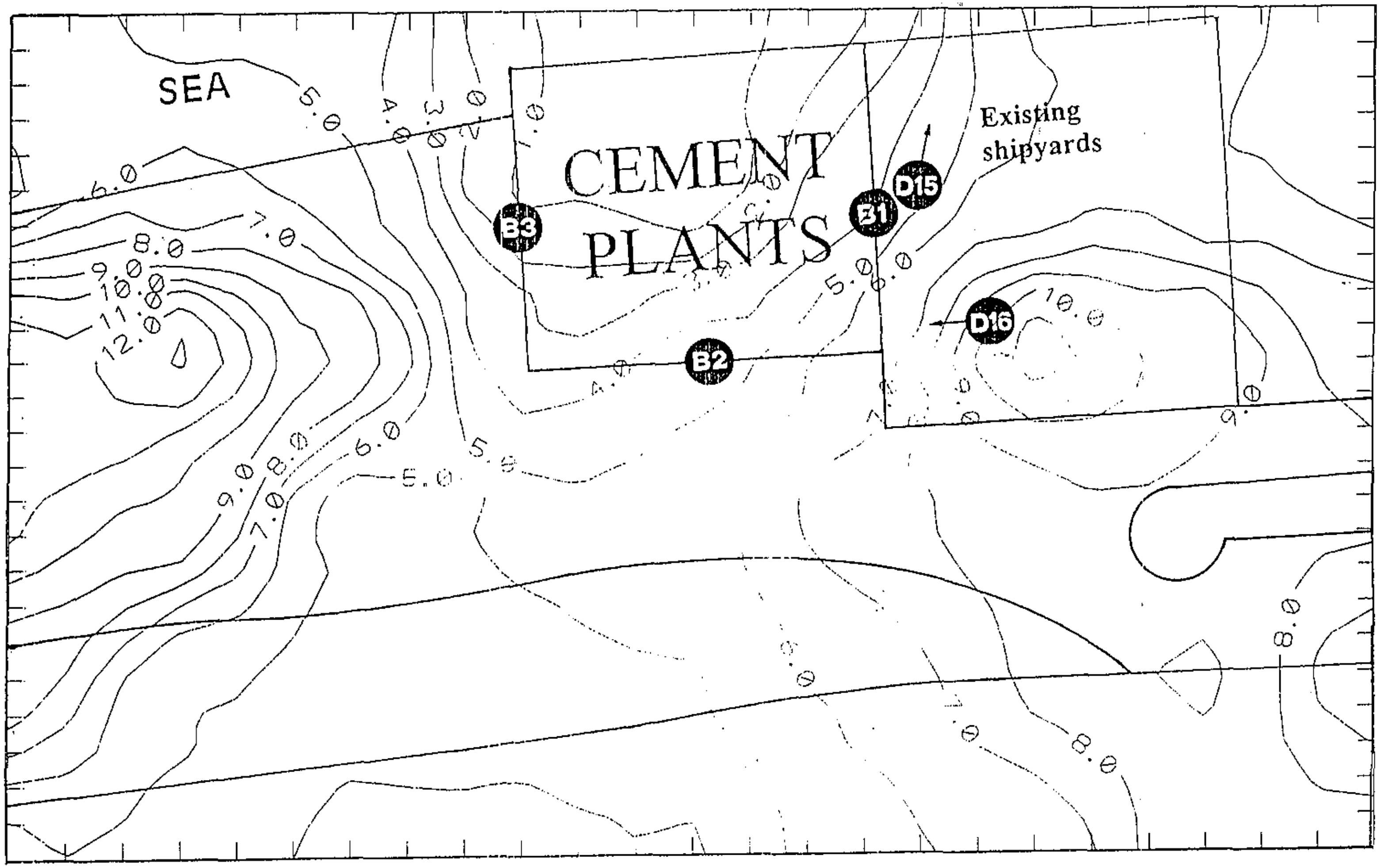
The cumulative highest daily average dust concentration generated from all the specified processes at the premises at different floor levels of the ASRs are shown in Table 5-14. The results is only a summation of all the predicted dust concentration at each individual ASRs modelled by ISCST and FDM. This cumulative dust concentration presented the worst possible case scenario of the highest daily concentration at each ASRs. The south boundary will experience the highest dust concentration among the four boundary sides. The cumulative dust concentration contour within 150m radius from the specified process operation is shown in Figure 5-16.

The cumulative dust impact at the sensitive receivers is contributed solely by the dust emitting processes of the two concrete batching plants. Nevertheless, the dust level from the four specified processes still below the AQOs standard even a background dust level of about 100$\mu g/m^3$.

With reference to EPD's ambient monitored dust level, the recorded RSP level is approximately ranging from about on third to almost half that of the TSP concentration. Applying the same assumption to the predicted dust level in Table 5-14, the maximum RSP level at the ASRs will be about 75$\mu g/m^3$. Adding on the background of 50$\mu g/m^3$, the cumulative RSP level is about 125$\mu g/m^3$, which is well below the AQO recommended level of 180$\mu g/m^3$.

Figure : 5-14

Scale : ---



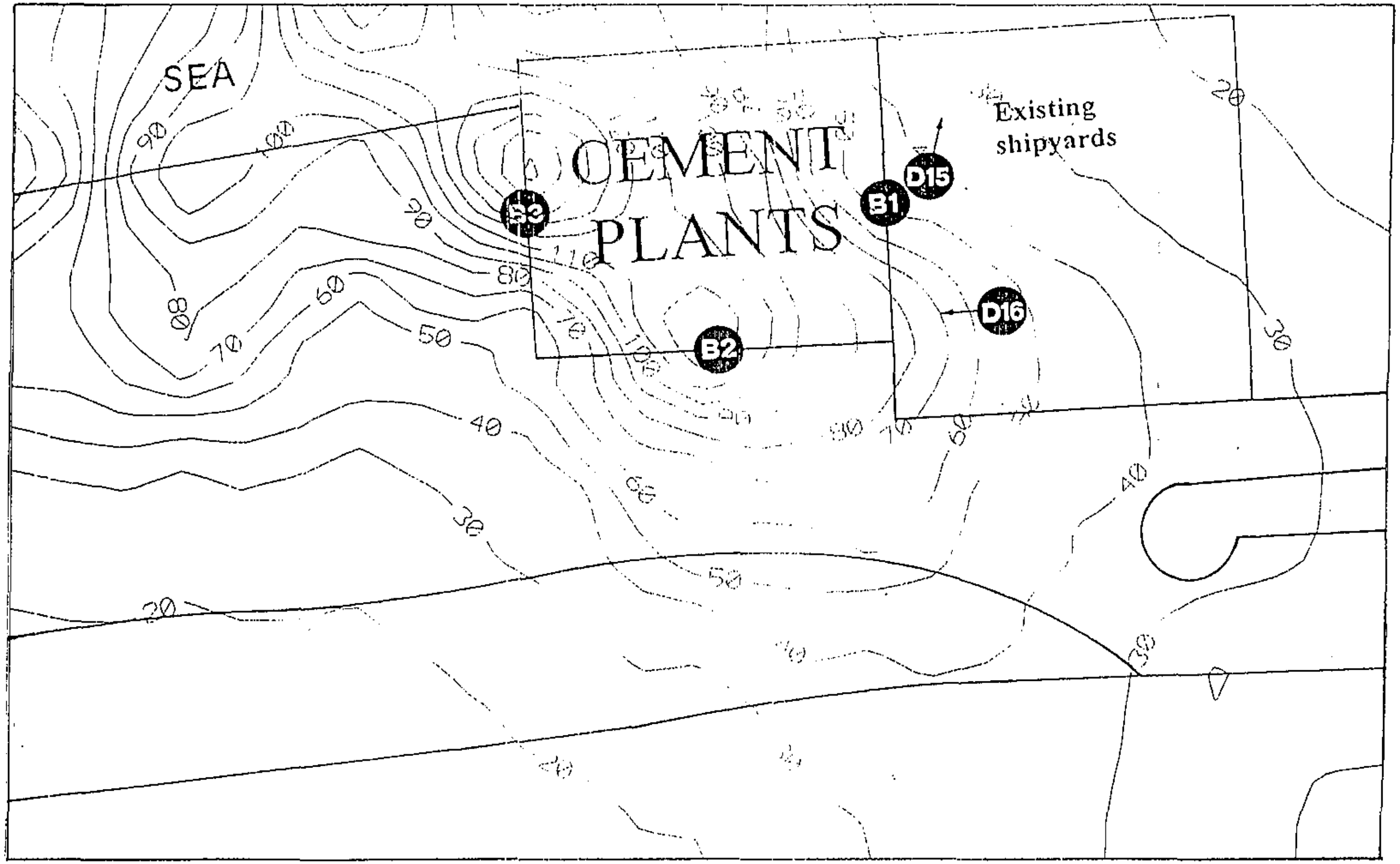
TITLE : Predicted Highest Daily Average Dust Concentration (ug/m^3) from the two Cement Depots

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
EIA Volume 3 : Key Issue Report (Air)

EHS Consultants Limited

Figure : 5-15

Scale : ---



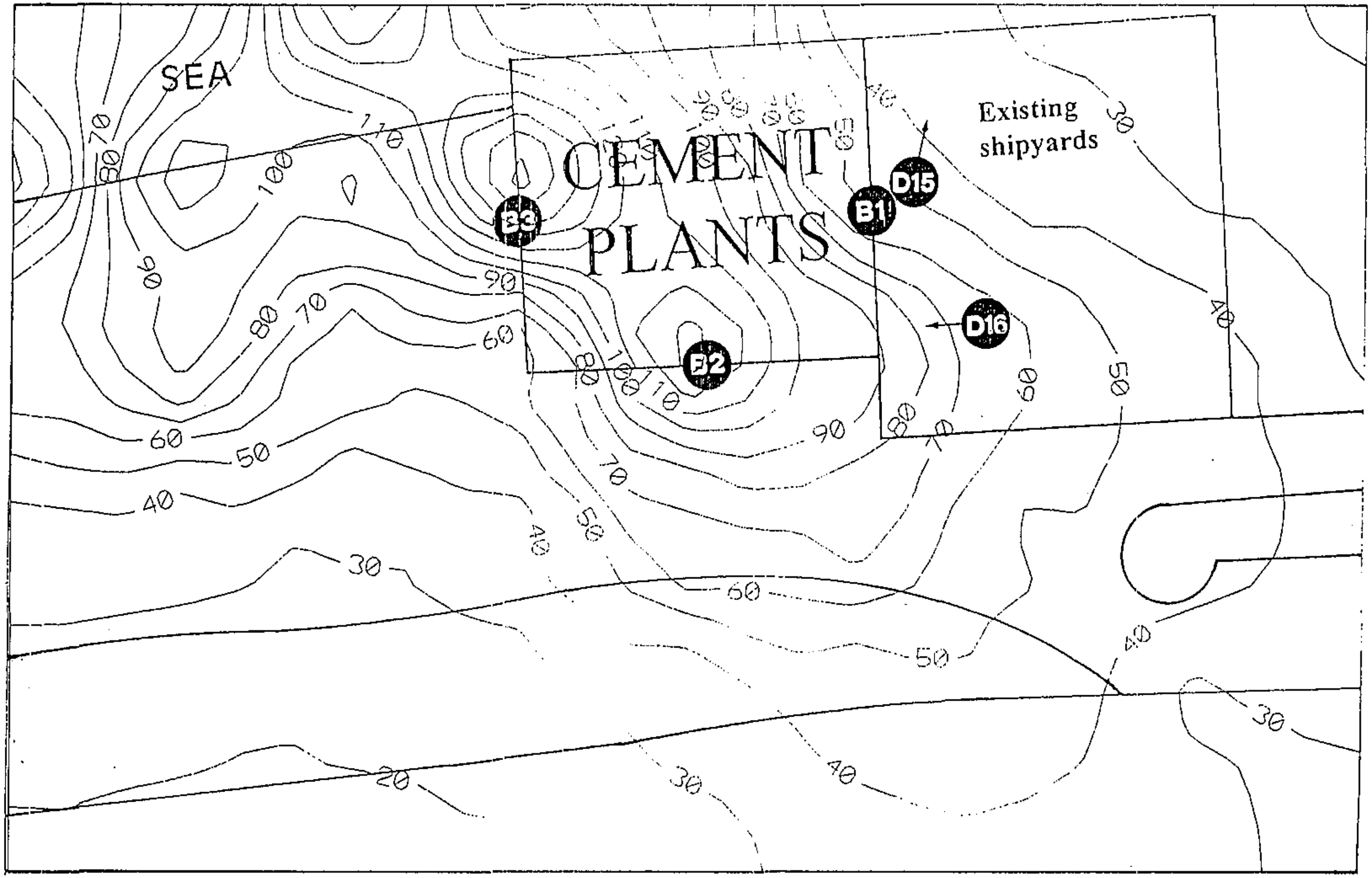
TITLE : Predicted Highest Daily Average Dust Concentration ($\mu g/m^3$) from the two Concrete Batching Plants and Site Access Roads

PROJECT : Cement and Concrete Batching Plant at Tsing Yi EIA Volume 3 : Key Issue Report (Air)

EHS Consultants Limited

Figure : 5-16

Scale : ---



TITLE : Cumulative Predicted Highest Daily Average Dust Concentration from all the Specified Processes

PROJECT : Cement and Concrete Batching Plant at Tsing Yi
EIA Volume 3 : Key Issue Report (Air)

EHS Consultants Limited

5.10 Off-Site Dust Emission Impact

Dust emission from the body and wheels of the vehicles leaving the four cement works may create a dust nuisance to the sensitive land users along the Tam Kon Shan Road. Vehicular engine emission has been assessed in the previous section and concluded the emission will be within acceptable levels.

All vehicles leaving the cement works will be passed through a vehicle cleaning facility so that any dust deposited on the wheels of the vehicle will be washed off. The vehicle cleaning facility will be undergone regular maintained and cleaning, so that the facility will be become a source of pollution. In additional, water hoses will be installed at suitable locations so that any areas which are not accessible by the vehicle cleaning facilities can be easily cleaned manually.

Lorries used to carry the bagged cement shall have properly fitting side and tail boards. When leaving the plant, the load area of the lorry will be covered with a clean tarpaulin. The tarpaulin shall be properly secured and shall be extend at least 300mm over the edges of the side and tail boards. Bagged cement transported in such matter will not create any dust nuisance to the sensitive receivers along the roads where the truck will passing through.

5.11 Control of Fugitive Dust Emissions

The following is listed general measures which will be implemented by all the plant operators to reduce the fugitive dust emission from various production processes of the plants.

