Initial Environmental Examination Report for Organic Farming: Cambodia

Organic Farming, Cambodia: Akay Cambodia Private Limited

Submitted to Asian Development Bank

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Initial Environmental Examination Report for Organic Farming: Cambodia

Prepared for
Asian Development Bank (ADB)

Prepared by

AECOM India Private Limited

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List of Abbreviations

ADB	Asian Development Bank
DG	Diesel Generator
EHS	Environment Health & Safety
EHSS	Environment Health Safety and Social
EIA	Environment Impact Assessment
EMP	Environment Management Plan
ETP	Effluent Treatment Plant
GHS	Globally Harmonized System
GOC	Government of Cambodia
GRM	Grievance Redressal Mechanism
Ha	Hectares
HR	Human Resources
IEE	Initial Environment Examination
IFC	International Finance Corporation
IP	Indigenous Peoples
Kgs	Kilograms
KLD	Kilo Litre per day
KW	Kilowatt
LA	Land Acquisition
mbgl	metres below ground level
MOWRAM	Ministry of Water Resources and Meteorology
MT	Metric Ton
NH	National Highway
PPE	Personal Protective Equipment
PUC	Pollution Under Control
SPS	Safeguard Policy Statements
USD	United States Dollars
WHO	World Health Organisation

A. Executive Summary

1 Akay Group, established in 1995, is engaged in the manufacture of paprika and spices oleoresins, natural essential oils, and natural colours for global food industry.

2 Akay is presently seeking financial assistance from Asian Development Bank (ADB) for expansion of its existing organic farms located at Cambodia (Battambang Province) for the following activities

i. drip irrigation systems for rubber, black pepper, turmeric, cocoa and dragon fruits;
ii. extension of black pepper cultivation, and
iii. expansion of drying yard
iv. Development of an oleoresin extraction plant in Cambodia (which will be the subject of a subsequent IEE)

3 Akay Cambodia Private Limited (hereinafter referred as Akay Cambodia) forms the supply chain partner of Akay group operations. Akay Cambodia operations primarily include organic farming in Cambodia.

4 Currently, Akay Cambodia has occupied 717 hectares of agricultural farm land for undertaking organic farming in Prey Thum Village which is located in the Kampong Lpou Commune Samlout District in Battambang Province in north-western Cambodia (hereinafter referred as "organic farm"). At present cultivation of black pepper, turmeric, rubber, dragon fruit, cocoa, tapioca and maize is carried out in 295.25 hectares of the existing 717 hectares land. The key operations in the organic farm include cultivation of crops, nursery, sun drying of the produce from farming activities, storage of solar dried produce in a warehouse (located within the farm) and minor repairs or maintenance works of farm equipments and vehicles (like trucks for transport of material, tractors, excavators, road rollers, etc.).

5 The details of area cultivated under different crops is provided in the ***Table 1*** below:

Table 1: Details of crops cultivated in organic farms of Akay Cambodia, Battambang Province, Cambodia

S.No.	Name of Crops Cultivated	Current Area Planted (in hectares)
1	Black pepper	2.75
2	Turmeric	26
3	Rubber	236.5
4	Dragon Fruit	5
5	Cocoa	25
6	Tapioca	10
7	Maize	25

Total Area Cultivated	**295.25**

6 As per Article 2 of the Sub- Decree #72, Environment Impact Assessment Process dated 11th August, 1999[1] (hereinafter referred as EIA Process, 1999[2]), Initial Environment Impact Assessment and Environment Impact Assessment study is required for every proposed project and activities and existing and in-process, private, joint-venture and public projects that are listed in an Annex of EIA Process, 1999.

7 Agricultural activities undertaken in area greater than or equal to 10,000 hectares, as listed in Item number 4 of Category B of Annex under the said Sub Decree require IEIA or EIA approval from Ministry of Environment, Cambodia. As the area required for Akay Cambodia is only 717 ha therefore, the requirement of approval of Initial Environment Impact Assessment (IEIA) or EIA study under EIA Process, 1999 is not triggered and hence operations do not require an EIA study and associated approval.

8 This IEE has been prepared as per the requirements of ADB Safeguard Policy Statement (2009). It identifies the potential impacts caused due to the proposed operations of Akay Cambodia that can be avoided or mitigated by adopting appropriate mitigation measures during the life cycle of the proposed operations and implementing a management plan.

9 There are no impacts pertaining to involuntary resettlement from the project as the land has been purchased on a 'willing seller and willing buyer' principle through direct negotiated settlement with each of the one hundred and thirty six (136) landowners. These landowners were granted possession of five to ten (5 to 10) hectares of land each, as part of Social Land Concession Policy of Cambodia, 2003[3]. The land-use of the area was converted to agricultural during allocation under the concession. During the procurement of land by Akay, a large portion of the said land was not under any use except for few patches where agricultural activities were being undertaken. As most of the land owner did not reside close to the land, it was not actively used for agriculture. Also infestation of land mines in the area prevented the use of land for agriculture on bigger scale. As the land parcels were of limited use to the land owners, hence no economic displacement is envisaged. Akay engaged UN Mine Action Coordination Centre (MACC) for mine clearing exercise in the 717 ha area. The 717 ha was de-mined by identifying and safely disposing twenty (20) land mines. The mine clearing exercise was conducted in the period between 2009- 10.

[1] Sub- Decree #72 on Environment Impact Assessment Process dated 11 August, 1999 can be accessed at the below link: http://www.cambodiainvestment.gov.kh/sub-decree-72-anrk-bk-on-environment-impact-assessment-process-pdf_990811.html
[2] Sub- Decree #72 on Environment Impact Assessment Process dated 11 August, 1999 can be accessed at the below link: http://www.cambodiainvestment.gov.kh/sub-decree-72-anrk-bk-on-environment-impact-assessment-process-pdf_990811.html
[3] Social Land Concession Policy of Cambodia, 2003 can be accessed at the following link: http://www.cambodiainvestment.gov.kh/sub-decree-19-on-social-land-concessions_030319.html

10 There are no indigenous population identified in Prey Thum Village, Kampong Lpou, Samlout District in Battambang Province in north-western Cambodia, where the organic farm is located, hence no impact is envisaged. This was also confirmed with the Village Major.

11 The farm will use organic manure instead of fertilizers, which mainly comprises of 'Panchamrutam'- sugar extract, green beans, cow dung and cow urine. For pest control, integrated pest management has been implemented in the farm operations.

12 The operation stage impacts are agricultural only and includes managements of liquid and solid waste, apart from adopting EHS performance standards for the work force at all Akay's proposed and current operations.

13 During the lifecycle of the project, the facility will undertake regular environmental, occupational health and safety, and social review for all its activities to comply with the operating permits, if any, as well as safeguards monitoring and reporting requirements of ADB.

14 The IEE has enabled to prepare an Environmental and Social Management Plan (ESMP) for the entire life cycle of the proposed operations and has suggested institutional arrangements for implementing the EMP. The IEE also includes a periodical environmental monitoring schedule for the entire life cycle of the project.

15 The implementation of the ESMP for all stages of the proposed activities, complying with the regulatory requirements at the local level and the national level like obtaining pre-construction permits and certificates and further implementation of environmental enhancement measures has been defined in the present IEE. Implementation of ESMP will enable the proposed operations to be environmentally sustainable and become consistent with the safeguard requirements of SPS, 2009 and will not involve any kind of reputational risk to ADB on safeguards and other social issues.

16 Akay procured land for the Cambodia farm through a local contact who directly purchased the land from the land owners by negotiating with them and therefore involuntary resettlement issues are not triggered. There were no physical structure in the land. There is no impact on indigenous peoples due to the absence of ethnic minorities in and around the farm area. Akay has had informal information disclosure and consultations with the local authorities in the vicinity of the farm area.

17 As per the EMP, Akay will keep a communication channel open for the local community to approach the management if faced with any difficulties and concerns arising out of the proposed farm's activities. In addition, a grievance redressal mechanism will be set up in the farm to receive any complaints/grievances (either orally or in documented form) related to the proposed activities from local people/adjacent land owners and such grievances will be resolved in a timely manner.

B. Policy, Legal and Administrative Framework

B1 Applicable National Regulatory Acts and Notifications to Akay Cambodia

18 As per review of Akay's operations in Cambodia, the following Environment Health Safety and Social (EHSS) national and local regulations were identified to be applicable:

19 **Environment.** The plant operations must comply with the following environmental laws and regulations and provisions made thereunder:

- Law on Environment Protection and Natural Resource Management, 1996
  - Sub-Decree on Solid Waste Management, 1999
  - Sub-Decree on Water Pollution Control, 1999
  - Sub-Decree on Air Pollution and Noise Disturbance Control, 2000
  - Sub Decree on the Standards and Management of Agricultural Materials, 1998
  - Sub Decree on Globally Harmonized System (GHS) of Classification and Labelling of Hazardous Chemicals, 2010
- Law on Water Resources Management, 2007
- Article 13 and 14 of Anukret on Solid Waste Management

20 **Applicability of Environmental Laws and Regulations:** The Cambodian farm operations will primarily involve drip irrigation facility for rubber, black pepper, turmeric, cocoa and dragon fruits; expansion of pepper cultivation and solar drying of spices.

21 As per Article 13 of Sub-Decree no. 42 on Air Pollution and Noise Disturbance Control, 2000, Discharge Permission shall be sought from Ministry of Environment prior to commencement of a project for emission of pollutants and noise from an immovable source(such as DG sets). The permission shall be applied by the project proponent or Akay at least 40 days prior to commencement in Phnom Penh and 60 days in case of any other town/province.

22 As per Articles 11 and 12 of the Law on Water Resources Management, 2007, a Water Use License shall be obtained from Ministry of Water Resources and Meteorology (MOWRAM) for usage of water for irrigating the agricultural land.

23 Maintenance of equipments in the maintenance yard would generate various types of hazardous waste like used oil, waste oil, contaminated cotton waste, paint and empty chemical containers, etc. which have been classified as hazardous waste under Sub-Decree on Solid Waste Management, 1999. Thus, such wastes shall be managed as per the provisions of the decree. All wastewater generated shall be passed through and oil trap.

24 Adequate stack heights will be provided to diesel generator sets in the area and shall ensure compliance to requirements in Sub-Decree on the Control of Air Pollution and Noise Disturbance.

25 The applicable environmental regulatory requirements to the proposed facility under ADB financing has been summarised in the following ***Table 2***

Table 2: Applicable Environmental Regulatory Requirements

S. No	Regulatory Requirement	Regulatory Agency	Applicability to proposed operations	Action Required
1.	**Discharge Permission** as per Sub-Decree on Air Pollution and Noise Disturbance Control, 2000	Ministry of Environment	**Applicable** Since the project activities will involve emission from DG sets	The farm shall apply for Discharge Permission at least 40 days prior to project commencement
2.	Water Use Licence	MOWRAM	**Applicable** Water used for irrigation purposes will be in excess of individual requirements.	Farm shall submit application along with prescribed fees for obtaining license in prescribed format to the MOWRAM.
3.	Solid and Hazardous Waste disposal	Ministry of Environment	**Applicable** Maintenance yard operations would result in generation solid and hazardous waste	Management shall submit an application in prescribed format to the Ministry of Environment

B2 Regulatory Framework for Involuntary Resettlement and Rehabilitation

26 **Land Law of the Kingdom of Cambodia, 1993 as amended in 2001 (Land Law 1993).** The Land law 1993, deals with land concession, acquisition of immovable properties under private or public ownership and defines the compensation terms. A land concession is a legal right established by a legal document issued under the discretion of the competent authority, given to any natural person or legal entity or group of persons to occupy a land and to exercise thereon the rights set forth by this law (Article 48). There are three types of concessions: Social Concessions, Economic Concessions and Use, Development or Exploitation Concessions. Economic Land Concession is granted under the law on the basis of five criteria. The licensing issuing authority shall ensure that there are no involuntary resettlement issues pertaining to the land for which concession is sought. In case of such issues, the concession will not be granted.

27 **Sub-Decree #19 on Social Land Concessions, 2003.** This decree deals with criteria, procedures and mechanism for the granting of social land concessions for residential use and/or family farming. Under Article 3, in case of resettlement issues, land shall be provided for displaced persons as a result of infrastructure development prior to licence issue. Under Article 18, the target land recipient of a social land concession for family farming shall actually cultivate the land within twelve (12) months after receiving the land and shall continue to utilize the land in accordance with the conditions of the concession program. After correctly complying with the criteria of the social land concession program for five (5) years the target land recipient has the right to ownership of the land and may request ownership title according to procedures determined in the instruction of the Minister of Ministry of Land Management, Urban Planning and Construction (MLMUPC). If a target land recipient dies during the implementation of the social land concession program, the successors in the target land recipient's family may continue to implement the social land concession program to complete five (5) years and shall have the right to ownership of that land. The target land recipient may not sell, rent or donate social concession land during the first five (5) years of the implementation of the social land concession program.

28 **Applicability of Land Law and Sub-decree on Social Concession:** Akay's organic farm is spread in an area of 717 hectares out of which 295.25 hectares is currently under cultivation, 0.038 hectares is the farm house quarters, 0.027 hectares the tractor house and workshop, 0.062 hectares the staff house and security house pig farm, 0.516 hectares the agricultural farm buildings (of 3 sheds), 0.090 hectares the ware house, 0.034 hectares the new villa, 0.001 hectare the agricultural store, 0.0009 hectare the diesel house, 0.004 hectares the generator house, 0.004 hectares the front security office, 0.057 hectares the new labour house and 1.37 hectares for the 34 existing ponds currently in use . Most of land owners were awarded land parcels (5 to 10 hectares) by the Government of Cambodia under the Social Concession Policy in 1996. The land was purchased by Akay's local point of contact from the 136 land owners in 2008-2009 through a process of 'willing buyer' and 'willing seller' arrangement. During the procurement of land by Akay, a significant portion of the land was not under any use except for few patches where agricultural activities were being undertaken. As most of the land owner did not reside close to the land, it was not actively used for agriculture. Also infestation of land mines in the area prevented the use of land for agriculture on bigger scale. The land parcels were of limited use to the land owners and hence no economic displacement is envisaged. As there was no immovable property in the said land parcel and payment was given in full to the land contributors, ADB's Involuntary Resettlement Safeguard requirement does not get triggered.

29 Article 8 of Land Law, 2001 states that only natural persons or legal entities of Khmer nationality have the right to ownership of land in the Kingdom of Cambodia. Thus, the following persons or entities may be owners of land in Cambodia: Cambodian citizens, public territorial collectives, public institutions, Cambodian public institutions, Cambodian communities or associations, public enterprises, Cambodian civil communities or associations, public enterprises, Cambodian civil or commercial enterprises and any Cambodian organization which is recognized by law as a

legal any Cambodian organization which is recognized by law as a legal entity. Akay's local point of contact (Khmer nationality) purchased the land from the individual land owners and transferred the land ownership of the farm area to Mr. Sen Matthew (Director of Akay Group) who has attained Cambodian citizenship. Currently, Mr. Sen Matthew, the Director of Akay Cambodia Private Limited owns the land on which organic farming is practiced by Akay Cambodia Private Limited. A letter of consent dated 9th August, 2014 stating Mr. Sen Matthew's consent to Akay Cambodia to carry out agricultural activities for a period of fifty years has been observed to be maintained.

30 The formal land registration at the national level of the said farm is currently not been done. At present, the land titling has been completed by Akay till the village and commune level. Sample copy of the land authorisation letter, sale deed and ownership transfer document has been provided in the annexure of the report. The formal titling of the land has been initiated by the Government of Cambodia and currently only Phnom Penh region has been completed till date. The land titling is yet to be completed by the Government of Cambodia in Battambang province.

31 After purchasing the land, a written informal notice was placed by Akay at the entrance of the farm area for 30 days as a grievance measure to invite any complaint from the land owners, if any.

B3 Regulatory/Legal Policy Framework for Indigenous Peoples

32 Indigenous People (IP) refer to a population with social, cultural, economic, and political traditions and institutions distinct from the mainstream or dominant society and culture.

33 As per ADB's Safeguard Policy Statement (2009), the term Indigenous People is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (i) self-identification as members of a distinct indigenous cultural group and recognition of its identity by others; (ii) collective annexure to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; (iii) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (iv) a distinct language, often different from the official language of the country or the region. Essentially, indigenous peoples have a social and cultural identity distinct from the mainstream society that makes them vulnerable to being overlooked in development processes.

34 **Land Law of the Kingdom of Cambodia, 1993 as amended in 2001.** According to Chapter 3, section 2 of the Land Law of Cambodia, 2001, indigenous communities need to be recognised as legal entities to be eligible for collective ownership of their lands. The Land Law states that immovable property of the state may be provided to natural persons or legal entities of Khmer

nationality. Article 8 lists the persons or legal persons covered by this provision, which includes 'Cambodian communities'. Article 10 defines collective ownership as "ownership by a group of persons exercising their prerogative through a legal way regulated for such ownership". Chapter 3, section 2 of the Land Law provides for collective ownership rights of indigenous communities to their lands. Article 23 envisages the legal recognition of indigenous communities to happen under 'a legal determination of the statutes of communities'.

35 **Forestry Law, 2002.** This law contains important provisions on traditional use and access rights to forest resources, though these do not include management rights. More important are the provisions that allow for the creation and management of community forests, whereby communities are granted an area of the Permanent Forest Reserve to manage and derive benefits from".

36 Article 2 ensures traditional user rights of timber products and non-timber forest products for local communities. Article 4 is remarkable in its recognition of "full public participation in all government decisions that have the potential impact on concerned communities, livelihoods of local communities and forest resources".

37 **Sub-Decree on Community Forestry, 2003.** This Sub-Decree aims at determining rules for the establishment, management and use of community forests throughout the Kingdom of Cambodia. The sub decree is applicable to the local Community which is the minority ethnic community or a group of local residents with original settlement in one or more villages, where they live in or near state forest with their tradition, custom, religious belief, culture and subsistence depending on the harvest of forest and non-forest products and the basic use of those forest resources.

38 **Applicability of Land Law, Forestry Law, Community Forestry.** As per the consultations conducted with the workers and site supervisors employed in the farm as well as the Villlage Major of Prey Thum Village and Deputy Commune Leader of Kampong Lpou Commune of Samlout District in Battambang province, the population of Prey Thum village belong to the largest ethnic "Khmer" group which constitutes 90% of Cambodian population. The indigenous communities in Cambodia consist of 24 ethnic minority groups namely, Kreung, Thmuon, Jarai, Kel, Steang, Kouy, Chhong, Tompuon, La'Eun, Brao, Kavet, Kachak, Lun, Radaer, Krol, Phnong, Ro'Ang, Sa'Ouch, Sam Rei, Mil, Koang, Por, Suoy and Spong [4]. Reportedly, there are no indigenous communities from these groups that are residing in or surrounding the farm area.

39 Besides the above mentioned laws, the national legislation pertaining to indigenous peoples also includes legal regulatory related to National Policy on Development of Indigenous Minorities 2009; Sub-Decree on Procedure of Commune Land Use Planning Process, 2009; Sub-Decree on Procedure, Establishment, Classification and Registration of Permanent Forest Estate, 2005; Sub-

[4] The list of ethnic minority group has been identified by IFAD in the Country Technical Note on Indigenous Peoples' Issues, 2012 which can be accessed at the below link: http://www.ifad.org/english/indigenous/pub/documents/tnotes/cambodia.pdf

Decree on State Land Management, 2005; Law on National Protected Area, 2008; Prakas on Identification and Mapping of State Land and State Land Classification, 2006. These national legislations are likewise not applicable due to the absence of indigenous population in the farm area.

40 Thus, ADB's Indigenous Peoples safeguards is not triggered in the case of Cambodia Farm as the projects do not directly or indirectly affects the dignity, human rights, livelihood systems, or culture of Indigenous Peoples or affects the territories or natural or cultural resources that Indigenous Peoples own, use, occupy, or claim as an ancestral domain or asset.

C. Description of Akay Operations: Current and Proposed Facilities

C1 About Akay

41 Akay Flavours and Aromatics Private Limited (hereinafter referred as 'AFAPL') is a manufacturer of spice based essential oils and oleoresins, based out of Kerala, India. The range of products, mainly extracted from various spices, include natural food colours, natural food flavours, natural antioxidants, organic spice extracts, essential Oils, neutraceutical products and seasonings. It is a part of a Dubai based company viz. A&P Group, which is a multi-dimensional conglomerate spread over the United Arab Emirates and India.

42 Mr. Alex Koshy is the Managing Director of A&P Group, which has interests in packaging, manufacturing concrete products, engineering, construction, oleoresins, packaged food and real estate business worldwide. Akay was founded, by A&P Group in the year 1995 with Mr. Alex Koshy as the Managing Director of the company. In 1996, Akay Group entered into a Joint Venture with Denmark based company Chr. Hansen A/S, however in 2007; Chr. Hansen sold its share back to A&P Group. Presently, Akay Group is solely owned by Dubai based A&P Group with Mr. Alex Koshy as its Chairman. Akay Group has warehouses or sale offices in Europe, China, Japan and USA. Research & Development and product development centre is in Cochin.

43 Akay intends to expand its operations both in India and Cambodia and therefore intends to obtain financial assistance from Asian Development Bank (hereinafter referred as "ADB" or "Bank" or "Investor"). To comply with ADB requirements, Akay have commissioned AECOM India Private Limited (hereinafter referred as "AECOM") to undertake an Environment and Social Assessment of the facilities under consideration which comprises of the following activities (hereinafter referred to as the "Project"):

- Development of manufacturing facility and marketing/distribution network for seasonings product at Akanadu, Kerala, India;
- Expansion of Laboratories at Ambunadu, Kerala, India;

- Expansion of organic farming in Cambodia (Battambang) where Akay has purchased 717 hectares of agricultural land and for which capital expenditures will be needed for :
    - Drip irrigation systems for rubber, black pepper, turmeric, cocoa and dragon fruits;
    - Extension of black pepper cultivation; and
    - Expansion of drying yard

C2 About the Report

44 The present document represents the Initial Environmental Examination (IEE) of the proposed Project of Akay Cambodia based operations as per the ADB Safeguard Policy Statement, 2009. The project has been categorised as "Category B" Project based on evaluation of various environment and social sensitivity of the project components, which has been detailed in the Categorisation Report (a standalone report), as per requirements under ADB Safeguard Policy Statement, 2009 viz. Environment, Involuntary Resettlement and Indigenous Peoples. "Category B" Projects have site specific impacts which can be mitigated by development and implementation of adequate management programs. The management programs and plans are developed based on initial environmental examination of the project.

C2 Akay Current and Proposed Operations in Cambodia

45 The details pertaining to Akay's existing and proposed operations is provided in ***Box 1-C*** and location map has been provided in ***Figure C-1*** as given below:

Box 1-C: Akay Current and Proposed Operations in Cambodia

Akay Current Operations in Cambodia:
Akay Cambodia has 717 hectares (ha) of land in Prey Thum Village, Kampong Lpou, Samlout District in Battambang Province in north-western Cambodia. About 295.25 ha of the existing 717 ha have been cleared and cultivation of black pepper, turmeric, rubber, dragon fruit, cocoa, etc. is undertaken. In addition, 0.038 hectares is the farm house quarters, 0.027 hectares the tractor house and workshop, 0.062 hectares the staff house and security house pig farm, 0.516 hectares the agricultural farm buildings (of 3 sheds), 0.090 hectares the ware house, 0.034 hectares the new villa, 0.001 hectare the agricultural store, 0.0009 hectare the diesel house, 0.004 hectares the generator house, 0.004 hectares the front security office, 0.057 hectares the new labour house and 1.37 hectares for the 34 existing ponds currently in use . The land was purchased on willing buyer-willing seller basis from 136 owners. Rain water is harvested for agricultural use and sprinklers are used in the existing farm in some places for irrigation. Currently, the farm has 34 rain water recharged ponds with a total capacity of 43252 m^3 (in total) which are used for irrigation. The farm houses a warehouse where the harvest is temporarily stored. The operations of the farm are managed by an Estate/Farm Manager with the assistance of fifteen site supervisors. The overall control of the farm is managed from the Akay headquarters in Kerala, India by the Managing Director and the corporate team. The indicative location map layout of the farm has been provided in ***Figure C-1*** of the present report.
Akay Proposed Operations in Cambodia:
ADB funding is sought for the following proposed activities: - Drip irrigation: The management intends to provide drip irrigation facility for rubber, black pepper, turmeric, cocoa, and dragon fruits. - Expansion of black pepper cultivation: Black pepper cultivation will be expanded in the year 2014-15, as reported. For expansion of black pepper cultivation, the management does not intend to

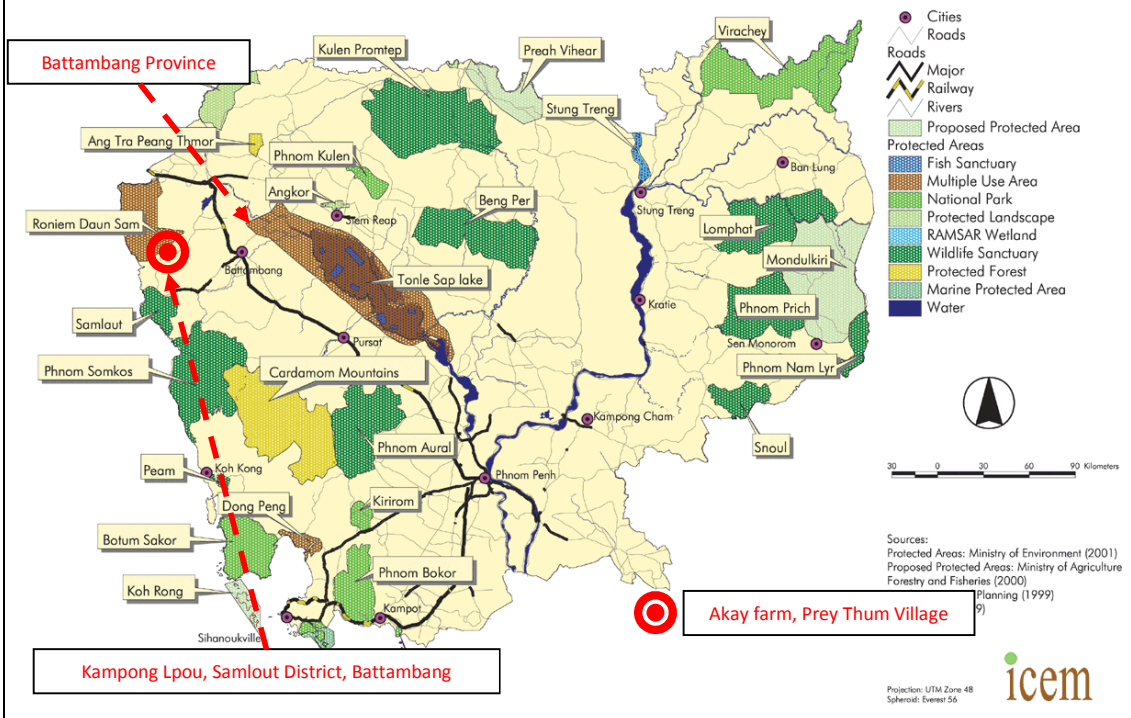
acquire more land. Approximately, 40 ha of the unutilised land parcel will be utilised for pepper cultivation. Currently, 2.75 ha of land is utilised for pepper cultivation which will be expanded to 40 ha.

- The break-up of the area to be covered under Drip Irrigation System in the model farm will be:
  Rubber: 437 Hectares
  Black Pepper: 42.75 Hectares
  Turmeric: 26.00 Hectares
  Cocoa: 25.00 Hectares
  Dragon fruit: 5.00 Hectares
  New Proposed Ponds (37 nos.): 1.8374 Hectares
  Proposed Strengthening/expansion of existing 20 ponds: 0.7 hectares

- The solar drying yard would be constructed near the warehouse in the existing 717 ha farm land occupied by Akay. The existing 717 ha includes the total area required for the 71 ponds (34 current ponds and 37 proposed new ponds) too which account for approximately 3.907 ha (1.37 ha for the 34 existing ponds currently in use, 1.8374 ha for 37 new ponds and 0.7 ha for strengthening/expansion of existing 20 ponds).The proposed expansion would be approximately 0.8 ha. The solar drying yard is proposed to be a concrete structure where the harvest from the organic farm would be stored in open for solar drying.

Figure C-1: Indicative Location Map of Akay Organic farm in Cambodia

(Prey Thum Village, Kampong Lpou, Samlout District in Battambang Province in north-western Cambodia)



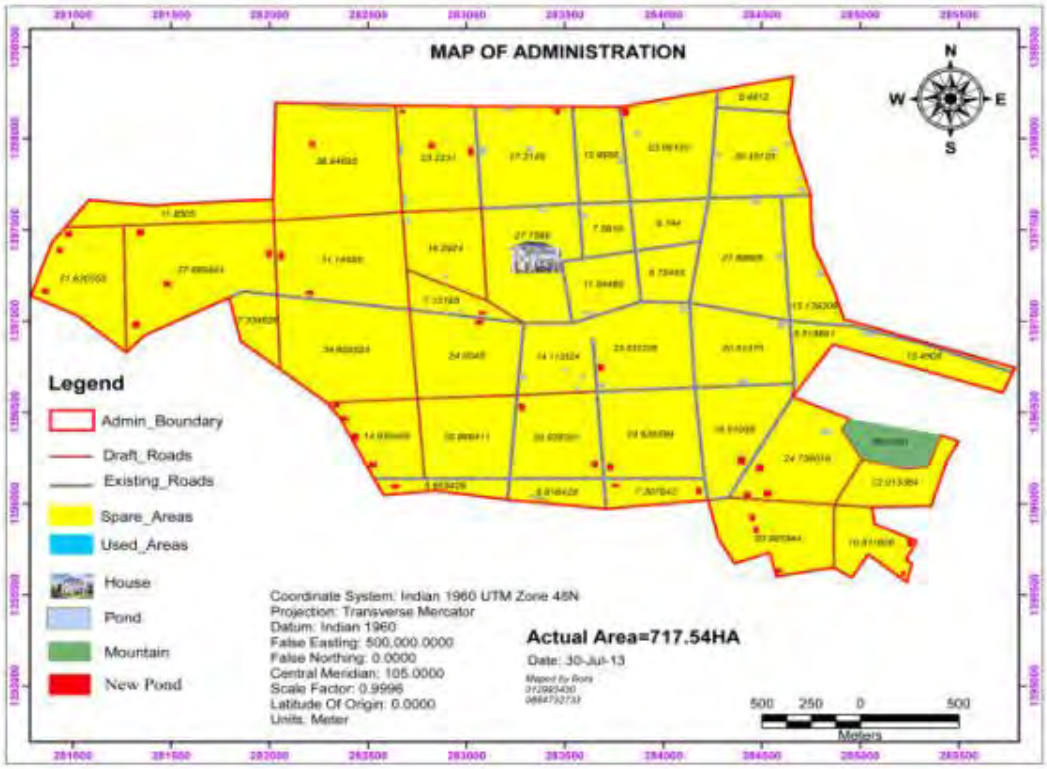
Source: *http://www.mekong-protected-areas.org/cambodia/pa-map.htm*

D. Description of Environment and Socio-Economic Baseline

46 **Site location:** The site is spread over an area of 717 hectares (ha) located in Prey Thum Village in Kampoung Lpou Commune, Samlout District, Battambang Province of Cambodia. A total of 295.25 hectares of the farm is currently utilized for cultivation. In addition, 0.038 hectares has been used for the construction of the farm house quarters, 0.027 hectares as the tractor house and workshop, 0.062 hectares as the staff house and security house pig farm, 0.516 hectares as the agricultural farm buildings (of 3 sheds), 0.090 hectares as the ware house, 0.034 hectares as the new villa, 0.001 hectare as the agricultural store, 0.0009 hectare as the diesel house, 0.004 hectares as the generator house, 0.004 hectares as the front security office, 0.057 hectares as the new labour house and 1.37 hectares for the 34 existing ponds currently in use. The map of the agricultural farm is provided in the ***Figure D-1*** below:

Figure D-1: Akay Organic farm in Cambodia

(Prey Thum Village, Kampong Lpou, Samlout District in Battambang Province in north-western Cambodia)

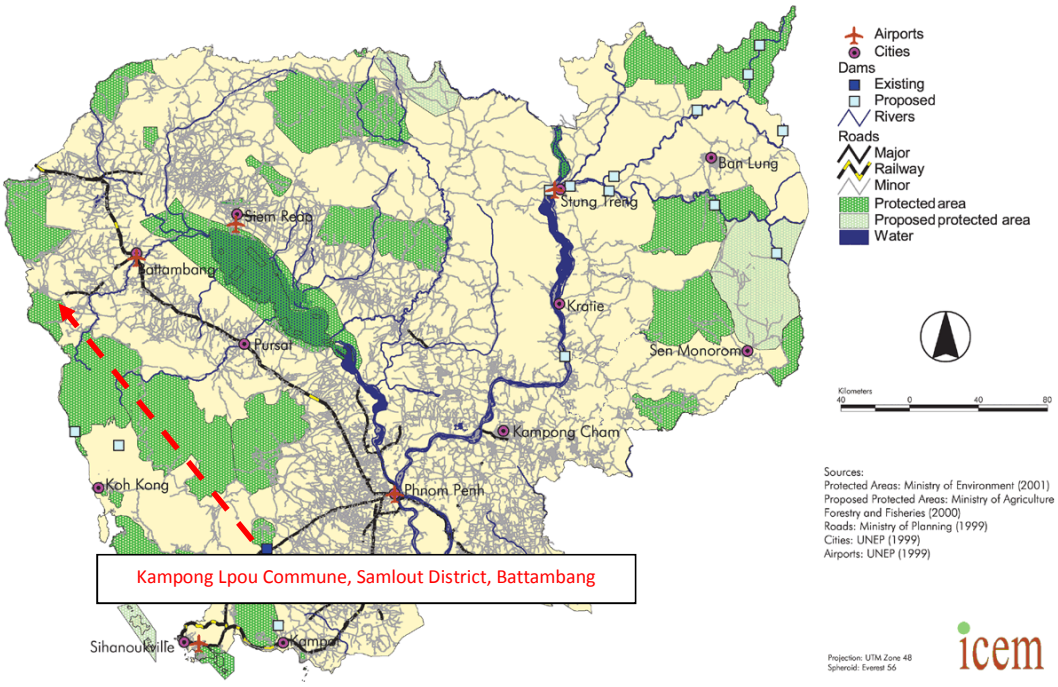


***Source**: Akay Cambodia Private Limited*

47 **Connectivity:** The site is an agricultural land area and is connected by Asian Highway (AH) 1. The site is 100 m from the Asothe Sub-village T-Junction which connects Battambang. The nearest airport is situated in Battambang which is approximately 65kms from the site. The connectivity of the site indicative to the existing infrastructure of Cambodia is depicted in ***Figure D-2*** below:

Figure D-2: Cambodia Infrastructure

Indicative road, railways and airport connectivity with Samlout District



Source: http://www.mekong-protected-areas.org

48 **Topography and Weather:** The topography is variable from the Tonle Sap (major fresh water lake in Central Cambodia which is approximately more than 150 km from the Prey Thum Village) floodplains in the East through a broad belt of lowland paddy fields in the centre to lowland/ upland mosaic and upland forested areas to the West**.** The Prey Thum village is on the western side of the Samlout district. The project location being in Battambang province, it's apparent from the ***Figure D-3*** that the region receives approximately 80-120 inches of rainfall annually.

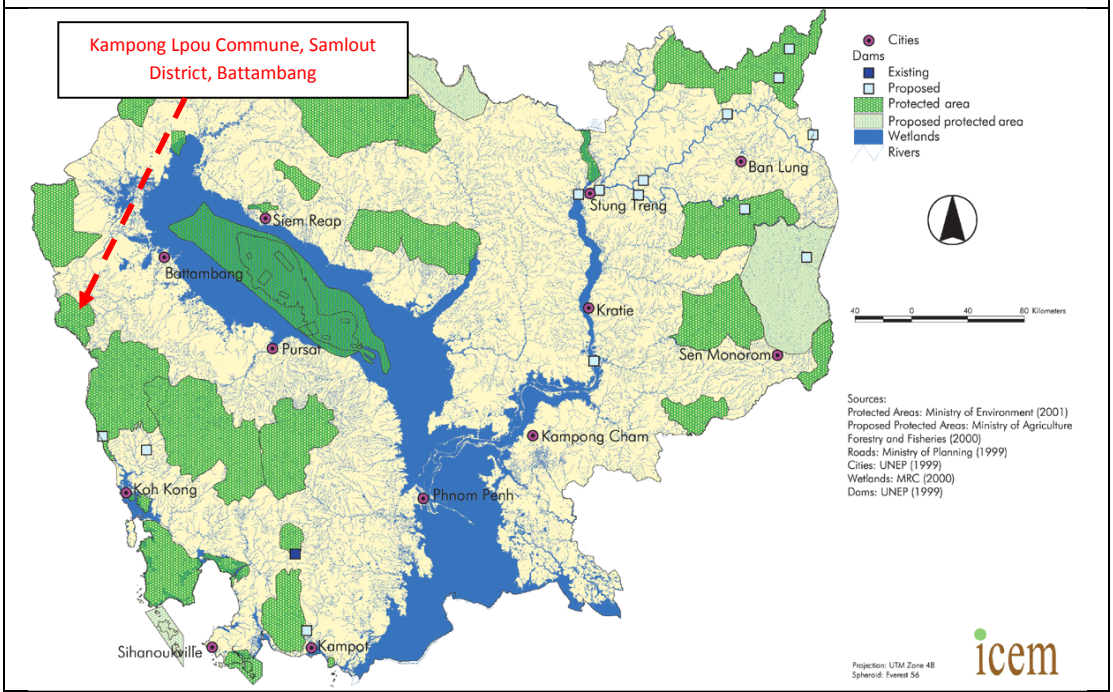
Figure D-3: Precipitation and Monsoon Airflow Map: Cambodia

***Source**: http://www.lib.utexas.edu/maps/indochina_atlas/txu-oclc-1092889-78339-8-70.jpg*

49 **Water Resources:** Kamping Puoy Reservoir (76 km) and Tonle Sap Lake (185 km) are the nearest surface water resources to the project site. Minor tributaries and canals flow in and around the project area which are majorly seasonal, as depicted in ***Figure D-4.*** As per Water Environment Partnership in Asia (WEPA) statistics, three groundwater wells existed in Battambang province in 1997 with an average yield of 25l/s and groundwater was found at an average productive depth of 43.5m bgl.[5] However, no canal/river water or groundwater will be intended to be used for farm works. The water for drip irrigation will be sourced from existing ponds and new proposed ponds. The management intends to strengthen the pond water network which is filled by rain water recharge. Currently there are 34 ponds existing in the 717 hectares land and additional 37 ponds would be constructed in the year 2014. The existing 34 ponds will also be strengthened and hence total water capacity of existing ponds would increase from 43252 cubic metre (in total) to 1, 21,226 cubic metre. The 37 ponds which would be constructed in the year 2014 will have the total water holding capacity of 1, 10,244 cubic metre. Hence, by the end of 2014, the total number of ponds in the 717 hectares farm would be 71 and the total water holding capacity would be 2, 31, 470 cubic metre. The map of existing and proposed water ponds and drip irrigation has not been developed by the management and was therefore, not available for review.

[5] The WEPA report can be accessed at the link given : http://www.wepa-db.net/policies/state/cambodia/groundwater4_3.htm

Figure D-4: River Basin Map: Cambodia



Source: *http://www.mekong-protected-areas.org*

50 **Flora and Fauna:** Samlout Protected Area, also referred to as Samlout Multiple Use Area[6], is part of the Cardamom Mountains in north-western Cambodia and is approximately 65 km away from Akay Cambodia Farm area. It sits in both Battambang and Pailin provinces. It is the gateway to Thailand. Samlout was declared a protected area in 1993 by King Norodom Sihanouk along with other forests and preserves. Samlout is a tropical rainforest in northwestern Cambodia, covering 60,000 hectares. Samlout is IUCN category VI (protected area with sustainable use of natural resources)[7] various land parcels in the area has been awarded by the Cambodian Government as part of the Social Land Concession Policy, for agricultural purposes to the local population. As per Commodity Intelligence Report of United States Department of Agriculture (USDA) 2010 on Cambodia[8] the Samlout region has been identified as scrub land which implies that the area was already majorly cleared by the local population before Akay operations in the area in the year 2009-10. The map depicting the land use from the above mentioned report in the year 2010 has been provided in the ***Figure D-6. Figure D-5*** provides details of protected area and land use pattern in 2001, as identified by Ministry of Environment and Ministry of Agriculture. Due to lack of recent ancillary and historic data, the direct impact on flora and fauna could not be deduced, however, it is observed during the site visits that

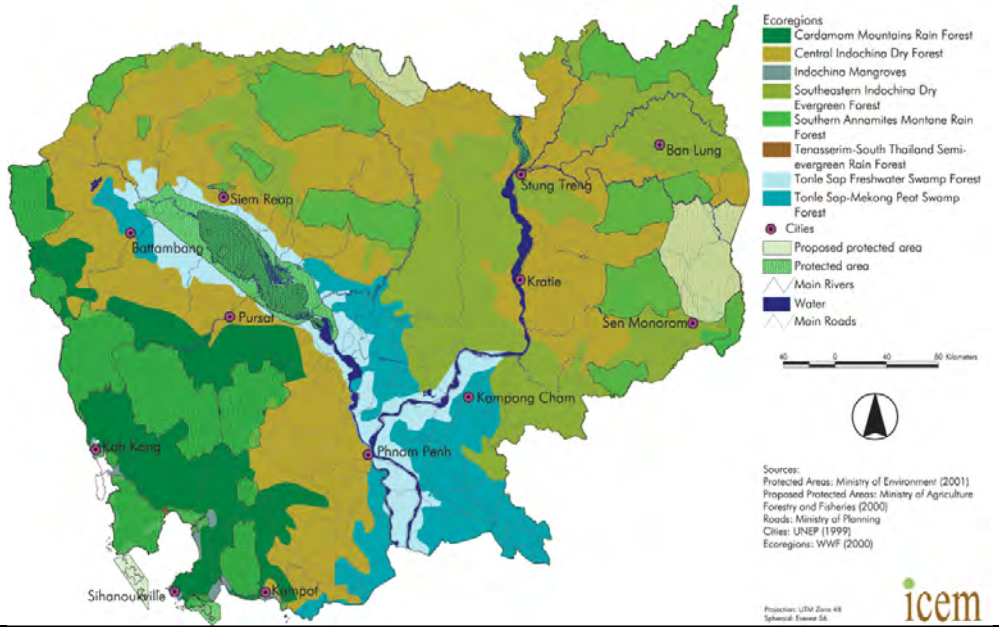
[6] National Report on Protected Areas and Development: Cambodia is available at the link below: http://www.mekong-protected-areas.org/cambodia/docs/Cambodia_nr.pdf

[7] Class VI of IUCN Protected Area Management Categories corresponds to the area which is to be managed mainly for the sustainable use of natural resources

[8] The Commodity Intelligence Report of United States Department of Agriculture (USDA) 2010 on Cambodia is available at the link: http://www.pecad.fas.usda.gov/highlights/2010/01/cambodia/

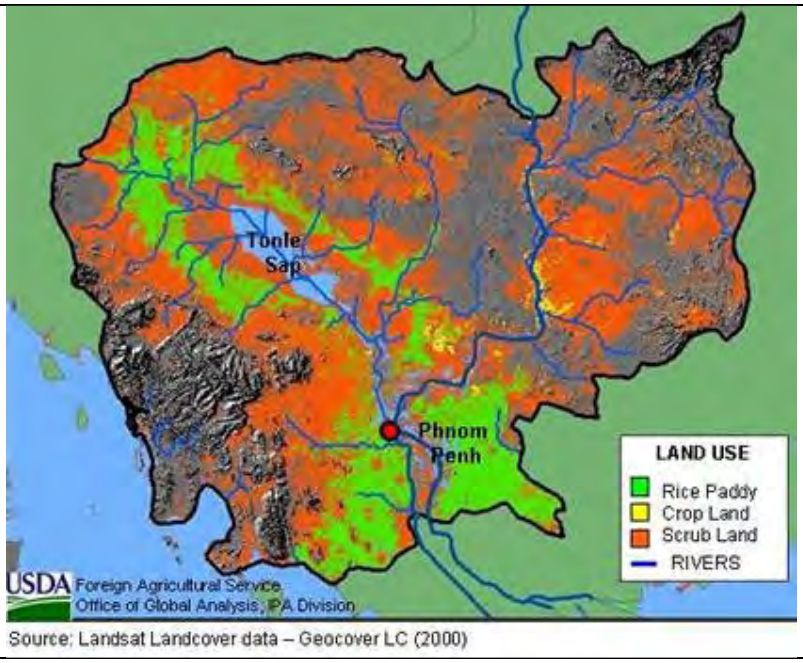
monoculture was prevalent in the area before the land was acquired by Mr. Sen Matthew and used by Akay for its operations. Hence, it is anticipated that due to agricultural operations of Akay no impact on the local flora and fauna is envisaged. The farm area reportedly has small mammals and reptiles which would not be disturbed significantly as the nature of project activities is agricultural. The surrounding area has adequate vegetation cover to accommodate the animals which may be influenced by the farm operations. No endangered fauna and flora species is present in the farm area in Prey Thum Village.

Figure D-5: Protected Area and Land use Map of 2001: Cambodia



Source: *http://dankoehl.blogspot.in/2011/12/elephants-in-cambodia.html*

Figure D-6: Land Use pattern: Cambodia-2010



***Source**: http://www.pecad.fas.usda.gov/highlights/2010/01/cambodia/*

51 **Archaeological/Historical Monuments:** As per the information available in the public domain (as depicted in the ***Figure D-7*** below), the project area in the Samlout district of Battambang province, Cambodia does not have structures of archaeological importance. During the site visit, no protected archaeological or historical monuments within 5km radius of the project site were observed and none was reported by the locals during public consultation undertaken by AECOM.

Figure D-7: Archaeological Structures: Cambodia

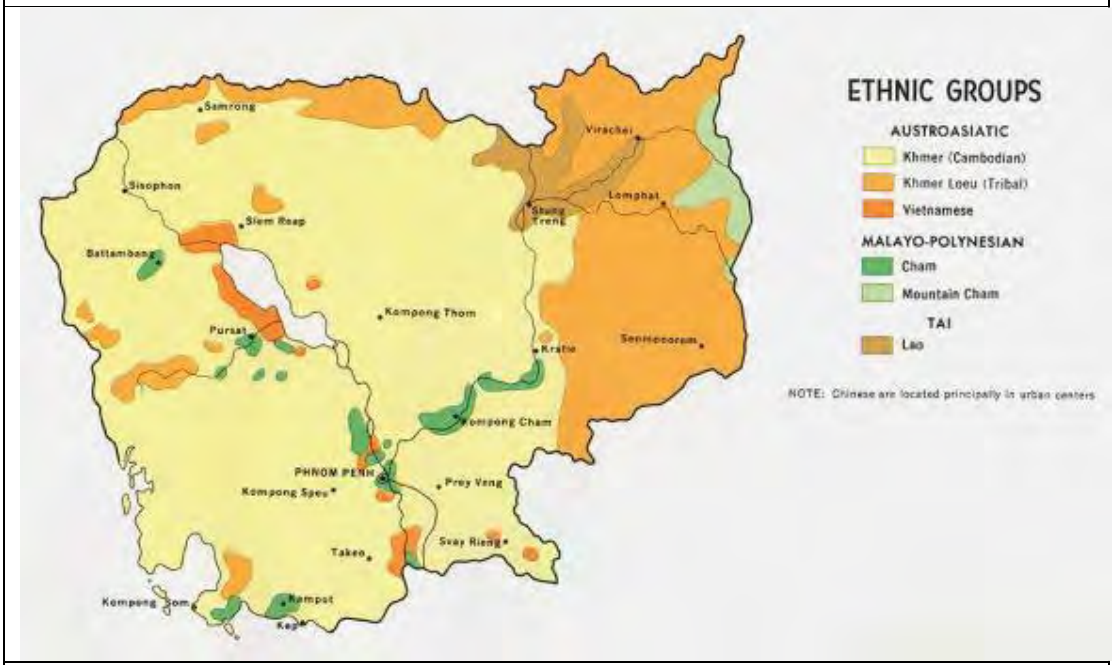
Source: *http://www.pnas.org/content/104/36/14277/F2.expansion.html*

52 **Land use:** The land prior to the procurement process was cultivated in patches with major parts having sparse secondary forest or scrub land as the land was infested with land mines. Akay engaged UN Mine Action Coordination Centre (MACC) for mine clearing exercise in the said area. MACC wherein the said agency de-mined the area by identifying and safely disposing twenty (20) land mines. The mine clearing exercise was conducted in the period between 2009-10 for the 717 ha land.

53 **Indigenous Population:** Consultations were conducted by AECOM during the site visit (on 6th and 7th March 2014) with temporary workers, permanent workers, site supervisors employed in the farm, the Village Major of Prey Thum Village and Deputy Commune Leader of Kampong Lpou Commune of Samlout District in Battambang province. During the consultation, it was understood that the population of Prey Thum village belong to the largest ethnic "Khmer" group which constitutes 90% of Cambodian population. The indigenous communities in Cambodia are made up of 24 ethnic minority groups namely, Kreung, Thmuon, Jarai, Kel, Steang, Kouy, Chhong, Tompuon, La'Eun, Brao, Kavet, Kachak, Lun, Radaer, Krol, Phnong, Ro'Ang, Sa'Ouch, Sam Rei, Mil, Koang, Por, Suoy and Spong. As per review of ancillary data available in the public domain, it was noted that the Samlout district has Khmer (Cambodian) and Khmer Loeu (Tribal) population. The farm area and the Prey Thum village have Khmer population only. No indigenous communities from the 24 ethnic minority groups as mentioned above reside in or

surrounding the farm area. ***Figure-D-8*** shows indicative geographical location of various ethnic groups in Cambodia.

Figure D-8: Ethnic Groups: Cambodia



Source: *http://www.lib.utexas.edu/maps/cambodia.html*

54 **Involuntary Resettlement:** Akay's organic farm is spread in an area of 717 hectares out of which 295.25 hectares is currently under cultivation. The land was under the ownership of 136 land owners. The land owners obtained the said parcels of land in 1996 from the Government of Cambodia under Social Concession Policy (2003). The parcels of land (5 to 10 hectares) were awarded to the people from other provinces also in Prey Thum Village by the Government of Cambodia for agriculture. Immovable assets were not present in the area. The land parcels had land-mines and unexploded ordnances due to which the area was not used by the local population. The concern of land mine prevented use of heavy machinery for agricultural practices and hence the market price of the land was insignificant. The land was therefore, cultivated in patches with majority of land being unutilised and uncultivated. The land owners were therefore willing to sell the said land mine infested area. Akay identified a local point of contact and the said 717 hectares of land was purchased on 'willing-buyer' and 'willing-seller' basis. The land was purchased by a local point of contact of Akay from the 136 land owners in 2008-2009 through a process of negotiated settlement individually. The land was purchased at the rate of 700 to 1300 USD per hectare, as reported by the four land seller and the village Major of Prey Thum Village. Documents pertaining to the payment given to the land owners have been provided in Annexure E. Three types of land record documents have been observed to be maintained by Akay Cambodia for all 136 land owners.

a. The Land Authority Letter (first document) stating the ownership of land from 1996 and classification of land as agricultural land has been mentioned along with the owner's contact details, total area of land and its boundaries which have been duly signed by the Land Owner, the Village Major of Prey Thum village and Commune Leader of Kampong Lpou Commune.
b. The Letter of Sale (second document) states the land owner's decision to sell the land to a party (Akay's local contact point) in 2008 after receiving an amount agreed upon. Once payment has been received, the land owner has given the authority of the land to the Party of Buyer. However, no rates of sale have been mentioned in the Letter of Sale. It has also been mentioned that if in case a third party has claims on the land producing some evidence, the Land Owner will be penalized as per Government Rules. This has been signed by seller, buyer, two witnesses – Village Major and Commune Leader and officially stamped and signed by the District Governor.
c. The Letter of Change of Land Authority (third document) states Akay's Local Contact Point transferring the land ownership to Mr. Sen Matthew (Director of Akay Cambodia) in 2012 which was signed by both parties and witnessed and stamped by the Village Major and Commune Leader.

55 The entire land procurement process was concluded in 18 months. As per review of the sale deeds provided by Akay Cambodia Limited for the 136 land parcels purchased, the land use was agricultural and it was sold in the presence of two witnesses namely, the Village Major (village head) of Prey Thum Village and Commune Leader of Kampong Lpou Commune. The land contributors were reportedly paid in full as confirmed by the four land owners consulted by AECOM as well as the Village Major and Deputy Commune Leader of Kampong Lpou Commune and no issues and concerns relating to the land rate emerged. The formal land registration at the national level (hard titling) of the said farm is currently not been done. At present, the land titling has been completed by Akay at the village and commune level. Sample copy of the land authorisation letter, sale deed and ownership transfer document has been provided in the annexure of the report. The formal titling of the land has been initiated by the Government of Cambodia and currently only Phnom Penh region has been completed till date. The land titling is yet to be completed by the Government of Cambodia in Battambang province.

56 **Social Protection (Labour related issues):** Akay Cambodia has adopted similar practice as implemented in the India operations in terms of Human Resource (HR) Policies and Procedures for its direct permanent employees. There is no formal HR Policy and Procedures developed for Akay Cambodia till date. However, the employment history record of the permanent staff members was reviewed wherein details of age proof, wage register with overtime, attendance record and leave record was maintained. As reported by Akay Management, the company does not employ children below 18 years of age as determined in Section 8 of Cambodian Labour Law, 1997. The permanent staffs receive salaries ranging between USD 150 to USD 600 per month depending on their designation and responsibility. The wages paid by Akay Cambodia is more than the minimum wages which is 80 USD per month as determined by the Labour

Advisory Committee of Ministry of Labour and Vocational Training (MoLVT) in May 2013.[9] Overtime compensation is given over and above the monthly salary if overtime work is involved. Reportedly, the permanent staffs are entitled to 30 days annual leave, 10 days medical leave and 12 days of encashed leaves. In addition, the company reimburses the actual cost of medical treatment based on the receipts produced from doctors/clinics.

57 For the casual/temporary workers engaged in the farm, the management has maintained 18 years as the cut off age in employing the workers. Based on the age proof document produced by each employee, a temporary or photo identity card is issued by Akay Cambodia Private Limited to all. In addition, details pertaining to the employee details, the field work daily report and wage register with overtime work have been maintained with the management. The minimum wages of USD 5 per day has been provided to the temporary workers employee at the farm as mentioned by the workers during the consultations conducted. This is above the minimum wage of USD 80 per month as determined by the Labour Advisory Committee of MoLVT.The overtime wage for the temporary workers has been set at 0.8 USD (3500 Cambodian Riel) for every hour for all temporary workers. The payment is disbursed weekly as per the recorded work undertaken by each employee as per the documents reviewed by AECOM during the site visit on 7th March 2014. No paid leaves have been provided to the temporary employees. As reported, the company provides medical benefits to the temporary workers by reimbursing the actual cost of medical treatment based on the receipts from doctors/clinics.

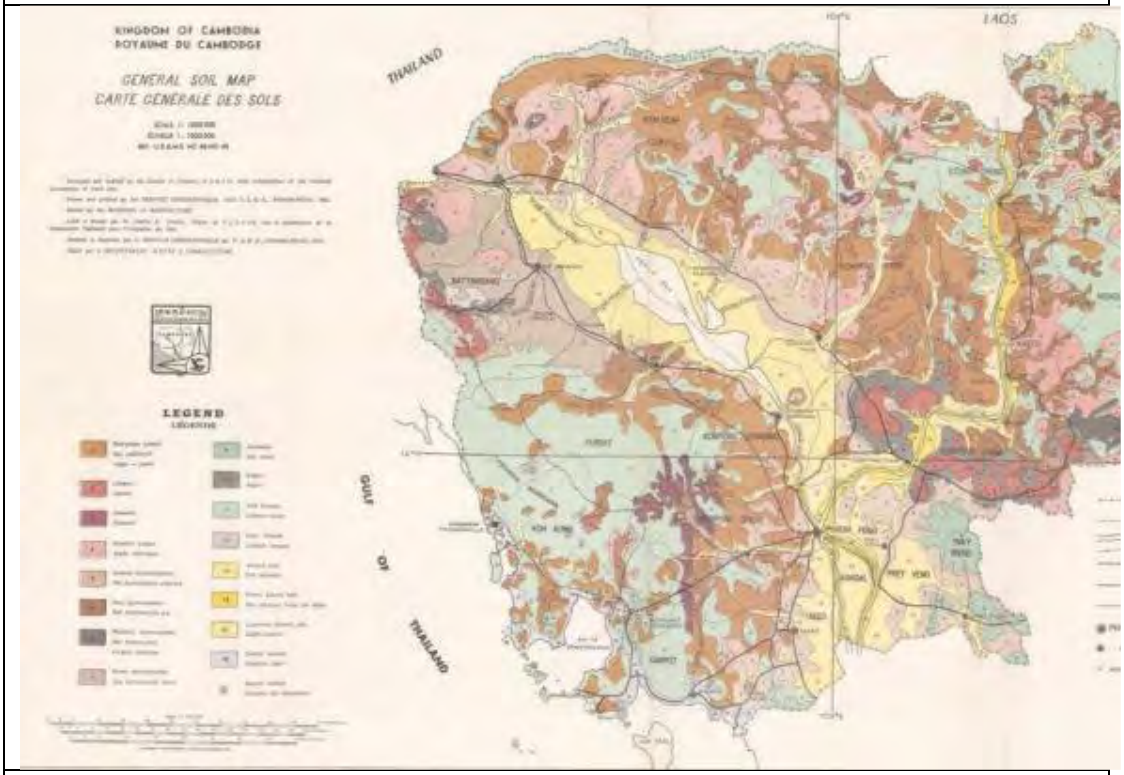
58 There are 215 temporary workers (85 males and 130 females) employed in the organic farm. Out of these, 31 temporary employees are from Prey Thum Village and surrounding areas while the remaining workers are from provinces like Pursat, Battambang, Kompung Cham, Kompot, Kampung Thom, Kandal and Svay Reang.

59 **Gender Mainstreaming**: Out of the 27 permanent employees employed, three are females. In addition, out of the 215 temporary workers (farm workers) employed, 130 workers are females.

60 **Soil:** Brown soil is the most predominant form of soil found in Battambang province followed by black soil. The soils are composed of primarily sandy to clayey loam. [10][11] As per review of the General Soil Map of Cambodia, published by Ministry of Agriculture (provided in the ***Figure D-9*** below), it is observed that Samlot district has acid and basic Lithosols primarily with patches of latosols and plinthic hydromorphics. The Battambang province has primarily cultural hydromorphics soils.

