URBAN POLICY & STRATEGIC PLANNING
P & D DEPARTMENT GOVT OF SINDH

ENVIRONMENTAL & SOCIAL MANAGEMENT FRAMEWORK (ESMF) STUDY

MULTI-SECTORAL ACTION FOR NUTRITION PROJECT



FINAL REPORT
DECEMBER 2016

EMC Pakistan Private Limited

Pakistan

Multi-Sectoral Action for Nutrition Program

Environmental and Social Management Framework (ESMF)

Directorate of Urban Policy & Strategic Planning, Planning & Development Department, Government of Sindh

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Executive Summary

Local Government and Housing Town Planning Department, GOS and Agriculture Department GOS with grant assistance from DFID funded multi donor trust fund for Nutrition in Pakistan are planning to undertake Multi-Sectoral Action for Nutrition (MSAN) Project. ESMF Consultant[1] has been commissioned by Directorate of Urban Policy & Strategic Planning to fulfil World Bank Operational Policies and to prepare "Environmental and Social Management Framework (ESMF) for MSAN Project" at its inception stage via assessing the project's environmental and social viability through various environmental components like air, water, noise, land, ecology along with the parameters of human interest and mitigating adverse impacts along with chalking out of guidelines, SOPs, procedure for detailed EA during project execution.

The project has two components under Inter Sectoral Nutrition Strategy of Sindh (INSS), i) the sanitation component of the project aligns with the Government of Sindh's sanitation intervention known as Saaf Suthro Sindh (SSS) in 13 districts in the province and aims to increase the number of ODF villages through certification while ii) the agriculture for nutrition (A4N) component includes pilot targeting beneficiaries for household production and consumption of healthier foods through increased household food production in 20 Union Councils of 4 districts.

Saaf Suthro Sindh (SSS)

This component of the project will be sponsored by Local Government and Housing Town Planning Department, Sindh and executed by Local Government Department (LGD) through NGOs working for the Inter-sectoral Nutrition Support Program. 100% "Open Defecation Free (ODF)" Villages will be maintained through the Village Org. (VOs) and the UC staff of the LGD. The sub-projects under this component will be located in Dadu, Jacobabad, Kashmore, Larkana, Kambar-Shahdadkot, Tharparkar, Badin, Sanghar, Tando Muhammad Khan, Umerkot, Shikarpur, Thatta; and Sujawal. The proposed interventions under this component are i) Preparation of District ODF Plans, ii) Human Resource Development, iii) Community Behavior Change Activities and iv) Hardware support for Schools.

Agriculture for Nutrition (A4N)

This component will be sponsored by Department of Agriculture (DOA), GOS and executed by DG, Agriculture extension. NGOs / CSO/ Communities are operating under this component. The sub-projects under this component will be located in Jacobabad, Tharparkar, Sanghar and Umerkot. The proposed interventions under this component are i) Mobilization and Group Formation, ii) Food Production and Management, iii) Awareness Raising, Capacity Building, Research and Knowledge Management and iv) Project Management, Inter-sectoral Coordination, Monitoring and Evaluation.

Targeted Results

The sanitation and agriculture components linked to the Inter Sectoral Nutrition Strategy (INSS) of Sindh and will focus on nutrition results in a coordinated manner to have integrated impact. Relevant core sector indicators are expected to be utilized, i.e. (i) People trained to improve hygiene behavior or sanitation practices under the project (number of), and (ii) Clients who have adopted agricultural technologies and

[1] M/s EMC Pakistan Private Limited

approaches promoted by the project. Expected key results will be further refined during project preparation and are likely to include:

- Eradication of open defecation of the villages in the 13 target districts;
- Percentage of targeted households that are consuming a more diverse and healthy diet;
- Platforms established and functioning for inter-sectoral coordination and planning at provincial and district levels.

Intermediate Results

- Capacity of key staff at local and provincial government is improved to coordinate across administrative boundaries and extend appropriate service to target households;
- Percentage of the rural population in targeted villages wash hands with soap at critical times;
- Number of small farmers, landless peasant / women are trained in kitchen gardening, poultry, honey bee keeping and livestock rearing including small ruminants;
- Number of household raising livestock and preparing livestock products.

Regulatory Review

Sindh Environmental Protection Act 2014 being as principle legislation of environmental protection in Sindh Province envisages protection, improvement, conservation and rehabilitation with the help of legal action against polluters and green awakening of communities. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the Sindh Environmental Quality Standards (SEQS) specified by the Sindh Environmental Protection Agency (SEPA) has been prohibited under the Act.

Location and design of the sub-projects to be undertaken under MSAN project are not known yet, therefore a framework approach has been being taken to carry out environmental and social assessment of these subprojects. Under this approach, the present ESMF/RPF has been prepared to identify the potential generic negative environmental and social impacts, propose generic mitigation measures, provide basic screening criteria, list the type of safeguard instruments to be developed and provide institutional, monitoring, reporting and documentation measures for environmental and social safeguards compliance.

The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. As per World Bank's OP 4.01: (7) Depending on the project, a range of instruments can be used to satisfy the Bank's EA requirement: environmental impact assessment (EIA), regional or sectoral EA, strategic environmental and social assessment (SESA), environmental audit, hazard or risk assessment, environmental management plan (EMP) and environmental and social management framework (ESMF). Therefore, this ESMF will be prepared to fulfill Bank's EA requirements and Operational Policies.

Triggered Operational Policies (OPs) of World Bank and their management under ESMF

OP 4.01 - Environmental Assessment: The Project intends to finance a variety of types of small-scale interventions (e.g. toilets and hand washing stations in schools, kitchen garden demonstrations comprising tunnel farming, livestock sheds, fish ponds, use of pesticides and chemical fertilizers) that can have adverse but small nature environmental impacts. *The ESMF checklist is designed to identify these potential impacts, and direct communities and project teams to practical ways of avoiding or mitigating them. If project*

screening used by implementing agencies that more detailed planning work is required, they can require that an acceptable ESMP be prepared before the project application can be considered further.

Operational Policy OP 4.09 - Pest Management: This policy is triggered for A4N component as the component comprising activities engaging with pesticides and pest management. *An Integrated Pest Management Plan (IPMP) will address pesticide usage especially in vegetable crops besides other crops being considered in the project. The plan will also articulate a strategy to incorporate IPM principles in A4N interventions specifically.*

Operational Policy OP 4.12 – Involuntary Resettlement: This policy is triggered in case the project needs to acquire small pieces of land for certain interventions (e.g. storage facilities). A Resettlement Policy Framework (RPF) has been prepared, and Resettlement Action Plans will be prepared where land is acquired. *In most other cases, small pieces of land for interventions will be taken using Voluntary Land Donation (VLD) with appropriate screening to ensure that land is donated without any pressure. This will be monitored to ensure that VLD procedures are properly documented and accepted by the community.* Chapter 8 – Resettlement Policy Framework describing involuntary resettlement is provided to address these concerns.

Environmental and Social Management

The ESMF report presents the regulatory review, broad baseline data collected for air, water, land, biological and socio-economic components of environment, identification, prediction and evaluation of generic impacts and preparation of ESMF with Resettlement Policy Framework (RPF) for mitigation of adverse impacts that may arise due to the proposed project interventions.

Baseline Data Collection

After initial information was collected and reviewed, Reconnaissance Survey (RS) in each district was conducted to collect primary information for the sub-projects. Profiles of each district were made during the RS depicting varied baseline conditions. 70-90 % of the population in the villages openly defecates. Unemployment is the also a main problem for females in villages. In fact, not a single female is educated in the some villages.

Northern parts of target area of project are subjected to waterlogging and salinity as well as the deltaic area of river Indus. Consequently in desert region, extreme drought conditions prevail throughout the year make it difficult for agriculture through irrigation. In desert areas, rain is the main source of water and therefore agriculture and livestock activities are dependent on rainfall, the failure of monsoon means no fodder for the cattle and livestock. The dug well is the only source of drinking water in the area. The underground water is largely brackish with limited spots of sweet water.

Stakeholder consultations

Stakeholder consultations have been carried out with (i) local communities who are the direct beneficiaries of the project interventions and (ii) institutions who have an important role in enabling the realization of the project interventions. These consultations have revealed that the proposed MSAN project is considered to have a positive social impact by improving sanitation while eradicating open defecation as well as provision of nutrition food by the introduction of nutrition sensitive agriculture. Communities were of the view that i) SSS programme can change villagers' health and environment and can save children from diseases ii) people

were aware that diseases are cause due to unhygienic conditions but find it very difficult for them to build latrines and enclosed washrooms, iii) several community members were expected to be provided financial assistance from any organization for the construction of latrines, iv) due to waterlogging situation in some districts, fish farming becomes a good source of livelihood and many farmers have switched their lands into fish farms, v) farmers are keen to learn good agriculture practices (GAP) because they are unaware of them, and vi) Improved employment opportunities and skill set trainings for women were identified as the priority areas for future interventions.

Consultation with institutions revealed that i) different environmental and socio-economic conditions of the target districts calls for localized management plans to implement the environmental and socio-economic targets, ii) training and capacity-building components must be imparted for implementation and monitoring of community-based environmental protection, iii) existing project should be designed to ensure rigorous periodic awareness and sensitization sessions, iv) clean water should be ensured in schools as part of the health and hygiene awareness component, v) lesson learning from previous projects and ground realities must be incorporated for both the SSS and A4N projects, vi) available technologies of latrine construction should be carefully revised for social and environmental implications, and vii) coordination amongst various stakeholders at all levels to enable knowledge-sharing, incorporation of lessons learnt and harmonization of project execution at the field level.

Impact Assessment

Most of the Project's environmental and social impacts will be beneficial, including for example the positive effect on health caused by the reduction in Diarrhea and sanitation related diseases and the associated socio-economic benefits, considerable behavior change activities at community and district levels, and improved productivity (particularly benefiting females) generated by taking nutritious diet and good sanitation and hygiene conditions. The potential negative environmental and social impacts of the project are i) construction related localized and short-term impacts under SSS such as air and water pollution, noise generation, drainage and safety hazards etc. ii) under A4N includes increased use of pesticides and other agro-chemicals, water contamination especially surface water etc. these impacts require appropriate mitigation and management measures to contain them.

Environmental and Social Management

Under ESMF approach, each subproject will be screened for the severity and extent of environmental and social impacts. Subprojects having negligible environmental and or social impacts will be screened through a rapid assessment checklist. Subprojects having some negative but localized environmental and or social impacts will require a generic Environmental and Social Management Plan (ESMP) to be prepared.

Recommendations under Environmental and Social Mitigation Plan

Subproject Siting to any sensitive area

- It will be ensured through screening checklist that the subproject avoids any ecologically sensitive areas, PCRs and involuntary resettlement.
- Involuntary Resettlement Screening Checklist to be used to check the land belong to the school or government land and free from any disputes.

- Village Organizations and LGD officials will be taken onboard for the identification construction site in schools.
- The subprojects will be established on the land owned by Agriculture department. However, private land if acquired will be through VLD procedure. If VLD will not be possible, the RPF as part of this report will be applied. Complete documentation will be maintained for VLD.
- Valuation and compensation of affected assets of community should be in line with RPF/Sub-projects RAPs and considered before the field activities.
- Community consultations will be carried out before establishing the sites.

Unsuitable toilet construction may lead to water contamination

- During behavior change activities in the communities, environment friendly designs of toilets (suitable for that specific area) will be disseminated within the communities as a guide and unfriendly design impacts shall be communicated.
- Monitoring shall be made during project life cycle to check the sustainability of implemented interventions.
- Flush toilets should not be encouraged in areas under the project where water is scarce and in dry season. It will be ensured to provide these site specific provisions in toilets construction guidelines by the project implementation unit.

Pit/septic tank Sludge Management

- Sludge Management should be made part ESMPs of each sub-project. Sludge after emptying the tanks/pits should be landfilled at proper location and left for degradation.
- During behavior change activities in the communities, this aspect will be communicated and awareness raising workshops will be conducted in communities.

Use of Adulterated/ banned Pesticide / Excessive use of chemical Fertilizer

- Judicious use of the irrigation water, chemical inputs and use of alternate techniques (such as integrated pest management, using disease-resistant seeds, and mulching) will be promoted through awareness raising and capacity building initiatives.
- The capacity building program will also include safe handling of hazardous substances such as pesticides.
- High efficiency irrigation technologies (e.g. tunnel farming) which is included one of the interventions of A4N component will be promoted to conserve already scarce irrigation water. ES of IP and ES from directorates will ensure to promote it in above areas after filling environmental checklists and incorporated in the FFS scope.

Health and Safety Hazards for the farmers

- Awareness and capacity building regarding Material Safety Data Sheet (MSDS) for each hazardous substance will be promoted.
- WB Group's EHS Guidelines will be implemented as appropriate.
- Use of appropriate personal protective equipment (PPE) will be mandatory while using pesticides.

Impacts on Women, Children, and Vulnerable Groups

- Women's participation is already included in project interventions like development Female farmer field schools (F3S), construction of girl toilets, focusing on women as the main agriculture producers.
- Lady Extension Workers (LEW) will be engaged as contingent staff for short period, so as, to work with women beneficiaries. (PC-I of A4N)
- Environmental screening checklist will provide first stage information about impacts on poor, women and other vulnerable groups including needs and priority for social and economic betterment;
- IPs and TSPs will ensure the active participation of women in project interventions as well as adequately consulted.
- In awareness raising under SSS, women share should be more compared to men.
- Ensure participation of vulnerable groups in project activities through consultations, to ensure planned investments take the well-being of such groups into consideration

Implementation Mechanism

Project Directors (PD) of SSS and A4N will be overall responsible for the implementation of ESMF compliance throughout the project life. Project Coordinator/ Deputy Director will coordinate with the Implementing Partners / technical support partners (IPs/TSPs) and the District Coordination Committee (DCC) of each district will take the prime responsibility to ensure the ESMF implementation across the district and reports to the PD. Environmental Specialists and Social Specialists will be hired by the PD under Sanitation / agriculture Directorates, who will assist PD to implement ESMF in letter and spirit. Both specialist will directly be responsible for subproject screening, development of subproject specific ESMPs and their implementation, internal monitoring and progress reporting. Environmental and Social Focal Persons (ESFPs) will be designated by the DCC for each district for the implementation of Environmental and social/resettlement issues, addressing grievances, conduct stakeholders consultations and coordination and reporting to Project Coordinator/ Deputy Director. IPs/TSPs will support community participation, consultations and other social activities from the sub-project identification to completion stage.

Monitoring Mechanism under ESMF: ESMF monitoring will be carried out to ensure that the mitigation plans are regularly and effectively implemented. It will be carried out at three levels. The directorate level, district level and at field level. At the provincial level, the environment and social specialists will carry out ESMF monitoring to ensure that the mitigation plans are being effectively implemented, and will conduct field visits on a regular basis. The district monitoring unit (DMU) and District nutrition coordination committee (DNCC) will also be responsible for ESMF implementation monitoring and evaluation. The DMU and DNCC will also conduct consultation with communities especially women. IPs and TSPs will carry out monitoring at field level.

Training Mechanism

Implementation of subprojects under SSS and A4N components under MSAN project will require comprehensive trainings, demonstrations & long-term sustainability. The environmental & social aspects identifications and mitigations integrated with the SSS/A4N training effort will equip the project facilitators for a keen sight of project component related environmental issues and their solutions. The trainings will include but not be limited on the subject of responsible social mobilization and eco-friendly approach for appropriate and feasible toilet construction with immediate and long term solutions for waste and waste

water disposal. The Components of A4N subproject presently include provisions for Training of the DOA and DOLF staff for promotion and implementation of nutrition sensitive agriculture (NSA).

Environmental specialist and social specialist under Sanitation Directorate will actually execute the training programs. They will also be responsible for preparing the reports for each of the trainings conducted by various project units. ESFPs will be responsible for the overall implementation of training plan at district level and will also ensure proper relevant documentation. Additionally, IPs/TSPs will be responsible to provide trainings to their field staff and workers under supervision of ESFPs and they will also document the trainings.

Grievance Redress Mechanism (GRM)

In an effort to deter fraud and corruption, the use of a dedicated mobile application has been proposed for reporting of grievances from field level to district and provincial headquarters. This will not only provide a coherent system of checks and balances but will also enable swift redressal and effective monitoring of complaints. The Directorates for both the SSS and A4N projects will serve as the secretariat for the Grievance Redressal Committee (GRC-Directorate) that will be responsible for providing oversight on the entire GRM process at a strategic level and monitoring of complaints management. Grievance Focal Points (GFPs), which will be the ambassador of change and educated people from each community on each sub-project site. Two GFPs (1 male and 1 female) will be selected for each sub-project locations and will be community members who are easily approached by the community. A Public Complaints Center (PCC), which will be responsible to receive, log, and resolve complaints. A Grievance Redress Committee (GRC-District) will be established for each district that will manage GRM aspects for all sub-project locations in each district including decisions to be taken, actions and monitoring of complaints resolution at sub-project level. The ESFPs will play an instrumental role in steering the GRC functions at the district levels.

Grievance Focal Persons will be trained to address grievances on the spot to discourage lengthy procedures and inconvenience to the local community. However, where the case cannot be dealt with by GFPs on an ad-hoc basis, GFPs will use smart phones to lodge and communicate those complaints at the district and directorate levels. The Grievance Redress Committee at the district level will review and identify actions to be taken to address the complaints at its weekly meeting. Also Public Complaints Center (PCC), which will be responsible to receive, log, and resolve complaints via its number(s) disseminated in local DC offices. If not satisfactorily resolved by the Grievance Redress Committee-District, the grievance will be referred to consideration by GRC at the Directorate level within one week. Every effort will be made to address or resolve grievances within the following fixed time-lines, which will be an indicator against the performance of the handling system. Acknowledgement of a written submission will be issued to the complainant within three working days. If not resolved earlier by the IP/TSP/ LGD/DOA/DOLF officers on site, grievances will be tabled for discussion/resolution during Committee meeting within one week of receipt of the written submission. If the complainant is not satisfied, the complaint will have the option to seek redress through court of law.

ESMF implementation cost

The total cost of the ESMF implementation has been estimated to be about Pak Rupees 72.23 million. This includes costs of environment and social specialists, trainings, third party validation, and ESMP preparation for individual subprojects. This cost is included in the overall project cost.