- The plant operators shall maintain high standard of housekeeping to prevent emission of fugitive dust emissions.
- The dust collected by the dust collector shall be returned to the process stream or disposed of without generating fugitive dust emissions.
- Cleaning, repair and maintenance of all plant facilities, tankers and trucks within the premises shall be carried out in a manner without generating fugitive dust emissions.
- All spillage or depositions of dusty materials on the plants facility shall be cleaned up as soon as practicable. The material shall be handled properly to prevent fugitive dust emission before cleaning.
- The plant operators shall take all practicable measures to minimize the emission which may be caused by handling the dusty waste generated from the plant operation. The dusty waste shall be conditioned with water for dust suppression immediately once generated. No accumulation and dumping of such waste is allowed at the open areas or any location not designation for treatment and storage of waste.
- Air pollution control equipment, including dust collectors, silo overfilling alarms and filling line interlocks shall be maintained in good condition and put into use whenever the relevant plant served by the air pollution control equipment is in operation.
- The plant operator shall thoroughly inspect each dust collector at least twice per week on the dust collection equipment
- Sufficient number of spare filter bags shall be kept in stock so as to allow speed repair of duct collectors.

6. DUST MONITORING REQUIREMENTS

Results from Section 5 indicated that dust emission from the four specified processes at TYTL 119 will not create any significant air quality impact upon the surroundings land users. Nevertheless, a series of sufficient and effective dust mitigation measures for on and off-site operations will be implemented by the plant operator to reduce the impact down to acceptable level. In order to oversee the effectiveness of the dust control measures, an ambient air quality monitoring programme is proposed.

In order to review the effectiveness of the on site dust control measures, dust monitoring station will be set up at appropriate location(s). The implementation of an ambient air quality monitoring programme along with effective reporting and enforcement procedures will be the key to ensuring the proper execution of dust control measure to prevent any deterioration in air quality during operating phase of the plants and to ensure that the AQOs are not exceeded.

Monitoring location(s) will be located within the site boundary, since the plant operator do not have the authority to set up any monitoring equipment outside its site boundary. The exact monitoring location(s) will be discussed with EPD once the sp application is approved. Nevertheless, a monitoring station was proposed for reference in this section. Relevant parameters related to the operation process (total materials input, material storage, production rate, malfunctioning and breakdown of air pollution control equipment) will be reported to the Authority on a regular interval. The format of the information will be agreed with the Authority once the sp application is approved. Implementation of the dust mitigation measures as well as the monitoring programme will be governed by the operation license issued by the Authority.

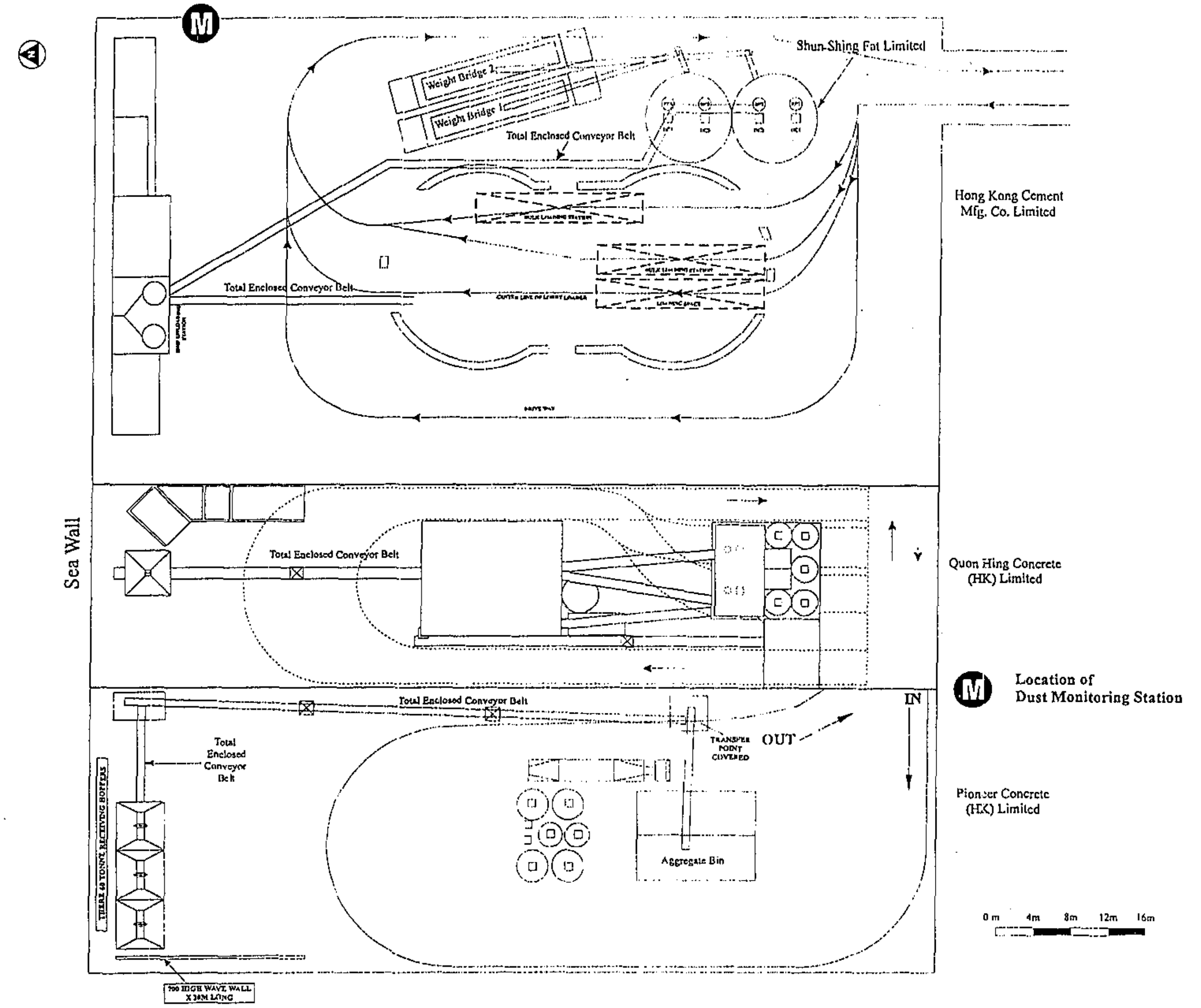


Figure : 6-1

Scale : ---

TITLE : Location of the Proposed Dust Monitoring Station for the Four specified Processes

PROJECT : Cement and Concrete Batching Plant at Tsing Yi EIA Volume 3 : Key Issue Report (Air)

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7. CONCLUSION

Dust emitting from the four specified processes during construction and operational phase have been assessed. With the best practicable means of dust mitigation measures incorporated into the operational processes and reduce the maximum production rate of the two concrete batching plants down to 125m^3/hr for each plant, the dust level generated by the cement works will be within acceptable level and will not create any nuisance to the public.

The recommended dust control measures will be implemented by the plant operators and governed by the conditions of the specified process license granted by the Authority. Dust monitoring programme will be carried out by the plant operator at appropriate location(s) to oversee the effectiveness of the dust control measures.

In conclusion, the cement works at the North-West of Tsing Yi Island will not create any unacceptable dust level upon any sensitive receivers.

Appendix 1

Typical Caline 4 Results Files

```
               IBM-PC VERSION (1.90)
               (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
               SERIAL NUMBER 7997
               SOLD TO E.H.S. CONSULTANTS LIMITED
               RUN BEGAN ON 01-17-95 AT 10:12:37




         CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                  JUNE 1989 VERSION
                  PAGE   1

             JOB: HONG KONE CEMENT PLANT
             RUN: CO -WO           (WORST CASE ANGLE)
       POLLUTANT: CO

  I.  SITE VARIABLES

       U=   2.0 M/S              Z0=  10. CM           ALT=     0. (M)
     BRG= WORST CASE             VD=    .0 CM/S
    CLAS=      4 (D)             VS=    .0 CM/S
    MIXH=  500. M               AMB=    .0 PPM
   SIGTH=   12. DEGREES        TEMP= 25.5 DEGREE (C)

 II.  LINK VARIABLES

      LINK        *  LINK COORDINATES (M)    *                 EF      H      W
   DESCRIPTION    *   X1    Y1    X2    Y2   * TYPE  VPH  (G/MI)  (M)    (M)
 -----------------*--------------------------*---------------------------------
 A. S1            * 28115 24630 28200 24675 *  AG    220   19.0     .0   15.0
 B. S2            * 28200 24675 28285 24751 *  AG    220   19.0     .0   15.0
 C. S3            * 28285 24751 28340 24765 *  AG    220   19.0     .0   15.0
 D. S4            * 28340 24765 28425 24800 *  AG    220   19.0     .0   15.0
 E. S5            * 28425 24800 28500 24790 *  AG    220   19.0     .0   15.0
 F. S6            * 28500 24790 28575 24750 *  AG    220   19.0     .0   15.0
 G. S7            * 28575 24750 28615 24690 *  AG    969   10.5     .0   15.0
 H. S8            * 28615 24690 28630 24625 *  AG    969   10.5     .0   15.0
 I. S9            * 28630 24625 28680 24565 *  AG    969   10.5     .0   15.0

 III.  RECEPTOR LOCATIONS

                *     COORDINATES (M)
   RECEPTOR     *     X       Y       Z
 ---------------*---------------------------
  1. A1         *  28245   24685    1.2
  2. A2 *  28300  24720   1.2
  3. A3 *  28390  24775   1.2
  4. A4 *  28470  24785   1.2
  5. A5 *  28550  24740   1.2
  6. A6 *  28610  24650   1.2
  7. A7 *  28455  24815   1.2
  8. A8 *  28515  24800   1.2
  9. A9 *  28640  24595   1.2
 10. A10 *  28700  24545   1.2




         CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                  JUNE 1989 VERSION
                  PAGE   2

             JOB: HONG KONE CEMENT PLANT
             RUN: CO -WO           (WORST CASE ANGLE)
       POLLUTANT: CO

   IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

               *        * PRED  *                 CONC/LINK
               *  BRG   * CONC  *                   (PPM)
```

```
                    IBM-PC VERSION (1.90)
                    (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
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                    SOLD TO E.H.S. CONSULTANTS LIMITED
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           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

               JOB: HONG KONE CEMENT PLANT
               RUN: CO -WE           (WORST CASE ANGLE)
         POLLUTANT: CO

    I.  SITE VARIABLES

          U=   2.0 M/S              Z0=  10. CM           ALT=     0. (M)
        BRG= WORST CASE             VD=   .0 CM/S
       CLAS=     4 (D)              VS=   .0 CM/S
       MIXH=  500. M               AMB=   .0 PPM
      SIGTH=   12. DEGREES        TEMP= 25.5 DEGREE (C)

   II.  LINK VARIABLES

        LINK       *  LINK COORDINATES (M)  *              EF     H     W
     DESCRIPTION   *   X1    Y1    X2    Y2 * TYPE  VPH  (G/MI)  (M)   (M)
   ----------------*------------------------*-------------------------------
   A. S1           * 28115 24630 28200 24675 *  AG    350  17.8     .0  15.0
   B. S2           * 28200 24675 28285 24751 *  AG    350  17.8     .0  15.0
   C. S3           * 28285 24751 28340 24765 *  AG    350  17.8     .0  15.0
   D. S4           * 28340 24765 28425 24800 *  AG    350  17.8     .0  15.0
   E. S5           * 28425 24800 28500 24790 *  AG    350  17.8     .0  15.0
   F. S6           * 28500 24790 28575 24750 *  AG    350  17.8     .0  15.0
   G. S7           * 28575 24750 28615 24690 *  AG   1089  10.9     .0  15.0
   H. S8           * 28615 24690 28630 24625 *  AG   1089  10.9     .0  15.0
   I. S9           * 28630 24625 28680 24565 *  AG   1089  10.9     .0  15.0

   III.  RECEPTOR LOCATIONS

                 *    COORDINATES (M)
     RECEPTOR    *    X        Y       Z
   --------------*---------------------------
   1. A1         *  28245  24685    1.2
   2. A2 *   28300  24720    1.2
   3. A3 *   28390  24775    1.2
   4. A4 *   28470  24785    1.2
   5. A5 *   28550  24740    1.2
   6. A6 *   28610  24650    1.2
   7. A7 *   28455  24815    1.2
   8. A8 *   28515  24800    1.2
   9. A9 *   28640  24595    1.2
  10. A10 *   28700  24545    1.2




           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   2

               JOB: HONG KONE CEMENT PLANT
               RUN: CO -WE           (WORST CASE ANGLE)
         POLLUTANT: CO

    IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

               *      * PRED  *                CONC/LINK
               *  BRG * CONC  *                  (PPM)
```

```
                 IBM-PC VERSION (1.90)
                 (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
                 SERIAL NUMBER 7997
                 SOLD TO E.H.S. CONSULTANTS LIMITED
                 RUN BEGAN ON 01-17-95 AT 10:12:24
```

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

             JOB: Hong Kong CEMENT PLANT
             RUN: NO2-WE           (WORST CASE ANGLE)
       POLLUTANT: NO2

   I.  SITE VARIABLES

         U=   2.0 M/S              Z0=  10. CM            ALT=      0. (M)
       BRG= WORST CASE             VD=    .0 CM/S
      CLAS=     4 (D)              VS=    .0 CM/S
      MIXH=  500. M               AMB=    .0 PPM
     SIGTH=   12. DEGREES        TEMP= 25.5 DEGREE (C)

  II.  LINK VARIABLES

      LINK          *  LINK COORDINATES (M)    *                 EF      H      W
   DESCRIPTION      *   X1    Y1    X2    Y2   * TYPE  VPH   (G/MI)   (M)    (M)
 -------------------*--------------------------*------------------------------------
 A. S1              * 28115 24630 28200 24675 *  AG     350   12.6     .0   15.0
 B. S2              * 28200 24675 28285 24751 *  AG     350   12.6     .0   15.0
 C. S3              * 28285 24751 28340 24765 *  AG     350   12.6     .0   15.0
 D. S4              * 28340 24765 28425 24800 *  AG     350   12.6     .0   15.0
 E. S5              * 28425 24800 28500 24790 *  AG     350   12.6     .0   15.0
 F. S6              * 28500 24790 28575 24750 *  AG     350   12.6     .0   15.0
 G. S7              * 28575 24750 28615 24690 *  AG    1089    7.9     .0   15.0
 H. S8              * 28615 24690 28630 24625 *  AG    1089    7.9     .0   15.0
 I. S9              * 28630 24625 28680 24565 *  AG    1089    7.9     .0   15.0