[9] Link on minimum wages in Cambodia: http://www.arbitrationcouncil.org/en/post/6/Minimum-wage-determination-in-Cambodia
[10] British geological Survey Report on mineralogical examination of soil samples from Cambodia: http://nora.nerc.ac.uk/3428/1/CR01096N.pdf
[11] Technical report on Soil Survey of the Province of Battambang, The Kingdom of Cambodia, Soil and Water Science Division, CARDI, can be accessed at http://researchrepository.murdoch.edu.au/15631/1/13_BTACIAR_SOIL_01_07.pdf

Figure D-9: Soil Type: Cambodia



Source: http://eusoils.jrc.ec.europa.eu/esdb_archive/eudasm/asia/maps/KH2000_SO.htm

61 **Agricultural Crops:** Rice is the predominantly grown crop in Battambang province. Other crops include food crops (such as maize, cassava, mung bean, vegetables) and non-food crops (jute, cotton and tobacco) are also cultivated.[12]

E. Anticipated Environmental Impacts and Mitigation Measures

E1 Pre-Construction Stage and Mitigation Measures

62 Pre-construction stage impacts are very limited and localised due to the project activities as drip irrigation equipment installation, expansion of black pepper and construction of civil structure for the solar drying yard have very less impact on land, soil, water resources, flora and fauna,

[12] Provincial Food Security Profile pages for Battambang by World Food Programme can be accessed at the link: http://www.foodsecurityatlas.org/khm/country/provincial-Profile/Battambang

and socio-economic environment which can be mitigated by implementation of Environment Management Plan.

63 As discussed earlier, the land required (717 ha) for the organic farm has already been acquired through negotiated settlement between Akay Cambodia and the land contributors on a 'willing buyer' 'willing seller' arrangement. The land prior to the acquisition was partly cultivated and with secondary forest or scrub land in the uncultivated area. The land procurement did not involve any involuntary resettlement or loss of livelihood.

64 During the site assessment, it is assessed that at least 4-6 trees per hectare would have been removed during land clearing in the past prior to acquisition. However, the agricultural activities being undertaken by Akay Cambodia will offset this loss of tree cover. The farm area reportedly has small mammals and reptiles which would not be disturbed as the nature of project activities is agricultural however these mammals may adapt to the changes and accommodate themselves in vegetation cover around the farm.

65 Akay engaged UN Mine Action Coordination Centre (MACC) for mine clearing exercise in the said area. MACC wherein the said agency de-mined the area by identifying and safely disposing twenty (20) land mines. The mine clearing exercise was conducted in the period between 2009-10 for the entire 717 ha of land.

E2. Construction Stage Impacts and Mitigation Measures

66 The expansion of organic farm will include:

- *Installation of drip irrigation systems*: This will involve setting up a network of pipes (main line, laterals, and tubing) and associated fittings (viz. drippers or spray heads, valves etc.), pump, screens or filters etc. The key impacts will be positive as drip irrigation will conserve water, in contrast to gravity or sprinkler irrigation, drip irrigation technology applies water slowly and directly to the targeted plant's root zone. Drip irrigation application uniformity is very high, usually over 90%. Unlike sprinklers, drip irrigation applies water directly to the soil, eliminating water loss from wind.
- *Extension of black pepper cultivation*: Land preparation (clearing and levelling) is the activity that will be undertaken at this stage. The pepper climbers require support structures like poles, logs etc. to spread along. Akay has proposed use of concrete poles hence there will be no need for wooden logs, which could have resulted in tree felling.
- *Expansion of drying yard*: Drying is a precursor to spice manufacturing, where the ingredients are dried to minimise the moisture content so that they can be easily ground into fine powder. The organic farm has a demarcated area in the open where spices are subjected to solar drying. The drying area basically comprises of an open area on with concrete/hard floor where the raw spice (pepper, turmeric, etc) are placed under the sun to

dry naturally over an identified period of time. There is an existing godown (warehouse) where the raw material can be stored during unfavourable conditions. Akay intends to expand the drying area in order to augment spice production. This may involve very limited construction of civil structures. Solar drying is energy efficient mechanism and saves on fuel consumption.

67 The proposed activities at the organic farm do not entail any significant impacts from construction of the facilities.

E3. Operation Stage Impacts and Mitigation Measures

68 Spice cultivation and drying are the two activities that will take place during operational stage of the organic farm. Hence, there are no significant negative environmental impacts associated with the farm operations.

69 The management is developing organic farms therefore usage of chemical fertilizers is not envisaged. Akay shall envisage the use of organic manure (Panchamrutam- sugar extract, green beans, cow dung and cow urine) usage over chemical fertilisers. However, if pesticide usage involved, in any cultivation it shall conform to requirements under Law on Pesticides and Chemical Fertilizer Control (Cambodia), 2011 and Pesticide Use guidelines mentioned under IFC EHS Guidelines for Plantation Crop Production. Usage of fertilisers classified as Hazard Class I or Class II by World Health organisation (WHO) shall be strictly prohibited. The emissions from mechanised equipment used in cultivation shall adhere to emission standards laid down in IFC EHS General Guidelines.

70 Drip irrigation being a water efficient technology, water conservation is the biggest positive environmental impact that can be associated with it. This irrigation technique conserves water in the following ways:

- High water application uniformity (≥90%) even when pressures vary from long lengths of run, or where planted areas are oddly shaped.
- Unlike sprinklers, drip irrigation applies water directly to the soil, eliminating water loss due to wind.
- Due to low water application rates, water may be spoon fed to the crop or plant root zone in the exact required amounts. If young plants need water frequently, much of the water applied is often wasted to deep percolation or runoff. Low application rates are less likely to run off from heavier soils or sloping terrain.
- Drip irrigation does not water non-targeted areas such as furrows and roads in agriculture, between the crop beds, blocks or benches in greenhouses, or hard-scape, buildings or roads in landscape.

- Drip irrigation easily adapts to odd-shaped planting areas which are difficult to address with sprinklers or gravity irrigation.
- Drip irrigation is capable of germinating seeds and setting transplants which eliminates the need for sprinklers and eliminates the resulting wastage in the early stages of crop growth.

71 The operation and maintenance of project vehicles, agricultural implement (tractors, etc) are prone to leaks and spillage of fuel and lubricants. The waste oil from maintenance area can contaminate soil and groundwater. Maintenance of equipments in the maintenance yard would generate various types of hazardous waste like used oil, waste oil, contaminated cotton waste, paint and empty chemical containers, etc. which have been classified as hazardous waste under Sub-Decree on Solid Waste Management, 1999. Thus, such wastes shall be managed as per the provisions of the decree. All wastewater generated shall be passed through an oil trap; waste oil shall be collected and stored in secured and paved area. Akay shall explore potential sell the waste oil to kiln/boiler operators in the area.

72 Engagement of large number of workers in future may lead to influx of migrant workers into the area. This can lead to conflict with local population and unwanted pressure on local amenities in future. However, this issue may not arise as the project envisages to opt for contract farming and intends to engage more community member as suppliers after appropriate training. The maximum farm workers required after expansion of farming activities would be approximately 200 – 300 workers depending upon the season of planting, harvesting etc.

73 The operation of farm will have positive impact on the livelihood of the workers who will be paid at par or above the prescribed minimum wages. The project will also improve the skill set of the working population through site training. The operations already comprises 70% women farm workers (permanent and seasonal) wherein the future expansion will lead to engagement of at least 1,000 (50%) women out of 2,000 (50%) new contract farmers. In addition, the women farmers are to have equal access to drip-water irrigation system, energy supply, wind mills and other farm technology set up by Akay Cambodia. For promotion of gender mainstreaming in Akay's Cambodia operations, certain benefits for the women workers have been laid out like establishment of child-care center for working mothers at Cambodia model farm, reservation/allocation of free housing facilities for women farm workers in Cambodia, establishment of women groups and assisting them in engagement of productive activities. To enhance the capacity of Akay Management and promote women services, a nodal person/ gender specialist shall be appointed in the Cambodian office. Moreover, trainings are to be provided to 800 women contract farmers in Cambodia. The training sessions are to include modules on (i) organic farming, (ii) best use of farm implements and (iii) farm machinery. Conduction of quarterly meetings with women farmers to disseminate new agricultural information and upcoming agricultural trainings and consultation on other concerns are also to be promoted. To improve financial inclusion and management of women workers, around 800 women contract farmers in Cambodia are to be assisted to have credit access, get access to

banks, open and operate a bank account and a training/orientation to women on financial management mechanisms are to be conducted including household expense budgeting, methods of saving and other opportunities for income generating activities, identifying and advertising opportunities of productive investment of savings; starting cooperatives, small scale businesses and investing in local infrastructure. To improve monitoring and reporting on implementation of gender measures, sex-disaggregated database (on farmers and workers deployment, benefits and improvement to socio-economic conditions) are to be maintained and reported.

F. EHS Performance Standards/Requirements

74 Occupational health and safety is of utmost importance and it covers various aspects viz., worker's health, safe working environment, etc. IFC has laid down General EHS Guidelines and Industry Specific EHS Guidelines. In order to ensure a safe and healthy working environment during the operation phase, industry specific EHS standards shall be implemented. The IFC EHS Guidelines for Plantation Crop Production will be applicable to these facilities. It shall also be ensured that EHS requirements as prescribed under applicable national regulations viz. Labour Law (Cambodia), 1997; Electricity Law (Cambodia), 2001; Law on the Management of Quality and Safety of Products and Services (Cambodia), 2000; Law on Social Security Schemes (Cambodia), 2002; and Law on Pesticides and Chemical Fertilizer Control (Cambodia), 2011 are complied with.

G. Analysis of Alternatives

75 This section describes the alternatives considered for the proposed facility. The following considerations were made:

- No project scenario;
- Equipment layout and selection of machinery; and
- Alternative site analysis.

G1 No project scenario

76 The proposed organic farm expansion will alter the current land use at the acquired land from waste land to agricultural, thus making it agriculturally productive. Thus, the project will contribute to the socio-economic growth and benefit of the community. Cambodia is exploring potential investment through various concessions; this project thus is in line with the requirements of the country.

G2 Equipment layout and selection of machinery

77 Akay intends to use the drip irrigation technique which will help in water conservation owing to high water efficiency of the technology as compared to existing sprinkler system. This is the most suitable alternate.

G3 Alternative site analysis

78 Site for the proposed facilities was selected on the basis of factors such as availability, prices, vegetation cover, habitation etc. The land procured had limited vegetation cover, no houses or structures, also the economic dependence on agricultural was limited. Akay considered another location also in the same province, but it had dense tree cover and clearing it would have resulted in loss of significant vegetation as well as required additional cost.

79 The only issue with the selected land was presence of land mines. Akay engaged UN agency for mine clearing in Cambodia to successfully clear the land after obtaining the possession.

H. Information Disclosure and Consultation

80 The community is aware of the farm activities as reported by the locals during the consultations conducted by AECOM during the site visit. The community members are regularly apprised of vacancies that emerge in the farm through oral communication with the workers working in the farm. In addition, an informal notice is displayed on the main gate whenever any vacancies arise in the farm. The local authorities are informally apprised on the progress and development in the farm area through the routine visits by the management representative who the authorities have developed a rapport with.

81 Formal process of communication with the community members has not been developed and implemented till date. It was reported by the Farm Manager that the internal communication with the workers is proposed to be held once a month wherein the workers would be informed of any significant developments in the company. No formal document of the same has been maintained by the management.

I. Grievance Redress Mechanism

82 There is no formal grievance redress mechanism developed by Akay Cambodia at the workers and community level. A formalised grievance redress mechanism (GRM) system for the workers will be put into place with the role of the management (which should include women as well) sketched out so that the procedures for addressing grievances as well as timelines are well demarcated for the feedback process. Once this is developed, information regarding will be disseminated among the workers so that they are aware of their right to appeal in cases of grievances. Grievance boxes are to be placed at all accessible points within the farm area to respect the anonymity of the workers. Information regarding this will be circulated among the

workers and the management is to maintain the confidentiality of the workers without projecting any reprisal towards the worker for approaching them. In addition, all grievances are to be formally registered and recorded along with the action undertaken in order to maintain transparency and accountability. In addition, a grievance redress cell within the GRM system will also be set up separately for women workers (direct and indirect) to maintain gender sensitivity amongst the workers.

83 A formalised grievance redress mechanism system for the community will be developed with the role of the management spokesperson or liaison officer sketched out so that the procedures for addressing grievances as well as timelines are well demarcated for the recourse process. Once this is developed, information regarding this will be disseminated among the community members residing within the vicinity of the farm area so that they are aware of their right to appeal in cases of grievances. Grievance boxes is to be placed at all accessible public places in the villages to respect the anonymity of the villagers and this will be checked once a week by the designated person of the farm area. Information regarding the use of the grievance box will be circulated among the community members. It is pertinent that the management maintains confidentiality of the community members and that the disputes or issues arising be resolved in an impartial manner. All grievances are to be formally registered and recorded along with the action undertaken so that transparency and accountability can be maintained.

J. Environmental and Social Management Plan

J1. Environmental Mitigation Measures

84 An Environmental and Social Management Plan (ESMP) has been formulated for mitigating impacts pertaining to construction and operation phase of the project. The details of the Environment Management Plan has been given in the ***Table 3*** below

Table 3: Environment and Social Management Plan for Akay Cambodia

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
PRE-CONSTRUCTION PHASE				
1.	Project Facility Siting	Not applicable as the land has already been procured.	-	-
2.	Obtain Permit from Ministry of Environment	• Prescribed application for obtaining permit shall be prepared with all project facility information and submitted to Ministry of Environment and Ministry of Water Resources and Meteorology (MOWRAM). • Copies of the application shall be submitted to other concerned ministries. • Additional information, if any sought by ministry shall be provided and the permit shall be obtained in a time bound manner. • No Construction work shall be commenced without obtaining adequate permit.	Akay Cambodia Project Development Team	Akay Cambodia Senior Management Team
3.	Contractor Bidding and Evaluation	Contractor bids shall be evaluated on the basis of their EHS policies, project track record for finalising the contractor for various works.	Akay Cambodia Project Development Team	Akay Cambodia Senior Management Team
4.	Contractor's Responsibility for Implementation of EMP	All the contract documents of contractor shall incorporate EHS requirements, including compliance with national labor laws and measures to comply with the international core labor standards (CLS), as conditions of contract in order to make the contractor clearly aware of the requirements.	Akay Cambodia Project Development Team	Akay Cambodia Senior Management Team
5.	Contractor's Supply Chain	Contractor's supply chain shall be scrutinised and evaluated for ensuring compliance to : • Applicable EHS requirements; • Akay Cambodia's HR policies, labour policy and Code of Conduct.	Akay Cambodia Project Development Team	Akay Cambodia Senior Management Team
CONSTRUCTION PHASE				
6.	Site Preparation and Vegetation Clearing	• The site shall be cleared off vegetation and prepared for proposed expansion, if any. It shall be ensured that afforestation is undertaken through greenbelt development. Records of deforestation and afforested area shall be maintained.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
7.	Concrete Batching	• All batching plants for production of concrete shall preferably be set	Akay Cambodia	Akay Cambodia

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		up within construction site. • The Contractor shall submit a detailed layout plan for all such sites for approval of from Akay Cambodia senior management prior to the establishment. • Arrangements to control air pollution due to dust generation shall be done through provision of windscreens or water sprinklers, etc. • Alternatively, contractor may be encouraged to source concrete from already established ready mix plants and transport it to site through tankers.	Project Development Team and Onsite Staff	Senior Management Team
8.	Construction Vehicles, Equipment and Machinery	• All vehicles shall be in possession of a valid Pollution under Control (PUC) issued by competent authorities authorised by the Kingdom of Cambodia. PUCs shall be renewed on expiry. • All vehicles, equipment and machinery procured for construction works shall be in good condition and preferably not more than 5 years old. • All vehicles carrying construction material shall be covered with tarpaulin sheets for preventing dust dispersion into air.	Akay Cambodia Project Development Team, Contractor and Onsite Staff	Akay Cambodia Senior Management Team
9.	Noise from Vehicles, Plants and Equipment	• The Contractor shall ensure that construction plants and equipment used shall strictly conform to the noise standards stipulated under the Sub-Decree on Air Pollution Control and Noise Disturbance, 2000 and those under IFC EHS General Guidelines, whichever of the two is more stringent. The maintenance of vehicles, equipment and machinery shall be done regularly to keep noise levels at the minimum. • All major noise generating activities of construction shall be restricted to day hours only and no night shifts shall be allowed for such activities under normal circumstances.	Akay Cambodia Project Development Team, Contractor and Onsite Staff	Akay Cambodia Senior Management Team
10.	Stone Aggregate Procurement	• Contractor shall procure all stone aggregates sourced from licensed stone crushers. • Contractor shall work out haul road network and obtain Akay Cambodia project development team's approval.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
11.	Sand Procurement	The Sand shall be procured from licensed sand mines. The Contractor shall obtain copy of the Lease Agreement of the supplier and submit to project	Akay Cambodia Project	Akay Cambodia Senior

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		development team before procuring the sand.	Development Team and Onsite Staff	Management Team
12.	Construction Water	• Construction water shall be supplied by tankers provided by Kingdom of Cambodia authorised agencies. • The contractor shall identify suitable (ground/surface) water as a source of water for the construction and/or may set up own bore well facility for construction work, after obtaining the requisite permissions, if any required under approval of the project development team.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
13.	Construction Labour Campsite	• The construction labour camp shall be setup in a designated area within the farm. If adequate area is not available, contractor may set up construction camps at any suitable nearby site with prior approval of project development team which shall further take approval from the local governing authorities. • The camp shall be provided with requisite number of sanitation facilities (toilets, bathrooms) as prescribed. It shall also be provided with adequate amount of potable water and other basic necessities. It shall be ensured that overall hygiene is maintained in the camps. • The toilets shall be provided with septic tanks and soak pits. • Health check-ups of construction labour shall be conducted at regular intervals. • Health awareness programs for construction labour and contractor shall be conducted by Akay Cambodia. It shall cover aspects such as HIV/AIDS, and other communicable diseases to sensitize the labourers.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
14.	Stockyard	• Material stockyards shall essentially be within the project facility construction site and all material shall be orderly stacked and covered to prevent dust pollution. • Stockyards shall be clearly marked with legible signboards etc.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
15.	Traffic and Transportation Management	• All vehicles used for transporting construction materials to the site shall be covered to avoid spillage of materials. • All existing roads used by material haulage vehicles, shall be kept clear of	Akay Cambodia Project Development	Akay Cambodia Senior Management

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		all dust/mud or other extraneous materials dropped by such vehicles. • Contractor shall arrange for regular cleaning and water sprinkling as necessary for dust suppression of all such roads and surfaces, if required. • Haul routes shall be avoided through human settlement areas as far as possible.	Team and Onsite Staff	Team
16.	Drainage	• Contractor shall ensure that no construction materials like earth, stone, or appendage disposed of in a manner that block the flow of water of any water course and cross drainage channels, in proximity to project facility site • In addition, Contractor shall take all required measures as directed by Akay Cambodia to prevent temporary or permanent flooding of the project site or any adjacent area.	Akay Cambodia Project Development Team, Onsite Staff and Contractor	Akay Cambodia Senior Management Team
17.	EHS (Environment, Health and Safety) Plan for Construction Site	• The contractor shall prepare an EHS plan conforming to the applicable EHS requirements, national labor laws and measures to comply with relevant international CLS and submit it to the project development team for approval. • The EHS plan shall be implemented after approval. • All construction labourers shall be provided with requisite PPEs such as safety shoes, goggles, eye shields nose masks, hard hats, fall protection measures, safety belts, etc. • Contractor shall comply with all regulations regarding safe scaffolding, ladders, safe platforms for working at heights, gangway, staircases, excavations, trenches and safe means of entry and egress. • Adequate number of fire extinguishers, sand buckets and water drums as prescribed shall be provided onsite at strategic locations. • Adequate First-aid arrangements as prescribed under Cambodia's Labour Law shall be ensured by the contractor onsite. The arrangements shall include availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital.	Akay Cambodia Project Development Team, Onsite Staff and Contractor	Akay Cambodia Senior Management Team
18.	Waste Management	• The Contractor shall provide garbage bins at construction workers camp sites and ensure that these are regularly emptied and disposed of in a hygienic manner approved by the project development team.	Akay Cambodia Project Development	Akay Cambodia Senior Management

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		• Contractor shall undertake site clean-up of operations, as approved by project development team. The clean-up operations shall be implemented by the Contractor prior to demobilization and shall comprise clearing of all temporary structures; dispose all garbage, construction debris, unused/waste materials unused among others. Housekeeping staff shall be engaged for keeping the site clean.	Team, Onsite Staff and Contractor	Team
19.	Community Engagement	• Communication channel should be kept open with local people around the project facility to ensure that the construction activities at project site are not causing undue inconvenience to the local people due to noise, dust or disposal of debris etc. • Corrective actions shall be taken immediately by contractor for issues identified through such engagements.	Akay Cambodia Project Development Team, Onsite Staff and Contractor	Akay Cambodia Senior Management Team
20.	Grievance Redressal Mechanism (GRM)	The contractor shall create a facility at project site to receive any complaints/grievances (either orally or in documented form) related to construction activities from local people/adjacent land owners and resolve the matters expeditiously. If grievance(s) cannot be resolved at site level itself, the matter shall be referred project development team for resolving the matter expeditiously.	Akay Cambodia Project Development Team, Onsite Staff and Contractor	Akay Cambodia Senior Management Team
21.	Environmental Training for Contractor's Staff	Akay Cambodia shall organize orientation and training sessions regularly at all construction stages of the project facility to contractor's staff to sensitize the environment safeguard requirements at construction site.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
OPERATION PHASE				
22.	Obtain Water Use Licence from MOWRAM for irrigation at organic farm	• The farm management shall submit application along with prescribed fees for obtaining license in prescribed format to the MOWRAM. • Additional information, if any sought by MOWRAM shall be provided for obtaining licence in a time-bound manner. • Irrigation operations shall not be commenced without obtaining the Water use licence from MOWRAM.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
23.	Emission control	• If Diesel generator sets are to be used during operations phase for	Akay Cambodia Project	Akay Cambodia Senior

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		irrigation system and providing electrical connection to the accommodation, it shall be provided with adequate stack height to ensure proper dispersion of air emissions.	Development Team and Onsite Staff	Management Team
24.	Noise Control	• DG sets shall be provided with acoustic enclosure for limiting noise exposure of workers within prescribed limits. • Conditions prescribed in the Discharge Permit shall be adhered to.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
25.	Water Treatment	• The farm shall have water testing and treatment facility to treat the water. The water shall be assessed for adherence to applicable drinking water quality standards prior to its use for drinking purposes.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
26.	Sewage Treatment	• Septic tanks along with soak pits shall be provided for sewage treatment. • Untreated sewage can be directly discharged into public sewer lines if available in the vicinity of the site. • All facilities shall have provisions for reuse / recycling of treated wash water for floor washing, toilet flushing, watering lawns within facility premises.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
27.	Solid Waste Management	• Solid waste generated during the operations shall be decomposed through aerobic composting or through vermi-composting process to generate organic manure with good fertility value. • In addition, metallic containers shall be provided for collection of non-bio degradable waste generated, if any at each of the facilities and transport it to the nearest urban municipal solid waste dump area and / or processing facility. This shall be done either with Akay Cambodia's own fleet and / or services can be contracted out for periodical clearance, depending upon the periodicity and quantum of waste generated based on actual.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
28.	Hazardous Waste Management	• Hazardous waste generated from maintenance and other activities shall be stored in containers in designated area provided with secondary containment and spill control tool-kit within the premises.	Akay Cambodia Project Development	Akay Cambodia Senior Management

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		• The storage area shall be properly marked and entry to the place shall be restricted to certain personnel only. • A licensed hazardous waste contractor shall be hired to do the final disposal of hazardous wastes generated within the farm.	Team and Onsite Staff	Team
29.	Pesticide and Fertilizer Use and Management	• Preference shall be given to the organic manure usage over chemical fertilisers. • Usage of fertilisers classified as Hazard Class I or Class II by World Health organisation (WHO) shall be strictly prohibited.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
30.	EHS Performance Standards and Practices	• The farm activities shall be undertaken with due consideration to environmental health, hygiene and sanitation upkeep systems and procedures in compliance with Cambodia's Labour Law, Electricity Law, Law on the Management of Quality and Safety of Products and Services, Law on Social Security Schemes, Law on Pesticides and Chemical Fertilizer Control (Cambodia) and IFC General EHS guidelines and those for Plantation Crop Production. • The operations shall implement an EHS performance Operations and Industry Best Practices and ensure its adherence by all workers and management staff (as relevant and applicable). • It shall be ensured that all workers are provided with PPEs as required under the EHS performance and Industry Best Practices standards/operations manual and same is used during the entire operational hours of the facility by all workers. • Environment and Social management System Shall be developed and implemented for Cambodia's model farming operations.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
31.	3rd Party Independent Environmental and Social Safeguards Audit	• An Environmental and Social Safeguards Compliance Audit shall be carried out every year through engagement of an independent 3rd party agency. All audit observations along with gaps identified shall be taken note of corrective action shall be implemented at the facility in a time bound manner. • The audit report along with 'Action Taken Report' shall be submitted to ADB.	Akay Cambodia Project Development Team, Onsite Staff and 3rd Party Agency	Akay Cambodia Senior Management Team

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
32.	Rainwater Harvesting and Groundwater Recharging	• The farm shall have provision for rainwater harvesting and groundwater recharging. • Akay management shall undertake a comprehensive study for development of rainwater harvesting (RH) structures in the farm area which shall also provide elements pertaining to ground water recharge potential through the developed RH structures.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
33.	Gender measures offering opportunities for women	• The operations already comprises 70% women farm workers (permanent and seasonal) wherein the future expansion shall lead to engagement of atleast 1,000 (50%) women out of 2,000 (50%) new contract farmers. • The women farmers shall have equal access to drip-water irrigation system, energy supply, wind mills and other farm technology set up by Akay Cambodia. • For promotion of gender mainstreaming in Akay's Cambodia operations, certain benefits for the women workers have been laid out like Akay shall establish a child-care center for working mothers at Cambodia model farm, reserve/allocate of free housing facilities for women farm workers in Cambodia, establishment of women groups and assisting them in engagement of productive activities. • To enhance the capacity of Akay Management and promote women services, a nodal person/ gender specialist shall be appointed in the Cambodian office. • Trainings shall be provided to 800 women contract farmers in Cambodia. The training sessions are to include modules on (i) organic farming, (ii) best use of farm implements and (iii) farm machinery. • Conduction of quarterly meetings with women farmers to disseminate new agricultural information and upcoming agricultural trainings and consultation on other concerns shall also to be promoted.	Gender Specialist along with Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		• To improve financial inclusion and management of women workers, around 800 women contract farmers in Cambodia shall be assisted to have credit access, get access to banks, open and operate a bank account and a training/orientation to women on financial management mechanisms shall be conducted including household expense budgeting, methods of saving and other opportunities for income generating activities, identifying and advertising opportunities of productive investment of savings; starting cooperatives, small scale businesses and investing in local infrastructure. • To improve monitoring and reporting on implementation of gender measures, sex-disaggregated database (on farmers and workers deployment, benefits and improvement to socio-economic conditions) shall be maintained and reported.		
34.	Community Participation	Communication channel should be kept open with local people around the project facility to ensure that the operations of the project facility are not causing undue inconvenience to the locals residing in the vicinity of project. ADB principles of Information disclosure and informed consent shall be strictly adhered to.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
35.	Grievance Redress Mechanism (GRM)	A proper GRM shall be implemented to receive complaints/grievances (in documented form) due to operations of the farm activities from local people/adjacent land owners and matters will be resolved expeditiously. If grievance(s) cannot be resolved at site level itself, the matter shall be referred to the senior management facility for resolving the matter expeditiously. A GRM shall also be implemented to receive complaints/grievances (in documented form) due to operations at the farm from workers engaged in the farm and the matter will be resolved expeditiously. If grievance(s) cannot be resolved at site level itself, the matter shall be referred to the senior management facility for resolving the matter expeditiously.	Akay Cambodia Project Development Team and Onsite Staff	Akay Cambodia Senior Management Team
DECOMISSIONING PHASE				
36.	General Environmental and social issues	• When a facility is to be decommissioned, as a standard practice all the process equipment shall be dismantled, reused elsewhere, or sold or	Akay Cambodia Project	Akay Cambodia Senior

S. No.	Environmental and Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		scrapped, whereas the civil structures shall be put to some other alternative use either by alterations or reconstruction. • The relevant / applicable IFC's EHS plans and practices for decommissioning of the facilities shall also be followed to the extent of relevance / applicability.	Development Team and Onsite Staff	Management Team

J2 Environmental Enhancement Measures

85 Besides EMP, the following measures for environmental enhancement shall be implemented at the proposed facilities:

- Adopting the 3R concept (Reduce, Reuse and Recycle) concept in various activities viz. process water usage, toilet cleaning, flushing etc.;
- Rainwater Harvesting and Recharge;
- Aesthetics improvement through landscaping and plantation;
- Adoption of energy efficient equipment and renewable solar energy for lighting applications;
- Occupational Health and Safety training programmes and regular health check-up of workers;
- Mandatory usage of Personal Protective Equipment (PPEs);

J3 Operation Stage Environmental Monitoring

86 Environmental monitoring needs to be conducted at regular intervals to assess the efficacy of EMP and identify corrective measures required, if any. The following monitoring activities shall be carried out at the proposed facilities :

- Drinking water quality assessment;
- Periodic assessment of hazardous waste storage facility; and
- Cleaning of Rainwater harvesting and recharging structures, prior to monsoon

87 It is recommended that Environment, Health, Safety and Social (EHSS) Audits are conducted periodically to ensure compliance with ADB SPS and other applicable national and local legislations.

J4 Budgetary Cost Provision for EMP Implementation

88 The implementation of EMP during planning/pre-construction, construction and operation stages for all proposed facilities will require a capital cost of INR 6, 00, 000 and a recurring cost of INR 4, 50, 000 per annum. The summary of the budgetary provision for implementing the EMP during planning/pre-construction, construction and operation stages in Cambodia is given in the ***Table 4*** below:

Table 4: Indicative Budgetary Cost for Implementation of Environment Management Plan

S. No.	Project Component	Organic Farm Development (in INR)
1	Land Lease	NA
2	Operational Licences/permits	As per license fee cost established by Ministry of Water Resources and Meteorology (MOWRAM).
3	Construction Stage Mitigation Measures	Incidental to civil and electro mechanical contracts awarded by Akay Management
6	Provision of PPE for Construction	100000
7	Installation of Septic Tank and Soak pit	500000
8	Rainwater harvesting and Recharging structures	Part of overall project cost
9	Landscaping and plantation	Part of overall project cost
10	Occupational Health Screening of workers (pre-employment)	As per actuals
	Total One Time Cost	**6,00,000**
Recurring Annual Cost		
1	Renewal of permits/licenses	As per license fee cost established by Ministry of Water Resources and Meteorology (MOWRAM).
2	Annual maintenance of pollution control devices (10% of equipment cost)	50000
3	Operational Stage Environment management Cost	300000
4	Rainwater harvesting and Recharging structures	Part of overall project cost
5	Provision of PPE	100000
6	Landscaping and plantation	Part of overall project cost
7	Occupational Health Screening of workers (pre-employment)	As per actuals
	Total Recurring Cost	**4,50,000**

K. Conclusion and Recommendations

89 The organic farm falls under purview of Prakas (Declaration by Kingdom of Cambodia) (Regulation) No.334 dated 7 August 2007 concerning the control of food safety of agricultural production.

90 Due to the nature and scale of the farm activities proposed by Akay, the impacts are minimal and can be mitigated by developing and implementing an adequate Environment Management Plan which has been provided in the present report.

91 The social impacts are avoided as the purchase of land was through direct negotiated settlement on a willing buyer and willing seller principle, thus not involving impact on social aspect due to involuntary resettlement and no negative impact on livelihood of the community. The community livelihood has been positively impacted due to generation of employment opportunities in the area. In addition, issues pertaining to indigenous peoples are not triggered as the project operations do not affect any ethnic minority groups due to the absence of indigenous population in and around the farm area in Cambodia.

92 Certain criteria relating to attendance register, minimum age, prohibition of employing child labour and forced labour, minimum wage, leaves, overtime payment, working hours are duly maintained by the Management and these procedures are in line with the national regulatory framework of the country.

93 The information disclosure and consultations have been informally carried out with the local authorities residing within the community at the vicinity of the farm.

94 The pre-construction, construction and operation stage environmental and social impacts can be mitigated by implementing management measures through an institutional arrangement with clearly defined roles and responsibilities and dedicated budgetary provisions. The project facilities will be subjected to periodical environmental and social monitoring during the construction and operation stage as per the regulatory permitting requirements and EMP as provided in this report.

95 Further, implementation of environmental enhancement measures like rain water harvesting and ground water recharging, adopting efficient equipments and use of renewable (solar) energy for lighting applications will enable the proposed facilities to be an environmentally sustainable, compliant to state regulatory requirements and consistent with the safeguard requirements of ADB Safeguard Policy Statement, 2009 and will not involve any kind of reputational risk to ADB on environmental and social safeguard issues.

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To enhance and sustain the world's built, natural and social environments

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List of Annexures

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Annex A: Details of Land Sellers

S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
1	Mr Mon Nel	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
2	Mr Sem Thearn	Boribo village, Sdav commune, Ratatak Mondol district and Battambang province.	7	Agricultural
3	Mr Hang Kimny	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	7	Agricultural
4	Mr Sek Nal	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	7	Agricultural
5	Mr Sok Douk	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	7	Agricultural
6	Ms Kun Nern	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	7	Agricultural
7	Ms Kun Bern	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
8	Mr Kav Lern	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
9	Mr Kan Nom	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
10	Ms Khoun Mom	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
11	Mr Ngat Sean	Boribo village, Sdav commune, Ratatak mondol district and Battambang province.	7	Agricultural
12	Mr Khav Nak	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
13	Mr Sok sarath	Otakom 3 village, Tultaeak commune, Battambang district and Battambang province.	6	Agricultural
14	Mr Horn Nern	Bosknor village, Changmanchay commune, Banan district and Battambang province.	6	Agricultural
15	Mr Ven Chanthorn	Sdav village, sdav commune, ratanak mondol district and Battambang province.	6	Agricultural
16	Mr Sngoun Deap	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
17	Mr Rerk Klai	Chang village, Changmanchay commune, Banan district and Battambang province.	6	Agricultural
18	Mr Chheam Eam	Dong village, Bengrang commune, Komreang district and Battambang province.	6	Agricultural
19	Ms Sour Nang	Otakom 2 village, Tultaeak commune, Battambang district and Battambang province.	6	Agricultural
20	Mr Chhouk Nern	Damspai village, slakat commune, Battambang district and Battambang province.	6	Agricultural
21	Mr Mang Moun	Svay chhom village, Kampong Lpou commune, Samlout district and Battambang province.	6	Agricultural
22	Mr kao Vy	Chang village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
23	Mr Khav Kherth	Rong village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
24	Mr U Hychangtho	13 makhara village, Prekpresdach commune, Battambang district and Battambang province.	5	Agricultural
25	Ms Chea Youkloung	Ratanak village, ratanak commune, Battambang district and Battambang province.	5	Agricultural
26	Mr Dearng saroun	Kamerkor village, svaypor commune, Battambang	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		district and Battambang province.		
27	Ms Chhay sophov	13 makhara village, Prekpresdach commune, Battambang district and Battambang province.	5	Agricultural
28	Mr Yang Vuthy	Orsrolav village, ordambong 1 commune, sankar district and Battambang province.	5	Agricultural
29	Mr Hak chhoum	Ordamchak village, kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
30	Mr Lauch Horm	Prey Thum village, kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
31	Mr Menh Pisith	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
32	Mr Sang Lean	Svay chhom village, Kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
33	Mr Serm Som earn	Dong village, bengrang commune, komreang district and Battambang province.	5	Agricultural
34	Mr Eang Kim	Svay chhom village, kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
35	Mr Soun Team	Vatamim village, ortakom 1 commune, sangkar district and Battambang province.	5	Agricultural
36	Ms Lim Thoun	Kampong kol village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
37	Mr Sak Sour	Boribo village, sdav commune, ratatak mondol district and Battambang province.	5	Agricultural
38	Mr Sour Ngae	Otakom 2 village, Tultaeak commune, Battambang district and Battambang province.	5	Agricultural
39	Ms Lim Lykhanh	Kampong kol village, Changmanchay commune, Banan district and	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		Battambang province.		
40	Mr Proum saroun	Chang village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
41	Mr Hor Kimhang	Kampong kol village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
42	Mr Chea Samneang	Ratanak village, ratanak commune, Battambang district and Battambang province.	5	Agricultural
43	Mr Oung Bunchouy	Chang village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
44	Mr Eang sambath	Dong village, bengrang commune, komreang district and Battambang province.	5	Agricultural
45	Mr Choun tean	Kampong Lpou village, Kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
46	Mr Both Bin	Svay chhom village, kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
47	Mr Yang Tith	Svay chhom village, kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
48	Ms Sok Phea	Svay chhom village, Kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
49	Mr Ray Noun	Svay chhom village, Kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
50	Mr sok teang	Pray toch village, pray toch commune, mong resay district and Battambang province.	5	Agricultural
51	Mr seam rean	Dong village, bengrang commune, komreang district and Battambang province.	5	Agricultural
52	Mr chhorn chhouy	Kampong kol village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
53	Mr Tang bul	Dong village, bengrang	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		commune, komreang district and Battambang province.		
54	Mr Houch rern	Svay chhom village, kompong Lpou commune, Samlout district and Battambang province.	5	Agricultural
55	Mr Ngouv hangmongfy	Ratanak village, ratanak commune, Battambang district and Battambang province.	5	Agricultural
56	Mr Chov tol	Prak pra village, chba orm pov2 commune, takmav district and komdal province.	5	Agricultural
57	Mr Lang chanthorn	Kampong kol village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
58	Ms Seim Phaly	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
59	Mr Kao Sorn nak	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
60	Mr Chhean Toup	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
61	Mr Bou sarek	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
62	Mr Ngouv Khang sang	Dobay makhara village Prakpresdach commune, Battambang district and Battambang provice.	5	Agricultural
63	Ms Ngouv Leang	Dobay makhara village Prakpresdach commune, Battambang district and Battambang provice.	5	Agricultural
64	Mr thai Sokhom	mapai osaphea village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
65	Mr Khat Nat	Dong village,bengrang commune, komreang district and Battambang province.	5	Agricultural
66	Mr Rean Khan	Rong village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
67	Mr Roun Searm	Damspay village, slakat commune, Battambang	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		district and Battambang province.		
68	Mr Eang Sambo	Romchak 3 village, ratanak commune, Battambang district and Battambang province.	5	Agricultural
69	Mr An Vy	Boribo village, sdav commune, ratatak mondol district and Battambang province.	5	Agricultural
70	Mr Lam Heng	Prak presdach village,Prak presdach commune, Battambang district and Battambang province.	5	Agricultural
71	Mr Ray chantha	Kamerkor village,svaypor commune ,Battambang district and Battambang province.	5	Agricultural
72	Mr Hong Thon	Boribo village, sdav commune, ratatak mondol district and Battambang province.	5	Agricultural
73	Ms Heng Chhonly	Romchak 3 village, ratanak commune, Battambang district and Battambang province.	5	Agricultural
74	Mr Sous Soun	Orchom kondal village, Kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
			5	Agricultural
75	Mr Seng sanghout	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
76	Mr Uy Lymang	Kampong kol village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
77	Mr Chea sombath	Ratanak village , ratanak commune, Battambang district and Battambang province.	5	Agricultural
78	Mr Chhern Chearth	Tngor village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
79	Mr Pao Pern	Boribo village, sdav commune ratatak mondol district and Battambang province.	5	Agricultural
80	Ms Lim lykech	Kampong kol village, changmanchay commune, Banan district and	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		Battambang province.		
81	Mr Bun date	Dapy village, psakondal ti pi commune, donpanh district and phnom penh city.	5	Agricultural
82	Mr Kao sophat	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
83	Ms Sok dalim	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
84	Mr Yong sareth	Dong village, bengrang commune, komreang district and Battambang province.	5	Agricultural
85	Mr Rous Hom	Boribo village, sdav commune, ratatak mondol district and Battambang province.	5	Agricultural
86	Mr La Tern	Or village, Trorpang rang commune, Chomkiri district and kompot province.	5	Agricultural
87	Mr Visoth Sambo	Kamerkor village,svaypor commune, Battambang district and Battambang province.	5	Agricultural
88	Mr Mas Mom	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
89	Mr Vang Kong	Or village, Trorpang rang commune, Chomkiri district and kompot province.	5	Agricultural
90	Mr Mak nhorn	Prey Thum village,Kampong Lpou commune, Samlout district and Battambang	5	Agricultural
91	Mr Sok toeur	Boribo village, sdav commune ratatak mondol district and Battambang province.	5	Agricultural
92	Mr Sen thoung	Boribo village, sdav commune ratatak mondol district and Battambang province.	5	Agricultural
93	Mr Sok Chhean	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
			5	Agricultural
94	Mr Uy Ny	Kampong kol village, Changmanchay commune, Banan district and Battambang province.	5	Agricultural
95	Mr Sun Sean	Orda kondal village, Kampong	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		Lpou commune, Samlout district and Battambang provice.		
96	Ms Sang sophea	13 makara village, Prekpresdach commune, Battambang district and Battambang province.	5	Agricultural
97	Mr Chhan samnang	Ratanak village , ratanak commune, Battambang district and Battambang province.	5	Agricultural
98	Ms Vang hount	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
99	Mr Lim sakphea	Kampong kol village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
100	Mr Moul Mon	Svay chhom village, kompong Lpou commune, Samlout district and Battambang province.	5	Agricultural
101	Mr Yin terng	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
102	Ms Uy Kunthea	Kampong kol village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
103	Mr Van thorn	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
104	Ms Heart Houy	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
105	Mr Ouk theam	Damspai village, slakat commune, Battambang district and Battambang province.	5	Agricultural
106	Mr Kath theam	Otakom 3 village, Tultaeak commune, Battambang district and Battambang province.	5	Agricultural
107	Mr Yen yeth	Dong village, bengrang commune, komreang district and Battambang province.	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
108	Mr Rous Rith	Otakom 1 village, Tultaeak commune, Battambang district and Battambang province.	5	Agricultural
109	Mr Nheam Phern	Or village, Trorpang rang commune, Chomkiri district and kompot province.	5	Agricultural
110	Mr Kong sopheak	Svay chhom village , kompong Lpou commune, Samlout district and Battambang province.	5	Agricultural
111	Mr Koy Heang	Ratanak village , ratanak commune, Battambang district and Battambang province.	5	Agricultural
112	Mr Long Map	Svay chhom village, kompong Lpou commune, Samlout district and Battambang province.	5	Agricultural
113	Mr Mas sarom	Boribo village, sdav commune ratatak mondol district and Battambang province.	5	Agricultural
114	Mr Bou chantha	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
115	Ms Horn Hoch	Rong village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
116	Mr Vern vath	Rong village, changmanchay commune ,Banan district and Battambang province.	5	Agricultural
117	Mr Sok tear	Boribo village, sdav commune ratatak mondol district and Battambang province.	5	Agricultural
118	Mr Ngerm sarerng	Onlong vel village, Onlong vel commune, sangkar district and Battambang province.	5	Agricultural
119	Mr Oung vanarith	Demmen village, demmen commune, takmao district and kondal province.	5	Agricultural
120	Mr Ros Horm	Boribo village, sdav commune ratatak mondol district and Battambang province.	5	Agricultural
121	Mr Rerth ty	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
122	Mr Lim vangsong	Prey Thum village, Kampong Lpou commune, Samlout district and Battambang	5	Agricultural

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S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		province.		
123	Mr Yong Hunchey	Kbal spen village, Presponlea commune, serasorphen district and bontay manchey province.	5	Agricultural
124	Mr Leav thol	Kampong Lpou village, Kampong Lpou commune, Samlout district and Battambang province.	5	Agricultural
125	Mr Sok Chhean	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
126	Ms Sok Van	Ratanak village , ratanak commune, Battambang district and Battambang province.	5	Agricultural
127	Mr Hour Mom	Kampong kol village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
128	Mr Hour Phally	Kampong kol village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
129	Ms Yin Thon	Orda kondal village, Kampong Lpou commune, Samlout district and Battambang provice.	5	Agricultural
130	Mr Long Sokha	dobay makhara village ,Prakpresdach commune ,Battambang district and Battambang province.	5	Agricultural
131	Mr Choub Ry	Bak orng rea village, Preaklong commune, eakphnom district and Battambang province.	5	Agricultural
132	Mr Chham Chhean	Kamerkor village, svaypor commune, Battambang district and Battambang province.	5	Agricultural
133	Mr Ma Ean	Pray toch village, pray toch commune,mong resay district and Battambang province.	5	Agricultural
134	Mr Chea Samnang	Ratanak village , ratanak commune, Battambang district and Battambang province.	5	Agricultural
135	Mr Sok Chhean chath	Kampong kol village, changmanchay commune,	5	Agricultural

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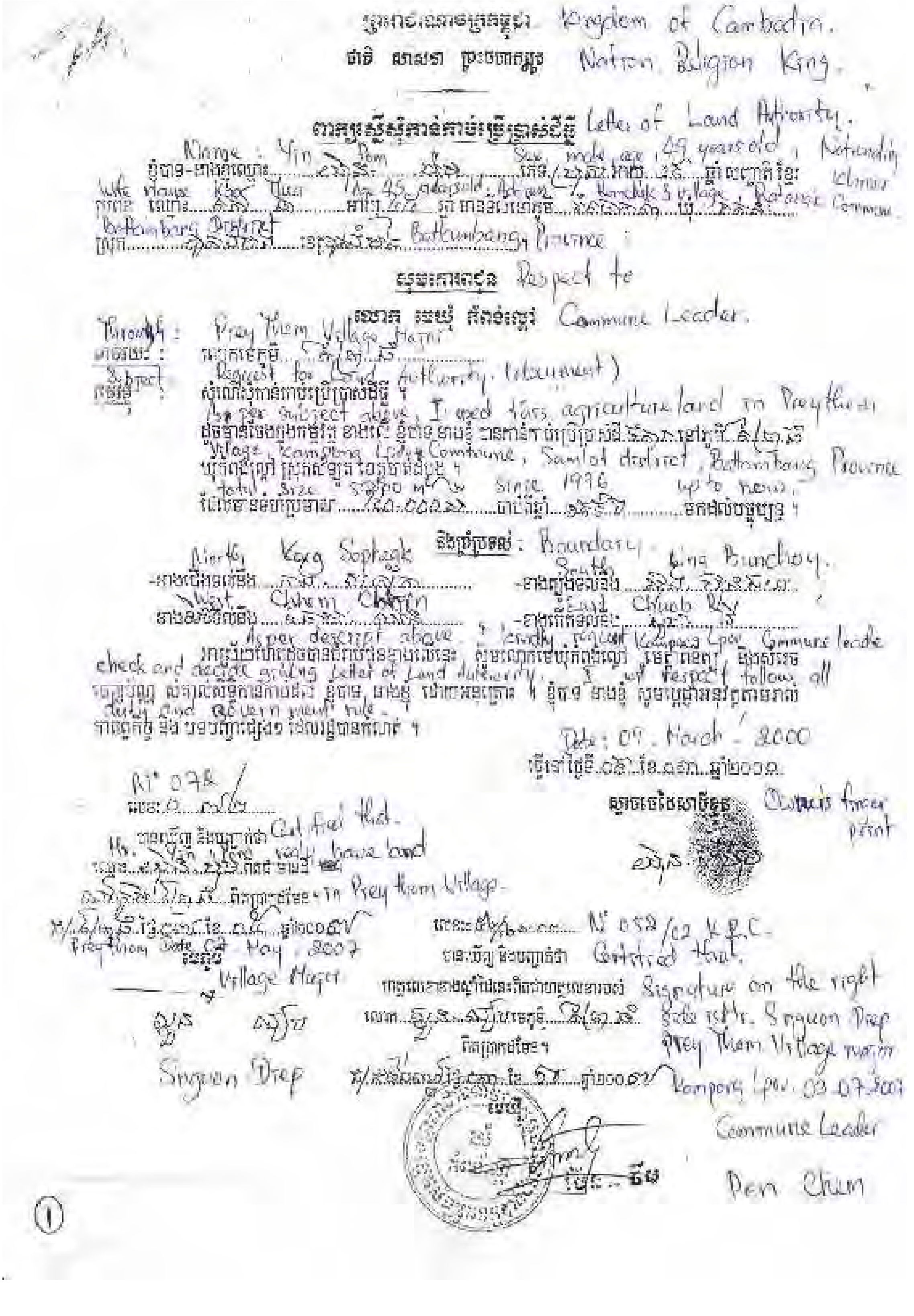
S. No	Name of Land Owner's	Address of the previous land owner	Land Area acquired by the Mr. Sen Matthew (in Ha)	Type of Land (land use)*
		Banan district and Battambang province.		
136	Mr Kao Sokny	Chang village, changmanchay commune, Banan district and Battambang province.	5	Agricultural
Total			**717 hectares**	

Annex B: Sample Letter of Land Authority



Kingdom of Cambodia.
Nation Religion King.

Letter of Land Authority.

Name: Yin Pom Sex: male, age 45 years old, Nationality Khmer
Wife Name: Khov Yun Age 45 ... Kandek 3 Village, Ratanak Commune
Battambang District, Battambang Province

Respect to
Commune Leader.

Through: Prey Thom Village Mayor
Subject: Request for Land Authority (document)

As per subject above, I used farm agricultural land in Prey Thom Village, Kampong Lpov Commune, Samlot district, Battambang Province, total size 50,000 m² since 1996 up to now.

Boundary:
North: Kong Sophak South: Ling Bunchoy
West: Chhem Chhorn East: Chuob Roy

As per described above, I kindly request Kampong Lpov Commune leader check and decide giving letter of Land Authority. I will respect follow all duty and government rule.

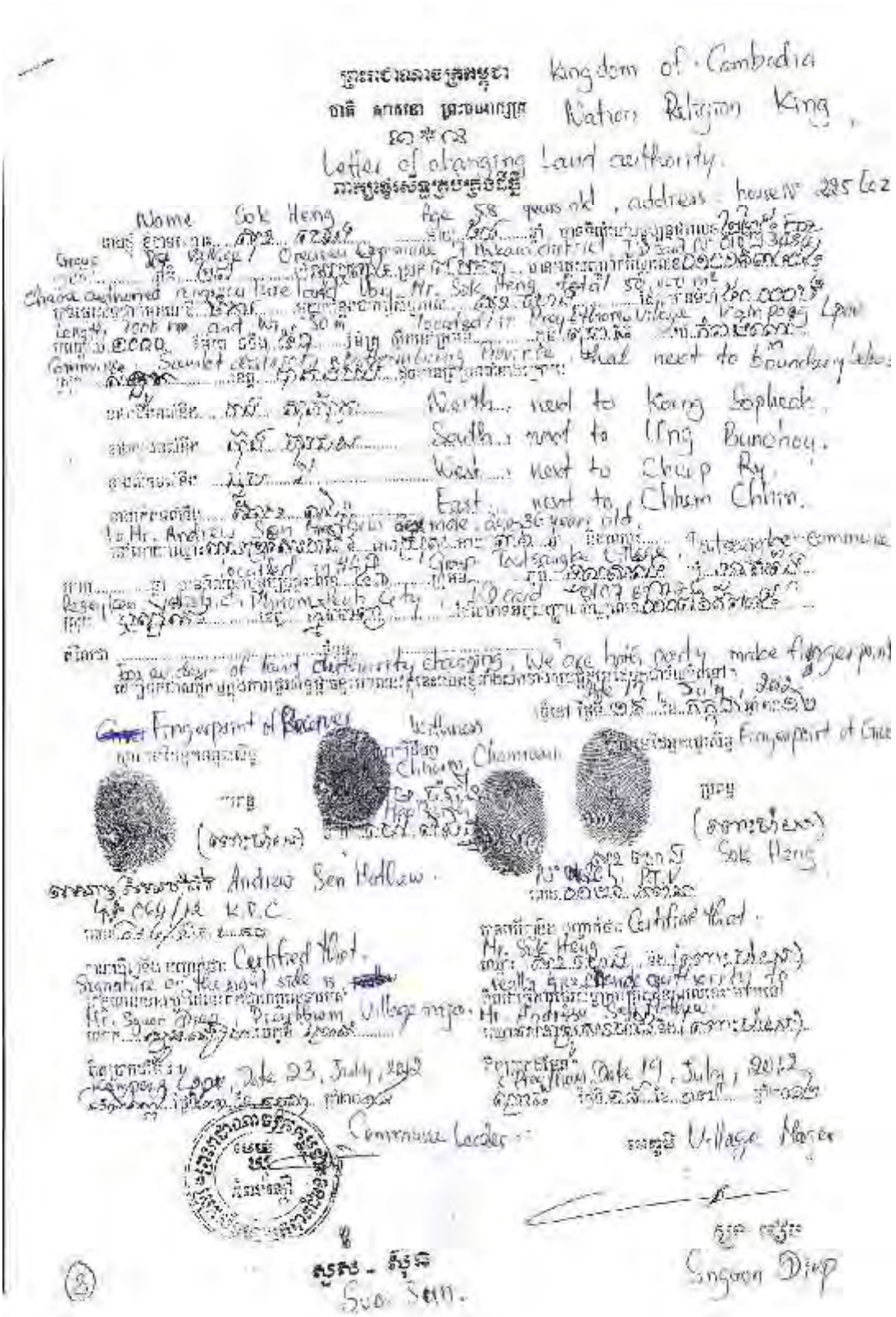
Date: 07. March 2000
Owner's finger print

N° 078
Certified that Mr. Yin Pom really have land in Prey Thom Village.
Prey Thom Date 07 May 2007
Village Mayer
Sngoun Drep

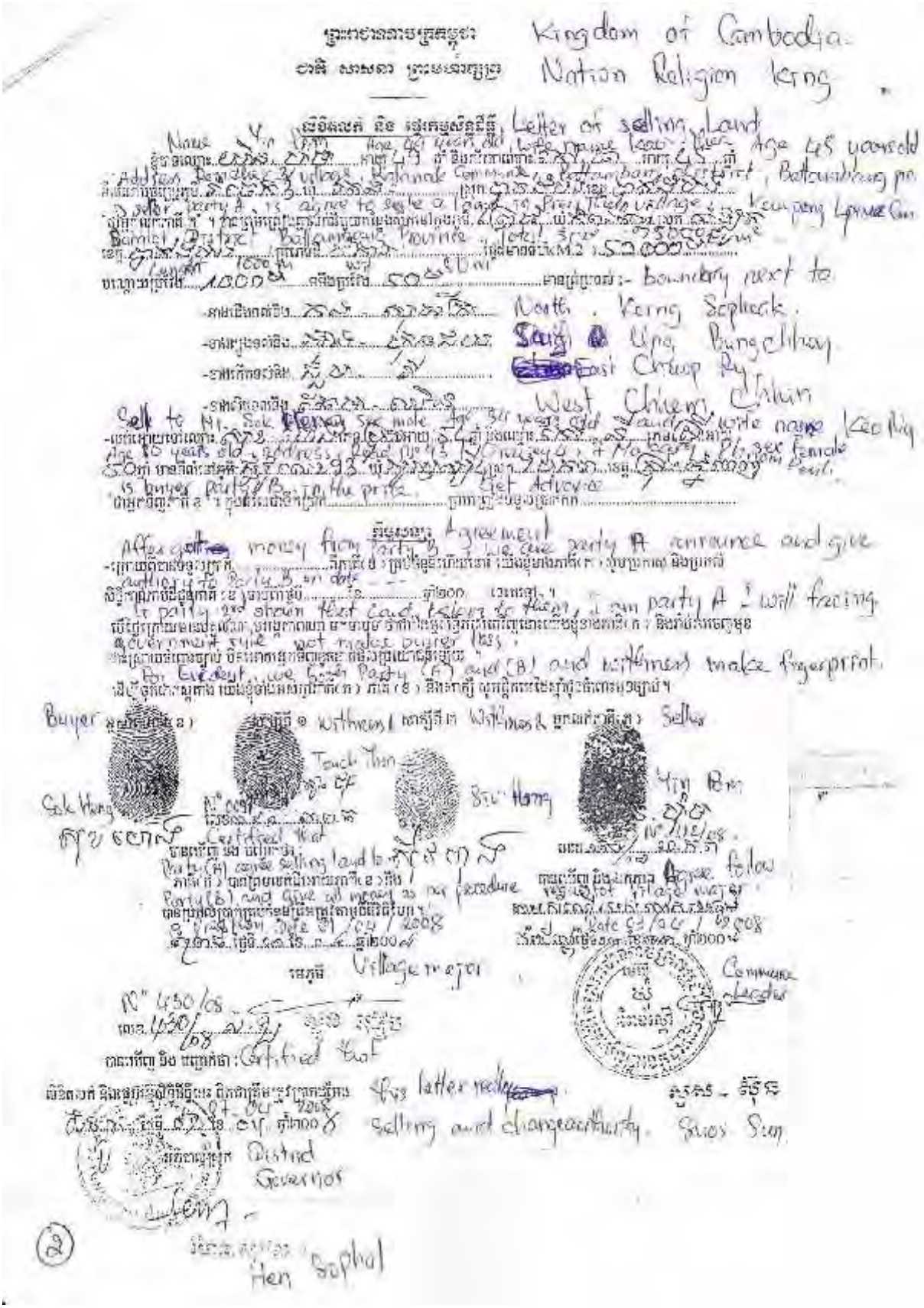
N° 052/07 K.P.C.
Certified that Signature on the right side is Mr. Sngoun Drep Prey Thom Village mayor
Kampong Lpov, 03.07.2007
Commune Leader
Pen Chum

(1)

Annex C: Sample Letter of Change in Land Authority



Annex D: Sample Sale Deed Document of Land



Annex E: Payment Records Land Owners

Date	Description		TT		Expense			Balance
			Akay	Received	Land	Turmeric	Other	
01.11.07	Cre Advice	Akay TT (Cambodia Public Bank)	3,000.00	2,970.00				2,970.00
13.12.07	Cre Advice	Akay TT (Cambodia Public Bank)	81,000.00	80,884.03				83,854.03
04.12.07	007286	DHL					25.00	83,829.03
15.12.07		Company Licence					1,200.00	82,629.03
18.12.07		Bank Cheque					5.00	82,624.03
19.12.07		Payment to 14 land Owners- 50 Ha			90,000			(7,375.97)
		Translated Company Licence					150.00	(7,525.97)
		Well at the land area					1,700.00	(9,225.97)
		Small Road at the land area					300.00	(9,525.97)
		Lawyer Stamps land contract					200.00	(9,725.97)

Akay Cambodia Ltd.