Resettlement Policy Framework (RPF)

The Resettlement Policy Framework which is a part of this report will only apply to interventions where land may be acquired for small-scale interventions that cannot be acquired through Voluntary Land Donation (VLD) procedures. Directorate of Agriculture will completely avoid land acquisition. Whenever there is additional land requirement, the directorate will interact with the land owners and facilitate voluntary donation of land required for taking up sub-projects under the project. This use of voluntary donation option will be limited to demonstration plots used by Farmer Field Schools (FFS). Under no circumstances, the titleholder shall be subjected to any pressure, directly or indirectly, to part with the land. These actions are expected to minimize adverse impacts on the local population and help in project benefits reaching all sections of community. The directorate will ensure that the process of voluntary donation of land is meticulously documented to avoid confusions, misunderstandings, litigations, etc. at a later stage. A protocol and format for this purpose is provided under VLD protocol.

A Resettlement Unit will be formed under each Directorates. The Directorate of Agriculture under A4N component will have the overall responsibility for implementation of all resettlement tasks. The Directorate will be assisted by SS for implementation of RAPs. The SS under Directorate of Agriculture will oversee and direct all the activities during the implementation of RAPs. ESFPs at the district level will be responsible for implementing the RAP according to the agreed principles and procedures. The Executive District Officer of Revenue Department, along with his staff, will be responsible for the acquisition of private land under Land Acquisition Act of Pakistan. The ESFPs will be responsible for coordination with the Revenue Department.

Sector-wise Recommendations

WASH: 1) Even after a village attains ODF Certification, maintaining this status is a challenge and arrangements should be made to minimize fallout. Trained District, Taluka-level administration and other trained personnel such as LHVs can be play an instrumental role in helping communities maintain ODF status post-project. The role of women both for the promotion of health and sanitation awareness is essential in rural areas of Sindh. 2) During behavior change activities in the communities, environment friendly designs of toilets (suitable for that specific area) will be disseminated within the communities as a guide and unfriendly design impacts shall be communicated. 3) Flush toilets should not be encouraged in areas under the project where water is scarce and in dry season. It will be ensured to provide these site specific provisions in toilets construction guidelines to the beneficiaries by the project implementation unit.

Nutrition Sensitive Agriculture: 1) In Jacobabad, western parts of Shanghar and Umerkot districts, water logging persisted due to availability of plenty of water due to the presence of IBIS. Interventions supporting water availability should be considered like fish farming, agriculture through irrigation. However, in water scarce areas like Tharparkar and eastern parts of Umerkot and Sanghar districts, careful planning will be required while implementing interventions under A4N. Livestock is the main livelihood of these areas and it should be promoted through better practices. However, to support the Nutrition Sensitive agriculture (NSA), crops which require less water and are saline water tolerant may be introduced. This idea will support the scarcity of water in the arid region. 2) Use of compost, or decomposed organic matter as fertilizer, has been found to improve soil structure, increasing its water-holding capacity. 3) Best Management Practices (BMP)s in the areas of organic farming should be incorporated.

پاکستان

ملٹی سیکٹورل ایکشن فار نیوٹریشن پراجیکٹ

ماحولیاتی اور معاشرتی انتظامی ڈھانچہ

ڈائیریکٹوریٹ اربن پالیسی اینڈ اسٹراٹیجک پلاننگ، پلاننگ اینڈ ڈویلپمینٹ ڈیپارٹمینٹ

حکومتِ سندھ

مختصر خلاصہ

دسمبر ۲۰۱۶

ماحولیاتی اور سماجی انتظامی ڈھانچہ (ESMF)

مقامی حکومت اور محکمہ برائے رہائش منصوبہ بندی حکومت سندھ اور زرعی محکمہ نے LGD کی امداد جو کثیر المقاصد فنڈ ٹرسٹ برائے غذائیت جو کہ پاکستان میں کثیر العلاقائی لائحہ عمل برائے غذائیت MSAN کے منصوبہ کی طرف پیش رفت ہے۔EMSF Consultant کو ڈائریکٹوریٹ آف اربن پالیسی کی طرف سے (MSAN) کا پراجیکٹ تفویز کیا گیا ہے تا کہ ورلڈ بینک کی آپریشنل پالیسیوں کی تکمیل ہو سکے اور ماحولیاتی اور سماجی انتظامی ڈھانچہ (ESMF) برائے MSAN اس کے ابتدائی مرحلہ پر نافذ العمل کرنے اور پرو جیکٹ کے ماحولیاتی اور سماجی جزویات کا احاطہ کرے اور احتیاتی تدابیر اور منفی اثرات سے تدارک کے ساتھ ساتھ ایک سربراہ لائحہ عمل برائے ماحولیاتی تجربہ کرنے کا طریقا کار وضع کرے جو کہ پروجیکٹ کے دوران اپنایا جا سکے۔اس منصوبہ کہ دو حصہ ہیں جو کہ بین لا کثیر العلاقائی غذائیت حکمت عملی برائے سندھ کے لیئے اپنائی گئی ہے۔

i) صفائی کا جزو حکومت سندھ کے صاف ستھرو سندھ (SSS) کے تحت ہو جو کہ سندھ کے ۱۳ ڈسٹرکٹ میں کام کرے گا۔

ii) جب کہ دوسرا زراعت برائے غذائیت (A4N) سے منسلک ہے جو کہ بنیادیطور پر گھریلو مدد سے زرعی پیداوار اور صحت بخش غذا کے فروغ اور پیداوار کی طرف سے مائیل ہے۔جن میں 4 ڈسٹرکٹ کی UC۲۰ شامل ہیں۔

صاف ستھرو سندھ (SSS): یہ پروجیکٹ کا جزو مقامی حکومت اور محکمہ برائے رہائشی اور بہتری منصوبہ بندی جیسے مقامی حکومت (LGD)، NGOs جو کہ بین کثیر العلاقائی غذائی تعاون منصوبہ کے تحت کھلے میدان میں رفائے حاجت سے پاک دیہات کے حصول دیہاتی تنظیمون، یونین کاؤنسل کے کارکن اور مقامی حکومت کے تعاون سے حاصل ہو سکے گی۔ذیلی منصوبہ اسی جزو کے تحت دادو، جیکب آباد، کشمور، لاڑکانہ، قمبر شہداد کوٹ، تھر پارکر، بدین، سانگھڑ، ٹنڈ محمد خان، عمر کوٹ، شکار پور، ٹھٹہ اور سجاول میں واقع ہوں گی۔ان کے تحت (ii) وسائل برائے انسانی ترقی (iii) برادری کا بدلنا (iv) اور اسکولوں کے لیئے امداد۔

زراعت برائے غذائیت (A 4 N): اس جزو کے تحت محکمہ زراعت، ڈائریکٹر جنرل کی معاونت سے عمل پذیر ہوگا۔ CSO/NGOs/ مختلف برادریاں سربراہ اس جزو میں عمل پیدا ہوں گی۔ذیلی منصوبہ کے تحت جیکب آباد، تھر پارکر، سانگھڑ اور عمر کوٹ میں یہ فعال ہوگا۔اس جزو میں (Mobilization) اور گروہ بندی (ii) خوراک کی پیداوار اور انتظام (iii) آگاہی تعمیر صلاحیت، تحقیق اور انتظام علم (iv) انتظام منصوبہ، بین علاقائی رابطہ، نگرانی و جائزہ شامل ہے۔

ھطمی نتائج:

صفائی اور زرعی جزو مل کر بین العلاقائی لائحہ عمل (NSS) برائے سندھ جو کہ غذائیت کے نتائج پر مذکورہ ہوگا اور ایک مربوط اور منظّم انداز میں اپنا اثر مرتب کرے گا ۔متعلقہ مرکزی علاقی عوامل کا بروئے کار آنے کا استعمال ہے (i) جیسا کہ عوام کا سنائی میں بہتری کا رجحان ادارہ عملہ طور پر مائل ہونا ان منصوبوں کے ذریعے (ii) وہ صارف جنہوں نے زرعی تکنولاجی اور عمل کو منصوبہ کے تحت بروئے کار لا کر اس میں حصہ لیا۔مطلوبہ کلیدی نتائج منصوبہ کی تکمیل کے دوران مزید لکھار کے ساتھ حاصل کیئے جائیں گے جس میں:

☆ کھلے میدان میں رفائے حاجات جو کہ ۱۳ اضلاع کے دیہات میں ہو رہی ہے اس کا صدباب کرنے کا ہدف ہے۔

☆ گھروں کا فیصدی حدف جو کہ ایک متنوع اور صحت مند غذا لیئے رہے ہیں۔

☆ ایک مساوی نظام اور عمل کا قیام جس میں بینا لعلاقائی معاونت اور منصوبہ بندی صوبائی اور ضلعی سطح پر ہو سکے۔

عبوری/غیر حتمی نتائج:

☆ کلیہ اسٹاف کی اہلیت و قابلیت کو مقامی اور صوبائی سطح پر بہتر بنانا تا کہ وہ انتظامی صلاحیت اور دائرہ کار کے پار مربوط طریقہ پر اپنی خدمات حدف یافتہ گھروں تک بہم پہنچا سکیں۔

☆ کئی چھوٹے کاشتکار، ھاری، اور عورتیں کی تربیت گھریلو باغبانی، مرغبانی، شہد مکھی ہانی اور مویشی بانی میں دینا ہے۔

☆ متعدد گھروں کو مویشی بانی اور ان کے ذریعہ سے مختلف اشاء کی تیاری کی تربیت دینا ہے۔

ضوابطی جائزہ:

سندھ ماحولیاتی تحفظ ایکٹ 2014 بحیثیت بنیادی ماحولیاتی تحفظ کے قانون اس صوبہ میں تحفظ بہتری، آبادگاری، قانونی کاروائی کے ساتھ آلودگی پھیلانے والوں کے خلاف اور سبز آگاہی اُجاگر کرنا عوام میں جیسے کام شامل ہیں کسی بھی قسم کا اخراج جو کہ سندھ کے ماحولیاتی معیار سے کم ہو یا منافی ہو SEPA کے ایکٹ کے تحت قابل قبول نھیں۔

MSAN کے تحت پروجیکٹ و منصوبہ اب تک ذیلی بنیادی پر نہ تو تیار ہوئے ہیں نہ ہی وقوع پذیر ہوئے ہیں چناچہ ان کا ڈھانچا ہی سامنے ہے جس کو رکھتے ہوئے ماحولیاتی اور سماجی تجربہ اسے تمام ذیلی منصوبوں کا کیا جا رہا ہے۔ اس روز رویہ کے تحت موجودہ ESMF/RPF اس طرح تیا رکیا گیا ہے کہ منفی ماحولیاتی اور سماجی اثرات کی اصلاحی تدابیر پیش کرے اور ساتھ ساتھ SCREENING یعنی چھٹائی کے طریقے کار تو یہ واضع کرے اس کے علاوہ احتیاتی عناصر کسی بھی نشاندہی کرے اور ادارتی، نگرانی، دستاویزی عمل کے ماحولیاتی اور سماجی تنخواہ کے لیئے قائم اور رائج رکھے۔

عالمی بینک کو منصوبوں کا ماحولیاتی تجربہ درکار رہنا ہے جن کو وہ مالی امداد دین تا کہ وہ اس بات کو یقینی بنالیں کردہ منصوبہ پائیدار اور ماحول کے لیئے موثر ہے لگے۔ عالمی بینک OP4.12 کے تحت منصوبہ کی بنیاد پر امن کی جانچ EIA، علاقائی ماحولیاتی تجربا , ESMF,EMP, Hazard/Risk assessment, Env. Aulit, SESA سے کی جاسکتی ہے چناچہ اس سلسلے میں ESMF کی بنیادی تیاری EA کی ضرورت WB کے لیئے پوری کی گئی ہے۔

عالمی بینک کی فعال لائحہ عملی اور انتظام برائے ESMF:

OP-4.01 ماحولیاتی تجزیہ: اس منصوبہ کے تحت متعدہ چھوٹے پیانے کے منصوبہ کی مالی امداد کرنا ہے جیسا کہ بیت الخلاء، اسکولوں میں ہاتھ دھونے کی جگھیں۔ گھریلو باغبانی جس میں سرنگ میں کھیتی لگانا، مویشی اور گلہ کے باڑے، مچھلی کے تالاب، کھاد اور کیمیائی اور کیڑا کش ادویات کا ستعمال شامل ہے جن کا ماحول پر منفی اثر ہوسکتا ہے۔ ESMF Checklist اس طرح ترتیب دی گئی ہے کہ یہ اثرات کو مئوثر طور پر نشاندہی کرتی ہے اور ان کا براہ داست برادری/لوگوں پر اثر انداز ہونے کی صورت میں انکا صدباب کے تدابیر بھی بتائی ہیں اگر منصوبہ کی Screening کی چھٹائی کا عمل اختیار کیا جائے تو مزید گھمبیر منصوبہ بندی کا کام درپیش آئے گا۔ جس کے لیئے ایک قابل

قبول ESMP کی بنیادی کی ضرورت ہوگی تا کہ منصوبہ کی درخواست آگے منظور ہو۔

فعال لائحہ عمل OP-4.09: کیڑوں کا انتظام:

یہ لائحہ عمل A4N جزو کہ ساتھ کارگر دی عمل آتا ہے جیسا کہ اس میں تمام وہ سرگرمی شامل ہے جس کا تعلق فصل کش کیڑوں اور ادویات سے ہے۔ IPMP (منضم کیڑوں کا انتظام کا منصوبہ) بالخصوص کیڑا کش ادویات کے استعمال سبزیوں کے فصل اور بالعموم دوسری فصلوں پر کرنے کی بابت دیکھے گا۔ اس کے علاوہ یہ لائحہ عمل بھی بتائے گا جس میں IPM کے اصولوں کو A4N میں اپنایا جا سکے۔

OP-4.12 غیر اختیاری آبادکاری:

اس پالیسی کو اس صورت میں متحرک کیا جا رہا ہے کہ شاید پراجیکٹ کے لئے زمین کے کچھ حصے کو حاصل کرنا پڑے (مثلاً اسٹورج کی سہولیات وغیرہ)۔ اس لئے ESMF میں ایک آبادی کی پالیسی کا فریم ورک تجویز کیا گیا ہے اور اسی کہ مدِ نظر رکھتے ہوئے آبادی کے پلان بنائے جائیں گے۔

زیادہ تر معاملات میں مناسب مسکرینگ کے ساتھ رضا کارانہ عطیہ برائے زمین (VLD) کے طریقے کو استعمال کیا جائے گا تا کہ چھوٹے ٹکرے زمین کے حاصل کئے جاسکیں اور یقینی بنایا جائے کہ کسی بھی دباؤ کے بغیر زمیں کا عطیہ دیا جائے۔ اس بات کی یقین دہائی کی جائے گی کہ VLD کے طریقے کا کہ صحی طرقے سے دستاویز کیا جائے اور کمیونٹی اسے قبول کرے۔ Chapter 8 جس میں آبادکاری کی پالیسی کا فریم ورک تجویز کیا گیا ہے اس موضوع کو بیان کرتا ہے۔

ماحولیاتی اور سماجی انتظام:

ESMF کی رپورٹ ضابطوں کا جائزہ، ہوا، پانی، زمین، ماحول، اوسماجی ومعاشی اجزاء کا ایک موثر اور بنیادی اعداد وشمار کی صورت میں کا خاکہ پیش کرتی ہے۔ جس کے ذریعے سے نشاندہی اثرات کی پیشگوئی اور تخفیہ لگا کر ESMF کی بنیادی بمع (RPF) برائے منفی اثرات جو کہ منصوبہ کی وقوع پزیر ہونے کی صورت میں آسکتے ہیں کا اہتمام کرنا ہے۔

بنیادی اعداد وشمار کا یکجا کرنا:

پہلی اور ابتدائی معلومات یکجا کی گئیں اور جائزہ لیا گیا۔ ریکی (RS) پر ضلعہ میں کی گئی تا کہ بنیادی معلومات ہر ذیلی منصوبہ کے بارے میں حاصل کی گئیں۔ ہر ضلعہ کا خاکہ ریکی میں تیار کیا گیا جو کہ ایک متنوع اعداد وشمار کا حاصل تھا 70.90% فیصد لوگ دیہاتوں میں کھلے میدان میں رفائے حاجت کرتے ہیں بے روزگاری بھی ایک اہم مسئلہ ہے۔ دیہاتوں کی خواتین میں اور اکثریت ان میں سے دیہاتوں کسی کسی میں ایک بھی خواندہ نہیں۔

منصوبے کے شمالی علاقے سیم وتھور کی کا شکار ہیں اور دریا سندہ کی جنوبی اراضی بھی اس مسئلہ سے دوچار ہے۔ چنانچہ صحرائی علاقوں میں قحط سالی ہے جس کی بناہ پر آب پاشی کے ذریعے ذراعت بہت مشکل ہے۔ صحرائی علاقوں میں بارش کا پانی اصل ذریعہ ہے۔ چنانچہ زراعت اور گلہ بانی کی سرگرمیاں بارش پر منحصر ہیں۔ بارش کا نا ہونا (MON SOON) کا نا آنا اس کا مطلب ہے مویشی اور گلہ کے لیے چارہ کی غیر دستابی۔ کنویں ہ محض پینے کے پانی کا ذریعہ ہیں۔ زیر زمین پانی زیادہ تر ترش ہے اور بہت کم میٹھا پانی دستیاب ہے۔

شراکت دار سے مشاورت:

شراکت داروں سے مشاورت جن سے کی گئی (i) ان میں بنیادی طور پر مقامی برادری جو کہ منصوبہ سے براہ راست مشید ہو رہی ہے۔ (ii) وہ دارے جو منصوبہ کو حیثیت بننے میں کلیہ کردار کر دیے ہیں ان مشاورتوں سے معلوم ہوا کہ محوذہ NSAN منصوبہ کا مثبت سماجی اثر سامنے آیا ہے۔ جس میں سنائی میں بہتری جد کہ کھلے میدان میں دفع حاجت میں کمی کی صورت اور غذائیت سوز خوراک کی فراہمی بذریعہ غذائیت فروغ زراعت شامل ہے برادریوں کا کا خیال تھا کر SSS (i) منصوبہ کے تحت دیہاتیوں کی صحت اور ماحول میں تبدیلی آسکتی ہے اور ان کے ان کی بچون کو بیماریوں سے بچایا جاسکتا ہے (ii) لوگ یہ جانتے ہیں کہ بیماریاں گندگی سے پھیلتی ہیں لیکن ان کے لیئے بیت الجلاد کی تعمیر اور مکان میں نہانے کی سہولتیں بنانا بیت مشکل ہے۔ (iii) اکثر برادر کے افراد یہ توقع کرتے ہیں کہ انہیں کسی تنظیم سے بیت الخلدد بنانے کے لیئے مالی امداد مل جائے گی (iv) سیم وشعور کی وجہ سے اکثر کسانوں نے کچھ اطلاح میں اپنی زمینوں کو ماہی گیر بانی اور ماہی گیری کے لیئے تالا برن تبدیل کر دیا ہے جو کہ آمدنی کا ایک مدثر ذریعہ ہے (v) کسان بہتر زرعی اعمال کی جسنو اور ان کی سکھاؤ میں دلچسپی لیتے پائے گئے ہیں (iv) بہتر روزگار کے ذرائع اور ہنر جو کہ عورتوں کے لیئے مخصوص ہوں اس منصوبہ میں مستقبل کی ترجیحات میں شامل ہیں۔

اثرات کا خمینہ:

منصوبہ کے اکثر ماحولیاتی اور سماجی اثرات مفیہ ثابت ہونگے جیسا کہ صحت پر مثبت اثر جو کہ اسحال میں کمی کا باعث ہوگی اسی طرح دیگر سفائی سے متعلق بیماریوں میں کمی اور اس سے متعلق سماجی ومعاشی فائدے، غیر معمولی برتاؤ میں تبدیلی جو کہ برادری اور ضلع سطح پر سرگرمیاں جن سے پڑوتگی میں بہتری (بالخصدمی عورتوں کے لیئے مفید) انداز میں موثر غذائیت والی خوراک، صفائی وستھرائی کی حالت سے حاصل ہوگی منفی ماحولیاتی اور سماجی اثرات اسی منصوبہ کہ (i) تعمیر سے منسلک اور محل ع قدع سے متعلق اور چھوٹے دورانیہ کے بتائے جاتے ہیں جو کہ (sss) کے تحت ہوا، پانی، شدد کی آلودگی، نکاس اور تحفظ وغیرہ سے متعلق ہیں (ii)، A4N کے تحت حد سے زیادہ کیڑا کش ادویات اور دیگر زرعی کیمیائی کھاد، پانی کی آلودگی بالخصوص سطح آب کی آلودگی وغیرہ یہ تمام اثرات مدثر تدابیر اور انتظامیات کے متقاعی ہیں۔

ماحولیاتی اور سماجی انتظام:

ESMF کے تحت پر ذیلی منصوبہ آب ماحولیاتی اور سماجی اثرات کی شدت کی بنیاد پر چھٹاد کے عمل سے گزرے گا۔ وہ ذیلی منصوبہ جن کے سعمد لی ماحولیاتی اور سماجی اثرات ہونگے۔ RAPID ASSESSMENT سے چھا لیئے جائیں گے۔ وہ ذیلی منصوبہ جن میں مگر مقامی اثرات مرتب ہوں گے میں ماحولیاتی اور سماجی انتظامی (EMP) منصوبہ کی تشکیل دنیا ہوگی۔

گزارشات ان ماحولیات اور سماجی اصلاحی تدابیر (ESMP)

<u>ذیلی منصوبہ کی جائے وقوع کسی حساس علاقہ میں:</u>

☆ یہ اچھی طرح سے اطمینان کر لیا جائے گا کہ ذیلی منصوبہ کسی حساس مقام پر نہیں ہے اور نہ ہی وہاں کوئی آبادکاری کا عمل ہونا ہے۔

☆ جبری آبادکاری ونقل مکانی کی Checklist کا استعمال اسکول، حکومتی اراضی، کی جانچ کے لیئے جائے گا اور اس بات کو یقینی بنایا

جائے گا کہ اس میں کوتنازع نہ ہو۔

☆ دیہی تنظیموں اور مقامی ضلعی حکومتوں کی مدد سے اسکول کی تعمیر کے لیئے زمینوں کی نشاندہی کی جائے گی۔

☆ ذیلی منصوبہ زرعی محکمہ کی زمیں پر تعمیر کئے جائیں گے اگر چہ ذاتی زمیں بھی حاصل کرنا پڑی تو VLD طریقے کار اپنایا جائے گا بصورت دیگر RPF سے کام لیا جائے گا۔ مکمل VLD کا ستاویز برقرار رکھا جائے گا۔

☆ برادری کی متاثرہ اثاثے تخمینہ اور معاوضے RAP/RPF کے مطابق طے پا جانے چاہیئے اس سے قبل کے سرگرمیاں شروع ہوں۔

☆ برادری سے مشاورت منصوبہ کی وقوع پذیر ہونے سے پہلے ہی شروع کردی جائیں گی۔

☆ غیر مناسب بیت الخلاء کی تعمیر پانی کی آلودگی کا باعث بن چکی ہے۔

☆ رویوں کی تبدیلی اور سرگرمیوں کے دوران برادریوں میں حاصل دوست بیت الخلاء کی ساخت کو نروغ دیے (اس مخصوص کے لئے موثر ہے) اور ایک غلط سافت کے بیت الخلاء کے منفی اثرات سے آگاہی دینا ہے

☆ نگرانی کا اصل منصوبہ کے دوران جاری رکھا جائے گا تا کہ پائیداری کا عنصر وعمل جاری وساری رہے۔

☆ پانی سے صفائی حاصل کرنے والے بیت الخلاء ان علاقوں میں جن میں پانی کی قلت خشک سالی میں ہوتی ہے غیر مناسب ہیں۔ ان باتوں کا خیال ان بیت الخلاء کی تعمیر کی ہدایت منصوبہ ہی عمل درآمد کرنے والے یونٹ سر ہوئی

کھڈا/ گڑھا برائے انتظام فضلہ

☆ فضلہ کا انتظام ESMP کا حصہ ہے جو کہ ہر ذہریلی منصوبہ کا جڑہ ہے۔ فضلہ جو کہ ینک یا گڈھے کے خالی ہونے پر زمین کی بھرائی جو کہ ایک مخصوص جگہ ہوتی ہے وہاں کی جائے اور اسے نامیانی مواد پر گلنے دیا جائے گا۔

☆ روئیوں کی تبدیلی کی سرگعمیوں کے دردانی برادری میں اس عنصر کا ہی پرچار کیا گیا اور اس کی بات آشنائی سی گئی۔

منصوبہ کیٹا کش، اور کیمیائی کھاد کا بت ذریع استعمال

☆ آب پائش کے پانی کا منعفانہ استعمال کیمیائی استعمال اور متبادل ترکیب (جیسا کہ صنم شدہ کیڑوں سے دفاع کا انتظام، بیماریوں سے مدافت بیجوں کا استعمال (Mulching) کو فروغ دینا اور آگاہی ک ساتھ صلاحیت کی تعمیر بھی کرنا شامل ہے۔

☆ صلاحیت کے حصول میں منفرد مادہ کی محفوظ انداز (HANDLING) شامل ہے جیسا کی کیڑے مار ادویات۔

☆ بہتر آب پاشی کی ترکیبیں جیسا کہ (Tunnel Farming) جو کہ A4N میں شامل ہے اس کو فروغ دیا جائے گا تا کہ پانی کی قلت پر قابو جا سکے۔

کسانوں کی صحت اور حفاظت کے لئے خطرات:

☆ آگاہی اور تعمیر صلاحیت برائے MSDS ہر اس خطرناک مادہ کے لئے بہم پہنچائی جائے گی۔

☆ WB گروپ اور EHS کے گائیڈنس نافض الاعمل کی جائیں گی۔

☆PPE ذاتی حفاظتی آلات کے استعمال کو یقنی بنایا جائیگا خصوصاً کیڑا کش ادیات کے استعمال کے لیے

عورتوں بچوں اور غیر محفوظ گروہوں پر اثرات:

☆عورتوں کی شمولیت پہلے سے ہی منصوبہ میں شامل ہی جیسا کہ (FSS)، لڑکیوں کے لیے بیت الخلاء کی تعمیر اور عورتوں کو بنیادی طور پر زرعی پیداوار اکا مرکز بنانا۔

☆(LEW) لیڈی ایکشن ورکرز امدادی کارکنان کے ساتھ محض عرصے کے لیے ام کری گے تا کہ عورتوں کے لیے مفید چابت ہو۔(PC-1, A4N)

ماحولیاتی چاغ کی فہرست ابتدائی مرحلہ کی معلومات جس کا تعلق غریب عورتوں اور غیر محفوظ گروہوں سے ہے فراہم کرے گا کہ ان کی ضروریات اور ترجیحات برائے سماجی و معاشی بہری کے لیے ہوگا۔

☆IPS اور TSP اس کو یقینی بنائیں گے کہ عورتیں منصوبہ میں بھرپور حصہ لیں اور ان سے پر اثر مشاورت کرو

☆SSS کو آگاہی میں عدات گا حصہ مرد کے مقابلہ میں ذیادہ رکھا جائے۔

☆نیز حفوظ گروہ کی منصوبہ میں سمولیت اور حصہ داری کو خشاورت سے یقینی بتایا جائے تا کہ جو سرمایہ کاری جو کسی جائے گی وہ ان تمام گروہ کے مفاد میں ہو۔

لائحہ عمل برائے عمل درآمد:

A4A اور SSS کے ESMF PD کے عمل درآمد کے مختار ہو گئے اور ساتھ ساتھ منصوبہ کے دوران اس کی عمل تحلیل کے ذمہ دار بھی ہو گے۔ منصوبہ کے رابطہ کار (PC) نالی ڈائریکٹر ناقص کرنے والے شراکت تکنیکی معرف (IPs / TSP) اور ضلعی رابطہ کمیٹی اس بات کو یقینی بنائے گی کہ وہ اپنی اپنی ذمہ داری پر ESMF پر عمل درامد کر رہی ہے اور Pb کو اس کی رپورٹ دینی ہوگی۔ ماحولیاتی اور سماجی ماہرین ماہرین کی خدمات Pb صفائی/زرعی ڈایریکٹریٹ کے تحت لیتا رہے گا جو Pb کو ESPMs کے نفاذ میں بھرپور مدد دیں گے۔ دونوں ماہرین ذیل منصوبوں میں چھٹائی EPMF کی تشکیل اور ان پر عمل درآمد اندرونی نگرانی اور پیش انٹ کے بارے میں آگاہ کرتے رہے گے۔ ماحولیاتی سماجی مرکزی اشخامی جو کہ ہر ضلع کی ضلعی قطی استفا میں تعینات کیسے ہونگے ماحولیاتی سماجی اور نقل مکانی سے متعلق مسائل کا عذارگ کرنے جیسا کہ شکایت دور کرنا، شراکت داروں کی مشاورت کا انعقاد، منصوبہ کے تحت اور اس کی پیش رفت کی رپورٹ منصوبہ کے رابطہ آفسر تک پہنچانا ہے IPs/TSPs برادری کی شرکت کو نروغ دینے میں مدد اور مشاورت اور سماجی سرگرمیوں میں حصہ لینے کے ساتھ ساتھ ذیلی منصوبہ کے تعین سے تکمیل مراحل تک کے کام سرانجام دیں گے۔

ESMF میں نگرانی کا لائحہ عمل:

ESMF کی نگرانی عمل میں لائی جائے گی تا کہ تدارک کا منصوبہ کو باقائدگی اور مدثر طور پر بنایا جاسکے۔ یہ تین سطح پر عمل پیرا ہوگا ۔ڈائریکٹوریٹ سطح پر ضلع سطح پر اور میدان پر ضلع سطح پر ماحولیاتی اور سماجی ماہرین ESMF کی نگرانی کریں گے جس مُں وہ اس بات کو یقینی بنائیں گے کہ تدارک کا عملی منصوبہ مدثر طور پر نافذ عمل ہے اور میدانی دوسرے کو اٹر سے لگائے جارہے ہیں ضلع نگرانی یونٹ DMU اور ضلع

غذائی رابطہ کمیٹی بھی ESMF کے نفاذ نگرانی اور جانچ کی ذمہ دار ہوگی DNCL یہ DMU بھی برادریون سے مشاورت کرے گی یا الخصوص عورتوں سے مشاورت میدانی سطح کی نگرانی انجام دیں گے۔

تربیت کالائحہ عمل:

ذیلی منصوبہ کا SSS کے تحت اور A4N کا MSAN کے تحت نافذ کرے لیئے جامع تربیت، اور دورست پائیداری کی ضرورت ہے ماحولیاتی اور سماجی عناصر کی نشاندہی اور تدارک جو کہ A4N/DSS سے جڑا ہو۔ کے لیئے تربیت درکار ہے جو کہ منصوبہ کے مما لک نے والوں پر تیز نگاہ اور اس کے ماحولیاتی پہلوں امدان کے حل پر رکھتے ہوں تربیت مخفی نہ صرف اس حدتک محدود رہے لگی بلکہ منوعات جسے ذمہ دار نہ سماجی برتاؤ، ماحول دوست رجحان برائے تعمیر بیت الخلا حسن میں فوری اور لمبے ذمہ دار نہ کے لیئے گندے پانی کو تلق ونکاس کا نظام بنانا ہے۔A4N کے جزو اور ذیلی منصوبہ جس میں تربیت کا پہلو برائے DOLF & DOA کے کارکنا کے لیئے رکھا گیا ہے تا کہ NSA کو نافذ اور فروغ دیا جائیں ماحولیاتی اور سماجی ماہر صفائی ڈائریکٹوریٹ کے ماتحت تربیتی پروگرام ک وچلائین گے وہ دیگر تربیتوں کی ایوارڈ بھی حد دوسرے منصوبہ کے تحت ہورہی ہوں گی تیار کریں گے ESFPs ضلع سطح پر ذمہ داری ہوگی کہ وہ اپنے میدانی عملے اور کارکنون کو تربیت اپن ESFPs کی نگرانی میں دین اور اس کو بھی دستاویز میں لائیں۔

نظام برائے تدارک شکایت GRM:

دھوکہ اور کرپشن کی روک تھام کے لیئے ایک مخصوص اور متحرک درخواست کا نظام بنایا گیا ہے۔ جو کہ ضلع سطح سے میدانی اور صوبائی سطح تک کی شکایات لیئے سکے ی ہنظام نہ صرف سربراہ ہونے کے ستھ ساتھ بلکہ لوگون کہ جلد اور موثر شکایات کے ازالے اور انکی نگرانی کا باعث بنے گا A4N اور SSS کے ڈائریکٹوریٹ دونوں اس کے سیکریٹریٹ برائے تدارک ازالہ شکایت کمیٹی کا کام انجام دیں گے جو کہ تمام G R M کی کاروائی کی ذمہ دار ہونگی جو کہ اور اس کے ساتھ ساتھ اس کے نگرانی بھی کرین گے شکایات کے مرکزی اشخاص (GFPs) دراصل تبدیل کا باعث ہونگے اور تعلیم کریں گے اپنی برادری میں ہر دیلی منصوبہ میں سے جس سکی اسائی آسان ہو عوامی شکایت مرکز PCC شکایات درج کرنے اور شکایت لینے کے لیئے قائم کیا جائے گا شکایت کے ازالے کی کمیٹی کا قیام کیا جائے گا ہر ضلع سطح پر جو کہ GRM چلائے گی جس کی تحت احکامات نگرانی اور ازائے شکایت ذیلی منصوبہ کی سطح پر دیکھا جائے گا۔ESFPs ضلع سطح پر GRC کو فعال بحالبنانے مین ایک کلیڈی کردار ادا کرے گا۔

شکایات کی مرکزی اشخاص کو شکایت لینے اور انکو موثر انداز میں سمیٹنے رطے رنے کی تربیت کی جائے گی تا کہ غیر ضروری وقت ضائع نہ ہو اور کام مختصر ہو جائے جس سے مقامی برادری کو دقت نہ ہو مگر کچھ ایسے بھی ہونگے GFPs کے بس سے باہر ہونگے جن کے لیئے GFPs موبائیل فون / Smart Phont کا استعمال کرتے ہو ضلع سے رابطہ کر کے شکایت درج کر سکتے ہیں شکایت کی ازالہ تدارک کمیٹی ضلع سطح پر ہفتہ وار جانچ ہوگی اور نشاندہی کرے گئی کہ کونسی اہم شکایت کی مد میں لی جائیں۔عوامی شکایات مرکز ذمہ دار ہوگا کہ شکایات درج کرے امدان کا ازالہ کرے وہ جو مقامی ضلع کمشنر کے دفتر سے آئیں گی اگر سطح پر خدش اسلوبی سے شکایات کا ازالہ ایک مہینہ مدت میں کیا جا سکے جو کہ کارگردگی کے اشارے سمجھے جاتے ہیں شکایات گزار کو مجزدہ تین ۳ رند میں وصولی کی جواب تحریری طور پر ہر

سال کر دیا جائے گا ۔ اگر اس سے قبل شکایت کا کا تصمینہ نہ ہوا تو ایک ہفتے میں شکایت طہ کرنے کے لیئے کمیٹی کی میٹنگ DOLF/IP/TSP/LGD/DOA کی جگہوں پر بلائی جائے گی ۔اگر پھر بھی شکایت دور نہ ہوسکی تو شکایت گزار عدالت سے رجوع کرنے کا مجاز ہوگا۔

ESMF کے نفاذ کی لاگت:

ESMF کے نفاذ کی کل لاگت کا تخمینہ پاکستانی روپیوں میں تقریبا72.23 ملین لگایا گیا ہے اس میں ماحولیاتی ماہر اور سماجی ماہر، تربیت ،سہ فریقی توثیق اور ESMF کی انفرادی ذیلی منصوبہ کی تیاری کی لاگت شامل ہے یہ لاگت اجتماعی لاگت میں شامل ہے۔

آبادکاری پالیسی کا ڈھانچہ:

یہ صرف اس وقت قابل عمل ہوگا جب کہیں زمیں کے حصول کا مسئلہ درپیش ہوگا جہاں زمیں رضا کارانہ طور پر حاصل نہیں کی جاسکتی ہے ۔زرعی ڈائریکٹوریٹ ایسے تمام زمیں کے حصل سے اجتناب کرے گا جب بھی زمیں کی ضرورت ہوگی زرعی محکمہ زمیندار سے رجوع کرے رضا کارانہ طور پر زمیں کے حصول میں اس سے معاونت حاصل کرے گا تا کہ ذیلی منصوبہ کے لیئے ایراضی حاصل ہو سکے یہ رضا کارانہ زمین کے حصول زمیندارون کی میدانی اسکول (FFS) کے نمائشی قطعہ اراضی تک ہی محدود ہونگے کسی بھی صورت میں زمین کے مالک پر کسی بھی قسم کا دباؤ راستہ یا الداستہ نہیں ڈالا جائے گ کہ وہ اپنی زمین چھوردے یہ اقدام اس لیئے اٹھائے جارہے ہیں کہ مقامی آبادی پر منفی اثرات کم سے کم ہوں اور منصوبہ سے فائدہ برادری کے پر طبقے تک پہنچے محکمہ اس کو یقینی بنائے گا کہ VLD کا عمل شفاف طریقے سے بغیر کسی غلط اور عدالتی کاروائی کے انجام پا جائے ۔اس مقصد کے لیئے طریقے کار VLD میں موجود ہے۔

آبادکاری پروفٹ پر ڈائریکٹوریٹ میں قائم کیا جائے گا زرعی ڈائریکٹوریٹ جو A4N کے ماتحت ہے اس کے سپرد آبادکاری کی مجموعی ذمہ داری ہوگی یہ SS کے ذریعے RAP کو نافذعمل کرے گا SS زرعی ڈائریکٹوریٹ کے ماتحت ان تمام سرگرمیون کی سرپرستی اور بجا لائے گا جو کہ RAP کو نافذعمل لانے کے لیئے ضروری ہونگی ESFPs ضلع سطح پر RAP کو نافذعمل لائے گا ان سطح پر جو پہلے سے طے پا چکی ہیں EDD محکمہ سال بمع اس کے کارکن نجی اراضی کے حصول کے ذمہ دار ہوں گے جو کہ پاکستان ایکٹ برائے حصول ایراضی کے تحت انجام دینگے ۔ESFPs محکمہ مال سے رابطہ کے ذمہ دار ہونگے ۔

گزارشات وشفارشات:

WASH: (1) ODF کی تصدیق حاصل کرنے بعد اسے برقرار رکھنا ایک بڑا مرحلہ ہے جس کے لیئے کوشش کرنا ضروری ہے ضلع کی تربیت یافتہ تعلقہ سطح کی انتظامیہ اور دیگر کارکنان جیسا کہ LHV برادریون کی مدد میں کلیہ کردار ادا کرسکتی ہے جس کے ذریعے ODF کے منصوبہ اپنی جگہ قائم رہ سکتا ہے ۔طورت کا کردار دونوں صحت اور صفائی کے فروغ کے لیئے سندھ کے دیسی علاقوں میں فروغ کے لیئے سندھ کی دیسی علاقوں میں اہم کردار ادا کرسکتا ہے (2) روپے کی تبدیلی کی سرگرمی کے دوران برادریوں میں ماحول دوست بیت الخلال کی تعمیر کے فروغ کے لیئے نمونے برادری میں عام کریں گے (3) پانی والے بیت الخلا ان علاقوں میں فروغ نہ دیئے جائیں جہاں پانی قلت ہے اور خشک سالی ہے اس بات کو یقینی بنایا جائے کہ وہی بیت الخلا دان مخصوص مقامات پر بنائیں جائے جیسا کہ جہاں ان کی ضرورت ہے۔

حساس غذائی زراعت:(1) جیکب آباد، سانگھڑ کے مغربی علاقے اور ضلع عمرکوٹ میں پانی کی واضع مقدار کی وجہ سے زمین میں صحیح ہے جو کہ IBIS کو وجہ ہے ایسی صورت میں منصوبہ کے ذریعے ماہی پروری اور آب پاشی پانی قلت ہے البتہ پانی کی قلت والے علاقے جسمیں تھر پارکر ،عمرکوٹ کا مشرقی علاقہ اور سانگھڑ شامل ہیں محتاط طریقے سے منصوبہ بندی کرنے کی ضرورت ہے تا کہ A4N کے تحت کام لیا جا سکے۔ گہ مویشی ان علاقوں کا اصل وہ بنیادی ذریعہ معاشی اور روزگار کا فیصلہ ہے لہذا اسی کو بہتر اصولوں فروغ دینا چاہے۔ البتہ NSA کو مدد اور فروغ دینے کے لیئے وہ فصل جو کم پانی اور تورز میں میں کسی حد تک پیدا ہو سکتی ہے آگاہی جانی چاہیئے اس طرح کی ترتیب پانی کی قلت اور خشک آب وہوا والے علاقوں کے لیئے مفید ثابت ہوگی قدم کھاد استعمال اور نامیاتی مادہ جو سستا ہوا سے مٹی میں بہتری آتی ہے اور پانی کے زمین میں شہراد میں مدد ملتی ہے۔(3) بہترین انتظامی طریقے (BMP) نامیاتی کا شکاری میں شامل کرنے چاہیے۔

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Acronyms

A4N	Agriculture for Nutrition	MAF	Million acre feet
ADP	Annual Development Program	MDGs	Millennium Development Goals
ALRI	Acute Lower Respiratory Infection	MHa	Million hectares
APs	Affected Persons	MICS	Multiple Indicator Cluster Survey
BHU	Basic Health Unit	MRL	Maximum Residue Limit
DC	Deputy Commissioner	MSAN	Multi-Sectoral Action for Nutrition
DCO	District Coordination Officer	NCCP	National Climate Change Policy
DMS	Detailed Measurement Survey	NGO	Non-governmental organization
DMU	District monitoring unit	NNS	National Nutrition Survey
DNCC	District Nutrition Coordination Committee	NPSC	Nutrition Project Steering Committee
DOA	Department of Agriculture, GOS	NSA	Nutrition sensitive agriculture
DOH	Department of Health, GOS	O&M	Operation & Maintenance
DOLF	Department of Livestock and Fisheries, GOS	ODF	Open Defecation Free
EA	Environmental Assessment	P&DD	Planning & Development Department, GOS
EIA	Environmental Impact Assessment	Pak-EPA	Pakistan Environmental Protection Agency
ENMCP	Enhanced Nutrition for Mothers and Children Project	PAHs	Project Affected Households
ESFP	Environmental and Social Focal Point	PARC	Pakistan Agricultural Research Council
EHS	Environment, Health, and Environment	PBS	Pakistan Bureau of Statistics

EIA	Environmental Impact Assessment	PCRs	Physical Cultural Resources
EPA	Environmental Protection Agency	PD	Project Director
ES	Environmental Specialist	PDMA	Provincial Disaster Management Authority
ESMF	Environmental and Social Management Framework	PKR	Pakistani Rupees
ESMP	Environmental and Social Management Plan	PMU	Project Management Unit
FAO	Food and Agriculture Organization	POPs	Persistent Organic Pollutants
F3S	Female Farmer Field School	PPE	Personal protective equipment
FBS	Farmer Business Schools	PSC	Poverty Scorecard
FFS	Farmer Field School	RAP	Resettlement Action Plan
FGD	Focus Group Discussion	RFP	Resettlement Policy Framework
FO	Farmers' Organization	RS	Reconnaissance Survey
GAP	Good Agriculture Practice	SIA	Social Impact Assessment
GDP	Gross Domestic Product	SEPA	Sindh Environmental Protection Agency
GOP	Government of Pakistan	SESA	Strategic environmental and social assessment
GOS	Government of Sindh	SEQS	Sindh Environmental Quality Standards
GRC	Grievance Redress Committee	SIDA	Sindh Irrigation Development Authority
GRM	Grievance redress mechanism	SS	Social Specialist
GPI	Gender Parity Index	SSS	Saaf Suthro Sindh
IESMC	Independent Environmental and Social Monitoring Consultant	SUN	Scaling Up Nutrition
INSS	Inter-Sectoral Nutrition Strategy of Sindh	SWD	Sindh Wildlife Department
IP	Indigenous people	SWMO	Sindh Water Management Ordinance
IPs	Implementation Partners	TA	Technical Assistance
IPM	Integrated pest management	TSP	Technical Support Partner
IPMP	Integrated pest management plan	UC	Union Council
IUCN	International Union for Conservation of Nature	UNDP	United Nations Development Programme
LAR	Land Acquisition and Resettlement	VOs	Village Organizations
LBOD	Left Bank Outfall Drain	WASH	Water, Sanitation and Hygiene
LGD	Local Government Department, GOS	WB	World Bank
M&E	Monitoring and evaluation	WHO	World Health Organization

Chapter 1 INTRODUCTION

Government of Sindh (GOS) has approved an Inter-Sectoral Nutrition Strategy of Sindh (INSS) in 2013. There was a need arise to support INSS by investing in two critical nutrition-sensitive goals: (a) *improving access to and use of sanitation and proper hygiene behavior through 'open defecation free' jurisdictions to reduce infection and disease*; and (b) *improving access to nutritious food and increasing awareness of the importance of a healthy diet, particularly for poor households with women of child-bearing age.* "The Government of Sindh has requested World Bank financing of the "Multi-Sectoral Action for Nutrition (MSAN) Project". This project corresponds with the Government of Sindh strategy to reduce malnutrition and improve health conditions among poor communities mainly targeting the women and children's in the province. The two goals as discussed above will work in connection with the nutrition-specific interventions of the Enhanced Nutrition for Mothers and Children Project (ENMCP) in support of the INSS which is also funded by the World Bank. The project is designed to fund a number of small-scale, community-based subprojects in sanitation and nutrition based agriculture.

Local Government and Housing Town Planning Department, GOS and Agriculture Department GOS with grant assistance from DFID funded multi donor trust fund for Nutrition in Pakistan are planning to undertake Multi-Sectoral Action for Nutrition (MSAN) Project. The Directorate of Urban Policy & Strategic Planning prepared the Environmental and Social Framework which compliance the World Bank Environmental and Social Safeguard Operational Policies 4.01 for executing and implementing MSAN Project" at its inception stage via assessing the project's environmental and social viability through various environmental components like air, water, noise, land, ecology along with the parameters of human interest and mitigating adverse impacts along with chalking out of guidelines, SOPs, procedure for detailed EA during project execution.

The objectives of this ESMF are:

- To establish clear procedures and methodologies for the environmental and social planning, review, approval and implementation of subprojects to be financed under the Project;
- To specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring environmental and social concerns related to subprojects;
- To determine the training, capacity building and technical assistance needed to successfully implement the provisions of the ESMF;
- To establish the project funding required to implement the ESMF requirements;
- To provide practical resources for implementing the ESMF.

This ESMF report presents the legal review, broad baseline data collected for air, water, land, biological and socio-economic components of environment, identification, prediction and evaluation of generic project impacts and preparation of ESMF with Resettlement Policy Framework (RPF) for mitigation of adverse impacts that may arise due to the proposed project interventions.

1.1. Background[2]

Sindh province, having a population of about 55.24 million, occupies land area of 14.091 million ha. (34.81 million acres). The average population density of the 13 districts is 292 persons per square km, based on population projection 2012. The population of the province constitutes 35.14 percent of province's total

[2] Adopted from PC-I documents

population (2012). The population of the Sindh province, which was 30.44 million in the 1998 Census, stands at 44.8 million (2012). The average population growth rate for the Sindh province was 2.8 percent per annum, as of 1998 census.

Poverty is increasing with passage of time in Sindh rural areas. In case of urban areas, poverty is more evident in slums and katchi abadies. The main causes of poverty are traditional agricultural practices, fragmented landholdings, non-availability of safe drinking water and sanitation facilities, low literacy rate, inadequate institutional arrangements for addressing social sector problems, and lack of access to social justice system.

In Sindh, ground plant protection measures (mostly pesticide sprays) are employed on 24% of the cropped area of all field crops including vegetables and orchards as compared to 21% on the national basis. It has also disturbed the agro-ecosystem and killed non-target bio-control agents and environment friendly organisms including birds. Such a disturbance in agro-ecosystem has induced pest resurgence and increased the resistance in resident pest populations.

1.2. Project Description

In Pakistan, nutrition status of population specially women, adolescent girls, infants and children has suffered due to lack of dedicated stakeholders, committed leadership, and poorly articulated strategy and implementation mechanisms. At the policy level, Pakistan recognized the importance of nutrition in 2002 following the findings of the 2001 National Nutrition Survey (NNS). It established a Nutrition Wing and developed a National Nutrition Program, albeit with limited success: Provincial Nutrition Cells were established but were not able to develop and deliver integrated nutrition programs. The 2010 floods again highlighted the critical nutrition situation, and the sector gained momentum towards a multi-sectoral approach with Pakistan joining the Scaling Up Nutrition (SUN) Movement in January 2013 followed by the formulation of provincial Policy Guidance Notes and Inter-Sectoral Nutrition Strategies during the 2013-14 period.

Sindh's nutrition indicators are among the worst in the country. Overall, stunting increased from 48 percent in 2001 to 50 percent in 2011, second only to Balochistan. Sindh also has the highest proportion of wasting (18 percent) and acute malnutrition (40 percent), with negligible improvement since 2001. Vitamin A deficiency and anemia among children under five are at 53 percent and 73 percent, respectively, with the latter about 10 percentage points above the national average. Over the past decade, increasing household food insecurity, poor quality and quantity of water, suboptimal sanitation and hygiene practices including open defecation, early and frequent childbearing as well as low literacy rates contributed to this decline trend.

To help reverse the increase in stunting, the Government of Sindh has approved an Inter- Sectoral Nutrition Strategy of Sindh (INSS) in 2013. The proposed project will support the INSS by investing in two critical nutrition-sensitive goals: (a) improving access to and use of sanitation and proper hygiene behavior through 'open defecation free' jurisdictions to reduce infection and disease; and (b) improving access to nutritious food and increasing awareness of the importance of a healthy diet, particularly for poor households with women of child-bearing age. The two goals will work in concert with the nutrition-specific interventions of the Enhanced Nutrition for Mothers and Children Project (ENMCP) in support of the INSS which is funded by the World Bank through an IDA loan. The project directly responds to the World Bank Group's (WBG) twin goals of ending extreme poverty and promoting shared prosperity by reducing open defecation and improving food security and the health and nutrition status of poor and vulnerable populations.

The project has two project components under INSS, i) the sanitation component of the project aligns with the Government of Sindh's sanitation intervention known as Saaf Suthro Sindh (SSS) in 13 districts in the province and aims to increase the number of ODF villages through certification while ii) the agriculture for nutrition (A4N) component includes pilot targeting beneficiaries for household production and consumption of healthier foods through increased household food production in 20 Union Councils of 4 districts where the hygiene and mother and child health interventions are taking place; with high levels of poverty and food insecurity and high DOH (Department of Health) profiles, and where agriculture interventions are feasible in the three districts with the highest stunting rates. The two components are linked to the joint objective of reduction in malnourishment under the INSS program. The project will be implemented by Local Government Department (LGD) and Department of Agriculture (DOA).

Project components and Target Areas:

1) *Saaf Suthro Sindh (SSS) Programme – Scaling Up Of Rural Sanitation*: This component of the project will be sponsored by Local Government and Housing Town Planning Department, Sindh and executed by Local Government Department (LGD) through NGOs working for the Inter-sectoral Nutrition Support Program. 100% "Open Defecation Free (ODF)" Villages will be maintained through the Village Org. (VOs) and the UC staff of the LGD. The sub-projects under this component will be located in Dadu, Jacobabad, Kashmore, Larkana, Kambar-Shahdadkot, Tharparkar, Badin, Sanghar, Tando Muhammad Khan, Umerkot, Shikarpur, Thatta; and Sujawal.
2) *Agriculture for Nutrition Project (A4N)*: This component of the project will be sponsored by Agriculture Department Government of Sindh and executed by Agriculture Department Government of Sindh. NGOs / CSO/ Communities are operating under this component. The sub-projects under this component will be located in Jacobabad, Tharparkar, Sanghar and Umerkot.

1.2.1. Targeted Results

The sanitation and agriculture components linked to the Inter Sectoral Nutrition Strategy (INSS) of Sindh and will focus on nutrition results in a coordinated manner to have integrated impact. Relevant core sector indicators are expected to be utilized, i.e. (i) People trained to improve hygiene behavior or sanitation practices under the project (number of), and (ii) Clients who have adopted agricultural technologies and approaches promoted by the project.

Expected key results will be further refined during project preparation and are likely to include:

- Eradication of open defecation of the villages in the 13 target districts;
- Percentage of targeted households that are consuming a more diverse and healthy diet;
- Platforms established and functioning for inter-sectoral coordination and planning at provincial and district levels.

Intermediate Results

- Capacity of key staff at local and provincial government is improved to coordinate across administrative boundaries and extend appropriate service to target households;
- Percentage of the rural population in targeted villages wash hands with soap at critical times;
- Number of small farmers, landless peasant / women are trained in kitchen gardening, poultry, honey bee keeping and livestock rearing including small ruminants;

- Number of household raising livestock and preparing livestock products.

1.3. Environmental and Social Management Framework (ESMF)

Location and design of the sub-projects to be undertaken under MSAN project are not known yet, therefore a framework approach has been being taken to carry out environmental and social assessment for MSAN project in line with the World Bank's Operational Safeguard Policy (OP 4.01) and local environmental legislations. Under this approach, the present ESMF/RPF has been prepared to identify the potential generic negative environmental and social impacts, propose generic mitigation measures, provide basic screening criteria, list the type of safeguard instruments to be developed and provide institutional, monitoring, reporting and documentation measures for environmental and social safeguards compliance.