 III.  RECEPTOR LOCATIONS

              *     COORDINATES (M)
   RECEPTOR   *     X       Y         Z
 -------------*-------------------------
 1. A1        *  28245  24685    1.2
 2. A2 *  28300  24720    1.2
 3. A3 *  28390  24775    1.2
 4. A4 *  28470  24785    1.2
 5. A5 *  28550  24740    1.2
 6. A6 *  28610  24650    1.2
 7. A7 *  28455  24815    1.2
 8. A8 *  28515  24800    1.2
 9. A9 *  28640  24595    1.2
10. A10 *  28700  24545    1.2
```

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

             JOB: Hong Kong CEMENT PLANT
             RUN: NO2-WE           (WORST CASE ANGLE)
       POLLUTANT: NO2

   IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

            *        * PRED  *                  CONC/LINK
            *  BRG   * CONC  *                    (PPM)
```

```
               IBM-PC VERSION (1.90)
               (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
               SERIAL NUMBER 7997
               SOLD TO E.H.S. CONSULTANTS LIMITED
               RUN BEGAN ON 01-17-95 AT 10:12:12




        CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                 JUNE 1989 VERSION
                 PAGE   1

            JOB: HONG KONE CEMENT PLANT
            RUN: NO2-WO           (WORST CASE ANGLE)
      POLLUTANT: NO2


  I.  SITE VARIABLES

       U=   2.0 M/S            Z0=  10. CM          ALT=      0. (M)
     BRG= WORST CASE           VD=   .0 CM/S
    CLAS=     4 (D)            VS=   .0 CM/S
    MIXH=  500. M             AMB=   .0 PPM
   SIGTH=   12. DEGREES      TEMP= 25.5 DEGREE (C)


  II.  LINK VARIABLES

     LINK         *  LINK COORDINATES (M)    *              EF      H      W
  DESCRIPTION     *   X1    Y1    X2    Y2   * TYPE  VPH  (G/MI)   (M)    (M)
 -----------------*--------------------------*--------------------------------
 A. S1            * 28115 24630 28200 24675 *  AG    220   10.1     .0   15.0
 B. S2            * 28200 24675 28285 24751 *  AG    220   10.1     .0   15.0
 C. S3            * 28285 24751 28340 24765 *  AG    220   10.1     .0   15.0
 D. S4            * 28340 24765 28425 24800 *  AG    220   10.1     .0   15.0
 E. S5            * 28425 24800 28500 24790 *  AG    220   10.1     .0   15.0
 F. S6            * 28500 24790 28575 24750 *  AG    220   10.1     .0   15.0
 G. S7            * 28575 24750 28615 24690 *  AG    969    6.7     .0   15.0
 H  S8            * 28615 24690 28630 24625 *  AG    969    6.5     .0   15.0
 I. S9            * 28630 24625 28680 24565 *  AG    969    6.5     .0   15.0


 III.  RECEPTOR LOCATIONS

              *    COORDINATES (M)
  RECEPTOR    *    X        Y       Z
 -------------*---------------------
 1. A1        *  28245   24685    1.2
 2. A2 *  28300  24720   1.2
 3. A3 *  28390  24775   1.2
 4. A4 *  28470  24785   1.2
 5. A5 *  28550  24740   1.2
 6. A6 *  28610  24650   1.2
 7. A7 *  28455  24815   1.2
 8. A8 *  28515  24800   1.2
 9. A9 *  28640  24595   1.2
10. A10 *  28700  24545   1.2




          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: HONG KONE CEMENT PLANT
              RUN: NO2-WO           (WORST CASE ANGLE)
        POLLUTANT: NO2


   IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

             *       * PRED  *                   CONC/LINK
             *  BRG  * CONC  *                     (PPM)
```

```
                  IBM-PC VERSION (1.90)
                  (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
                  SERIAL NUMBER 7997
                  SOLD TO E.H.S. CONSULTANTS LIMITED
                  RUN BEGAN ON 01-17-95 AT 10:13:26




         CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                  JUNE 1989 VERSION
                  PAGE   1

             JOB: HONG KONE CEMENT PLANT
             RUN: RSP-WE-AM        (WORST CASE ANGLE)
       POLLUTANT: RSP
       (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

  I.  SITE VARIABLES

        U=   2.0 M/S              Z0=  10. CM            ALT=      0. (M)
      BRG= WORST CASE             VD=   .0 CM/S
     CLAS=      4 (D)             VS=   .0 CM/S
     MIXH=  500. M               AMB=   .0 PPM
    SIGTH=   12. DEGREES        TEMP= 25.5 DEGREE (C)


 II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *                 EF      H      W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)   (M)   (M)
 ---------------*-------------------------*----------------------------------
 A. S1          * 28115 24630 28200 24675 *  AG    350    1.4     .0  15.0
 B. S2          * 28200 24675 28285 24751 *  AG    350    1.4     .0  15.0
 C. S3          * 28285 24751 28340 24765 *  AG    350    1.4     .0  15.0
 D. S4          * 28340 24765 28425 24800 *  AG    350    1.4     .0  15.0
 E. S5          * 28425 24800 28500 24790 *  AG    350    1.4     .0  15.0
 F. S6          * 28500 24790 28575 24750 *  AG    350    1.4     .0  15.0
 G. S7          * 28575 24750 28615 24690 *  AG   1089    1.3     .0  15.0
 H. S8          * 28615 24690 28630 24625 *  AG   1089    1.3     .0  15.0
 I. S9          * 28630 24625 28680 24565 *  AG   1089    1.3     .0  15.0

 III.  RECEPTOR LOCATIONS

              *    COORDINATES (M)
   RECEPTOR   *    X       Y       Z
 -------------*--------------------
  1. A1       *  28245  24685    1.2
  2. A2 *  28300   24720   1.2
  3. A3 *  28390   24775   1.2
  4. A4 *  28470   24785   1.2
  5. A5 *  28550   24740   1.2
  6. A6 *  28610   24650   1.2
  7. A7 *  28455   24815   1.2
  8. A8 *  28515   24800   1.2
  9. A9 *  28640   24595   1.2
 10. A10 *  28700   24545   1.2




          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   2

              JOB: HONG KONE CEMENT PLANT
              RUN: RSP-WE-AM        (WORST CASE ANGLE)
        POLLUTANT: RSP
        (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

              *       * PRED  *                  CONC/LINK
              *  BRG  * CONC  *                    (PPM)
```

```
                    IBM-PC VERSION (1.90)
                    (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
                    SERIAL NUMBER 7997
                    SOLD TO E.H.S. CONSULTANTS LIMITED
                    RUN BEGAN ON 01-17-95 AT 10:13:02
```

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   1

               JOB: HONG KONE CEMENT PLANT
               RUN: RSP-WO-AM         (WORST CASE ANGLE)
         POLLUTANT: RSP
         (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

    I.  SITE VARIABLES

         U=    2.0 M/S              Z0=  10. CM            ALT=      0. (M)
       BRG= WORST CASE              VD=   .0 CM/S
      CLAS=      4 (D)              VS=   .0 CM/S
      MIXH=  500. M                AMB=   .0 PPM
     SIGTH=   12. DEGREES         TEMP= 25.5 DEGREE (C)


   II.  LINK VARIABLES

       LINK        *  LINK COORDINATES (M)    *              EF      H      W
    DESCRIPTION    *   X1    Y1    X2    Y2   * TYPE  VPH  (G/MI)  (M)    (M)
  -----------------*--------------------------*---------------------------------
  A. S1            * 28115 24630 28200 24675 *  AG    220    1.1     .0  15.0
  B. S2            * 28200 24675 28285 24751 *  AG    220    1.1     .0  15.0
  C. S3            * 28285 24751 28340 24765 *  AG    220    1.1     .0  15.0
  D. S4            * 28340 24765 28425 24800 *  AG    220    1.1     .0  15.0
  E. S5            * 28425 24800 28500 24790 *  AG    220    1.1     .0  15.0
  F. S6            * 28500 24790 28575 24750 *  AG    220    1.1     .0  15.0
  G. S7            * 28575 24750 28615 24690 *  AG    969    1.2     .0  15.0
  H. S8            * 28615 24690 28630 24625 *  AG    969    1.2     .0  15.0
  I. S9            * 28630 24625 28680 24565 *  AG    969    1.2     .0  15.0


  III.  RECEPTOR LOCATIONS

                 *     COORDINATES (M)
    RECEPTOR     *     X        Y       Z
  ---------------*---------------------
  1. A1          *  28245   24685    1.2
  2. A2 *  28300   24720   1.2
  3. A3 *  28390   24775   1.2
  4. A4 *  28470   24785   1.2
  5. A5 *  28550   24740   1.2
  6. A6 *  28610   24650   1.2
  7. A7 *  28455   24815   1.2
  8. A8 *  28515   24800   1.2
  9. A9 *  28640   24595   1.2
 10. A10 *  28700   24545   1.2
```

```
           CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                    JUNE 1989 VERSION
                    PAGE   2

               JOB: HONG KONE CEMENT PLANT
               RUN: RSP-WO-AM         (WORST CASE ANGLE)
         POLLUTANT: RSP
         (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

    IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

                *        * PRED   *                  CONC/LINK
                *   BRG  * CONC   *                    (PPM)
```

```
                IBM-PC VERSION (1.90)
                (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
                SERIAL NUMBER 7997
                SOLD TO E.H.S. CONSULTANTS LIMITED
                RUN BEGAN ON 01-17-95 AT 10:13:14




     CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
              JUNE 1989 VERSION
              PAGE   1

        JOB: HONG KONE CEMENT PLANT
        RUN: RSP-WO-PM        (WORST CASE ANGLE)
   POLLUTANT: RSP
   (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

 I.  SITE VARIABLES

      U=    1.0 M/S             Z0=  10. CM           ALT=      0. (M)
    BRG= WORST CASE             VD=   .0 CM/S
   CLAS=      6 (F)             VS=   .0 CM/S
   MIXH=  500. M               AMB=   .0 PPM
  SIGTH=     5. DEGREES       TEMP= 25.5 DEGREE (C)


II.  LINK VARIABLES

     LINK       *  LINK COORDINATES (M)   *               EF     H     W
  DESCRIPTION   *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
----------------*-------------------------*--------------------------------
A. S1           * 28115 24630 28200 24675 *  AG    220    .9     .0  15.0
B. S2           * 28200 24675 28285 24751 *  AG    220    .9     .0  15.0
C. S3           * 28285 24751 28340 24765 *  AG    220    .9     .0  15.0
D. S4           * 28340 24765 28425 24800 *  AG    220    .9     .0  15.0
E. S5           * 28425 24800 28500 24790 *  AG    220    .9     .0  15.0
F. S6           * 28500 24790 28575 24750 *  AG    220    .9     .0  15.0
G. S7           * 28575 24750 28615 24690 *  AG    947   1.1     .0  15.0
H. S8           * 28615 24690 28630 24625 *  AG    947   1.1     .0  15.0
I. S9           * 28630 24625 28680 24565 *  AG    947   1.1     .0  15.0


III.  RECEPTOR LOCATIONS

            *    COORDINATES (M)
 RECEPTOR   *    X      Y      Z
------------*--------------------
 1. A1      *  28245  24685   1.2
 2. A2 *  28300  24720   1.2
 3. A3 *  28390  24775   1.2
 4. A4 *  28470  24785   1.2
 5. A5 *  28550  24740   1.2
 6. A6 *  28610  24650   1.2
 7. A7 *  28455  24815   1.2
 8. A8 *  28515  24800   1.2
 9. A9 *  28640  24595   1.2
10. A10 *  28700  24545   1.2




     CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
              JUNE 1989 VERSION
              PAGE   2

        JOB: HONG KONE CEMENT PLANT
        RUN: RSP-WO-PM        (WORST CASE ANGLE)
   POLLUTANT: RSP
   (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

 IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

          *       * PRED  *                 CONC/LINK
          *  BRG  * CONC  *                   (PPM)
```

```
                    IBM-PC VERSION (1.90)
                    (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
                    SERIAL NUMBER 7997
                    SOLD TO E.H.S. CONSULTANTS LIMITED
                    RUN BEGAN ON 01-17-95 AT 10:13:39





            CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                     JUNE 1989 VERSION
                     PAGE   1

               JOB: HONG KONE CEMENT PLANT
               RUN: RSP-WE-PM         (WORST CASE ANGLE)
          POLLUTANT: RSP
          (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

     I.  SITE VARIABLES

         U=    1.0 M/S               Z0=  10. CM             ALT=      0. (M)
       BRG= WORST CASE               VD=   .0 CM/S
      CLAS=     6 (F)                VS=   .0 CM/S
      MIXH=  500. M                 AMB=   .0 PPM
     SIGTH=     5. DEGREES         TEMP= 25.5 DEGREE (C)


    II.  LINK VARIABLES

       LINK       *  LINK COORDINATES (M)    *               EF     H     W
    DESCRIPTION   *   X1    Y1    X2    Y2   * TYPE  VPH  (G/MI)  (M)   (M)
  ----------------*--------------------------*-------------------------------
   A. S1          * 28115 24630 28200 24675 *  AG    350    1.4     .0  15.0
   B. S2          * 28200 24675 28285 24751 *  AG    350    1.4     .0  15.0
   C. S3          * 28285 24751 28340 24765 *  AG    350    1.4     .0  15.0
   D. S4          * 28340 24765 28425 24800 *  AG    350    1.4     .0  15.0
   E. S5          * 28425 24800 28500 24790 *  AG    350    1.4     .0  15.0
   F. S6          * 28500 24790 28575 24750 *  AG    350    1.4     .0  15.0
   G. S7          * 28575 24750 28615 24690 *  AG   1107    1.3     .0  15.0
   H. S8          * 28615 24690 28630 24625 *  AG   1107    1.3     .0  15.0
   I. S9          * 28630 24625 28680 24565 *  AG   1107    1.3     .0  15.0


   III.  RECEPTOR LOCATIONS

                *    COORDINATES (M)
     RECEPTOR   *     X       Y       Z
   -------------*---------------------
   1. A1        *  28245  24685    1.2
   2. A2 *  28300  24720   1.2
   3. A3 *  28390  24775   1.2
   4. A4 *  28470  24785   1.2
   5. A5 *  28550  24740   1.2
   6. A6 *  28610  24650   1.2
   7. A7 *  28455  24815   1.2
   8. A8 *  28515  24800   1.2
   9. A9 *  28640  24595   1.2
  10. A10 *  28700  24545   1.2




            CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                     JUNE 1989 VERSION
                     PAGE   2

               JOB: HONG KONE CEMENT PLANT
               RUN: RSP-WE-PM         (WORST CASE ANGLE)
          POLLUTANT: RSP
          (NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

     IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

               *       * PRED  *                 CONC/LINK
               *  BRG  * CONC  *                   (PPM)
```

Appendix 2

Emission Strength
of the
Paved Access Road

RE paved road

Table 2 Emission Strength of Site Paved Road With Dust Mitigation Measures									
emission rate from industrial paved road (kg/v-km) =					$k(1.7)(s/12)(S/48)(W/2.7)^{0.7}(w/4)^{0.5}$				
where	k =	particular size multiplier =				0.28			
	s =	silt content of road surface materials (%) =				5.5			
	S =	mean vehicle speed (km/hr) =				5			
	W =	mean vehicle weight (Mg) =				24			
	w =	mean number of wheels =				10			
emission rate from industrial paved road (kg/v-km) =						0.165837			
emission rate from industrial paved road (g/v-m) =						0.165837			
total production rate of the two concrete batchng plants (m^3/hr) =						250			
total production rate of the two concrete batchng plants (T/hr) =						625			
weight of concrete that a mixer truck can carry (T) =						15			
number of truck per hour plant (veh/hr) =						42			
number of bulk cement truck (veh/hr) =						7.5			
number of bagged cement truck (veh/hr) =						1			
Road Characteristics									
Label	*X1*	*Y1*	*X2*	*Y2*	*Distance*	*Veh/hr*	*Efficiency*	*Emis rate*	*Total rate*
					(m)		*(%)*	*(g/m/s)*	*(g/s)*
R1	827188.0	824712.4	827156.0	824712.4	32.0	50.5	95	0.000116	0.00372
R2	827156.0	824712.4	827129.2	824712.4	26.8	42.0	95	0.000097	0.00259
R3	827129.8	824712.4	827099.4	824712.4	30.4	21.0	95	0.000048	0.00147
R4	827099.4	824712.4	827099.4	824769.0	56.6	21.0	95	0.000048	0.00274
R5	827099.4	824769.0	827122.2	824769.0	22.8	21.0	95	0.000048	0.00110
R6	827122.2	824713.0	827147.4	824713.0	25.2	21.0	95	0.000048	0.00122
R7	827129.8	824713.0	827129.8	824771.0	58.0	21.0	95	0.000048	0.00281
R8	827129.8	824771.0	827147.4	824771.0	17.6	21.0	95	0.000048	0.00085
R9	827156.6	824713.0	827156.6	824777.0	64.0	8.5	95	0.000020	0.00125
R10	827156.6	824777.0	827195.4	824777.0	38.8	8.5	95	0.000020	0.00076
R11	827147.4	824713.0	827193.0	824713.0	45.6	42.0	95	0.000097	0.00441
				Total	*417.8*	*277.5*		*0.000639*	*0.02293*

Appendix 3

Emission Strength
of the
Hong Kong Cement Manufacturing Co. Limited

HKC

Emission Strength of Hong Kong Cement Mgf. Co. Limited						
	Emission Point					
Parameter	**1**	**2**	**3**	**4**	**5**	**6**
Equipment	cement silo	cement silo	cement silo	cement silo	cement silo	cement silo
operating hours	8: 00 to 24:00	8: 00 to 24:00	8: 00 to 24:00	8: 00 to 24:00	8: 00 to 24:00	8: 00 to 24:00
diameter (m)	0.520	0.520	0.520	0.520	0.520	0.650
height (m)	45.00	45.00	20.50	45.00	45.00	20.50
temperature (K)	298	298	298	298	298	298
exhaust gas flow rate (m^3/min)	85.0	85.0	250.0	85.0	85.0	270.0
exhaust gas flow rate (m^3 /hr)	5100.0	5100.0	15000.0	5100.0	5100.0	16200.0
exhaust gas flow rate (CFM)	3014.2	3014.2	8865.2	3014.2	3014.2	9574.5
"stack" exit velocity (m/s)	6.67	6.67	19.62	6.67	6.67	13.56
max. emission conc. (mg/m^3)	50	50	50	50	50	50
max emission rate (mg/hr)	255000.0	255000.0	750000.0	255000.0	255000.0	810000.0
max emission rate (g/s)	0.0708	0.0708	0.2083	0.0708	0.0708	0.2250
control equipment	dust collector	dust collector	dust collector	dust collector	dust collector	dust collector
eff. of control equip. (%)	99	99	99	99	99	99

Appendix 4

Emission Strength
of the
Shun Shing Fat Limited

Top Form

Table 1 Emission Strength of Shun Shing Fat Limited

	Emission Point			
Parameter	1	2	3	4
Equipment	cement silo	cement silo	cement silo	cement silo
operating hours	8:00 to 19:00	8:00 to 19:00	8:00 to 19:00	8:00 to 19:00
diameter (m)	0.200	0.120	0.195	0.200
height (m)	23.60	23.60	23.60	23.60
temperature (K)	298	298	298	298
exhaust gas flow rate (m^3/min)	40.0	40.0	40.0	40.0
exhaust gas flow rate (m^3/hr)	2400.0	2400.0	2400.0	2400.0
exhaust gas flow rate (CFM)	84755.2	8040.0	4000.0	925.0
"stack" exit velocity (m/s)	21.22	58.95	22.32	21.22
max. emission conc. (mg/m^3)	50	50	50	50
max emission rate (mg/hr)	120000.0	120000.0	120000.0	120000.0
max emission rate (g/s)	0.0333	0.0333	0.0333	0.0333
control equipment	dust collector	dust collector	dust collector	dust collector
eff. of control equip. (%)	99	99	99	99

Appendix 5

Emission Strength
of the
Concrete Batching Plants

8.10 CONCRETE BATCHING

8.10.1 Process Description[1-4]

Concrete is composed essentially of water, cement, sand (fine aggregate) and coarse aggregate. Coarse aggregate may consist of gravel, crushed stone or iron blast furnace slag. Some specialty aggregate products could be either heavyweight aggregate (of barite, magnetite, limonite, ilmenite, iron or steel) or lightweight aggregate (with sintered clay, shale, slate, diatomaceous shale, perlite, vermiculite, slag, pumice, cinders, or sintered fly ash). Concrete batching plants store, convey, measure and discharge these constituents into trucks for transport to a job site. In some cases, concrete is prepared at a building construction site or for the manufacture of concrete products such as pipes and prefabricated construction parts. Figure 8.10-1 is a generalized process diagram for concrete batching.

The raw materials can be delivered to a plant by rail, truck or barge. The cement is transferred to elevated storage silos pneumatically or by bucket elevator. The sand and coarse aggregate are transferred to elevated bins by front end loader, clam shell crane, belt conveyor, or bucket elevator. From these elevated bins, the constituents are fed by gravity or screw conveyor to weigh hoppers, which combine the proper amounts of each material.

Truck mixed (transit mixed) concrete involves approximately 75 percent of U. S. concrete batching plants. At these plants, sand, aggregate, cement and water are all gravity fed from the weigh hopper into the mixer trucks. The concrete is mixed on the way to the site where the concrete is to be poured. Central mix facilities (including shrink mixed) constitute the other one fourth of the industry. With these, concrete is mixed and then transferred to either an open bed dump truck or an agitator truck for transport to the job site. Shrink mixed concrete is concrete that is partially mixed at the central mix plant and then completely mixed in a truck mixer on the way to the job site. Dry batching, with concrete is mixed and hauled to the construction site in dry form, is seldom, if ever, used.

8.10-2 Emissions and Controls[5-7]

Emission factors for concrete batching are given in Table 8.10-1, with potential air pollutant emission points shown. Particulate matter, consisting primarily of cement dust but including some aggregate and sand dust emissions, is the only pollutant of concern. All but one of the emission points are fugitive in nature. The only point source is the transfer of cement to the silo, and this is usually vented to a fabric filter or "sock". Fugitive sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The amount of fugitive emissions generated during the transfer of sand and aggregate depends primarily on the surface moisture content of these materials. The extent of fugitive emission control varies widely from plant to plant.

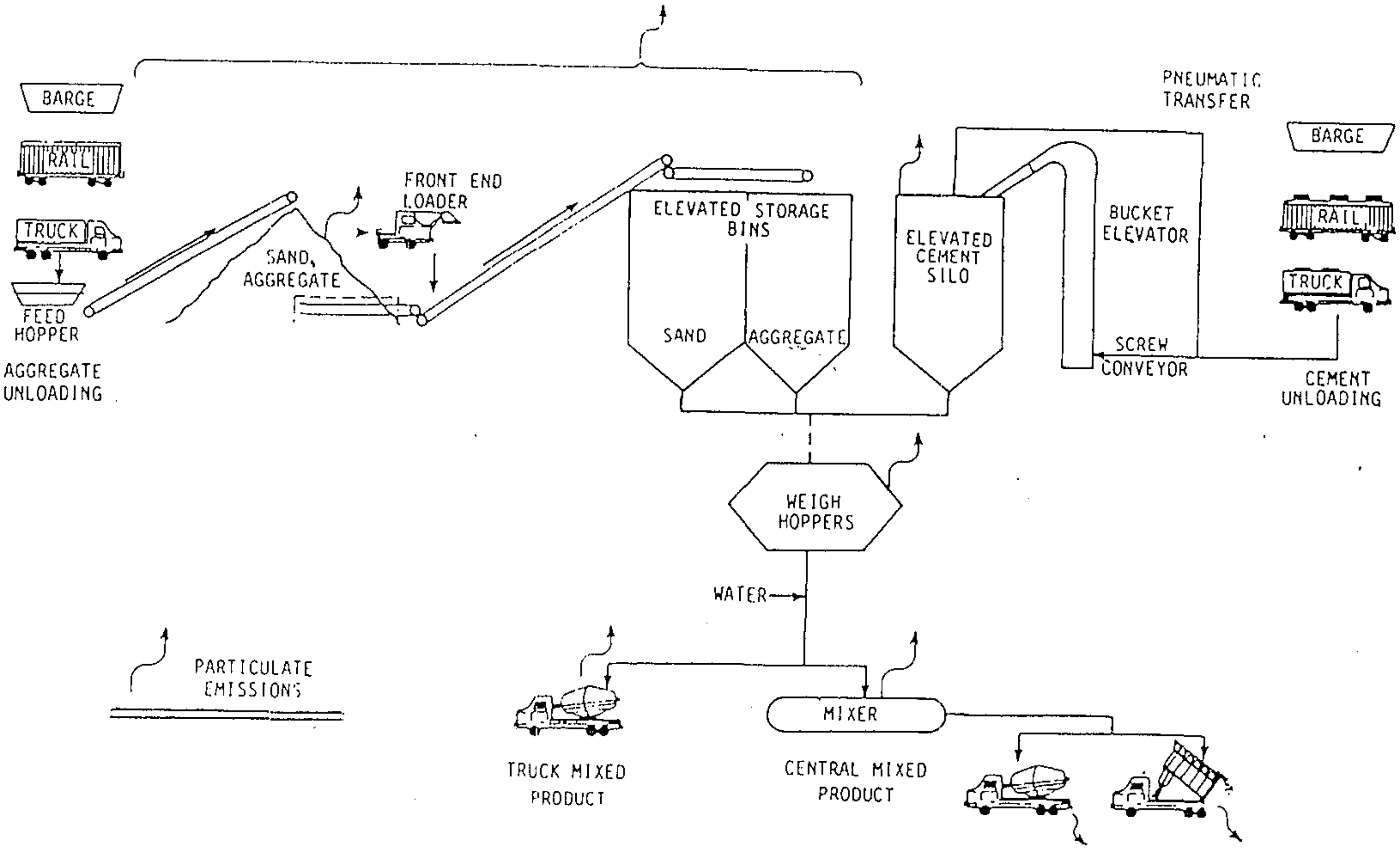

Figure 8.1-1. Typical concrete batching process.

TABLE 8.10-1. UNCONTROLLED PARTICULATE EMISSION FACTORS FOR CONCRETE BATCHING

1.6821

yd^3 603 kg/m^3

Source	kg/Mg of material	lb/ton of material	lb/yd^3 of concrete[a]	Emission Factor Rating
Sand and aggregate transfer to elevated bin[b]	0.014	0.029	0.05	E
Cement unloading to elevated storage silo				
Pneumatic[c]	0.13	0.27	0.07	D
Bucket elevator[d]	0.12	0.24	0.06	E
Weigh hopper loading[e]	0.01	0.02	0.04	E
Truck loading (truck mix)[e]	0.01	0.02	0.04	E
Mixer loading (central mix)[e]	0.02	0.04	0.07	E
Vehicle traffic (unpaved road)[f]	4.5 kg/VKT	16 lb/VMT	0.2[g]	C
Wind erosion from sand and aggregate storage piles[h]	3.9 kg/ hectare/day	3.5 lb/ acre/day	0.1[i]	D
Total process emissions (truck mix)[j]	0.05	0.10	0.20	E

[a] Based on a typical yd^3 weighing 1,818 kg (4,000 lb) and containing 227 kg (500 lb) cement, 564 kg (1,240 lb) sand, 864 kg (1,900 lb) coarse aggregate and 164 kg (360 lb) water.

[b] Reference 6.

[c] For uncontrolled emissions measured before filter. Based on two tests on pneumatic conveying controlled by a fabric filter.

[d] Reference 7. From test of mechanical unloading to hopper and subsequent transport of cement by enclosed bucket elevator to elevated bins with fabric socks over bin vent.

[e] Reference 5. Engineering judgement, based on observations and emission tests of similar controlled sources.

[f] From Section 11.2.1, with k = 0.8, s = 12, S = 20, W = 20, w = 14, and p = 100. VKT = vehicle kilometers traveled. VMT = vehicle miles traveled.

[g] Based on facility producing 23,100 m^3/yr (30,000 yd^3/yr), with average truck load of 6.2m^3 (8 yd^3) and plant road length of 161 meters (1/10 mile).

[h] From Section 8.19.1, for emissions <30 um for inactive storage piles.

[i] Assumes 1,011 m^2 (1/4 acre) of sand and aggregate storage at plant with production of 23,100 m^3/yr (30,000 yd^3/yr).

[j] Based on pneumatic conveying of cement at a truck mix facility. Does not include vehicle traffic or wind erosion from storage piles.

cm^3/hr

Types of controls used may include water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, and the like. A major source of potential emissions, the movement of heavy trucks over unpaved or dusty surfaces in and around the plant, can be controlled by good maintenance and wetting of the road surface.

Predictive equations which allow for emission factor adjustment based on plant specific conditions are given in Chapter 11. Whenever plant specific data are available, they should be used in lieu of the fugitive emission factors presented in Table 8.10-1.

References for Section 8.10

1. Air Pollutant Emission Factors, APTD-0923, U. S. Environmental Protection Agency, Research Triangle Park, NC, April 1970.

2. Air Pollution Engineering Manual, 2nd Edition, AP-40, U. S. Environmental Protection Agency, Research Triangle Park, NC, 1974. Out of Print.

3. Telephone and written communication between Edwin A. Pfetzing, Pedco Environmental, Inc., Cincinnati, OH, and Richard Morris and Richard Meininger, National Ready Mix Concrete Association, Silver Spring, MD, May 1984.

4. Development Document for Effluent Limitations Guidelines and Standards of Performance, The Concrete Products Industries, Draft, U. S. Environmental Protection Agency, Washington, DC, August 1975.

5. Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions, EPA-450/3-77-010, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1977.

6. Fugitive Dust Assessment at Rock and Sand Facilities in the South Coast Air Basin, Southern California Rock Products Association and Southern California Ready Mix Concrete Association, Santa Monica, CA, November 1979.

7. Telephone communication between T. R. Blackwood, Monsanto Research Corp., Dayton, OH, and John Zoller, Pedco Environmental, Inc., Cincinnati, OH, October 18, 1976.

Emission Strength of a Concrete Batching Plant

Quon Hing / Pioneer Tsing Yi Plant

installed capacity of the concrete batching plant (T) =		312.5
production rate of the concrete batching plant (m^3/hr) =		125
	Efficiency (%)	
PFA/cement unloading to elevated storage silo (pneumatic) (lb/yd^3) =		0.0700
(without mitigation measures)		
PFA/cement unloading to elevated storage silo (pneumatic) (g/s) =		0.0143
(using dust collector and total enclosure as dust mitigation measures)	*99*	
loading weigh hopper (lb/yd^3) =		0.0400
(without mitigation measures)		
emission factor for aggregate weigh hopper loading (g/s) =		0.0082
(using dust collector, total enclosure and watering as dust mitigation measures)	*99*	
loading concrete trucks from mixer (wet mixing) (lb/yd^3) =		0.0700
(without mitigation measures)		
emission factor for mixer truck loading (g/s) =		0.0717
(using dust collector, total enclosure and watering as dust mitigation measures)	*95*	

Summary of Emission Factor (g/s) for the Concrete Batching Plants

Source	*Type*	*Modelled By*	*Emi. Rate*	*Height*
unloading of cement	Point	FDM	0.0143	19.9
weigh hopper loading	Point	FDM	0.0082	11
mixer truck loading	Point	FDM	0.0717	3.4
		TOTAL	*0.0942*	

11.2.3 AGGREGATE HANDLING AND STORAGE PILES

11.2.3.1 General

Inherent in operations that use minerals in aggregate form is the maintenance of outdoor storage piles. Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage.

Dust emissions occur at several points in the storage cycle, such as during material loading onto the pile, disturbances by strong wind currents, and loadout from the pile. The movement of trucks and loading equipment in the storage pile area is also a substantial source of dust.