Date		Description	TT		Expense			Balance
			Akay	Received	Land	Turmeric	Other	
		Opening Balance						(8,725.97)
07.03.08		Governor Battambang City					400.00	(10,125.97)
08.03.08		Turmeric (50mt x 200$)				10,000.00		(20,125.97)
17.03.08	Credit Advice	Akay TT (Cambodia Public Bank)	90,000.00	88,885.02				68,759.05
17.03.08		Bank Cheque					5.00	68,754.05
17.03.08		Payment to 12 Land Owners- 70 Ha (approx.)			70,000.00			(245.95)
24.03.08		Weather News CD					300.00	(545.95)
24.03.08		Send CD (Weather News) CHI						(545.95)
17.04.08		Akay TT	150,000.00	148,805.04				148,259.09
21.04.08		Payment to 20 Land Owners 150 Hectares Approx.			150,000.00			(740.91)
21.04.08		Bank Cheque					5.00	(745.91)
22.04.08		Expenses for general withholding tax (Jan-08)					20.26	(766.17)
22.04.08		Expenses for general withholding tax (Feb-08)					20.26	(786.43)
22.04.08		Tax Accountant Salary for Feb-08					150.00	(936.43)
22.04.08		Expenses for general withholding tax (Mar-08)					20.26	(956.69)
22.04.08		Tax Accountant Salary for Mar-08					150.00	(1,106.69)
24.04.08		Motorcycle Honda CD (90cc)					1,900.00	(3,006.69)
30.04.08		Payment to 8 Land Owners			25,000.00			(28,006.69)
30.04.08		Bank Cheque					5.00	(28,011.69)
10.05.08		Expenses for general withholding tax (Apr-08)					20.26	(28,031.95)
10.05.08		Tax Accountant Salary for Apr-08					150.00	(28,181.95)
12.05.08		Payment to 10 Land owners- approximate Extent: 50 Ha			50,000.00			(78,181.95)
12.05.08		Bank Cheque					5.00	(78,186.95)
20.05.08	Credit Advice	Akay TT	100,000.00	99,865.03				21,678.08
22.05.08		25 Land Owners- 125 ha			125,000.00			(103,321.92)
22.05.08		Bank Cheque					5.00	(103,326.92)
27.05.08		To 6 Land Owners for approx. 30 ha land			30,000.00			(133,326.92)
27.05.08		Bank Cheque					5.00	(133,331.92)
01.06.08		Trip To Battambang					202.40	(133,534.32)
04.06.08	Credit Advice	Akay TT	170,000.00	166,786.04				33,250.72
06.06.08		2 Cottage (2950Usd x 2 = 5,900 Usd)					5,900.00	27,350.72
09.06.08		Water Basins N° 01 (1.40 x 1950)					2,730.00	24,620.72
09.06.08		Water Basins N° 02 (1.40 x 2130)					2,986.00	21,634.72
24.05.08		Send CD (Weather News) CHI.					20.51	21,614.21
14.06.08	AK2008-06-00	Petrol 14.06.08					80.00	21,534.21
14.06.08	AK2008-06-00	Dinner 14.06.08					34.90	21,099.31
14.06.08	AK2008-06-00	Parasol + Rain code + Other					36.00	21,063.31
14.06.08	AK2008-06-00	Breakfast + Cookl at tela 15.06.08					34.00	21,029.31
14.06.08	AK2008-06-00	Drking Water 15.06.08					10.00	21,019.31
14.06.08	AK2008-06-00	Ice Cream at Restaurant					7.00	21,012.31
14.06.08	AK2008-06-00	Petrol at tela 15.06.08					85.00	20,927.31
14.06.08	AK2008-06-00	Dinner 15.06.08					95.50	20,831.81
14.06.08	AK2008-06-00	Hotel Room (Two room)					50.06	20,781.81
20.06.08	AK2008-06-00	Chhup Rubber Guice					10.00	20,771.81
20.06.08	AK2008-06-00	Lunch at Kompong Cham					21.75	20,750.06
20.06.08	AK2008-06-00	Breakfast at Skun & Other					20.00	20,730.06
22.06.08	AK2008-06-00	Petrol at Kompong Cham					83.00	20,647.06
22.06.08	AK2008-06-00	Snack at Caltex					32.70	20,614.36
22.06.08	AK2008-06-00	Breakfast at Skun					6.00	20,608.36
22.06.08	AK2008-06-00	Lunch at Skun					23.00	20,585.36
22.06.08	AK2008-06-00	Petrol at room long					77.83	20,507.78
23.06.08	AK2008-06-00	Visa for year (Mr. Muthu)					285.00	20,222.78
23.06.08	AK2008-06-00	Maid Phone					33.00	20,189.78
23.06.08	AK2008-06-00	Sim Card + Card					17.00	20,172.78
23.06.08	AK2008-06-00	Lawer Fee for Stamp on the land file					1,000.00	19,172.78
23.06.08	AK2008-06-00	Dinner with the rubber institute					110.00	19,062.78
23.06.08	AK2008-06-00	Dinner with Sun Shibu Muthu Teacher Saren					90.00	18,972.78
23.06.08	AK2008-06-00	English Khmer Dictionary (4 Books)					18.00	18,954.78
23.06.08	AK2008-06-00	Bought one Toyota Tacoma					15,300.00	3,654.78
23.06.08	AK2008-06-00	Maintenance All					665.00	2,989.78
23.06.08	AK2008-06-00	Buit new Car's rack of the back					220.00	2,769.78
23.06.08	AK2008-06-00	Change new key for Car					20.00	2,749.78
23.06.08	AK2008-06-00	Bell for motorcycle at Battambang					20.00	2,729.78
23.06.08	AK2008-06-00	As Per Bill 16.06.08					10.30	2,719.48
23.06.08	AK2008-06-00	As Per Bill 16.06.08					8.50	2,710.98
23.06.08	AK2008-06-00	As Per Bill 18.06.08					25.00	2,685.98
23.06.08	AK2008-06-00	As Per Bill 21.06.08					6.00	2,679.98
23.06.08	AK2008-06-00	As Per Bill 21.06.08					35.00	2,644.98
23.06.08	AK2008-06-00	As Per Bill 23.06.08					8.00	2,636.98
23.06.08	AK2008-06-00	As Per Invoice 24.06.08					34.00	2,602.98
23.06.08	AK2008-06-00	Bas From Phnom Penh to Battambang					6.50	2,596.48
29.06.08	AK2008-06-00	Petrol 29.06.08					84.00	2,512.48
29.06.08	AK2008-06-00	Dinner with Muthu & Thon 29.06.08					36.00	2,476.48
29.06.08	AK2008-06-00	By far Luch to the Farms					37.10	2,439.38
29.06.08	AK2008-06-00	Hotel Room (Two room) Saren & Ngkun					30.00	2,409.38
29.06.08	AK2008-06-00	Breakfast 29.06.08					10.00	2,399.38
29.06.08	AK2008-06-00	Petrol 30.06.08					82.00	2,317.38
29.06.08	AK2008-06-00	Car Repared N° 7182					14.00	2,303.38
30.06.08	AK2008-06-00	Dinner (Mr. Srilou,Mr. Muthu, Sella)					84.20	2,219.18
30.06.08	AK2008-06-00	Insurance For Car N° 2C 7182					66.63	2,152.55
30.06.08	AK2008-06-00	Charge Driving License (Mr. Muthu)					40.00	2,112.55
30.06.08	AK2008-06-00	Tax Accountant Salary for May-2008					150.00	1,962.55
30.06.08	AK2008-06-00	Expenses for general withholding tax (May-08)					20.26	1,942.29
30.06.08	AK2008-06-00	Tax Accountant Salary for Jun-2008					150.00	1,792.29
30.06.08	AK2008-06-00	Expenses for general withholding tax (Jun-08)					20.26	1,772.03
06.07.08	AK2008-07-00	Petrol 06.07.08					80.00	1,692.03
06.07.08	AK2008-07-00	Lunch (Kampot Provice)					27.00	1,665.03
06.07.08	AK2008-07-00	Dinner					40.00	1,625.03
06.07.08	AK2008-07-00	Breakfast					6.00	1,619.03
06.07.08	AK2008-07-00	Other					30.00	1,589.03
07.07.08	AK2008-07-00	Petrol 09.07.08					72.00	1,517.03
07.07.08	AK2008-07-00	Memot Lunch					10.00	1,507.03
07.07.08	AK2008-07-00	Snack memot					10.15	1,496.88
07.07.08	AK2008-07-00	Breakfast					10.00	1,486.78
07.07.08	AK2008-07-00	Dinner with Three Commander at PP Mr Motha					167.00	1,319.78
10.07.08	AK2008-07-00	Salary Balance Jun-08 (Mr. Muthu)					119.00	1,200.78
10.07.08	AK2008-07-00	Allowance 8 Day * 16 (Muthu)					128.00	1,072.78
01.07.08	Credit Advice	Akay TT	29,070.00	28,840.03			-	28,912.81
29.07.08	AK2008-07-00	Breakfast					3.00	28,184.51
29.07.08	AK2008-07-00	Stationary					3.00	28,181.51
29.07.08	AK2008-07-00	Sre Leap Hotel					34.00	28,147.51
29.07.08	AK2008-07-00	Bus Charge					5.50	28,142.01

Akay Cambodia Ltd.

28.07.08	AK2008-07-00	Bill on 19/07/08					9.50	35,132.51
28.07.08	AK2008-07-00	Stationary					2.95	35,129.56
29.07.08	AK2008-07-00	Petrol Car 3/7,4/7 15/7 24/7					82.10	35,047.46
29.07.08	AK2008-07-00	Petrol					8.00	35,039.46
29.07.08	AK2008-07-00	Stationary 31/08					3.95	35,035.41
29.07.08	AK2008-07-00	Cost on Rose on 19/07 on bill					5.00	35,030.41
29.07.08	AK2008-07-00	Room Rent 24/06 to 24/07/08					270.00	34,760.41
29.07.08	AK2008-07-00	Bus Charge					5.50	34,754.91
29.07.08	AK2008-07-00	Guest House on Phnom Penh					11.00	34,743.91
29.07.08	AK2008-07-00	Food Expenses 21 s 16					465.00	34,278.91
29.07.08	AK2008-07-00	Communication					30.00	34,248.91
29.07.08	AK2008-07-00	T O Hotel 30/06,15/07/08					15.00	34,233.91
29.07.08	AK2008-07-00	Personal Payment on 12/07/08					23.00	34,210.91
30.07.08	AK2008-07-00	Tax Accountant Salary for Jul-2008					150.00	34,060.91
30.07.08	AK2008-07-00	Expenses for general withholding tax (Jul-08)					24.00	34,036.91
30.07.08	AK2008-07-00	Car Repaired Nº 7182 (28.06.08)					37.00	33,999.91
30.07.08	AK2008-07-00	Car Repaired Nº 7182 (03.06.08)					202.00	33,797.91
30.07.08	AK2008-07-00	Salary Mr. Thon (15/06 to 30/07/08)					450.00	33,347.91
30.07.08	AK2008-07-00	Salary Mr. Orn					200.00	33,147.91
30.07.08	AK2008-07-00	Car New Certificate					120.00	33,027.91
30.07.08	AK2008-07-00	To Memot Pepper Food					30.00	32,997.91
30.07.08	AK2008-07-00	Petrol					84.00	32,913.91
30.07.08	AK2008-07-00	To Memot Pepper Food					41.80	32,872.11
30.07.08	AK2008-07-00	Petrol					73.00	32,799.11
30.07.08	AK2008-07-00	Mr.Muthu Tools on July					19.19	32,779.92
30.07.08	AK2008-07-00	Radio ICF - SW32 (Mr. Muthu)					7.00	32,772.92
30.07.08	AK2008-07-00	Bought Shoe (Mr. Muthu)					6.00	32,766.92
30.07.08	AK2008-07-00	Electric tools					22.50	32,744.42
30.07.08	AK2008-07-00	Car Repaired 1C-7182					230.00	32,514.42
10.08.08	AK 2008-08-00	Hotel 1 room					15.00	32,499.42
10.08.08	AK 2008-08-00	Petrol 09/05/08					80.00	32,419.42
10.08.08	AK 2008-08-00	Petrol 10/05/08					99.00	32,320.42
10.08.08	AK 2008-08-00	Breakfast					11.00	32,309.42
10.08.08	AK 2008-08-00	Dinner 09/05/08					30.00	32,279.42
10.08.08	AK 2008-08-00	Dinner 10/05/08					13.00	32,266.42
10.08.08	AK 2008-08-00	Sneck & Water					30.00	32,236.42
10.08.08	AK 2008-08-00	Mr. Seila Sick at Battambang					53.00	32,183.42
10.08.08	AK 2008-08-00	Bought Phone for Mr. Orn					43.00	32,140.42
10.08.08	AK 2008-08-00	Bought TV & Battery					150.00	31,990.42
10.08.08	AK 2008-08-00	Marking Dam Near Boundary					6,387.00	25,612.42
10.08.08	AK 2008-08-00	Corn & Pepper Boundary Clean					26,221.00	(608.58)
10.08.08	AK 2008-08-00	Boundary JCB					3,466.00	(4,074.58)
10.08.08	AK 2008-08-00	Turmeric Cleaning					4,312.00	(8,386.58)
10.08.08	AK 2008-08-00	Pepper Pole & Other Expensec					6,782.00	(15,168.58)
10.08.08	AK 2008-08-00	Turmeric Plants					15,770.00	(30,938.58)
10.08.08	AK 2008-08-00	Corn Plants					3,250.00	(34,170.58)
30.08.08	AK 2008-09-00	Pepper Plant 2000x 1					2,000.00	(36,170.58)
30.08.08	AK 2008-08-00	Labor for cutting					35.00	(36,205.58)
30.08.08	AK 2008-08-00	Petrol for pickup at Phnom penh 18.08.08					77.00	(36,282.58)
30.08.08	AK 2008-08-00	Petrol at memot pepper farm					36.00	(36,318.58)
30.08.08	AK 2008-08-00	Petrol at Battambang 2 time be one accident					91.20	(36,409.78)
30.08.08	AK 2008-08-00	Food for 2 day (5 person)					56.30	(36,466.08)
30.08.08	AK 2008-08-00	Bus Ticket for Mr. Orn Sick					6.00	(36,472.08)
30.08.08	AK 2008-08-00	Medecine & Treatment for Mr. Orn					65.00	(36,537.08)
30.08.08	AK 2008-08-00	Cocoa and Rubber plan from Vietnam to farm						(36,537.08)
30.08.08	AK 2008-08-00	Custom clearance and Transportation 19.08					850.00	(37,387.08)
30.08.08	AK 2008-08-00	Sim Card 089 606 414 (Mr. Anand)					10.00	(37,397.08)
30.08.08	AK 2008-08-00	E-Card 10 x 2 (Mr. Anand)					20.00	(37,417.08)
30.08.08	AK 2008-08-00	Pancake & Honey					26.30	(37,443.38)
30.08.08	AK 2008-08-00	One Year Visa (Mr. Anand)					285.00	(37,728.38)
30.08.08	AK 2008-08-00	Petrol for Lexus to BTB on 20.08.08 (Mr. Bau)					104.80	(37,833.18)
30.08.08	AK 2008-08-00	Commander for resol car accden & Transport					100.00	(37,933.18)
30.08.08	AK 2008-08-00	Transport Pickup to Phnom Penh					370.00	(38,303.18)
30.08.08	AK 2008-08-00	Medecine for Driver					38.75	(38,341.93)
30.08.08	AK 2008-08-00	Fun to driver car Accident					40.00	(38,381.93)
30.08.08	AK 2008-08-00	Petrol at Battambang 21.08.08					90.00	(38,471.93)
30.08.08	AK 2008-08-00	Dinner at Phnom penh 21.08.08					23.10	(38,495.03)
30.08.08	AK 2008-08-00	Petrol for Lexus to BTB 28.08.08 (Mr. Bau)					104.00	(38,599.03)
30.08.08	AK 2008-08-00	Petrol for Lexus to BTB to PP on 27.08.08					101.00	(38,700.03)
30.08.08	AK 2008-08-00	Sim Card for Mr. Muthu & Mr. Orn					30.00	(38,730.03)
30.08.08	AK 2008-08-00	Internet fees for Aug-08					10.54	(38,740.57)
30.08.08	AK 2008-09-00	Internet fees for Sep-08					109.00	(38,849.57)
30.08.08	AK 2008-08-00	Deposit for Internet					150.00	(38,999.57)
30.08.08	AK 2008-08-00	fees technican for Insial Internet at BTB					141.00	(39,140.57)
30.08.08	AK 2008-09-00	Tax Accountant Salary for Aug-08					150.00	(39,290.57)
30.08.08	AK 2008-08-00	Expenses for general withholding tax (Aug-08)					24.00	(39,314.57)
30.08.08	AK 2008-08-00	House Rental at 7 Juntina for four month					800.00	(40,114.57)
30.08.08	AK 2008-08-00	Salary paid to Mr. Thon Aug 08					300.00	(40,414.57)
30.08.08	AK 2008-08-00	Salary paid to Mr. Orn Aug-08					200.00	(40,614.57)
	None *****	Advance for Mr. Anand 2 time					9,000.00	(49,614.57)
11.09.08	Credit Advice	Akay TT	50,000.00	49,630.03				385.40
12.09.08	AK2008-09	land owners-4 persons			15732			(15,426.64)
16.09.08	AK 2008-09-00	Petrol 12.09.08					63.00	(15,489.64)
16.09.08	AK 2008-09-00	Dinner 12.09.08					22.50	(15,512.04)
16.09.08	AK 2008-09-00	Breakfast & Water					30.36	(15,542.40)
16.09.08	AK 2008-09-00	Lunch					25.75	(15,568.15)
16.09.08	AK 2008-09-00	Petrol 13.09.08					69.00	(15,637.85)
16.09.08	AK 2008-09-00	Hotel 2 Room					30.00	(15,667.85)
16.09.08	AK 2008-09-00	Dinner					16.30	(15,684.15)
16.09.08	AK 2008-09-00	To Pagoda (Pchumben day)					50.00	(15,734.15)
16.09.08	AK 2008-09-00	To Police issue					200.00	(15,934.15)
16.09.08	AK 2008-09-00	Salary paid to Mr. Thon 15.09.08					150.00	(16,084.15)
16.09.08	AK 2008-09-00	Advance for Mr. Anand					2,000.00	(18,084.15)
26.09.08	AK 2008-09-00	UPS for Mr. Anand					63.00	(18,147.15)
26.09.08	AK 2008-09-00	Battery for Mr. Anand					105.00	(18,252.15)
26.09.08	AK 2008-09-00	3 Sim Ram Code for Mr. Anad, Mr. Muthu					60.00	(18,312.15)
26.09.08	AK 2008-09-00	Blot mud nuid 4 pairs					15.00	(18,327.15)
26.09.08	AK 2008-09-00	Petrol at point on 20.09.08					110.00	(18,437.15)
26.09.08	AK 2008-09-00	Lunch with Balut & Mr. Sivan in Phnom penh					16.00	(18,453.15)
26.09.08	AK 2008-09-00	Salary paid to Mr. Bai for Aug-08					120.00	(18,573.15)
26.09.08	AK 2008-09-00	Salary paid to Mr. Leang for Aug-08					120.00	(18,693.15)
26.09.08	AK 2008-09-00	Extra paid to Mr. Bai on 21.09.08					20.00	(18,713.15)
26.09.08	AK 2008-09-00	Petrol & Driver at Tractor 21.09.08					30.00	(18,743.15)
26.09.08	AK 2008-09-00	Advance for Mr. Anand (21.09.08)					2,000.00	(20,743.15)
30.09.08	AK 2008-09-00	Tax Accountant Salary for Sep-08					150.00	(20,893.15)

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30.09.08	AK 2008-09-00	Expenses for general withholding tax (Sep-08)					24.00	(20,917.15)
30.09.08	AK 2008-09-00	Salary paid to Mr. Orth Sep-08					200.00	(21,117.15)
15.10.08	AK 2008-10-00	Petrol (auto) 9 10.08					100.00	(21,217.15)
15.10.08	AK 2008-10-00	Breakfast + Bread 03.10.08					20.30	(21,237.45)
15.10.08	AK 2008-10-00	Petrol + water +Softdrink BTB					90.11	(21,327.56)
15.10.08	AK 2008-10-00	Dinner With Deputer Govement BTB 03.10.2008					100.00	(21,427.56)
15.10.08	AK 2008-10-00	Breakfas. a. BTB					15.00	(21,442.56)
15.10.08	AK 2008-10-00	Hotel At BTB					56.00	(21,498.56)
15.10.08	AK 2008-10-00	Dinner with Shibu at Tail					38.30	(21,536.86)
15.10.08	AK 2008-10-00	Petrol as Kang pongsnam 04.10.08					85.00	(21,622.86)
15.10.08	AK 2008-10-00	Lunch with Peter & Shibu					33.00	(21,655.86)
15.10.08	AK 2008-10-00	Mosquito Refill for Farm					22.35	(21,678.21)
15.10.08	AK 2008-10-00	Flight Glue for Farm					17.70	(21,695.91)
15.10.08	AK 2008-10-00	Rain Coat for Peter & Shibu					18.50	(21,714.41)
15.10.08	AK 2008-10-00	Internet fee for Oct-08					108.00	(21,823.41)
15.10.08	AK 2008-10-00	Dinner with Shibu Ngoun, Thai, Sok					87.00	(21,910.41)
15.10.08	AK 2008-10-00	Advance for Mr. Anand (04.10.08)					2,000.00	(23,910.41)
24.10.08	AK 2008-10-00	Dinner with Mr. Anand & Muthu & Sok 17.10.08					21.00	(23,931.41)
24.10.08	AK 2008-10-00	Breakfast with Mr. Anand & Muthu & Sok 19.10.08					18.00	(23,949.41)
24.10.08	AK 2008-10-00	Bread for Lunch to rubber farm					16.00	(23,965.41)
24.10.08	AK 2008-10-00	Petrol					85.00	(24,001.41)
24.10.08	AK 2008-10-00	One Person guide to farm					15.00	(24,046.41)
24.10.08	AK 2008-10-00	Advance for Mr. Anand. (20.10.08)					1,000.00	(25,046.41)
05.11.08	AK 2008-10-00	Cable for wild boar					34.50	(25,080.91)
05.11.08	AK 2008-10-00	Pancake & Wheel for Anand					19.70	(25,100.61)
05.11.08	AK 2008-10-00	Bus & foods for Heany & Orth Come to PP					60.00	(25,160.61)
05.11.08	AK 2008-10-00	Tax Accountant Salary for Oct-08					150.00	(25,310.61)
05.11.08	AK 2008-10-00	Expenses for general withholding tax (Oct-08)					24.00	(25,334.61)
08.11.08	AK 2008-11-00	Petrol (Lexus 470) 2 time					150.00	(25,484.61)
08.11.08	AK 2008-11-00	Hotel 2 Room at TO					23.00	(25,507.61)
08.11.08	AK 2008-11-00	Cable for wild boar					20.00	(25,527.61)
09.11.08	AK 2008-11-00	Lunch & Dinner (08.11.08)					35.24	(25,562.85)
09.11.08	AK 2008-11-00	Breakfast & Snack to farm (09.11.08)					25.00	(25,587.85)
09.11.08	AK 2008-11-00	Lunch at BTB (09.11.08)					25.00	(25,612.85)
09.11.08	AK 2008-11-00	Dinner at P. Penh 4 person					16.00	(25,628.85)
08.11.08	AK 2008-11-00	Internet fee for Nov-08					79.86	(25,708.71)
08.11.08	AK 2008-11-00	Petrol (Lexus) 12.11.08					40.00	(25,748.71)
08.11.08	AK 2008-11-00	Breakfast & Lunch (Labor) 12.11.08					34.14	(25,782.85)
08.11.08	AK 2008-11-00	Advance for Mr. Anand (08.11.08)					1,000.00	(26,782.85)
17.11.08	AK 2008-11-00	To pay Labor (Petrol)					30.00	(26,812.85)
17.11.08	AK 2008-11-00	To take Labor (Other Expense)					20.00	(26,832.85)
17.11.08	AK 2008-11-00	Nyet Tan (10x7) to farm					70.00	(26,902.85)
20.11.08	AK 2008-11-00	Advance to Mr. Anand (Clearance Contractor)					1,000.00	(27,902.85)
24.11.08	Credit Advice	Akay TT	30,000.00	29,940.03				2,037.18
05.12.08	AK 2008-11-00	Petrol to BTB (29 11.08)					64.00	1,973.18
05.12.08	AK 2008-11-00	Cash to Debt (Approval Mr. Balu) 29.11.08					100.00	1,873.18
05.12.08	AK 2008-11-00	Breakfast at BTB & food to farm 30.11.08					20.00	1,853.18
05.12.08	AK 2008-11-00	Lunch at Kampong Cham 01.12.08					12.00	1,841.18
05.12.08	AK 2008-11-00	Internet for Dec-08					71.00	1,770.18
05.12.08	AK 2008-11-00	the seed of vegitable					32.00	1,710.18
05.12.08	AK 2008-11-00	Advisoral Salary for Mr. Orth (Oct & Nov/2008)					160.00	1,550.18
05.12.08	AK 2008-11-00	four person new labor (Kg. Thom to farm)					50.00	1,500.18
05.12.08	AK 2008-11-00	Transport the Generator & Pump to farm with 4 person labor					50.00	1,450.18
05.12.08	AK 2008-11-00	Tax Accountant Salary for Nov-08					150.00	1,300.18
05.12.08	AK 2008-11-00	Expenses for general withholding tax (Nov-08)					24.00	1,276.18
05.12.08	AK 2008-11-00	Payment to 6 Land Owners 30 Hectares approx.			30,210.00			(29,033.82)
05.12.08	AK 2008-11-00	Advance to Mr. Anand (30.11.2008)					1,000.00	(30,033.82)
06.12.08	AK 2008-11-00	Advance to Mr. Anand (07.12.2008)					400.00	(30,433.82)
06.12.08	AK 2008-11-00	Generator					850.00	(31,283.82)
06.12.08	AK 2008-11-00	Pump					870.00	(32,053.82)
06.12.08	AK 2008-12-00	Water pipe & Electric body					280.00	(32,333.82)
12.12.08	AK 2008-12-00	Advance to Mr. Anand (12.12.2008) Commander for Corr					2,000.00	(34,333.82)
18.12.08	Credit Advice	Akay TT	35,000.00	34,035.03				801.21
19.12.08	AK 2008-12-00	Land owner for 6 Ha			7,644.00			(7,042.79)
19.12.08	AK 2008-12-00	Land owner for 10 ha			10,017.00			(17,059.79)
25.12.08	AK 2008-12-00	Petrol 25.12.08					35.00	(17,094.79)
25.12.08	AK 2008-12-00	Breakfast 25.12.08					10.00	(17,104.79)
25.12.08	AK 2008-12-00	Lunch & Snack to farm					20.00	(17,124.79)
25.12.08	AK 2008-12-00	Dinner					58.00	(17,182.79)
25.12.08	AK 2008-12-00	Hotel 2 Room					23.00	(17,205.79)
25.12.08	AK 2008-12-00	Breakfast with Commander 26.12.08					15.00	(17,220.79)
25.12.08	AK 2008-12-00	Water					10.00	(17,230.79)
25.12.08	AK 2008-12-00	Lunch					15.00	(17,245.79)
25.12.08	AK 2008-12-00	Petrol 26.12.08					42.00	(17,287.79)
25.12.08	AK 2008-12-00	Medicine for labor					65.60	(17,353.39)
25.12.08	AK 2008-12-00	Two person new labor (Kg. Thom to farm)					57.00	(17,390.39)
25.12.08	AK 2008-12-00	Bought pot (Mr. Oth)					25.00	(17,415.39)
25.12.08	AK 2008-12-00	Bought Coat for lroer 15 unit					45.00	(17,460.39)
25.12.08	AK 2008-12-00	Food for Mr. Anand					50.70	(17,511.09)
25.12.08	AK 2008-12-00	Petrol for Commander (Tractor) & Car go back Anana					100.00	(17,611.09)
28.12.08	AK 2008-12-00	Land owner for 5 Ha			6,950.00			(24,561.09)
28.12.08	AK 2008-12-00	Land owner for 3 Ha			3,246.00			(27,807.09)
29.12.08	AK 2008-12-00	Advance to Mr. Anand (25.12.2008)					2,000.00	(29,807.09)
29.12.08	AK 2008-12-00	Advance to Mr. Anand (26.12.2008)					900.00	(30,707.09)
29.12.08	AK 2008-12-00	Advance to Mr. Anand (29.12.2008) by commander					1,000.00	(31,707.09)
30.12.08	AK 2008-12-00	Water Tank 2000ml 12 x 195)					390.00	(32,107.09)
30.12.08	AK 2008-12-00	Motor Cut & Polish					173.00	(32,280.09)
30.12.08	AK 2008-12-00	Chemical Copper					6.25	(32,286.34)
30.12.08	AK 2008-12-00	Motor Sharpen					42.00	(32,328.34)
30.12.08	AK 2008-12-00	Water Connection					30.60	(32,358.94)
30.12.08	AK 2008-12-00	Internet for Jan-09					109.00	(32,467.94)
30.12.08	AK 2008-12-00	Tax Accountant Salary for Dec-08					150.00	(32,617.94)
30.12.08	AK 2008-12-00	Expenses for general withholding tax (Dec-08)					24.00	(32,641.94)
30.12.08	AK 2008-12-00	Anna Land Survey					2,040.00	(34,731.94)

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Date	Description		TT		Expense			Balance
			Akey	Received	Land	Turmeric	Other	
								(34,731.84)
		Opening Balance					1,000.00	(35,731.84)
09.01.09	Ak 2009-01-001	Advance to Mr. Anand (09.01.2009)	35,000.00	34,930.03				(801.81)
13.01.09	Credit Advice	Akay TT					2,000.00	(2,801.81)
21.01.09	Ak 2009-01-002	Advance to Mr. Anand (21.01.2009)					58.00	(2,859.81)
22.01.09	Ak 2009-01-003	Petrol on 18.01.2009					200.00	(3,059.91)
22.01.09	Ak 2009-01-003	Commodity and Comand & District office					60.00	(3,110.91)
22.01.09	Ak 2009-01-003	Food expenses					34.80	(3,154.71)
22.01.09	Ak 2009-01-003	Food for anand					56.00	(3,210.71)
22.01.09	Ak 2009-01-003	Hotel At BTB					120.00	(3,330.71)
22.01.09	Ak 2009-01-003	Water & food on the way to BTB and Back to PP with Sofia	35,000.00	34,930.03				31,599.32
26.01.09	Credit Advice	Akay TT			21,831.00			9,768.32
03.02.09	Ak 2009-02-001	Land Owners 20 Ha- 4 land owners' payment					529.00	9,239.32
03.02.09	Ak 2009-02-001	Water Tank (900Ltd & 3500Ltr)					40.00	9,199.32
03.02.09	Ak 2009-02-001	Petrol 03.02.09					54.00	9,145.32
03.02.09	Ak 2009-02-001	Dinner 01.02.09					112.05	9,033.27
03.02.09	Ak 2009-02-001	Dinner & Lunch with Anand (5 time)					200.00	8,833.27
03.02.09	Ak 2009-02-001	Pay to Mr. Rat by Anand					5.00	8,828.27
03.02.09	Ak 2009-02-001	Bank Charge for buy Tractor					118.00	8,710.27
03.02.09	Ak 2009-02-001	Internet for Feb-09					150.00	8,560.27
03.02.09	Ak 2009-02-001	Tax Accountant Salary for Jan-09					14.00	8,546.27
03.02.09	Ak 2009-02-001	Expenses for general withholding tax (Jan-09)					2,000.00	6,546.27
05.02.09	Ak 2009-02-002	Advance to Mr. Anand (05.02.2009)					1,065.00	5,481.27
05.02.09	Ak 2009-02-003	land clearing			8,050.00			(2,568.73)
05.02.09	Ak 2009-02-003	Land owner- 10 Ha			6,195.00			(8,763.73)
05.02.09	Ak 2009-02-003	land owner- 5 Ha					1,738.00	(10,501.73)
17.02.09	Ak 2009-02-004	Tractor & Tools					2,000.00	(12,501.73)
25.02.09	Ak 2009-02-005	Advance to Mr. Anand (18.02.2009)					3,000.00	(15,501.73)
25.02.09	Ak 2009-02-005	Advance to Mr. Anand (25.02.2009)					4,000.00	(19,501.73)
16.03.09	Ak 2009-03-001	Advance to Mr. Anand (16.03.2009)	25,000.00	24,940.03				5,438.30
19.03.09	Credit Advice	Akay TT					320.00	5,118.30
31.03.09	Ak 2009-03-002	Salary paid to Mr. Chea (Dec-08 to Mar-09)					300.00	4,818.30
31.03.09	Ak 2009-03-002	Tax Office (Balance Sheet 2008)					338.00	4,480.30
31.03.09	Ak 2009-03-002	Patent 2009					140.00	4,340.30
31.03.09	Ak 2009-03-002	Tax Accountant Salary for Feb-09					24.00	4,318.30
31.03.09	Ak 2009-03-002	Expenses for general withholding tax (Feb-09)					150.00	4,166.30
31.03.09	Ak 2009-03-002	Tax Accountant Salary for Mar-09					24.00	4,142.30
31.03.09	Ak 2009-03-002	Expenses for general withholding tax (Mar-09)					109.00	4,033.30
31.03.09	Ak 2009-03-002	Internet for Mar-09					109.00	3,924.30
31.03.09	Ak 2009-03-002	Internet for Apr-09					64.00	3,860.30
08.04.09	Ak 2009-04-001	Gasoline (JUB, Sen, Shibu, Sapan) 08.04.09					32.00	3,828.30
08.04.09	Ak 2009-04-001	Sweet rice (Shibu, Nuer, Kotra)					36.00	3,792.30
08.04.09	Ak 2009-04-001	Petrol: Soc road E1 (08.04.09) (to Kg Thom)					10.00	3,782.30
08.04.09	Ak 2009-04-001	Breakfast (Snak)					58.50	3,723.80
08.04.09	Ak 2009-04-001	Petrol (Kg. Chhang 05.04.09					45.00	3,678.80
08.04.09	Ak 2009-04-001	Hotel Battambang (Mr. Sen, Sok Heng, Driver)					19.00	3,659.80
08.04.09	Ak 2009-04-001	Lunch go to farm 05.04.09					24.50	3,635.30
08.04.09	Ak 2009-04-001	Breakfast 05.04.09					10.00	3,625.30
08.04.09	Ak 2009-04-001	Photo for CDC					43.45	3,581.85
08.04.09	Ak 2009-04-001	Petrol Kg. Chhang from Battambang 06.04.09						

Akay Cambodia Ltd

08.04.09	Ak 2009-04-002	Food for Mr. Anand					27.10	3,564.75
08.04.09	Ak 2009-04-002	Dinner with Mr. Shiba, Mr. Sek Heng 03.04.09					37.40	3,517.35
08.04.09	Ak 2009-04-002	Lunch with Mr.Sen,Mr. Shiba , Mr. Heng 06.04.09					20.00	3,497.35
08.04.09	Ak 2009-04-002	Lunch Mr.Sen,Mr. Shiba , Mr. Heng 07.04.09					13.00	3,484.35
08.04.09	Ak 2009-04-002	Lunch Mr.Sen,Mr. Shiba , Mr. Heng 08.04.09					26.00	3,458.35
08.04.09	Ak 2009-04-002	Lunch Mr.Sen,Mr. Shiba , Mr. Heng 09.04.09					25.00	3,433.35
08.04.09	Ak 2009-04-002	Bought wine (Tax Division for Cambodia New Year)					215.70	3,217.65
08.04.09	Ak 2009-04-002	Dinner with Bettr pharma Group 06.04.09					37.60	3,180.05
08.04.09	Ak 2009-04-002	Hammock,Bed sheed,Blanket,Net (for farm)					160.00	3,020.05
08.04.09	Ak 2009-04-002	Land owners 25 Ha approx 5 persons			25,000.00			(21,979.95)
02.05.09	Ak 2009-04-004	Advance to Mr. Anand (05.04.2009)					4,000.00	(25,979.95)
02.05.09	Ak 2009-04-004	Advance to Mr. Anand (06.04.2009)					2,000.00	(27,979.95)
18.05.09	Credit Advice	Akay TT	28,000.00	24,940.03				(3,039.92)
24.05.09	Ak 2009-05-001	Petrol Phnom Penh to BTB					37.40	(3,087.32)
24.05.09	Ak 2009-05-001	Petrol BTB to PP					60.00	(3,162.92)
24.05.09	Ak 2009-05-001	Hotel two room (BTB)					20.00	(3,182.92)
24.05.09	Ak 2009-05-001	Food for Mr. Anand					16.10	(3,209.02)
24.05.09	Ak 2009-05-001	Food & Bread to farm					20.00	(3,229.02)
24.05.09	Ak 2009-05-001	Dinner at BTB					25.80	(3,255.82)
24.05.09	Ak 2009-05-001	Breakfast & Lunch 24.05.09					35.00	(3,290.82)
24.05.09	Ak 2009-05-001	Internet for May-09					100.00	(3,399.82)
28.05.09	Ak 2009-05-002	Advance to Mr. Anand (11.05.2009)					3,000.00	(6,399.82)
29.05.09	Ak 2009-05-002	Advance to Mr. Anand (20.05.2009)					4,000.00	(10,399.82)
31.05.09	Ak 2009-05-003	Internet Monthly Charge for Jun-09					100.00	(10,508.82)
31.05.09	Ak 2009-05-003	Expenses for general withholding tax (Apr-09)					24.00	(10,532.82)
31.05.09	Ak 2009-05-003	Tax Accountant Salary for Apr-09					150.00	(10,682.82)
31.05.09	Ak 2009-05-003	Expenses for general withholding tax (May-09)					24.00	(10,706.82)
31.05.09	Ak 2009-05-003	Tax Accountant Salary for May-09					150.00	(10,856.82)
13.06.09	Ak 2009-06-001	Suite Bill & Petrol to SR					69.60	(10,926.42)
13.06.09	Ak 2009-06-001	Food on the way to SR 2 person					40.00	(10,966.42)
13.06.09	Ak 2009-06-001	Petrol at BTB					81.50	(11,047.92)
13.06.09	Ak 2009-06-001	Petrol at Kampong Chhang					59.00	(11,106.92)
13.06.09	Ak 2009-06-001	Bread & Food to Rubber farm (Chhanka ombong)					22.00	(11,128.92)
13.06.09	Ak 2009-06-001	Food at BTB					60.00	(11,188.92)
13.06.09	Ak 2009-06-002	Airticket					211.00	(11,399.92)
13.06.09	Ak 2009-06-002	airport tax					18.00	(11,417.92)
13.06.09	Ak 2009-06-002	Hotel 2 night					228.30	(11,646.22)
13.06.09	Ak 2009-06-002	Taxi from airport to hotel					30.00	(11,676.22)
13.06.09	Ak 2009-06-002	Dinner with Bettr pharma					170.00	(11,846.22)
13.06.09	Ak 2009-06-002	Other for Bettr pharma at PP					59.76	(11,905.98)
19.06.09	Ak 2009-06-003	Cash to Mr. Anand 14.06.09					7,000.00	(18,905.98)
19.06.09	Ak 2009-06-003	Cash to Mr. Anand 19/06/09					5,000.00	(18,905.98)
19.06.09	Ak 2009-06-003	Cash for Agriculture offices at the farm [illegible]					200.00	(19,105.98)
27.06.09	Ak 2009-06-004	Cash to Mr. Anand 27/06/09					3,000.00	(22,105.98)

Akay Cambodia Ltd

Date	Description		TT		Expense		
			Akey	Received	Land	Turmeric	Other
15.11.2009	CPB 103456	Recieved from Mr. Anand		2,000.00			
15.11.2009		Old Account Akay (date 31.10.2009)					464.51
15.11.2009	Ak 2009-11-001	Petrol 14/11/09					55.00
15.11.2009	Ak 2009-11-001	Dinner At Battambang					56.90
15.11.2009	Ak 2009-11-001	Breakfast					20.00
15.11.2009	Ak 2009-11-001	Water + Snack					20.00
15.11.2009	Ak 2009-11-001	Lunch To Farm					30.00
15.11.2009	Ak 2009-11-001	Hotel + Rooms					56.00
15.11.2009	Ak 2009-11-001	Petrol To Phnom Penh On 15/11/09					80.00
15.11.2009	Ak 2009-11-001	Dinner At Phnom Penh on 15/11/09					75.00
15.11.2009	Ak 2009-11-001	DHL to Akay INDIA					25.00
19.11.2009	Credit Advice	Organina Naturals PVT Ltd		10,000.00			-
24.11.2009	CN Voucher R117	Mr. Anand (Organic Naturals)					10,000.00
30.11.2009	Ak 2009-11-002	Expenses for general withholding tax (Nov-09) (Akay)					24.00
31.11.2009	Ak 2009-11-002	Tax Accountant Salary for Nov-09 (Akay)					150.00
30.11.2009	Ak 2009-11-002	Expenses for general withholding tax (Nov-09)(OGN)					24.00
30.11.2009	Ak 2009-11-002	Tax Accountant Salary for Nov-09 (OGN)					150.00
30.11.2009	Ak 2009-11-002	Internet Monthly fee for Dec-09					139.00
30.11.2009	Ak 2009-11-002	Seed Pump to Battambang					2.50
30.11.2009	Ak 2009-11-002	Send Ginger & Annatto to India(EE002 1553980)					31.00
30.11.2009	Ak 2009-11-002	Send Turmeric & Annatto to India(EE002 1553980)					31.00
15.12.2009	CPB 104752	Recieved from Akay		15,500.00			
15.12.2009	CPB 104753	Recieved from Akay		30,000.00			
31.12.2009	Ak 2009-12-001	land owners- 4 persons			9,000.00		19,000.00
31.12.2009	Ak 2009-12-001	Motorcycle SL					2,520.00
31.12.2009	Ak 2009-12-001	Transport CAT 307 to farm					450.00
31.12.2009	Ak 2009-12-001	Genset 27U (Generator)					1,530.00
31.12.2009	Ak 2009-12-001	Car (TOYOTA TACOMA)					15,400.00
31.12.2009	Ak 2009-12-001	Car Repairing & Oil & Adjust					956.00
31.12.2009	Ak 2009-12-001	Extra to driver 1 day					30.00
31.12.2009	Ak 2009-12-002	Paid to Mr. Anand (15.12.2009)					4,000.00
31.12.2009	Ak 2009-12-002	Paid to Mr. Anand (21.12.2009)					1,800.00
31.12.2009	Ak 2009-12-002	Paid to Mr. Anand (30.12.2009)					2,000.00
31.12.2009	Ak 2009-12-003	Expenses for general withholding tax (Dec-09) (Akay)					24.00
31.12.2009	Ak 2009-12-003	Tax Accountant Salary for Dec-09 (Akay)					150.00
31.12.2009	Ak 2009-12-003	Expenses for general withholding tax (Dec-09)(OGN)					24.00
31.12.2009	Ak 2009-12-003	Tax Accountant Salary for Dec-09 (OGN)					150.00
31.12.2009	Ak 2009-12-003	Internet Monthly fee for Jan-10					139.00
31.12.2009	Ak 2009-12-004	Electricity tools for farm office					35.25
31.12.2009	Ak 2009-12-004	power tools for farm office					175.50
31.12.2009	Ak 2009-12-004	Wire for wheedder machin					35.00
31.12.2009	Ak 2009-12-004	Used Tank & pipe					367.50
31.12.2009	Ak 2009-12-004	Wrench & Blade saw					32.00
31.12.2009	Ak 2009-12-004	Cord & Pipe					13.00
31.12.2009	Ak 2009-12-004	Tools 99 (Excavator)					11.00
31.12.2009	Ak 2009-12-005	Dinner with Better pharma & akay					170.00
31.12.2009	Ak 2009-12-005	Bread and water to Kompong Speu					22.00
31.12.2009	Ak 2009-12-005	Petrol to Kompong Speu					54.00
31.12.2009	Ak 2009-12-006	Petrol At Phnom Penh					20.00
31.12.2009	Ak 2009-12-006	Petrol At Kompong Chhnang					50.00
31.12.2009	Ak 2009-12-006	Hotel & food (night 2days					30.00
31.12.2009	Ak 2009-12-006	Extra for driver					20.00
31.12.2009	Ak 2009-12-006	Petrol to phnom penh on 25/12/09					52.00
31.12.2009	Ak 2009-12-007	Breakfast 3 person					15.00
31.12.2009	Ak 2009-12-007	Lunch At Market 3 person					30.00
31.12.2009	Ak 2009-12-007	Petrol 12/12/09					55.71
31.12.2009	Ak 2009-12-007	Dinner At phnom penh					20.00
31.12.2009	Ak 2009-12-008	Petrol At Phnom Penh					80.00
31.12.2009	Ak 2009-12-008	Breakfast At Kompong Chhnang					10.00
31.12.2009	Ak 2009-12-008	Lunch Box & Water To Farm					27.00
31.12.2009	Ak 2009-12-008	Petrol at battambang to phnom penh					77.00
31.12.2009	Ak 2009-12-008	Hotel 5 room (bala, sok, better ph, driver, ,otiah)					67.00
31.12.2009	Ak 2009-12-008	Petrol at skun (Kompong cham) 21/12/09					80.00
31.12.2009	Ak 2009-12-009	Breakfast					10.00
31.12.2009	Ak 2009-12-009	Lunch					25.00
31.12.2009	Ak 2009-12-009	Dinner					25.00
31.12.2009	Ak 2009-12-009	Petrol					59.00

PAYMENT VOUCHER

VOUCHER NO. BP-419

ACCOUNT:

DATE: 7/12/2011

SLNO.	DATE	PARTICULARS	AMOUNT	
			US$	RIEL
1		In Savirith		
2				
3		Land purchase	10000/	
4				
5		Ch: No: 118857		
6				
		Total		

AMOUNT IN WORDS:

SIGNATURE OF PAYEE

MANAGER

CAMBODIAN PUBLIC BANK
TEK THLA BRANCH
No. 7-9-11Eo/E4, Street 110A, Sangkat Tek Thla, Khan Reussey Keo, Phnom Penh

Check

លេខ/No 118857

កាលបរិច្ឆេទ: Date: 07 12 11

Pay to: In Saorith — ឬអ្នកកាន់/Or Bearer

The Sum of: Ten thousand US dollers oney

USD 10000/-

For:

NO SIGNATURE BELOW THIS LINE

⑈118857⑈004⑆090 7⑆0902100017710⑈01

Annex F: Letter of Consent to Akay Cambodia Private Limited

Akay Cambodia Ltd.
No. 181-183, Kamkor Village,
Svaypor Commune,
Battambang Town, Battambang Province

LETTER OF CONSENT

I, Sen Mathew Andrews, Holder of Cambodian Identity Card No. 010769775, aged 36 years; No. 4D, Phum Toul Sangke, Sangkat Toul Sangke, Khan Russey Keo, Phnom Phen Cambodia; Businessman hereby express my consent in favour of **Akay Cambodia Limited**, Company incorporated and registered under the laws of the Kingdom of Cambodia and having its registered office located at No. 181-183, Kamkor Village, Svaypor Commune, Battambang Town, Battambang Province in which myself own 51% of the equity share capital and the remaining 49% of equity share capital is owned by Mr. Alex Koshy, for using the land owned by me in Prey thum Village, Samlout District, Battambang Province, Cambodia for the purpose of undertaking farming operations including but not limited to growing all kinds of spices, cash crops such as rubber, cocoa, vegetables , fruits and rearing of cattle etc.

The Company **Akay Cambodia Ltd.** will have the absolute authority to undertake all such activities which are incidental or ancillary to the farming activities being carried out by the Company using the above referred land unconditionally for a further period of fifty years from the date of this consent. By virtue of perpetual succession of the Company, this letter of consent stands irrevocable on whatsoever change in ownership of the Company through additional investments if any from any co-investor.

Dated on Nineth day of August Two Thousand Fourteen

SEN MTHEW ANDREWS

This Letter of consent is accepted for and on behalf of Akay Cambodia Ltd

Alex Koshy
Director

Initial Environmental Examination Report for Spices Manufacturing Operations: India

Akay Flavours & Aromatics Private Limited, Ambunadu, Kerala, India

Spice Rich Seasonings Private Limited, Akanadu, Kerala, India

Submitted to Asian Development Bank

`

Initial Environmental Examination Report

Prepared for
Asian Development Bank (ADB)

Prepared by

AECOM India Private Limited
www.aecom.com

August, 2014

Quality Information

Document	IEE for Spice Manufacturing Operations: India		
Ref	DELD13148	Date	07/08/2014
Prepared by	Amit Goswami Susan Vauquelin	Reviewed by	Ajay Pillai

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List of Abbreviations

AFAPL	Akay Flavours and Aromatics Private Limited
ADB	Asian Development Bank
CPCB	Central Pollution Control Board
CTE	Consent to Establish
CTO	Consent to Operate
CSR	Corporate Social Responsibility
DG	Diesel Generator
ETP	Effluent Treatment Plant
ESMS	Environment and Social Management System
EHS	Environment Health & Safety
EHSS	Environment Health Safety and Social
EIA	Environment Impact Assessment
EMP	Environment Management Plan
GOI	Government of India
GRM	Grievance Redressal Mechanism
HWR	Hazardous Waste Rules
HR	Human Resource
IP	Indigenous People
IEE	Initial Environmental Examination
IMS	Integrated Management System
IFC	International Finance Corporation
KPCB	Kerala Pollution Control Board
KSPCB	Kerala State Pollution Control Board
KLD	Kilo Litre Per day
KW	Kilowatt
LA	Land Acquisition
mbgl	metres below ground level
MT	Metric Tonnes
MoEF	Ministry of Environment and Forest
NH	National Highway
NOC	No Objection Certificate
PESA	Panchayat Extension to the Scheduled Areas
PPE	Personal Protective Equipment
PUC	Pollution Control Board
SPS	Safeguard Policy Statement
ST	Schedule Tribe
SA	Social Accountability
SPCB	State Pollution Control Board
TDP	Tonnes Per day
USD	United States Dollar

A. Executive Summary

1 Akay Group, established in 1995, is engaged in the manufacture of paprika, spices oleoresins, natural essential oils, and natural colours for global food industry.

2 Akay is seeking financial assistance from ADB for its India operations for development of a proposed seasoning manufacturing facility at Akanadu, Kerala, India and expansion of laboratories at the existing spices manufacturing facility situated at Ambunadu in Cochin, Kerala, India (hereinafter referred as "Ambunadu Laboratory").

3 The seasoning manufacturing facility in Akanadu, Kerala, known as Spice Rich Seasonings Private Limited (hereinafter referred as "Spicerich") will be engaged in manufacturing of 3000 Metric Tonnes (MT) per annum of seasoning products. Construction of Spicerich would commence by September 2014.

4 Spicerich will be constructed on approximately 1.8 acres of land in Akanadu, Cochin, Kerala, which has been obtained on lease from Mr. Alex Koshy (Chairman of A&P group) in the year 2012 for 99 years. Mr. Alex Koshy purchased the said land parcel from a single owner in the year 2006. The land parcel was used for limited agriculture and sale of excavated soil to brickmakers by its previous owner, before selling to Mr. Koshy. The land parcel was purchased on a 'willing-buyer and willing-seller' basis negotiated as per the prevailing market price in the area with no involvement of any government agencies, hence provisions under the Land Acquisition Act 1894 as amended in 1984, is not triggered. The said act has been superseded by The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (which became effective from January 2014), which is also not triggered as the land was purchased in 2006.

5 The proposed Ambunadu Laboratory will be an expansion of existing laboratory operations which is part of the existing manufacturing facility, Akay Flavours & Aromatics Private Limited (AFAPL), located at Ambunadu, Cochin, Kerala. There will be no manufacturing operations inside the laboratory. The laboratory will be purely used for and restricted to research and development activities like research of new phytonutrients, bioactive ingredients and nutrients. The research is at time focused on the specifications identified by the marketing team of Akay for a specific product (demands based on cutting edge technologies for various value-added formulations of the ingredients for better appeal, applicability, storage and process stability, and functional benefits) that a client may request to research of new extracts for direct human consumption. The management currently has plans for upgradation of the existing laboratory which involves installing equipments only and minor repair and civil works.

6 The current laboratory is operational in approximately 416 sq m area. The upgradation of the laboratory would require minor construction (civil) works in additional 200 sq m area adjacent to the existing laboratory (towards west). The said area is currently a vacant piece of land owned

by AFAPL and is in the factory boundary of AFAPL. Hence, no additional land requirement will be required for the proposed expansion.

7 In accordance with ADB's Safeguard Policy Statement (SPS) 2009, the requirements for financial assistance apply in addition to the applicable safeguard requirements for transactions involving the implementation of project facilities proposed by Akay (Spicerich and Ambunadu Laboratory in this case). An Initial Environmental Examination (IEE) was carried out for the proposed facilities, to determine the likely potential impacts and risks, and to enable preparation of an environmental and social management plan, so as to develop the facilities in environmentally sustainable manner and in compliance with the SPS, 2009 as well as National and State regulatory requirements.

8 Due to the nature and scale, Akay's presently proposed facilities i.e. Spicerich and Ambunadu Laboratory do not require prior environmental clearances and is out of purview of EIA Notification, 2006 as amended till date[1] of Ministry of Environment and Forest (MoEF), Government of India (GOI).

9 At the state level, the Spicerich facility will require to obtain permits/licenses from Kerala State Pollution Control Board (KSPCB) like 'Consent to Establishment' (CTE) during pre-construction stage and 'Consent to Operation' (CTO), prior to commencement of commercial operations [under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974] and hazardous waste authorisation for generation, storage and management of hazardous waste [under Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 as amended till date]. The procedure for obtaining CTE, CTO and authorisation for management of hazardous waste from the State Pollution Control Board in Kerala (Kerala State Pollution Control Board hereinafter termed as "KSPCB") is well established and consents can be obtained in a time bound manner and it is not a major constraint to establish and operate the proposed facilities.

10 At the state level, the Ambunadu Laboratory will not require any permits/licenses from Kerala State Pollution Control Board (KSPCB) as there will be no change in the manufacturing process of the facility in which the laboratory is situated. There will be no significant change in the effluent quantity/quality and air emissions of AFAPL in totality by laboratory expansion and hence permit requirement from KSPCB is not triggered.

11 The IEE indicates that the pre-construction stage impacts due to location or siting of facility can be mitigated through adopting pre-determined criteria for siting and finalization of location for the facilities. The involuntary resettlement impacts are not triggered in case for Spicerich as the land for Spicerich is leased from Mr. Alex Koshy (Managing Director of A&P Group) who in turn has bought the land from one land owner on willing-buyer and willing-seller arrangement. Similarly, the involuntary resettlement impacts are not triggered in case for Ambunadu Laboratory expansion as the laboratory is already part of existing AFAPL. Therefore, involuntary

[1] The EIA Notification 2006 as amended till date published by MoEF can be accessed at the link below: http://envfor.nic.in/legis/eia/so1533.pdf

resettlement impacts are not triggered in Spicerich and Ambunadu Laboratory construction, each.

12 The proposed facilities will not have any impact on indigenous peoples due to the absence of indigenous people in and around the proposed facilities.

13 The construction stage impacts of the Spicerich facility and Ambunadu laboratory is comparable to any general building construction projects (like dust emissions, traffic influx, labour related, onsite health and safety, etc.) and can be mitigated through site specific environmental management plan/ measures.

14 During the operation stage, the proposed facilities will adopt a schedule for monitoring environmental, occupational health and safety indicators in all of Akay's proposed facilities to comply with the consent conditions stipulated by the KSPCB, if any as well as safeguards monitoring and reporting requirements of ADB.

15 The IEE has enabled to prepare an Environmental and Social Management Plan (ESMP) for the pre-construction, construction and operations phase of the proposed facilities and has suggested institutional arrangements for implementing the ESMP along with the required budgetary provisions. The IEE also includes a periodical environmental monitoring schedule for the operation stage of the facilities.

16 The implementation of the ESMP for all stages of the facilities, complying with the regulatory requirements of the State Pollution Control Board like obtaining pre-construction and operating stage consents (CTE & CTO) and further implementation of environmental management plan as provided in this report which will enable the proposed facilities to be environmentally sustainable operation and become consistent with the safeguard requirements of SPS, 2009 and will not involve any kind of reputational risk to ADB on environmental and social safeguard issues. A designated EHS Officer will be responsible to oversee and monitor compliance with national government requirements. He/she will also supervise and document the status of the contractor's implementation with the ESMP. Annual environmental monitoring report to be submitted to government office and ADB will be prepared by the EHS officer.

17 Akay's proposed facilities do not fall under the purview of the EIA Notification, 2006, which exempts Akay from conducting formal public consultation with the communities, where the project facilities are located. Despite this, Akay has had informal information disclosure and consultations with the local authorities situated in the particular area. As per the ESMP, Akay will keep a communication channel open for the local community to approach the management if faced with any difficulties or concerns arising out of construction and operational stages. In addition, the contractor engaged by the Management will create a facility at project site to receive any complaints/grievances (either orally or in documented form) related to construction activities from local people/adjacent land owners and such grievances will be resolved in a timely manner.

B. Policy, Legal and Administrative Framework

B1 Applicable National Regulatory Acts and Notifications to Akay India

18 As per review of Akay's India operations, the following Environment Health Safety and Social (EHSS) national and local regulations of India were identified to be applicable:

19 The operations for the proposed facility owing to its nature and scale do not require prior environmental clearance from Ministry of Environment and Forest (MoEF), Government of India (GoI) under Environmental Impact Assessment Notification, 2006 (as amended till date).

20 As per Section 25 of Water (Prevention and Control of Pollution) Act, 1974 any individual, industry or institution responsible for discharging industrial or domestic wastewater is required to obtain consent of the State Pollution Control Board (SPCB). Similarly, Section 21 of Air (Prevention and Control of Pollution) Act, 1981 mandates any individual, industry or institution whose activities involve smoke or particulate or gaseous pollutant emission to obtain prior consent from the SPCB.

21 The SPCBs issues two types of consents viz. Consent to Establish (CTE) and Consent to Operate (CTO) under Air (Prevention and Control of Pollution) Act, 1981 as amended till date and Water (Prevention and Control of Pollution), 1974 as amended till date. For management of hazardous waste, the SPCB issues authorisation for management of hazardous waste under Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 as amended till date. CTE has to be obtained prior to commissioning of an industry whereas CTO shall be obtained prior to commencement of plant operations and continuing emission and pollutant discharge or for expansion of existing facility. The hazardous waste authorisation is issued by SPCB for construction and operation phase. The consents and authorisation for hazardous waste management are issued by the SPCBs, on submission of project related information in a prescribed application along with applicable consent/authorisation fee, based on the scale and category[2] of a specific industry.

22 The Spicerich facility involves manufacturing of seasonings products which will result in waste water (industrial and domestic effluent), air emissions and hazardous waste generation. Therefore, the plant shall obtain CTE prior to construction phase and CTO prior to production from the KSPCB and authorisation for management of hazardous waste.

23 The Ambunadu Laboratory will be operational within the premises of AFAPL. There will be no significant change in the waste water and air emissions generation due to expansion of the laboratory in the AFAPL premises. Therefore, revised Consent to Establish/Operate under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974 is not required to be obtained from Kerala Pollution Control Board. Similarly,

[2] The list of categorisation of industries by KSPCB is available at http://keralapcb.org/writereaddata/consent_fee.html. The SPCB reserves the right to change the category of industry based on its discretion.

authorisation for generation and management of hazardous waste from Kerala Pollution Control Board will also not required to be revised for construction and operation of the proposed laboratory.