1.3.1. Purpose of the ESMF Study

The objective of the ESMF study is to carrying out broad safeguards analysis, screening the proposed subproject interventions against adverse environmental and social impacts and recommending, where necessary, appropriate mitigation and enhancement measures, and course of action for further and detailed assessment so as to enable the preparation of an Environmental and Social Management Framework (ESMF) as well as the generic Environmental and Social Management Plans (ESMP) and Integrated Pest Management Plan (IPMP) or the identified activities/investments of the sanitation and A4N components of the subprojects. Also to broadly assess generic environmental and social consequences. The relevant portions of the ESMP and IPMP will be suitably integrated with the contract documents to facilitate smooth implementation during project operation phases.

Sindh Environmental Protection Act 2014 which is the principal legislation on environmental protection and compliance in Sindh since 2014, states the provisions of environmental protection and compliance and this ESMF has been prepared in line with those provisions laid down in the Act. Also the ESMF will need to comply with the WB safeguards requirements given in different operational policies (OPs).

1.3.2. Scope of the Study

The client prepared an ESMF for the subprojects under Sanitation (SSS) and A4N. The Framework will provide specifically an overview of the baseline conditions and also identify generic environmental as well as social impacts of the subprojects. The Framework will also provide the template ESMP for construction of latrines, livestock waste management and other type of infrastructure to be supported by the project. The detailed ToRs of the ESMF study are placed at **Annexure A**.

The ESMF will be required to be reviewed and cleared by the World Bank. The ESMF will be subject to consultations in Sindh Province before it is disclosed locally, in the local language and in English in the World Bank Infoshop, before appraisal of the proposed project.

1.3.3. Study Methodology

Methodology for the ESMF comprise a series of integrated tasks and this was based on a combination of field and desktop assignments.

1) A legislative review has been conducted for the project and selected all the legislations, guidelines and WB OPs which are relevant to the project and applicable in conducting ESMF study.

2) Meetings with GOS officials and relevant information of the project has been collected and analyzed as part of ESMF process. However, a detailed review of information is presented in the Project description section of ESMF study.
3) After initial information has been collected and reviewed, site surveys were conducted to collect primary information for the sub-projects.
4) Stakeholder consultations were carried including a series of focus group discussions with communities and consultation meeting will be held with the institutional stakeholders and key environmental and social issues were discussed.
5) Environmental aspects and their associated impacts were considered for anticipated sub-projects and sub-project exclusions. Mitigation measures were identified where required to minimize the significant environmental impacts. An environmental management framework was also developed in the form of an ESMF for the implementation of the mitigation measures identified during the study.

1.3.4. Layout of ESMF

Chapter 2 discusses the legislative, regulatory, and institutional setup that exists in the Country, as well as the World Bank's safeguard policies relevant to the environmental and social assessment. **Chapter 3** provides a simplified description of the Project and its components. The environmental and social baseline conditions are presented in **Chapter 4**. The stakeholder consultations have been covered in **Chapter 5**. The assessment of environmental as well as socioeconomic impacts, their mitigation measures are presented in **Chapters 6**. The Environmental and Social Management Framework is presented in **Chapter 7**. Finally the Resettlement Policy Framework (RPF) is presented in **Chapter 8**.

Chapter 2 REGULATORY REVIEW

This section provides synopsis of policies, legislation, and guidelines that may have relevance to the proposed nutrition and sanitation interventions under the SSS and A4N components of the project and administrative framework as well as institutional set-up relevant to the environmental and social assessment of the proposed Project.

2.1. National Laws and Regulations

Pakistan's statute books contain a number of laws related to the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new practice. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. After the Eighteenth amendment in the constitution of Pakistan many federal subjects devolved to provincial legislation. The Concurrent List in fourth schedule of the constitution containing entries of subjects wherein federal and provincial legislation could legislate has been abolished. Since project coverage is in province of Sindh; therefore, only those national laws and regulations are discussed here which have application in the project. There are still several federal laws which have not been repealed by the provinces and applicable in provinces with its original titles. The laws relevant to the proposed project are briefly reviewed below.

2.1.1. National Environmental Policy, 2005

The National Environmental Policy, 2005 aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development. It provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives direction for addressing the cross sectorial issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environmental Policy, 2005 while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources.

2.1.2. National Sanitation Policy, 2006

The national Sanitation Policy, 2006 devised to provide a broad framework and policy guidelines for all level of governments to enhance and support sanitation coverage in the country.

The primary focus of the policy is on the safe disposal of excreta away from the dwelling units and work places by using a sanitary latrine and includes creation of an Open Defecation Free environment along with the safe disposal of liquid and solid wastes; and the promotion of health and hygiene policy in the country.

The Policy identifies minimum sanitation options which include flush latrines or pour flush latrines in homes for urban areas and high density rural settlement connected to an underground sewerage system terminating in a sewerage treatment facility. Similarly at in serviced urban areas and low density rural settlements minimum options are ventilated pit privies/pour flush latrines connected to a septic tank linked to a waste

water disposal and/or collection system. The Policy proposes reward for all 'Open Defecation Free' tehsils/Towns, for achieving '100 percent Sanitation Coverage'.

2.1.3. Agriculture Pesticides Ordinance, 1971

The Agriculture Pesticides Ordinance promulgated to regulate the import, manufacture, formulation, sale, distribution and use of pesticides and for matters ancillary thereto. The Ordinance prohibits sale, use etcetera of adulterated pesticides, which means a pesticide with which spurious, deleterious or harmful substance has been mixed. The Ordinance provides punishments for manufacturing, importing, sale etcetera of adulterated or substandard pesticides. The ordinance is in line with World Bank OP.4.09. Subcomponent of MSAN project i.e. Agriculture for Nutrition will include and invest in the use of pesticides. IPMP will be implemented as part of A4N sub-component and addressed the control of adulterated pesticides.

2.1.4. The Canal and Drainage Act, 1873 (amended in 1952, 1965, 1968 and 1970)

Prohibits corrupting or fouling of canal water, which may be used for domestic purposes. This Act will be applicable if the effluent/solid waste generated from components of sub-projects *i.e.* A4N and SSS will be discharged in to the canals. The possibilities of fouling of canal water are a) the sludge collected from pits/septic tanks of toilets will disposed in the canals, b) the effluent of toilets will discharge directly into the canals without septic treatment, c) the effluent from demonstration plots contaminated with pesticides discharged into the canals.

2.2. Provincial Laws and Regulations

2.2.1. Sindh Environmental Protection Act, 2014

Legislative assembly of Sindh province of Pakistan passed the bill on 24th February 2014 to enact Sindh Environmental Protection Act 2014. The Act envisages protection, improvement, conservation and rehabilitation of environment of Sindh with the help of legal action against polluters and green awakening of communities. It equally lays emphasis for the preservation of the natural resources of Sindh and to adopt ways and means for restoring the balance in its eco-system by avoiding all types of environmental hazards. This act has also provided for Sindh Sustainable Fund derived from various sources such as voluntary contributions or fees generated etc. This fund is utilized for protection, conservation or improvement of environment.

Sindh Environmental Protection Agency (SEPA): SEPA would be headed by Director General (DG) with the aim to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made there under. The Agency shall have technical and legal staff and may form advisory committees. The Agency shall administer and implement the provisions of this Act and rules and regulations. It shall also prepare environmental policies, take measures for implementation of environmental policies, prepare Sindh Environment Report and prepare or revise Sindh Environmental Quality Standards. SEPA shall also establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation research, inspection and audit to prevent and control pollution and to estimate the costs of cleaning up pollution and rehabilitating the environment and sustainable development.

2.2.2. Sindh Solid Waste Management Board Act, 2014

The SSWMB Act, 2014 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant

matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex officio members of other relevant departments.

2.2.3. Sindh Environmental Quality Standards (SEQS)

With the SEPA Act, 2014 the Sindh EPA revised the Environmental Quality Standards (EQS) with full consultation of the private sector, industrialist, trade and business associations and NGOs and approval of Sindh Environmental Protection Council has developed Sindh Environmental Industrial Wastewater, Effluent, Domestic Sewerage, Industrial Air Emission, Ambient Air, Noise for vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards 2015 vide Notification No.EPA/TECH/739/2014. Only a few of these standards will be applicable to the Nosie and liquid effluents discharged to the environment from the activities under the proposed project. The SEQS is presented in **Annex B**.

2.3. The World Bank Operational Policies

The World Bank is the donor agency of the project. Therefore it is obligatory for the project to abide by the World Bank safeguard polices. The triggering status of the World Bank Operational Policies is described below in Table 2.1 and further discussed in the subsequent sections.

Table 2.1: World Bank Safeguard Policies Triggered

S#	Environmental Assessment	Policy Reference	Triggered	Not Triggered	Remarks
1.	Environmental Assessment	OP/BP 4.01	✓		This project is classified as "Category B" project per the WB Environment Safeguard category since the activities under the project would be small-scale interventions in terms of construction of toilets and hand washing facilities in selected local schools as well as preparation of small plots for nutrition sensitive agriculture for communities and small ponds for aquaculture
2.	Natural Habitat	OP/BP 4.04		✓	This OP is not triggered as the project interventions will not have any adverse impact on natural habitats
3.	Pest Management	OP 4.09	✓		This policy is triggered for A4N component as the component comprising activities engaging nutrition sensitive kitchen gardening and agriculture activities which may involve some use of pesticides and require pest management.
4.	Indigenous People	OP/BP 4.10		✓	Although there are no known indigenous people as defined by OP 4.10 in Sindh.
5.	Physical Cultural Resources	OP/BP 4.11		✓	Since the project activities will be carried out in government schools and in community backyards, it is unlikely that any sites of cultural, archeological, historical, or religious significance will be affected. Therefore this OP is not triggered.
6.	Involuntary Resettlement	OP/BP 4.12	✓		This policy is triggered in case the project needs to acquire small pieces of land for certain interventions (e.g. storage facilities). A Resettlement Policy Framework (RPF) has been prepared, and Resettlement Action Plans will be prepared where land is acquired. In most other cases, small pieces of land for interventions will be taken using Voluntary Land Donation (VLD) with appropriate screening to ensure that land is

					donated without any pressure. This will be monitored to ensure that VLD procedures are properly documented and accepted by the community. Chapter 8 – Resettlement Policy Framework describing involuntary resettlement is provided to address these concerns.
7.	Forestry	OP 4.36		✓	This OP is not triggered since the sub-projects will not be located in the forest areas.
8.	Safety of Dams	OP 4.37		✓	This OP is not relevant since the proposed project does not involve construction of dams.
9.	Projects on International Waterways	OP/BP 7.50		✓	This OP is not relevant since the proposed project interventions do not located on international waterways.

2.3.1. Environmental Assessment (OP 4.01)

The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The OP defines the EA process and various types of the EA instruments. The proposed project may consist of activities which can potentially have environmental and social consequences, hence the policy is triggered and this instrument is being developed. Since the activities under the project would be small-scale interventions in terms of construction of toilets and hand washing facilities in already existing schools as one of the component of SSS as well as preparation of small plots for nutrition sensitive agriculture (Kitchen Gardening), the level of environmental impacts is likely to be low to moderate. This project is classified as "Category B" with partial assessment per the WB safeguards category.

The OP 4.01 also defines ESMF as "An instrument that examines the issues and impacts associated when a project consists of a program and/or series of sub-projects, and the impacts cannot be determined until the program or sub-project details have been identified. The ESMF sets out the principles, rules, guidelines and procedures to assess the environmental and social impacts. It contains measures and plans to reduce, mitigate and/or offset adverse impacts and enhance positive impacts, provisions for estimating and budgeting the costs of such measures, and information on the agency or agencies responsible for addressing project impacts. The term "Environmental Management Framework" or "EMF" may also be used."

The proposed project may consist of activities which can potentially have environmental and social consequences, hence the policy is triggered and this instrument is being developed. Since the activities under the project would be small-scale interventions in terms of construction of toilets and hand washing facilities in already existing schools as one of the component of SSS as well as preparation of small plots for nutrition sensitive agriculture (Kitchen Gardening, (e.g. toilets and hand washing stations in schools, kitchen garden demonstrations comprising tunnel farming, livestock sheds, fish ponds, use of pesticides and chemical fertilizers), the level of environmental impacts is likely to be low to moderate. The ESMF checklist is designed to identify these potential impacts, and direct communities and project teams to practical ways of avoiding or mitigating them. If project screening used by implementing agencies that more detailed planning work is required, they can require that an acceptable ESMP be prepared before the project application can be considered further.

2.3.2. Natural Habitat (OP 4.04)

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions.

This OP is not triggered as the project interventions will not have any adverse impact on natural habitats

2.3.3. Pest Management (OP 4.09)

Through this OP, the WB supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. This policy is triggered for A4N component as the component comprising activities engaging with pesticides and pest management.

This OP is triggered and a project specific Integrated Pest Management Plan (IPMP) will be prepared under A4N component which will address pesticide usage especially in vegetable crops besides other crops being considered in the project. The plan will also articulate a strategy to incorporate IPM principles in A4N interventions specifically. A model IPMP for A4N component is developed and presented in **Annex G**.

2.3.4. Indigenous People (OP 4.10)

For purposes of this policy, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing characteristics in varying degrees.

This policy is not triggered as there are no indigenous people in the project area. Although there are no known indigenous people as defined by OP 4.10 in Sindh.

2.3.5. Physical Cultural Resources (OP 4.11)

The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The specific aspects of the Policy are given below.

- The Bank normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage.
- The Bank will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ. In other cases, structures can be relocated, preserved, studied, and restored on alternate sites. Often, scientific study, selective salvage, and museum preservation before destruction is all that is necessary. Most such projects should include the training and strengthening of institutions entrusted with safeguarding a nation's cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.
- This policy pertains to any project in which the Bank is involved, irrespective of whether the Bank is itself financing the part of the project that may affect cultural property.

Since the project activities will be carried out in government schools and in community backyards, it is unlikely that any sites of cultural, archeological, historical, or religious significance will be affected. Therefore this OP is not triggered.

2.3.6. Involuntary Resettlement (OP 4.12)

The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks. This policy includes safeguards to address and mitigate these risks. The overall objectives of the Policy are:

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits.
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them.

This policy is triggered in case the project needs to acquire small pieces of land for certain interventions (e.g. storage facilities). A Resettlement Policy Framework (RPF) has been prepared, and Resettlement Action Plans will be prepared where land is acquired. In most other cases, small pieces of land for interventions will be taken using Voluntary Land Donation (VLD) with appropriate screening to ensure that land is donated without any pressure. This will be monitored to ensure that VLD procedures are properly documented and accepted by the community. Chapter 8 – Resettlement Policy Framework describing involuntary resettlement is provided to address these concerns.

2.3.7. Forestry (OP 4.36)

The objective of this Policy is to assist the WB's borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

This policy is not triggered in case of SSS sub-project because the hard component i.e. establishing toilet and hand washing facilities will be developed in schools and will not relevant to any reserved forest protected under Forest Department, Government of Sindh. For A4N sub-project, it should be avoided that the demonstrations plots should not be located in above mentioned forest areas protected under Forest Department. Therefore, this OP is not triggered.

2.3.8. Safety of Dams (OP 4.37)

The Policy seeks to ensure that appropriate measures are taken and sufficient resources provided for the safety of dams the WB finances.

However this OP is not relevant since the proposed project does not involve construction of dams.

2.3.9. Projects on International Waterways (OP 7.50)

This OP defines the procedure to be followed for projects the WB finances that are located on any water body that forms a boundary between, or flows through two or more states.

However this OP is not relevant since the proposed project interventions do not located on international waterways.

2.4. Obligations under International Laws/Treaties

Pakistan is signatory of several Multilateral Environmental Agreements (MEAs), including:

- UN Framework Convention on Climate Change (UNFCCC),
- Kyoto Protocol,
- Montreal Protocol,
- UN Convention to Combat Desertification,
- Stockholm Convention on Persistent Organic Pollutants (POPs),
- Cartagena Protocol.

These MEAs impose requirements and restrictions of varying degrees upon the member countries, in order to meet the objectives of these agreements. Therefore, the provisions of these laws and treaties are to be taken care of if any of the project activity falls in the jurisdiction of any of the above mentioned MEAs. These MEA are briefly described in **Annex R**.

2.5. Administrative Framework

Environmental issues are governed by three levels of the government viz. Federal, Provincial and Local Government. The Cabinet Secretariat through Climate Change Division is the Ministry at the Federal level, which oversees the affairs of the environment in the country. The Government of Sindh (GOS) has designated its Ministry of Environment and Alternative Energy, to administer matters related to the environment in Sindh.

2.5.1. Institutional Setup for Environmental Management

The highest environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided over by the Chief Executive of the country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs (for four provinces, AJK and Northern Areas), and Environmental Tribunals. The Federal government has also formed the Federal EPA, which is headed by a Director General and has wide-ranging functions given in PEPA 1997. These include the preparation and coordination of national environmental policy for approval by the PEPC, administering and implementing the PEPA 1997 and preparation, revision or establishment of NEQS. The Provincial Environmental Protection Agencies are formed by the respective Provincial Governments. A Director General who exercises powers delegated to him by the Provincial Government heads each Provincial EPA. IEEs and EIAs are submitted to provincial EPAs for approval.

2.6. Environmental and Social Guidelines

Two sets of guidelines, the Pakistan-EPA's guidelines and the World Bank Guidelines are reviewed here. Since Sindh EPA has not formulated separate guidelines therefore, Pakistan EPA's guidelines have been benefited from. These guidelines address the environmental as well as social aspects.

2.6.1. Environmental Protection Agency's Environmental and Social Guidelines

The Federal EPA has prepared a set of guidelines for conducting environmental and social assessments. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the environmental and social guidelines form a part, includes the PEPA 1997 and the NEQS. These guidelines are listed below followed by comments on their relevance to proposed project:

- **Policy and Procedures for Filing, Review and Approval of Environmental Assessments, Pakistan Environmental Protection Agency, September 1997:** These guidelines define the policy context and the administrative procedures that govern the environmental assessment process from the project pre-feasibility stage to the approval of the environmental report. The section on administrative procedures has been superseded by the IEE-EIA Regulations, 2000.
- **Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997:** The guidelines on the preparation and review of environmental reports target project proponents and specify:
  - The nature of the information to be included in environmental reports
  - The minimum qualifications of the EIA conductors appointed
  - The need to incorporate suitable mitigation measures at every stage of project implementation
  - The need to specify monitoring procedures.
- The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the Study Area, detailed assessment thereof, and mitigation measures.
- **Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997:** These guidelines support the two guidelines mentioned above. They deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study.
- **Guidelines for Sensitive and Critical Areas:** The guidelines identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites, etc., and present checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

2.6.2. World Bank Social Guidelines

The principal World Bank publications that contain environmental and social guidelines are listed below.