11.2.3.2 Emissions And Correction Parameters

The quantity of dust emissions from aggregate storage operations varies with the volume of aggregate passing through the storage cycle. Also, emissions depend on three parameters of the condition of a particular storage pile: age of the pile, moisture content and proportion of aggregate fines.

When freshly processed aggregate is loaded onto a storage pile, its potential for dust emissions is at a maximum. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents, either from aggregate transfer itself or from high winds. As the aggregate weathers, however, potential for dust emissions is greatly reduced. Moisture causes aggregation and cementation of fines to the surfaces of larger particles. Any significant rainfall soaks the interior of the pile, and the drying process is very slow.

Silt (particles equal to or less than 75 microns in diameter) content is determined by measuring the portion of dry aggregate material that passes through a 200 mesh screen, using ASTM-C-136 method. Table 11.2.3-1 summarizes measured silt and moisture values for industrial aggregate materials.

11.2.3.3 Predictive Emission Factor Equations

Total dust emissions from aggregate storage piles are contributions of several distinct source activities within the storage cycle:

1. Loading of aggregate onto storage piles (batch or continuous drop operations).
2. Equipment traffic in storage area.
3. Wind erosion of pile surfaces and ground areas around piles.
4. Loadout of aggregate for shipment or for return to the process stream (batch or continuous drop operations).

Adding aggregate material to a storage pile or removing it both usually involve dropping the material onto a receiving surface. Truck dumping on the pile or loading out from the pile to a truck with a front end loader are examples of batch drop operations. Adding material to the pile by a conveyor stacker is an example of a continuous drop operation.

TABLE 11.2.3-1. TYPICAL SILT AND MOISTURE CONTENT VALUES OF MATERIALS AT VARIOUS INDUSTRIES

Industry	Material	Silt (%)			Moisture (%)		
		No. of test samplers	Range	Mean	No. of test samplers	Range	Mean
Iron and steel production[a]	Pellet ore	10	1.4 - 13	4.9	8	0.64 - 3.5	2.1
	Lump ore	9	2.8 - 19	9.5	6	1.6 - 8.1	5.4
	Coal	7	2 - 7.7	5	6	2.8 - 11	4.8
	Slag	3	3 - 7.3	5.3	3	0.25 - 2.2	0.92
	Flue dust	2	14 - 23	18.0	0	NA	NA
	Coke breeze	1		5.4	1		6.4
	Blended ore	1		15.0	1		6.6
	Sinter	1		0.7	0	NA	NA
	Limestone	1		0.4	0	NA	NA
Stone quarrying and processing[b]	Crushed limestone	2	1.3 - 1.9	1.6	2	0.3 - 1.1	0.7
Taconite mining and processing[c]	Pellets	9	2.2 - 5.4	3.4	7	0.05 - 2.3	0.9
	Tailings	2	NA	11.0	1		0.35
Western surface coal mining[d]	Coal	15	3.4 - 16	6.2	7	2.8 - 20	6.9
	Overburden	15	3.8 - 15	7.5	0	NA	NA
	Exposed ground	3	5.1 - 21	15.0	3	0.8 - 6.4	3.4
Coal fired power generation[e]	Coal	60	0.6 - 4.8	2.2	59	2.7 - 7.4	4.5

[a] References 2-5. NA = not applicable.

[b] Reference 1.

[c] Reference 6.

[d] Reference 7.

[e] Reference 8. Values reflect "as received" conditions of a single power plant.

The quantity of particulate emissions generated by either type of drop operation, per ton of material transferred, may be estimated, with a rating of A, using the following empirical expression[2]:

$$E = k(0.0016)\ \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\ (kg/Mg)$$

$$E = k(0.0032)\ \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\ (lb/ton)$$

where:
E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, m/s (mph)
M = material moisture content (%)

The particle size multiplier, k, varies with aerodynamic particle diameter, as shown in Table 11.2.3-2.

TABLE 11.2.3-2. AERODYNAMIC PARTICLE SIZE MULTIPLIER (k)

<30 um	<15 um	<10 um	<5 um	<2.5 um
0.74	0.48	0.35	0.20	0.11

The equation retains the assigned quality rating if applied within the ranges of source conditions that were tested in developing the equation, as given in Table 11.2.3-3. Note that silt content is included in Table 11.2.3-3, even though silt content does not appear as a correction parameter in the equation. While it is reasonable to expect that silt content and emission factors are interrelated, no significant correlation between the two was found during the derivation of the equation, probably because most tests with high silt contents were conducted under lower winds, and vice versa. It is recommended that estimates from the equation be reduced one quality rating level, if the silt content used in a particular application falls outside the range given in Table 11.2.3-3.

TABLE 11.2.3-3. RANGES OF SOURCE CONDITIONS FOR EQUATION 1

Silt Content	Moisture Content	Wind Speed (m/s)	Wind Speed (mph)
0.44 - 19	0.25 - 4.8	0.6 - 6.7	1.3 - 15

Also, to retain the equation's quality rating when applied to a specific facility, it is necessary that reliable correction parameters be determined for the specific sources of interest. The field and laboratory procedures for aggregate sampling are given in Reference 3. In the event that site specific values for correction parameters cannot be obtained, the appropriate mean values from Table 11.2.3-1 may be used, but, in that case, the quality rating of the equation is reduced by one level.

For emissions from equipment traffic (trucks, front end loaders, dozers, etc.) traveling between or on piles, it is recommended that the equations for vehicle traffic on unpaved surfaces be used (see Section 11.2.1). For vehicle travel between storage piles, the silt value(s) for the areas among the piles (which may differ from the silt values for the stored materials) should be used.

Worst case emissions from storage pile areas occur under dry windy conditions. Worst case emissions from materials handling operations may be calculated by substituting into the equation appropriate values for aggregate material moisture content and for anticipated wind speeds during the worst case averaging period, usually 24 hours. The treatment of dry conditions for vehicle traffic (Section 11.2.1), centering on parameter p, follows the methodology described in Section 11.2.1. Also, a separate set of nonclimatic correction parameters and source extent values corresponding to higher than normal storage pile activity may be justified for the worst case averaging period.

11.2.3.4 Controls

Watering and chemical wetting agents are the principal means for control of aggregate storage pile emissions. Enclosure or covering of inactive piles to reduce wind erosion can also reduce emissions. Watering is useful mainly to reduce emissions from vehicle traffic in the storage pile area. Watering of the storage piles themselves typically has only a very temporary slight effect on total emissions. A much more effective technique is to apply chemical wetting agents for better wetting of fines and longer retention of the moisture film. Continuous chemical treatment of material loaded onto piles, coupled with watering or treatment of roadways, can reduce total particulate emissions from aggregate storage operations by up to 90 percent.[9]

References for Section 11.2.3

1. C. Cowherd, Jr., *et al.*, *Development Of Emission Factors For Fugitive Dust Sources*, EPA-450/3-74-037, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. R. Bohn, et al., Fugitive Emissions From Integrated Iron And Steel Plants, EPA-600/2-78-050, U. S. Environmental Protection Agency, Cincinnati, OH, March 1978.

3. C. Cowherd, Jr., et al., Iron And Steel Plant Open Dust Source Fugitive Emission Evaluation, EPA-600/2-79-103, U. S. Environmental Protection Agency, Cincinnati, OH, May 1979.

4. R. Bohn, Evaluation Of Open Dust Sources In The Vicinity Of Buffalo, New York, EPA Contract No. 68-02-2545, Midwest Research Institute, Kansas City, MO, March 1979.

5. C. Cowherd, Jr., and T. Cuscino, Jr., Fugitive Emissions Evaluation, MRI-4343-L, Midwest Research Institute, Kansas City, MO, February 1977.

6. T. Cuscino, et al., Taconite Mining Fugitive Emissions Study, Minnesota Pollution Control Agency, Roseville, MN, June 1979.

7. K. Axetell and C. Cowherd, Jr., Improved Emission Factors For Fugitive Dust From Western Surface Coal Mining Sources, 2 Volumes, EPA Contract No. 68-03-2924, PEI, Inc., Kansas City, MO, July 1981.

8. E. T. Brookman, et al., Determination of Fugitive Coal Dust Emissions From Rotary Railcar Dumping, 1956-L81-00, TRC, Hartford, CT, May 1984.

9. G. A. Jutze, et al., Investigation Of Fugitive Dust Sources Emissions And Control, EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

Emission Strength of the Concrete Batching Plant

Sand and Aggregate transfer to elevated bin

	PIC	QHC
wind speed (m/s) (u)	1	1
moisture content (%) (M)	0.7	0.7
multiplier (k)	0.74	0.74
aggregate used (kg/hr)	220000	118800
aggregate used (Mg/hr)	220	118.8
emission factor(kg/Mg)	0.001847	0.001847
emission factor (kg/hr)	0.406377	0.219444
emission factor (g/s)	0.112883	0.060957
dust mitigation efficiency (%)	85	85
(3-sides and top enclosure & watering)		
emission factor (g/s)	0.016932	0.009143
wind dependenet factor	1.3	1.3
Emission height (m)	3.5	3.5
Source Type	Point	Point
PIC = Pioneer Concrete (HK) Ltd		
QHC = Quon Hing Concrete Ltd		

Dust Mitigation Measures for Material Transfer to Elevated Bin

The raw materials will be adequately wetted in the barge before they are being transferred to the receiving hopper. These receiving hoppers shall be enclosed on three sides up to 3 metre above the unloading points. In no case shall these hoppers be used as the material storage devices. In addition, automatic water sprinklers will be installed at suitable locations of the shed to further suppress fugitive dust emission during the loading process. Through the totally enclosed conveyor belts, the aggregates are transported to an overhead storage bin. All conveyor transfer points shall be total enclosed and opening for passage of conveyors shall be fitted with flexible seals so that minimal dust emission is occurring during the aggregate fill in. Scrapers will be provided at the turning points of all conveyors to remove dust adhered to the belt surface.

Dust Mitigation Measures for PFA/Cement Unloading to Elevated Silo (pneumatic)

Cement will be transferred to the elevated storage silos by totally enclosed pneumatic conveying system from the cement depots next door or by bulk tankers. The cement/PFA will be stored in the silos which will be fitted with fabric filtration system to vent dust laden-air, and high level alarm has also been installed to avoid over-filling. The high level alarm indicators shall be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed.

Dust Mitigation Measures for Loading Weigh Hopper

Fabric collection systems will be installed for the process of loading the aggregate weigh hopper from the elevation storage bin and loading the cement weigh hopper from the cement silos. All dust laden-air generated from these loading processes will be connected to the dust collector . In order to achieve a better dust collection efficiency, the filter capacity will be increased from its original of 1700m^3/hr up to 10,000m^3/hr. An improvement of almost 6 times. All weight hopper transfer are undergone in a total enclosed environment.

Dust Mitigation Measures for Loading Concrete trucks (wet mixing)

Combined with water all the raw materials will be mixed together at a mixer and unloading through a serve hopper directly into a mixer truck. The loading process is undergoing in an enclosed environment with flexible curtain covering the entrance and exit point. All dust-laden air generated by the concrete loading process shall be vented to a fabric filtering system so that the dust emitting from such process can be reduced down to an acceptable level. The filter capacities of these dust collectors will be increased to 10,000m^3 /hr. During the concrete is loading into the mixer truck, water sprinklers will be used to suppress any dust emission.

Material Transfer to Elevation Bin Required Mitigation Efficiency =						85%
Assumption: a dust level of 100						
Mitigation Measure			Assumed Efficiency		Effect on Dust Level	
			(%)		(% Remain)	
wetting before trasferring			60		40	
shedding of loading point			10		36	
water spraying during trasferring			60		14.4	
Loading Concrete Trucks Required Mitigation efficiency =						95%
Assumption: a dust level of 100						
Mitigation Measures			Assumed Efficiency		Effect on Dust Level	
			(%)		(% Remain)	
total enclosed wetting mixing			70		30	
dust laden-air to dust collector			80		6	
covered with flexible curtain			20		4.8	

Appendix 6

Typical ISCST Result File
of the
Hong Kong Cement Manufacturing Co. Limited
and
Shun Shing Fat Limited