24 The applicable environmental regulatory requirements to the proposed facility under ADB financing has been summarised in the following **Table 1-1**

Table 1-1: Applicable Environmental Regulatory Permitting Requirements

S. No	Regulatory Requirement	Regulatory Agency	Applicability to Spicerich	Action Required
1.	Environmental Clearance as per EIA notification 2006	MoEF	**Not Applicable** Since the facility does not fall within the purview of the Notification.	None
2.	Consent to Establish (CTE) prior to pre-construction phase	KSPCB	**Applicable** Since the management intends to establish an operational facility, which will have effluent generation from the process and domestic sewage and point and non point sources of emissions by using diesel generator set, etc. the management shall obtain a CTE under Section 25 of the Water (Prevention and Control) Act , 1974 (Amended) in 1988; And Section 21 of the Air (Prevention &Control of Pollution) Act,1981 from KSPCB	Application shall be submitted by project proponent to KSPCB in the prescribed application form along with consent fee depending on capital investment.
3.	Consent to Operate (CTO) prior to commencement of plant operation	KSPCB	**Applicable** Since the plant activities will entail generation of domestic sewage, industrial wastewater etc. therefore the management shall obtain CTO under Section 25 of the Water (Prevention and Control) Act , 1974 (Amended) in 1988; And Section 21 of the Air (Prevention &Control of Pollution) Act,1981 from KSPCB	Application shall be submitted by project proponent to KSPCB in the prescribed application form along with consent fee depending on capital investment.
4.	Hazardous waste authorisation prior to project commencement phase	KSPCB	**Applicable** The operational manufacturing activities will involve operations and maintenance of equipments and Diesel Generator (DG) set and Effluent Treatment Plant (ETP) operation. Used/waste oil from operations and maintenance of equipments, empty chemical	Application for storage shall be submitted by project proponent to KSPCB in the prescribed application form (Form 1) along with prescribed application fees.

S. No	Regulatory Requirement	Regulatory Agency	Applicability to Spicerich	Action Required
			containers, oil contaminated cotton cloth or material as well as ETP sludge has been classified as hazardous waste which requires proper treatment, storage and disposal as prescribed by Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 as amended till date. .	The authorisation shall be renewed on expiry by making prescribed application along with fees.
5.	Hazardous waste inventory and Authorisation	KSPCB	**Applicable** Since the project activities entail generation of hazardous waste viz. used oil, waste oil, empty chemical containers, oil contaminated cotton cloth or material and Effluent Treatment Plant (ETP) sludge.	A record of hazardous wastes handled shall be maintained by the facility in the prescribed format (Form 3) under Hazardous Waste Rules (HWR). The facility shall also submit to KSPCB an annual return containing details of hazardous waste handled by it in the prescribed format (Form 4). A legal register shall be updated to identify storage, handling, transportation and disposal requirements as per HWR 2008.

B2. Regulatory Framework for Involuntary Resettlement and Rehabilitation in India

25 In India, compensation for land acquisition (LA) and resettlement assistance for project affected persons/families is governed by The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (effective 1st January 2014). Prior to the enforcement of this Act, all land acquisition cases were regulated by the Land Acquisition Act (1894) and National Rehabilitation and Resettlement Policy, 2007.

26 **Land Acquisition Act, 1894 as amended in 1984.** This Act enables the State to acquire private land for public purposes and has provisions for acquisitions of land for industrial purposes. The Act ensures that no person is deprived of land except under law and entitles affected persons (landowners, tenant or licensee) to a hearing before acquisition, with due and adequate compensation made thereafter. The Act deals with cash compensation and provides several methods of valuing compensation. Several Indian states are using negotiations as a means to determine compensation and acquire land. The Act has a provision which enables any project proponent to opt for direct purchase of land on the basis of negotiated price after issue of notification requiring acquisition of land under relevant Act(s) i.e. section 4(1) of the Land Acquisition Act, 1894 through the competent District authorities. However, only landowners, tenants and licensees are possible compensation recipients and the Act does not recognize and exclude the landless, agricultural and non-agricultural labourers, artisans, forest produce collectors. Grievance redress mechanisms are also in place and affected persons may seek the intervention of the High Court and Supreme Court under this Act.

27 **National Rehabilitation and Resettlement Policy, 2007**. The National Rehabilitation and Resettlement Policy, 2007 recognises rehabilitation and resettlement issues as intrinsic to the development process formulated with the active participation of the affected persons, rather than as externally imposed requirements. The objectives of the policy are as follows:-

a) To minimise displacement and to promote, as far as possible, non-displacing or least displacing alternatives;
b) To ensure adequate rehabilitation package and expeditious implementation of the rehabilitation process with the active participation of the affected families;
c) To ensure that special care is taken for protecting the rights of the weaker sections of society, especially members of the Scheduled Castes and Scheduled Tribes, and to create obligations on the State for their treatment with concern and sensitivity.
d) To provide a better standard of living, making concerted efforts for providing sustainable income to the affected families;
e) To integrate rehabilitation concerns into the development planning and implementation process.
f) Where displacement is on account of land acquisition, to facilitate harmonious relationship between the requiring body and affected families through mutual cooperation.

28 **The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.** The Act ensures that a participative, informed and transparent process of land acquisition for industrialization, development of essential infrastructural facilities and urbanization with the least disturbance to the owners of the land and other affected families would be provided. In addition, provision for just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition has been ascertained. This Act enables a private company as prescribed by the appropriate Government to acquire private land through private negotiation with the owner of the land. The Act ensures that no person is deprived of land except under law and entitles Affected Persons (landowner, tenant or licensee) to a hearing before acquisition, with due and adequate

compensation made thereafter. The Act deals with cash compensation and provides several methods of valuing compensation. Several Indian states are using negotiations as a means to determine compensation and acquire land. A unique feature of the Act is that it recognises rights of artisans, small traders and non – agricultural labourers to get a onetime grant. Grievance redress mechanisms are also in place and Affected Persons may seek the intervention of the High Court under this Act.

29 **Applicability of Land Acquisition Act and National Policy of Rehabilitation and Resettlement.** Akay requires 1.8 acres of land for its proposed SpiceRich facility in Akanadu. The required land has been leased by SpiceRich Seasonings Private Limited from Mr. Alex Koshy (Chairman of Akay Group) in 2012 for the construction of the proposed SpiceRich facility. Mr. Alex Koshy purchased the said land parcel from only one person in the year 2006. Reportedly, the land was used as for limited agriculture and sale of excavated soil to brickmakers by the previous landowner before sale to Mr. Alex Koshy. The said parcel of land was purchased on one to one negotiated basis as per the prevailing market price in the area. Issues pertaining to any informal rights or any other formal rights on land were not reported during the consultation carried by AECOM with village Panchayat of Mudakuzha, Cochin, India.

30 The land for AFAPL facility, i.e. 7.27 acres has been purchased directly from three land owners. Reportedly, immovable assets were not present on the said land parcel and the land was unutilised and undulating due to which cultivation of crops was not undertaken by the land owners. The said parcel of land was purchased on one to one negotiated basis as per the prevailing market price in the area. Issues pertaining to any informal rights or any other formal rights on land were not reported during the consultation carried by AECOM with village Panchayat at Kizhakkambalam, Cochin, India. The details of the land procured for the proposed Spice Rich facility and existing Ambunadu facility has been provided in **Table 1-2**.

Table 1-2: Details of land procured for proposed Spice Rich and existing Ambunadu facility

S. No.	Facility	Land Area (acre)	Location	Land Seller	Land Purchaser	Land Leased	Date of Sale
1	AFAPL	2.034	Ambunadu, Ernakulam District	P. K. Rajendran	M/s Akay Flavours & Aromatics Ltd.	-	4th September 2003
2	AFAPL	1.521	Ambunadu, Ernakulam District	P.K. Rajendran	M/s Akay Flavours & Aromatics Ltd.	-	4th September 2003
3	AFAPL	1.389	Ambunadu, Ernakulam District	Vilasini	M/s Akay Flavours & Aromatics Ltd.	-	18th September 2003
4	AFAPL	1.965	Ambunadu, Ernakulam District	Vilasini	M/s Akay Flavours & Aromatics Ltd.	-	18th September 2003

S. No.	Facility	Land Area (acre)	Location	Land Seller	Land Purchaser	Land Leased	Date of Sale
5	AFAPL	0.620 & 0.298	Ambunadu, Ernakulam District	Bhavaniyamma, Gangadharan, Jayakumar, Madhu, Dileep Kumar, Anil Kumar & Indulekha	M/s Akay Flavours & Aromatics Ltd.	-	16th April 2004
6	Spice Rich	1.8	Koovappady, Ernakulam District	Poulose	Alex Koshy	Spice Rich Seasonings Private Limited	12th April 2006

31 The Land Acquisition Act, 1894 and National Rehabilitation and Resettlement Policy, 2007 are not triggered as these land acquisition legal regularity gets triggered only when the proceeding for land acquisition are made through the government office (District Collector's office). Akay has either leased the land or directly purchased the land from individual owners. In such a case where the buyer and seller has mutually negotiated the cost and sold wilfully, there is no role of Government agencies. Hence, there is no involuntary acquisition of land here and hence no legal requirement with respect to Land acquisition laws is triggered. The land was sold at the prevailing market values and there was no physical resettlement involved in any of the land.

B3. Regulatory/Legal Policy Framework for Indigenous Peoples in India

32 Indigenous People (IP) refer to a population with social, cultural, economic, and political traditions and institutions distinct from the mainstream or dominant society and culture. IP with similar cultural characteristics are known as Adivasi in Hindi and are recognized as Scheduled Tribes (STs) as per Article 342 of the Indian Constitution.

33 As per Safeguard Policy Statement, 2009, the term Indigenous People is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (i) self-identification as members of a distinct indigenous cultural group and recognition of its identity by others; (ii) collective annexure to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; (iii) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (iv) a distinct language, often different from the official language of the country or the region. Essentially, indigenous peoples have a social and cultural identity distinct from the mainstream society that makes them vulnerable to being overlooked in development processes. The Legal Policy Framework in India for Indigenous People is listed hereunder:

34 **National Commission for Scheduled Tribes.** The National Commission for Scheduled Tribes has been formed through bifurcation of the Commission for Scheduled Castes and Scheduled Tribes

is under the 94th Amendment Act of the Constitution. Although, the National Commission for Scheduled Tribes has been created in August 2003, little measures in terms of adequate budgetary and staff allocations have been made to make the Commission function effectively. One of the duties assigned to the National Commission for Scheduled Tribes and Scheduled Castes is to submit reports to the President annually or at such other time as the Commission may deem fit, upon the working of the safeguards.

35 **Panchayat Extension to the Scheduled Areas Act (PESA), 1996.** The Parliament of India has passed the Provisions of the PESA, to extend the provisions of the 73rd Constitutional Amendment to the Schedule V Areas of the country. This Act accords statutory status to the Gram Sabhas (local self governing institutions) in Schedule V areas with wide-ranging powers and authority. This aspect was missing from the provisions of the 73rd Constitutional Amendment. This Act recognizes the prevailing traditional practices and customary laws besides providing the management and control of all the natural resources- land, water and forest in the hands of people living in the Scheduled Areas. The Act empowers people in the tribal areas through self-governance.

36 One of the important provisions of this Act states that "Gram Sabha or Panchayats at the appropriate level shall be consulted before making the land acquisition in the Scheduled Areas for development project and before re-settling or rehabilitating persons affected by such projects in the Scheduled Areas.

37 **The Scheduled Tribes and Other Traditional Forest Dwellers Act 2006.** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006, recognises and vests the forest rights and occupation in forest land to Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights are not recorded. This law provides for recognition of forest rights to Scheduled Tribes in occupation of the forestland prior to 13th December 2005 and to other traditional forest dwellers who are in occupation of the forestland for at least 3 generations i.e. 75 years, up to maximum of 4 hectares. These rights are heritable but not alienable or transferable.

38 **The National Policy on Tribals, 2006.** The success of the National Policy on Tribals of the Government of India to a large extent will depend on strengthening of the National Commission for Scheduled Tribes, implementation of the Civil Rights Act and the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989 and making necessary budgetary allocations.

39 **Applicability of Acts and Provisions related to Indigenous People.** As per the Census Population Data of India 2011[3], the Scheduled Tribe population in Kerala comprises 1.45% of the total population of the State. The tribes reside in the northern district of Wayanad which is approximately 267 km from Cochin and thus, away from the influence of the project site of proposed Spicerich facility and AFAPL. In addition, Kerala does not fall under the Scheduled

[3] http://www.censusindia.gov.in/2011census/PCA/PCA_Highlights/pca_highlights_file/kerala/Exeutive_Summary.pdf

Areas as determined by the Fifth Schedule (for Scheduled Tribes) of the Indian Constitution. Due to the absence of indigenous population in and around the proposed Spicerich facility and existing Ambunadu facility, the regularity framework relating to the Indigenous Peoples will not be applicable.

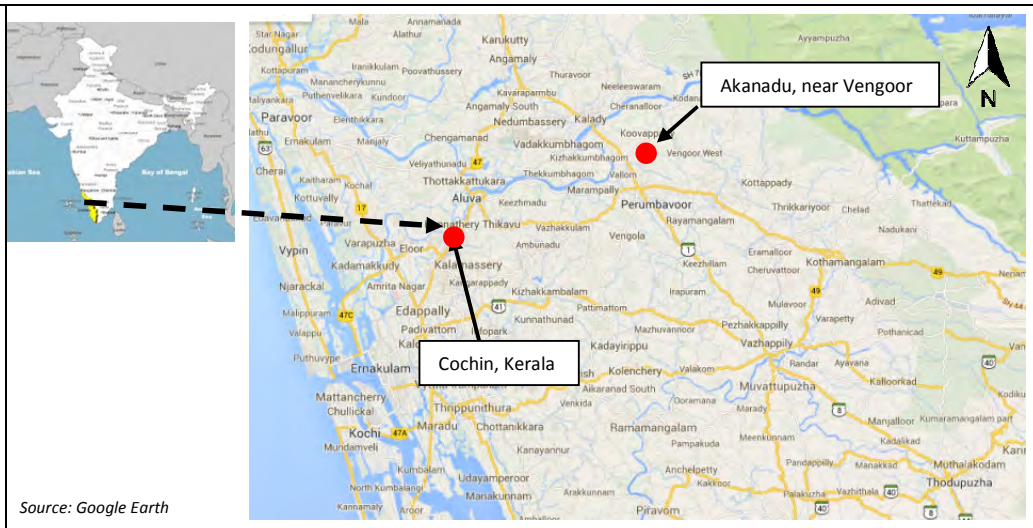
C. Description of Proposed Project Facilities

40 Akay was founded by A&P Group in the year 1995 and is engaged in manufacturing of paprika, spices oleoresins, natural essential oils, and natural colours for global food industry. A brief description of proposed facilities of Akay in India has been given hereunder.

Box C-1: Akay Proposed Projects in Akanadu and Ambunadu in India

1. Proposed Spicerich Seasonings Private Limited at Akanadu, Cochin:	
Proposed manufacturing facility at Akanadu:	• **Spicerich Seasonings Private Limited** is proposed to be constructed by September 2014, in the premises adjoining to the existing plant. Spicerich is part of the proposed Nutra –Bio-Food[4]. This proposed facility will be located at Vengoor West village, District Ernakulum, Kerala, India. An area of 1.8 acres of land has been leased to Spice Rich Seasonings Private Limited from Mr. Alex Koshy in 2012 for 99 years. • The facility will be engaged in production of 3000 Metric Tonnes (MT) per annum of seasoning products. During the manufacturing process, the raw spices from farm are converted to high end quality spice products through various value addition processes of cleaning, de stoning, pre-cutting, grinding, sieving and sterilization. Machinery and equipment appropriate for the spices proposed to be processed are being procured for erection in the unit. The Production process using such sophisticated machinery is designed in such a way that it meets the international standards and quality requirements. • Number of workers to be employed at Spicerich is 25. During the construction works approximately 120 workers will be engaged. Currently, the contractors for undertaking the construction phase have not been identified by the management. • The facility layout map is provided in **Annexure 1**

[4] Akay Nutra Bio Food Park is an expansion strategy (future vision) of Akay Management to incorporate 'Optimum Nutrition Products' under one roof. The Park is envisaged to cost an investment of 200 crores which will generate revenue to the tune of INR 1500 crores. It is to be located in Akanadu, Cochin, Kerala India and will comprise Akay Spices, Spicerich, Fruiteseuticals, Vegeseuticals, Spiceuticals and Vitamin Water. The present report does not provide details pertaining to the Nutra Bio Food Park as it is out of scope of the present assessment as ADB is not funding the Nutra Bio-Food Park.

Location of Plant with respect to Cochin, Kerala	 *Source: Google Earth*
Site Settings	The Spicerich Facility is located at Akanadu, Aluva, Cochin, Kerala. The facility is situated at approximately 3 km South of Vengoor west Village, 0.6 km East of Kuruppamapady Village, 1.2 km West of Mudikkarayi Village and 3 km North of Pullwazhy Village. The site is located at National Highway 16 with semi urban settlement all around the facility.
Water requirement at Spicerich	The total water requirement for the facility at the operational stage is expected to be 20 KL per day (KLD). Process water requirement for the operations will be 10 KLD. For domestic purposes like irrigation, drinking water, hand washing or shower and flushing in toilets for approximately 25 direct workers and indirect workers (the number of indirect workers to be engaged has not been identified by the management till date) is envisaged to be 10 KLD. The water requirement will be met through an onsite open well, which is located in the north eastern portion of the operational facility of Akay, Akay Spices Limited, by installing electrical pump for withdrawing the water. The onsite open well is a circular well with a radius of approximately 1.5 m and depth of approximately 12 m bgl. Wellhead protection of approximately 1.5 m is provided to the well. A pump house is installed adjacent the well from which the water is pumped to the desired location. The waste water will be routed to Akay Spices Limited, another manufacturing facility operational in the vicinity of proposed Spicerich facility. The effluent treatment plant (ETP) installed at Akay Spices Limited will handle the waste water generated from Spicerich. The capacity of the ETP installed is 45 KLD and is based on anaerobic treatment of effluent. The waste water generated from Akay spices is 10 KLD. However, the efficiency and adequacy assessment study of the ETP system for handling the waste water from Spicerich, has not been undertaken. Rain water harvesting and groundwater recharge structures will be installed within the premises. The details of the said structures and plans have not been developed by the management. As the management has to undertake the adequacy and efficiency assessment of the existing ETP, additional technologies for correcting any anomalies as identified in the adequacy and efficiency report shall be implemented by Akay Management.
Power requirement at Spicerich	To operate the facility, Akay would require approximately 283 Kilo Watt of power which will be sourced from Kerala Electricity Board, Government of Kerala. To provide backup source of energy, Akay would provide a diesel generator set (the capacity of the DG set has not been identified by the management till date) in the premises. At the time of construction, the contractor will be utilising its own diesel generator sets on site and the construction power will also be provided by the Kerala Electricity Board.
New set of machinery and	Akay intends to the most modern sophisticated machinery and equipment for the manufacturing processes. The following capital goods shall be procured by the manufacturing unit at Spice Rich

equipment	Seasonings for production as well as other support processes: • Blending System • FFS Packing Systems • Duplex Packing System • Bottling Plant • Bulk Packing System • Material Transfer Lift • Ventilation System • Conveying System • Metal Detectors • Lab equipments • Racking in FGS • Electricals and Utility Equipments
2. Akay Flavours & Aromatics Private Limited Facility at Ambunadu, Cochin	
Existing Facility:	• Akay Flavours & Aromatics Private Limited (hereinafter referred as 'AFAPL') is engaged in the manufacturing of 800 kgs per day of Chilly Oleoresins[5]. The premises also houses a Nutra Plant called as Spiceuticals, which is dedicated for the manufacturing of 4 tonnes per day (TPD) of seasoning products. The Nutra plant has been operational in the premises since February 2013. • The management currently has plans for upgradation of the existing laboratory which involves installing equipments only and minor repair works. Reportedly, the facility does not envisage any major construction or change in the plant layout. The laboratory is expected to install laboratory equipments and clinical trials. The list of equipments has been provided in the Section B of the report. • The Ambunadu facility is located at Ambunadu, Ernakulum District, Cochin, Kerala. The facility is spread in an area of 7.27 acres and is surrounded by agricultural land. • The facility and proposed expansion area is provided in **Annexure 2** of the present report.
Proposed Expansion of Laboratories within the existing Ambunadu facilities	• The facility has an onsite laboratory for assuring quality control; however, the Akay management has plans for expansion of the existing laboratory which will involve installing of additional equipment and minor repair and civil works. • The current laboratory is operational in approximately 416 sq m area. The upgradation of the laboratory would require minor construction (civil) works in additional 200 sq m area adjacent to the existing laboratory (towards west). The said area is currently vacant piece of land and is within the factory boundary. • No further land acquisition is proposed for expansion as the laboratory will be within the existing premises owned by Akay.. • The proposed operations in the laboratory are: - Animal facility and bio analytical laboratory: For the purpose of validating the experimental studies undertaken in the Research & Development works, in vitro

[5] **Oleoresins:** Spice oleoresins represent the complete flavour profile of the spice. It contains the volatile as well as non volatile constituents of spices. Oleoresins can be defined as the true essence of the spices and can replace whole/ground spices without impairing any flavour and aroma characteristic. Oleoresins are obtained from spices by extraction with a non-aqueous solvent followed by removal of the solvent by evaporation. Spice oleoresins guarantee superior quality of flavour and aroma. They are complete and balanced, consistent and standardised. They ensure storage stability in the final product and are free from contamination. Custom made blends are also offered to suit the specific requirement of the buyer. Spice oleoresins are mainly used in processed meat, fish and vegetables, soups, sauces, chutneys and dressings, cheeses and other dairy products, baked foods, confectionery, snacks and beverages.

	biochemical assays and in vivo evaluations using animal models in preclinical studies is proposed to be initiated at the research laboratory. The in vitro and in vivo toxicity studies, anti-oxidant assays, bioavailability and elimination and evaluation of metabolic pathways provide an early indication of whether the compound which worked in animals would work in human as well. In-vitro metabolic stability profile is a qualitative as well as quantitative comparison of metabolism of a compound in animal and human models for the toxicity studies. To ensure a reliable and proper development in research a well-equipped Bio-analytical lab and Animal house facilities with requirements mentioned as follows is proposed: • Biochemistry Analyzer • Hematology Analyzer • ELISA Reader and Washer • Spectrofluorometer • Luminometer • Spectrophotometer • Metrohm Rancimat • Milli-Q Integral Water Purification System • Needle Incinerator • pH meter • Refrigerated Centrifuge • Tissue Homogenizer • Analytical Balance • Weighing Balance • Lab Refrigerator - Chemical /Application lab expansion: Various formulations and application trials like tablets, instant release tablets, mouth dissolving films, capsules, controlled release pellets, targeted release pellets, liquids etc. need to be optimized for the proper application demonstration of the botanical ingredients. Regarding the use of such ingredients as functional ingredient, food and beverages need to be prepared with proper dosage of the botanical ingredients. Further, analysis of the various forms needs to be performed to make sure the proper impregnation of the extracts in the finished food/food supplements. The said activities would be the part of the chemical/application lab. Equipment's proposed to be installed in the expansion of current R & D lab is provided in **Table 2-1**. - Clinical Trials: Before marketing the products proper preclinical and clinical studies are to be undertaken as part of the proposed operations. Toxicity and efficacy of the botanical extracts would be proved as a verification of the concept that the supplementation of a particular ingredient can have a particular benefit to the consumer, without causing any side effects. Clinical trials will be undertaken which will include prospective biomedical or behavioural research studies on human subjects that are designed to answer specific questions about biomedical or behavioural interventions which will be initiated as a collaborative research works with institutions like M/s Amala Cancer Research Centre, Trissur, M/s Amrita Institute of Medical Science, Cochin, at M/s Care Keralam Research Centre, Koratty, India, etc.

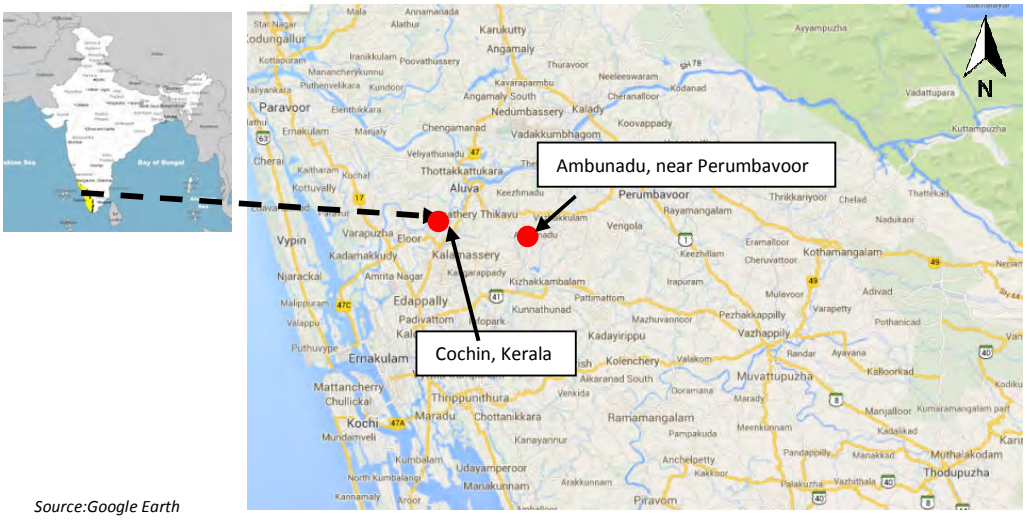
Location with respect to Cochin, Kerala	 *Source:Google Earth*
Site Settings	The AFAPL is located at Ambunadu, Malayidamthuruthu PO, Aluva, Ernakulum District, Cochin, Kerala and is approximately 0.2 km East of Ambunadu - Vazhakulam MES Canal Road. The facility is approximately 1.05 km South West of Vazhakulam Village, 2.3 km North East of Pukkattupady Village and 3.3 Km East of Edathala Village in Ambunadu, Cochin, Kerala.
Manpower requirement	Construction phase: The estimated number of workers and masons for the construction phase is expected to be 600 mandays of an average 7 -9 workers in a day. Operations phase: The facility currently employs 107 permanent employees and 18 contract workers in the premises. Akay is proposing to employ 15 more employees after expansion of the laboratory thus, increasing total strength of employee to 122.
Water requirement	The total water requirement for the facility currently is 45 KLD which will not be significantly changed with expansion of the laboratory. Water is sourced from an onsite open well located toward the eastern portion of the facility. The onsite open well is a circular well with a radius of approximately 2 m and depth of approximately 13-15 m bgl. Wellhead protection of approximately 1.5 m is provided to the well. A pump house is installed adjacent to the well from which the water is pumped to above ground tanks from where it is routed to the desired location. The water from the laboratories, though not quantified till date, will be routed to the existing ETP of AFAPL. The treatment system has a capacity of 30 KL and is chemical based treatment. The management will convert the treatment system into anaerobic system, the details of which is currently not available.
Power requirement	Currently, the facility has a power requirement of 1095 KW which is met by the Kerala Electricity Board and has installed a DG set to provide supply of electricity as power back up. Additional power requirement 150 KW is expected for expanded laboratory operations which will be obtained from Kerala Electricity Board.

Table 2-1.: List of Equipments to be installed in the proposed laboratory, Ambunadu, Cochin, India

Make	Instrument	Description
M/s Umang Pharma Tech, Mumbai	Single Screw Extruder	• Umang Single screw extruder for processing granules 0.5mm – 10mm size. • To prepare extrudes from wet mass
	Spheroidizer	• To prepare pellets from extrudes
	Fluid Bed Multi- Processor	• For coating of pellets/by bottom spray Wurster technology
M/s Shakti Pharmatech Pvt Ltd	Lab Coating Unit – Conventional	• Suitable for sugar or film coating of Tablets, Pallets, and Granules etc. High Tech system extremely reliable, perfect for even the most demanding of processing requirements in R &D.
M/s Silverson	Heavy Duty Laboratory Mixer	• Mixing, Emulsifying, Homogenizing, Disintegrating, Dissolving.
M/s Weighmatics	Bulk density meter	• A general purpose instrument that can be used to measure the Apparent Bulk Density (or Tamping Density) of any dry free-flowing Powders, Granules, Particles or Flakes.
M/s Buchi	Rotavapor	• Evaporation under vacuum for efficient removal of solvents from samples.
M/s IKA	Multi Point Magnetic Stirrer	• 5-position digital magnetic stirrer without heating, designed for synchronous stirring. The magnetic coil technology provides noiseless and consistent stirring on all positions
M/s Aqualab	Water Activity Meter	• The instrument is used to measure the Water Activity in all kinds of products. It is accepted that Water Activity is closely related to the physical, chemical and biological properties of food and other natural products than in total moisture content. Specific changes in colour, aroma, flavour, texture, stability and acceptability of raw and processed food products have been associated with relatively narrow Water Activity ranges.
M/s Mettler Toledo	Moisture analyzer	• The instrument of choice for the repetitive, routine moisture determination of the same few samples in the lab
M/s RO-TAP	Sieve shakers	• A unique two-dimensional operation: a horizontal, circular motion and a vertical, tapping motion allow material particles to stratify and “seek” critical openings in the test media. This unit provides the most accurate and consistent particle analysis testing.
M/s Anton Paar	ABBEMAT 350 Automatic Refractometer	• Measure the refractive index and concentration of liquids, gels and solids.
M/s Brookfield	High-range viscometer	A viscometer is used to measure the viscosity of a fluid under defined flow conditions.

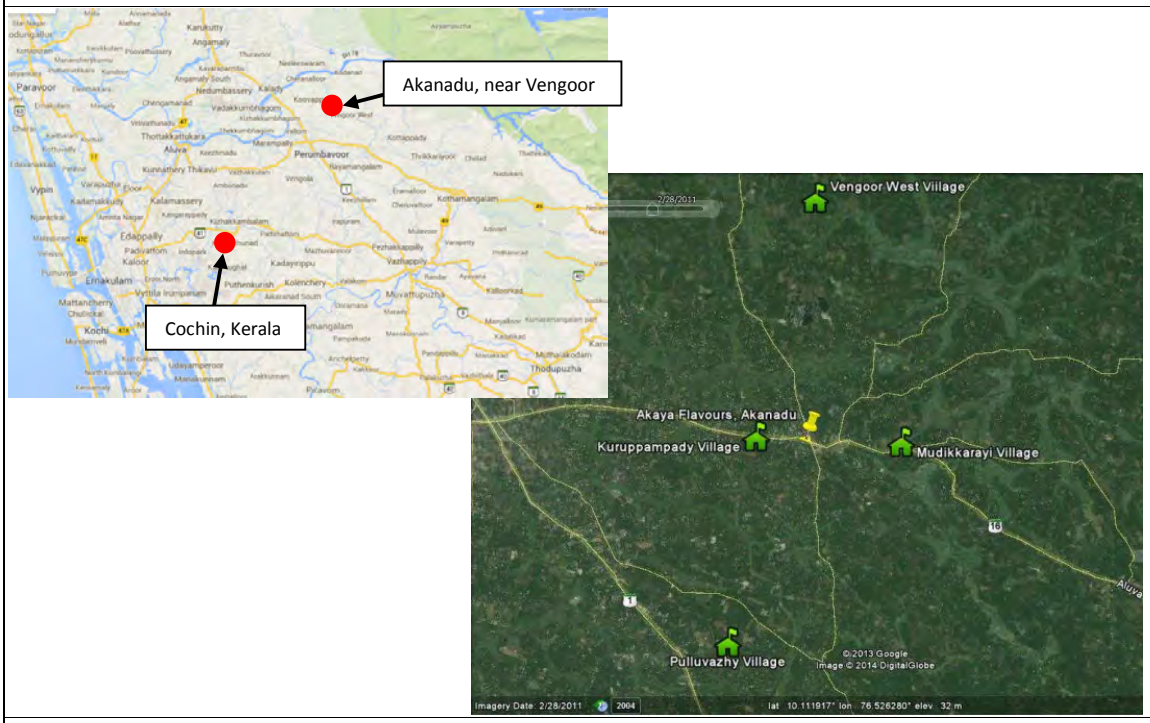
Make	Instrument	Description
M/s Shimadzu	Semi Preparative Hplc System	Isolation and purification of compounds. The goal is to get a high yield of product with certain purity by separating discrete compounds from a mixture by fractionation.

D. Description of Environment and Socio-Economic Baseline

D1. Baseline Environmental and Socio-Economic Profile of proposed Spicerich Facility Located at Akanadu

41 **Site location:** The proposed Spice Rich facility is to be located at Akanadu, Ernakulam District, Kerala. The facility is situated at approximately 3 km South of Vengoor west Village, 0.6 km East of Kuruppamapady Village, 1.2 km West of Mudikkarayi Village and 3 km North of Pullwazhy Village. The site location map is provided in the figure D-1 below:

Figure D-1: Location Map: Spicerich Seasonings Private limited, Akanadu, India



Source: Google Earth

42 **Road Connectivity:** The proposed site is located at National Highway (NH) 16 and near NH 1 with semi urban settlement all around the facility. It is situated approximately 43km from Ernakulam South Railway Station which is a major node of Southern Railways and is well connected to the India Railways network.

43 **Weather:** The project area experiences a moderate climate with annual average temperature ranging between a minimum of 19.2°C to a maximum of 34.7°C. The district receives an average annual rainfall of 2607.8mm with the monsoon season spanning over the months of June to August in the area.[6]

44 **Water Resources:** As the project region receives significant rainfall hence, the groundwater level in the area is high. The depth of ground water in the project district i.e., Ernakulam ranges from 0.9 to 10.58 mbgl (metres below ground level). The groundwater quality in the shallow aquifers in the areas is characterised by low mineralisation and is generally fit for all domestic, industrial and agricultural purposes. However, the groundwater in deeper aquifers is saline in nature owing to presence of saline coastal sedimentary formation in such aquifer beds. A summary of the general ground water characteristics in the area is given in the following **Table 3-1**,

Table 3-1: Groundwater characteristics in Project region

S. No	Chemical Constituent	Unit	Range in Concentration	
			Maximum	Minimum
1.	Electrical Conductivity at 25°C	µS/cm	27	9370
2.	Total hardness as $CaCO_3$	mg/L	4	1075
3.	Calcium	mg/L	1.6	144
4.	Magnesium	mg/L	Trace	174
5.	Chloride	mg/L	5.7	3138
6.	Fluoride	mg/L	0	0.47

Source: *Groundwater Information Booklet of Ernakulam District by Central Groundwater Board, Ministry of Water Resources, Government of India*

45 Periyar River is at an approximate distance of 4.5 km from the project site. A canal which draws water from the same river flows at a distance of 500 m from the project site. The river water will not be used for industrial or domestic purposes. The site will use groundwater for industrial and domestic purposes.

46 **Flora and Fauna:** The area does not have significant forest cover or do not fall under any reserved or protected forest. The area has agricultural land with rubber plantation near the facility premises. The area has local species of animals like squirrels, bats, lizards, frogs etc. along with lower group of organisms. The land has already been cleared with no significant vegetation cover.

47 **Archaeological/Historical Monuments:** There is no Government of India declared protected archaeological or historical monuments within 5km radius of the project site. However, a few places of religious importance do fall within 5km radius of the project site viz. St. Mary's Church (1 km), Sacred Heart Church (2 km), Vallam Mosque(4.5 km), Kanjirakkad Juma Masjid (4.8km), St. Joseph Church (5km), St. Francis Xavier Church (5 km) etc. The project activities will have no impact on the religious structures present in the vicinity.

[6] *Source : Climatological Normals 1961-1990, Indian Meteorological Department*

48 **Landuse:** The land use of the proposed Spice rich facility is partly covered with rubber plantation, while the major portion was barren with scattered tree cover.

49 **Scheduled Tribes:** As per the Census Population Data of India 2011, the Scheduled Tribe population in Kerala comprises 1.45% of the total population of the State. The tribes reside in the northern district of Wayanad which is approximately 267 km from Cochin and thus, away from the influence of the project site of proposed Spicerich facility and AFAPL. In addition, Kerala does not fall under the Scheduled Areas as determined by the Fifth Schedule (for Scheduled Tribes) of the Indian Constitution. Indigenous population in and around the proposed Spicerich facility is not present.

50 **Social Protection (Labour related issues):** Currently, there is no formal Human Resources Management (HRM) Policy developed for the proposed Spicerich facility, however, the AFAPL being the corporate entity, policies and procedures developed at AFAPL will be extended to Spicerich. The details of AFAPL policies and procedures are provided in the section D2. For the contractors that will be engaged for the civil works, they will be required to comply with the national labor laws and Akay to undertake measures to comply with the international core labor standards.

51 **Corporate Social Responsibility (CSR) Activities:** The range of activities that have been Akay's focus area till date relate to

- Prosperity through entrepreneurship
- Looking beyond profit
- Women empowerment.

52 The community development activities implemented till date by Akay depend upon the demand based approach wherein the CSR activities are undertaken based on the request by the beneficiaries. The CSR activities or initiatives are at the group level. The activities have been mainly undertaken around the villages of the operational facilities in existing Akanadu, Ambunadu and Pathanamthitta. The focus of the activities undertaken by Akay relate to areas like education, Health Care, Sustainable Livelihood, Infrastructural Development and espousing social causes. The details of the CSR activities planned and implemented for the Financial Year 2014-2015 as defined by Akay Management have been provided below in **Table 4-1**:

Table 4-1: Details of CSR Activities planned and implemented for the Financial Year 2014-2015

CSR Activity	Location	Year	Beneficiaries	Budget
Dialysis Facilitation in association with Kidney Federation of India	Cochin	2014	People seeking medical aid for Kidney treatment	INR 100000
Helping the inmates of Mother Teresa Old Age Destitute	Cochin	2014	The inmates of Mother Teresa Old Age Destitute Home	INR 100000

CSR Activity	Location	Year	Beneficiaries	Budget
Home				
Providing Computer to Secondary Schools	Cochin, Pathanamthitta, Akanadu	2014	Secondary school students of local schools of all sites	INR 100000
Providing Study Material to Local Schools	Cochin, Pathanamthitta, Akanadu	2014	Local school students of all the sites	INR 100000
Establishment and Maintenance of Public Water Supply System	Akanadu	2014	More than 100 families of Akanadu village	INR 100000
Development of Green Belt in operational premises by planting trees	Cochin, Pathanamthitta, Akanadu	2014	Ecological prevention for sustainable development	INR 100000
Providing Street Light Facility in association with Local Governing Body	Pathanamthitta, Akanadu	2014	Local Community of Cochin and Pathanamthitta	INR 100000
Providing Drinking Water to Nearby Families	Pathanamthitta	2014	More than 10 families of Cheneerkara Village	INR 100000
Implementation of a "Women Empowerment through Employment" Scheme in Tadas	Tadas	2014	Local Women Community in Tadas village in Bygady	INR 100000
Proposed to Improve the standards of Public Roads (Tarring)	Cochin	2015	Local Community of Cochin (Ambunadu)	INR 100000
Proposed to Improve the standards of Public Roads (Tarring)	Akanadu	2015	Local Community of Akanadu	INR 100000
Proposed to Implement a "Water Purifying System" for Local Governing Body Office	Cochin, Pathanamthitta, Akanadu	2015	Local Community of all the Sites	INR 100000

53 **Gender Mainstreaming:** Twenty five (25) employees would be employed in Spicerich proposed operations. As part of gender mainstreaming their operations in India, Akay has committed to increase women participation of at least 1,500 out of 3,000 (50%) in new contract farming in India operations. In addition, new training to women on operation of machinery and processes in extraction plants is also to be undertaken. To enhance Akay's capacity to undertaken these tasks, a nodal person/ gender specialist is to be appointed in India to support and guide the

implementation and monitoring of gender measures. In addition, appointment of staff and volunteers to conduct gender awareness and information programs in community is also to be undertaken. Akay has further committed to improve the financial inclusion and management of women farmers by assisting around 2500 women contract farmers in India to have credit access, access to banks, open and operate a bank account, conduct training/orientation to women on financial management mechanisms, household expense budgeting, methods of saving and other opportunities for income generating activities, identifying and advertising opportunities of productive investment of savings; starting cooperatives and small scale businesses and investing in local infrastructure. To improve monitoring and reporting on implementation of gender measures sex-disaggregated database (on farmers and workers deployment, benefits and improvement to socioeconomic conditions), is to be maintained and reported.

54 **Soil:** Lateritic soil is the most predominant soil type in the district. These soils are well drained, low in organic matter and plant nutrients. Brown hydromorphic soil is the second most prevalent soil type of the district and they are encountered in valley bottoms. The soil is enriched in clay content and plant nutrients. Small patches of hydromorphic saline soil are encountered in the coastal tracts of the district in Kanayannur and Cochin taluk. The tidal backwaters contribute to the salinity of the soil. Riverine alluvium is restricted to the banks of rivers and their tributaries. They are composed of sandy to clayey loam and are enriched in plant nutrients.[7] A summary of the different soil types found in the project district has been given in the following **Table 5-1**,

Table 5-1: Major Soil Types found in Ernakulam district, India

S. No	Soil Type	Area (in thousand hectares)	Percentage of total area (%)
1.	Laterite soil with well-defined B horizon	105.3	35.7
2.	Forest Soil	69.0	23.2
3.	Alluvial Soil	52.1	17.5
4.	Hilly Soil	36.0	12.1
5.	Sandy loam	26.2	8.8
6.	Pokkali Soil	8.0	2.7
	Total	**296.6**	**100**

***Source**: Agricultural Contingency Plan for Ernakulam District (http://agricoop.nic.in/Agriculture%20Contingency%20Plan/Kerala/KER12-Ernakulam-30-06-2011.pdf)*

55 **Agricultural Crops:** The details of area under principal crops cultivated in the district have been given in the following **Table 6-1.** It can be seen that coconut (659.25 km^2) is the most predominantly grown crop in the area followed by rubber plantation (552.78 km^2). Rice/paddy is the third largest grown crop with a cultivated area of 539.88 km^2. Pepper and other non-food crops are also grown in the district.

[7] Source : Groundwater Information Booklet of Ernakulam District by Central Groundwater Board, Ministry of Water Resources, GOI

Table 6-1: Area under principal crops, Ernakulum, India

S. No.	Crop Type	Area (km^2)
1.	Coconut	659.25
2.	Rubber	552.78
3.	Paddy	539.88
4.	Pepper	58.37
5.	Other non-food crops	37.00

***Source**: Groundwater Information Booklet of Ernakulam District by Central Groundwater Board, Ministry of Water Resources, GOI*

D2. Baseline Environmental and Socio-Economic Profile of Facility Located at Ambunadu, Kerala

56 **Site location:** AFAPL is located at Ambunadu, Malayidamthuruthu PO, Aluva, Ernakulum District, Cochin, Kerala and is approximately 0.2 km East of Ambunadu - Vazhakulam MES Canal Road. The facility is approximately 1.05 km South West of Vazhakulam Village, 2.3 km North East of Pukkattupady Village and 3.3 Km East of Edathala Village in Ambunadu, Cochin, Kerala.

57 **Road and Rail Connectivity:** The site is located near National Highway (NH) 16 and NH 1 with semi urban settlement all around the facility. It is situated an approximate distance of 9 km from Aluva Railway station and 22km from Ernakulam South Railway Station which is a major node of Southern Railways and is well connected to the India Railways network.

58 **Weather:** The project area experiences a moderate climate with annual average temperature ranging between a minimum of 19.2°C to a maximum of 34.7°C. The district receives an average annual rainfall of 2607.8mm with the monsoon season spanning over the months of June to August in the area.[8]

59 **Water Resources:** As the project region receives significant rainfall hence, the groundwater level in the area is high. The depth of ground water in the project district i.e., Ernakulam ranges from 0.9 to 10.58 mbgl (metres below ground level). The groundwater quality in the shallow aquifers in the areas is characterised by low mineralisation and is generally fit for all domestic, industrial and agricultural purposes. However, the groundwater in deeper aquifers is saline in nature owing to presence of saline coastal sedimentary formation in such aquifer beds. A summary of the general ground water characteristics in the area is given in the **Table 3-1** in section D1 of the report.

60 The site is located at an approximate distance of 5.5 km from the Periyar River. Different canals which have been developed for irrigation purposes flow near the project site. The project however, does not intend to use water from any canal or river. Instead, groundwater would be extracted for industrial and domestic works.

[8] Source : Climatological Normals 1961-1990, Indian Meteorological Department

61 **Flora and Fauna.** The expansion of laboratories will be in the existing premises of AFAPL. Within the premises of AFAPL and nearby there is no population of flora and fauna and hence impact on biodiversity due to expansion is negligible.

62 **Archaeological/Historical Monuments:** There is no Government of India declared protected archaeological or historical monuments within 5km radius of the project site. However, places of religious importance such as mosques, churches do fall within 5km radius of the area. Expansion of laboratory will have no impact to any structure of religious importance.

63 **Scheduled Tribe:** Scheduled Tribes in and around the existing Ambunadu facility are not present.

64 **Social Protection (Labour related issues):** Labour issues are managed through HR Policies and Procedures which is developed by Akay management (AFAPL) and is applicable to all permanent (direct) employees and trainees employed by AFAPL. There is a welfare policy within Akay's HR Policy which defines statutory and non statutory welfare measures for its permanent direct employees. To ensure the statutory welfare measures to its employees, Akay adheres to legal enactment and amendments related to Employee Provident Fund and Miscellaneous Provisions Act, Employee's State Provision Act, Employment Exchanges (Compulsory Notification of Vacancies) Act, Equal Remuneration Act, Factories Act, Industrial Disputes Act, Industrial Employment (Standing Orders) Act, Inter-State Migrant Workmen Act, Labour Laws Act, Maternity Benefit Act, Minimum Wages Act, Payment of Bonus Act, Payment of Gratuity Act and Payment of Wages Act. Under the non statutory welfare measures, uniform, medical claim insurance schemes, workmen compensation, recreation, personal protective equipment and food subsidy are also provided to the employees.[9] The HR Policy has also incorporated aspects of leaves applicable to its direct employees within a calendar year. The leaves relate to medical (10 days to a maximum of 60 days), casual (12 days) and earned (1 EL for every 15 days worked) respectively. In addition, travel policies have also been included within the HR Policy like travel procedures, travel expense policies and reporting requirements. The HR policies relating to adherence of legal enactments and amendments are to be extended to the contractor workers as well.

65 As defined in the HR Policy, the workers work in three 8 hour shift duration each and a general shift for administrative staff.

66 **CSR Activities:** The CSR activities are the same as discussed in the previous section on the proposed Spicerich facility.

67 **Gender Mainstreaming:** In the existing Ambunadu facility, out of 107 permanent employees, 9 are females. With the proposed expansion of the laboratories, 15 employees would be employed. The number of female employees to be employed in the future has not been

[9] The non-statutory welfare measure as discussed is made out of the conciliations with the employee associations that represent the valuable points of opinion from the beneficiaries and subject to the approval of the same by the concerned association as mentioned in Akay's HR Policy, Pg- 15.

identified till date. As part of gender mainstreaming their operations in India, Akay has committed to increase women participation of at least 1,500 out of 3,000 (50%) in new contract farming in India operations. In addition, new training to women on operation of machinery and processes in extraction plants is also to be undertaken. To enhance Akay's capacity to undertaken these tasks, a nodal person/ gender specialist is to be appointed in India to support and guide the implementation and monitoring of gender measures. In addition, appointment of staff and volunteers to conduct gender awareness and information programs in community is also to be undertaken. Akay has further committed to improve the financial inclusion and management of women farmers by assisting around 2500 women contract farmers in India to have credit access, access to banks, open and operate a bank account, conduct training/orientation to women on financial management mechanisms, household expense budgeting, methods of saving and other opportunities for income generating activities, identifying and advertising opportunities of productive investment of savings; starting cooperatives and small scale businesses and investing in local infrastructure. To improve monitoring and reporting on implementation of gender measures sex-disaggregated database (on farmers and workers deployment, benefits and improvement to socioeconomic conditions), is to be maintained and reported.

68 **Landuse:** The total land area for the Ambunadu facility measuring 7.27 acres was procured by Akay between the period of 2003 and 2004. Before the land acquisition, the land was undulating and unutilised which was converted for construction of the AFAPL facility.

69 **Soil:** Soil profile at the district level is same as discussed in the section D-1.

70 **Agricultural Crops**: Soil profile at the district level is same as discussed in the section D-1.

E. Anticipated Environmental and Social Impacts and Mitigation Measures for Akay India Operations

E1. Pre-Construction Stage and Mitigation Measures

71 The land for Spicerich is mostly barren and undulating in nature. Hence, environmental impacts due to clearing of vegetation are anticipated to be negligible.

72 No land cleaning /vegetation clearing will be required for Ambunadu laboratory as the expansion zone is already a part of operational facility.

73 Thus, there will not be any impacts on flora and fauna. Similarly, construction of civil structures for Ambunadu laboratory will have no impacts on local flora and fauna.

74 The land for the proposed facilities i.e. Spicerich at Akanadu and Ambunadu Laboratory were procured through a willing buyer – willing seller arrangement and the parcel of land for Spice

Rich has accordingly been leased to Akay. Hence, it does not entail any resettlement or loss of livelihood.

E2. Construction Stage Impacts and Mitigation Measures

75 The impacts due to construction activities will be generic in nature similar to any building construction project. The impacts during the construction phase has been listed in the **Table 7-1** below:

Table 7-1: Potential Impacts during Pre-Construction and Construction Phases and its Mitigation Measures

S. No.	Issue	Details	Mitigation Measures
PRE-CONSTRUCTION PHASE			
1.	Project Facility Siting	*Spicerich Seasonings* No indigenous People or structure of archaeological importance and biodiversity. *Ambunadu Laboratory* No indigenous People or structure of archaeological importance and biodiversity	The land shall not be in proximity to any archaeological monuments, large natural water bodies, national parks, wild life sanctuaries, forest areas and ecologically sensitive areas as declared by the State or Government of India.
2.	Land Acquisition	*Spicerich Seasonings* No impact as the land is on lease from Mr. Alex Koshy, who in turn has purchased the land on negotiated willing-buyer and willing seller basis from one land seller. *Ambunadu Laboratory* The laboratory expansion will be undertaken in the already operational facility of AFAPL. The premise is owned by AFAPL and is purchased from three land sellers on negotiated willing-buyer and willing seller basis from one land seller. Hence, no impact due project citing	• Land was purchased through direct negotiations with the consenting land owners on a willing seller and willing buyer principle and any involuntary resettlement issues and social impacts thereof shall be avoided. • In case, land owners belong to Scheduled Tribe, it is the responsibility of the land owners to get required permission from district authorities, prior to transaction/ transfer of title. There are no legacy issues or court cases related to the land and other assets acquired. • Akay shall address all concerns/grievance of local community, if any received at the stage of the project construction or implementation or operation stage and reserve the same in the best interest of the community.

S. No.	Issue	Details	Mitigation Measures
3.	Obtain CTE from KSPCB	*Spicerich Seasonings* • Prescribed application for obtaining CTE shall be prepared with all project facility information and submitted to KSPCB. • Additional information, if any sought by SPCB shall be provided and CTE shall be obtained in a time bound manner. No Construction work shall be commenced without obtaining CTE from KSPCB. *Ambunadu Laboratory* No CTE is required	• Prescribed application for obtaining CTE shall be prepared with all project facility information and submitted to KSPCB. • Additional information, if any sought by SPCB shall be provided and CTE shall be obtained in a time bound manner. • No Construction work shall be commenced without obtaining CTE from KSPCB.
4.	Contractor Bidding and Evaluation	*Spicerich Seasonings* Contractor not identified based on EHS performance and project track record. *Ambunadu Laboratory* Contractor not identified based on EHS performance and project track record.	Contractor bids shall be evaluated on the basis of their EHS policies, project track record for finalising the contractor for various works.
5.	Contractor's Responsibility for Implementation of ESMP		All the contract documents for civil, mechanical and electrical works shall incorporate EHS requirements as well as compliance with the national labor laws and to undertake measures to comply with the relevant international core labor standards as conditions of contract in order to make the contractor clearly aware of the requirements.
6.	Contractor's Supply Chain		Contractor's supply chain shall be scrutinised and evaluated for ensuring compliance to : • Applicable EHS requirements; • Akay's HR policies, labour policy and Code of Conduct. • Compliance with national labor laws and to undertake measures to comply with the relevant international core labor standards
CONSTRUCTION PHASE			

S. No.	Issue	Details	Mitigation Measures
7.	Site Preparation and Vegetation Clearing	*Spicerich Seasonings* Significant vegetation clearance of land has already been done. Green belt development is part of the project plan *Ambunadu Laboratory* No clearance of vegetation required.	• The site shall be cleared off vegetation and prepared for construction of proposed facility. It shall be ensured that afforestation is undertaken through greenbelt development.
8.	Concrete Batching	*Spicerich Seasonings* Siting of batching plant is not decided yet. Construction plan from the contractor is not in place. Estimation and management of air pollution from construction works will be mitigated. *Ambunadu Laboratory* Minor civil works in 200 sq m area only and hence there will be no significant impact.	• All batching plants for production of concrete shall preferably be set up within construction site. In case sufficient land not available within project site, then it shall be located at any other suitable site located at least 100m away from the nearest settlement preferably in the downwind direction. • The Contractor shall submit a detailed layout plan for all such sites for approval of from Akay senior management prior to the establishment. • Arrangements to control air pollution due to dust generation shall be done through provision of windscreens, water sprinklers and dust extraction systems onsite. • Alternatively, contractor may be encouraged to source concrete from already established ready mix plants and transport it to site through tankers.

S. No.	Issue	Details	Mitigation Measures
9.	Construction Vehicles, Equipment and Machinery		• All vehicles shall be in possession of a valid Pollution under Control (PUC) issued by competent authorities authorised by the Central Motor Vehicles Department. PUCs shall be renewed on expiry. • All vehicles, equipment and machinery procured for construction works shall be in good condition and preferably not more than 5 years old. • All vehicles carrying construction material shall be covered with tarpaulin sheets for preventing dust dispersion into air.
10.	Noise from Vehicles, Plants and Equipment	*Spicerich Seasonings* Noise pollution control mechanism from construction works will be mitigated. *Ambunadu Laboratory* Noise pollution control mechanism from construction works will be mitigated.	• The Contractor shall ensure that construction plants and equipment used shall strictly conform to the MoEF/CPCB/KSPCB/IFC noise standards. The maintenance of vehicles, equipment and machinery shall be done regularly to keep noise levels at the minimum. • All major noise generating activities of construction shall be restricted to day hours only and no night shifts shall be allowed for such activities under normal circumstances.
11.	Borrow Pits	*Spicerich Seasonings* Permitting requirements for borrow pits by the contractor, location, transportation, etc. will be obtained prior to construction. *Ambunadu Laboratory* Not applicable.	• Borrow pits locations shall be submitted by the contractor for approval by the Akay project development team. • Borrow pit shall have the proper government permit before extraction activities is done by contractor. • Such locations shall be located away from human settlements and be covered for preventing dust particle dispersion into surroundings. • The haul roads shall be routed to avoid human settlement and sensitive receptors like schools, hospitals as far as possible and shall use the existing

S. No.	Issue	Details	Mitigation Measures
			roads wherever available.
12.	Stone Aggregate Procurement	*Spicerich Seasonings* Permitting requirements for stone aggregate procurement by the contractor, location, transportation, will be obtained prior to construction. *Ambunadu Laboratory* Not applicable.	• Contractor shall procure all stone aggregates sourced from stone crushers, which conform to KSPCB Norms. • Contractor shall work out haul road network and obtain Akay project development team's approval.
13.	Sand Procurement	*Spicerich Seasonings* Permitting requirements for sand procurement by the contractor, location, transportation, etc. will be obtained prior to construction. *Ambunadu Laboratory* Permitting requirements for sand procurement by the contractor, location, transportation, etc. will be obtained prior to construction.	The Sand shall be procured from licensed sand mines. The Contractor shall obtain copy of the Lease Agreement of the supplier and submit to project development team before procuring the sand.
14.	Water Supply for construction		• The management shall install water meters (calibrated) on source of water and record the water consumption data. • Construction water may be supplied by tankers provided by KSPCB authorised agencies. • The contractor shall identify suitable (ground/surface) water as a source of water for the construction and/or may set up own bore well facility for construction work, after obtaining the requisite permissions, if any required under approval of the project development team.
15.	Construction Labour Campsite	*Spicerich Seasonings* Location of Campsite is already identified. The land for the camp site belongs to Mr. Alex Koshy.	• The construction labour camp shall be setup in a designated area within the project facility site. If adequate area is not available, contractor may set up construction camps at any

S. No.	Issue	Details	Mitigation Measures
		Ambunadu Laboratory No labour camp is required for implementation of construction works. However, it is suggested that the company should provide a rest area during break time for the workers.	suitable nearby site with prior approval of project development team. • The camp shall be provided with requisite number of sanitation facilities (toilets, bathrooms). • The management shall ensure compliance to requirements for workers accommodation as per IFC/EBRD guidelines. The guidelines can be downloaded at the below link (http://www.ifc.org/wps/wcm/connect/9839db00488557d1bdfcff6a6515bb18/workers_accomodation.pdf?MOD=AJPERES). • The worker accommodation shall also be provided with adequate amount of potable water and other basic necessities. It shall be ensured that overall hygiene is maintained in the camps. • The toilets shall be provided with septic tanks and soak pits. Schedule for cleaning of soak pits shall be established. • Health check-ups of construction labour shall be conducted at regular intervals. • Health awareness programs for construction labour and contractor shall be conducted by Akay. It shall cover aspects such as HIV/AIDS, and other communicable diseases to sensitize the labourers. • Comply with national labor laws and to undertake measures to comply with the relevant international core labor standards
16.	Stockyard	*Spicerich Seasonings* Health and safety requirements pertaining to stockyard management will be identified prior to construction.	• Material stockyards shall essentially be within the project facility construction site and all material shall be orderly stacked and covered

S. No.	Issue	Details	Mitigation Measures
		Ambunadu Laboratory Health and safety requirements pertaining to stockyard management will be identified prior to construction.	to prevent dust pollution. • Stockyards shall be clearly marked with legible health, safety and security signboards etc.
17.	Traffic and Transportation Management	*Spicerich Seasonings* Traffic safety management procedures for preventing community health & safety impacts will be developed prior to construction. *Ambunadu Laboratory* Traffic safety management procedures for preventing community health & safety impacts will be developed prior to construction.	• All vehicles used for transporting construction materials to the site shall be covered to avoid spillage of materials. • All existing roads used by material haulage vehicles, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Contractor shall arrange for regular cleaning and water sprinkling as necessary for dust suppression of all such roads and surfaces, if required. • Haul routes shall be avoided through human settlement areas as far as possible. • Drivers shall be trained for defensive driving.
18.	Drainage	*Spicerich Seasonings* Construction waste management procedures for prevention of blockage of drainage systems associated with the land parcel will be identified prior to construction.	• Contractor shall ensure that no construction materials like earth, stone, or appendage disposed of in a manner that block the flow of water of any water course and cross drainage channels, in proximity to

S. No.	Issue	Details	Mitigation Measures
		Ambunadu Laboratory Construction waste management procedures for prevention of blockage of drainage systems associated with the operational facility will be identified prior to construction.	project facility site • In addition, Contractor shall take all required measures as directed by Akay to prevent temporary or permanent flooding of the project site or any adjacent area.
19.	EHS (Environment, Health and Safety) Plan for Construction Site	*Spicerich Seasonings* Procedure for management of contractor's health and safety has not been developed. *Ambunadu Laboratory* Procedure for management of contractor's health and safety has not been developed.	• The contractor shall prepare an EHS plan conforming to the applicable EHS requirements and submit it to Akay's project development team for approval. • The EHS plan shall be implemented after approval. • Comply with national labor laws and to undertake measures to comply with the relevant international core labor standards • All construction labourers shall be provided with requisite PPEs such as safety shoes, goggles, eye shields nose masks, hard hats, fall protection measures, safety belts, etc. • Contractor shall comply with all regulations regarding safe scaffolding, ladders, safe platforms for working at heights, gangway, staircases, excavations, trenches and safe means of entry and egress. • Adequate number of fire extinguishers, sand buckets and water drums as prescribed shall be provided

S. No.	Issue	Details	Mitigation Measures
			onsite at strategic locations. • Adequate First-aid arrangements as prescribed under Kerala Factories Rules shall be ensured by the contractor onsite. The arrangements shall include availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital.
20.	Aesthetic improvement	*Spicerich Seasonings* Currently landscaping plan will be developed prior to construction. *Ambunadu Laboratory* Landscaping is not required as the laboratory is already part of operational facility of AFAPL.	The Contractor shall initiate preparatory activities for landscaping so as to ensure landscaping and plantation within project facility site are fully developed as per the developmental plan and coincide with the completion of construction activities.
21.	Waste Management	*Spicerich Seasonings* Waste management procedure for construction works and labour camp will be developed prior to construction. *Ambunadu Laboratory* Waste management plan for construction works will be developed prior to construction.	• The Contractor shall provide garbage bins at construction workers camp sites and ensure that these are regularly emptied and disposed of in a hygienic manner approved by the project development team. • Contractor shall undertake site clean-up of operations, as approved by project development team. The clean-up operations shall be implemented by the Contractor prior to demobilization and shall comprise clearing of all temporary structures; dispose all garbage, construction debris, unused/waste materials unused among others. Housekeeping staff shall be engaged for keeping the site clean.
22.	Monitoring	*Spicerich Seasonings* Monitoring frequency for environmental parameters will be identified prior to construction.	The periodical (monthly) monitoring of the ambient air quality, noise level, water quality, at selected locations within the

S. No.	Issue	Details	Mitigation Measures
		Ambunadu Laboratory Monitoring frequency for environmental parameters will be identified prior to construction.	project facility shall be undertaken either by in house facility or through an external laboratory approved by KSPCB. Monitor compliance with national labor laws, measures undertaken to comply with the relevant international core labor standards and labor issues, if any.
23.	Community Engagement	*Spicerich Seasonings* Procedures for community engagement will be further improved and documented. *Ambunadu Laboratory* Community engagement is identified as part of the existing management system.	• Communication channel shall be kept open with local people around the project facility to ensure that the construction activities at project site are not causing undue inconvenience to the local people due to noise, dust or disposal of debris etc. • Corrective actions shall be taken immediately by contractor for issues identified through such engagements.
24.	Gender and development	*Spicerich Seasonings* Implementation of the Gender Action Plan to promote gender mainstreaming in India operations. *Ambunadu Laboratory* Implementation of the Gender Action Plan to promote gender mainstreaming in India operations.	• Akay has committed to increase women participation of at least 1,500 out of 3,000 (50%) in new contract farming in India operations. In addition, new training to women on operation of machinery and processes in extraction plants is also to be undertaken. • To enhance Akay's capacity to undertaken these tasks, a nodal person/ gender specialist is to be appointed in India to support and guide the implementation and monitoring of gender measures. In addition, appointment of staff and volunteers to conduct gender awareness and information programs in community is also to be undertaken. • Akay has further committed to improve the financial inclusion and management of women farmers by assisting around 2500 women contract farmers in India to have credit

S. No.	Issue	Details	Mitigation Measures
			access, access to banks, open and operate a bank account, conduct training/orientation to women on financial management mechanisms, household expense budgeting, methods of saving and other opportunities for income generating activities, identifying and advertising opportunities of productive investment of savings; starting cooperatives and small scale businesses and investing in local infrastructure. • To improve monitoring and reporting on implementation of gender measures sex-disaggregated database (on farmers and workers deployment, benefits and improvement to socioeconomic conditions), is to be maintained and reported.
25.	Grievance Redress Mechanism (GRM)	*Spicerich Seasonings* GRM for contractor workers and community will be developed prior to actual construction activities. *Ambunadu Laboratory* GRM for contractor workers and community will be identified prior to construction.	The contractor shall create a facility at project site to receive any complaints/grievances (either orally or in documented form) related to construction activities from local people/adjacent land owners and resolve the matters expeditiously. If grievance(s) cannot be resolved at site level itself, the matter shall be referred project development team for resolving the matter expeditiously.
26.	Environmental Training for Contractor workers	*Spicerich Seasonings* Training procedure for EHS and Social aspects will be further improved. *Ambunadu Laboratory* Training procedure for EHS and Social aspects will be further improved.	Akay shall organize orientation and training sessions regularly at all construction stages of the project facility to contractor's staff to sensitize the environment safeguard requirements at construction site.