- Environment, Health, and Safety (EHS) Guidelines prepared by International Finance Corporation and World Bank in 2007.
- Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues.
- Social Analysis Sourcebook.

The screening checklists (**Annexures C&D**) and generic ESMP (**Annexures E**) are prepared for the subprojects under Multi-Sectoral Action for Nutrition Program would need to comply with the above guidelines. In case of any conflict between the above guidelines and the ones discussed under Section 2.6.1, the WB guidelines will be followed.

Chapter 3 Project Description

3.1. Project Context

The Project Objective is to improve the quality and diversity of diets and change behaviors related to food, hygiene and sanitation in project areas, thereby contributing to reduction in malnourishment. This will be achieved by a) a sanitation intervention focusing on behavioral change to achieve open defecation-free (ODF) villages, combined with b) an agriculture intervention to increase household knowledge of and capacity to produce and consume nutritious foods to boost nutrition in the province.

The project has two project components under INSS, i) the sanitation component of the project aligns with the Government of Sindh's sanitation intervention known as Saaf Suthro Sindh (SSS) in 13 districts in the province and aims to increase the number of ODF villages through certification while ii) the agriculture for nutrition (A4N) component includes pilot targeting beneficiaries for household production and consumption of healthier foods through increased household food production in 20 Union Councils where the hygiene and mother and child health interventions are taking place; with high levels of poverty and food insecurity and high DOH (Department of Health) profiles, and where agriculture interventions are feasible in the three districts with the highest stunting rates. The two components are linked to the joint objective of reduction in malnourishment under the INSS program. The project will be implemented by LGD and DOA.

The following section provides the detailed description of the proposed components and anticipated subprojects;

3.2. Project Components

The project consists of two subcomponents;

1) **Saaf Suthro Sindh (SSS)** – an initiative of the Local Government Department (LGD), Government of Sindh (GoS), to achieve an Open Defecation Free (ODF) Sindh province through sanitary and hygiene practices. The program aims that everyone in Sindh has access to and use sanitary latrines by 2025.
2) **Agriculture for Nutrition (A4N)** – aims to improve the quality and diversity of diets in target households through nutrition sensitive agricultural practices. This will be accomplished by introducing diverse production systems in target households, improving the quality of production, and introducing techniques to store and process food to smoothen the consumption.

3.3. Saaf Suthro Sindh (SSS) Program – Scaling up of Rural Sanitation – US$ 14.65 Million

Saaf Suthro Sindh (SSS) Program has been conceived as an additional component of the Sindh Inter-Sectoral Nutrition Support Program (NSP).

3.3.1. Objectives

The general objective of the SSS program is to improve the nutritional status of the entire Sindh, predominantly the rural communities through sanitation interventions. The SSS program is also aligned with the federal government vision 2025 and aims to achieve an open defecation free (ODF) Sindh by 2025. Intermediate targets are enumerated as follows;

1. Eradication of 50% Open Defecation from:

a. Thirteen (13) target districts in three years
b. Rest of the districts by 2020
2. 70% of rural households have access to and use sanitary latrines by 2020
3. 90% of rural population may wash hands with soap at critical times by 2020.

3.3.2. Scope

The objective is to cover the entire Sindh to make it ODF and to improve hand washing and hygiene behavior throughout Sindh. However, SSS in the first phase will target 50% villages in 13 districts of Sindh. The targeting of villages will be done on selection criteria presented below. Remaining population of these 13 districts and other districts of Sindh shall be covered in the second phase of this program.

3.3.3. Village Selection Criteria

In selection of the villages for SSS program a special attention will be paid to opinions and inputs from the District ODF Committees and all relevant key stakeholders. In general, the Directorate of Sanitation will prioritize the village for selection and incorporating in the respective NGO contract based on the following key criteria:

Criterion 1: Incidence of Sanitation linked diseases

1. Villages with high incidence of sanitation linked diseases, especially diarrhea.

Criterion 2: Nutritional and Health Stats

1. High statistics for stunting and malnutrition in children.
2. High child mortality rates.

Criterion 3: Sanitation Coverage

1. High percentage of open defecation.
2. Low toilet coverage and/or sanitary use.

Criterion 4: Population, Location and Validation

1. Population based on at least 25 households and/or 150-200 individuals.
2. Located within geographic boundaries of the respective district.
3. Classified as village in government records.

The above criteria is a presentation of likely criteria however, it will be consulted and improved, where needed.

3.3.4. Location

The thirteen districts for SSS program were selected on poverty indicators and service coverage and dialogue of the Government of Sindh and World Bank with other sector partners (e.g. UNICEF, Water Aid, Plan, Merlin etc). The following districts have been identified for initial phasing of the SSS program. These Phase 1 districts are:

1) Jacobabad, 2) Kashmore, 3) Kambar-Shahdadkot, 4) Larkana, 5) Tharparkar, 6) Badin, 7) Sanghar 8) Tando Muhammad Khan 9) Umerkot 10) Shikarpur 11) Dadu 12) Thatta; and 13) Sujawal

The remaining districts of Sindh will be covered in phase-II during the post 2017 period.

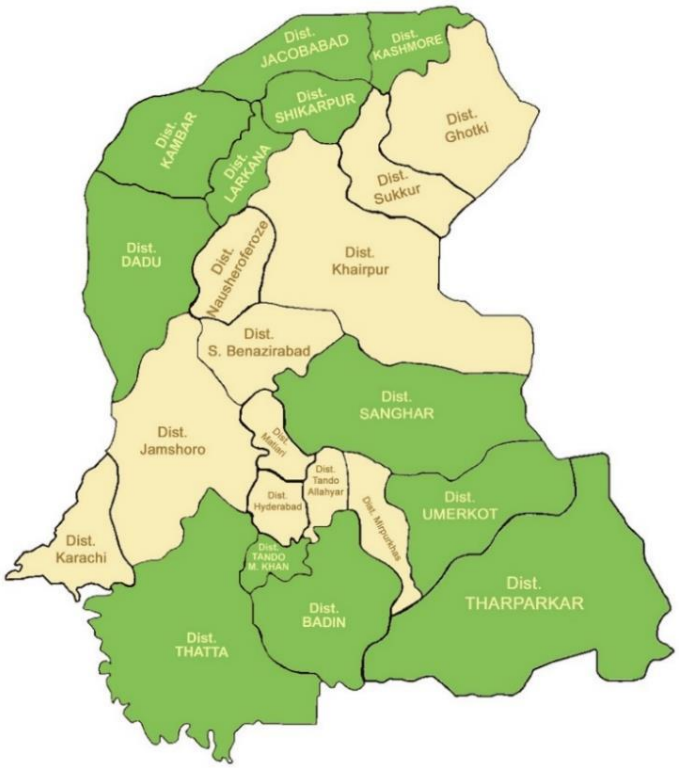


Figure 3.1: SSS Project Location Map

3.3.5. Project Implementation

The project will be implemented using an integrated Sanitation-Nutrition Behavior Change Approach as has been demonstrated in Umerkot district by Shifa International. This essentially means that the tools used including triggering (e.g. i-Rapport Building, ii-Social Mapping iii risk mapping iv-Transect Walk, v-Feces calculation, vi-identification of water and sanitation related diseases medical expense estimation etc.) will incorporate the activity for screening of acute malnourished children present in the village. The identified cases of malnutrition and its negative impacts on health and future wellbeing of the children will be linked to the open defecation practices in the community and will serve as yet another behavior trigger.

The integration of nutrition with sanitation behavior change communication will require some adjustments in the training approach and materials for the field staff. Hence training materials will be reviewed and if required, necessary adjustments will be done. Wherever possible, material from ongoing sanitation programs will be used to ensure that behavior change messages are designed in a way not to overburden staff.

Responsible authority

The SSS will be implemented through the Directorate of Sanitation based in the LGD which will be responsible for all sanitation related interventions in the province and also maintain integrated coordination with the Nutrition Program for the desired results of SSS.

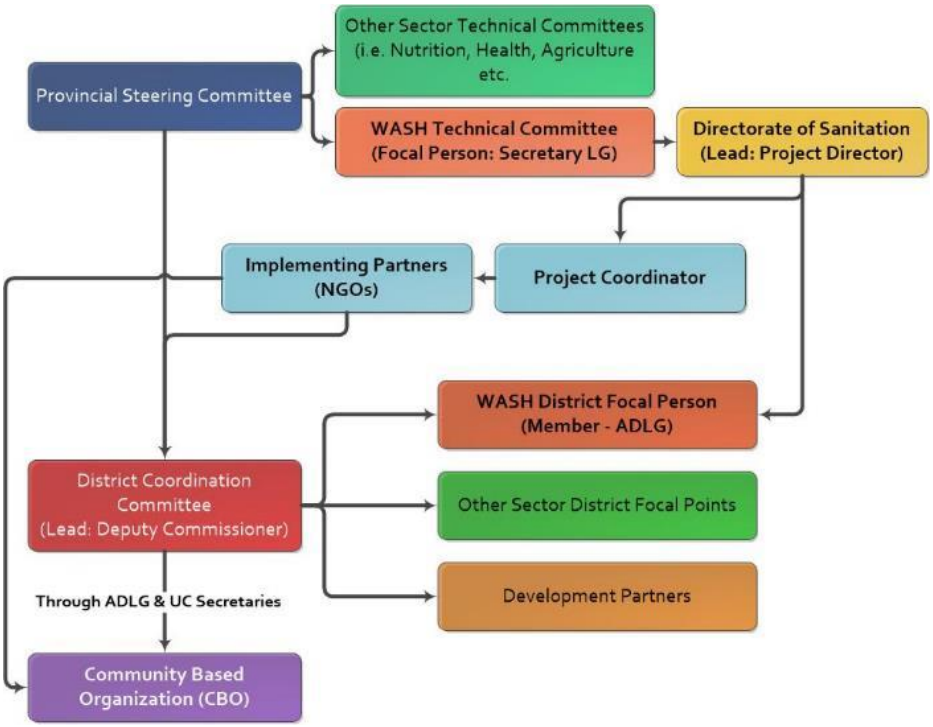


Figure 3.2: Overall Sectoral Coordination Framework[3]

In essence there will be two levels of implementation:

Component 1: Provincial Level program support

At the provincial level, a Directorate of Sanitation will be established at LGD for implementing the program activities while working closely with NGOs – called Implementation Partners (IPs). These will be different NGOs jointly supervised by the Directorate of Sanitation and the project management setup at the district level. Ideally each district will be assigned to an NGO called the Implementing Partner, through a contract but there may be cases where more than one NGO will cover the whole district. The Directorate will strengthen and further enhance the sector coordination mechanisms and will have specific terms of references for each area of its interest and operations.

Subcomponent 1: Provincial level support activities

The primary support responsibilities of the Directorate will be to perform the activities below in coordination with the Nutrition Program;

1. Assist District Management and respective IPs in the Target Districts to develop their ODF District Plan
2. Respond to the funding requirements and financial submissions of NGO Partners and LGD District level offices;
3. Assist and enable the district Management to mobilize resources to meet ODF District Plan targets through budgetary allocations in District ADPs;
4. Develop capacities of front line facilitators (e.g. NGO Staff and Secretary UC) in relevant sanitation approach and Behavior Change Skills.

[3] PC-I of Saaf Suthro Sindh (SSS)

5. Develop an effective M&E and reporting system for routine monitoring and more effective evidence based planning to achieve planned targets.
6. Conduct and arrange for research and evaluations. Document and disseminate best practices and lessons learnt.
7. Identify ways and means to mobilize partners and CSR resources
8. Promote private sector in marketing of low cost sanitation materials.
9. Develop effective communication tools and engage media: The plan proposes to follow local media approach for creating mass awareness on sanitation and hygiene. Such an approach would ensure not only wholesale 'triggering', but also visibility of this campaign and sustaining the message.

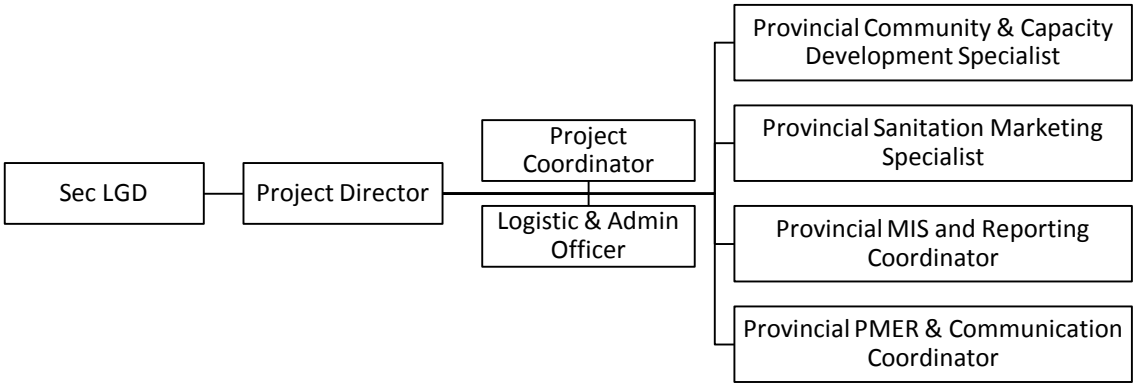


Figure 3.3: Management Structure of Directorate of Sanitation

Component 2: District Level program Implementation

The SSS program will actually focus at the district level. An Open Defecation Free District Coordination Committee (called District ODF Committee) in cooperation with the nutrition district plans will be formed which will be responsible for development and implementation of District ODF Plan. The District ODF Committee will be headed by the District Commissioner (following the practice from the three pilot districts of Umerkot, TM Khan and Thatta where DC led Committee exists), the committee will provide coordination support to field implementation teams (NGOs). The field activities will be conducted by Implementing Partners, hired by the LGD (one or more per district), with extensive experience of hygiene and sanitation promotion in the targeted areas. Secretaries of Union Councils (UCs) through Directorate will be involved in regulations and monitoring the program activities, verifying results and ensuring sustainability of ODF status. In each district the IPs will hire teams of trained facilitators for smooth implementation of SSS Program.

Subcomponent 1: District implementation activities

1. *Preparation of District ODF Plans*: Directorate with support of WSP and other lead sector partners will arrange and conduct orientation sessions for the concerned district administration and key stakeholders. Necessary agreements and understanding will be developed. This will be followed by orientations for wider district level stakeholders, which will lead to the development of the District ODF Plan and their approvals by District ODF committees.

2. *Human Resource Development*: Building capacity at the various levels of government and program IPs is critical to achieve the planned goal with quality. The district wide scaling up of sanitation program in

the target districts will require a variety of trainings and orientations. The trainings will include but not be limited on the subject of social mobilization and Technical for appropriate and feasible toilet construction with immediate and long term solutions for waste and waste water disposal.

3. *Community Behavior Change Activities*: These activities will be conducted by selected NGO IPs, (e.g. Villages Selection, Formation/Reactivation of Village Committees, Registering Committees with Sec UCs and/or social welfare department, Triggering, Follow Up with Sec UCs, Verification of ODF claims, Supporting District ODF Committee in ODF Certification by 3rd party, ODF Declaration, ODF Celebrations and Performance based incentives and rewards). The NGOs will hire its staff inclusive of sanitarians/social organizers, conduct PRAs and impart training with the help of the Directorate on pre-designed modules. The trainings will be essentially on sanitation marketing for supply side entrepreneurs, CLTS for demand side, orientation to district management, head of the VSC. These will be supported by the Water and Sanitation Program (WSP) program.

4. *Hardware support for Schools*: The support will be an incentive of achieving ODF status by entire District via providing improved latrines in 2600 facilities in 13 districts through NGO Partners. This will help provide 200 latrines covering almost all the government schools in the area under implementation in each district which will be 50% of each district. Each set of latrine will be inclusive of a boy latrine, girl latrine and a hand washing station. In some cases, hand washing station may also need a bore with hand pump.

5. Behavior change will be achieved through the program as a sustainable outcome that would focus on improved hygiene behavior that is more directly relates to stunting (food and personal hygiene during preparation of child food, feeding practices, washing hands at five critical time a day

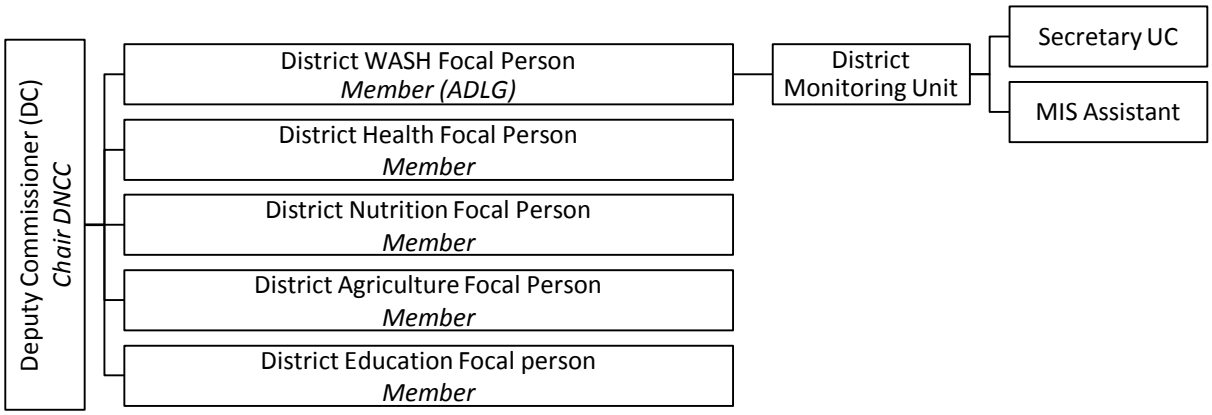


Figure 3.4: Management Structure of District Coordination Committee

3.3.6. Expected Benefits

The benefits of the project are directly impacting the well-being, health and quality of life of the people of Sindh.