```
1          ISCST - (DATED 90346)

           IBM-PC VERSION (2.05)
           (C) COPYRIGHT 1990, TRINITY CONSULTANTS, INC.
           SERIAL NUMBER 7303 SOLD TO EHS CONSULTANTS
           RUN BEGAN ON 06-22-95 AT 11:21:56


1
                     *** HKC ASR at Boundary                                    ***

        CALCULATE (CONCENTRATION=1,DEPOSITION=2)                         ISW(1) =   1
        RECEPTOR GRID SYSTEM (RECTANGULAR=1 OR 3, POLAR=2 OR 4)          ISW(2) =   3
        DISCRETE RECEPTOR SYSTEM (RECTANGULAR=1,POLAR=2)                 ISW(3) =   1
        TERRAIN ELEVATIONS ARE READ (YES=1,NO=0)                         ISW(4) =   1
        CALCULATIONS ARE WRITTEN TO TAPE (YES=1,NO=0)                    ISW(5) =   0
        LIST ALL INPUT DATA (NO=0,YES=1,MET DATA ALSO=2)                 ISW(6) =   1

        COMPUTE AVERAGE CONCENTRATION (OR TOTAL DEPOSITION)
        WITH THE FOLLOWING TIME PERIODS:
          HOURLY (YES=1,NO=0)                                            ISW(7) =   0
          2-HOUR (YES=1,NO=0)                                            ISW(8) =   0
          3-HOUR (YES=1,NO=0)                                            ISW(9) =   0
          4-HOUR (YES=1,NO=0)                                           ISW(10) =   0
          6-HOUR (YES=1,NO=0)                                           ISW(11) =   0
          8-HOUR (YES=1,NO=0)                                           ISW(12) =   0
          12-HOUR (YES=1,NO=0)                                          ISW(13) =   0
          24-HOUR (YES=1,NO=0)                                          ISW(14) =   1
        PRINT 'N'-DAY TABLE(S) (YES=1,NO=0)                             ISW(15) =   0

        PRINT THE FOLLOWING TYPES OF TABLES WHOSE TIME PERIODS ARE
        SPECIFIED BY ISW(7) THROUGH ISW(14):
          DAILY TABLES (YES=1,NO=0)                                     ISW(16) =   0
          HIGHEST & SECOND HIGHEST TABLES (YES=1,NO=0)                  ISW(17) =   1
          MAXIMUM 50 TABLES (YES=1,NO=0)                                ISW(18) =   1
        METEOROLOGICAL DATA INPUT METHOD (PRE-PROCESSED=1,CARD=2)       ISW(19) =   1
        RURAL-URBAN OPTION (RU.=0,UR. MODE 1=1,UR. MODE 2=2,UR. MODE 3=3)  ISW(20) =   3
        WIND PROFILE EXPONENT VALUES (DEFAULTS=1,USER ENTERS=2,3)       ISW(21) =   1
        VERTICAL POT. TEMP. GRADIENT VALUES (DEFAULTS=1,USER ENTERS=2,3)  ISW(22) =   1
        SCALE EMISSION RATES FOR ALL SOURCES (NO=0,YES>0)               ISW(23) =   0
        PROGRAM CALCULATES FINAL PLUME RISE ONLY (YES=1,NO=2)           ISW(24) =   1
        PROGRAM ADJUSTS ALL STACK HEIGHTS FOR DOWNWASH (YES=2,NO=1)     ISW(25) =   1
        PROGRAM USES BUOYANCY INDUCED DISPERSION (YES=1,NO=2)           ISW(26) =   1
        CONCENTRATIONS DURING CALM PERIODS SET = 0 (YES=1,NO=2)         ISW(27) =   1
        REG. DEFAULT OPTION CHOSEN (YES=1,NO=2)                         ISW(28) =   2
        TYPE OF POLLUTANT TO BE MODELLED (1=SO2,2=OTHER)                ISW(29) =   2
        DEBUG OPTION CHOSEN (YES=1,NO=2)                                ISW(30) =   2
        ABOVE GROUND (FLAGPOLE) RECEPTORS USED (YES=1,NO=0)             ISW(31) =   1

        NUMBER OF INPUT SOURCES                                          NSOURC =  10
        NUMBER OF SOURCE GROUPS (=0,ALL SOURCES)                         NGROUP =   0
        TIME PERIOD INTERVAL TO BE PRINTED (=0,ALL INTERVALS)             IPERD =   0
        NUMBER OF X (RANGE) GRID VALUES                                  NXPNTS =   0
        NUMBER OF Y (THETA) GRID VALUES                                  NYPNTS =   0
        NUMBER OF DISCRETE RECEPTORS                                     NXWYPT =  15
        SOURCE EMISSION RATE UNITS CONVERSION FACTOR                         TK =.10000E+07
        HEIGHT ABOVE GROUND AT WHICH WIND SPEED WAS MEASURED                 ZR = 136.00  METERS
```

```
         LOGICAL UNIT NUMBER OF METEOROLOGICAL DATA                          IMET =   9
         DECAY COEFFICIENT FOR PHYSICAL OR CHEMICAL DEPLETION               DECAY = .000000E+00
         SURFACE STATION NO.                                                  ISS = 92001
         YEAR OF SURFACE DATA                                                 ISY = 92
         UPPER AIR STATION NO.                                                IUS = 92002
         YEAR OF UPPER AIR DATA                                               IUY = 92
         ALLOCATED DATA STORAGE                                             LIMIT = 43500 WORDS
         REQUIRED DATA STORAGE FOR THIS PROBLEM RUN                         MIMIT =  3236 WORDS
1
                   *** HKC ASR at Boundary                                          ***

                              *** METEOROLOGICAL DAYS TO BE PROCESSED ***
                                               (IF=1)

  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1

                         *** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
                                             (METERS/SEC)

                                   1.54,   3.09,   5.14,   8.23,  10.80,


                                     *** WIND PROFILE EXPONENTS ***


       STABILITY                                WIND SPEED CATEGORY
       CATEGORY          1             2             3             4             5             6
          A         .15000E+00    .15000E+00    .15000E+00    .15000E+00    .15000E+00    .15000E+00
          B         .15000E+00    .15000E+00    .15000E+00    .15000E+00    .15000E+00    .15000E+00
          C         .20000E+00    .20000E+00    .20000E+00    .20000E+00    .20000E+00    .20000E+00
          D         .25000E+00    .25000E+00    .25000E+00    .25000E+00    .25000E+00    .25000E+00
          E         .30000E+00    .30000E+00    .30000E+00    .30000E+00    .30000E+00    .30000E+00
          F         .30000E+00    .30000E+00    .30000E+00    .30000E+00    .30000E+00    .30000E+00


                             *** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
                                       (DEGREES KELVIN PER METER)


       STABILITY                                WIND SPEED CATEGORY
       CATEGORY          1             2             3             4             5             6
          A         .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
          B         .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
          C         .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
          D         .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00    .00000E+00
          E         .20000E-01    .20000E-01    .20000E-01    .20000E-01    .20000E-01    .20000E-01
          F         .35000E-01    .35000E-01    .35000E-01    .35000E-01    .35000E-01    .35000E-01


                                *** X,Y COORDINATES OF DISCRETE RECEPTORS ***
```

```
                                                              (METERS)

      ( 827195.0, 824755.0),  ( 827195.0, 824755.0),  ( 827195.0, 824755.0),  ( 827195.0, 824755.0),  ( 827195.0, 824755.0),
      ( 827140.0, 824710.0),  ( 827140.0, 824710.0),  ( 827140.0, 824710.0),  ( 827140.0, 824710.0),  ( 827140.0, 824710.0),
      ( 827090.0, 824755.0),  ( 827090.0, 824755.0),  ( 827090.0, 824755.0),  ( 827090.0, 824755.0),  ( 827090.0, 824755.0),
      (
1

                              *** HKC ASR at Boundary                                              ***


                                                  * ELEVATION HEIGHTS IN METERS *
                                                * FOR THE DISCRETE RECEPTOR POINTS *

    - X -      - Y -          ELE.            - X -      - Y -         ELE.            - X -      - Y -         ELE.
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

  827195.0  824755.0       .00000        827195.0  824755.0       .00000        827195.0  824755.0       .00000
  827195.0  824755.0       .00000        827195.0  824755.0       .00000        827140.0  824710.0       .00000
  827140.0  824710.0       .00000        827140.0  824710.0       .00000        827140.0  824710.0       .00000
  827140.0  824710.0       .00000        827090.0  824755.0       .00000        827090.0  824755.0       .00000
  827090.0  824755.0       .00000        827090.0  824755.0       .00000        827090.0  824755.0       .00000
1

                              *** HKC ASR at Boundary                                              ***


                                           * ABOVE GROUND RECEPTOR HEIGHTS IN METERS *
                                                * FOR THE DISCRETE RECEPTOR POINTS *

    - X -      - Y -          HGT.            - X -      - Y -         HGT.            - X -      - Y -         HGT.
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

  827195.0  824755.0      5.00000        827195.0  824755.0     10.00000        827195.0  824755.0     15.00000
  827195.0  824755.0     20.00000        827195.0  824755.0     25.00000        827140.0  824710.0      5.00000
  827140.0  824710.0     10.00000        827140.0  824710.0     15.00000        827140.0  824710.0     20.00000
  827140.0  824710.0     25.00000        827090.0  824755.0      5.00000        827090.0  824755.0     10.00000
  827090.0  824755.0     15.00000        827090.0  824755.0     20.00000        827090.0  824755.0     25.00000
1
                              *** HKC ASR at Boundary                                              ***

                                                   *** SOURCE DATA ***

                   EMISSION RATE                                             TEMP.    EXIT VEL.
                      TYPE=0,1                                               TYPE=0    TYPE=0
        T W        (GRAMS/SEC)                                               (DEG.K);  (M/SEC);             BLDG.    BLDG.    BLDG.
        Y A NUMBER    TYPE=2                              BASE               VERT.DIM  HORZ.DIM DIAMETER  HEIGHT   LENGTH   WIDTH
 SOURCE P K  PART.  (GRAMS/SEC)     X         Y         ELEV.    HEIGHT     TYPE=1    TYPE=1,2  TYPE=0    TYPE=0   TYPE=0   TYPE=0
 NUMBER E E  CATS. *PER METER**2 (METERS)  (METERS)  (METERS)  (METERS)  (METERS)  (METERS)  (METERS)  (METERS)  (METERS)  (METERS)
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

      1  0 0   19    .70800E-01  827165.0  824763.0       .0     45.00    298.00      6.67      .52       .00      .00      .00
      2  0 0   19    .70800E-01  827165.0  824759.0       .0     45.00    298.00      6.67      .52       .00      .00      .00
```

```
      3  0 0    19    .20830E-01  827165.0  824755.0      .0    20.50   298.00     19.62     .52     .00     .00     .00
      4  0 0    19    .70800E-01  827165.0  824744.0      .0    45.00   298.00      6.67     .52     .00     .00     .00
      5  0 0    19    .70800E-01  827165.0  824739.0      .0    45.00   298.00      6.67     .52     .00     .00     .00
      6  0 0    19    .22500E+00  827165.0  824730.0      .0    20.50   298.00     13.56     .65     .00     .00     .00
      7  0 0    19    .33330E-01  827180.0  824743.0      .0    23.60   298.00     21.22     .20     .00     .00     .00
      8  0 0    19    .33330E-01  827180.0  824740.0      .0    23.60   298.00     58.95     .12     .00     .00     .00
      9  0 0    19    .33330E-01  827180.0  824734.0      .0    23.60   298.00     22.32     .19     .00     .00     .00
     10  0 0    19    .33330E-01  827180.0  824730.0      .0    23.60   298.00     21.22     .20     .00     .00     .00
1
                          *** HKC ASR at Boundary                                    ***

                                    *** SOURCE PARTICULATE DATA ***


         *** SOURCE NUMBER =      1 ***

         MASS FRACTION =
          .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
          .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

         SETTLING VELOCITY(METERS/SEC) =
           .0000,   .0001,   .0001,   .0002,   .0002,   .0003,   .0004,   .0004,   .0005,   .0005,
           .0006,   .0007,   .0007,   .0008,   .0008,   .0009,   .0012,   .0014,   .0015,

         SURFACE REFLECTION COEFFICIENT =
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,

         *** SOURCE NUMBER =      2 ***

         MASS FRACTION =
          .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
          .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

         SETTLING VELOCITY(METERS/SEC) =
           .0000,   .0001,   .0001,   .0002,   .0002,   .0003,   .0004,   .0004,   .0005,   .0005,
           .0006,   .0007,   .0007,   .0008,   .0008,   .0009,   .0012,   .0014,   .0015,

         SURFACE REFLECTION COEFFICIENT =
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,

         *** SOURCE NUMBER =      3 ***

         MASS FRACTION =
          .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
          .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

         SETTLING VELOCITY(METERS/SEC) =
           .0000,   .0001,   .0001,   .0002,   .0002,   .0003,   .0004,   .0004,   .0005,   .0005,
           .0006,   .0007,   .0007,   .0008,   .0008,   .0009,   .0012,   .0014,   .0015,

         SURFACE REFLECTION COEFFICIENT =
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
1
```

```
                    *** HKC ASR at Boundary                                          ***

                                        *** SOURCE PARTICULATE DATA ***



   *** SOURCE NUMBER =      4 ***

   MASS FRACTION =
    .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
    .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

   SETTLING VELOCITY(METERS/SEC) =
     .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
     .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

   SURFACE REFLECTION COEFFICIENT =
    .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
    .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,

   *** SOURCE NUMBER =      5 ***

   MASS FRACTION =
    .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
    .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

   SETTLING VELOCITY(METERS/SEC) =
     .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
     .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

   SURFACE REFLECTION COEFFICIENT =
    .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
    .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,

   *** SOURCE NUMBER =      6 ***

   MASS FRACTION =
    .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
    .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

   SETTLING VELOCITY(METERS/SEC) =
     .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
     .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

   SURFACE REFLECTION COEFFICIENT =
    .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
    .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
1
                    *** HKC ASR at Boundary                                          ***

                                        *** SOURCE PARTICULATE DATA ***



   *** SOURCE NUMBER =      7 ***

   MASS FRACTION =
```

```
  .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
  .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

 SETTLING VELOCITY(METERS/SEC) =
   .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
   .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

 SURFACE REFLECTION COEFFICIENT =
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,

 *** SOURCE NUMBER =     8 ***

 MASS FRACTION =
  .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
  .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .01450,

 SETTLING VELOCITY(METERS/SEC) =
   .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
   .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

 SURFACE REFLECTION COEFFICIENT =
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,

 *** SOURCE NUMBER =     9 ***

 MASS FRACTION =
  .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
  .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .14500,

 SETTLING VELOCITY(METERS/SEC) =
   .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
   .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

 SURFACE REFLECTION COEFFICIENT =
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
1
                      *** HKC ASR at Boundary                                          ***