76 The activities, potential impacts and corresponding mitigation measures have been addressed in the Environmental Management Plan (EMP). It shall be ensured that the outlined mitigation

measures in the plan are effectively implemented and incorporated in contractor/sub-contractor agreements for compliance with National Labour and Safety Standards to be maintained at site during work.

E3 Operation Stage Impacts and Mitigation Measures

77 During the operation phase various types of waste streams will be generated from the Spicerich facility like process water, solid waste, sewage from toilets and wash areas and accidental spillages which may result in contamination of surface water, soil and groundwater, etc. if not managed adequately.

78 The industrial waste water generated from the process will be routed to Akay Spices Limited, manufacturing facility operational in the vicinity of proposed Spicerich facility. The effluent treatment plant (ETP) installed at Akay Spices Limited will handle the waste water generated from Spicerich. The capacity of the ETP installed is 45 KLD and is based on anaerobic treatment of effluent. The waste water generated from Akay spices is 10 KLD. However, the efficiency and adequacy assessment study of the ETP system for handling the waste water from Spicerich has not been undertaken.

79 Amount of industrial wastewater generated from the proposed Spicerich manufacturing facility is anticipated to be 10 KLD. The treated water from the effluent treatment plant (ETP) will be discharged within the premises for irrigation, used for flushing in washrooms and floor washing. However, the amount of water required for all the above mentioned activities and suitability of discharge of water on land for irrigation has not been assessed by Akay. A study shall be undertaken by the management to assess the carrying capacity of soil for discharge of water on land. The following discharge standards as provided in **Table 8-1** shall be followed by the management before discharge of treated effluent to land:

Table 8-1: Effluent Discharge Standards as per IFC EHS Guidelines and India Regulatory Requirement

S. No.	Parameter	Unit	IFC Guideline values for food and beverage sector	Effluent Standards for Food and Vegetable Processing Industry, EPA Act 1986, Govt. of India
1.	pH	-	6-9	6.5 – 8.5
2.	BOD	mg/L	50 (5 days at 20°C)	30 (3 days at 30°C)
3.	COD	mg/L	250	Not specified
4.	Total Nitrogen	mg/L	10	Not specified
5.	Total Phosphorus	mg/L	2	Not specified
6.	Oil and Grease	mg/L	10	10
7.	Total Suspended Solids	mg/L	50	50
8.	Total Coliform Bacteria	MPN/100 mL	400	Not specified
9.	Temperature increase	°C	< 3°C	Not specified
10.	Active Ingredients/ Antibiotics	-	To be determined on	Not specified

			case specific basis	

80 Septic tank along with soak pits shall be provided at the facility for treating the sewage generated. Provision of septic tanks and soak-pit disposal arrangements shall be as per standard designs of Central Public Works Department, Govt. of India. It shall be noted that the septic tank shall be designed to prevent contamination of soil and groundwater.

81 Since the amount of waste water generation is insignificant from the Ambunadu Laboratory, existing ETP upgradation is not required. The operational phase impacts in the laboratory are limited like general spills of chemicals etc. which can be mitigated by development of chemical handling plans as part of the Environment and Social Management Plan (ESMP).

E4 EHS Performance Standards/Requirements

82 Occupational health and safety is of utmost importance and it covers various aspects viz., worker's health, safe working environment, etc. IFC has laid down General Environment Health and Safety (EHS) Guidelines and Industry Specific EHS Guidelines. In order to ensure a safe and healthy working environment during the operation phase, industry specific EHS standards shall be implemented. The IFC EHS Guidelines for Food and Beverage Industry will be applicable to these facilities. It shall also be ensured that EHS requirements as prescribed under applicable national and state regulations viz. Kerala Factories Rules, 1957 (as amended) are complied with. Compliance to requirements under IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts), Performance Standard 2 (Labour and Working Condition) and Performance Standard 4 (Community Health, Safety and Security) shall be ensured.

E5 Decommissioning Plan

83 Whenever, a facility is to be decommissioned, as a standard practice all the process equipment will be dismantled, reused elsewhere, or sold or scrapped, whereas the civil structures will be put to some other alternative use either by alterations or reconstruction. It is recommended that Akay Cambodia follows World Bank General EHS Guidelines (as provided in **Annexure 3**) for decommissioning phase.

F. Analysis of Alternatives for Akay India Operations

84 This section describes the alternatives considered for the proposed facility. The following considerations were made:

- No project scenario;
- Alternative site analysis.

F1. No project scenario

85 The Indian spice industry is regulated by the Spices Board which is a subsidiary to the Ministry of Commerce and Industry, Government of India. Currently, India produces 3.2 million tonnes of different spices valued at approximately USD 4 billion, and holds a prominent position in world spice production. Owing to the varying climates - from tropical to sub-tropical to temperate, almost all spices grow splendidly in India. Under the act of Parliament, a total of 52 spices are brought within the purview of Spices Board. However, 109 spices are notified in the ISO list.[10]

86 India is a major global exporter of spices. Spices exports have registered substantial growth during the last five years, registering a compound annual average growth rate of 23% in value and 11% in volume and India commands a formidable position in the World Spice Trade. During the 2012-13, a total of 7, 26, 613 tonnes of spices and spice products valued Rs.12112.76 crore (USD 2212.13 Million) has been exported from the country as against 5, 75, 270 tonnes valued Rs.9783.42 crore (USD 2037.76 Million) in 2011-12, registering an increase of 26% in volume and 24% in rupee terms and 8.5% in dollar terms of value.

87 Compared to the target of fixed 5,66,000 tonnes valued Rs.8203.50 crore (USD 1650 million) for the financial year 2012-13, the achievement is 128% in terms of quantity and 148 % in rupee and 134% dollar terms of value. During this period, the achievement in export earning is high and it is mainly due to the rigorous focus and initiatives taken by the Board for value addition and higher end processing of Spices.

88 The proposed project will boost the spice production capacity of the country. A No-project scenario will not only hinder the growth of the industry and revenue generation from export, but will also affect the targeted spice production capacity addition. Thus, the project will contribute to the country's socio-economic growth.

F2 Alternative Site analysis

89 Alternative sites for the proposed facilities were selected in the basis of factors such as availability, prices, land use etc. As discussed in earlier sections, the land required for the proposed facilities at Akanadu is 1.8 acres and Ambunadu is 7.27 acres which has been acquired through lease and willing buyer willing seller basis arrangement respectively. The land acquisition did not involve any resettlement, loss of livelihood, indigenous peoples or any impact on environment, and flora and fauna species. Thus, the site selected for the proposed facilities is the best out of the alternatives considered.

G. Information Disclosure, Consultation for Akay India

[10] Spices Board of India : http://www.indianspices.com/html/spicesCatlg.html

90 As per the consultations conducted on 4th and 5th March 2014 by AECOM during the site assessment with the Panchayat (local self governing institutions) members of Mudakuzha Panchayat concerning the proposed Spice rich facility at Akanadu and Kizhakkambalam Panchayat concerning the Ambunadu facility, it was reported that the Panchayat members were informally aware about the land of the facilities when it was sold to the Mr. Koshy and Akay Flavours and Aromatics Private Limited respectively. A No Objection Certificate (NOC) has been obtained for the Ambunadu facility from the Panchayat. There was no objection raised by the local community for setting up of the facility. Reportedly, there was no disclosure of information undertaken for the community at the time of procurement. Formal records on any current and future communications held with the local communities and local authorities should be maintained by Akay management.

G1 Grievance Redress Mechanism

91 A formalised grievance redress mechanism (GRM) system for the workers is to be put into place with the role of the management (which shall include women as well) sketched out so that the procedures for addressing grievances as well as timelines are well demarcated for the feedback process. Once this is developed, information regarding this will be disseminated among the workers so that they are aware of their right to appeal in cases of grievances. Grievance boxes are to be placed at all accessible points within the facilities to respect the anonymity of the workers. Information regarding this will be circulated among the workers and the management is to maintain the confidentiality of the workers without projecting any reprisal towards the worker for approaching them. In addition, all grievances are to be formally registered and recorded along with the action undertaken in order to maintain transparency and accountability. In addition, a grievance redress cell within the GRM system will also be set up separately for women workers (direct and indirect) to maintain gender sensitivity amongst the workers.

92 A formalised grievance redress mechanism system for the community will be developed with the role of the management spokesperson or liaison officer sketched out so that the procedures for addressing grievances as well as timelines are well demarcated for the recourse process. Once this is developed, information regarding this will be disseminated among the community members residing within the vicinity of the facilities so that they are aware of their right to appeal in cases of grievances. Grievance boxes is to be placed at all accessible public places in the villages to respect the anonymity of the villagers and this will be checked once a week by the designated person of the facilities . Information regarding the use of the grievance box will be circulated among the community members. It is pertinent that the management maintains confidentiality of the community members and that the disputes or issues arising be resolved in an impartial manner. All grievances are to be formally registered and recorded along with the action undertaken so that transparency and accountability can be maintained.

H. Environmental Management Plan

H1 Environmental Mitigation Measures

93 An Environmental Management Plan (EMP) has been formulated for mitigating impacts pertaining to construction and operation phase of the project in India. The details of the Environment Management Plan has been given in the **Table 9-1** below:

Table 9-1: Environment Management Plan for Akay India

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
PRE-CONSTRUCTION PHASE				
1.	Project Facility Citing	The land shall not be in proximity to any archaeological monuments, large natural water bodies, national parks, wild life sanctuaries, forest areas and ecologically sensitive areas as declared by the State or Government of India.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
2.	Land Acquisition	• Land was purchased through direct negotiations with the consenting land owners on a willing seller and willing buyer principle and any involuntary resettlement issues and social impacts thereof shall be avoided. • In case, land owners belong to Scheduled Tribe, it shall be their responsibility to get required permission from district authorities, prior to transaction/ transfer of title. • All required information to the probable land sellers and neighbouring land owners about the proposed facilities shall be disclosed by Akay and any concerns prior to transaction and transfer of title shall be resolved. • Akay shall address all concerns/grievance of local community, if any received at the stage of the project construction or implementation or operation stage and reserve the same in the best interest of the community.	Akay Project Development Team	Akay Senior Management Team
3.	Obtain CTE from KSPCB	• Prescribed application for obtaining CTE shall be prepared with all project facility information and submitted to KSPCB. • The Ambunadu laboratory operations if generates additional waste water streams or point sources of pollution, CTE and CTO shall be revised for AFAPL. • Additional information, if any sought by SPCB shall be provided and CTE shall be obtained in a time bound manner. • No Construction work shall be commenced without obtaining CTE from KSPCB.	Akay Project Development Team	Akay Senior Management Team
4.	Contractor Bidding and Evaluation	Contractor bids shall be evaluated on the basis of their EHS policies, project track record for finalising the contractor for various works.	Akay Project Development Team	Akay Senior Management Team
5.	Contractor's Responsibility for Implementation of EMP	All the contract documents for civil, mechanical and electrical works shall incorporate EHS requirements as conditions of contract in order to make the contractor clearly aware of the requirements.	Akay Project Development Team	Akay Senior Management Team
6.	Contractor's Supply Chain	Contractor's supply chain shall be scrutinised and evaluated for ensuring compliance to : • Applicable EHS requirements; • Akay's HR policies, labour policy and Code of Conduct.	Akay Project Development Team	Akay Senior Management Team
CONSTRUCTION PHASE				
7.	Site	• The site shall be cleared off vegetation and prepared for	Akay Project	Akay

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
	Preparation and Vegetation Clearing	construction of proposed facility. It shall be ensured that afforestation is undertaken through greenbelt development.	Development Team and Onsite Staff	Senior Management Team
8.	Concrete Batching	• All batching plants for production of concrete shall preferably be set up within construction site. In case sufficient land not available within project site, then it shall be located at any other suitable site located at least 100m away from the nearest settlement preferably in the downwind direction. • The Contractor shall submit a detailed layout plan for all such sites for approval of from Akay senior management prior to the establishment. • Arrangements to control air pollution due to dust generation shall be done through provision of windscreens, water sprinklers and dust extraction systems onsite. • Alternatively, contractor may be encouraged to source concrete from already established ready mix plants and transport it to site through tankers.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
9.	Construction Vehicles, Equipment and Machinery	• All vehicles shall be in possession of a valid Pollution under Control (PUC) issued by competent authorities authorised by the Central Motor Vehicles Department. PUCs shall be renewed on expiry. • All vehicles, equipment and machinery procured for construction works shall be in good condition and preferably not more than 5 years old. • All vehicles carrying construction material shall be covered with tarpaulin sheets for preventing dust dispersion into air.	Akay Project Development Team, Contractor and Onsite Staff	Akay Senior Management Team
10.	Noise from Vehicles, Plants and Equipment	• The Contractor shall ensure that construction plants and equipment used shall strictly conform to the MoEF/CPCB/KSPCB/IFC noise standards. The maintenance of vehicles, equipment and machinery shall be done regularly to keep noise levels at the minimum. • All major noise generating activities of construction shall be restricted to day hours only and no night shifts shall be allowed for such activities under normal circumstances.	Akay Project Development Team, Contractor and Onsite Staff	Akay Senior Management Team
11.	Borrow Pits	• Borrow pits locations shall be submitted by the contractor for approval by the Akay project development team. • Borrow pit shall have the proper government permit before extraction activities is done by contractor. • Such locations shall be located away from human settlements and be covered for preventing dust particle dispersion into surroundings. • The haul roads shall be routed to avoid human settlement and sensitive receptors like schools, hospitals as far as possible and shall use the existing roads wherever available.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
12.	Stone Aggregate Procurement	• Contractor shall procure all stone aggregates sourced from stone crushers, which conform to KSPCB Norms. • Contractor shall work out haul road network and obtain Akay project development team's approval.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
13.	Sand Procurement	The Sand shall be procured from licensed sand mines. The Contractor shall obtain copy of the Lease Agreement of the supplier and submit to project development team before procuring the sand.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
14.	Water Supply for construction	• The management shall install water meters (calibrated) on source of water and record the water consumption data. • Construction water may be supplied by tankers provided by KSPCB authorised agencies. • The contractor shall identify suitable (ground/surface) water as a source of water for the construction and/or may set up own bore well facility for construction work, after obtaining the requisite permissions, if any required under approval of the project development team.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
15.	Construction Labour Campsite	• The construction labour camp shall be setup in a designated area within the project facility site. If adequate area is not available, contractor may set up construction camps at any suitable nearby site with prior approval of project development team. • The camp shall be provided with requisite number of sanitation facilities (toilets, bathrooms). • The management shall ensure compliance to requirements for workers accommodation as per IFC/EBRD guidelines. The guidelines can be downloaded at the below link (http://www.ifc.org/wps/wcm/connect/9839db00488557d1bdfcff6a6515bb18/workers_accomodation.pdf?MOD=AJPERES). • The worker accommodation shall also be provided with adequate amount of potable water and other basic necessities. It shall be ensured that overall hygiene is maintained in the camps. • The toilets shall be provided with septic tanks and soak pits. Schedule for cleaning of soak pits shall be established. • Health check-ups of construction labour shall be conducted at regular intervals. • Health awareness programs for construction labour and contractor shall be conducted by Akay. It shall cover aspects such as HIV/AIDS, and other communicable diseases to sensitize the labourers.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
16.	Stockyard	• Material stockyards shall essentially be within the project facility construction site and all material shall be orderly stacked and covered to prevent dust pollution. • Stockyards shall be clearly marked with legible health,	Akay Project Development Team and Onsite Staff	Akay Senior Management

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		safety and security signboards etc.		Team
17.	Traffic and Transportation Management	• All vehicles used for transporting construction materials to the site shall be covered to avoid spillage of materials. • All existing roads used by material haulage vehicles, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Contractor shall arrange for regular cleaning and water sprinkling as necessary for dust suppression of all such roads and surfaces, if required. • Haul routes shall be avoided through human settlement areas as far as possible. • Drivers shall be trained for defensive driving.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
18.	Drainage	• Contractor shall ensure that no construction materials like earth, stone, or appendage disposed of in a manner that block the flow of water of any water course and cross drainage channels, in proximity to project facility site • In addition, Contractor shall take all required measures as directed by Akay to prevent temporary or permanent flooding of the project site or any adjacent area.	Akay Project Development Team, Onsite Staff and Contractor	Akay Senior Management Team
19.	EHS and Labor(Environment, Health and Safety) Plan for Construction Site	• The contractor shall prepare an EHS plan conforming to the applicable EHS requirements and submit it to the project development team for approval. • The EHS plan shall be implemented after approval. • Contractor to comply with the national labor laws and take measures to comply with relevant international CLS • All construction labourers shall be provided with requisite PPEs such as safety shoes, goggles, eye shields nose masks, hard hats, fall protection measures, safety belts, etc. • Contractor shall comply with all regulations regarding safe scaffolding, ladders, safe platforms for working at heights, gangway, staircases, excavations, trenches and safe means of entry and egress. • Adequate number of fire extinguishers, sand buckets and water drums as prescribed shall be provided onsite at strategic locations. • Adequate First-aid arrangements as prescribed under Kerala Factories Rules shall be ensured by the contractor onsite. The arrangements shall include availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital.	Akay Project Development Team, Onsite Staff and Contractor	Akay Senior Management Team
20.	Aesthetic improvement	The Contractor shall initiate preparatory activities for landscaping so as to ensure landscaping and plantation within project facility site are fully developed as per the developmental plan and coincide with the completion of construction activities.	Akay Project Development Team, Onsite Staff and Contractor	Akay Senior Management Team
21.	Waste Management	• The Contractor shall provide garbage bins at construction workers camp sites and ensure that these	Akay Project Development Team, Onsite	Akay Senior Manag

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		are regularly emptied and disposed of in a hygienic manner approved by the project development team. • Contractor shall undertake site clean-up of operations, as approved by project development team. The clean-up operations shall be implemented by the Contractor prior to demobilization and shall comprise clearing of all temporary structures; dispose all garbage, construction debris, unused/waste materials unused among others. Housekeeping staff shall be engaged for keeping the site clean.	Staff and Contractor	ement Team
22.	Monitoring	• The periodical (monthly) monitoring of the ambient air quality, noise level, water quality, at selected locations within the project facility shall be undertaken either by in house facility or through an external laboratory approved by KSPCB. • During construction monthly monitoring and testing results should be analysed and compiled as entry to the Annual Environmental Monitoring Report to be submitted to ADB. • Monitor compliance with national labor laws, measures undertaken to comply with the relevant international core labor standards and labor issues, if any.	Akay Project Development Team, Onsite Staff and Contractor	Akay Senior Management Team
23.	Community Engagement	• Communication channel shall be kept open with local people around the project facility to ensure that the construction activities at project site are not causing undue inconvenience to the local people due to noise, dust or disposal of debris etc. • Corrective actions shall be taken immediately by contractor for issues identified through such engagements.	Akay Project Development Team, Onsite Staff and Contractor	Akay Senior Management Team
24.	Gender and Development	• Akay has committed to increase women participation of at least 1,500 out of 3,000 (50%) in new contract farming in India operations. In addition, new training to women on operation of machinery and processes in extraction plants is also to be undertaken. • To enhance Akay's capacity to undertaken these tasks, a nodal person/ gender specialist is to be appointed in India to support and guide the implementation and monitoring of gender measures. In addition, appointment of staff and volunteers to conduct gender awareness and information programs in community is also to be undertaken. • Akay has further committed to improve the financial inclusion and management of women farmers by assisting around 2500 women contract farmers in India to have credit access, access to banks, open and operate a bank account, conduct training/orientation to women on financial management mechanisms, household expense budgeting, methods of saving and other	Gender Specialist, Akay Project Development Team and Onsite Staff	Akay Senior Management Team

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		opportunities for income generating activities, identifying and advertising opportunities of productive investment of savings; starting cooperatives and small scale businesses and investing in local infrastructure. • To improve monitoring and reporting on implementation of gender measures sex-disaggregated database (on farmers and workers deployment, benefits and improvement to socioeconomic conditions), is to be maintained and reported.		
25.	Grievance Redress Mechanism (GRM)	The contractor shall create a facility at project site to receive any complaints/grievances (either orally or in documented form) related to construction activities from local people/adjacent land owners and resolve the matters expeditiously. If grievance(s) cannot be resolved at site level itself, the matter shall be referred project development team for resolving the matter expeditiously.	Akay Project Development Team, Onsite Staff and Contractor	Akay Senior Management Team
26.	Environmental Training for Contractor's Staff	Akay shall organize orientation and training sessions regularly at all construction stages of the project facility to contractor's staff to sensitize the environment safeguard requirements at construction site.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
OPERATION PHASE				
27.	Obtain CTO from KSPCB	• Prescribed application for obtaining CTO shall be prepared with all project facility information, prior to commencement of commercial operations and submitted to KSPCB. • Arrange for visit of KSPCB officials for field verification of the facility. • Additional information, if any sought by KSPCB shall be provided for obtaining CTO in a time-bound manner. • No commercial operations shall be commenced without obtaining the CTO from KSPCB.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
28.	Emission control	• Emission control measures for DG sets as mentioned in the CTE shall be implemented.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
29.	Noise Control	• DG sets shall be provided with acoustic enclosure for limiting noise exposure of workers within prescribed limits. • Conditions prescribed in the CTE shall be adhered to.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
30.	Water Treatment	• All facilities shall have water testing and treatment facility to treat the bore well water. The water shall be assessed for adherence to IS 10500:2012 prior to its use for drinking purposes.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
31.	Sewage Treatment	• Septic tanks along with soak pits shall be provided as per Public Works Department design for sewage treatment. • If in case the municipal sewage systems are provided to the facility the sewage may be directly discharged into	Akay Project Development Team and Onsite Staff	Akay Senior Management

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		public sewer lines with adequate approvals from the concerned authorities • All facilities shall have provisions for reuse / recycling of treated wash water for floor washing, toilet flushing, watering lawns within facility premises.		Team
32.	Effluent Treatment	• The facility shall have ETP for treatment of process wastewater prior to discharge. • The treated effluent shall be checked for conformance to discharge standards laid down in CTO and IFC Effluent Discharge Standards whichever of the two is more stringent. Strict compliance to standards shall be ensured. • Adequate studies shall be undertaken for the type of system to be installed for waste water treatment. In case, additional waste water streams are to be directed to existing ETP, an adequacy and efficiency assessment study shall be undertaken. The adequacy and efficiency assessment study shall also incorporate recommendations for installation of any new technology like oil and grease separators, etc. for adequate treatment of the effluent. • Besides the aforementioned components, any additional components as mentioned in the CTE shall be provided in the ETP unit. • Study on carrying capacity of land for discharge of treated ETP water to land shall be carried out. • Treated effluent shall be disposed off as per conditions provided in the CTE and CTO from KSPCB.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
33.	Solid Waste Management	• Organic solid waste generated during the operations shall be decomposed through aerobic composting or through vermin composting process to generate organic manure with good fertility value. • The compost and vermin treatment facility for the organic solid waste shall be executed through a turnkey contract for design construct, operate and maintain, with guaranteed performance standards for composts as per CPCB norms. • In addition, metallic containers shall be provided for collection of non-bio degradable waste generated, if any at each of the facilities and transport it to the nearest urban municipal solid waste dump area and / or processing facility. This shall be done either with Akay's own fleet and / or services can be contracted out for periodical clearance, depending upon the periodicity and quantum of waste generated based on actual.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
34.	Hazardous Waste Management	• Used diesel oil from DG sets shall be stored in containers in designated area provided with secondary containment and spill control tool-kit within the premises. • The storage area shall be properly marked and entry to the place shall be restricted to certain personnel only. • ETP sludge shall be treated in biogas plant along with	Akay Project Development Team and Onsite Staff	Akay Senior Management Team

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
		biodegradable waste.		
35.	EHS Performance Standards and Practices	• The facility shall operate environmental health, hygiene and sanitation upkeep systems and procedures in compliance with Factories Act, Kerala Factories Rules and IFC EHS guidelines for food and beverage industry. • The project facility shall implement an EHS performance Operations and Industry Best Practices and ensure its adherence by all workers and management staff (as relevant and applicable). • It shall be ensured that all workers are provided with PPEs as required under the EHS performance and Industry Best Practices standards/operations manual and same is used during the entire operational hours of the facility by all workers.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
36.	Environmental Monitoring	• The periodical (monthly) monitoring of the ambient air quality, noise level, water quality, waste water (before and after treatment) at selected locations within the project facility shall be undertaken either through an external laboratory approved by KSPCB. • The periodical monitoring reports are to be submitted to KSPCB and ADB annually as per compliance requirements. • Any other conditions stipulated in the CTE and CTO are to be fully complied and avoid any regulatory violations either wilfully or due to negligence.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
37.	3rd Party Independent Environmental and Social Safeguards Audit (excluded from the External ISO and OHSAS Certification Audits)	• An Environmental and Social Safeguards Audit shall be carried out every year through engagement of an independent 3rd party agency. All audit observations along with gaps identified shall be taken note of corrective action shall be implemented at the facility in a time bound manner. • The audit report along with 'Action Taken Report' shall be submitted to ADB. • These audits are standalone audits and shall not be covered under ISO 9001, ISO 14001 and OHSAS 18001 external or internal certification audits.	Akay Project Development Team, Onsite Staff and 3rd Party Agency	Akay Senior Management Team
38.	Rainwater Harvesting and Groundwater Recharging	• All facilities shall have provision for rainwater harvesting and groundwater recharging. • The rainwater harvesting and groundwater recharging systems shall be constructed as per the standard designs of the Central Ground Water Board and / or Central Public Works Department, Government of India.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
39.	Energy Efficient equipment usage	• All facilities shall use most energy efficient appliances and equipment, specifically for cooling and refrigerating systems. • All facilities shall have provision for use of renewable (solar) energy for general lighting (non-industrial) within the facility to enhance environmental sustainability of the proposed facilities.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team

S. No.	Environment & Social Issue	Mitigation Measures	Responsibility	
			Planning and Implementation	Monitoring
40.	Community Participation	Communication channel shall be kept open with local people around the project facility to ensure that the operations of the project facility are not causing undue inconvenience to the locals residing in the vicinity of project. ADB principles of Information disclosure and informed consent shall be strictly adhered to.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
41.	Grievance Redress Mechanism (GRM)	A proper GRM shall be implemented to receive complaints/grievances (in documented form) due to operations of the project facility from local people/adjacent land owners and resolve the matters expeditiously. If grievance(s) cannot be resolved at site level itself, the matter shall be referred to the senior management facility for resolving the matter expeditiously.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team
DECOMISSIONING PHASE				
42.		• When a facility is to be decommissioned, as a standard practice all the process equipment shall be dismantled, reused elsewhere, or sold or scrapped, whereas the civil structures shall be put to some other alternative use either by alterations or reconstruction. • The relevant / applicable IFC's EHS plans and practices for decommissioning of the facilities shall also be followed to the extent of relevance / applicability.	Akay Project Development Team and Onsite Staff	Akay Senior Management Team

H2 Environmental Enhancement Measures

94 Besides ESMP, the following measures for environmental enhancement shall be implemented at the proposed facilities:

- Adopting the 3R concept (Reduce, Reuse and Recycle) concept in various activities viz. process water usage, toilet cleaning, flushing etc.;
- Rainwater Harvesting and Recharge;
- Aesthetics improvement through landscaping and plantation;
- Adoption of energy efficient equipment and renewable solar energy for lighting applications;
- Occupational Health and Safety training programmes and regular health check-up of workers;
- Mandatory usage of Personal Protective Equipment (PPEs);

H3. Operation Stage Environmental Monitoring

95 Environmental monitoring needs to be conducted at regular intervals to assess the efficacy of EMP and identify corrective measures required, if any. The following monitoring activities shall be carried out at the proposed facilities :

- Drinking water quality assessment as per IS 10500:2012;
- ETP treated effluent quality assessment;
- Periodic assessment of hazardous waste storage facility; and
- Cleaning of Rainwater harvesting and recharging structures, prior to monsoon

96 It is recommended that Environment, Health, Safety and Social (EHSS) Audits are conducted periodically to ensure compliance with ADB SPS and other applicable national and local legislations.

H4 Budgetary Cost Provision for EMP Implementation

97 The implementation of EMP during planning/pre-construction, construction and operation stages for all proposed facilities will require a capital cost of INR 61,50,000 and a recurring cost of INR 19,95,000 per annum. The summary of the budgetary provision for implementing the EMP during planning/pre-construction, construction and operation stages is given in the Table **10-1** below:

Table 10-1: Indicative Budgetary Cost for Implementation of Environment Management Plan

S. No.	Project Component	Expansion of Laboratory	Construction and Operation of Spicerich Seasonings
1	Land Lease	NA	As per negotiated rates with Mr. Alex Koshy
2	Operational Licences/permits	As per the requirements under Food Safety and Standards Authority, India	As per license fee cost established by KPCB (Cost of EIA not included)
3	Construction Stage Mitigation Measures	Incidental to Civil & Electro Mechanical Contracts awarded by Akay Management	
4	Improvement/Modification of Effluent Treatment Plant with adequate studies	10,00,000	40,00,000
5	Installation of Bag Filters and dust collection units	NA	20,00,000
6	Provision of PPE for Construction	1,00,000	1,00,000
7	Installation of Septic Tank and Soak pit	NA	5,00,000
8	Rainwater harvesting and Recharging structures	NA	4,50,000
9	Landscaping and plantation	Part of overall project cost	
10	Occupational Health Screening of workers (pre-employment)	As per actual	
	Total One Time Cost	**11,00,000**	**50,50,000**
Recurring Annual Cost			
1	Renewal of permits/licenses	As per the requirements under Food Safety and Standards Authority, India	
2	Annual maintenance of pollution control devices (10% of equipment cost)	100000	450000

3	Operational Stage Environment management Cost	6,00,000	6,00,000
4	Rainwater harvesting and Recharging structures	NA	45000
5	Provision of PPE	1,00,000	1,00,000
6	Landscaping and plantation	Part of overall project cost	
7	Occupational Health Screening of workers (pre-employment)	As per actual	
	Total Recurring Cost	8,00,000	11,95,000

I. Conclusion and Recommendations

98 The proposed spices and seasonings manufacturing facility in India fall under the purview of Food Safety and Standards Act, 2006, Government of India and will have to mandatorily comply with all licensing requirements under the Act including food safety issues, sanitation and hygiene at all its facilities operational in India.

99 Due to the nature and scale of the facilities proposed by Akay, the impacts due to the proposed facilities are moderate and can be mitigated by developing and implementing an adequate Environment Management Plan which has been provided in the present report.

100 The social impacts are avoided as the purchase and lease of land was through direct negotiated settlement on a willing buyer and willing seller principle, thus not involving impact on social aspect due to involuntary resettlement. In addition, issues pertaining to indigenous peoples are not triggered as the project operations do not affect the scheduled tribe population due to the absence of indigenous population near and around the proposed Spicerich facility and existing Ambunadu facility in India.

101 Certain criteria relating to attendance register, minimum age, prohibition of employing child labour and forced labour, minimum wage, leaves, overtime payment, working hours, welfare measures are duly maintained by the Management and these procedures are in line with the national regulatory framework of the country which will extend to the future employees that would be recruited in the proposed facilities.

102 The information disclosure and consultations have been carried out with the local authorities where the proposed project facility will be situated.

103 The pre-construction, construction and operation stage environmental impacts can be mitigated by implementing management measures through an institutional arrangement with clearly defined roles and responsibilities and dedicated budgetary provisions. The regulatory compliance (consents from State Pollution Control Board) for establishing and operation of the proposed project facilities can be obtained from KSPCB in a time bound manner in India. The project facilities will be subjected to periodical environmental monitoring during the construction and operation stage as per the regulatory permitting requirements.

104 Further, implementation of environmental enhancement measures like recycling of treated effluent water, rain water harvesting and ground water recharging, adopting efficient equipments and use of renewable (solar) energy for lighting applications will enable the proposed facilities to be an environmentally sustainable, compliant to state regulatory requirements and consistent with the safeguard requirements of SPS, 2009 and will not involve any kind of reputational risk to ADB on environmental and social safeguard issues.

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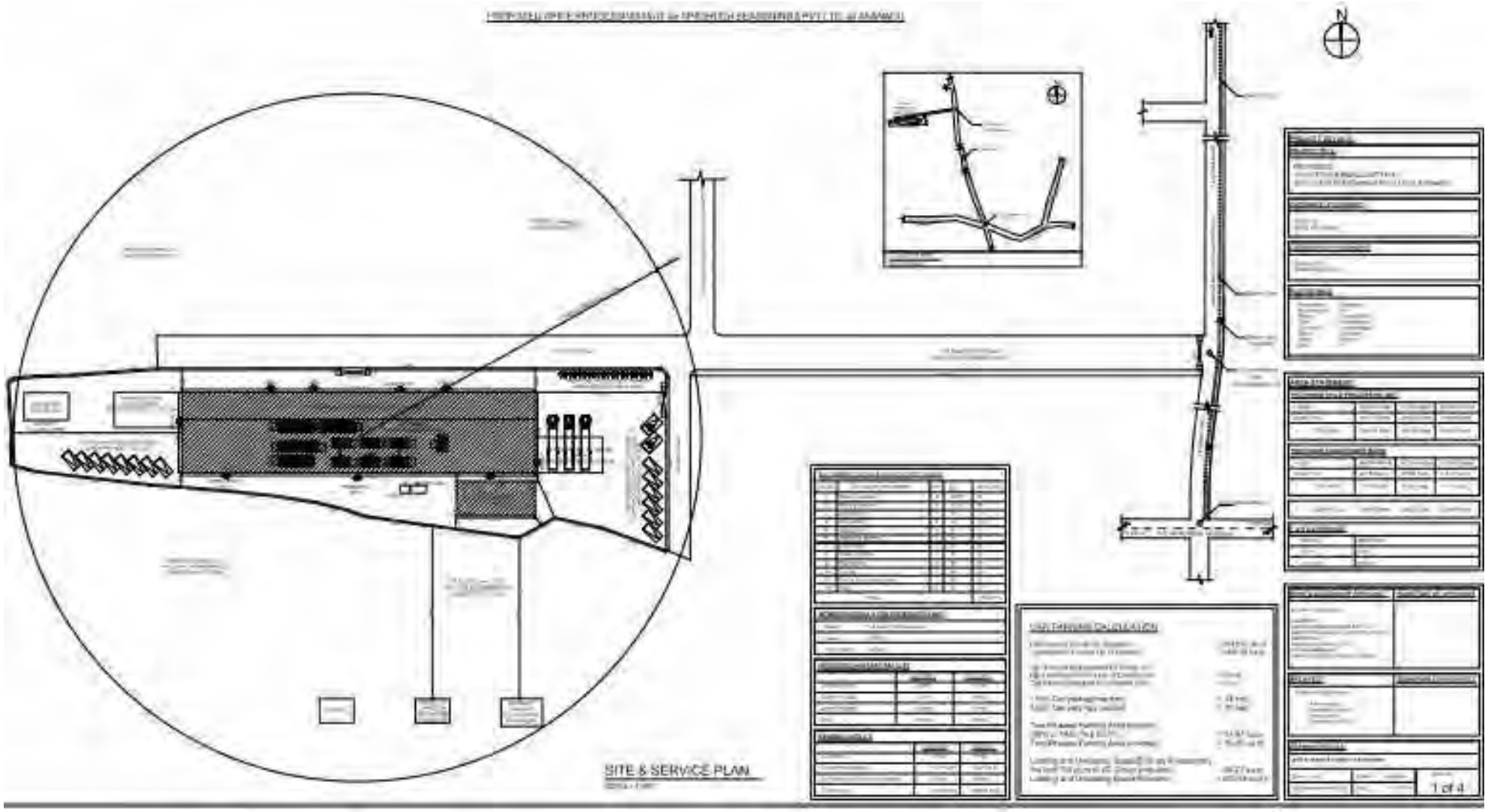
To enhance and sustain the world's built, natural and social environments

Annexure

Annexure 1



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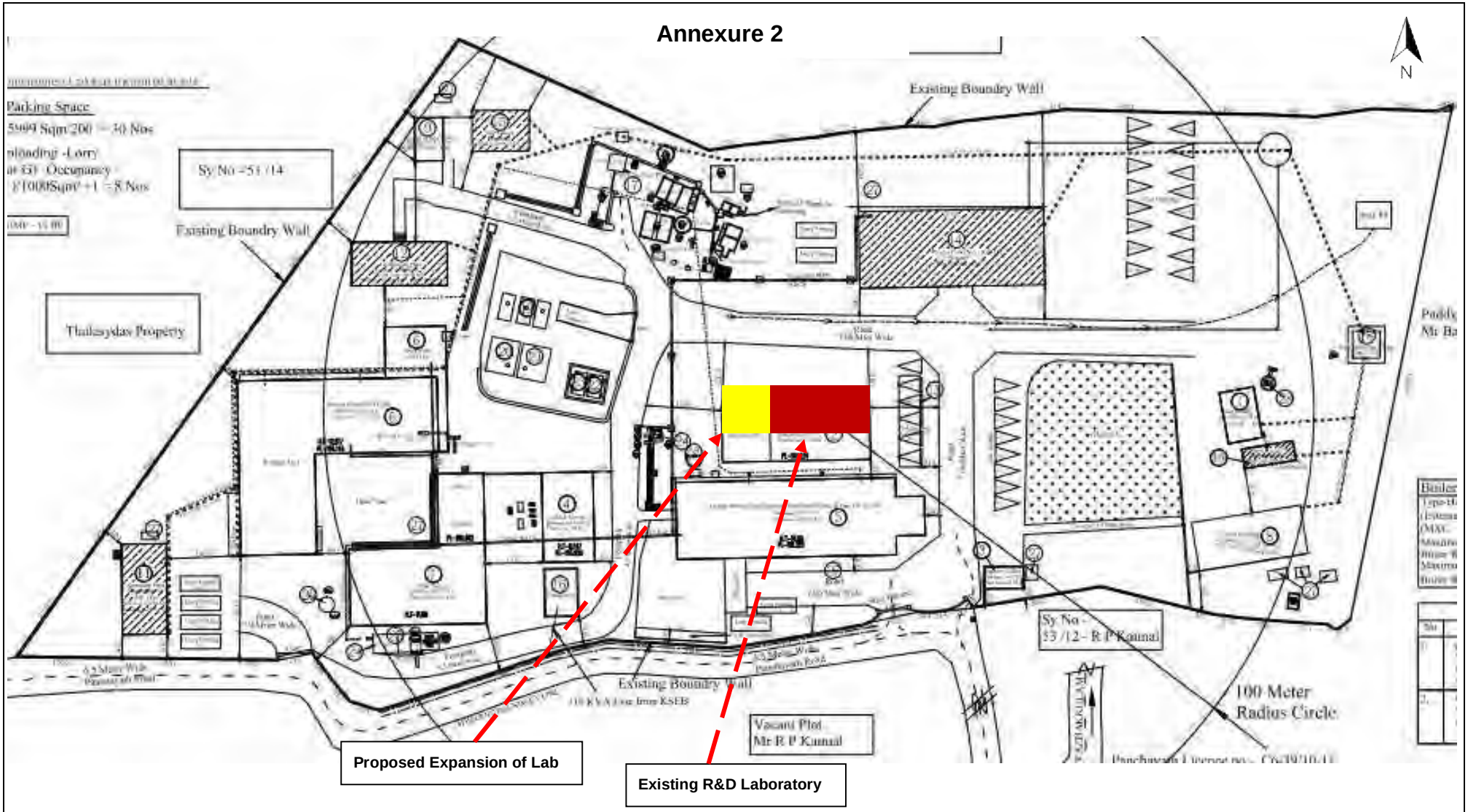
Layout of Proposed Spicerich facility at Kerala			Annexure 1
			1
DRAWN BY:	DATE :	PROJECT NUMBER:	SHEET NUMBER:
AECOM	May 2014		1 0f 2

Annexure 2



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Layout of Akay Flavours and Aromatis Private Limited, Ambunadu, Cochin, Kerala and proposed laboratory expansion

Annexure 2			
2			
DRAWN BY:	**DATE :**	**PROJECT NUMBER:**	**SHEET NUMBER:**
AECOM	May 2014		2 0f 2

Environmental, Health, and Safety General Guidelines

Introduction

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP)[1]. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These **General EHS Guidelines** are designed to be used together with the relevant **Industry Sector EHS Guidelines** which provide guidance to users on EHS issues in specific industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at: www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment[2] in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

The **General EHS Guidelines** are organized as follows:

[1] Defined as the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

[2] For IFC, such assessment is carried out consistent with Performance Standard 1, and for the World Bank, with Operational Policy 4.01.

General Approach to the Management of EHS Issues at the Facility or Project Level

Effective management of environmental, health, and safety (EHS) issues entails the inclusion of EHS considerations into corporate- and facility-level business processes in an organized, hierarchical approach that includes the following steps:

- Identifying EHS project hazards[3] and associated risks[4] as early as possible in the facility development or project cycle, including the incorporation of EHS considerations into the site selection process, product design process, engineering planning process for capital requests, engineering work orders, facility modification authorizations, or layout and process change plans.
- Involving EHS professionals, who have the experience, competence, and training necessary to assess and manage EHS impacts and risks, and carry out specialized environmental management functions including the preparation of project or activity-specific plans and procedures that incorporate the technical recommendations presented in this document that are relevant to the project.
- Understanding the likelihood and magnitude of EHS risks, based on:
    - The nature of the project activities, such as whether the project will generate significant quantities of emissions or effluents, or involve hazardous materials or processes;
    - The potential consequences to workers, communities, or the environment if hazards are not adequately managed, which may depend on the proximity of project activities to people or to the environmental resources on which they depend.
- Prioritizing risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and / or significant impacts.
- Favoring strategies that eliminate the cause of the hazard at its source, for example, by selecting less hazardous materials or processes that avoid the need for EHS controls.
- When impact avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences, for example, with the application of pollution controls to reduce the levels of emitted contaminants to workers or environments.
- Preparing workers and nearby communities to respond to accidents, including providing technical and financial resources to effectively and safely control such events, and restoring workplace and community environments to a safe and healthy condition.
- Improving EHS performance through a combination of ongoing monitoring of facility performance and effective accountability.

[3] Defined as "threats to humans and what they value" (Kates, et al., 1985).

[4] Defined as "quantitative measures of hazard consequences, usually expressed as conditional probabilities of experiencing harm" (Kates, et. al., 1985)

1.0 Environmental

1.1 Air Emissions and Ambient Air Quality

Applicability and Approach

This guideline applies to facilities or projects that generate emissions to air at any stage of the project life-cycle. It complements the industry-specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for emissions management that may be applied to a range of industry sectors. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. It is also intended to provide additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards.

Emissions of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of a project. These activities can be categorized based on the spatial characteristic of the source including point sources, fugitive sources, and mobile sources and, further, by process, such as combustion, materials storage, or other industry sector-specific processes.

Where possible, facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air. Where this is not possible, the generation and release of emissions of any type should be managed through a combination of:

- Energy use efficiency
- Process modification
- Selection of fuels or other materials, the processing of which may result in less polluting emissions
- Application of emissions control techniques

The selected prevention and control techniques may include one or more methods of treatment depending on:

- Regulatory requirements
- Significance of the source
- Location of the emitting facility relative to other sources
- Location of sensitive receptors
- Existing ambient air quality, and potential for degradation of the airshed from a proposed project
- Technical feasibility and cost effectiveness of the available options for prevention, control, and release of emissions

Ambient Air Quality

General Approach

Projects with significant[5,6] sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards[9] by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines[10] (see Table 1.1.1), or other internationally recognized sources[11];
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.[12]

At facility level, impacts should be estimated through qualitative or quantitative assessments by the use of baseline air quality assessments and atmospheric dispersion models to assess potential ground level concentrations. Local atmospheric, climatic, and air quality data should be applied when modeling dispersion, protection against atmospheric downwash, wakes, or eddy effects of the source, nearby[13] structures, and terrain features. The dispersion model applied should be internationally recognized, or comparable. Examples of acceptable emission estimation and dispersion modeling approaches for point and fugitive sources are

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]

	Averaging Period	Guideline value in μg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

[5] Significant sources of point and fugitive emissions are considered to be general sources which, for example, can contribute a net emissions increase of one or more of the following pollutants within a given airshed: PM10: 50 tons per year (tpy); NOx: 500 tpy; SO2: 500 tpy; or as established through national legislation; and combustion sources with an equivalent heat input of 50 MWth or greater. The significance of emissions of inorganic and organic pollutants should be established on a project-specific basis taking into account toxic and other properties of the pollutant.

[6] United States Environmental Protection Agency, Prevention of Significant Deterioration of Air Quality, 40 CFR Ch. 1 Part 52.21. Other references for establishing significant emissions include the European Commission. 2000. "Guidance Document for EPER implementation." http://ec.europa.eu/environment/ippc/eper/index.htm ; and Australian Government. 2004. "National Pollutant Inventory Guide." http://www.npi.gov.au/handbooks/pubs/npiguide.pdf

[7] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.

[8] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

[9] Ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes, and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization).

[10] Available at World Health Organization (WHO). http://www.who.int/en

[11] For example the United States National Ambient Air Quality Standards (NAAQS) (http://www.epa.gov/air/criteria.html) and the relevant European Council Directives (Council Directive 1999/30/EC of 22 April 1999 / Council Directive 2002/3/EC of February 12 2002).

[12] US EPA Prevention of Significant Deterioration Increments Limits applicable to non-degraded airsheds.

included in Annex 1.1.1. These approaches include screening models for single source evaluations (SCREEN3 or AIRSCREEN), as well as more complex and refined models (AERMOD OR ADMS). Model selection is dependent on the complexity and geo-morphology of the project site (e.g. mountainous terrain, urban or rural area).

Projects Located in Degraded Airsheds or Ecologically Sensitive Areas

Facilities or projects located within poor quality airsheds[14], and within or next to areas established as ecologically sensitive (e.g. national parks), should ensure that any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established in the project-specific environmental assessment. Suitable mitigation measures may also include the relocation of significant sources of emissions outside the airshed in question, use of cleaner fuels or technologies, application of comprehensive pollution control measures, offset activities at installations controlled by the project sponsor or other facilities within the same airshed, and buy-down of emissions within the same airshed.

Specific provisions for minimizing emissions and their impacts in poor air quality or ecologically sensitive airsheds should be established on a project-by-project or industry-specific basis. Offset provisions outside the immediate control of the project sponsor or buy-downs should be monitored and enforced by the local agency responsible for granting and monitoring emission permits. Such provisions should be in place prior to final commissioning of the facility / project.

Point Sources

Point sources are discrete, stationary, identifiable sources of emissions that release pollutants to the atmosphere. They are typically located in manufacturing or production plants. Within a given point source, there may be several individual 'emission points' that comprise the point source.[15]

Point sources are characterized by the release of air pollutants typically associated with the combustion of fossil fuels, such as nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM), as well as other air pollutants including certain volatile organic compounds (VOCs) and metals that may also be associated with a wide range of industrial activities.

Emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on ambient conditions, through the combined application of process modifications and emissions controls, examples of which are provided in Annex 1.1.2. Additional recommendations regarding stack height and emissions from small combustion facilities are provided below.

Stack Height

The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to GIIP (see Annex 1.1.3) to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive. Non-significant sources of emissions,

[13] "Nearby" generally considers an area within a radius of up to 20 times the stack height.

[14] An airshed should be considered as having poor air quality if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly.

[15] Emission points refer to a specific stack, vent, or other discrete point of pollution release. This term should not be confused with point source, which is a regulatory distinction from area and mobile sources. The characterization of point sources into multiple emissions points is useful for allowing more detailed reporting of emissions information.

including small combustion sources,[16] should also use GIIP in stack design.

Small Combustion Facilities Emissions Guidelines

Small combustion processes are systems designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type, with a total, rated heat input capacity of between three Megawatt thermal (MWth) and 50 MWth.

The emissions guidelines in Table 1.1.2 are applicable to small combustion process installations operating more than 500 hours per year, and those with an annual capacity utilization of more than 30 percent. Plants firing a mixture of fuels should compare emissions performance with these guidelines based on the sum of the relative contribution of each applied fuel[17]. Lower emission values may apply if the proposed facility is located in an ecologically sensitive airshed, or airshed with poor air quality, in order to address potential cumulative impacts from the installation of more than one small combustion plant as part of a distributed generation project.

[16] Small combustion sources are those with a total rated heat input capacity of 50MWth or less.

[17] The contribution of a fuel is the percentage of heat input (LHV) provided by this fuel multiplied by its limit value.

Table 1.1.2 - Small Combustion Facilities Emissions Guidelines (3MWth – 50MWth) – (in mg/Nm^3 or as indicated)				
Combustion Technology / Fuel	**Particulate Matter (PM)**	**Sulfur Dioxide (SO_2)**	**Nitrogen Oxides (NOx)**	**Dry Gas, Excess O_2 Content (%)**
Engine				
Gas	N/A	N/A	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Liquid	50 or up to 100 if justified by project specific considerations (e.g. Economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site)	1.5 percent Sulfur or up to 3.0 percent Sulfur if justified by project specific considerations (e.g. Economic feasibility of using lower S content fuel, or adding secondary treatment to meet levels of using 1.5 percent Sulfur, and available environmental capacity of the site)	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.) If bore size diameter [mm] > or = 400: 1,850	15
Turbine				
Natural Gas =3MWth to < 15MWth	N/A	N/A	42 ppm (Electric generation) 100 ppm (Mechanical drive)	15
Natural Gas =15MWth to < 50MWth	N/A	N/A	25 ppm	15
Fuels other than Natural Gas =3MWth to < 15MWth	N/A	0.5 percent Sulfur or lower percent Sulfur (e.g. 0.2 percent Sulfur) if commercially available without significant excess fuel cost	96 ppm (Electric generation) 150 ppm (Mechanical drive)	15
Fuels other than Natural Gas =15MWth to < 50MWth	N/A	0.5% S or lower % S (0.2%S) if commercially available without significant excess fuel cost	74 ppm	15
Boiler				
Gas	N/A	N/A	320	3
Liquid	50 or up to 150 if justified by environmental assessment	2000	460	3
Solid	50 or up to 150 if justified by environmental assessment	2000	650	6

Notes: -N/A/ - no emissions guideline; Higher performance levels than these in the Table should be applicable to facilities located in urban / industrial areas with degraded airsheds or close to ecologically sensitive areas where more stringent emissions controls may be needed.; MWth is heat input on HHV basis; Solid fuels include biomass; Nm^3 is at one atmosphere pressure, 0ºC.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. Guidelines values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent.

Fugitive Sources

Fugitive source air emissions refer to emissions that are distributed spatially over a wide area and not confined to a specific discharge point. They originate in operations where exhausts are not captured and passed through a stack. Fugitive emissions have the potential for much greater ground-level impacts per unit than stationary source emissions, since they are discharged and dispersed close to the ground. The two main types of fugitive emissions are Volatile Organic Compounds (VOCs) and particulate matter (PM). Other contaminants (NO_x, SO_2 and CO) are mainly associated with combustion processes, as described above. Projects with potentially significant fugitive sources of emissions should establish the need for ambient quality assessment and monitoring practices.

Open burning of solid wastes, whether hazardous or non-hazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively.

Volatile Organic Compounds (VOCs)

The most common sources of fugitive VOC emissions are associated with industrial activities that produce, store, and use VOC-containing liquids or gases where the material is under pressure, exposed to a lower vapor pressure, or displaced from an enclosed space. Typical sources include equipment leaks, open vats and mixing tanks, storage tanks, unit operations in wastewater treatment systems, and accidental releases. Equipment leaks include valves, fittings, and elbows which are subject to leaks under pressure. The recommended prevention and control techniques for VOC emissions associated with equipment leaks include:

- Equipment modifications, examples of which are presented in Annex 1.1.4;
- Implementing a leak detection and repair (LDAR) program that controls fugitive emissions by regularly monitoring to detect leaks, and implementing repairs within a predefined time period.[18]

For VOC emissions associated with handling of chemicals in open vats and mixing processes, the recommended prevention and control techniques include:

- Substitution of less volatile substances, such as aqueous solvents;
- Collection of vapors through air extractors and subsequent treatment of gas stream by removing VOCs with control devices such as condensers or activated carbon absorption;
- Collection of vapors through air extractors and subsequent treatment with destructive control devices such as:
  - Catalytic Incinerators: Used to reduce VOCs from process exhaust gases exiting paint spray booths, ovens, and other process operations
  - Thermal Incinerators: Used to control VOC levels in a gas stream by passing the stream through a combustion chamber where the VOCs are burned in air at temperatures between 700º C to 1,300º C
  - Enclosed Oxidizing Flares: Used to convert VOCs into CO_2 and H_2O by way of direct combustion
- Use of floating roofs on storage tanks to reduce the opportunity for volatilization by eliminating the headspace present in conventional storage tanks.

Particulate Matter (PM)

The most common pollutant involved in fugitive emissions is dust or particulate matter (PM). This is released during certain operations, such as transport and open storage of solid materials, and from exposed soil surfaces, including unpaved roads.

[18] For more information, see Leak Detection and Repair Program (LDAR), at: http://www.ldar.net

Recommended prevention and control of these emissions sources include:

- Use of dust control methods, such as covers, water suppression, or increased moisture content for open materials storage piles, or controls, including air extraction and treatment through a baghouse or cyclone for material handling sources, such as conveyors and bins;
- Use of water suppression for control of loose materials on paved or unpaved road surfaces. Oil and oil by-products is not a recommended method to control road dust. Examples of additional control options for unpaved roads include those summarized in Annex 1.1.5.

Ozone Depleting Substances (ODS)

Several chemicals are classified as ozone depleting substances (ODSs) and are scheduled for phase-out under the Montreal Protocol on Substances that Deplete the Ozone Layer.[19] No new systems or processes should be installed using CFCs, halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide or HBFCs. HCFCs should only be considered as interim / bridging alternatives as determined by the host country commitments and regulations.[20]

Mobile Sources – Land-based

Similar to other combustion processes, emissions from vehicles include CO, NO_x, SO_2, PM and VOCs. Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following approach should be considered:

- Regardless of the size or type of vehicle, fleet owners / operators should implement the manufacturer recommended engine maintenance programs;
- Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits;
- Operators with fleets of 120 or more units of heavy duty vehicles (buses and trucks), or 540 or more light duty vehicles[21] (cars and light trucks) within an airshed should consider additional ways to reduce potential impacts including:
  - Replacing older vehicles with newer, more fuel efficient alternatives
  - Converting high-use vehicles to cleaner fuels, where feasible
  - Installing and maintaining emissions control devices, such as catalytic converters
  - Implementing a regular vehicle maintenance and repair program

Greenhouse Gases (GHGs)

Sectors that may have potentially significant emissions of greenhouse gases (GHGs)[22] include energy, transport, heavy industry (e.g. cement production, iron / steel manufacturing, aluminum smelting, petrochemical industries, petroleum refining, fertilizer manufacturing), agriculture, forestry and waste management. GHGs may be generated from direct emissions

[19] Examples include: chlorofluorocarbons (CFCs); halons; 1,1,1-trichloroethane (methyl chloroform); carbon tetrachloride; hydrochlorofluorocarbons (HCFCs); hydrobromofluorocarbons (HBFCs); and methyl bromide. They are currently used in a variety of applications including: domestic, commercial, and process refrigeration (CFCs and HCFCs); domestic, commercial, and motor vehicle air conditioning (CFCs and HCFCs); for manufacturing foam products (CFCs); for solvent cleaning applications (CFCs, HCFCs, methyl chloroform, and carbon tetrachloride); as aerosol propellants (CFCs); in fire protection systems (halons and HBFCs); and as crop fumigants (methyl bromide).