Financial benefits: The Program targets to save the precious human resource from the morbidity and mortality due to diseases, low nutrition status and hence qualitatively contributes to the boosting of local economy and National GDP. Betterment in nutritional status eventually contributes to better economic outcomes, reduced annual loss of GDP due to sanitation.

Social benefits: The Economics of Sanitation Initiative highlights seven diseases among others which attribute to a loss of 3.9% of GDP due to non-action in sanitation. These diseases include Diarrhea, Typhoid, ALRI, Malaria, Hepatitis, etc. The cost due to sanitation issues in health, contributes to 87% of the total loss which in the case of Sindh is estimated to be 262 billion rupees. Reduction of such losses will contribute to improved nutritional status.

Employment generation: Employment generation would only be for the period of project implementation for establishment of hub. The job will be done through NGOs, therefore there will be job opportunities for social mobilizes and other staff during implementation phase of the program.

Environmental benefits: The health education for adopting hygiene practices would definitely improve the living pattern in the substantial poor and disadvantaged section of society at rural, sub-urban and urban poverty pockets. Safe practices should be the cornerstone of policies and employed through the implementation of this project.

3.3.7. Project Schedule

The initial phase of the project will be completed in a period of three years.

3.3.8. Project Costs

Total program costs are estimated to be Rs. 1,523.31 Million or US$ 14.65 Million. The prospective donor is proposed to contribute 80% of the required budget as grant funds while 20% will be provided from the Provincial government.

3.4. Agriculture for Nutrition (A4N) Project, Sindh – US$ 5.0 Million

The project objective is to improve the quality and diversity of diets in target households through nutrition sensitive agriculture.

3.4.1. Objectives

The project will improve the quality and diversity of diets in target households through nutrition sensitive agriculture by introducing diverse production systems in target households, improving the quality of production, and introducing techniques to store and process food to smooth consumption. The project will pilot a method to introduce household production and use of healthy foods to boost nutrition as well as introducing cottage industry for food processing/preservation to smooth consumption throughout the year. The approaches and technologies can ultimately be scaled up to conventional farms to boost provincial production of healthy foods.

3.4.2. Scope

Within each of 4 targeted districts, the project will target 5 union councils based on (a) the presence of the health and sanitation projects; (b) the level of poverty; (c) the level of food insecurity; (d) the DOH profile risk; and the feasibility of agriculture, livestock and fisheries interventions to address the malnutrition situation. Agriculture and livestock interventions will be targeting households (HHs) within the target villages, with priority given to HHs with women of reproductive age and/or children under 5 years of age. The project will use the poverty scorecard (PSC) data from BISP (Benazir income support program?) to target the types of interventions to households:

- PSC 0-11: asset transfer + training (may be 100% of them)

- PSC 12-23: training (may be 100% of them)
- All households: raising awareness on the importance of a healthy and diverse diet.

3.4.3. Location

Three target districts for the program are Tharparkar, Jacobabad, Sanghar and Umerkot.

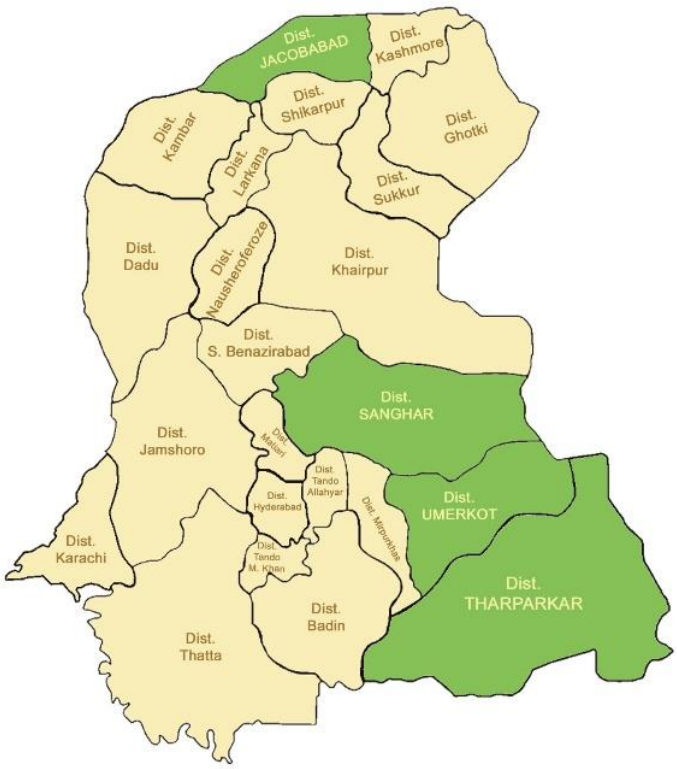


Figure 3.5: A4N Project Location Map

3.4.4. Project Implementation

The project will work through four inter-connected components:

3.4.4.1. Component 1: Mobilization and Group Formation

This component will work in close coordination with the Health and Sanitation projects to reach out to existing village organizations (or support the formation of new ones where needed), to introduce the concept of nutrition in target Union Councils and Villages and to educate people on the role of a healthy diet in achieving good nutrition. Each project will be working with specialized groups focusing on their particular area—e.g., WASH (water, hygiene and sanitation) with the ODF committees, and MNSP with the Mother's Groups, etc. Agriculture will establish Farmers' Groups e.g. **Farmer Field Schools (FFS)**, and particularly **Female Farmer Field Schools (F3S)**. The project will also support the formation of **Farmer Business Schools (FBS)** out of successful FFSs and F3Ss to support marketing and value addition for marketable surplus.

Given the need to (1) work across sectors on a general mobilization, technology transfers, and behavior change; and (2) target the smallest farms and poorest households in a complex cultural environment, a rigorous mobilization and group formation process will be carried out. Departments of Agriculture and

Livestock& Fisheries will work with the NGO partner technical assistance provider in the operational districts to do the necessary mobilization and group capacity building of the village organizations.

3.4.4.2. Component 2: Food Production and Processing

This component will focus on training technical assistance and small-scale investment support for activities related to diversify agricultural production and post-harvest management that are identified through the mobilization activities and baseline survey.

Subcomponent 1: *Agriculture for Nutrition investment fund*. The A4N fund would respond to demand from community members of Farmers' Groups (FFS, F3S, and FBS) for investment in nutrition-sensitive agricultural activities—e.g., kitchen gardens, small-scale vegetable farming, small-scale livestock rearing (poultry, ruminants, fisheries), and small-scale food storage and preservation. The funds would finance the purchase of supplies needed to start the intervention—e.g., seeds, farm implements, livestock sheds, equipment for tunnel farming, facilities for food preservation, etc.

Subcomponent 2: *Technical assistance to communities*. To ensure the quality of the activities financed by the investment fund, the Department of Agriculture (DOA) and Department of Livestock and Fisheries (DOLF) will prepare demonstration plots and training packages to be delivered using the farmer field school approach. These packages would include, but not be limited to—how to identify quality seeds, seed preparation and plantation, general good agricultural practices, integrated pest management, soil nutrient management, tunnel farming, nursery establishment, water management, organic agriculture practices, animal nutrition and health, food processing techniques, food safety, etc. The training would be packaged with the assets transferred in subcomponent 1, to maximize the impact of the nutrition sensitive investment.

3.4.4.3. Component 3: Awareness Raising, Capacity Building, Research and Knowledge Management.

Subcomponent 1: *Awareness raising.* The department will collaborate with officials from the health and sanitation projects to develop a cohesive communications program on nutrition targeting the population of the project area, but applicable to a wider audience through any government program. The focus will be made on increasing nutrition awareness among various target groups, particularly women and farmers to improve knowledge, attitude, and practices around nutrition. Promotion of nutritious foods and providing households' necessary knowledge to prepare and consume these foods to complement their diets will be part of the awareness campaign. Activities include: developing messages/materials on nutritious foods, recipes, and cooking techniques; the benefits of cultivating nutritious crops like vegetables, pulses and oil seeds; the importance of animal products or other protein sources in a healthy diet.

In addition, the project will offer a knowledge-sharing forum for policy planners, decision makers, the private sector, and civil society through thematic advocacy seminars, awareness raising events, research studies and consultative meetings focusing on the nexus between Agriculture and Nutrition. It will open up venues for Provincial level dialogues and exert more pressure on decision makers to bring about lasting changes in program priorities, design, and implementation.

Subcomponent 2: *Capacity building*. Nutrition sensitive agriculture is essentially a new business line for the DOA and DOLF staff, and it requires capacity building of the staff to be able to promote and implement activities. Working at the provincial and district/UC levels through workshops, seminars, exposure visits, and training programs to increase the skills of staff to (1) be able to explain and advocate for nutrition sensitive agriculture to diverse audiences; and (2) provide technical assistance to communities and producers

in nutritious crop cultivation. An institutional capacity assessment building with framework at the provincial district and union council levels will be developed for defining and implementing a capacity development plan.

Subcomponent 3: *Research and knowledge management*. To contribute project activities and the broader implementation of the Provincial strategy on nutrition, the project will document lessons from implementation to share with staff of both departments and other projects under implementation in the agriculture, livestock & fisheries sectors.

3.4.4.4. Component 4: Project Management, Inter-sectoral Coordination, Monitoring, Evaluation

This component will cover the activities of the government officials responsible for implementing the project. It covers activities to monitor progress toward project objectives and to derive lessons from implementation for wider application.

Subcomponent 1: *Project management*. The project will be managed by the Agriculture Department in collaboration with the Department of Livestock and Fisheries and a technical support agency. At the provincial level, there will be Project Director dedicated to project implementation within Agriculture Extension Wing and the necessary positions to ensure proper management of fiduciary responsibilities (financial) management and procurement) and safeguards (social and environmental), project monitoring, and knowledge management and communications.

Subcomponent 2: *Inter-sectoral coordination*. This subcomponent will cover the meetings, workshops, and consultations necessary to align the activities and monitoring between the 3 projects that are part of the broader nutrition program. The project will work in close coordination with relevant stakeholders including: Ministry of National Food Security and Research, PARC, and Ministry of Health (at the national level), and Departments of Livestock & Fisheries, Planning & Development, Health and Local Government and the Nutrition Cells (at Provincial and District levels). Moreover, it will engage with a wide-range of public, private and civil society stakeholders including UN agencies, donors, NGOs, farmers, communities, academia and research institutions, training centers, and media partners employing legally applicable policies and regulations that ensures transparency, efficiency, economy and equal opportunity and are fit for purpose. It will provide a common platform for harmonization, and multi-sector synergies for effective nutrition response. Moreover, high level coordination will help to enhance political will and commitment to nutrition at national level.

Subcomponent 3: *Monitoring and Evaluation*. The project's M&E Framework will be developed in collaboration with the Health and Sanitation projects to ensure the impact of multi-sector nutrition action is captured. Each Project Management Unit (PMU) will monitor their own implementation and outcome indicators against their sectorally-focused project development objective. The confluence of indicators will be collected and monitored at the district level through the **District Nutrition Coordination Committee (DNCC)** and at the Provincial level through the Provincial **Nutrition Project Steering Committee (NPSC)** in the Planning & Development Department, which was established under the Enhanced Nutrition for Mother and Children Project. The NPSC will have a monitoring focal person in Planning and Development Department and in each district, essential to maintain accountability for all key levels and observe overall progress. The district monitoring teams of the project will carry out the regular field visits to monitor progress on project interventions. The Agriculture Department, as a lead implementation agency, will inform the NPSC about progress against its project outcome targets.

Nutrition Projects Steering Committee Planning & Development Department M&E Specialist		
↑		
Provincial Implementation Units		
Agriculture PMU M&E Specialist	Local Government PMU M&E Specialist	Health PMU M&E Specialist
↑		
District Nutrition Coordination Committee District Monitoring Team (led by P&D)		
Agriculture Committee DOA	District ODF Committee	Health Committee

3.4.5. Technical Transfer Aspects

Department of Agriculture and Department of Livestock and Fisheries (DOLF), with the support of the technical service provider (TSP), will develop information and guidelines on the technology and information needs of communities/households who will participate in the project. The TSP will lead multi-sector teams from DOA, DOLF, DOLF, and DOH to mobilize the villages around nutrition awareness. Information on required technology will be used in the mobilization process to generate informed demand among project beneficiaries, who can receive a grant to purchase the goods that they need. Each target village will form a procurement committee to receive the grant from the government and purchase the technical assets. The government will schedule the FFF/F3S to provide the necessary training to the beneficiaries.

DOA and DOLF have a system of staff within the district and UCs that will provide front-line support of the beneficiaries with support of the TSP. There are some vacant sanctioned positions in all three departments that could be filled to meet the needs of the project. DOA can reassign staff to be dedicated to the implementation of this project as needed, and fill some vacant position on contingency basis with women to meet the outreach needs of the project.

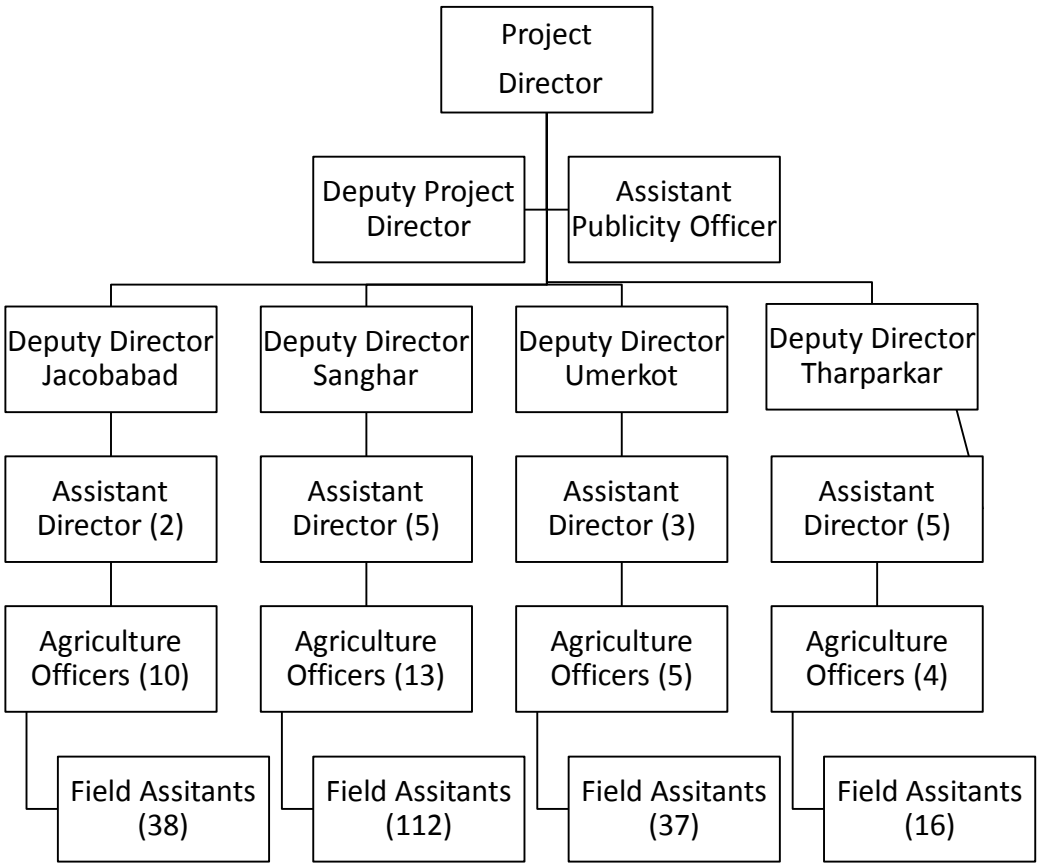


Figure 3.6: Human Resource Structure at District Level for DOA (sanctioned positions/working positions)

DOA and DOLF staff will lead the technical assistance and training of beneficiaries through FFS, F3S, and FBS. The curricula, which will be developed by departmental staff with support of the TA provider, will cover topics relevant to small scale food production, including (but not limited to):

- General information on the link between food and nutrition;
- Elements of a healthy diet;
- Food for complementary feeding;
- Garden preparation and vegetable cultivation methods;
- Integrated pest management (including reducing pesticide residues);
- How to purchase good seeds and breeds in the market;
- Animal nutrition and health;
- Livestock waste management;
- Tunnel farming techniques;
- Food storage techniques;
- Home based preservation of vegetables and fruits (canning, pickling, drying, etc.);
- Storage of food grain and fodder for animals, etc.

DOA and DOLF will also monitor and document the implementation process to define standard operating procedures for DOA and DOLF staff working on other projects and in non-target districts (contributing to the scale-up of nutrition sensitive approaches).

3.4.6. Expected Benefits

Financial benefits: The project's primary aim will be to increase food supply for the producing households, so a direct financial return is not anticipated; however, it will provide avenues to poor farming community, landless and women-headed household involved with agriculture including livestock to support in improvement of their nutrition. This way health of household will be sustainable to resist disease, increase stamina and productivity, etc.

Economic benefits: The nutritional intervention will enhance health, stamina of very poor household by addressing nutritional deficiencies/gaps. This project will support poor segment of society which will support them to work with full capacity that ultimately increase agriculture productivity; children's health will enhance their learning capacity by attending schools regularly. Thus, the nation will be benefitting from having additional agriculture produce, reduction in health bill, etc. including healthy manpower.

Social benefits: The causes of malnutrition- mortality is prevailing due to inadequate food intake and disease caused by in-sufficient access to healthy food, inadequate care for mothers / children, in-sufficient access to education and health care. The project would increase food availability which would lead to improvement in health especially women and children, reduction in school dropout, and increase the earning potential.

Employment generation: The project is expected to directly generate about 250 jobs, putting about 10,000 households in agriculture activities in 20 union councils of selected 4 districts also provide employment opportunities in directly and at secondary level to about 5000 persons/ household along with service provider.

Environmental benefits: This project would focus on boosting production such that it not only meet year round needs of household but also earn income from profitable sale in the market. As proposed, the scheme would contribute towards sustainable economic growth through increase in nutrition food crops, and also creation of new job and labor market.

3.4.7. Project Schedule

Project is expected to be completed in Three (3) Years, from July 2016 to June 2019.