                                     *** SOURCE PARTICULATE DATA ***



 *** SOURCE NUMBER =    10 ***

 MASS FRACTION =
  .03630, .03110, .06220, .03630, .08810, .05180, .06740, .04660, .03110, .05180,
  .05180, .03110, .03120, .03110, .04150, .02070, .09330, .05180, .01450,

 SETTLING VELOCITY(METERS/SEC) =
   .0000,  .0001,  .0001,  .0002,  .0002,  .0003,  .0004,  .0004,  .0005,  .0005,
   .0006,  .0007,  .0007,  .0008,  .0008,  .0009,  .0012,  .0014,  .0015,

 SURFACE REFLECTION COEFFICIENT =
  .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
```

```
          .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000, .30000,
1
                                   *** HKC ASR at Boundary                                     ***

                                   * SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *


     HOUR    SCALAR        HOUR    SCALAR        HOUR    SCALAR        HOUR    SCALAR        HOUR    SCALAR        HOUR    SCALAR
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -


 SOURCE NO. =      1
       1   .00000E+00       2   .00000E+00       3   .00000E+00       4   .00000E+00       5   .00000E+00       6   .00000E+00
       7   .00000E+00       8   .00000E+00       9   .10000E+01      10   .10000E+01      11   .10000E+01      12   .10000E+01
      13   .10000E+01      14   .10000E+01      15   .10000E+01      16   .10000E+01      17   .10000E+01      18   .10000E+01
      19   .10000E+01      20   .10000E+01      21   .10000E+01      22   .10000E+01      23   .10000E+01      24   .10000E+01


 SOURCE NO. =      2
       1   .00000E+00       2   .00000E+00       3   .00000E+00       4   .00000E+00       5   .00000E+00       6   .00000E+00
       7   .00000E+00       8   .00000E+00       9   .10000E+01      10   .10000E+01      11   .10000E+01      12   .10000E+01
      13   .10000E+01      14   .10000E+01      15   .10000E+01      16   .10000E+01      17   .10000E+01      18   .10000E+01
      19   .10000E+01      20   .10000E+01      21   .10000E+01      22   .10000E+01      23   .10000E+01      24   .10000E+01


 SOURCE NO. =      3
       1   .00000E+00       2   .00000E+00       3   .00000E+00       4   .00000E+00       5   .00000E+00       6   .00000E+00
       7   .00000E+00       8   .00000E+00       9   .10000E+01      10   .10000E+01      11   .10000E+01      12   .10000E+01
      13   .10000E+01      14   .10000E+01      15   .10000E+01      16   .10000E+01      17   .10000E+01      18   .10000E+01
      19   .10000E+01      20   .10000E+01      21   .10000E+01      22   .10000E+01      23   .10000E+01      24   .10000E+01


 SOURCE NO. =      4
       1   .00000E+00       2   .00000E+00       3   .00000E+00       4   .00000E+00       5   .00000E+00       6   .00000E+00
       7   .00000E+00       8   .00000E+00       9   .10000E+01      10   .10000E+01      11   .10000E+01      12   .10000E+01
      13   .10000E+01      14   .10000E+01      15   .10000E+01      16   .10000E+01      17   .10000E+01      18   .10000E+01
      19   .10000E+01      20   .10000E+01      21   .10000E+01      22   .10000E+01      23   .10000E+01      24   .10000E+01


 SOURCE NO. =      5
       1   .00000E+00       2   .00000E+00       3   .00000E+00       4   .00000E+00       5   .00000E+00       6   .00000E+00
       7   .00000E+00       8   .00000E+00       9   .10000E+01      10   .10000E+01      11   .10000E+01      12   .10000E+01
      13   .10000E+01      14   .10000E+01      15   .10000E+01      16   .10000E+01      17   .10000E+01      18   .10000E+01
      19   .10000E+01      20   .10000E+01      21   .10000E+01      22   .10000E+01      23   .10000E+01      24   .10000E+01


 SOURCE NO. =      6
       1   .00000E+00       2   .00000E+00       3   .00000E+00       4   .00000E+00       5   .00000E+00       6   .00000E+00
       7   .00000E+00       8   .00000E+00       9   .10000E+01      10   .10000E+01      11   .10000E+01      12   .10000E+01
      13   .10000E+01      14   .10000E+01      15   .10000E+01      16   .10000E+01      17   .10000E+01      18   .10000E+01
      19   .10000E+01      20   .00000E+00      21   .00000E+00      22   .00000E+00      23   .00000E+00      24   .00000E+00

1
                                   *** HKC ASR at Boundary                                     ***

                                   * SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *
```

```
     HOUR    SCALAR      HOUR    SCALAR      HOUR    SCALAR      HOUR    SCALAR      HOUR    SCALAR      HOUR    SCALAR
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -


SOURCE NO. =      7
       1  .00000E+00      2  .00000E+00      3  .00000E+00      4  .00000E+00      5  .00000E+00      6  .00000E+00
       7  .00000E+00      8  .10000E+01      9  .10000E+01     10  .10000E+01     11  .10000E+01     12  .10000E+01
      13  .10000E+01     14  .10000E+01     15  .10000E+01     16  .10000E+01     17  .10000E+01     18  .10000E+01
      19  .10000E+01     20  .10000E+01     21  .00000E+00     22  .00000E+00     23  .00000E+00     24  .00000E+00


SOURCE NO. =      8
       1  .00000E+00      2  .00000E+00      3  .00000E+00      4  .00000E+00      5  .00000E+00      6  .00000E+00
       7  .00000E+00      8  .10000E+01      9  .10000E+01     10  .10000E+01     11  .10000E+01     12  .10000E+01
      13  .10000E+01     14  .10000E+01     15  .10000E+01     16  .10000E+01     17  .10000E+01     18  .10000E+01
      19  .10000E+01     20  .10000E+01     21  .00000E+00     22  .00000E+00     23  .00000E+00     24  .00000E+00


SOURCE NO. =      9
       1  .00000E+00      2  .00000E+00      3  .00000E+00      4  .00000E+00      5  .00000E+00      6  .00000E+00
       7  .00000E+00      8  .10000E+01      9  .10000E+01     10  .10000E+01     11  .10000E+01     12  .10000E+01
      13  .10000E+01     14  .10000E+01     15  .10000E+01     16  .10000E+01     17  .10000E+01     18  .10000E+01
      19  .10000E+01     20  .10000E+01     21  .00000E+00     22  .00000E+00     23  .00000E+00     24  .00000E+00


SOURCE NO. =     10
       1  .00000E+00      2  .00000E+00      3  .00000E+00      4  .00000E+00      5  .00000E+00      6  .00000E+00
       7  .00000E+00      8  .10000E+01      9  .10000E+01     10  .10000E+01     11  .10000E+01     12  .10000E+01
      13  .10000E+01     14  .10000E+01     15  .10000E+01     16  .10000E+01     17  .10000E+01     18  .10000E+01
      19  .10000E+01     20  .10000E+01     21  .00000E+00     22  .00000E+00     23  .00000E+00     24  .00000E+00
* CALM HOURS (=1) FOR DAY  35 *  0  1  1  0  1  1  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY  38 *  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY  43 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
* CALM HOURS (=1) FOR DAY  44 *  0  0  0  0  0  1  0  0  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY  46 *  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY  68 *  0  1  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY  69 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0
* CALM HOURS (=1) FOR DAY  81 *  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY  93 *  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 104 *  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 105 *  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1
* CALM HOURS (=1) FOR DAY 106 *  0  1  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  0  0
* CALM HOURS (=1) FOR DAY 107 *  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 110 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  1  1  0  1  0
* CALM HOURS (=1) FOR DAY 117 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
* CALM HOURS (=1) FOR DAY 118 *  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 119 *  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 121 *  1  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 130 *  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 134 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 136 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
* CALM HOURS (=1) FOR DAY 138 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0
* CALM HOURS (=1) FOR DAY 139 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 144 *  1  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  1  0  0  1
* CALM HOURS (=1) FOR DAY 145 *  1  1  0  0  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

```
* CALM HOURS (=1) FOR DAY 150 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1
* CALM HOURS (=1) FOR DAY 151 *  1  1  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
* CALM HOURS (=1) FOR DAY 156 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 157 *  1  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 160 *  0  0  1  0  0  0  0  0  1  1  0  0  0  0  0  0  0  1  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 163 *  0  0  0  0  0  0  1  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 166 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
* CALM HOURS (=1) FOR DAY 167 *  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  1  0  1  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 190 *  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 193 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0
* CALM HOURS (=1) FOR DAY 196 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
* CALM HOURS (=1) FOR DAY 197 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  0
* CALM HOURS (=1) FOR DAY 202 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 203 *  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 211 *  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 218 *  0  0  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 219 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0
* CALM HOURS (=1) FOR DAY 220 *  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 221 *  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 222 *  0  0  0  0  0  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 223 *  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 231 *  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
* CALM HOURS (=1) FOR DAY 233 *  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 234 *  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 235 *  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 236 *  0  0  0  1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 237 *  0  0  0  0  1  0  1  0  0  0  0  0  1  0  0  0  1  0  0  0  0  1  0  0
* CALM HOURS (=1) FOR DAY 238 *  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 239 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1
* CALM HOURS (=1) FOR DAY 240 *  1  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  1  0  1  0
* CALM HOURS (=1) FOR DAY 245 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1
* CALM HOURS (=1) FOR DAY 247 *  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 248 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
* CALM HOURS (=1) FOR DAY 258 *  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 259 *  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 260 *  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 267 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0
* CALM HOURS (=1) FOR DAY 268 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0
* CALM HOURS (=1) FOR DAY 272 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 273 *  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 275 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
* CALM HOURS (=1) FOR DAY 276 *  0  1  1  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 277 *  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 279 *  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 298 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 299 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 300 *  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 302 *  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 303 *  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  1  1  1  1  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 304 *  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 305 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 306 *  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 313 *  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 317 *  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  1  0  1  0  0  0  0  1  0
* CALM HOURS (=1) FOR DAY 318 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 320 *  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
* CALM HOURS (=1) FOR DAY 324 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
```

```
 * CALM HOURS (=1) FOR DAY 327 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
 * CALM HOURS (=1) FOR DAY 328 *  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 329 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  1  0  0
 * CALM HOURS (=1) FOR DAY 330 *  0  0  0  1  0  0  0  1  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 332 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0
 * CALM HOURS (=1) FOR DAY 333 *  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  1  1  0  1  1  0  0  0
 * CALM HOURS (=1) FOR DAY 334 *  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0  1  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 335 *  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1
 * CALM HOURS (=1) FOR DAY 336 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  0  1
 * CALM HOURS (=1) FOR DAY 341 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0
 * CALM HOURS (=1) FOR DAY 342 *  0  0  0  0  1  0  0  0  0  0  0  0  0  0  1  0  1  1  0  0  0  0  1  0
 * CALM HOURS (=1) FOR DAY 344 *  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  1  0  0  1  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 345 *  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 355 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
 * CALM HOURS (=1) FOR DAY 356 *  0  0  0  0  0  0  0  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 359 *  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 361 *  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1
 * CALM HOURS (=1) FOR DAY 362 *  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  1  0  0  0  0  0  0
 * CALM HOURS (=1) FOR DAY 363 *  0  0  0  0  0  0  1  1  0  0  1  0  1  1  1  0  1  0  0  0  1  1  0  0
1                                                                                                                    HIGH
                                                                                                                     24-HR
                                                                                                                     SGROUP#   1

                                  *** HKC ASR at Boundary                                          ***


                                 * HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER)      *
                                                        * FROM ALL SOURCES *
                                                 * FOR THE DISCRETE RECEPTOR POINTS *

                 - X -       - Y -          CON.      (DAY,PER.)             - X -       - Y -          CON.      (DAY,PER.)
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

               827195.0    824755.0        .06230   (212, 1)             827195.0    824755.0       .27520C (203, 1)
               827195.0    824755.0       1.96367C (203, 1)              827195.0    824755.0     10.35531C (203, 1)
               827195.0    824755.0      33.78474C (203, 1)              827140.0    824710.0       .53944  (254, 1)
               827140.0    824710.0       1.51048  ( 57, 1)              827140.0    824710.0      5.43198  ( 57, 1)
               827140.0    824710.0      17.71852  ( 48, 1)              827140.0    824710.0     49.48260  ( 48, 1)
               827090.0    824755.0       3.71888  (274, 1)              827090.0    824755.0      4.04492  (274, 1)
               827090.0    824755.0       5.28451  (274, 1)              827090.0    824755.0      7.63250  ( 33, 1)
               827090.0    824755.0      10.01613  ( 33, 1)
1                                                                                                                    2ND HIGH
                                                                                                                     24-HR
                                                                                                                     SGROUP#   1

                                  *** HKC ASR at Boundary                                          ***


                              * SECOND HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER)      *
                                                        * FROM ALL SOURCES *
                                                 * FOR THE DISCRETE RECEPTOR POINTS *

                 - X -       - Y -          CON.      (DAY,PER.)             - X -       - Y -          CON.      (DAY,PER.)
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

               827195.0    824755.0        .05429C ( 51, 1)              827195.0    824755.0       .23780  (212, 1)
               827195.0    824755.0        .86268  (212, 1)              827195.0    824755.0      2.91719C (277, 1)
               827195.0    824755.0       8.43633C (277, 1)              827140.0    824710.0       .51274  (249, 1)
               827140.0    824710.0       1.44791  ( 55, 1)              827140.0    824710.0      5.26040  ( 55, 1)
```

```
           827140.0  824710.0      17.18524  ( 47, 1)                  827140.0  824710.0      45.35955  ( 50, 1)
           827090.0  824755.0       2.90077  (281, 1)                  827090.0  824755.0       3.03424  (281, 1)
           827090.0  824755.0       5.00424  ( 33, 1)                  827090.0  824755.0       7.29318  (274, 1)
           827090.0  824755.0       9.83672  (274, 1)
 1                                                                                                                    MAX 50
                                                                                                                      24-HR
                                                                                                                      SGROUP#  1
                          *** HKC ASR at Boundary                                                   ***

                       * 50 MAXIMUM 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER)     *

                                                * FROM ALL SOURCES *

                                                X      Y(METERS)                                                X      Y(METERS)
                                               OR         OR                                                   OR         OR
                                             RANGE     DIRECTION                                             RANGE     DIRECTION
      RANK        CON.       PER. DAY      (METERS)   (DEGREES)          RANK        CON.       PER. DAY      (METERS)   (DEGREES)
   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

        1       49.48260      1   48    827140.0   824710.0           26       16.00174      1  252    827140.0   824710.0
        2       45.35955      1   50    827140.0   824710.0           27       15.93603      1   57    827140.0   824710.0
        3       43.92039      1   47    827140.0   824710.0           28       15.86181      1   55    827140.0   824710.0
        4       43.44819      1   53    827140.0   824710.0           29       15.72832      1  263    827140.0   824710.0
        5       43.01530      1   52    827140.0   824710.0           30       15.53861      1   53    827140.0   824710.0
        6       41.49039      1   49    827140.0   824710.0           31       15.42298      1   52    827140.0   824710.0
        7       40.14400      1   54    827140.0   824710.0           32       15.33427      1   56    827140.0   824710.0
        8       39.99253      1   51    827140.0   824710.0           33       15.19197      1   49    827140.0   824710.0
        9       34.95993      1   55    827140.0   824710.0           34       15.14144C     1  359    827140.0   824710.0
       10       33.81146      1   57    827140.0   824710.0           35       15.05790      1   39    827140.0   824710.0
       11       33.78474C     1  203    827195.0   824755.0           36       14.75294      1   50    827140.0   824710.0
       12       33.68502      1   56    827140.0   824710.0           37       14.63178      1   54    827140.0   824710.0
       13       25.15986      1  131    827140.0   824710.0           38       14.14268      1   37    827140.0   824710.0
       14       19.65196      1  360    827140.0   824710.0           39       13.31155      1  349    827140.0   824710.0
       15       18.65515C     1  306    827140.0   824710.0           40       13.15265      1   82    827140.0   824710.0
       16       17.71852      1   48    827140.0   824710.0           41       12.55487      1  291    827140.0   824710.0
       17       17.68090      1  179    827140.0   824710.0           42       12.52779      1   99    827140.0   824710.0
       18       17.18524      1   47    827140.0   824710.0           43       12.29123C     1  248    827140.0   824710.0
       19       17.12536      1  253    827140.0   824710.0           44       12.21327      1   96    827140.0   824710.0
       20       16.83156      1   41    827140.0   824710.0           45       11.55482      1  194    827140.0   824710.0
       21       16.75508      1  251    827140.0   824710.0           46       11.36901C     1  279    827140.0   824710.0
       22       16.46284      1   51    827140.0   824710.0           47       11.36208      1  199    827140.0   824710.0
       23       16.44020      1  254    827140.0   824710.0           48       11.08163      1   32    827140.0   824710.0
       24       16.31551      1  250    827140.0   824710.0           49       10.81289C     1   44    827140.0   824710.0
       25       16.27883      1  249    827140.0   824710.0           50       10.79828      1  262    827140.0   824710.0
 1
                                               * EXCEEDENCE TABLE *

                                       EXCEEDENCE LEVELS IN (MICROGRAMS/CUBIC METER)
                                       NUMBER OF CALM HOURS:  217


                            AVERAGE - 24 HOUR
                            LEVEL -   .16E+03
```

```
          RECEPTORS              EXCEEDENCES
 #        X          Y         PERCENT    NUMBER
- - - - - - - - - - - - - - - - - - - - - - - -
  1 827195.00 824755.00 |       .00%         0
  2 827195.00 824755.00 |       .00%         0
  3 827195.00 824755.00 |       .00%         0
  4 827195.00 824755.00 |       .00%         0
  5 827195.00 824755.00 |       .00%         0
  6 827140.00 824710.00 |       .00%         0
  7 827140.00 824710.00 |       .00%         0
  8 827140.00 824710.00 |       .00%         0
  9 827140.00 824710.00 |       .00%         0
 10 827140.00 824710.00 |       .00%         0
 11 827090.00 824755.00 |       .00%         0
 12 827090.00 824755.00 |       .00%         0
 13 827090.00 824755.00 |       .00%         0
 14 827090.00 824755.00 |       .00%         0
 15 827090.00 824755.00 |       .00%         0

RUN ENDED ON 06-22-95 AT 11:31:58
```