[20] Additional information is available through the Montreal Protocol Secretariat web site available at: http://ozone.unep.org/

[21] The selected fleet size thresholds are assumed to represent potentially significant sources of emissions based on individual vehicles traveling 100,000 km / yr using average emission factors.

[22] The six greenhouse gases that form part of the Kyoto Protocol to the United Nations Framework Convention on Climate Change include carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF_6).

from facilities within the physical project boundary and indirect emissions associated with the off-site production of power used by the project.

Recommendations for reduction and control of greenhouse gases include:

- Carbon financing;[23]
- Enhancement of energy efficiency (see section on 'Energy Conservation');
- Protection and enhancement of sinks and reservoirs of greenhouse gases;
- Promotion of sustainable forms of agriculture and forestry;
- Promotion, development and increased use of renewable forms of energy;
- Carbon capture and storage technologies;[24]
- Limitation and / or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy (coal, oil, and gas).

Monitoring

Emissions and air quality monitoring programs provide information that can be used to assess the effectiveness of emissions management strategies. A systematic planning process is recommended to ensure that the data collected are adequate for their intended purposes (and to avoid collecting unnecessary data). This process, sometimes referred to as a data quality objectives process, defines the purpose of collecting the data, the decisions to be made based on the data and the consequences of making an incorrect decision, the time and geographic boundaries, and the quality of data needed to make a correct decision.[25] The air quality monitoring program should consider the following elements:

- *Monitoring parameters*: The monitoring parameters selected should reflect the pollutants of concern associated with project processes. For combustion processes, indicator parameters typically include the quality of inputs, such as the sulfur content of fuel.
- *Baseline calculations*: Before a project is developed, baseline air quality monitoring at and in the vicinity of the site should be undertaken to assess background levels of key pollutants, in order to differentiate between existing ambient conditions and project-related impacts.
- *Monitoring type and frequency*: Data on emissions and ambient air quality generated through the monitoring program should be representative of the emissions discharged by the project over time. Examples of time-dependent variations in the manufacturing process include batch process manufacturing and seasonal process variations. Emissions from highly variable processes may need to be sampled more frequently or through composite methods. Emissions monitoring frequency and duration may also range from continuous for some combustion process operating parameters or inputs (e.g. the quality of fuel) to less frequent, monthly, quarterly or yearly stack tests.
- *Monitoring locations*: Ambient air quality monitoring may consists of off-site or fence line monitoring either by the project sponsor, the competent government agency, or by collaboration between both. The location of ambient air

[23] Carbon financing as a carbon emissions reduction strategy may include the host government-endorsed Clean Development Mechanism or Joint Implementation of the United Nations Framework Convention on Climate Change.

[24] Carbon dioxide capture and storage (CCS) is a process consisting of the separation of CO_2 from industrial and energy-related sources; transport to a storage location; and long-term isolation from the atmosphere, for example in geological formations, in the ocean, or in mineral carbonates (reaction of CO_2 with metal oxides in silicate minerals to produce stable carbonates). It is the object of intensive research worldwide (Intergovernmental Panel on Climate Change (IPCC), Special Report, Carbon Dioxide Capture and Storage (2006).

[25] See, for example, United States Environmental Protection Agency, Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4, EPA/240/B-06/001 February 2006.

quality monitoring stations should be established based on the results of scientific methods and mathematical models to estimate potential impact to the receiving airshed from an emissions source taking into consideration such aspects as the location of potentially affected communities and prevailing wind directions.

- *Sampling and analysis methods*: Monitoring programs should apply national or international methods for sample collection and analysis, such as those published by the International Organization for Standardization,[26] the European Committee for Standardization,[27] or the U.S. Environmental Protection Agency.[28] Sampling should be conducted by, or under, the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and analysis Quality Assurance / Quality Control (QA/QC) plans should be applied and documented to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). Monitoring reports should include QA/QC documentation.

Monitoring of Small Combustion Plants Emissions

- Additional recommended monitoring approaches for **boilers**:

  Boilers with capacities between =3 MWth and < 20 MWth:

  - Annual Stack Emission Testing: SO_2, NO_x and PM. For gaseous fuel-fired boilers, only NO_x. SO_2 can be calculated based on fuel quality certification if no SO_2 control equipment is used.
  - If Annual Stack Emission Testing demonstrates results consistently and significantly better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
  - Emission Monitoring: None

  Boilers with capacities between =20 MWth and < 50 MWth

  - Annual Stack Emission Testing: SO_2, NO_x and PM. For gaseous fuel-fired boilers, only NO_x. SO_2 can be calculated based on fuel quality certification (if no SO_2 control equipment is used)
  - Emission Monitoring: SO_2. Plants with SO_2 control equipment: Continuous. NO_x: Continuous monitoring of either NO_x emissions or indicative NO_x emissions using combustion parameters. PM: Continuous monitoring of either PM emissions, opacity, or indicative PM emissions using combustion parameters / visual monitoring.

- Additional recommended monitoring approaches for **turbines**:
  - Annual Stack Emission Testing: NO_x and SO_2 (NO_x only for gaseous fuel-fired turbines).
  - If Annual Stack Emission Testing results show constantly (3 consecutive years) and significantly (e.g. less than 75 percent) better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
  - Emission Monitoring: NO_x: Continuous monitoring of either NO_x emissions or indicative NO_x emissions using combustion parameters.SO_2: Continuous monitoring if SO_2 control equipment is used.

- Additional recommended monitoring approaches for **engines**:
  - Annual Stack Emission Testing: NO_x ,SO_2 and PM (NO_x only for gaseous fuel-fired diesel engines).

[26] An on-line catalogue of ISO standards relating to the environment, health protection, and safety is available at: http://www.iso.org/iso/en/CatalogueListPage.CatalogueList?ICS1=13&ICS2=&ICS3=&scopelist=

[27] An on-line catalogue of European Standards is available at: http://www.cen.eu/catweb/cwen.htm .

[28] The National Environmental Methods Index provides a searchable clearinghouse of U.S. methods and procedures for both regulatory and non-regulatory monitoring purposes for water, sediment, air and tissues, and is available at http://www.nemi.gov/.

- If Annual Stack Emission Testing results show constantly (3 consecutive years) and significantly (e.g. less than 75 percent) better than the required levels, frequency of Annual Stack Emission Testing can be reduced from annual to every two or three years.
- Emission Monitoring: NO_x: Continuous monitoring of either NO_x emissions or indicative NO_x emissions using combustion parameters. SO_2: Continuous monitoring if SO_2 control equipment is used. PM: Continuous monitoring of either PM emissions or indicative PM emissions using operating parameters.

Annex 1.1.1 – Air Emissions Estimation and Dispersion Modeling Methods

The following is a partial list of documents to aid in the estimation of air emissions from various processes and air dispersion models:

Australian Emission Estimation Technique Manuals
http://www.npi.gov.au/handbooks/

Atmospheric Emission Inventory Guidebook, UN / ECE / EMEP and the European Environment Agency
http://www.aeat.co.uk/netcen/airqual/TFEI/unece.htm

Emission factors and emission estimation methods, US EPA Office of Air Quality Planning & Standards
http://www.epa.gov/ttn/chief

Guidelines on Air Quality Models (Revised), US Environmental Protection Agency (EPA), 2005
http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

Frequently Asked Questions, Air Quality Modeling and Assessment Unit (AQMAU), UK Environment Agency
http://www.environment-agency.gov.uk/subjects/airquality/236092/?version=1&lang=_e

OECD Database on Use and Release of Industrial Chemicals
http://www.olis.oecd.org/ehs/urchem.nsf/

Annex 1.1.2 – Illustrative Point Source Air Emissions Prevention and Control Technologies

Principal Sources and Issues	General Prevention / Process Modification Approach	Control Options	Reduction Efficiency (%)	Gas Condition	Comments
Particulate Matter (PM)					
Main sources are the combustion of fossil fuels and numerous manufacturing processes that collect PM through air extraction and ventilation systems. Volcanoes, ocean spray, forest fires and blowing dust (most prevalent in dry and semiarid climates) contribute to background levels.	Fuel switching (e.g. selection of lower sulfur fuels) or reducing the amount of fine particulates added to a process.	Fabric Filters	99 - 99.7%	Dry gas, temp <400F	Applicability depends on flue gas properties including temperature, chemical properties, abrasion and load. Typical air to cloth ratio range of 2.0 to 3.5 cfm/ft^2 Achievable outlet concentrations of 23 mg/Nm^3
		Electrostatic Precipitator (ESP)	97 – 99%	Varies depending of particle type	Precondition gas to remove large particles. Efficiency dependent on resistivity of particle. Achievable outlet concentration of 23 mg/Nm^3
		Cyclone	74 – 95%	None	Most efficient for large particles. Achievable outlet concentrations of 30 - 40 mg/Nm^3
		Wet Scrubber	93 – 95%	None	Wet sludge may be a disposal problem depending on local infrastructure. Achievable outlet concentrations of 30 - 40 mg/Nm3
Sulfur Dioxide (SO_2)					
Mainly produced by the combustion of fuels such as oil and coal and as a by-product from some chemical production or wastewater treatment processes.	Control system selection is heavily dependent on the inlet concentration. For SO2 concentrations in excess of 10%, the stream is passed through an acid plant not only to lower the SO2 emissions but also to generate high grade sulfur for sale. Levels below 10% are not rich enough for this process and should therefore utilize absorption or 'scrubbing,' where SO2 molecules are captured into a liquid phase or adsorption, where SO2 molecules are captured on the surface of a solid adsorbent.	Fuel Switching	>90%		Alternate fuels may include low sulfur coal, light diesel or natural gas with consequent reduction in particulate emissions related to sulfur in the fuel. Fuel cleaning or beneficiation of fuels prior to combustion is another viable option but may have economic consequences.
		Sorbent Injection	30% - 70%		Calcium or lime is injected into the flue gas and the SO_2 is adsorbed onto the sorbent
		Dry Flue Gas Desulfurization	70%-90%		Can be regenerable or throwaway.
		Wet Flue Gas Desulfurization	>90%		Produces gypsum as a by-product

Annex 1.1.2: Illustrative Point Source Air Emissions Prevention and Control Technologies (continued)

Oxides of Nitrogen (NOx)		Percent Reduction by Fuel Type			Comments
Associated with combustion of fuel. May occur in several forms of nitrogen oxide; namely nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O), which is also a greenhouse gas. The term NOx serves as a composite between NO and NO_2 and emissions are usually reported as NOx. Here the NO is multiplied by the ratio of molecular weights of NO_2 to NO and added to the NO_2 emissions. Means of reducing NOx emissions are based on the modification of operating conditions such as minimizing the resident time at peak temperatures, reducing the peak temperatures by increasing heat transfer rates or minimizing the availability of oxygen.	**Combustion modification** (Illustrative of boilers)	**Coal**	**Oil**	**Gas**	These modifications are capable of reducing NOx emissions by 50 to 95%. The method of combustion control used depends on the type of boiler and the method of firing fuel.
	Low-excess-air firing	10–30	10–30	10–30	
	Staged Combustion	20–50	20–50	20–50	
	Flue Gas Recirculation	N/A	20–50	20–50	
	Water/Steam Injection	N/A	10–50	N/A.	
	Low-NOx Burners	30–40	30–40	30–40	
	Flue Gas Treatment	**Coal**	**Oil**	**Gas**	Flue gas treatment is more effective in reducing NOx emissions than are combustion controls. Techniques can be classified as SCR, SNCR, and adsorption. SCR involves the injection of ammonia as a reducing agent to convert NOx to nitrogen in the presence of a catalyst in a converter upstream of the air heater. Generally, some ammonia slips through and is part of the emissions. SNCR also involves the injection of ammonia or urea based products without the presence of a catalyst.
	Selective Catalytic Reduction (SCR)	60–90	60–90	60–90	
	Selective Non-Catalytic Reduction (SNCR)	N/A	30–70	30–70	

Note: Compiled by IFC based on inputs from technical experts.

Annex 1.1.3 - Good International Industry Practice (GIIP) Stack Height

(Based on United States 40 CFR, part 51.100 (ii)).

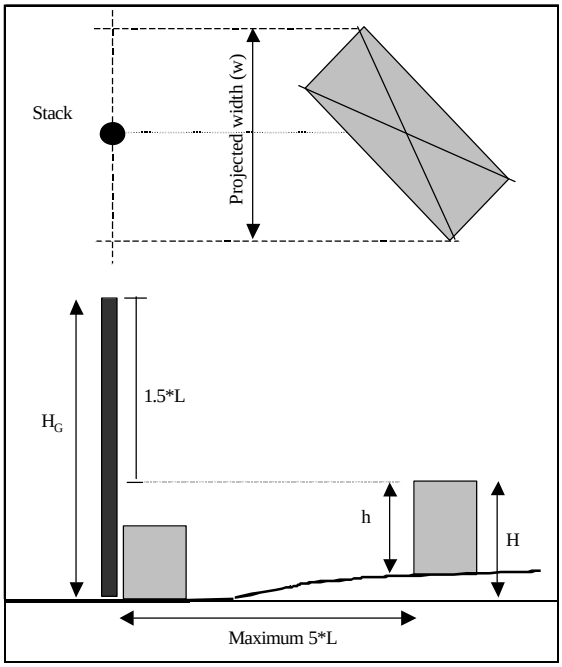
$H_G = H + 1.5L$; where

H_G = GEP stack height measured from the ground level elevation at the base of the stack

H = Height of nearby structure(s) above the base of the stack.

L = Lesser dimension, height (h) or width (w), of nearby structures

"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.



Annex 1.1.4 - Examples of VOC Emissions Controls

Equipment Type	Modification	Approximate Control Efficiency (%)
Pumps	Seal-less design	100[29]
	Closed-vent system	90[30]
	Dual mechanical seal with barrier fluid maintained at a higher pressure than the pumped fluid	100
Compressors	Closed-vent system	90
	Dual mechanical seal with barrier fluid maintained at a higher pressure than the compressed gas	100
Pressure Relief Devices	Closed-vent system	Variable[31]
	Rupture disk assembly	100
Valves	Seal-less design	100
Connectors	Weld together	100
Open-ended Lines	Blind, cap, plug, or second valve	100
Sampling Connections	Closed-loop sampling	100
Note: Examples of technologies are provided for illustrative purposes. The availability and applicability of any particular technology will vary depending on manufacturer specifications.		

29 Seal-less equipment can be a large source of emissions in the event of equipment failure.
30 Actual efficiency of a closed-vent system depends on percentage of vapors collected and efficiency of control device to which the vapors are routed.
31 Control efficiency of closed vent-systems installed on a pressure relief device may be lower than other closed-vent systems.

Annex 1.1.5 - Fugitive PM Emissions Controls

Control Type	Control Efficiency
Chemical Stabilization	0% - 98%
Hygroscopic salts Bitumens/adhesives	60% - 96%
Surfactants	0% - 68%
Wet Suppression – Watering	12% - 98%
Speed Reduction	0% - 80%
Traffic Reduction	Not quantified
Paving (Asphalt / Concrete)	85% - 99%
Covering with Gravel, Slag, or "Road Carpet"	30% - 50%
Vacuum Sweeping	0% - 58%
Water Flushing/Broom Sweeping	0% - 96%

1.2 Energy Conservation

Applicability and Approach

This guideline applies to facilities or projects that consume energy in process heating and cooling; process and auxiliary systems, such as motors, pumps, and fans; compressed air systems and heating, ventilation and air conditioning systems (HVAC); and lighting systems. It complements the industry-specific emissions guidance presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines by providing information about common techniques for energy conservation that may be applied to a range of industry sectors.

Energy management at the facility level should be viewed in the context of overall consumption patterns, including those associated with production processes and supporting utilities, as well as overall impacts associated with emissions from power sources. The following section provides guidance on energy management with a focus on common utility systems often representing technical and financially feasible opportunities for improvement in energy conservation. However, operations should also evaluate energy conservation opportunities arising from manufacturing process modifications.

Energy Management Programs

Energy management programs should include the following elements:

- Identification, and regular measurement and reporting of principal energy flows within a facility at unit process level
- Preparation of mass and energy balance;
- Definition and regular review of energy performance targets, which are adjusted to account for changes in major influencing factors on energy use
- Regular comparison and monitoring of energy flows with performance targets to identify where action should be taken to reduce energy use
- Regular review of targets, which may include comparison with benchmark data, to confirm that targets are set at appropriate levels

Energy Efficiency

For any energy-using system, a systematic analysis of energy efficiency improvements and cost reduction opportunities should include a hierarchical examination of opportunities to:

- Demand/Load Side Management by reducing loads on the energy system
- Supply Side Management by:
  - Reduce losses in energy distribution
  - Improve energy conversion efficiency
  - Exploit energy purchasing opportunities
  - Use lower-carbon fuels

Common opportunities in each of these areas are summarized below.[32]

Process Heating

Process heating is vital to many manufacturing processes, including heating for fluids, calcining, drying, heat treating, metal heating, melting, melting agglomeration, curing, and forming[33].

In process heating systems, a system heat and mass balance will show how much of the system's energy input provides true process heating, and quantify fuel used to satisfy energy losses caused by excessive parasitic loads, distribution, or conversion losses. Examination of savings opportunities should be directed by the results of the heat and mass balance, though the following techniques are often valuable and cost-effective.

Heating Load Reduction

- Ensure adequate insulation to reduce heat losses through furnace/oven etc. structure
- Recover heat from hot process or exhaust streams to reduce system loads
- In intermittently-heated systems, consider use of low thermal mass insulation to reduce energy required to heat the system structure to operating temperature
- Control process temperature and other parameters accurately to avoid, for example, overheating or overdrying
- Examine opportunities to use low weight and/or low thermal mass product carriers, such as heated shapers, kiln cars etc.
- Review opportunities to schedule work flow to limit the need for process reheating between stages
- Operate furnaces/ovens at slight positive pressure, and maintain air seals to reduce air in-leakage into the heated system, thereby reducing the energy required to heat unnecessary air to system operating temperature
- Reduce radiant heat losses by sealing structural openings and keep viewing ports closed when not in use
- Where possible, use the system for long runs close to or at operating capacity
- Consider use of high emissivity coatings of high temperature insulation, and consequent reduction in process temperature
- Near net weight and shape heat designs
- Robust Quality assurance on input material
- Robust Scheduled maintenance programs

Heat Distribution Systems

Heat distribution in process heating applications typically takes place through steam, hot water, or thermal fluid systems. Losses can be reduced through the following actions:

- Promptly repair distribution system leaks
- Avoid steam leaks despite a perceived need to get steam through the turbine. Electricity purchase is usually cheaper overall, especially when the cost to treat turbine-quality boiler feed water is included. If the heat-power ratio of the distribution process is less than that of power systems, opportunities should be considered to increase the ratio; for example, by using low-pressure steam to drive absorption cooling systems rather than using electrically-driven vapor-compression systems.
- Regularly verify correct operation of steam traps in steam systems, and ensure that traps are not bypassed. Since

[32] Additional guidance on energy efficiency is available from sources such as Natural Resources Canada (NRCAN http://oee.nrcan.gc.ca/commercial/financial-assistance/new-buildings/mnecb.cfm?attr=20); the European Union (EUROPA. http://europa.eu.int/scadplus/leg/en/s15004.htm), and United States Department of Energy (US DOE, http://www.eere.energy.gov/consumer/industry/process.html).

[33] US DOE. http://www.eere.energy.gov/consumer/industry/process.html

steam traps typically last approximately 5 years, 20% should be replaced or repaired annually

- Insulate distribution system vessels, such as hot wells and de-aerators, in steam systems and thermal fluid or hot water storage tanks
- Insulate all steam, condensate, hot water and thermal fluid distribution pipework, down to and including 1" (25 mm) diameter pipe, in addition to insulating all hot valves and flanges
- In steam systems, return condensate to the boiler house for re-use, since condensate is expensive boiler-quality water and valuable beyond its heat content alone
- Use flash steam recovery systems to reduce losses due to evaporation of high-pressure condensate
- Consider steam expansion through a back-pressure turbine rather than reducing valve stations
- Eliminate distribution system losses by adopting point-of-use heating systems

Energy Conversion System Efficiency Improvements

The following efficiency opportunities should be examined for process furnaces or ovens, and utility systems, such as boilers and fluid heaters:

- Regularly monitor CO, oxygen or CO2 content of flue gases to verify that combustion systems are using the minimum practical excess air volumes
- Consider combustion automation using oxygen-trim controls
- Minimize the number of boilers or heaters used to meet loads. It is typically more efficient to run one boiler at 90% of capacity than two at 45%. Minimize the number of boilers kept at hot–standby
- Use flue dampers to eliminate ventilation losses from hot boilers held at standby
- Maintain clean heat transfer surfaces; in steam boilers, flue gases should be no more than 20 K above steam temperature)
- In steam boiler systems, use economizers to recover heat from flue gases to pre-heat boiler feed water or combustion air
- Consider reverse osmosis or electrodialysis feed water treatment to minimize the requirement for boiler blowdown
- Adopt automatic (continuous) boiler blowdown
- Recover heat from blowdown systems through flash steam recovery or feed-water preheat
- Do not supply excessive quantities of steam to the de-aerator
- With fired heaters, consider opportunities to recover heat to combustion air through the use of recuperative or regenerative burner systems
- For systems operating for extended periods (> 6000 hours/year), cogeneration of electrical power, heat and /or cooling can be cost effective
- Oxy Fuel burners
- Oxygen enrichment/injection
- Use of turbolators in boilers
- Sizing design and use of multiple boilers for different load configurations
- Fuel quality control/fuel blending

Process Cooling

The general methodology outlined above should be applied to process cooling systems. Commonly used and cost-effective measures to improve process cooling efficiency are described below.

Load Reduction

- Ensure adequate insulation to reduce heat gains through cooling system structure and to below-ambient temperature refrigerant pipes and vessels
- Control process temperature accurately to avoid overcooling
- Operate cooling tunnels at slight positive pressure and maintain air seals to reduce air in-leakage into the cooled system, thus reducing the energy required to cool this unnecessary air to system operating temperature
- Examine opportunities to pre-cool using heat recovery to a process stream requiring heating, or by using a higher temperature cooling utility
- In cold and chill stores, minimize heat gains to the cooled space by use of air curtains, entrance vestibules, or rapidly opening/closing doors. Where conveyors carry products into chilled areas, minimize the area of transfer openings, for example, by using strip curtains
- Quantify and minimize "incidental" cooling loads, for example, those due to evaporator fans, other machinery, defrost systems and lighting in cooled spaces, circulation fans in cooling tunnels, or secondary refrigerant pumps (e.g. chilled water, brines, glycols)
- Do not use refrigeration for auxiliary cooling duties, such as compressor cylinder head or oil cooling
- While not a thermal load, ensure there is no gas bypass of the expansion valve since this imposes compressor load while providing little effective cooling
- In the case of air conditioning applications, energy efficiency techniques include:
  - Placing air intakes and air-conditioning units in cool, shaded locations
  - Improving building insulation including seals, vents, windows, and doors
  - Planting trees as thermal shields around buildings
  - Installing timers and/or thermostats and/or enthalpy-based control systems
  - Installing ventilation heat recovery systems[34]

Energy Conversion

The efficiency of refrigeration service provision is normally discussed in terms of Coefficient of Performance ("COP"), which is the ratio of cooling duty divided by input power. COP is maximized by effective refrigeration system design and increased refrigerant compression efficiency, as well as minimization of the temperature difference through which the system works and of auxiliary loads (i.e. those in addition to compressor power demand) used to operate the refrigeration system.

System Design

- If process temperatures are above ambient for all, or part, of the year, use of ambient cooling systems, such as provided by cooling towers or dry air coolers, may be appropriate, perhaps supplemented by refrigeration in summer conditions.
- Most refrigeration systems are electric-motor driven vapor compression systems using positive displacement or centrifugal compressors. The remainder of this guideline relates primarily to vapor-compression systems. However, when a cheap or free heat source is available (e.g. waste heat from an engine-driven generator—low-pressure steam

[34] More information on HVAC energy efficiency can be found at the British Columbia Building Corporation (Woolliams, 2002. http://www.greenbuildingsbc.com/new_buildings/pdf_files/greenbuild_strategies_guide.pdf), NRCAN's EnerGuide (http://oee.nrcan.gc.ca/equipment/english/index.cfm?PrintView=N&Text=N) and NRCAN's Energy Star Programs (http://oee.nrcan.gc.ca/energystar/english/consumers/heating.cfm?text=N&printview=N#AC), and the US Energy Star Program (http://www.energystar.gov/index.cfm?c=guidelines.download_guidelines).

that has passed through a back-pressure turbine), absorption refrigeration may be appropriate.

- Exploit high cooling temperature range: precooling by ambient and/or 'high temperature' refrigeration before final cooling can reduce refrigeration capital and running costs. High cooling temperature range also provides an opportunity for countercurrent (cascade) cooling, which reduces refrigerant flow needs.
- Keep 'hot' and 'cold' fluids separate, for example, do not mix water leaving the chiller with water returning from cooling circuits.
- In low-temperature systems where high temperature differences are inevitable, consider two-stage or compound compression, or economized screw compressors, rather than single-stage compression.

Minimizing Temperature Differences

A vapor-compression refrigeration system raises the temperature of the refrigerant from somewhat below the lowest process temperature (the evaporating temperature) to provide process cooling, to a higher temperature (the condensing temperature), somewhat above ambient, to facilitate heat rejection to the air or cooling water systems. Increasing evaporating temperature typically increases compressor cooling capacity without greatly affecting power consumption. Reducing condensing temperature increases evaporator cooling capacity and substantially reduces compressor power consumption.

Elevating Evaporating Temperature

- Select a large evaporator to permit relatively low temperature differences between process and evaporating temperatures. Ensure that energy use of auxiliaries (e.g. evaporator fans) does not outweigh compression savings. In air-cooling applications, a design temperature difference of 6-10 K between leaving air temperature and evaporating temperature is indicative of an appropriately sized evaporator. When cooling liquids, 2K between leaving liquid and evaporating temperatures can be achieved, though a 4K difference is generally indicative of a generously-sized evaporator.
- Keep the evaporator clean. When cooling air, ensure correct defrost operation. In liquid cooling, monitor refrigerant/process temperature differences and compare with design expectations to be alert to heat exchanger contamination by scale or oil.
- Ensure oil is regularly removed from the evaporator, and that oil additions and removals balance.
- Avoid the use of back-pressure valves.
- Adjust expansion valves to minimize suction superheat consistent with avoidance of liquid carry-over to compressors.
- Ensure that an appropriate refrigerant charge volume is present.

Reducing Condensing Temperature

- Consider whether to use air-cooled or evaporation-based cooling (e.g. evaporative or water cooled condensers and cooling towers). Air-cooled evaporators usually have higher condensing temperatures, hence higher compressor energy use, and auxiliary power consumption, especially in low humidity climates. If a wet system is used, ensure adequate treatment to prevent growth of *legionella* bacteria.
- Whichever basic system is chosen, select a relatively large condenser to minimize differences between condensing and the heat sink temperatures. Condensing temperatures with air cooled or evaporative condensers should not be more than 10K above design ambient condition, and a 4K approach in a liquid-cooled condenser is possible.

- Avoid accumulation of non-condensable gases in the condenser system. Consider the installation of refrigerated non-condensable purgers, particularly for systems operating below atmospheric pressure.
- Keep condensers clean and free from scale. Monitor refrigerant/ambient temperature differences and compare with design expectations to be alert to heat exchanger contamination.
- Avoid liquid backup, which restricts heat transfer area in condensers. This can be caused by installation errors such as concentric reducers in horizontal liquid refrigerant pipes, or "up and over" liquid lines leading from condensers.
- In multiple condenser applications, refrigerant liquid lines should be connected via drop-leg traps to the main liquid refrigerant line to ensure that hot gases flow to all condensers.
- Avoid head pressure control to the extent possible. Head pressure control maintains condensing temperature at, or near, design levels. It therefore prevents reduction in compressor power consumption, which accompanies reduced condensing temperature, by restricting condenser capacity (usually by switching off the condenser, or cooling tower fans, or restricting cooling water flow) under conditions of less severe than design load or ambient temperature conditions. Head pressure is often kept higher than necessary to facilitate hot gas defrost or adequate liquid refrigerant circulation. Use of electronic rather than thermostatic expansion valves, and liquid refrigerant pumps can permit effective refrigerant circulation at much reduced condensing temperatures.
- Site condensers and cooling towers with adequate spacing so as to prevent recirculation of hot air into the tower.

Refrigerant Compression Efficiency

- Some refrigerant compressors and chillers are more efficient than others offered for the same duty. Before purchase, identify the operating conditions under which the compressor or chiller is likely to operate for substantial parts of its annual cycle. Check operating efficiency under these conditions, and ask for estimates of annual running cost. Note that refrigeration and HVAC systems rarely run for extended periods at design conditions, which are deliberately extreme. Operational efficiency under the most commonly occurring off-design conditions is likely to be most important.
- Compressors lose efficiency when unloaded. Avoid operation of multiple compressors at part-load conditions. Note that package chillers can gain coefficient of performance (COP) when slightly unloaded, as loss of compressor efficiency can be outweighed by the benefits of reduced condensing and elevated evaporating temperature. However, it is unlikely to be energy efficient to operate a single compressor-chiller at less than 50% of capacity.
- Consider turndown efficiency when specifying chillers. Variable speed control or multiple compressor chillers can be highly efficient at part loads.
- Use of thermal storage systems (e.g., ice storage) can avoid the need for close load-tracking and, hence, can avoid part-loaded compressor operation.

Refrigeration System Auxiliaries

Many refrigeration system auxiliaries (e.g. evaporator fans and chilled water pumps) contribute to refrigeration system load, so reductions in their energy use have a double benefit. General energy saving techniques for pumps and fans, listed in the next section of these guidelines, should be applied to refrigeration auxiliaries.

Additionally, auxiliary use can be reduced by avoidance of part-load operation and in plant selection (e.g. axial fan evaporative condensers generally use less energy than equivalent centrifugal fan towers).

Under extreme off-design conditions, reduction in duty of cooling system fans and pumps can be worthwhile, usually when the lowest possible condensing pressure has been achieved.

Compressed Air Systems

Compressed air is the most commonly found utility service in industry, yet in many compressed air systems, the energy contained in compressed air delivered to the user is often 10% or less of energy used in air compression. Savings are often possible through the following techniques:

Load reduction

- Examine each true user of compressed air to identify the air volume needed and the pressure at which this should be delivered.
- Do not mix high volume low pressure and low volume high pressure loads. Decentralize low volume high-pressure applications or provide dedicated low-pressure utilities, for example, by using fans rather than compressed air.
- Review air use reduction opportunities, for example:
  - Use air amplifier nozzles rather than simple open-pipe compressed air jets
  - Consider whether compressed air is needed at all
  - Where air jets are required intermittently (e.g. to propel product), consider operating the jet via a process-related solenoid valve, which opens only when air is required
  - Use manual or automatically operated valves to isolate air supply to individual machines or zones that are not in continuous use
  - Implement systems for systematic identification and repair of leaks
  - All condensate drain points should be trapped. Do not leave drain valves continuously 'cracked open'
  - Train workers never to direct compressed air against their bodies or clothing to dust or cool themselves down.

Distribution

- Monitor pressure losses in filters and replace as appropriate
- Use adequately sized distribution pipework designed to minimize pressure losses

1.3 Wastewater and Ambient Water Quality

Applicability and Approach

This guideline applies to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or stormwater to the environment. These guidelines are also applicable to industrial discharges to sanitary sewers that discharge to the environment without any treatment. Process wastewater may include contaminated wastewater from utility operations, stormwater, and sanitary sewage. It provides information on common techniques for wastewater management, water conservation, and reuse that can be applied to a wide range of industry sectors. This guideline is meant to be complemented by the industry-specific effluent guidelines presented in the Industry Sector Environmental, Health, and Safety (EHS) Guidelines. Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or stormwater should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment.

In the context of their overall ESHS management system, facilities should:

- Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points
- Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and stormwater categories, in order to limit the volume of water requiring specialized treatment. Characteristics of individual streams may also be used for source segregation.
- Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes).
- Assess compliance of their wastewater discharges with the applicable: (i) discharge standard (if the wastewater is discharged to a surface water or sewer), and (ii) water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation).

Additionally, the generation and discharge of wastewater of any type should be managed through a combination of:

- Water use efficiency to reduce the amount of wastewater generation
- Process modification, including waste minimization, and reducing the use of hazardous materials to reduce the load of pollutants requiring treatment
- If needed, application of wastewater treatment techniques to further reduce the load of contaminants prior to discharge, taking into consideration potential impacts of cross-media transfer of contaminants during treatment (e.g., from water to air or land)

When wastewater treatment is required prior to discharge, the level of treatment should be based on:

- Whether wastewater is being discharged to a sanitary sewer system, or to surface waters
- National and local standards as reflected in permit requirements and sewer system capacity to convey and treat wastewater if discharge is to sanitary sewer
- Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater if discharge is to surface water
- Intended use of the receiving water body (e.g. as a source of drinking water, recreation, irrigation, navigation, or other)
- Presence of sensitive receptors (e.g., endangered species) or habitats
- Good International Industry Practice (GIIP) for the relevant industry sector

General Liquid Effluent Quality

Discharge to Surface Water

Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality.[35] Receiving water use[36] and assimilative capacity[37], taking other sources of discharges to the receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality. Additional considerations that should be included in the setting of project-specific performance levels for wastewater effluents include:

- Process wastewater treatment standards consistent with applicable Industry Sector EHS Guidelines. Projects for which there are no industry-specific guidelines should reference the effluent quality guidelines of an industry sector with suitably analogous processes and effluents;
- Compliance with national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 1.3.1 below;
- Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations.

Discharge to Sanitary Sewer Systems

Discharges of industrial wastewater, sanitary wastewater, wastewater from utility operations or stormwater into public or private wastewater treatment systems should:

- Meet the pretreatment and monitoring requirements of the sewer treatment system into which it discharges.
- Not interfere, directly or indirectly, with the operation and maintenance of the collection and treatment systems, or pose a risk to worker health and safety, or adversely impact

[35] An example is the US EPA National Recommended Water Quality Criteria http://www.epa.gov/waterscience/criteria/wqcriteria.html

[36] Examples of receiving water uses as may be designated by local authorities include: drinking water (with some level of treatment), recreation, aquaculture, irrigation, general aquatic life, ornamental, and navigation. Examples of health-based guideline values for receiving waters include World Health Organization (WHO) guidelines for recreational use (http://www.who.int/water_sanitation_health/dwq/guidelines/en/index.html)

[37] The assimilative capacity of the receiving water body depends on numerous factors including, but not limited to, the total volume of water, flow rate, flushing rate of the water body and the loading of pollutants from other effluent sources in the area or region. A seasonally representative baseline assessment of ambient water quality may be required for use with established scientific methods and mathematical models to estimate potential impact to the receiving water from an effluent source.

characteristics of residuals from wastewater treatment operations.

- Be discharged into municipal or centralized wastewater treatment systems that have adequate capacity to meet local regulatory requirements for treatment of wastewater generated from the project. Pretreatment of wastewater to meet regulatory requirements before discharge from the project site is required if the municipal or centralized wastewater treatment system receiving wastewater from the project does not have adequate capacity to maintain regulatory compliance.

Land Application of Treated Effluent

The quality of treated process wastewater, wastewater from utility operations or stormwater discharged on land, including wetlands, should be established based on local regulatory requirements. . Where land is used as part of the treatment system and the ultimate receptor is surface water, water quality guidelines for surface water discharges specific to the industry sector process should apply.[38] Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long term sustainability of water and land resources should be assessed when land is used as part of any wastewater treatment system.

Septic Systems

Septic systems are commonly used for treatment and disposal of domestic sanitary sewage in areas with no sewerage collection networks, Septic systems should only be used for treatment of sanitary sewage, and unsuitable for industrial wastewater treatment. When septic systems are the selected form of wastewater disposal and treatment, they should be:

- Properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater.
- Well maintained to allow effective operation.
- Installed in areas with sufficient soil percolation for the design wastewater loading rate.
- Installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

Wastewater Management

Wastewater management includes water conservation, wastewater treatment, stormwater management, and wastewater and water quality monitoring.

Industrial Wastewater

Industrial wastewater generated from industrial operations includes process wastewater, wastewater from utility operations,, runoff from process and materials staging areas, and miscellaneous activities including wastewater from laboratories, equipment maintenance shops, etc.. The pollutants in an industrial wastewater may include acids or bases (exhibited as low or high pH), soluble organic chemicals causing depletion of dissolved oxygen, suspended solids, nutrients (phosphorus, nitrogen), heavy metals (e.g. cadmium, chromium, copper, lead, mercury, nickel, zinc), cyanide, toxic organic chemicals, oily materials, and volatile materials. , as well as from thermal characteristics of the discharge (e.g., elevated temperature). Transfer of pollutants to another phase, such as air, soil, or the sub-surface, should be minimized through process and engineering controls.

Process Wastewater – – Examples of treatment approaches typically used in the treatment of industrial wastewater are summarized in Annex 1.3.1. While the choice of treatment

[38] Additional guidance on water quality considerations for land application is available in the WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Volume 2: Wastewater Use in Agriculture http://www.who.int/water_sanitation_health/wastewater/gsuweg2/en/index.html

technology is driven by wastewater characteristics, the actual performance of this technology depends largely on the adequacy of its design, equipment selection, as well as operation and maintenance of its installed facilities. Adequate resources are required for proper operation and maintenance of a treatment facility, and performance is strongly dependent on the technical ability and training of its operational staff. One or more treatment technologies may be used to achieve the desired discharge quality and to maintain consistent compliance with regulatory requirements. The design and operation of the selected wastewater treatment technologies should avoid uncontrolled air emissions of volatile chemicals from wastewaters. Residuals from industrial wastewater treatment operations should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Wastewater from Utilities Operations - Utility operations such as cooling towers and demineralization systems may result in high rates of water consumption, as well as the potential release of high temperature water containing high dissolved solids, residues of biocides, residues of other cooling system anti-fouling agents, etc. Recommended water management strategies for utility operations include:

- Adoption of water conservation opportunities for facility cooling systems as provided in the Water Conservation section below;
- Use of heat recovery methods (also energy efficiency improvements) or other cooling methods to reduce the temperature of heated water prior to discharge to ensure the discharge water temperature does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity among other considerations;
- Minimizing use of antifouling and corrosion inhibiting chemicals by ensuring appropriate depth of water intake and use of screens. Least hazardous alternatives should be used with regards to toxicity, biodegradability, bioavailability, and bioaccumulation potential. Dose applied should accord with local regulatory requirements and manufacturer recommendations;
- Testing for residual biocides and other pollutants of concern should be conducted to determine the need for dose adjustments or treatment of cooling water prior to discharge.

Stormwater Management - Stormwater includes any surface runoff and flows resulting from precipitation, drainage or other sources. Typically stormwater runoff contains suspended sediments, metals, petroleum hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), coliform, etc. Rapid runoff, even of uncontaminated stormwater, also degrades the quality of the receiving water by eroding stream beds and banks. In order to reduce the need for stormwater treatment, the following principles should be applied:

- Stormwater should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge
- Surface runoff from process areas or potential sources of contamination should be prevented
- Where this approach is not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff
- Runoff from areas without potential sources of contamination should be minimized (e.g. by minimizing the area of impermeable surfaces) and the peak discharge rate should

be reduced (e.g. by using vegetated swales and retention ponds);

- Where stormwater treatment is deemed necessary to protect the quality of receiving water bodies, priority should be given to managing and treating the first flush of stormwater runoff where the majority of potential contaminants tend to be present;
- When water quality criteria allow, stormwater should be managed as a resource, either for groundwater recharge or for meeting water needs at the facility;
- Oil water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas.
- Sludge from stormwater catchments or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Sanitary Wastewater

Sanitary wastewater from industrial facilities may include effluents from domestic sewage, food service, and laundry facilities serving site employees. Miscellaneous wastewater from laboratories, medical infirmaries, water softening etc. may also be discharged to the sanitary wastewater treatment system. Recommended sanitary wastewater management strategies include:

- Segregation of wastewater streams to ensure compatibility with selected treatment option (e.g. septic system which can only accept domestic sewage);
- Segregation and pretreatment of oil and grease containing effluents (e.g. use of a grease trap) prior to discharge into sewer systems;
- If sewage from the industrial facility is to be discharged to surface water, treatment to meet national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 1.3.1;
- If sewage from the industrial facility is to be discharged to either a septic system, or where land is used as part of the treatment system, treatment to meet applicable national or local standards for sanitary wastewater discharges is required.
- Sludge from sanitary wastewater treatment systems should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

Table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges[a]

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN[b] / 100 ml	400[a]

Notes:
[a] Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation.
[b] MPN = Most Probable Number

Emissions from Wastewater Treatment Operations

Air emissions from wastewater treatment operations may include hydrogen sulfide, methane, ozone (in the case of ozone disinfection), volatile organic compounds (e.g., chloroform generated from chlorination activities and other volatile organic compounds (VOCs) from industrial wastewater), gaseous or volatile chemicals used for disinfection processes (e.g., chlorine and ammonia), and bioaerosols. Odors from treatment facilities can also be a nuisance to workers and the surrounding community. Recommendations for the management of emissions are presented in the Air Emissions and Ambient Air Quality section of this document and in the EHS Guidelines for Water and Sanitation.

Residuals from Wastewater Treatment Operations

Sludge from a waste treatment plant needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste and managed accordingly as described in the Waste Management section of this document.

Occupational Health and Safety Issues in Wastewater Treatment Operations

Wastewater treatment facility operators may be exposed to physical, chemical, and biological hazards depending on the design of the facilities and the types of wastewater effluents managed. Examples of these hazards include the potential for trips and falls into tanks, confined space entries for maintenance operations, and inhalation of VOCs, bioaerosols, and methane, contact with pathogens and vectors, and use of potentially hazardous chemicals, including chlorine, sodium and calcium hypochlorite, and ammonia. Detailed recommendations for the management of occupational health and safety issues are presented in the relevant section of this document. Additional guidance specifically applicable to wastewater treatment systems is provided in the EHS Guidelines for Water and Sanitation.

Monitoring

A wastewater and water quality monitoring program with adequate resources and management oversight should be developed and implemented to meet the objective(s) of the monitoring program. The wastewater and water quality monitoring program should consider the following elements:

- *Monitoring parameters*: The parameters selected for monitoring should be indicative of the pollutants of concern from the process, and should include parameters that are regulated under compliance requirements;

- *Monitoring type and frequency*: Wastewater monitoring should take into consideration the discharge characteristics from the process over time. Monitoring of discharges from processes with batch manufacturing or seasonal process variations should take into consideration of time-dependent

variations in discharges and, therefore, is more complex than monitoring of continuous discharges. Effluents from highly variable processes may need to be sampled more frequently or through composite methods. Grab samples or, if automated equipment permits, composite samples may offer more insight on average concentrations of pollutants over a 24-hour period. Composite samplers may not be appropriate where analytes of concern are short-lived (e.g., quickly degraded or volatile).

- *Monitoring locations*: The monitoring location should be selected with the objective of providing representative monitoring data. Effluent sampling stations may be located at the final discharge, as well as at strategic upstream points prior to merging of different discharges. Process discharges should not be diluted prior or after treatment with the objective of meeting the discharge or ambient water quality standards.

- *Data quality*: Monitoring programs should apply internationally approved methods for sample collection, preservation and analysis. Sampling should be conducted by or under the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and Analysis Quality Assurance/Quality Control (QA/QC) plans should be prepared and, implemented. QA/QC documentation should be included in monitoring reports.

Annex 1.3.1 - Examples of Industrial Wastewater Treatment Approaches

Pollutant/Parameter	Control Options / Principle	Common End of Pipe Control Technology
pH	Chemical, Equalization	Acid/Base addition, Flow equalization
Oil and Grease / TPH	Phase separation	Dissolved Air Floatation, oil water separator, grease trap
TSS - Settleable	Settling, Size Exclusion	Sedimentation basin, clarifier, centrifuge, screens
TSS - Non-Settleable	Floatation, Filtration - traditional and tangential	Dissolved air floatation, Multimedia filter, sand filter, fabric filter, ultrafiltration, microfiltration
Hi - BOD (> 2 Kg/m^3)	Biological - Anaerobic	Suspended growth, attached growth, hybrid
Lo - BOD (< 2 Kg/m^3)	Biological - Aerobic, Facultative	Suspended growth, attached growth, hybrid
COD - Non-Biodegradable	Oxidation, Adsorption, Size Exclusion	Chemical oxidation, Thermal oxidation, Activated Carbon, Membranes
Metals - Particulate and Soluble	Coagulation, flocculation, precipitation, size exclusion	Flash mix with settling, filtration - traditional and tangential
Inorganics / Non-metals	Coagulation, flocculation, precipitation, size exclusion, Oxidation, Adsorption	Flash mix with settling, filtration - traditional and tangential, Chemical oxidation, Thermal oxidation, Activated Carbon, Reverse Osmosis, Evaporation
Organics - VOCs and SVOCs	Biological - Aerobic, Anaerobic, Facultative; Adsorption, Oxidation	Biological : Suspended growth, attached growth, hybrid; Chemical oxidation, Thermal oxidation, Activated Carbon
Emissions – Odors and VOCs	Capture – Active or Passive; Biological; Adsorption, Oxidation	Biological : Attached growth; Chemical oxidation, Thermal oxidation, Activated Carbon
Nutrients	Biological Nutrient Removal, Chemical, Physical, Adsorption	Aerobic/Anoxic biological treatment, chemical hydrolysis and air stripping, chlorination, ion exchange
Color	Biological - Aerobic, Anaerobic, Facultative; Adsorption, Oxidation	Biological Aerobic, Chemical oxidation, Activated Carbon
Temperature	Evaporative Cooling	Surface Aerators, Flow Equalization
TDS	Concentration, Size Exclusion	Evaporation, crystallization, Reverse Osmosis
Active Ingredients/Emerging Contaminants	Adsorption, Oxidation, Size Exclusion, Concentration	Chemical oxidation, Thermal oxidation, Activated Carbon, Ion Exchange, Reverse Osmosis, Evaporation, Crystallization
Radionuclides	Adsorption,Size Exclusion, Concentration	Ion Exchange, Reverse Osmosis, Evaporation, Crystallization
Pathogens	Disinfection, Sterilization	Chlorine, Ozone, Peroxide, UV, Thermal
Toxicity	Adsorption, Oxidation, Size Exclusion, Concentration	Chemical oxidation, Thermal oxidation, Activated Carbon, Evaporation, crystallization, Reverse Osmosis

1.4 Water Conservation

Applicability and Approach

Water conservation programs should be implemented commensurate with the magnitude and cost of water use. These programs should promote the continuous reduction in water consumption and achieve savings in the water pumping, treatment and disposal costs. Water conservation measures may include water monitoring/management techniques; process and cooling/heating water recycling, reuse, and other techniques; and sanitary water conservation techniques.

General recommendations include:

- Storm/Rainwater harvesting and use
- Zero discharge design/Use of treated waste water to be included in project design processes
- Use of localized recirculation systems in plant/facility/shops (as opposed to centralized recirculation system), with provision only for makeup water
- Use of dry process technologies e.g. dry quenching
- Process water system pressure management
- Project design to have measures for adequate water collection, spill control and leakage control system

Water Monitoring and Management

The essential elements of a water management program involve:

- Identification, regular measurement, and recording of principal flows within a facility;
- Definition and regular review of performance targets, which are adjusted to account for changes in major factors affecting water use (e.g. industrial production rate);
- Regular comparison of water flows with performance targets to identify where action should be taken to reduce water use.

Water measurement (metering) should emphasize areas of greatest water use. Based on review of metering data, 'unaccounted' use–indicating major leaks at industrial facilities–could be identified.

Process Water Reuse and Recycling

Opportunities for water savings in industrial processes are highly industry-specific. However, the following techniques have all been used successfully, and should be considered in conjunction with the development of the metering system described above.

- *Washing Machines:* Many washing machines use large quantities of hot water. Use can increase as nozzles become enlarged due to repeated cleaning and /or wear. Monitor machine water use, compare with specification, and replace nozzles when water and heat use reaches levels warranting such work.
- *Water reuse:* Common water reuse applications include countercurrent rinsing, for example in multi-stage washing

and rinsing processes, or reusing waste water from one process for another with less exacting water requirements. For example, using bleaching rinse water for textile washing, or bottle-washer rinse water for bottle crate washing, or even washing the floor. More sophisticated reuse projects requiring treatment of water before reuse are also sometimes practical.

- *Water jets/sprays:* If processes use water jets or sprays (e.g. to keep conveyors clean or to cool product) review the accuracy of the spray pattern to prevent unnecessary water loss.
- *Flow control optimization:* Industrial processes sometimes require the use of tanks, which are refilled to control losses. It is often possible to reduce the rate of water supply to such tanks, and sometimes to reduce tank levels to reduce spillage. If the process uses water cooling sprays, it may be possible to reduce flow while maintaining cooling performance. Testing can determine the optimum balance.
    - If hoses are used in cleaning, use flow controls to restrict wasteful water flow
    - Consider the use of high pressure, low volume cleaning systems rather than using large volumes of water sprayed from hosepipes
    - Using flow timers and limit switches to control water use
    - Using 'clean-up' practices rather than hosing down

Building Facility Operations

Consumption of building and sanitary water is typically less than that used in industrial processes. However, savings can readily be identified, as outlined below:

- Compare daily water use per employee to existing benchmarks taking into consideration the primary use at the facility, whether sanitary or including other activities such as showering or catering
- Regularly maintain plumbing, and identify and repair leaks
- Shut off water to unused areas
- Install self-closing taps, automatic shut-off valves, spray nozzles, pressure reducing valves, and water conserving fixtures (e.g. low flow shower heads, faucets, toilets, urinals; and spring loaded or sensored faucets)
- Operate dishwashers and laundries on full loads, and only when needed
- Install water-saving equipment in lavatories, such as low-flow toilets

Cooling Systems

Water conservation opportunities in cooling systems include:

- Use of closed circuit cooling systems with cooling towers rather than once-through cooling systems
- Limiting condenser or cooling tower blowdown to the minimum required to prevent unacceptable accumulation of dissolved solids
- Use of air cooling rather than evaporative cooling, although this may increase electricity use in the cooling system
- Use of treated waste water for cooling towers
- Reusing/recycling cooling tower blowdown

Heating Systems

Heating systems based on the circulation of low or medium pressure hot water (which do not consume water) should be closed. If they do consume water, regular maintenance should be conducted to check for leaks. However, large quantities of water may be used by steam systems, and this can be reduced by the following measures:

- Repair of steam and condensate leaks, and repair of all failed steam traps
- Return of condensate to the boilerhouse, and use of heat exchangers (with condensate return) rather than direct steam injection where process permits
- Flash steam recovery
- Minimizing boiler blowdown consistent with maintaining acceptably low dissolved solids in boiler water. Use of reverse osmosis boiler feed water treatment substantially reduces the need for boiler blowdown
- Minimizing deaerator heating

1.5 Hazardous Materials Management

Applicability and Approach

These guidelines apply to projects that use, store, or handle any quantity of hazardous materials (Hazmats), defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. Hazmats can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; radioactive material; and corrosive substances. Guidance on the transport of hazardous materials is covered in Section 3 of this document.

When a hazardous material is no longer usable for its original purpose and is intended for disposal, but still has hazardous properties, it is considered a *hazardous waste* (see Section 1.4).

This guidance is intended to be applied in conjunction with traditional occupational health and safety and emergency preparedness programs which are included in Section 2.0 on Occupational Health and Safety Management, and Section 3.7 on Emergency Preparedness and Response. Guidance on the Transport of Hazardous Materials is provided in Section 3.5.

This section is divided into two main subsections:

General Hazardous Materials Management: Guidance applicable to all projects or facilities that handle or store any quantity of hazardous materials.

Management of Major Hazards: Additional guidance for projects or facilities that store or handle hazardous materials at, or above, threshold quantities[39], and thus require special treatment to prevent accidents such as fire, explosions, leaks or spills, and to prepare and respond to emergencies.

The overall objective of hazardous materials management is to avoid or, when avoidance is not feasible, minimize uncontrolled releases of hazardous materials or accidents (including explosion and fire) during their production, handling, storage and use. This objective can be achieved by:

[39] For examples, threshold quantities should be those established for emergency planning purposes such as provided in the US Environmental Protection Agency. *Protection of Environment* (Title Threshold quantities are provided in the US Environmental Protection Agency. *Protection of Environment* (Title 40 CFR Parts 68, 112, and 355).

- Establishing hazardous materials management priorities based on hazard analysis of risky operations identified through Social and Environmental Assessment;
- Where practicable, avoiding or minimizing the use of hazardous materials. For example, non-hazardous materials have been found to substitute asbestos in building materials, PCBs in electrical equipment, persistent organic pollutants (POPs) in pesticides formulations, and ozone depleting substances in refrigeration systems;
- Preventing uncontrolled releases of hazardous materials to the environment or uncontrolled reactions that might result in fire or explosion;
- Using engineering controls (containment, automatic alarms, and shut-off systems) commensurate with the nature of hazard;
- Implementing management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been prevented or controlled through engineering measures.

General Hazardous Materials Management

Projects which manufacture, handle, use, or store hazardous materials should establish management programs that are commensurate with the potential risks present. The main objectives of projects involving hazardous materials should be the protection of the workforce and the prevention and control of releases and accidents. These objectives should be addressed by integrating prevention and control measures, management actions, and procedures into day-to-day business activities. Potentially applicable elements of a management program include the following:

Hazard Assessment

The level of risk should be established through an on-going assessment process based on:

- The types and amounts of hazardous materials present in the project. This information should be recorded and should include a summary table with the following information:
  - Name and description (e.g. composition of a mixture) of the Hazmat
  - Classification (e.g. code, class or division) of the Hazmat
  - Internationally accepted regulatory reporting threshold quantity or national equivalent[40] of the Hazmat
  - Quantity of Hazmat used per month
  - Characteristic(s) that make(s) the Hazmat hazardous (e.g. flammability, toxicity)
- Analysis of potential spill and release scenarios using available industry statistics on spills and accidents where available
- Analysis of the potential for uncontrolled reactions such as fire and explosions
- Analysis of potential consequences based on the physical-geographical characteristics of the project site, including aspects such as its distance to settlements, water resources, and other environmentally sensitive areas

Hazard assessment should be performed by specialized professionals using internationally-accepted methodologies such as Hazardous Operations Analysis (HAZOP), Failure Mode and Effects Analysis (FMEA), and Hazard Identification (HAZID).

Management Actions

The management actions to be included in a Hazardous Materials Management Plan should be commensurate with the level of

[40] Threshold quantities are provided in the US Environmental Protection Agency. *Protection of Environment* (Title 40 CFR Parts 68, 112, and 355).

potential risks associated with the production, handling, storage, and use of hazardous materials.

Release Prevention and Control Planning

Where there is risk of a spill of uncontrolled hazardous materials, facilities should prepare a spill control, prevention, and countermeasure plan as a specific component of their Emergency Preparedness and Response Plan (described in more detail in Section 3.7). The plan should be tailored to the hazards associated with the project, and include:

- Training of operators on release prevention, including drills specific to hazardous materials as part of emergency preparedness response training
- Implementation of inspection programs to maintain the mechanical integrity and operability of pressure vessels, tanks, piping systems, relief and vent valve systems, containment infrastructure, emergency shutdown systems, controls and pumps, and associated process equipment
- Preparation of written Standard Operating Procedures (SOPs) for filling USTs, ASTs or other containers or equipment as well as for transfer operations by personnel trained in the safe transfer and filling of the hazardous material, and in spill prevention and response
- SOPs for the management of secondary containment structures, specifically the removal of any accumulated fluid, such as rainfall, to ensure that the intent of the system is not accidentally or willfully defeated
- Identification of locations of hazardous materials and associated activities on an emergency plan site map
- Documentation of availability of specific personal protective equipment and training needed to respond to an emergency
- Documentation of availability of spill response equipment sufficient to handle at least initial stages of a spill and a list of external resources for equipment and personnel, if necessary, to supplement internal resources
- Description of response activities in the event of a spill, release, or other chemical emergency including:
  - Internal and external notification procedures
  - Specific responsibilities of individuals or groups
  - Decision process for assessing severity of the release, and determining appropriate actions
  - Facility evacuation routes
  - Post-event activities such as clean-up and disposal, incident investigation, employee re-entry, and restoration of spill response equipment.

Occupational Health and Safety

The Hazardous Materials Management Plan should address applicable, essential elements of occupational health and safety management as described in Section 2.0 on Occupational Health and Safety, including:

- Job safety analysis to identify specific potential occupational hazards and industrial hygiene surveys, as appropriate, to monitor and verify chemical exposure levels, and compare with applicable occupational exposure standards[41]
- Hazard communication and training programs to prepare workers to recognize and respond to workplace chemical hazards. Programs should include aspects of hazard identification, safe operating and materials handling procedures, safe work practices, basic emergency procedures, and special hazards unique to their jobs.

[41] Including: Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®), American Conference of Governmental Industrial Hygienists (ACGIH), http://www.acgih.org/TLV/; U.S. National Institute for Occupational Health and Safety (NIOSH), http://www.cdc.gov/niosh/npg/; Permissible Exposure Limits (PELs), U.S. Occupational Safety and Health Administration (OSHA), http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992; Indicative Occupational Exposure Limit Values, European Union, http://europe.osha.eu.int/good_practice/risks/ds/oel/; and other similar sources.

Training should incorporate information from Material Safety Data Sheets[42] (MSDSs) for hazardous materials being handled. MSDSs should be readily accessible to employees in their local language.

- Definition and implementation of permitted maintenance activities, such as hot work or confined space entries
- Provision of suitable personal protection equipment (PPE) (footwear, masks, protective clothing and goggles in appropriate areas), emergency eyewash and shower stations, ventilation systems, and sanitary facilities
- Monitoring and record-keeping activities, including audit procedures designed to verify and record the effectiveness of prevention and control of exposure to occupational hazards, and maintaining accident and incident investigation reports on file for a period of at least five years

Process Knowledge and Documentation

The Hazardous Materials Management Plan should be incorporated into, and consistent with, the other elements of the facility ES/OHS MS and include:

- Written process safety parameters (i.e., hazards of the chemical substances, safety equipment specifications, safe operation ranges for temperature, pressure, and other applicable parameters, evaluation of the consequences of deviations, etc.)
- Written operating procedures
- Compliance audit procedures

[42] MSDSs are produced by the manufacturer, but might not be prepared for chemical intermediates that are not distributed in commerce. In these cases, employers still need to provide workers with equivalent information.

Preventive Measures

Hazardous Materials Transfer

Uncontrolled releases of hazardous materials may result from small cumulative events, or from more significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. Recommended practices to prevent hazardous material releases from processes include:

- Use of dedicated fittings, pipes, and hoses specific to materials in tanks (e.g., all acids use one type of connection, all caustics use another), and maintaining procedures to prevent addition of hazardous materials to incorrect tanks
- Use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure safe transfer
- Regular inspection, maintenance and repair of fittings, pipes and hoses
- Provision of secondary containment, drip trays or other overflow and drip containment measures, for hazardous materials containers at connection points or other possible overflow points.

Overfill Protection

Overfills of vessels and tanks should be prevented as they are among the most common causes of spills resulting in soil and water contamination, and among the easiest to prevent. Recommended overfill protection measures include:

- Prepare written procedures for transfer operations that includes a checklist of measures to follow during filling operations and the use of filling operators trained in these procedures
- Installation of gauges on tanks to measure volume inside
- Use of dripless hose connections for vehicle tank and fixed connections with storage tanks

- Provision of automatic fill shutoff valves on storage tanks to prevent overfilling
- Use of a catch basin around the fill pipe to collect spills
- Use of piping connections with automatic overfill protection (float valve)
- Pumping less volume than available capacity into the tank or vessel by ordering less material than its available capacity
- Provision of overfill or over pressure vents that allow controlled release to a capture point

Reaction, Fire, and Explosion Prevention

Reactive, flammable, and explosive materials should also be managed to avoid uncontrolled reactions or conditions resulting in fire or explosion. Recommended prevention practices include:

- Storage of incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) in separate areas, and with containment facilities separating material storage areas
- Provision of material-specific storage for extremely hazardous or reactive materials
- Use of flame arresting devices on vents from flammable storage containers
- Provision of grounding and lightning protection for tank farms, transfer stations, and other equipment that handles flammable materials
- Selection of materials of construction compatible with products stored for all parts of storage and delivery systems, and avoiding reuse of tanks for different products without checking material compatibility
- Storage of hazardous materials in an area of the facility separated from the main production works. Where proximity is unavoidable, physical separation should be provided using structures designed to prevent fire, explosion, spill, and other emergency situations from affecting facility operations
- Prohibition of all sources of ignition from areas near flammable storage tanks

Control Measures

Secondary Containment (Liquids)

A critical aspect for controlling accidental releases of liquid hazardous materials during storage and transfer is the provision of secondary containment. It is not necessary for secondary containment methods to meet long term material compatibility as with primary storage and piping, but their design and construction should hold released materials effectively until they can be detected and safely recovered. Appropriate secondary containment structures consist of berms, dikes, or walls capable of containing the larger of 110 percent of the largest tank or 25% percent of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters and will be made of impervious, chemically resistant material. Secondary containment design should also consider means to prevent contact between incompatible materials in the event of a release.

Other secondary containment measures that should be applied depending on site-specific conditions include:

- Transfer of hazardous materials from vehicle tanks to storage in areas with surfaces sufficiently impervious to avoid loss to the environment and sloped to a collection or a containment structure not connected to municipal wastewater/stormwater collection system
- Where it is not practical to provide permanent, dedicated containment structures for transfer operations, one or more alternative forms of spill containment should be provided, such as portable drain covers (which can be deployed for the duration of the operations), automatic shut-off valves on storm water basins, or shut off valves in drainage or sewer facilities, combined with oil-water separators

- Storage of drummed hazardous materials with a total volume equal or greater than 1,000 liters in areas with impervious surfaces that are sloped or bermed to contain a minimum of 25 percent of the total storage volume
- Provision of secondary containment for components (tanks, pipes) of the hazardous material storage system, to the extent feasible
- Conducting periodic (e.g. daily or weekly) reconciliation of tank contents, and inspection of visible portions of tanks and piping for leaks;
- Use of double-walled, composite, or specially coated storage and piping systems particularly in the use of underground storage tanks (USTs) and underground piping. If double-walled systems are used, they should provide a means of detecting leaks between the two walls.

Storage Tank and Piping Leak Detection

Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations[43]. Leak detection is especially important in situations where secondary containment is not feasible or practicable, such as in long pipe runs. Acceptable leak detection methods include:

- Use of automatic pressure loss detectors on pressurized or long distance piping
- Use of approved or certified integrity testing methods on piping or tank systems, at regular intervals
- Considering the use of SCADA[44] if financially feasible

[43] High-risk locations are places where the release of product from the storage system could result in the contamination of drinking water source or those located in water resource protection areas as designated by local authorities.

[44] Supervisory Control and Data Acquisition

Underground Storage Tanks (USTs)[45]

Although there are many environmental and safety advantages of underground storage of hazardous materials, including reduced risk of fire or explosion, and lower vapor losses into the atmosphere, leaks of hazardous materials can go undetected for long periods of time with potential for soil and groundwater contamination. Examples of techniques to manage these risks include:

- Avoiding use of USTs for storage of highly soluble organic materials
- Assessing local soil corrosion potential, and installing and maintaining cathodic protection (or equivalent rust protection) for steel tanks
- For new installations, installing impermeable liners or structures (e.g., concrete vaults) under and around tanks and lines that direct any leaked product to monitoring ports at the lowest point of the liner or structure
- Monitoring the surface above any tank for indications of soil movement
- Reconciling tank contents by measuring the volume in store with the expected volume, given the stored quantity at last stocking, and deliveries to and withdrawals from the store
- Testing integrity by volumetric, vacuum, acoustic, tracers, or other means on all tanks at regular intervals
- Considering the monitoring groundwater of quality down gradient of locations where multiple USTs are in use
- Evaluating the risk of existing UST in newly acquired facilities to determine if upgrades are required for USTs that will be continued to be used, including replacement with new systems or permanent closure of abandoned USTs.

  Ensuring that new USTs are sited away from wells,

[45] Additional details on the management of USTs is provided in the EHS Guidelines for Retail Petroleum Stations.

reservoirs and other source water protection areas and floodplains, and maintained so as to prevent corrosion.

Management of Major Hazards

In addition to the application of the above-referenced guidance on prevention and control of releases of hazardous materials, projects involving production, handling, and storage of hazardous materials *at or above threshold limits*[46] should prepare a Hazardous Materials Risk Management Plan, in the context of its overall ES/OHS MS, containing all of the elements presented below.[47] The objective of this guidance is the prevention and control of catastrophic releases of toxic, reactive, flammable, or explosive chemicals that may result in toxic, fire, or explosion hazards.[48]

Management Actions

- *Management of Change:* These procedures should address:
  - The technical basis for changes in processes and operations
  - The impact of changes on health and safety
  - Modification to operating procedures
  - Authorization requirements
  - Employees affected
  - Training needs
- *Compliance Audit*: A compliance audit is a way to evaluate compliance with the prevention program requirements for each process. A compliance audit covering each element of the prevention measures (see below) should be conducted at least every three years and should include:
  - Preparation of a report of the findings
  - Determination and documentation of the appropriate response to each finding
  - Documentation that any deficiency has been corrected
- *Incident Investigation:* Incidents can provide valuable information about site hazards and the steps needed to prevent accidental releases. An incident investigation mechanism should include procedures for:
  - Initiation of the investigation promptly
  - Summarizing the investigation in a report
  - Addressing the report findings and recommendations
  - A review of the report with staff and contractors
- *Employee Participation:* A written plan of action should describe an active employee participation program for the prevention of accidents.
- *Contractors:* There should be a mechanism for contractor control which should include a requirement for them to develop hazard materials management procedures that meet the requirements of the hazardous materials management plan. Their procedures should be consistent with those of the contracting company and the contractor workforce should undergo the same training. Additionally, procedures should require that contractors are:
  - Provided with safety performance procedures and safety and hazard information
  - Observe safety practices
  - Act responsibly
  - Have access to appropriate training for their employees
  - Ensure that their employees know process hazards and applicable emergency actions

[46] Threshold quantities should be those established for emergency planning purposes such as provided in the US Environmental Protection Agency. *Protection of Environment* (Title 40 CFR Parts 300-399 and 700 to 789).

[47] For further information and guidance, please refer to International Finance Corporation (IFC) Hazardous Materials Risk Management Manual. Washington, D.C. December 2000.

[48] The approach to the management of major hazards is largely based on an approach to Process Safety Management developed by the American Institute of Chemical Engineers.

- Prepare and submit training records for their employees to the contracting company
- Inform their employees about the hazards presented by their work
- Assess trends of repeated similar incidents
- Develop and implement procedures to manage repeated similar incidents

- *Training*: Project employees should be provided training on Hazmat management. The training program should include:
  - A list of employees to be trained
  - Specific training objectives
  - Mechanisms to achieve the objectives (i.e., hands-on workshops, videos, etc.)
  - The means to determine whether the training program is effective
  - Training procedures for new hires and refresher courses for existing employees

Preventive Measures

The purpose of preventive measures is to ensure that safety-related aspects of the process and equipment are considered, limits to be placed on the operations are well known, and accepted standards and codes are adopted, where they apply.

- *Process Safety Information:* Procedures should be prepared for each hazardous materials and include:
  - Compilation of Material Safety Data Sheets (MSDS)
  - Identification of maximum intended inventories and safe upper/lower parameters
  - Documentation of equipment specifications and of codes and standards used to design, build and operate the process
- *Operating Procedures:* SOPs should be prepared for each step of all processes or operations within the project (e.g. initial startup, normal operations, temporary operations, emergency shutdown, emergency operations, normal shutdown, and start-up following a normal or emergency shutdown or major change). These SOPs should include special considerations for Mazmats used in the process or operations (e.g. temperature control to prevent emissions of a volatile hazardous chemical; diversion of gaseous discharges of hazardous pollutants from the process to a temporary storage tank in case of emergency).

Other procedures to be developed include impacts of deviations, steps to avoid deviations, prevention of chemical exposure, exposure control measures, and equipment inspections.

Mechanical Integrity of process equipment, piping and instrumentation: Inspection and maintenance procedures should be developed and documented to ensure mechanical integrity of equipment, piping, and instrumentation and prevent uncontrolled releases of hazardous materials from the project. These procedures should be included as part of the project SOPs. The specific process components of major interest include pressure vessels and storage tanks, piping systems, relief and vent systems and devices, emergency shutdown systems, controls, and pumps. Recommended aspects of the inspection and maintenance program include:

- Developing inspection and maintenance procedures
- Establishing a quality assurance plan for equipment, maintenance materials, and spare parts
- Conducting employee training on the inspection and maintenance procedures
- Conducting equipment, piping, and instrumentation inspections and maintenance
- Identifying and correcting identified deficiencies

- Evaluating the inspection and maintenance results and, if necessary, updating the inspection and maintenance procedures
- Reporting the results to management.

- *Hot Work Permit:* Hot work operations – such as brazing, torch-cutting, grinding, soldering, and welding – are associated with potential health, safety, and property hazards resulting from the fumes, gases, sparks, and hot metal and radiant energy produced during hot work. Hot work permit is required for any operation involving open flames or producing heat and/or sparks. The section of SOPs on hot work should include the responsibility for hot work permitting, personal protection equipment (PPE), hot work procedures, personnel training, and recordkeeping.
- *Pre-Start Review:* Procedures should be prepared to carry out pre-start reviews when a modification is significant enough to require a change in safety information under the management of change procedure. The procedures should:
  - Confirm that the new or modified construction and/or equipment meet design specifications
  - Ensure that procedures for safety, operation, maintenance, and emergency are adequate
  - Include a process hazard assessment, and resolve or implement recommendations for new process
  - Ensure that training for all affected employees is being conducted

Emergency Preparedness and Response

When handling hazardous materials, procedures and practices should be developed allowing for quick and efficient responses to accidents that could result in human injury or damage to the environment. An Emergency Preparedness and Response Plan, incorporated into and consistent with, the facility's overall ES/OHS MS, should be prepared to cover the following:[49]

- *Planning Coordination:* Procedures should be prepared for:
  - Informing the public and emergency response agencies
  - Documenting first aid and emergency medical treatment
  - Taking emergency response actions
  - Reviewing and updating the emergency response plan to reflect changes, and ensuring that employees are informed of such changes
- *Emergency Equipment:* Procedures should be prepared for using, inspecting, testing, and maintaining the emergency response equipment.
- *Training:* Employees and contractors should be trained on emergency response procedures.

Community Involvement and Awareness

When hazardous materials are in use above threshold quantities, the management plan should include a system for community awareness, notification and involvement that should be commensurate with the potential risks identified for the project during the hazard assessment studies. This should include mechanisms for sharing the results of hazard and risk assessment studies in a timely, understandable and culturally sensitive manner with potentially affected communities that provides a means for public feedback. Community involvement activities should include:

- Availability of general information to the potentially affected community on the nature and extent of project operations, and the prevention and control measures in place to ensure no effects to human health

[49] For a comprehensive treatment of the development of emergency response plans in conjunction with communities refer to the Awareness and Preparedness for Emergencies at Local Level (APELL) Guidelines available at: http://www.uneptie.org/pc/apell/publications/handbooks.html

- The potential for off-site effects to human health or the environment following an accident at planned or existing hazardous installations
- Specific and timely information on appropriate behavior and safety measures to be adopted in the event of an accident including practice drills in locations with higher risks
- Access to information necessary to understand the nature of the possible effect of an accident and an opportunity to contribute effectively, as appropriate, to decisions concerning hazardous installations and the development of community emergency preparedness plans.

1.6 Waste Management

Applicability and Approach

These guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It is not intended to apply to projects or facilities where the primary business is the collection, transportation, treatment, or disposal of wastes. Specific guidance for these types of facilities is presented in the Environmental Health and Safety (EHS) Guidelines for Waste Management Facilities.

A *waste* is any solid, liquid, or contained gaseous material that is being discarded by disposal, recycling, burning or incineration. It can be byproduct of a manufacturing process or an obsolete commercial product that can no longer be used for intended purpose and requires disposal.

Solid (non-hazardous) wastes generally include any garbage, refuse. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste); and residual waste from industrial operations, such as boiler slag, clinker, and fly ash.

Hazardous waste shares the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as "hazardous" by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics.

Sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial operations needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste.

Facilities that generate and store wastes should practice the following:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste

- Where waste can not be recovered or reused, treating, destroying, and disposing of it in an environmentally sound manner

General Waste Management

The following guidance applies to the management of non-hazardous and hazardous waste. Additional guidance specifically applicable to hazardous wastes is presented below. Waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring.

Waste Management Planning

Facilities that generate waste should characterize their waste according to composition, source, types of wastes produced, generation rates, or according to local regulatory requirements. Effective planning and implementation of waste management strategies should include:

- Review of new waste sources during planning, siting, and design activities, including during equipment modifications and process alterations, to identify expected waste generation, pollution prevention opportunities, and necessary treatment, storage, and disposal infrastructure
- Collection of data and information about the process and waste streams in existing facilities, including characterization of waste streams by type, quantities, and potential use/disposition
- Establishment of priorities based on a risk analysis that takes into account the potential EHS risks during the waste cycle and the availability of infrastructure to manage the waste in an environmentally sound manner
- Definition of opportunities for source reduction, as well as reuse and recycling
- Definition of procedures and operational controls for on-site storage
- Definition of options / procedures / operational controls for treatment and final disposal

Waste Prevention

Processes should be designed and operated to prevent, or minimize, the quantities of wastes generated and hazards associated with the wastes generated in accordance with the following strategy:

- Substituting raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volumes
- Applying manufacturing process that convert materials efficiently, providing higher product output yields, including modification of design of the production process, operating conditions, and process controls[50]
- Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs
- Instituting procurement measures that recognize opportunities to return usable materials such as containers and which prevents the over ordering of materials
- Minimizing hazardous waste generation by implementing stringent waste segregation to prevent the commingling of non-hazardous and hazardous waste to be managed

[50] Examples of waste prevention strategies include the concept of Lean Manufacturing found at http://www.epa.gov/epaoswer/hazwaste/minimize/lean.htm

Recycling and Reuse

In addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans, which should consider the following elements:

- Evaluation of waste production processes and identification of potentially recyclable materials
- Identification and recycling of products that can be reintroduced into the manufacturing process or industry activity at the site
- Investigation of external markets for recycling by other industrial processing operations located in the neighborhood or region of the facility (e.g., waste exchange)
- Establishing recycling objectives and formal tracking of waste generation and recycling rates
- Providing training and incentives to employees in order to meet objectives

Treatment and Disposal

If waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed of and all measures should be taken to avoid potential impacts to human health and the environment. Selected management approaches should be consistent with the characteristics of the waste and local regulations, and may include one or more of the following:

- On-site or off-site biological, chemical, or physical treatment of the waste material to render it non-hazardous prior to final disposal
- Treatment or disposal at permitted facilities specially designed to receive the waste. Examples include: composting operations for organic non-hazardous wastes; properly designed, permitted and operated landfills or incinerators designed for the respective type of waste; or other methods known to be effective in the safe, final disposal of waste materials such as bioremediation.

Hazardous Waste Management

Hazardous wastes should always be segregated from non-hazardous wastes. If generation of hazardous waste can not be prevented through the implementation of the above general waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles:

- Understanding potential impacts and risks associated with the management of any generated hazardous waste during its complete life cycle
- Ensuring that contractors handling, treating, and disposing of hazardous waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled
- Ensuring compliance with applicable local and international regulations[51]

Waste Storage

Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where:

[51] International requirements may include host-country commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their disposal (http://www.basel.int/) and Rotterdam Convention on the prior Inform Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (http://www.pic.int/)

- Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs
- Store in closed containers away from direct sunlight, wind and rain
- Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment
- Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location
- Provide adequate ventilation where volatile wastes are stored.

Hazardous waste storage activities should also be subject to special management actions, conducted by employees who have received specific training in handling and storage of hazardous wastes:

- Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents
- Limiting access to hazardous waste storage areas to employees who have received proper training
- Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan
- Conducting periodic inspections of waste storage areas and documenting the findings
- Preparing and implementing spill response and emergency plans to address their accidental release (additional information on Emergency Plans in provided in Section 3 of this document)
- Avoiding underground storage tanks and underground piping of hazardous waste

Transportation

On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance provided in Section 3.4 on the Transport of Hazardous Materials.

Treatment and Disposal

In addition to the recommendations for treatment and disposal applicable to general wastes, the following issues specific to hazardous wastes should be considered:

Commercial or Government Waste Contractors

In the absence of qualified commercial or government-owned waste vendors (taking into consideration proximity and transportation requirements), facilities generating waste should consider using:

- Have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment
- Have all required permits, certifications, and approvals, of applicable government authorities

- Have been secured through the use of formal procurement agreements

In the absence of qualified commercial or government-owned waste disposal operators (taking into consideration proximity and transportation requirements), project sponsors should consider using:

- Installing on-site waste treatment or recycling processes
- As a final option, constructing facilities that will provide for the environmental sound long-term storage of wastes on-site (as described elsewhere in the General EHS Guidelines) or at an alternative appropriate location up until external commercial options become available

Small Quantities of Hazardous Waste

Hazardous waste materials are frequently generated in small quantities by many projects through a variety of activities such as equipment and building maintenance activities. Examples of these types of wastes include: spent solvents and oily rags, empty paint cans, chemical containers; used lubricating oil; used batteries (such as nickel-cadmium or lead acid); and lighting equipment, such as lamps or lamp ballasts. These wastes should be managed following the guidance provided in the above sections.

Monitoring

Monitoring activities associated with the management of hazardous and non-hazardous waste should include:

- Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored. When significant quantities of hazardous wastes are generated and stored on site, monitoring activities should include:
  - Inspection of vessels for leaks, drips or other indications of loss
  - Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors
  - Verification of locks, emergency valves, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied)
  - Checking the operability of emergency systems
  - Documenting results of testing for integrity, emissions, or monitoring stations (air, soil vapor, or groundwater)
  - Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage
- Regular audits of waste segregation and collection practices
- Tracking of waste generation trends by type and amount of waste generated, preferably by facility departments
- Characterizing waste at the beginning of generation of a new waste stream, and periodically documenting the characteristics and proper management of the waste, especially hazardous wastes
- Keeping manifests or other records that document the amount of waste generated and its destination
- Periodic auditing of third party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties. Whenever possible, audits should include site visits to the treatment storage and disposal location

- Regular monitoring of groundwater quality in cases of Hazardous Waste on site storage and/or pretreatment and disposal
- Monitoring records for hazardous waste collected, stored, or shipped should include:
  - Name and identification number of the material(s) composing the hazardous waste
  - Physical state (i.e., solid, liquid, gaseous or a combination of one, or more, of these)
  - Quantity (e.g., kilograms or liters, number of containers)
  - Waste shipment tracking documentation to include, quantity and type, date dispatched, date transported and date received, record of the originator, the receiver and the transporter
  - Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the hazardous waste
  - Location of each hazardous waste within the facility, and the quantity at each location

1.7 Noise

Applicability

This section addresses impacts of noise beyond the property boundary of the facilities. Worker exposure to noise is covered in Section 2.0 on Occupational Health and Safety.

Prevention and Control

Noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception.[52] The preferred method for controlling noise from stationary sources is to implement noise control measures at source.[53] Methods for prevention and control of sources of noise emissions depend on the source and proximity of receptors. Noise reduction options that should be considered include:

- Selecting equipment with lower sound power levels
- Installing silencers for fans
- Installing suitable mufflers on engine exhausts and compressor components
- Installing acoustic enclosures for equipment casing radiating noise
- Improving the acoustic performance of constructed buildings, apply sound insulation
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective
- Installing vibration isolation for mechanical equipment
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding
- Siting permanent facilities away from community areas if possible
- Taking advantage of the natural topography as a noise buffer during facility design
- Reducing project traffic routing through community areas wherever possible
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas
- Developing a mechanism to record and respond to complaints

Noise Level Guidelines

Noise impacts should not exceed the levels presented in Table 1.7.1, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

[52] A point of reception or receptor may be defined as any point on the premises occupied by persons where extraneous noise and/or vibration are received. Examples of receptor locations may include: permanent or seasonal residences; hotels / motels; schools and daycares; hospitals and nursing homes; places of worship; and parks and campgrounds.

[53] At the design stage of a project, equipment manufacturers should provide design or construction specifications in the form of *"Insertion Loss Performance"* for silencers and mufflers, and *"Transmission Loss Performance"* for acoustic enclosures and upgraded building construction.

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

Highly intrusive noises, such as noise from aircraft flyovers and passing trains, should not be included when establishing background noise levels.

Monitoring

Noise monitoring[56] may be carried out for the purposes of establishing the existing ambient noise levels in the area of the proposed or existing facility, or for verifying operational phase noise levels.

Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently, as appropriate (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert. Monitors should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface (e.g., wall). In general, the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation.

[54] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

[55] For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).

[56] Noise monitoring should be carried out using a Type 1 or 2 sound level meter meeting all appropriate IEC standards.

1.8 Contaminated Land

Applicability and Approach

This section provides a summary of management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes, or oil, including naturally occurring substances. Releases of these materials may be the result of historic or current site activities, including, but not limited to, accidents during their handling and storage, or due to their poor management or disposal.

Land is considered contaminated when it contains hazardous materials or oil concentrations above background or naturally occurring levels.

Contaminated lands may involve surficial soils or subsurface soils that, through leaching and transport, may affect groundwater, surface water, and adjacent sites. Where subsurface contaminant sources include volatile substances, soil vapor may also become a transport and exposure medium, and create potential for contaminant infiltration of indoor air spaces of buildings.

Contaminated land is a concern because of:

- The potential risks to human health and ecology (e.g. risk of cancer or other human health effects, loss of ecology);
- The liability that it may pose to the polluter/business owners (e.g., cost of remediation, damage of business reputation and/or business-community relations) or affected parties (e.g. workers at the site, nearby property owners).

Contamination of land should be avoided by preventing or controlling the release of hazardous materials, hazardous wastes, or oil to the environment. When contamination of land is suspected or confirmed during any project phase, the cause of the uncontrolled release should be identified and corrected to avoid further releases and associated adverse impacts.

Contaminated lands should be managed to avoid the risk to human health and ecological receptors. The preferred strategy for land decontamination is to reduce the level of contamination at the site while preventing the human exposure to contamination.

To determine whether risk management actions are warranted, the following assessment approach should be applied to establish whether the three risk factors of 'Contaminants', 'Receptors', and 'Exposure Pathways' co-exist, or are likely to co-exist, at the project site under current or possible future land use:

- *Contaminant(s)*: Presence of hazardous materials, waste, or oil in any environmental media at potentially hazardous concentrations
- *Receptor(s)*: Actual or likely contact of humans, wildlife, plants, and other living organisms with the contaminants of concern
- *Exposure pathway(s)*: A combination of the route of migration of the contaminant from its point of release (e.g., leaching into potable groundwater) and exposure routes

(e.g., ingestion, transdermal absorption), which would allow receptor(s) to come into actual contact with contaminants

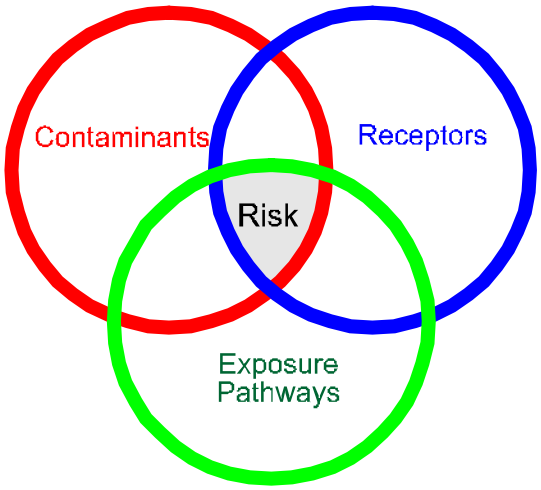


FIGURE 1.8.1: Inter-Relationship of Contaminant Risk Factors

When the three risk factors are considered to be present (in spite of limited data) under current or foreseeable future conditions, the following steps should be followed (as described in the remaining parts of this section):

1) Risk screening;
2) Interim risk management;
3) Detailed quantitative risk assessment; and
4) Permanent risk reduction measures.

Risk Screening

This step is also known as "problem formulation" for environmental risk assessment. Where there is potential evidence of contamination at a site, the following steps are recommended:

- Identification of the location of suspected highest level of contamination through a combination of visual and historical operational information;
- Sampling and testing of the contaminated media (soils or water) according to established technical methods applicable to suspected type of contaminant[57,58];
- Evaluation of the analytical results against the local and national contaminated sites regulations. In the absence of such regulations or environmental standards, other sources of risk-based standards or guidelines should be consulted to obtain comprehensive criteria for screening soil concentrations of pollutants.[59]
- Verification of the potential human and/or ecological receptors and exposure pathways relevant to the site in question

The outcome of risk-screening may reveal that there is no overlap between the three risk-factors as the contaminant levels identified are below those considered to pose a risk to human health or the environment. Alternatively, interim or permanent

[57] BC MOE. http://www.env.gov.bc.ca/epd/epdpa/contam_sites/guidance

[58] Massachusetts Department of Environment. http://www.mass.gov/dep/cleanup

[59] These may include the USEPA Region 3 Risk-Based Concentrations (RBCs). http://www.epa.gov/reg3hwmd/risk/human/index.htm. These RBCs are considered acceptable for specific land use and contaminant exposure scenarios as they have been developed by governments using risk assessment techniques for use as general targets in the site remediation. Separate PRGs have been developed or adopted for soil, sediment or groundwater, and often a distinction is made between land uses (as noted earlier) because of the need for more stringent guidelines for residential and agricultural versus commercial/industrial landuse. The RBC Tables contains Reference Doses (RfDs) and Cancer Slope Factors (CSFs) for about 400 chemicals. These toxicity factors have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration) in water, air, fish tissue, and soil for individual chemical substances. The primary use of RBCs is for chemical screening during baseline risk assessment (see EPA Regional Guidance EPA/903/R-93-001, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening"). Additional useful soil quality guidelines can also be obtained from Lijzen et al. 2001.

risk reduction measures may need to be taken with, or without, more detailed risk assessment activities, as described below.

Interim Risk Management

Interim risk management actions should be implemented at any phase of the project life cycle if the presence of land contamination poses an "imminent hazard", i.e., representing an immediate risk to human health and the environment if contamination were allowed to continue, even a short period of time. Examples of situations considered to involve imminent hazards include, but are not restricted to:

- Presence of an explosive atmosphere caused by contaminated land
- Accessible and excessive contamination for which short-term exposure and potency of contaminants could result in acute toxicity, irreversible long term effects, sensitization, or accumulation of persistent biocumulative and toxic substances
- Concentrations of pollutants at concentrations above the Risk Based Concentrations (RBCs[60]) or drinking water standards in potable water at the point of abstraction

Appropriate risk reduction should be implemented as soon as practicable to remove the condition posing the imminent hazard.

Detailed Risk Assessment

As an alternative to complying with numerical standards or preliminary remediation goals, and depending on local regulatory requirements, a detailed site-specific, environmental risk assessment may be used to develop strategies that yield acceptable health risks, while achieving low level contamination on-site. An assessment of contaminant risks needs to be considered in the context of current and future land use, and development scenarios (e.g., residential, commercial, industrial, and urban parkland or wilderness use).

A detailed quantitative risk assessment builds on risk screening (problem formulation). It involves first, a detailed site investigation to identify the scope of contamination.[61] Site investigation programs should apply quality assurance/quality control (QA/QC) measures to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). The site investigation in turn should be used to develop a *conceptual site model* of how and where contaminants exist, how they are transported, and where routes of exposure occur to organisms and humans. The risk factors and conceptual site model provide a framework for assessing contaminant risks.

Human or ecological risk assessments facilitate risk management decisions at contaminated sites. Specific risk assessment objectives include:

- Identifying relevant human and ecological receptors (e.g., children, adults, fish, wildlife)
- Determining if contaminants are present at levels that pose potential human health and/or ecological concerns (e.g., levels above applicable regulatory criteria based on health or environmental risk considerations)
- Determining how human or ecological receptors are exposed to the contaminants (e.g., ingestions of soil, dermal contact, inhalation of dust)

[60] For example, USEPA Region 3 Risk-Based Concentrations (RBCs). http://www.epa.gov/reg3hwmd/risk/human/index.htm.

[61] Examples include processes defined by the American Society of Testing and Materials (ASTM) Phase II ESA Process; the British Columbia Ministry of Environment Canada (BC MOE) http://www.env.gov.bc.ca/epd/epdpa/contam_sites/guidance); and the Massachusetts Department of Environment http://www.mass.gov/dep/cleanup.

- Identifying the types of adverse effects that might result from exposure to the contaminants (e.g., effect on target organ, cancer, impaired growth or reproduction) in the absence of regulatory standards
- Quantifying the magnitude of health risks to human and ecological receptors based on a quantitative analysis of contaminant exposure and toxicity (e.g. calculate lifetime cancer risk or ratios of estimated exposure rates compared to safe exposure rates)
- Determining how current and proposed future land use influence the predicted risks (e.g. change of land use from industrial to residential with more sensitive receptors such as children)
- Quantifying the potential environmental and/or human health risks from off-site contaminant migration (e.g., consider if leaching and groundwater transport, or surface water transport results in exposure at adjacent lands/receptors)
- Determining if the risk is likely to remain stable, increase, or decrease with time in the absence of any remediation (e.g., consider if the contaminant is reasonably degradable and likely to remain in place, or be transported to other media)[62]

Addressing these objectives provides a basis to develop and implement risk reduction measures (e.g., clean-up, on-site controls) at the site. If such a need exists, the following additional objectives become relevant:

- Determining where, and in what conceptual manner, risk reduction measures should be implemented
- Identifying the preferred technologies (including engineering controls) needed to implement the conceptual risk reduction measures
- Developing a monitoring plan to ascertain whether risk reduction measures are effective
- Considering the need and appropriateness for institutional controls (e.g. deed restriction, land use restrictions) as part of a comprehensive approach

Permanent Risk Reduction Measures

The *risk factors* and *conceptual site model* within the contaminant risk approach described also provide a basis to manage and mitigate environmental contaminant health risks. The underlying principle is to reduce, eliminate, or control any or all of the three risk factors illustrated in Figure 1.8.1. A short list of examples of risk mitigation strategies is provided below, although actual strategies should be developed based on site-specific conditions, and the practicality of prevailing factors and site constraints. Regardless of the management options selected, the action plan should include, whenever possible, *contaminant source reduction* (i.e., net improvement of the site) as part of the overall strategy towards managing health risks at contaminated sites, as this alone provides for improved environmental quality.

Figure 1.8.2 presents a schematic of the inter-relationship of risk factors and example strategies to mitigate contaminant health risk by modifying the conditions of one or more risk factors to ultimately reduce contaminant exposure to the receptor. The selected approach should take into consideration the technical and financial feasibility (e.g. operability of a selected technology given the local availability of technical expertise and equipment and its associated costs).

Example risk mitigation strategies for contaminant source and exposure concentrations include:

[62] An example of a simplified quantitative risk assessment method is the ASTM E1739-95(2002) Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites and the ASTM E2081-00(2004)e1 Standard Guide for Risk-Based Corrective Action (at chemical release sites).

- Soil, sediment, and sludge:
  - In situ biological treatment (aerobic or anaerobic)
  - In situ physical/chemical treatment (e.g., soil vapor extraction with off-gas treatment, chemical oxidation)
  - In situ thermal treatment (e.g., steam injection, 6-phase heating)
  - Ex situ biological treatment (e.g., excavation and composting)
  - Ex situ physical/chemical treatment (e.g., excavation and stabilization)
  - Ex situ thermal treatment (e.g., excavation and thermal desorption or incineration)
  - Containment (e.g. landfill)
  - Natural attenuation
  - Other treatment processes
- Groundwater, surface water, and leachate:
  - In situ biological treatment (aerobic and/or aerobic)
  - In situ physical/chemical treatment (e.g., air sparging, zero-valent iron permeable reactive barrier)
  - Ex situ biological, physical, and or chemical treatment (i.e., groundwater extraction and treatment)
  - Containment (e.g., slurry wall or sheet pile barrier)
  - Natural attenuation
  - Other treatment processes
- Soil vapor intrusion:
  - Soil vapor extraction to reduce VOC contaminant source in soil
  - Installation of a sub-slab depressurization system to prevent migration of soil vapor into the building
  - Creating a positive pressure condition in buildings
  - Installation (during building construction) of an impermeable barrier below the building and/or an alternative flow pathway for soil vapor beneath building foundations (e.g., porous media and ventilation to shunt vapors away from building)

Example risk mitigation strategies for receptors include:

- Limiting or preventing access to contaminant by receptors (actions targeted at the receptor may include signage with instructions, fencing, or site security)
- Imposing health advisory or prohibiting certain practices leading to exposure such as fishing, crab trapping, shellfish collection
- Educating receptors (people) to modify behavior in order to reduce exposure (e.g., improved work practices, and use of protective clothing and equipment)

Example risk mitigation strategies for exposure pathways include:

- Providing an alternative water supply to replace, for example, a contaminated groundwater supply well
- Capping contaminated soil with at least 1m of clean soil to prevent human contact, as well as plant root or small mammal penetration into contaminated soils
- Paving over contaminated soil as an interim measure to negate the pathway of direct contact or dust generation and inhalation
- Using an interception trench and pump, and treat technologies to prevent contaminated groundwater from discharging into fish streams

The above-reference containment measures should also be considered for immediate implementation in situations where source reduction measures are expected to take time.

Occupational Health and Safety Considerations

Investigation and remediation of contaminated lands requires that workers be mindful of the occupational exposures that could arise from working in close contact with contaminated soil or other environmental media (e.g., groundwater, wastewater, sediments, and soil vapor). Occupational health and safety precautions should be exercised to minimize exposure, as described in Section 2 on Occupational Health and Safety. In addition, workers on contaminated sites should receive special health and safety training specific to contaminated site investigation and remediation activities.[63]

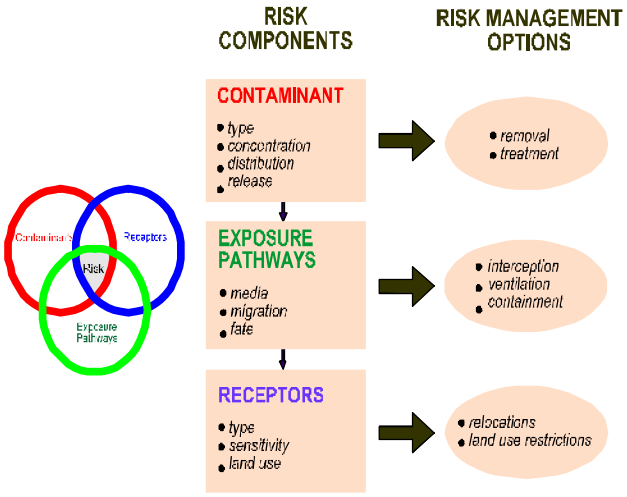


FIGURE 1.8.2: Inter-Relationship of Risk Factors and Management Options

[63] For example, US Occupational Safety and Health Agency (OSHA) regulations found at 40 CFR 1910.120. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9765

2.0 Occupational Health and Safety

Applicability and Approach

Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. Companies should hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements.

Preventive and protective measures should be introduced according to the following order of priority:

- *Eliminating the hazard* by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;
- *Controlling the hazard* at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- *Minimizing the hazard* through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- *Providing appropriate personal protective equipment (PPE)* in conjunction with training, use, and maintenance of the PPE.

The application of prevention and control measures to occupational hazards should be based on comprehensive job

safety or job hazard analyses. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards. An example of a qualitative risk ranking or analysis matrix to help identify priorities is described in Table 2.1.1.

Table 2.1.1. Risk Ranking Table to Classify Worker Scenarios Based on Likelihood and Consequence

Likelihood	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catas-trophic 5
A. Almost certain	L	M	E	E	E
B. Likely	L	M	H	E	E
C. Moderate	L	M	H	E	E
D. Unlikely	L	L	M	H	E
E. Rare	L	L	M	H	H

Legend
E: extreme risk; immediate action required
H: high risk; senior management attention needed
M: moderate risk; management responsibility should be specified
L: low risk; manage by routine procedures

2.1 General Facility Design and Operation

Integrity of Workplace Structures

Permanent and recurrent places of work should be designed and equipped to protect OHS:

- Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds.
- Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.
- Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls.
- Floors should be level, even, and non-skid.
- Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.

Severe Weather and Facility Shutdown

- Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.
- Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should also be undertaken annually.

Workspace and Exit

- The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products.
- Passages to emergency exits should be unobstructed at all times. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area.

- Facilities also should be designed and built taking into account the needs of disabled persons.

Fire Precautions

The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures include:

- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
- Provision of manual firefighting equipment that is easily accessible and simple to use
- Fire and emergency alarm systems that are both audible and visible

The IFC Life and Fire Safety Guideline should apply to buildings accessible to the public (See Section 3.3).

Lavatories and Showers

- Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is "In Use" or "Vacant". Toilet facilities should also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.
- Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.

Potable Water Supply

- Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking
- Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards

Clean Eating Area

- Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances

Lighting

- Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met.
- Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

Safe Access

- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access
- Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

- Openings should be sealed by gates or removable chains
- Covers should, if feasible, be installed to protect against falling items
- Measures to prevent unauthorized access to dangerous areas should be in place

First Aid

- The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work
- Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response
- Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first-aid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids
- Remote sites should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.

Air Supply

- Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and process-related emissions. Air distribution systems should be designed so as not to expose workers to draughts
- Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning.
- Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and microorganisms. Heating, ventilation and air conditioning (HVAC) and industrial evaporative cooling systems should be equipped, maintained and operated so as to prevent growth and spreading of disease agents (e.g. *Legionnella pneumophilia*) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

Work Environment Temperature

- The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.

2.2 Communication and Training

OHS Training

- Provisions should be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees.
- Training should consist of basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or color coding in use should be thoroughly reviewed as part of orientation training.

Visitor Orientation

- If visitors to the site can gain access to areas where hazardous conditions or substances may be present, a visitor orientation and control program should be established to ensure visitors do not enter hazard areas unescorted.

New Task Employee and Contractor Training

- The employer should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to

understand work hazards and to protect their health from hazardous ambient factors that may be present.

The training should adequately cover:

- Knowledge of materials, equipment, and tools
- Known hazards in the operations and how they are controlled
- Potential risks to health
- Precautions to prevent exposure
- Hygiene requirements
- Wearing and use of protective equipment and clothing
- Appropriate response to operation extremes, incidents and accidents

Basic OHS Training

- A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training should generally be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.
- Workers with rescue and first-aid duties should receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers. Training would include the risks of becoming infected with blood–borne pathogens through contact with bodily fluids and tissue.
- Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

Area Signage

- Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately.
- Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate.

Labeling of Equipment

- All vessels that may contain substances that are hazardous as a result of chemical or toxicological properties, or temperature or pressure, should be labeled as to the contents and hazard, or appropriately color coded.
- Similarly, piping systems that contain hazardous substances should be labeled with the direction of flow and contents of the pipe, or color coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

Communicate Hazard Codes

- Copies of the hazard coding system should be posted outside the facility at emergency entrance doors and fire emergency connection systems where they are likely to come to the attention of emergency services personnel.
- Information regarding the types of hazardous materials stored, handled or used at the facility, including typical maximum inventories and storage locations, should be shared proactively with emergency services and security personnel to expedite emergency response when needed.
- Representatives of local emergency and security services should be invited to participate in periodic (annual) orientation tours and site inspections to ensure familiarity with potential hazards present.

2.3 Physical Hazards

Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity. Single exposure to physical hazards may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged

periods can result in disabling injuries of comparable significance and consequence.

Rotating and Moving Equipment

Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Recommended protective measures include:

- Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions. Examples of proper design considerations include two-hand operated machines to prevent amputations or the availability of emergency stops dedicated to the machine and placed in strategic locations. Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards.[64]
- Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance, in conformance with a standard such as CSA Z460 Lockout or equivalent ISO or ANSI standard
- Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms

[64] For example: CSA Z432.04 Safe Guarding of Machinery, CSA Z434 Robot Safety, ISO 11161 Safety of Machinery – Integrated Manufacturing Systems or ISO 14121 Safety of Machinery – Principals of Risk Management or equivalent ANSI standard.

Noise

Noise limits for different working environments are provided in Table 2.3.1.

- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).
- Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.[65]
- Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible
- Periodic medical hearing checks should be performed on workers exposed to high noise levels

Vibration

Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and

[65] The American Conference of Governmental Industrial Hygienists (ACGIH), 2006

action values, (i.e. the level of exposure at which remediation should be initiated) are provided by the ACGIH[66]. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers.

Electrical

Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

Table 2.3.1. Noise Limits for Various Working Environments

Location /activity	Equivalent level LA_{eq},8h	Maximum LA_{max},fast
Heavy Industry (no demand for oral communication)	85 dB(A)	110 dB(A)
Light industry (decreasing demand for oral communication)	50-65 dB(A)	110 dB(A)
Open offices, control rooms, service counters or similar	45-50 dB(A)	-
Individual offices (no disturbing noise)	40-45 dB(A)	-
Classrooms, lecture halls	35-40 dB(A)	-
Hospitals	30-35 dB(A)	40 dB(A)

- Marking all energized electrical devices and lines with warning signs
- Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance
- Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools
- Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits
- Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas
- Appropriate labeling of service rooms housing high voltage equipment ('electrical hazard') and where entry is controlled or prohibited (see also Section 3 on Planning, Siting, and Design);
- Establishing "No Approach" zones around or under high voltage power lines in conformance with Table 2.3.2
- Rubber tired construction or other vehicles that come into direct contact with, or arcing between, high voltage wires may need to be taken out of service for periods of 48 hours and have the tires replaced to prevent catastrophic tire and wheel assembly failure, potentially causing serious injury or death;
- Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work

[66] ACGIH, 2005

Table 2.3.2. No Approach Zones for High Voltage Power Lines	
Nominal phase-to-phase voltage rating	Minimum distance
750 or more volts, but no more than 150,000 volts	3 meters
More than 150,000 volts, but no more than 250,000 volts	4.5 meters
More than 250,000 volts	6 meters

Eye Hazards

Solid particles from a wide variety of industrial operations, and / or a liquid chemical spray may strike a worker in the eye causing an eye injury or permanent blindness. Recommended measures include:

- Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO (see also Section 2.3 on Rotating and Moving Equipment and 2.7 on Personal Protective Equipment).
- Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors.
- Provisions should be made for persons who have to wear prescription glasses either through the use overglasses or prescription hardened glasses.

Welding / Hot Work

Welding creates an extremely bright and intense light that may seriously injur a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include:

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hotwork on tanks or vessels that have contained flammable materials.

Industrial Vehicle Driving and Site Traffic

Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios. Industrial vehicle driving and site traffic safety practices include:

- Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits
- Ensuring drivers undergo medical surveillance
- Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction
- Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate

Working Environment Temperature

Exposure to hot or cold working conditions in indoor or outdoor environments can result temperature stress-related injury or death. Use of personal protective equipment (PPE) to protect against other occupational hazards can accentuate and aggravate heat-related illnesses. Extreme temperatures in permanent work environments should be avoided through implementation of engineering controls and ventilation. Where this is not possible, such as during short-term outdoor work, temperature-related stress management procedures should be implemented which include:

- Monitoring weather forecasts for outdoor work to provide advance warning of extreme weather and scheduling work accordingly
- Adjustment of work and rest periods according to temperature stress management procedures provided by ACGIH[67], depending on the temperature and workloads
- Providing temporary shelters to protect against the elements during working activities or for use as rest areas
- Use of protective clothing
- Providing easy access to adequate hydration such as drinking water or electrolyte drinks, and avoiding consumption of alcoholic beverages

Ergonomics, Repetitive Motion, Manual Handling

Injuries due to ergonomic factors, such as repetitive motion, over-exertion, and manual handling, take prolonged and repeated exposures to develop, and typically require periods of weeks to months for recovery. These OHS problems should be minimized or eliminated to maintain a productive workplace. Controls may include:

- Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind
- Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds
- Selecting and designing tools that reduce force requirements and holding times, and improve postures
- Providing user adjustable work stations
- Incorporating rest and stretch breaks into work processes, and conducting job rotation
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions
- Taking into consideration additional special conditions such as left handed persons

Working at Heights

Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention may include:

[67] ACGIH, 2005

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area
- Proper use of ladders and scaffolds by trained employees
- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines
- Appropriate training in use, serviceability, and integrity of the necessary PPE
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall

Illumination

Work area light intensity should be adequate for the general purpose of the location and type of activity, and should be supplemented with dedicated work station illumination, as needed. The minimum limits for illumination intensity for a range of locations/activities appear in Table 2.3.3.

Table 2.3.3. Minimum Limits For Workplace Illumination Intensity

Location / Activity	Light Intensity
Emergency light	10 lux
Outdoor non working areas	20 lux
Simple orientation and temporary visits (machine storage, garage, warehouse)	50 lux
Workspace with occasional visual tasks only (corridors, stairways, lobby, elevator, auditorium, etc.)	100 lux
Medium precision work (simple assembly, rough machine works, welding, packing, etc.)	200 lux
Precision work (reading, moderately difficult assembly, sorting, checking, medium bench and machine works, etc.), offices.	500 lux
High precision work (difficult assembly, sewing, color inspection, fine sorting etc.)	1,000 – 3,000 lux

Controls should include:

- Use of energy efficient light sources with minimum heat emission
- Undertaking measures to eliminate glare / reflections and flickering of lights
- Taking precautions to minimize and control optical radiation including direct sunlight. Exposure to high intensity UV and IR radiation and high intensity visible light should also be controlled
- Controlling laser hazards in accordance with equipment specifications, certifications, and recognized safety standards. The lowest feasible class Laser should be applied to minimize risks.

2.4 Chemical Hazards

Chemical hazards represent potential for illness or injury due to single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. They also represent a risk of uncontrolled reaction, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed. Chemical hazards can most effectively be prevented through a hierarchical approach that includes:

- Replacement of the hazardous substance with a less hazardous substitute
- Implementation of engineering and administrative control measures to avoid or minimize the release of hazardous substances into the work environment keeping the level of exposure below internationally established or recognized limits
- Keeping the number of employees exposed, or likely to become exposed, to a minimum

- Communicating chemical hazards to workers through labeling and marking according to national and internationally recognized requirements and standards, including the International Chemical Safety Cards (ICSC), Materials Safety Data Sheets (MSDS), or equivalent. Any means of written communication should be in an easily understood language and be readily available to exposed workers and first-aid personnel
- Training workers in the use of the available information (such as MSDSs), safe work practices, and appropriate use of PPE

Air Quality

Poor air quality due to the release of contaminants into the work place can result in possible respiratory irritation, discomfort, or illness to workers. Employers should take appropriate measures to maintain air quality in the work area. These include:

- Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended by the ACGIH[68] as TWA-TLV's (threshold limit value)—concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs/week, week-after-week), without sustaining adverse health effects.
- Developing and implementing work practices to minimize release of contaminants into the work environment including:
  - Direct piping of liquid and gaseous materials
  - Minimized handling of dry powdered materials;
  - Enclosed operations
  - Local exhaust ventilation at emission / release points
  - Vacuum transfer of dry material rather than mechanical or pneumatic conveyance
  - Indoor secure storage, and sealed containers rather than loose storage
- Where ambient air contains several materials that have similar effects on the same body organs (additive effects), taking into account combined exposures using calculations recommended by the ACGIH[69]
- Where work shifts extend beyond eight (8) hours, calculating adjusted workplace exposure criteria recommended by the ACGIH[70]

Fire and Explosions

Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers. Prevention and control strategies include:

- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:
  - Remote from entry and exit points into buildings
  - Away from facility ventilation intakes or vents
  - Have natural or passive floor and ceiling level ventilation and explosion venting
  - Use spark-proof fixtures
  - Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time
- Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area
- Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems

[68] ACGIH, 2005

[69] ACGIH, 2005.

[70] ACGIH, 2005.

- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment)
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression

Corrosive, oxidizing, and reactive chemicals

Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:

- Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills
- Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc).
- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water

Asbestos Containing Materials (ACM)

The use of asbestos containing materials (ACM) should be avoided in new buildings or as a new material in remodeling or renovation activities. Existing facilities with ACM should develop an asbestos management plan which clearly identifies the locations where the ACM is present, its condition (e.g. whether it is in friable form with the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should only be performed by specially trained personnel[71] following host country requirements, or in their absence, internationally recognized procedures.[72]

2.5 Biological Hazards

Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. Biological hazards can be prevented most effectively by implementing the following measures:

- If the nature of the activity permits, use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents can not be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognized exposure limits.

[71] Training of specialized personnel and the maintenance and removal methods applied should be equivalent to those required under applicable regulations in the United States and Europe (examples of North American training standards are available at: http://www.osha.gov/SLTC/asbestos/training.html)

[72] Examples include the American Society for Testing and Materials (ASTM) E 1368 - Standard Practice for Visual Inspection of Asbestos Abatement Projects; E 2356 - Standard Practice for Comprehensive Building Asbestos Surveys; and E 2394 - Standard Practice for Maintenance, Renovation and Repair of Installed Asbestos Cement Products.

- Work processes, engineering, and administrative controls should be designed, maintained, and operated to avoid or minimize release of biological agents into the working environment. The number of employees exposed or likely to become exposed should be kept at a minimum.
- The employer should review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs.
- Measures to eliminate and control hazards from known and suspected biological agents at the place of work should be designed, implemented and maintained in close co-operation with the local health authorities and according to recognized international standards.

Biological agents should be classified into four groups[73]:

- ***Group 1:*** Biological agents unlikely to cause human disease, and consequently only require controls similar to those required for hazardous or reactive chemical substances;
- ***Group 2:*** Biological agents that can cause human disease and are thereby likely to require additional controls, but are unlikely to spread to the community;
- ***Group 3***: Biological agents that can cause severe human disease, present a serious hazard to workers, and may present a risk of spreading to the community, for which there usually is effective prophylaxis or treatment available and are thereby likely to require extensive additional controls;
- ***Group 4:*** Biological agents that can cause severe human disease, are a serious hazard to workers, and present a high risk of spreading to the community, for which there is usually no effective prophylaxis or treatment available and are thereby likely to require very extensive additional controls.

The employer should at all times encourage and enforce the highest level of hygiene and personal protection, especially for activities employing biological agents of Groups 3 and 4 above. Work involving agents in Groups 3 and 4 should be restricted only to those persons who have received specific verifiable training in working with and controlling such materials.

Areas used for the handling of Groups 3 and 4 biological agents should be designed to enable their full segregation and isolation in emergency circumstances, include independent ventilation systems, and be subject to SOPs requiring routine disinfection and sterilization of the work surfaces.

HVAC systems serving areas handling Groups 3 and 4 biological agents should be equipped with High Efficiency Particulate Air (HEPA) filtration systems. Equipment should readily enable their disinfection and sterilization, and maintained and operated so as to prevent growth and spreading of disease agents, amplification of the biological agents, or breeding of vectors e.g. mosquitoes and flies of public health concern.

[73] World Health Organization (WHO) Classification of Infective Microorganisms by Risk Group (2004).

2.6 Radiological Hazards

Radiation exposure can lead to potential discomfort, injury or serious illness to workers. Prevention and control strategies include:

- Places of work involving occupational and/or natural exposure to ionizing radiation should be established and operated in accordance with recognized international safety standards and guidelines.[74] The acceptable effective dose limits appear Table 2.6.1.
- Exposure to non-ionizing radiation (including static magnetic fields; sub-radio frequency magnetic fields; static electric fields; radio frequency and microwave radiation; light and near-infrared radiation; and ultraviolet radiation) should be controlled to internationally recommended limits[75].

Table 2.6.1. Acceptable Effective Dose Limits for Workplace Radiological Hazards

Exposure	Workers (min.19 years of age)	Apprentices and students (16-18 years of age)
Five consecutive year average – effective dose	20 mSv/year	
Single year exposure – effective dose	50 mSv/year	6 mSv/year
Equivalent dose to the lens of the eye	150 mSv/year	50 mSv/year
Equivalent dose to the extremities (hands, feet) or the skin	500 mSv/year	150 mSv/year

- In the case of both ionizing and non-ionizing radiation, the preferred method for controlling exposure is shielding and limiting the radiation source. Personal protective equipment is supplemental only or for emergency use. Personal protective equipment for near-infrared, visible and ultraviolet range radiation can include appropriate sun block creams, with or without appropriate screening clothing.

2.7 Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems.

PPE is considered to be a last resort that is above and beyond the other facility controls and provides the worker with an extra level of personal protection. Table 2.7.1 presents general examples of occupational hazards and types of PPE available for different purposes. Recommended measures for use of PPE in the workplace include:

- Active use of PPE if alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce, a hazard or exposure
- Identification and provision of appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual
- Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. Proper use of PPE should be part of the recurrent training programs for employees

[74] International Basic Safety Standard for protection against Ionizing Radiation and for the Safety of Radiation Sources and its three interrelated Safety Guides.

IAEA. http://www-ns.iaea.org/standards/documents/default.asp?sub=160

[75] For example ACGIH (2005) and International Commission for Non-Ionizing Radiation (ICNIRP).

- Selection of PPE should be based on the hazard and risk ranking described earlier in this section, and selected according to criteria on performance and testing established by recognized organizations[76].

Table 2.7.1. Summary of Recommended Personal Protective Equipment According to Hazard

Objective	Workplace Hazards	Suggested PPE
Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety Glasses with side-shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic Helmets with top and side impact protection.
Hearing protection	Noise, ultra-sound.	Hearing protectors (ear plugs or ear muffs).
Foot protection	Falling or rolling objects, pointed objects. Corrosive or hot liquids.	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures.	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors.	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen deficiency	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulating clothing, body suits, aprons etc. of appropriate materials.

2.8 Special Hazard Environments

Special hazard environments are work situations where all of the previously described hazards may exist under unique or especially hazardous circumstances. Accordingly, extra precautions or rigor in application of precautions is required.

Confined Space

A confined space is defined as a wholly or partially enclosed space not designed or intended for human occupancy and in which a hazardous atmosphere could develop as a result of the contents, location or construction of the confined space or due to work done in or around the confined space. A "permit-required" confined space is one that also contains physical or atmospheric hazards that could trap or engulf the person.[77]

Confined spaces can occur in enclosed or open structures or locations. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space. Recommended management approaches include:

- Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations.

[76] Examples include the American National Standards Institute (ANSI), http://www.ansi.org/; National Institute for Occupational Safety and Health[76] (NIOSH), http://www.cdc.gov/niosh/homepage.html; Canadian Standards Association[76] (CSA), http://www.csa.ca/Default.asp?language=english; Mine Safety and Health Administration[76] (MSHA), http://www.msha.gov.

[77] US OSHA CFR 1910.146

- Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing. The most current ISO and EN standards should be consulted for design specifications;
- Prior to entry into a permit-required confined space:
  - Process or feed lines into the space should be disconnected or drained, and blanked and locked-out.
  - Mechanical equipment in the space should be disconnected, de-energized, locked-out, and braced, as appropriate.
  - The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL).
  - If the atmospheric conditions are not met, the confined space should be ventilated until the target safe atmosphere is achieved, or entry is only to be undertaken with appropriate and additional PPE.
- Safety precautions should include Self Contained Breathing Apparatus (SCBA), life lines, and safety watch workers stationed outside the confined space, with rescue and first aid equipment readily available.
- Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space.

Lone and Isolated Workers

A lone and isolated worker is a worker out of verbal and line of sight communication with a supervisor, other workers, or other persons capable of providing aid and assistance, for continuous periods exceeding one hour. The worker is therefore at increased risk should an accident or injury occur.

- Where workers may be required to perform work under lone or isolated circumstances, Standard Operating Procedures (SOPs) should be developed and implemented to ensure all PPE and safety measures are in place before the worker starts work. SOPs should establish, at a minimum, verbal contact with the worker at least once every hour, and ensure the worker has a capability for summoning emergency aid.
- If the worker is potentially exposed to highly toxic or corrosive chemicals, emergency eye-wash and shower facilities should be equipped with audible and visible alarms to summon aid whenever the eye-wash or shower is activated by the worker and without intervention by the worker.

2.9 Monitoring

Occupational health and safety monitoring programs should verify the effectiveness of prevention and control strategies. The selected indicators should be representative of the most significant occupational, health, and safety hazards, and the implementation of prevention and control strategies. The occupational health and safety monitoring program should include:

- *Safety inspection, testing and calibration:* This should include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection should verify that issued PPE continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters should be regularly tested and calibrated, and the respective records maintained.
- *Surveillance of the working environment:* Employers should document compliance using an appropriate combination of

portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each project following a review of the hazards. Generally, monitoring should be performed during commissioning of facilities or equipment and at the end of the defect and liability period, and otherwise repeated according to the monitoring plan.

- *Surveillance of workers health:* When extraordinary protective measures are required (for example, against biological agents Groups 3 and 4, and/or hazardous compounds), workers should be provided appropriate and relevant health surveillance prior to first exposure, and at regular intervals thereafter. The surveillance should, if deemed necessary, be continued after termination of the employment.
- *Training:* Training activities for employees and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer adequate training documentation before start of their assignment.

Accidents and Diseases monitoring

- The employer should establish procedures and systems for reporting and recording:
  - Occupational accidents and diseases
  - Dangerous occurrences and incidents

  These systems should enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health.
- The systems and the employer should further enable and encourage workers to report to management all:
  - Occupational injuries and near misses
  - Suspected cases of occupational disease
  - Dangerous occurrences and incidents
- All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses should be investigated with the assistance of a person knowledgeable/competent in occupational safety. The investigation should:
  - Establish what happened
  - Determine the cause of what happened
  - Identify measures necessary to prevent a recurrence
- Occupational accidents and diseases should, at a minimum, be classified according to Table 2.10.1. Distinction is made between fatal and non-fatal injuries. The two main categories are divided into three sub-categories according to time of death or duration of the incapacity to work. The total work hours during the specified reporting period should be reported to the appropriate regulatory agency.