Appendix 7

Typical FDM Result File
of the
Pioneer Concrete (HK) Limited,
Quon Hing Concrete Co. Limited
and
Site Access Roads

```
1                    FDM - (DATED 91109)

                     IBM-PC VERSION (1.01)
                     (C) COPYRIGHT 1991, TRINITY CONSULTANTS, INC.
                     SERIAL NUMBER 9181  SOLD TO EHS CONSULTANTS LTD
                     RUN BEGAN ON  6/22/95 AT 16:24:11




        RUN TITLE:
             Quon Hing & Pioneer & Paved Site Access Roads

             INPUT FILE NAME: CBPB1.DAT
             OUTPUT FILE NAME: CBPB1.LST
             MET DATA READ FROM FILE NAME: CPH92S.BIN
             PLOT OUTPUT WRITTEN TO FILE NAME: CBPB1.RAW


             CONVERGENCE OPTION 1=OFF, 2=ON                      1
             MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED          2
             PLOT FILE OUTPUT, 1=NO, 2=YES                       2
             MET DATA PRINT SWITCH, 1=NO, 2=YES                  1
             POST-PROCESSOR OUTPUT, 1=NO, 2=YES                  1
             DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER       1
             PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES            1
             PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES            1
             PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES            1
             PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES           3
             PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES         1
             BYPASS RAMMET CALMS RECOGNITION, 1=NO, 2=YES        2
             NUMBER OF SOURCES PROCESSED                        19
             NUMBER OF RECEPTORS PROCESSED                       5
             NUMBER OF PARTICLE SIZE CLASSES                    19
             NUMBER OF HOURS OF MET DATA PROCESSED            8760
             LENGTH IN MINUTES OF 1-HOUR OF MET DATA           60.
             ROUGHNESS LENGTH IN CM                          10.00
             SCALING FACTOR FOR SOURCE AND RECPTORS         1.0000
             PARTICLE DENSITY IN G/CM**3                      2.50
             ANEMOMETER HEIGHT IN M                         136.00

             PREPROCESSED METEOROLOGICAL DATA SELECTION SWITCHES
             11111111111111111111111111111111111111111111111111111111111111111111111111111111
             11111111111111111111111111111111111111111111111111111111111111111111111111111111
             11111111111111111111111111111111111111111111111111111111111111111111111111111111
             11111111111111111111111111111111111111111111111111111111111111111111111111111111
             1111111111111111111111111111111111111111111110


             GENERAL PARTICLE SIZE CLASS INFORMATION

                                          GRAV.                  FRACTION
               PARTICLE          CHAR.   SETTLING   DEPOSITION    IN EACH
                   SIZE           DIA.   VELOCITY    VELOCITY       SIZE
                  CLASS           (UM)   (M/SEC)     (M/SEC)       CLASS
```

```
               -----  ---------  --------  ----------  --------
                   1  1.0000000        **          **     .0363
                   2  2.0000000        **          **     .0311
                   3  4.0000000        **          **     .0622
                   4  5.0000000        **          **     .0363
                   5  8.0000000        **          **     .0881
                   6 10.0000000        **          **     .0518
                   7 12.0000000        **          **     .0674
                   8 14.0000000        **          **     .0466
                   9 16.0000000        **          **     .0311
                  10 18.0000000        **          **     .0518
                  11 20.0000000        **          **     .0518
                  12 22.0000000        **          **     .0311
                  13 24.0000000        **          **     .0312
                  14 26.0000000        **          **     .0311
                  15 28.0000000        **          **     .0415
                  16 30.0000000        **          **     .0207
                  17 40.0000000        **          **     .0933
                  18 45.0000000        **          **     .0518
                  19 50.0000000        **          **     .1451
          ----------
          ** COMPUTED BY FDM
1

          RECEPTOR COORDINATES (X,Y,Z)

(827195., 824755.,  5.)  (827195., 824755., 10.)  (827195., 824755., 15.)
(827195., 824755., 20.)  (827195., 824755., 25.)  (
1

          SOURCE INFORMATION

                 ENTERED EMIS.      TOTAL
                  RATE (G/SEC,   EMISSION   WIND
                   G/SEC/M OR        RATE  SPEED     X1       Y1      X2       Y2   HEIGHT   WIDTH
          TYPE     G/SEC/M**2)    (G/SEC)   FAC.    (M)      (M)      (M)      (M)     (M)     (M)
          ---- ---------------   -------- ------ -------  ------- -------  -------  ------  -------
             2      .000116000     .00371   .000 827188.  824712. 827156.  824712.    1.00     2.00
             2      .000097000     .00260   .000 827156.  824712. 827129.  824712.    1.00     2.00
             2      .000048000     .00146   .000 827130.  824712. 827099.  824712.    1.00     2.00
             2      .000048000     .00272   .000 827099.  824712. 827099.  824769.    1.00     2.00
             2      .000048000     .00110   .000 827099.  824769. 827122.  824769.    1.00     2.00
             2      .000048000     .00119   .000 827122.  824713. 827147.  824713.    1.00     2.00
             2      .000048000     .00278   .000 827130.  824713. 827130.  824771.    1.00     2.00
             2      .000048000     .00082   .000 827130.  824771. 827147.  824771.    1.00     2.00
             2      .000020000     .00128   .000 827157.  824713. 827157.  824777.    1.00     2.00
             2      .000020000     .00076   .000 827157.  824777. 827195.  824777.    1.00     2.00
             2      .000097000     .00446   .000 827147.  824713. 827193.  824713.    1.00     2.00
             1      .016930000     .01693  1.300 827100.  824789.      0.       0.    3.50      .00
             1      .014300000     .01430   .000 827108.  824736.      0.       0.   19.90      .00
             1      .008200000     .00820   .000 827104.  824748.      0.       0.   11.00      .00
             1      .071700000     .07170   .000 827104.  824748.      0.       0.    3.40      .00
             1      .009143000     .00914  1.300 827132.  824794.      0.       0.    3.50      .00
             1      .014300000     .01430   .000 827138.  824728.      0.       0.   19.90      .00
             1      .008200000     .00820   .000 827133.  824724.      0.       0.   11.00      .00
```

```
        1      .071700000      .07170    .000 827133.  824724.       0.        0.    3.40      .00
                          ===========
     TOTAL EMISSIONS             .23735
     NOTE:  SOME SOURCE EMISSION RATES ARE A FUNCTION OF WIND SPEED AND TOTAL IS NOT CORRECT
1


  TOP 50 TABLE FOR 24 HOUR AVERAGES


  RANK    RECEPTOR   X-COORDINATE    Y-COORDINATE    ENDING HOUR    CONCENTRATION     DEPOSITION
  ----    --------   ------------    ------------    -----------    -------------    ------------

    1         1        827195.0        824755.0         6240C          36.6384           .6574
    2         1        827195.0        824755.0         5064C          35.2657           .6063
    3         1        827195.0        824755.0         8016C          34.7492           .6375
    4         1        827195.0        824755.0         5904C          34.3557          1.3845
    5         1        827195.0        824755.0         2064C          30.6058          1.3503
    6         1        827195.0        824755.0         1632C          30.0491           .6283
    7         1        827195.0        824755.0         6216C          27.2308           .6050
    8         1        827195.0        824755.0         7704C          27.1231           .4819
    9         1        827195.0        824755.0         5280C          25.7347           .6575
   10         1        827195.0        824755.0         5256C          24.8459           .4528
   11         1        827195.0        824755.0         5856C          24.0951          1.3378
   12         1        827195.0        824755.0         4752C          22.3702           .3384
   13         1        827195.0        824755.0         5880C          22.2748          1.0263
   14         1        827195.0        824755.0         7680C          21.3530           .6345
   15         1        827195.0        824755.0         8712C          20.7258           .2706
   16         1        827195.0        824755.0         5760C          20.5590           .6605
   17         1        827195.0        824755.0         1680C          20.0456           .3993
   18         1        827195.0        824755.0         7896C          20.0082           .4501
   19         1        827195.0        824755.0         5688C          19.8247           .2743
   20         1        827195.0        824755.0         2184C          19.6884           .4946
   21         1        827195.0        824755.0         4728C          19.3791           .6397
   22         1        827195.0        824755.0         7272C          19.2806           .7043
   23         1        827195.0        824755.0         6552C          18.4276           .3904
   24         1        827195.0        824755.0         7248C          18.1363           .2520
   25         1        827195.0        824755.0         5784C          18.0762           .7398
   26         1        827195.0        824755.0         8064C          16.7949           .3108
   27         2        827195.0        824755.0         5904C          16.5751           .6669
   28         1        827195.0        824755.0         1560C          16.1721           .8624
   29         1        827195.0        824755.0         5184C          16.1530           .2386
   30         1        827195.0        824755.0          840C          16.0272           .2266
   31         1        827195.0        824755.0         5112C          15.7914           .2342
   32         1        827195.0        824755.0         5160C          15.6623           .2324
   33         1        827195.0        824755.0         6408C          15.4939           .6661
   34         1        827195.0        824755.0         5208C          15.2239           .2485
   35         1        827195.0        824755.0         7176C          15.1341           .2217
   36         1        827195.0        824755.0         8208C          14.6741           .4566
   37         1        827195.0        824755.0         8424C          14.2679           .4713
   38         1        827195.0        824755.0         1032C          14.1537           .3164
   39         1        827195.0        824755.0         1656C          14.0888           .1804
   40         1        827195.0        824755.0         5136C          14.0445           .2117
   41         1        827195.0        824755.0         4536C          13.7249           .6809
   42         1        827195.0        824755.0         4896C          13.1566          1.1736
```

```
  43        1       827195.0      824755.0      2208C       12.7909      .4589
  44        1       827195.0      824755.0      1536C       12.7435      .5250
  45        1       827195.0      824755.0      2112C       11.4667      .4695
  46        1       827195.0      824755.0      6432C       11.3198      .2980
  47        1       827195.0      824755.0      4008C       11.1643      .2975
  48        2       827195.0      824755.0      2064C       10.5451      .5165
  49        1       827195.0      824755.0      3816C       10.4184      .4125
  50        1       827195.0      824755.0      5088C       10.3001      .1551
1


  HIGHEST AND SECOND HIGHEST VALUES FOR 24 HOUR AVERAGES


  RECEPTOR   X-COORDINATE Y-COORDINATE HIGHEST VALUE  ENDING HOUR  DEPOSITION   SECOND HIGH  ENDING HOUR  DEPOSTION
  --------   ------------ ------------ ---------------------------------------   -----------------------------------

      1        827195.0     824755.0      36.6384    6240.C        .6574         35.2657     5064.C         .6063
      2        827195.0     824755.0      16.5751    5904.C        .6669         10.5451     2064.C         .5165
      3        827195.0     824755.0       9.4725    5904.C        .4521          6.6597     5280.C         .3926
      4        827195.0     824755.0       7.5896    7272.C        .1123          7.1061     5280.C         .1765
      5        827195.0     824755.0       3.0271    5904.C        .0960          1.5993     5280.C         .0291

 RUN ENDED ON  6/22/95 AT 16:45:26
```