Table 2.9.1. Occupational Accident Reporting

a. Fatalities (number)	**b. Non-fatal injuries** (number) [78]	**c. Total time lost** non-fatal injuries (days)
a.1 Immediate	**b.1** Less than one day	
a.2 Within a month	**b.2** Up to 3 days	**c.1** Category b.2
a.3 Within a year	**b.3** More than 3 days	**c.2** Category b.3

[78] The day on which an incident occurs is not included in b.2 and b.3.

3.0 Community Health and Safety

This section complements the guidance provided in the preceding environmental and occupational health and safety sections, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis. These issues may arise at any stage of a project life cycle and can have an impact beyond the life of the project.

3.1 Water Quality and Availability

Groundwater and surface water represent essential sources of drinking and irrigation water in developing countries, particularly in rural areas where piped water supply may be limited or unavailable and where available resources are collected by the consumer with little or no treatment. Project activities involving wastewater discharges, water extraction, diversion or impoundment should prevent adverse impacts to the quality and availability of groundwater and surface water resources.

Water Quality

Drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or in their absence the current edition of WHO Guidelines for Drinking-Water Quality. Air emissions, wastewater effluents, oil and hazardous materials, and wastes should be managed according to the guidance provided in the respective sections of the General EHS Guidelines with the objective of protecting soil and water resources.

Where the project includes the delivery of water to the community or to users of facility infrastructure (such as hotel hosts and hospital patients), where water may be used for drinking, cooking, washing, and bathing, water quality should comply with national acceptability standards or in their absence the current edition of with WHO Drinking Water Guidelines. Water quality for more sensitive well-being-related demands such as water used in health care facilities or food production may require more stringent, industry-specific guidelines or standards, as applicable. Any dependency factors associated with the deliver of water to the local community should be planned for and managed to ensure the sustainability of the water supply by involving the community in its management to minimize the dependency in the long-term.

Water Availability

The potential effect of groundwater or surface water abstraction for project activities should be properly assessed through a combination of field testing and modeling techniques, accounting for seasonal variability and projected changes in demand in the project area.

Project activities should not compromise the availability of water for personal hygiene needs and should take account of potential future increases in demand. The overall target should be the availability of 100 liters per person per day although lower levels may be used to meet basic health requirements.[79] Water volume requirements for well-being-related demands such as water use in health care facilities may need to be higher.

3.2 Structural Safety of Project Infrastructure

Hazards posed to the public while accessing project facilities may include:

- Physical trauma associated with failure of building structures
- Burns and smoke inhalation from fires
- Injuries suffered as a consequence of falls or contact with heavy equipment
- Respiratory distress from dust, fumes, or noxious odors
- Exposure to hazardous materials

Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily. The following issues should be considered and incorporated as appropriate into the planning, siting, and design phases of a project:

- Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions
- Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire. To this end, all project structures should be designed in accordance with engineering and design criteria mandated by site-specific risks, including but not limited to seismic activity, slope stability, wind loading, and other dynamic loads
- Application of locally regulated or internationally recognized building codes[80] to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response
- Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.

International codes, such as those compiled by the International Code Council (ICC)[81], are intended to regulate the design, construction, and maintenance of a built environment and contain detailed guidance on all aspects of building safety, encompassing methodology, best practices, and documenting compliance. Depending on the nature of a project, guidance provided in the ICC or comparable codes should be followed, as appropriate, with respect to:

- Existing structures
- Soils and foundations
- Site grading
- Structural design
- Specific requirements based on intended use and occupancy
- Accessibility and means of egress
- Types of construction
- Roof design and construction
- Fire-resistant construction
- Flood-resistant construction

[79] World Health Organization (WHO) defines 100 liters/capita/day as the amount required to meet all consumption and hygiene needs. Additional information on lower service levels and potential impacts on health are described in "Domestic Water Quantity, Service Level and Health" 2003. http://www.who.int/water_sanitation_health/diseases/wsh0302/en/index.html

[80] ILO-OSH, 2001. http://www.ilo.org/public/english/protection/safework/cops/english/download/e000013.pdf

[81] ICC, 2006.

- Construction materials
- Interior environment
- Mechanical, plumbing and electrical systems
- Elevators and conveying systems
- Fire safety systems
- Safeguards during construction
- Encroachments into public right-of-way

Although major design changes may not be feasible during the operation phase of a project, hazard analysis can be undertaken to identify opportunities to reduce the consequences of a failure or accident. Illustrative management actions, applicable to hazardous materials storage and use, include:

- Reducing inventories of hazardous materials through inventory management and process changes to greatly reduce or eliminate the potential off-site consequences of a release
- Modifying process or storage conditions to reduce the potential consequences of an accidental off-site release
- Improving shut-down and secondary containment to reduce the amount of material escaping from containment and to reduce the release duration
- Reducing the probability that releases will occur through improved site operations and control, and through improvements in maintenance and inspection
- Reducing off-site impacts of releases through measures intended to contain explosions and fires, alert the public, provide for evacuation of surrounding areas, establish safety zones around a site, and ensure the provision of emergency medical services to the public

3.3 Life and Fire Safety (L&FS)

Applicability and Approach

All new buildings accessible to the public should be designed, constructed, and operated in full compliance with local building codes, local fire department regulations, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard. The Life Safety Code[82], which provides extensive documentation on life and fire safety provisions, is one example of an internationally accepted standard and may be used to document compliance with the Life and Fire Safety objectives outlined in these guidelines. With regard to these objectives:

- Project sponsors' architects and professional consulting engineers should demonstrate that affected buildings meet these life and fire safety objectives.
- Life and fire safety systems and equipment should be designed and installed using appropriate prescriptive standards and/or performance based design, and sound engineering practices.
- Life and fire safety design criteria for all existing buildings should incorporate all local building codes and fire department regulations.

These guidelines apply to buildings that are accessible to the public. Examples of such buildings include:

- Health and education facilities
- Hotels, convention centers, and leisure facilities
- Retail and commercial facilities
- Airports, other public transport terminals, transfer facilities

Specific Requirements for New Buildings

The nature and extent of life and fire safety systems required will depend on the building type, structure, construction, occupancy, and exposures. Sponsors should prepare a Life and Fire Safety Master Plan identifying major fire risks, applicable codes, standards and regulations, and mitigation measures. The Master

[82] US NFPA. http://www.nfpa.org/catalog/product.asp?category%5Fname=&pid=10106&target%5Fpid=10106&src%5Fpid=&link%5Ftype=search

Plan should be prepared by a suitably qualified professional, and adequately cover, but not be limited to, the issues addressed briefly in the following points. The suitably qualified professional selected to prepare the Master Plan is responsible for a detailed treatment of the following illustrative, and all other required, issues.

Fire Prevention

Fire prevention addresses the identification of fire risks and ignition sources, and measures needed to limit fast fire and smoke development. These issues include:

- Fuel load and control of combustibles
- Ignition sources
- Interior finish flame spread characteristics
- Interior finish smoke production characteristics
- Human acts, and housekeeping and maintenance

Means of Egress

Means of Egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency, such as:

- Clear, unimpeded escape routes
- Accessibility to the impaired/handicapped
- Marking and signing
- Emergency lighting

Detection and Alarm Systems

These systems encompass all measures, including communication and public address systems needed to detect a fire and alert:

- Building staff
- Emergency response teams
- Occupants
- Civil defense

Compartmentation

Compartmentation involves all measures to prevent or slow the spread of fire and smoke, including:

- Separations
- Fire walls
- Floors
- Doors
- Dampers
- Smoke control systems

Fire Suppression and Control

Fire suppression and control includes all automatic and manual fire protection installations, such as:

- Automatic sprinkler systems
- Manual portable extinguishers
- Fire hose reels

Emergency Response Plan

An Emergency Response Plan is a set of scenario–based procedures to assist staff and emergency response teams during real life emergency and training exercises. This chapter of the Fire and Life Safety Master Plan should include an assessment of local fire prevention and suppression capabilities.

Operation and Maintenance

Operation and Maintenance involves preparing schedules for mandatory regular maintenance and testing of life and fire safety features to ensure that mechanical, electrical, and civil structures and systems are at all times in conformance with life and fire safety design criteria and required operational readiness.

L&FS Master Plan Review and Approval

- A suitably qualified professional prepares and submits a Life and Fire Safety (L&FS) Master Plan, including preliminary drawings and specifications, and certifies that the design

meets the requirements of these L&FS guidelines. The findings and recommendations of the review are then used to establish the conditions of a Corrective Action Plan and a time frame for implementing the changes.

- The suitably qualified professional conducts a review as part of the project completion test at the time of life and fire safety systems testing and commissioning, and certifies that construction of these systems has been carried out in accordance with the accepted design. The findings and recommendations of the review are used as the basis for establishing project completion or to establish the conditions of a Pre-Completion Corrective Action Plan and a time frame for implementing the changes.

Specific Requirements for Existing Buildings

- All life and fire safety guideline requirements for new buildings apply to existing buildings programmed for renovation. A suitably qualified professional conducts a complete life and fire safety review of existing buildings slated for renovation. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.
- If it becomes apparent that life and fire safety conditions are deficient in an existing building that is not part of the project or that has not been programmed for renovation, a life and fire safety review of the building may be conducted by a suitably qualified professional. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.

Other Hazards

- Facilities, buildings, plants, and structures should be situated to minimize potential risks from forces of nature (e.g. earthquakes, tsunamis, floods, windstorms, and fires from surrounding areas).
- All such structures should be designed in accordance with the criteria mandated by situation-, climatic-, and geology-specific location risks (e.g. seismic activity, wind loading, and other dynamic loads).
- Structural engineers and architects responsible for facilities, buildings, plants and structures should certify the applicability and appropriateness of the design criteria employed.
- National or regional building regulations typically contain fire safety codes and standards[83] or these standards are found in separate Fire Codes.[84,85] Generally, such codes and regulations incorporate further compliance requirements with respect to methodology, practice, testing, and other codes and standards[86]. Such nationally referenced material constitutes the acceptable fire life safety code.

3.4 Traffic Safety

Traffic accidents have become one of the most significant causes of injuries and fatalities among members of the public worldwide. Traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents[87]. Road safety initiatives proportional to the scope and nature of project activities should include:

[83] For example, Australia, Canada, South Africa, United Kingdom

[84] Réglementation Incendie [des ERP]

[85] USA NFPA, 2006.

[86] Prepared by National Institutes and Authorities such as American Society for Testing and Materials (ASTM), British Standards (BS), German Institute of Standardization (DIN), and French Standards (NF)

[87] Additional information on vulnerable users of public roads in developing countries is provided by Peden et al., 2004.

- Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:
  - Emphasizing safety aspects among drivers
  - Improving driving skills and requiring licensing of drivers
  - Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
  - Avoiding dangerous routes and times of day to reduce the risk of accidents
  - Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

Where the project may contribute to a significant increase in traffic along existing roads, or where road transport is a significant component of a project, recommended measures include:

- Minimizing pedestrian interaction with construction vehicles
- Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns)[88]
- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents
- Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic
- Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

3.5 Transport of Hazardous Materials

General Hazardous Materials Transport

- Projects should have procedures in place that ensure compliance with local laws and international requirements applicable to the transport of hazardous materials, including:
  - IATA requirements[89] for air transport
  - IMDG Code[90] sea transport
  - UN Model Regulations[91] of other international standards as well as local requirements for land transport
  - Host-country commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their disposal and Rotterdam Convention on the prior Inform Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, if applicable to the project activities
- The procedures for transportation of hazardous materials (Hazmats) should include:
  - Proper labeling of containers, including the identify and quantity of the contents, hazards, and shipper contact information
  - Providing a shipping document (e.g. shipping manifest) that describes the contents of the load and its associated hazards in addition to the labeling of the containers. The shipping document should establish a chain-of-custody using multiple signed copies to show that the waste was properly shipped, transported and received by the recycling or treatment/disposal facility

[88] Additional sources of information for implementation of road safety measures is available at WHO, 1989, Ross et al., 1991, Tsunokawa and Hoban, 1997, and OECD, 1999

[89] IATA, 2005. www.iata.org

[90] IMO. www.imo.org/safety

[91] United Nations. Transport of Dangerous Goods - Model Regulations. 14th Revised Edition. Geneva 2005. http://www.unece.org/trans/danger/publi/unrec/rev14/14files_e.html

- Ensuring that the volume, nature, integrity and protection of packaging and containers used for transport are appropriate for the type and quantity of hazardous material and modes of transport involved
- Ensuring adequate transport vehicle specifications
- Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures
- Using labeling and placarding (external signs on transport vehicles), as required
- Providing the necessary means for emergency response on call 24 hours/day

Major Transportation Hazards

Guidance related to major transportation hazards should be implemented in addition to measures presented in the preceding section for preventing or minimizing the consequences of catastrophic releases of hazardous materials, which may result in toxic, fire, explosion, or other hazards during transportation.

In addition to these aforementioned procedures, projects which transport hazardous materials *at or above the threshold quantities*[92] should prepare a Hazardous Materials Transportation Plan containing all of the elements presented below[93].

Hazard Assessment

The hazard assessment should identify the potential hazard involved in the transportation of hazardous materials by reviewing:

- The hazard characteristics of the substances identified during the screening stage
- The history of accidents, both by the company and its contractors, involving hazardous materials transportation
- The existing criteria for the safe transportation of hazardous materials, including environmental management systems used by the company and its contractors

This review should cover the management actions, preventive measures and emergency response procedures described below. The hazard assessment helps to determine what additional measures may be required to complete the plan.

Management Actions

- *Management of Change:* These procedures should address:
  - The technical basis for changes in hazardous materials offered for transportation, routes and/or procedures
  - The potential impact of changes on health and safety
  - Modification required to operating procedures
  - Authorization requirements
  - Employees affected
  - Training needs
- *Compliance Audit:* A compliance audit evaluates compliance with prevention requirements for each transportation route or for each hazardous material, as appropriate. A compliance audit covering each element of the prevention measures (see below) should be conducted at least every three years. The audit program should include:
  - Preparation of a report of the findings
  - Determination and documentation of the appropriate response to each finding
  - Documentation that any deficiency has been corrected.
- *Incident Investigation:* Incidents can provide valuable information about transportation hazards and the steps needed to prevent accidental releases. The implementation of incident investigation procedures should ensure that:
  - Investigations are initiated promptly
  - Summaries of investigations are included in a report
  - Report findings and recommendations are addressed

[92] Threshold quantities for the transport of hazardous materials are found in the UN – Transport of Dangerous Goods – Model Regulations cited above.

[93] For further information and guidance, please refer to International Finance Corporation (IFC) Hazardous Materials Transportation Manual. Washington, D.C. December 2000.

- Reports are reviewed with staff and contractors

- *Employee Participation:* There should be a written plan of action regarding the implementation of active employee participation in the prevention of accidents.

- *Contractors:* The plan should include procedures to ensure that:
  - The contractor is provided with safety performance procedures and safety and hazard information
  - Contractors observe safety practices
  - Verify that the contractor acts responsibly

  The plan should also include additional procedures to ensure the contractors will:
  - Ensure appropriate training for their employees
  - Ensure their employees know process hazards and applicable emergency actions
  - Prepare and submit training records
  - Inform employees about the hazards presented by their work

- *Training:* Good training programs on operating procedures will provide the employees with the necessary information to understand how to operate safely and why safe operations are needed. The training program should include:
  - The list of employees to be trained
  - Specific training objectives
  - Mechanisms to achieve objectives (i.e. hands-on workshops, videos, etc.)
  - Means to determine the effectiveness of the training program
  - Training procedures for new hires and refresher programs

Preventive Measures

The plan should include procedures to implement preventive measures specific to each hazardous material offered for transportation, including:

- Classification and segregation of hazardous materials in warehouses and transport units
- Packaging and packaging testing
- Marking and labeling of packages containing hazardous materials
- Handling and securing packages containing hazardous materials in transport units
- Marking and placarding of transport units
- Documentation (e.g. bills of lading)
- Application of special provisions, as appropriate

Emergency Preparedness and Response

It is important to develop procedures and practices for the handling of hazardous materials that allow for quick and efficient responses to accidents that may result in injury or environmental damage. The sponsor should prepare an Emergency Preparedness and Response Plan that should cover:

- *Planning Coordination:* This should include procedures for:
  - Informing the public and emergency response agencies
  - Documenting first aid and emergency medical treatment
  - Taking emergency response actions
  - Reviewing and updating the emergency response plan to reflect changes and ensuring that the employees are informed of such changes

- *Emergency Equipment:* The plan should include procedures for using, inspecting, testing, and maintaining emergency response equipment.

- *Training:* Employees should be trained in any relevant procedures

3.6 Disease Prevention

Communicable Diseases

Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications.

Recommended interventions at the project level include[94]:

- Providing surveillance and active screening and treatment of workers
- Preventing illness among workers in local communities by:
  - Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection, and protecting others from infection, by encouraging condom use
  - Training health workers in disease treatment
  - Conducting immunization programs for workers in local communities to improve health and guard against infection
  - Providing health services
- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers
- Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization

Vector-Borne Diseases

Reducing the impact of vector-borne disease on the long-term health of workers is best accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease. Project sponsors, in close collaboration with community health authorities, can implement an integrated control strategy for mosquito and other arthropod-borne diseases that might involve:

- Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements
- Elimination of unusable impounded water
- Increase in water velocity in natural and artificial channels
- Considering the application of residual insecticide to dormitory walls
- Implementation of integrated vector control programs
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites
- Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs
- Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread
- Collaboration and exchange of in-kind services with other control programs in the project area to maximize beneficial effects
- Educating project personnel and area residents on risks, prevention, and available treatment
- Monitoring communities during high-risk seasons to detect and treat cases

[94] Additional sources of information on disease prevention include IFC, 2006; UNDP, 2000, 2003; Walley et al., 2000; Kindhauser, 2003; Heymann, 2004.

- Distributing appropriate education materials
- Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure

3.7 Emergency Preparedness and Response

An emergency is an unplanned event when a project operation loses control, or could lose control, of a situation that may result in risks to human health, property, or the environment, either within the facility or in the local community. Emergencies do not normally include safe work practices for frequent upsets or events that are covered by occupational health and safety.

All projects should have an Emergency Preparedness and Response Plan that is commensurate with the risks of the facility and that includes the following basic elements:

- Administration (policy, purpose, distribution, definitions, etc)
- Organization of emergency areas (command centers, medical stations, etc)
- Roles and responsibilities
- Communication systems
- Emergency response procedures
- Emergency resources
- Training and updating
- Checklists (role and action list and equipment checklist)
- Business Continuity and Contingency

Additional information is provided for key components of the emergency plan, as follows below.

Communication Systems

Worker notification and communication

Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency. Related measures include:

- Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment, or other considerations
- Installing a back-up system for communications on-site with off-site resources, such as fire departments, in the event that normal communication methods may be inoperable during an emergency

Community Notification

If a local community may be at risk from a potential emergency arising at the facility, the company should implement communication measures to alert the community, such as:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)
- Providing advise on selecting an appropriate protection option

Media and Agency Relations

Emergency information should be communicated to the media through:

- A trained, local spokesperson able to interact with relevant stakeholders, and offer guidance to the company for speaking to the media, government, and other agencies
- Written press releases with accurate information, appropriate level of detail for the emergency, and for which accuracy can be guaranteed

Emergency Resources

Finance and Emergency Funds

- A mechanism should be provided for funding emergency activities.

Fire Services

- The company should consider the level of local fire fighting capacity and whether equipment is available for use at the facility in the event of a major emergency or natural disaster. If insufficient capacity is available, fire fighting capacity should be acquired that may include pumps, water supplies, trucks, and training for personnel.

Medical Services

- The company should provide first aid attendants for the facility as well as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital.

Availability of Resources

Appropriate measures for managing the availability of resources in case of an emergency include:

- Maintaining a list of external equipment, personnel, facilities, funding, expert knowledge, and materials that may be required to respond to emergencies. The list should include personnel with specialized expertise for spill clean-up, flood control, engineering, water treatment, environmental science, etc., or any of the functions required to adequately respond to the identified emergency
- Providing personnel who can readily call up resources, as required
- Tracking and managing the costs associated with emergency resources
- Considering the quantity, response time, capability, limitations, and cost of these resources, for both site-specific emergencies, and community or regional emergencies
- Considering if external resources are unable to provide sufficient capacity during a regional emergency and whether additional resources may need to be maintained on-site

Mutual Aid

Mutual aid agreements decrease administrative confusion and provide a clear basis for response by mutual aid providers.

- Where appropriate, mutual aid agreements should be maintained with other organizations to allow for sharing of personnel and specialized equipment.

Contact List

- The company should develop a list of contact information for all internal and external resources and personnel. The list should include the name, description, location, and contact details (telephone, email) for each of the resources, and be maintained annually.

Training and Updating

The emergency preparedness facilities and emergency response plans require maintenance, review, and updating to account for changes in equipment, personnel, and facilities. Training programs and practice exercises provide for testing systems to ensure an adequate level of emergency preparedness. Programs should:

- Identify training needs based on the roles and responsibilities, capabilities and requirements of personnel in an emergency
- Develop a training plan to address needs, particularly for fire fighting, spill response, and evacuation

- Conduct annual training, at least, and perhaps more frequent training when the response includes specialized equipment, procedures, or hazards, or when otherwise mandated
- Provide training exercises to allow personnel the opportunity to test emergency preparedness, including:
  - Desk top exercises with only a few personnel, where the contact lists are tested and the facilities and communication assessed
  - Response exercises, typically involving drills that allow for testing of equipment and logistics
- Debrief upon completion of a training exercise to assess what worked well and what aspects require improvement
- Update the plan, as required, after each exercise. Elements of the plan subject to significant change (such as contact lists) should be replaced
- Record training activities and the outcomes of the training

Business Continuity and Contingency

Measures to address business continuity and contingency include:

- Identifying replacement supplies or facilities to allow business continuity following an emergency. For example, alternate sources of water, electricity, and fuel are commonly sought.
- Using redundant or duplicate supply systems as part of facility operations to increase the likelihood of business continuity.
- Maintaining back-ups of critical information in a secure location to expedite the return to normal operations following an emergency.

4.0 Construction and Decommissioning

Applicability and Approach

This section provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities. Cross referencing is made to various other sections of the General EHS Guidelines.

4.1 Environment{ TC "4.1 Environment" \f C \l "2" }

Noise and Vibration

During construction and decommissioning activities, noise and vibration may be caused by the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people. Some recommended noise reduction and control strategies to consider in areas close to community areas include:

- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance
- Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines.
- Avoiding or minimizing project transportation through community areas

Soil Erosion

Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters. Recommended soil erosion and water system management approaches include:

Sediment mobilization and transport

- Reducing or preventing erosion by:
  - Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical
  - Contouring and minimizing length and steepness of slopes
  - Mulching to stabilize exposed areas
  - Re-vegetating areas promptly
  - Designing channels and ditches for post-construction flows
  - Lining steep channel and slopes (e.g. use jute matting)
- Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and water treatment, and modifying or suspending activities during extreme rainfall and high winds to the extent practical.

Clean runoff management

- Segregating or diverting clean water runoff to prevent it mixing with water containing a high solids content, to minimize the volume of water to be treated prior to release

Road design

- Limiting access road gradients to reduce runoff-induced erosion
- Providing adequate road drainage based on road width, surface material, compaction, and maintenance

Disturbance to water bodies

- Depending on the potential for adverse impacts, installing free-spanning structures (e.g., single span bridges) for road watercourse crossings
- Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna (e.g., migration, spawning, etc.)
- For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water
- Consider using trenchless technology for pipeline crossings (e.g., suspended crossings) or installation by directional drilling

Structural (slope) stability

- Providing effective short term measures for slope stabilization, sediment control and subsidence control until long term measures for the operational phase can be implemented
- Providing adequate drainage systems to minimize and control infiltration

Air Quality

Construction and decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. A secondary source of emissions may include exhaust from diesel engines of earth moving equipment, as well as from open burning of solid waste on-site. Techniques to consider for the reduction and control of air emissions from construction and decommissioning sites include:

- Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone)
- Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content
- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements
- Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition
- Managing emissions from mobile sources according to Section 1.1
- Avoiding open burning of solid (refer to solid waste management guidance in Section 1.6)

Solid Waste

Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include office, kitchen, and dormitory wastes when these types of operations are part of construction project activities. *Hazardous solid waste* includes contaminated soils, which could potentially be encountered on-site due to previous land use activities, or small

amounts of machinery maintenance materials, such as oily rags, used oil filters, and used oil, as well as spill cleanup materials from oil and fuel spills. Techniques for preventing and controlling non-hazardous and hazardous construction site solid waste include those already discussed in Section 1.6.

Hazardous Materials

Construction and decommissioning activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. These materials may also be encountered during decommissioning activities in building components or industrial process equipment. Techniques for prevention, minimization, and control of these impacts include:

- Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids,
- Using impervious surfaces for refueling areas and other fluid transfer areas
- Training workers on the correct transfer and handling of fuels and chemicals and the response to spills
- Providing portable spill containment and cleanup equipment on site and training in the equipment deployment
- Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities, and managing their treatment and disposal according to Sections 1.5 and 1.6 on Hazardous Materials and Hazardous Waste Management, respectively
- Assessing the presence of hazardous substances in or on building materials (e.g., polychlorinated biphenyls, asbestos-containing flooring or insulation) and decontaminating or properly managing contaminated building materials

Wastewater Discharges

Construction and decommissioning activities may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at all construction sites. Sanitary wastewater in construction and other sites should be managed as described in Section 1.3.

Contaminated Land

Land contamination may be encountered in sites under construction or decommissioning due to known or unknown historical releases of hazardous materials or oil, or due to the presence of abandoned infrastructure formerly used to store or handle these materials, including underground storage tanks. Actions necessary to manage the risk from contaminated land will depend on factors such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy should include:

- Managing contaminated media with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post construction or post decommissioning
- Understanding the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction or decommissioning activities
- Preparing plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land in Section 1.6
- Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section 1.6.

Successful implementation of any management strategy may require identification and cooperation with whoever is responsible and liable for the contamination.

4.2 Occupational Health and Safety{ TC "4.2 Occupational Health and Safety" \f C \l "2" }

Over-exertion

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction and decommissioning sites. Recommendations for their prevention and control include:

- Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary
- Planning work site layout to minimize the need for manual transfer of heavy loads
- Selecting tools and designing work stations that reduce force requirements and holding times, and which promote improved postures, including, where applicable, user adjustable work stations
- Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks

Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction and decommissioning sites. Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths
- Cleaning up excessive waste debris and liquid spills regularly
- Locating electrical cords and ropes in common areas and marked corridors
- Use of slip retardant footwear

Work in Heights

Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction or decommissioning sites. If fall hazards exist, a fall protection plan should be in place which includes one or more of the following aspects, depending on the nature of the fall hazard[95]:

- Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface
- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support 5000 pounds (also described in this section in Working at Heights above), as well as fall rescue procedures to deal with workers whose fall has been successfully arrested. The tie in point of the fall arresting system should also be able to support 5000 pounds
- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as

[95] Additional information on identification of fall hazards and design of protection systems can be found in the United States Occupational Health and Safety Administration's (US OSHA) web site: http://www.osha.gov/SLTC/fallprotection/index.html

securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces

Struck By Objects

Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. Techniques for the prevention and control of these hazards include:

- Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels
- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable
- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap
- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged
- Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes

Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving. Techniques for the prevention and control of these impacts include:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic
- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle
- Ensuring moving equipment is outfitted with audible back-up alarms
- Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

Dust

- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements
- PPE, such as dusk masks, should be used where dust levels are excessive

Confined Spaces and Excavations

Examples of confined spaces that may be present in construction or demolition sites include: silos, vats, hoppers, utility vaults, tanks, sewers, pipes, and access shafts. Ditches and trenches may also be considered a confined space when access or egress is limited. In addition to the guidance provided in Section 2.8 the occupational hazards associated with confined spaces and excavations in construction and decommissioning sites should be prevented according to the following recommendations:

- Controlling site-specific factors which may contribute to excavation slope instability including, for example, the use of excavation dewatering, side-walls support, and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment, or drowning
- Providing safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders
- Avoiding the operation of combustion equipment for prolonged periods inside excavations areas where other workers are required to enter unless the area is actively ventilated

Other Site Hazards

Construction and decommissioning sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms, which should be prevented through the implementation of project-specific plans and other applicable management practices, including:

- Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition
- Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls (PCBs), electrical components containing mercury[96]
- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection

4.3 Community Health and Safety{ TC "4.3 Community Health and Safety" \f C \l "2" }

General Site Hazards

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards. Risk management strategies may include:

- Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community
- Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials

Disease Prevention

Increased incidence of communicable and vector-borne diseases attributable to construction activities represents a potentially serious health threat to project personnel and residents of local communities. Recommendations for the prevention and control of communicable and vector-borne diseases also applicable to

[96] Additional information on the management and removal of asbestos containing building materials can be found in ASTM Standard E2356 and E1368

construction phase activities are provided in Section 3.6 (Disease Prevention).

Traffic Safety

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures described in Section 3.4 (Traffic Safety).

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Environmental, Health, and Safety Guidelines for Food and Beverage Processing

Introduction

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP)[1]. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the **General EHS Guidelines** document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at: www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

Applicability

These guidelines cover the processing of meat[2], vegetable, and fruit raw materials into value-added food and beverage[3] products for human consumption. Meat and poultry slaughtering and processing activities, from reception of the animals until the carcasses are ready for sale or further processing, are covered in the EHS Guidelines for Meat Processing and the EHS Guidelines for Poultry Processing. This document is organized according to the following sections:

Section 1.0 — Industry-Specific Impacts and Management
Section 2.0 — Performance Indicators and Monitoring
Section 3.0 — References
Annex A — General Description of Industry Activities

[1] Defined as the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

[2] Meat includes beef, pig, and poultry.

[3] Includes only the manufacturing of non-fermented beverages. Beer manufacturing is addressed in the EHS Guidelines for Breweries.

1.0 Industry Specific Impacts and Management

The following section provides a summary of EHS issues associated with food and beverage processing, which occur during the operational phase, along with recommendations for their management. Recommendations for the management of EHS issues common to most large industrial facilities during the construction and decommissioning phases are provided in the **General EHS Guidelines**.

1.1 Environment

Essential tools for managing impacts while optimizing water, energy, and resource use and improving working practices involve the adoption of industry-specific good-manufacturing practice, quality management systems (including ISO 9000 series, ISO 22000), risk management systems (e.g., Hazard Analysis Critical Control Points, HACCP), and environmental management standards (e.g., ISO 14000).[4]

Environmental issues in food and beverage processing facilities primarily include the following:

- Solid waste
- Wastewater
- Energy consumption
- Emissions to air

Solid Waste

Depending on the raw materials, food and beverage processing activities may generate significant volumes of organic, putrescible solid waste in the form of inedible materials and rejected products from sorting, grading and other production processes.[5] Where meat products are the raw material, solid waste generated during processing may include organic materials that have the potential to significantly impact food safety due to the proliferation of pathogenic microorganisms.[6]

Recommended measures to prevent and control solid waste generation include the following:

- Minimize inventory storage time for raw materials to reduce losses from putrefaction;
- Monitor and regulate refrigeration and cooling systems during storage and processing activities to minimize product loss, optimize energy consumption, and prevent odors;
- Consider use of enclosure techniques to minimize damage to raw materials stored outdoors;
- Monitor and optimize process yields, e.g. during manual grading or cutting activities, and encourage the most productive employees to train others in efficient processing.
- Clean, sort, and grade raw foodstuffs at an early stage (e.g. at the farm site), in order to reduce organic waste and substandard products at the processing facility;
- Contain solid waste in dry form and consider disposal through composting and / or use for soil amendment;
- Organic and non-organic debris / soil, solid organic matter, and liquid effluents, including sludge from wastewater

[4] HACCP is for the systematic identification and management of risks associated with the production and distribution of foodstuffs. ISO 22000:2005 covers requirements for a food safety management system in which an organization in the food chain demonstrates its ability to control food safety impacts to ensure that food is safe at the time of human consumption. ISO 9000 series is an international standard for the certification of manufacturing and quality management systems; ISO 14001 is an international standard for the certification of environmental management systems.

[5] For example, mushrooms have a low wastage factor (around 3 – 5 percent) whereas the wastage factor for sweet corn kernel processing is much higher (around 50-60 percent). United Nations Environment Programme (UNEP). 2004. Working Group for Cleaner Production in the Food Industry. Fact Sheet 3: Food Manufacturing Series. Food and Beverage Processing.

[6] The proportion of animal by-products in food processing activities in relation to their carcass weight ranges from approximately 8 to 16.5 percent for pig, 7 to 8 percent for poultry, and 12 percent for beef. European Union (EU) Commission. 2006. Directorate General Joint Research Council (JRC) Institute for Prospective Technological Studies. Integrated Pollution Prevention and Control Reference Document on Best Available Techniques in the Food, Drink and Milk Industries.

treatment, which remain after the implementation of waste prevention strategies should be recycled as a soil amendment (based on an assessment of potential impacts to soil and water resources) or other beneficial uses such as energy production;

- Collect and reuse rejected raw materials for manufacturing other products;[7]
- Provide leak-proof containers for collected solid and liquid waste;
- Segregating individual by-products from each other and from waste to maximize their use and minimize waste.

Wastewater

Industrial Process Wastewater

Effluent streams from food and beverage processing may have a high biochemical and chemical oxygen demand (BOD and COD) resulting from organic wastes entering into the wastewater stream, and from the use of chemicals and detergents in various processes including cleaning (discussed below). In addition, effluent may contain pathogenic bacteria, pesticide residues, suspended and dissolved solids such as fibers and soil particles, nutrients and microbes, and variable pH. The effluent load should be reduced by preventing raw materials, intermediates, product, by-product and wastes from unnecessarily entering the wastewater system, as discussed in the solid waste section above.

Process Wastewater Treatment

Techniques for treating industrial process wastewater in this sector include grease traps, skimmers or oil water separators for separation of floatable solids; flow and load equalization; sedimentation for suspended solids reduction using clarifiers; biological treatment, typically anaerobic followed by aerobic treatment, for reduction of soluble organic matter (BOD); biological nutrient removal for reduction in nitrogen and phosphorus; chlorination of effluent when disinfection is required; dewatering and disposal of residuals; in some instances composting or land application of wastewater treatment residuals of acceptable quality may be possible. Additional engineering controls may be required to contain and neutralize nuisance odors.

Management of industrial wastewater and examples of treatment approaches are discussed in the **General EHS Guidelines**. Through use of these technologies and good practice techniques for wastewater management, facilities should meet the Guideline Values for wastewater discharge as indicated in the relevant table of Section 2 of this industry sector document.

Other Wastewater Streams & Water Consumption

Guidance on the management of non-contaminated wastewater from utility operations, non-contaminated stormwater, and sanitary sewage is provided in the **General EHS Guidelines**. Contaminated streams should be routed to the treatment system for industrial process wastewater. Food and beverage processing activities (e.g. washing, internal transport of raw materials using water, cooling of blanched foods, and general equipment cleansing) may consume large quantities of water.[8] In addition to the recommendations on water conservation included in the **General EHS Guidelines**, industry specific measures include the following:

[7] Secondary products may include jams and cut products, such as coleslaws; sauerkraut; orange peels for use in dietary fiber supplements; potato pulp for production of biofuel; onion material for onion oil production, fructooligosaccarides, pectic polysaccharides, and low-lignin dietary fiber; animal waste for production of animal feeds with strict recognition of biosafety considerations; and use of bones, fat, and other by-products from meat as raw material for glue, detergents, gelatin, and other materials.

[8] Water demands in meat processing are diverse and may, depending upon the specific operation, include thawing of frozen materials, continuous equipment, boot, apron and clothing washing and disinfection as well as generation of steam and process heat, and cooling processes.

- Minimize water consumed during production processes:
  - Optimize product conveying systems to reduce contact of raw material and product with water, for example by using dry instead of wet conveying systems. Optimize process line operations to avoid spills of raw materials and water, reducing the need to wastewater treatment and associated energy consumption;
  - Use dry methods, such as air classifiers, magnetic separators and vibration over sieving and screening devices, for the primary cleaning of robust raw materials with low moisture content;
  - Where feasible, use a continuous / batch steam or a dry caustic process for peeling activities, or alternatively, consider dry caustic peeling;
  - Minimize rate of make-up supply to continuously overflowing tanks, flumes etc.
  - Use taps with automatic shut-off valves and use high water pressure and optimized nozzles,
  - Use counter-current wash techniques for primary wash of raw materials;
  - Implement dry clean of equipment with scraper or broom before cleaning with water
  - Minimize wet transport (pumping) of waste
- Reuse water streams in the production processes to the maximum extent possible while avoiding water contamination or compromising food safety:
  - Separate and recirculate cooling water from process and waste water streams. Recirculate and reuse thawing water in a closed circuit provided this practice does not compromise food safety
  - Recirculate fluming water used in vegetable transfer provided this practice does not compromise food safety
  - Return condensate for use as boiler feed water. Alternative uses for condensate include as a sprinkling agent for dust suppression or in general factory wash down (e.g. cleaning the floor)
  - Where feasible, recycle low grade wash water and reusing it for the primary wash of raw materials or for wet transport
  - Explore opportunities collection and use of storm water consistent with food safety requirements
- Review process lines and operations to identify opportunities to reduce the effluent load by minimizing contact with water at every stage of the process, to avoid contamination of the water and the need for consequent treatment, including:
  - Use dry methods (e.g. vibration or air jet) to clean raw materials
  - Install grids to reduce or avoid the introduction of solid materials into the wastewater drainage system. Install trays to catch waste from trimming operations and juice / product on conveyors
  - Ensure regular integrity testing of bulk storage tanks for product and waste
  - Provide secondary containment for storage and process vessels to contain spills
  - Adopt best-practice methods for plant cleaning, which can be manual or automated Clean In Place (CIP)[9] systems, using approved chemicals and (or) detergents with minimal environmental impact and compatibility with subsequent wastewater treatment processes.

[9] Automated CIP systems reduce chemical, water, and energy consumption and facilitate rinse recovery but may not be appropriate for all applications.

Energy Consumption

Food and beverage processing activities may require high levels of thermal energy consumption in process heating, cooling, and refrigeration. In addition to the recommendations on energy conservation included in the **General EHS Guidelines**, industry specific measures include the following[10]:

- Implement operational, maintenance and housekeeping measures:
  - Insulate refrigeration room/areas and use of automatically closing doors and airlocks
  - Insulate refrigeration rooms / areas
- Optimize plant processes for energy efficiency:
  - Use Combined Heat and Power (CHP) particularly in plants which have high heat and power demand for more than 5000 hours/year
  - Reduce the size of refrigeration rooms where feasible, but still taking food safety into consideration
  - Design plant layout to reduce pumping and conveyor belt transportation distances
  - Ensure that fouling on heat transfer surfaces, for example in the sterilization process, is regularly cleaned to ensure optimum efficiency
  - Avoid refrigeration of fruits, vegetables and by-products intended for animal feed by storing outside in clean covered areas or in containers, when climate conditions and plant design allow
  - Use high temperature pre-cooling before refrigerated cooling and freezing, for example, after blanching pre-chill products by passing them cold water before freezing. This is particularly cost –effective when liquid nitrogen freezing is used.
- Recover energy from thermal processes where possible. Heat recovery opportunities may include, for example[11]:
  - Recovering heat from ovens, dryers, evaporators, pasteurizers and sterilizers.
  - Maximizing regeneration efficiency in plate heat exchanger pasteurizers (regeneration efficiency up to 94 percent is possible)
  - Recovering heat from condensed steam for blanching and steam peeling operations before it is discharged
  - Using multi-effect evaporators in large scale evaporator applications.

Emissions to Air

The main air pollutants from food and beverage processing operations consist of particulate matter (PM) and odor. PM may arise from solids handling, solid reduction and drying. Odor may be released by thermal processing steps such as steam peeling, blanching and dehydrating and by microbial action in stored solid waste. In meat processing, odor may also be emitted from cooking and smoking activities. [12]

Management of emissions to air from combustion sources for electricity generation is addressed in the **General EHS Guidelines**.

Particulate Matter

Recommended techniques to prevent and control particulate matter emissions include[13]:

- Cover skips and vessels, and stockpiles, especially outdoors;
- Enclose silos and containers used for bulk storage of powders and fine materials;

[10] EC (2006)

[11] EC (2006)
[12] EC (2006)
[13] Based on Environment Agency. 2003. Environment and Heritage Service. Guidance for the Food and Drink Sector. Sector Guidance Note IPPC S6.20.

- Where enclosure is not feasible, use sprays, windbreaks, sweeping, sprinkling, and other stockpile management techniques to suppress dust ;
- Use closed conveyors equipped with filters to clean transport air prior to release;
- Use cyclones and, if necessary, and fabric filters to remove dust from exhaust air;
- Remove particulate matter from the gas stream using dry cyclones, venturi scrubbers, electrostatic precipitators (ESPs) or dry filter systems, as necessary.

Odor

Recommended techniques to prevent and control point source odor emissions include:

- Use exhaust stack heights that are consistent with Good Engineering Practice (GEP) as described in the **General EHS Guidelines**;
- If the plant is in close proximity to residential areas consider the use of wet scrubbers to remove odor emissions. Wet scrubbers are used to remove odors with a high affinity to water, such as ammonia emitted during the rendering process; and
- During the procurement of air emission systems for smoking units, it is best practice to install integrated systems that combine air cleaning, incineration, and heat recovery. Such systems are highly effective with regard to the reduction of odor emissions, production / energy efficiency;
- Recirculate exhaust gas from frying and other cooking operations to the burner.

Recommended techniques to prevent and control fugitive emissions of odor include:

- Minimize storage duration for solid waste to avoid putrefaction;
- Operate facilities under partial vacuum to prevent fugitive odor emission;
- Regular inspection of chilling and freezing equipment to monitor loss of refrigerants.

1.2 Occupational Health and Safety

Occupational health and safety issues associated with the operation of food and beverage processing during the construction and decommissioning phases are discussed in the **General EHS Guidelines**. Hazards during the operational phase include the following:

- Physical hazards
- Exposure to noise
- Biological hazards
- Chemical hazards
- Exposure to heat and cold

Physical Hazards

Physical hazards include exposure to same-level fall hazards due to slippery conditions, the use of machines and tools, and collisions with internal transport equipment, such as forklift trucks and containers. Guidance on general workplace conditions, including design and maintenance of working and walking surfaces to prevent slips and falls, is presented in the **General EHS Guidelines**. Additional, industry-specific recommendations are presented below.

- Maintain walking and working surfaces clean and dry by preventing spillages through equipment design and operation, providing workers with anti slip footwear where still necessary;

- Control of occupational risks at their source through implementation of engineering controls. Address residual risks based on hygiene and safety surveys and by providing workers with training in the proper use and maintenance of safety devises (including the proper use of machine safety devises) and personal protective equipment (PPE), such as hearing protection, and gloves, aprons etc. to avoid cuts, amputations, and other sharp instrument traumas;
- Ensure that the process layout reduces opportunities for process activities to cross paths, thus avoiding collisions and falls;
- Demarcate transport corridors and working areas and ensure the proper placement of handrails on platforms, ladders, and stairs;
- Prevent ingress of water;
- Ground all electrical equipment and installations;
- Prepare emergency plans and train staff for emergency situations.

Lifting, Repetitive Work, and Work Posture Injuries

Food and beverage processing activities may include a variety of situations in which workers can be exposed to lifting, carrying, repetitive work, and work-posture injuries. Such injuries may result from heavy manual lifting and repetitive work, including the operation of slicing and vacuum-packing machines and poor working postures caused by inadequate workstation and process activity design. Recommended management approaches to reduce these injuries are discussed in the **General EHS Guidelines**.

Exposure to Noise

A variety of operations in food and beverage processing units generate substantial noise levels, for example the canning plant, bottling machines, conveyors and blanching applications. Recommended measures to prevent and control worker exposure to noise are discussed in the **General EHS Guidelines**.

Biological Hazards

Exposure to biological and microbiological agents may be associated with inhalation and ingestion of dust and aerosols. Dust from the ingredients used in food and beverage processing and high levels of humidity may cause skin irritation or other allergic reactions.

Recommendations for the prevention and control of exposures to biological hazards specific to food and beverage processing include the following:

- Avoid dust- and aerosol-generating activities (such as use of compressed air or high-pressure water for cleaning) and, where they cannot be avoided, provide proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to dust and aerosols;
- Install exhaust ventilation equipped with filters, cyclones, etc., at sources of dust;
- Provide workers with PPE that is appropriate for the process activity, e.g. masks and gloves;
- Ensure physical segregation of work and welfare facilities to maintain worker personal hygiene.

Chemical Hazards

Exposure to chemicals (including gases and vapors) typically involves chemical-handling activities related to cleaning operations, disinfection of process areas and use of preservatives in long-term food storage, in addition to the maintenance of heating (thermal oils) and cooling systems (ammonia). Recommended measures to prevent and control exposure to chemicals are discussed in the **General EHS Guidelines**.

Food and beverage processing sites usually have large refrigeration systems, which often use ammonia as a primary refrigerant, and may have secondary refrigerants such as glycols or brines. Ammonia is a toxic substance and can form explosive mixtures with air. Guidance on the safe use of ammonia and other refrigerants is readily available from professional refrigeration institution[14] and should be considered.

Heat and Cold

Food and beverage processing may create changing temperature conditions due to activities such as heat treatment, chilling and freezing. Workers may be exposed to heat from steam peeling, pasteurization, and canning processes and exposed to low temperatures in refrigerated areas / rooms. Irradiation dosing to extend the shelf-life of fruits and vegetables should be monitored for occupational exposure to radiation. Recommended measures to prevent and control exposure to heat, cold, and radiation are discussed in the **General EHS Guidelines**.

1.3 Community Health and Safety

Community health and safety impacts during the construction and decommissioning of food and beverage processing facilities are common to those of most industrial facilities and are discussed in the **General EHS Guidelines.** Industry-specific issues with the potential to impact the community are those associated with hygiene and food safety.

Process, Equipment, and Staff Hygiene

The design of the processing plant should be organized to ensure that products move from "dirty" to "clean" areas to avoid recontamination. Employee movement within the facility should be opposite to the flow direction of products (i.e. from "clean" towards "dirty" zones). Cleaning activities during processing will depend on the particular production and processing systems. Daily cleaning and disinfection should comprise:

- Ensuring proper equipment clearance for cleaning
- Removal of solid waste
- Pre-rinsing with water
- Application of detergent(s)
- Rinsing
- Disinfection
- Post rinsing
- Post treatment

Staff should be trained in food safety issues and should follow established procedures for hand washing, working attire (clothes, shoes, gloves and hair coverage), and how to handle injuries and diseases.

Food Safety Impacts and Management

A food product recall caused by contaminated or adulterated food products can devastate a viable business. If a company can trace its products to specific lot numbers, then recall is a matter of removing all foods associated with those numbers. With a robust food safety program in place, a company can protect itself from product adulteration, contamination, and the impacts of food recalls.

Food and beverage processing should therefore be performed according to internationally recognized food safety standards consistent with the principles and practices of Hazard Analysis Critical Control Points (HACCP)[15]; and Codex Alimentarius[16].

[14] See the Institute of Refrigeration (IOR) for guidelines on the safe design of ammonia and other refrigeration systems, as well as safe handling of ammonia. Also, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

[15] International Organization for Standardization (ISO) (2005)
[16] Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) (1962-2005)

The Codex Alimentarius provides Current Official Standards for a range of specific products from the food and beverage processing sector including canned, quick frozen, and whole fresh food products. In addition the Codex Alimentarius provides Current Official Standards for general and specific manufacturing steps in the production process, for example General Principles of Food Hygiene, Recommended International Code of Hygienic Practice for Canned Food and Beverage Products and the Recommended International Code of Practice for the Packaging and Transport of Tropical Fresh Food and beverages. In general, recommended food safety principles include:

- Strictly maintain cold chains and other preservation processes;
- Full institutionalization of HACCP prerequisites as well as Standard Operational Procedures, including:
  - Sanitation
  - Good Manufacturing Practice (GMP)
  - Pest control
  - Chemical control
  - Allergen control
  - Staff hygiene and education
  - Customer complaints mechanism
  - Traceability and reuse

2.0 Performance Indicators and Monitoring

2.1 Environment

Emissions and Effluent Guidelines

Table 1 presents effluent guidelines for this sector. Guideline values for process emissions and effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with recognized regulatory frameworks. These guidelines are achievable under normal operating conditions in appropriately designed and operated facilities through the application of pollution prevention and control techniques discussed in the preceding sections of this document. These levels should be achieved, without dilution, at least 95 percent of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Deviation from these levels in consideration of specific, local project conditions should be justified in the environmental assessment.

Effluent guidelines are applicable for direct discharges of treated effluents to surface waters for general use. Site-specific discharge levels may be established based on the availability and requirements of publicly operated sewage collection and treatment systems or, if discharged directly to surface waters, on the receiving water use classification as described in the **General EHS Guidelines**.

Emissions from food processing activities are principally associated with particulate matter (PM) and odor. PM and odor emissions from point sources such as ventilation exhaust systems and smoking units should be released through GEP-designed stacks. Smoking unit emissions of PM should typically not exceed 50 mg/Nm3. Combustion source emissions guidelines associated with steam- and power-generation activities from sources with a capacity equal to or lower than 50 MWth are addressed in the **General EHS Guidelines** with larger power source emissions addressed in the Thermal Power EHS Guidelines. Guidance on ambient considerations based on the total load of emissions is provided in the **General EHS Guidelines**.

Table 1. Effluent levels for food and beverage processing

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD_5	mg/l	50
COD	mg/l	250
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Temperature increase	°C	<3[b]
Total coliform bacteria	MPN[a] / 100 ml	400
Active Ingredients / Antibiotics	To be determined on a case specific basis	

Notes:
[a] MPN = Most Probable Number
[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

Table 2: Waste Generation in the Food and Beverage Processing Sector

Solid waste produced per tonne of product	Unit	Industry Benchmark
Maize	Kg	40
Peas	Kg	40
Potatoes	Kg	40
Broccoli	Kg	200
Carrots	Kg	200
Strawberries	Kg	60
Apples	Kg	90
Peaches	Kg	180

Resource Use and Waste Generation

Tables 2 and 3 provide examples of resource consumption indicators for energy, water, materials, and waste in this sector. Industry benchmark values are provided for comparative purposes only and individual projects should target continual improvement in these areas.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and resource use applicable to the particular project.

Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the **General EHS Guidelines**.

2.2 Occupational Health and Safety

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),[17] the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),[18] Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),[19] Indicative Occupational Exposure Limit Values published by European Union member states,[20] or other similar sources.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive)[21].

Occupational Health and Safety Monitoring

The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals[22] as part of an occupational health and safety monitoring program.

Table 3: Resource and Energy Consumption in Food and Beverage Processing

Outputs per unit of product	Unit	Industry Benchmark
Electricity Consumption [a]	kWh$_e$/t frozen vegetables	
Sorting of vegetables (carrots)		8
Caustic peeling of vegetables		2
Steam peeling of vegetables		3.5
Washing of vegetables (carrots)		2.5
Mechanical processing prior to freezing (diced carrots)		2.5
Drum blanching in deep freezing of vegetables		0.5 – 1.3
Countercurrent water cooling of vegetable		0.5 – 1.3
Belt blancher with water cooler		2 - 9
Belt blancher with air cooling		7 - 30
Water Consumption	m^3/ton	
Canned fruit		2.5-4.0
Canned vegetables		3.5-6.0
Frozen vegetables		5.0 – 8.5
Fruit juices		6.5
Jams		6.0
Potato processing: [b] Range Well managed		4.5 – 9.0 5.1
Cooked Ham [b]		4 - 18
Cured Ham [b]		2 - 20
Sausages, ham, bacon, etc. [b]		10 - 20

NOTES
[a] Tables 3.31 – 3.39. European Commission. IPPC. Reference Document on BAT in the Food Drink and Milk Industries. P. 169 - 177.
[b] Table 3.20: Water consumption for some processes in the food and beverage sector. European Commission. IPPC. Reference Document on BAT in the Food Drink and Milk Industries. P. 162.

[17] Available at: http://www.acgih.org/TLV/ and http://www.acgih.org/store/
[18] Available at: http://www.cdc.gov/niosh/npg/
[19] Available at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992
[20] Available at: http://europe.osha.eu.int/good_practice/risks/ds/oel/
[21] Available at: http://www.bls.gov/iif/ and http://www.hse.gov.uk/statistics/index.htm

[22] Accredited professionals may include Certified Industrial Hygienists, Registered Occupational Hygienists, or Certified Safety Professionals or their equivalent.

Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the **General EHS Guidelines**.

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Annex A: General Description of Industry Activities

The food and beverage processing sector covers a wide range of products. Many process steps are common to the manufacture activities of different products. Food and beverage processing plants vary in size and location, and are ideally located in close proximity to fresh water resources. Plant operation is often seasonal reflecting the harvesting of the raw materials, however product lines are unaffected by seasonal variations and take place throughout the year.

Figure 1.0 summarizes the major processes for most food and beverage products from fruit and vegetable sources, though the actual process flow will vary depending on the product and the plant set-up. Figure 2.0 summarizes the major steps for processing of meat products, specifically applicable to cooked ham manufacturing.

Fruit and Vegetable Processing[23]

Fruit and vegetable production begins with the preparation of the raw food and beverages thorough a variety of methods including cleaning, trimming and peeling to reduce the product to a uniform size before cooking, canning, drying or freezing, as well as pulping and filtration to make soft drinks. The process culminates with the packaging and transport of the final product.

There are two major sub-sectors including fresh packed products and processed products. Processed products involve other unit operations such as cooking, evaporating and drying to provide product diversity and increase shelf-life. Common examples of processed fruit products are canned peaches and pears, dried fruits, jams and jellies, and fruit purees for use in the food industry. Examples of processed vegetable products include canned beans and frozen peas, as well as vacuum packed beetroot. Typical examples of soft drinks are food and beverage juices and concentrated fruit extracts for dilution with water.

Receipt of Raw Materials

Raw materials are typically delivered in bulk on trucks and are off-loaded directly for processing or for storage (e. g. in silos). Other solid material ingredients may be delivered in bags on pallets. Liquid raw materials and ingredients may be transported in bulk tankers and pumped to storage tanks or delivered in containers on pallets. Solid raw materials are conveyed by belts and elevators.

Primary Grading / Screening

This process stage often covers grading and sorting but its main objective is the assessment of the overall quality of the food using a number of criteria. Solid raw materials should preferably be sorted and graded on the farm in order to minimize the quantity of waste material, organic and non-organic debris, and off-specification product that is transported to the processing plant.

Intermediary Storage

Storage of food and beverages can be required at various stages of the manufacturing process and the storage conditions will be dependent on the product. In general the parameters to be controlled for storage include humidity, temperature, atmospheric conditions, and hygiene.

Primary Cleaning

Primary cleaning removes and separates off-specification material, organic and non-organic debris, metals, and pesticide residues, among other contaminants, from the raw material prior

[23] This section briefly describes the major manufacturing steps in the food and beverage processing sector and has been adapted from text in the British Environment Agency's Guidance for the Food and Drink Sector, Environmental Agency (2003).

to further processing. The method used depends on the type of materials to be removed and may include the use of water although dry methods are favored for water conservations and wastewater prevention reasons.

When water is used, the raw materials may be sprayed, and then immersed for organic and non-organic debris removal using brushes, shaking, and stirring. The spray water may be chlorinated and detergents may be added to the wash water, which may also be heated to increase cleaning efficiency.

Sorting, Grading and Inspection

The washed material may be sorted, graded and inspected prior to further processing to ensure uniformity. Sorting is the separation of materials into categories and the main factors are size, shape, weight, and color. Size sorting is typically done using screens and sieves. Shape sorting may be done manually or mechanically and weight sorting is typically used for valuable material such as tropical fruits. Color sorting is performed manually or by use of computer technology whereby the material passes the control point on conveyor belts at high rates and rejected items are blasted away using compressed air.

Product Preparation

Most raw materials have parts that are inedible and need to be removed in order to make the raw materials uniform and suitable for further processing. In the product preparation phase, the sorted and graded materials are subjected to a variety of processes including trimming (manual or by rotating knives), peeling, and size reduction, as well as mixing, forming, separation and concentration of the food components. Various peeling methods are available including flash steam, flame, knife, abrasion, and caustic.

Product Processing

Food and beverages can be processed as a single operation or in a combination of several operations. The most common processing methods are through heat application and heat removal. The heat application methods include blanching, pasteurization, heat sterilization, evaporation, and dehydration including heat processing by baking or cooking in oils. Heat removal processing includes chilling, controlled or modified storage and packaging (to reduce the rate of respiration), freezing, and freeze-drying. Other preservation and processing methods include the use of sodium chloride and sugar, food additives, and irradiation.

Packaging

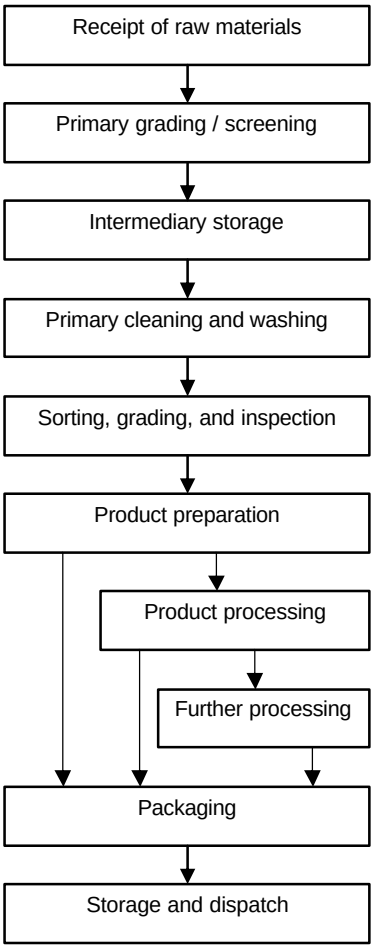
Products are packed to provide containment, protection, communication, and convenience. Packaging materials typically used in the food and beverage processing sector include flexible polymer materials (e.g. single films and laminates), paper, cardboard and corrugated cardboard, glass, cans, and wooden or polymer boxes.

Meat Processing

If beef, poultry and pork are received frozen, processing involves thawing after arrival to the processing plant using air, water showers, or water immersion techniques. The first two techniques generally require less water consumption than immersion thawing methods. Thawed meat is then cut into retail portions using electric cutting systems. Excess fat and bones can be reprocessed into commercial products such as gelatin, glues, etc. Fresh cuts are refrigerated prior to further processing into preserved meat products, such as sausage, ham, and bacon. Cuts may be ground down and reconstituted into different product shapes using various processing machinery. Preservation techniques include heat, such as cooking (e.g. in water bath, shower, steam, and hot air ovens) and smoking,

dehydration, fermentation, brining, curing, pickling, and canning. These activities are performed to increase the shelf life of the product. Brining, curing and pickling typically involve injection of a saline solution, followed by a massaging process to ensure mixing of ingredients and product additives. Meats are then inserted into casings to define their shape and size.

Figure A.1: General Process for Food and Beverage Processing Operations



Source: Adapted from UNEP (2004)

Figure A.2: Canned Meat Production (Including Cured and Cooked Meat)