3.4.8. Project Costs

Estimated project cost is Rs.582 Million or US$ 5.0 Million. Sources of funding is as follows;

- Sponsors own resources — Rs.82.0 million
  (Through Development Budget, GoS) — (14%)
- World Bank grant — Rs.500.0 million
  Through 'Nutrition Multi-donor Trust Fund Donor (NMDTF)) — (86%)

3.5. Anticipated Subprojects

Anticipated Subprojects (financed under project) under SSS and A4N are;

The SSS focuses on creation of ODF jurisdictions and promotion of hand washing in 13 districts through behavior change of communities, capacity development of government staff and mobilization of NGOs and village organizations. The Sanitation Directorate will focus on:

a) hand washing facilities in 2600 schools
b) Improvement/rehabilitation/construction of toilets/pit latrines in 2600 schools
c) Guidelines for community based toilet construction via awareness, and
d) community behavioral change activities

The Agriculture Directorate (A4N) will invest in:

a) kitchen garden Demonstration - (200 in 20 UCs)
b) Livestock production Demonstration - (100 in 20 UCs)
c) Fish Production Demonstration – (12 in 4 UCs)
d) purchase of supplies needed to start the intervention—e.g., seeds, farm implements, livestock sheds, equipment for tunnel farming, facilities for food preservation, etc. in 20 UCs.
e) Training and guidance for the use of these supplies

Subprojects exclusions (not financed under project) are;

a) Toilets constructed by communities
b) Sludge management by communities
c) Introduction and use of farm implements including pesticides and fertilizers by communities
d) Kitchen Gardens / Livestock pens / Fish ponds commercially developed by communities

It was revealed during consultation with communities (see chapter 5 and Annex N) that the local capacity of using pesticides and Good agriculture practices (GAP) is lacking and need to provide training and awareness raising throughout the communities. This component is also included in the scope of A4N and implemented by FFS during project implementation. Therefore, the subproject i.e. purchases of supplies needed to start the intervention which specifically includes use of pesticides and fertilizers should not be funded until local capacity for the use of these supplies will be developed via Farmer Field Schools.

Chapter 4 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

This section of the Report presents a broad picture of the existing environmental and social conditions of project areas comprising districts of Jacobabad, Kashmore, Shikarpur, Kambar Shahdadkot, Larkana, Dadu, Sanghar, Umerkot, Badin, Tando Muhammad Khan, Thatta, Sujawal and Tharparkar. Available secondary data from published literature and previous studies conducted by EMC in the area, case studies, district census reports, and other documents was used to develop the baseline profile.

The project Districts are shown in the following map:

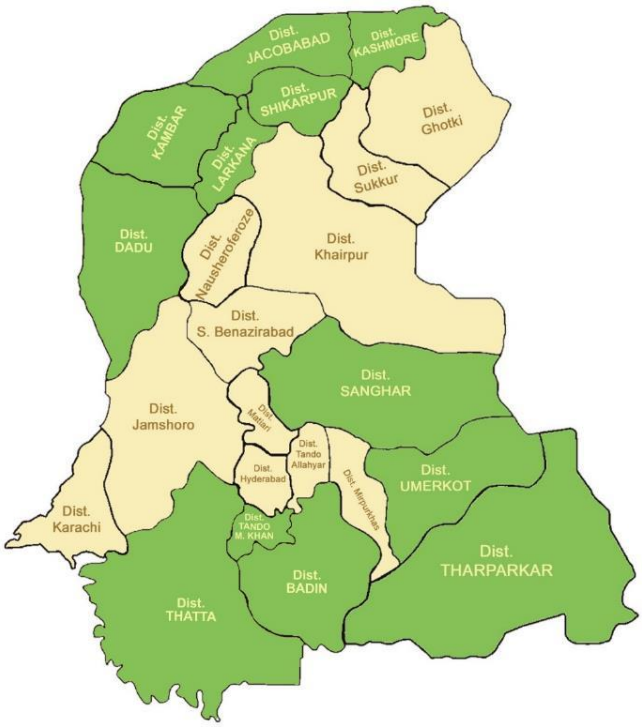


Figure 4.1: Project Area Districts

4.1. Physical Environment

The physical environment of Project Districts has been described in this study with respect to the air shed, watershed, geology, soil characteristics, hydrology and seismicity. Baseline data on the air shed describe the climatic conditions and quality of air. Similarly baseline data on watershed describe the hydrology and quality of surface and groundwater as well as water availability. Data on Geology, geomorphology, soil characteristics and seismicity are needed to evaluate the terrestrial resources with respect to quality of minerals and soil characteristics particularly stability.

4.1.1. Geography

Sindh can be divided into four distinct parts topographically: Kirthar range on the west, a central alluvial plain bisected by the Indus River in the middle, a desert belt in the east and south-east, and the Indus delta in the south. The Kirthar range consists of three parallel tiers of ridges, which run from north to south with varying width between 20 and 50 kilometers. The range consists of ascending series of ridges from east to west, which are about 4,000 to 5,000 meters high. The hills decrease in altitude from north to south. Towards

the south, they spread out in width and form a Sindh Kohistan. The fertile central plain constitutes the valley of the Indus River. This plain is about 580 kilometers long and about 51,800 square kilometers in area and gradually slopes downward from north to south. The lower part of this plain, which starts from Hyderabad is predominantly covered with flood silt. There are also a few depressions and lakes in this plain. The eastern desert region includes low dunes and flats in the north, the Achhrro Thar (white sand desert) to the south and the Thar Desert in the southeast. Its major portion lies in India. In the north it extends up to Bahawalpur division of Punjab, where it is called Cholistan. With little rainfall and low water table, most of the area is a barren land with scattered stunted thorny bushes. In the extreme southeast corner of the desert is Nagar Parkar taluka of Tharparkar district. There is small hilly tract known as Karunjhar hills. These hills are about 20 kilometers in length from north to south and have height of about 300 meters. It consist of granite rocks, probably an outlying mass of the crystalline rocks of the Aravalli rang. The Aravalli series belongs to Archaen system, which constitutes the oldest rocks of the earth crust. The small dam sub-projects of Tharparkar District would be located in this zone. The distributaries of the Indus start spreading out near Thatta across the deltaic flood plain in the sea. The even surface is marked by a network of active and abandoned channels. At a high tide, a coastal strip of 10 to 40 kilometers wide is flooded.

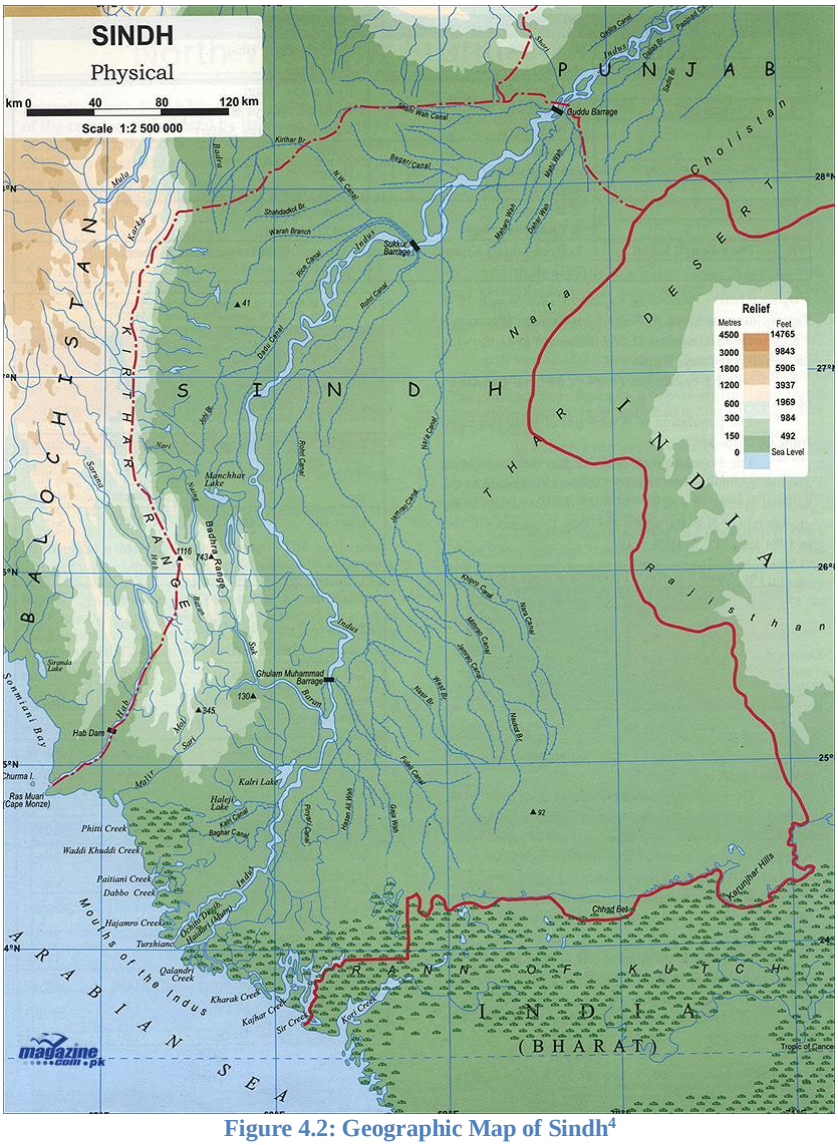


Figure 4.2: Geographic Map of Sindh[4]

[4] http://www.magazine.com.pk/travel/Pakistan/maps/

4.1.2. Geology and Geomorphology

The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar, Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karonjhar Mountains, which is famous for Nagarparkar Granite. In the north Sindh is enquired by rocks of Laki range extending to Suleiman range and its southern most part is encircled by the Arabian Sea. The rocks exposed in this area belong to upper Cretaceous which is recent in age. The sub-surface rocks are about 20,000 feet thick and belong to Cretaceous and Pre-Cretaceous periods. Mostly the rocks are of sedimentary origin of clastic and non-clastic nature and belong to marine, partly marine and fluviatile depositional environments.

Basin wise Sindh lies in the lower Indus Basin and its main tectonic features are the platform and fore deep areas. Thick sequences of Pab sandstone of Upper Cretaceous, Ranikot Group (Khadro, Bara, Lakhra) of Paleocene, Laki, Tiyon, and Kirthar of Eocene age, Nari Formation of Oligocene, Gaj Formation of Lower to Middle Miocene, Manchar of Upper Miocene to Pliocene, Dada Conglomerate of Pleistocene are present in various areas of Sindh. Limestone and sandstones are the most dominant sedimentary rocks in the area.

4.1.3. Seismicity

The major active faults in the province are as under:

Fault Name	Trending	Features	Maximum magnitude on Richter Scale
Surjan Fault	N-S	Located in the west of Larkana, it cuts Quaternary deposits	M=6.1
Pab Fault	NN-W	The fault is located in the eastern part of Pab range	
Jhimpir Fault	N-W	A number of epicenters are located on the fault	M=5.6
Rann of Kutch	E-W	Recent studies have revealed that this fault traverses the Karachi Metropolitan Area.	M=7.6

According to PDMA report 2013, a geological tectonic line runs under Karachi through Kirthar Hills / Mountains to North West of Sindh and Thar Desert, due to which Sindh has risk of a major earthquake in the future.

4.1.4. Soil Morphology

Large quantitative of sediments is brought by Indus River and is deposited along the Indus River banks and especially in the deltaic zone. Further hill torrents also bring silt and clay deposits in the lower reaches. These silts provide a highly fertile layer of soil to the region. The soils along the Indus River banks are silt and sandy loam. Outside the active flood plain, the soils are generally calcareous, loamy and silty clay. Most of the soils in the district of Thar are sandy. Moving sand dunes are also found in these districts. In Tharparkar area, the undulating flat plain is covered with variable soils mainly derived by erosion and residual weathering of the granites, granite gneisses and amphibolite's. While in the case of Dadu and Jamshoro, the soils in the plain near to subproject sites have homogenous porous structure, mainly silt and fine silt clayey, strongly calcareous with 18-20 % lime content uniformly distributed in the profile. Small patches contain shallow or very shallow, strongly calcareous, gravely and stony loams. While the soils afford very sparse shrub and grass vegetation offering limited grazing, the rocky outcrop only has a water catchment value.

4.1.5. Surface Hydrology

The Indus River is the major source of surface water in the province. There are canals drawn from the rivers and a number of wetlands also exist in the province. Sindh is one of the primary beneficiaries of the Indus Basin Irrigation System (IBIS). It has three major barrages on the Indus River that divert approximately 48 million acre feet (MAF or 59.0 billion cubic meters- BCM) of water annually to the 14 main canal commands in Sindh. These canal systems have an aggregate length of 13,325 miles (21,445 km), which serve a gross command area (GCA) of 14.391 million acres (5.8million ha). There are about 42,000 watercourses (tertiary channels), which have an aggregate length of about 75,000 miles (120,000 Km). Around 78% of the area in Sindh province is underlain by saline groundwater, which is unsuitable for irrigation. Surface and sub-surface drainage systems are inadequate, resulting in much of the drainage effluent being either retained in the basin or disposed into rivers and canals. There are 13 existing surface drainage systems in Sindh, which serve a total area of over 6.2 million acres (2.5 million hectares) and have an aggregate length of about 3,811 miles (6,133 Km). In addition, there are two sub-surface drainage systems, which serve an area of 0.10 million acres (0.04million ha). Due to inadequate drainage cover, nearly one-fifth of the canal command areas have been affected by water logging and salinity.

4.1.6. Sub-Surface Hydrology

4.1.6.1. Groundwater Use in Lower Indus Plain—A Contrast to Upper Indus[5]

Compared to the situation in the Upper Indus, groundwater use in the Lower Indus is very modest; yet waterlogging (groundwater within 1.5 meter of the soil surface) is common and has been assessed to prevail over 1.5 to 3.5 Mha. While in Punjab groundwater use at field scale is equivalent to canal water use in various canal commands, in Sindh this is not the case. For example, for the Lower Bari Doab Canal, based on the 2005 tube well survey data, total groundwater abstraction was estimated as 4674 MCM (million cubic meter). On the basis of the same data, the Halcrow consultants for LBDC (Lower Bari Doab Canal) calculated the revised estimates of groundwater abstraction for the year 2005 as 4796 MCM, against annual average canal supplies of 4849 MCM (3.93 MAF) diverted to the LBDC at its head. Thus, canal and ground water use in the LBDC irrigation system are at par with each other. In addition, there is no waterlogging in the command, which means that whatever is recharged to the aquifer from the irrigation and rainfall is again pumped for meeting deficit supplies from the irrigation system.

The most recent assessment of overall groundwater abstraction in Sindh was 4.3 BCM. Another study from the same period by the IWMI (International Water Management Institute) estimated the discharge through tube wells to be even lower, i.e., at 2.15 BCM (about 2 MAF). In other words, groundwater use stands at about 4%–8% of surface water use in Sindh, whereas in the canal areas of Punjab, the use of surface and groundwater at farm level are approximately 50:50. These figures may need to be updated, but in general, groundwater is an underutilized resource in the canal-irrigated areas of Sindh. A large part of the groundwater use in Sindh is in the riverine areas where there are no irrigation canals and the soils are relatively sandy. In contrast, there is relatively limited use of groundwater in the canal command areas due to the high surface water allocations.

Water Management Challenges Being Faced in Lower Indus

The amount of annually renewable groundwater available in Sindh is estimated to be 22 to 27 BCM (18 to 22 MAF); yet only a fraction of this is used—with the groundwater discharge now leading to waterlogging

[5] Resources 2015, 4(4), 831-856 (http://www.mdpi.com/2079-9276/4/4/831/htm)

and soil salinity. There is a need to make better use of groundwater in Sindh. One of the reasons for this concerns the challenge of climate change: with more extreme hydrological situations, the buffering role of groundwater becomes important. Another reason is the expected reduced availability of surface water due to sedimentation of the current large storage reservoirs. Over the years, three main water reservoirs in Pakistan have been constructed, Tarbela, Mangla and Chashma, with a total live storage of 20 BCM (16.29 MAF). However, as a result of sedimentation, the effective gross capacity of these reservoirs has been reduced by 5.4 BCM (4.37 MAF) (28%) as of 2012. Moreover, it is expected that the process of sedimentation will continue and gross surface storage loss would reach 7.18 BCM (5.82 MAF) (37%) by 2025. This calls for better management of groundwater reservoirs.

At present, the groundwater buffer is not well managed, with waterlogging being the main manifestation. This suppresses farm yields and keeps cropping intensity relatively low. In Sindh, these cropping intensities have increased significantly over the original intensities. They are, however, considerably lower than they are in Punjab, varying from 116.7% in Sindh Cotton Wheat zone (SCWS) to 234.0% in Punjab Sugarcane Wheat zone (PSW). The impacts are not only limited to agriculture but also extend beyond. Thus, the area is facing multifaceted water management challenges that are interlinked and acting in combination to produce various ill effects regarding water management and the ensuing crop and soil environment. These water management challenges are discussed in detail as follows.

Groundwater Salinity

Groundwater salinity in Sindh is widespread. In 1959, a program of investigations was started by Water and Power Development Authority (WAPDA) by the name of Lower Indus Project (LIP). Bore holes, varying from 30 to 90 m deep, were drilled in the Guddu, Sukkur and Kotri Barrage commands, to determine aquifer characteristics and the quality of groundwater in horizontal and vertical scales. The general pattern of groundwater distribution in the Lower Indus Plains is one of good quality water immediately adjacent to the river, with increasing salinity as we move away from the river (Figure 4.3). A lesser quantity of good quality water is available on the right bank of the river than on the left. This is due to the proximity of limestone hills on the right bank as well as the poor aquifers associated with piedmont plains. Another feature of importance is the complete absence of usable groundwater in the deltaic area south of Hyderabad, with the exception of some shallow pockets in the recently abandoned riverbeds of the Gaja Command.

Throughout the region, the salinity of groundwater increases with depth and no case has been recorded in Sindh where saline water overlies fresh water. Based on the assessments of LIP, it is estimated that 71% of Sindh's irrigated area has groundwater that is too saline (>1500 ppm) for irrigation. However, the picture improves if one looks at shallower depths (<15 m), where salinity is less widespread. According to Ahmad, there are many sites where shallow useable groundwater exists. The total fresh groundwater zones at shallow depth (15 m) are tentatively estimated as spreading over 46% of the area. However, further detailed groundwater investigations are needed for precise assessment of different groundwater qualities at shallow depths.

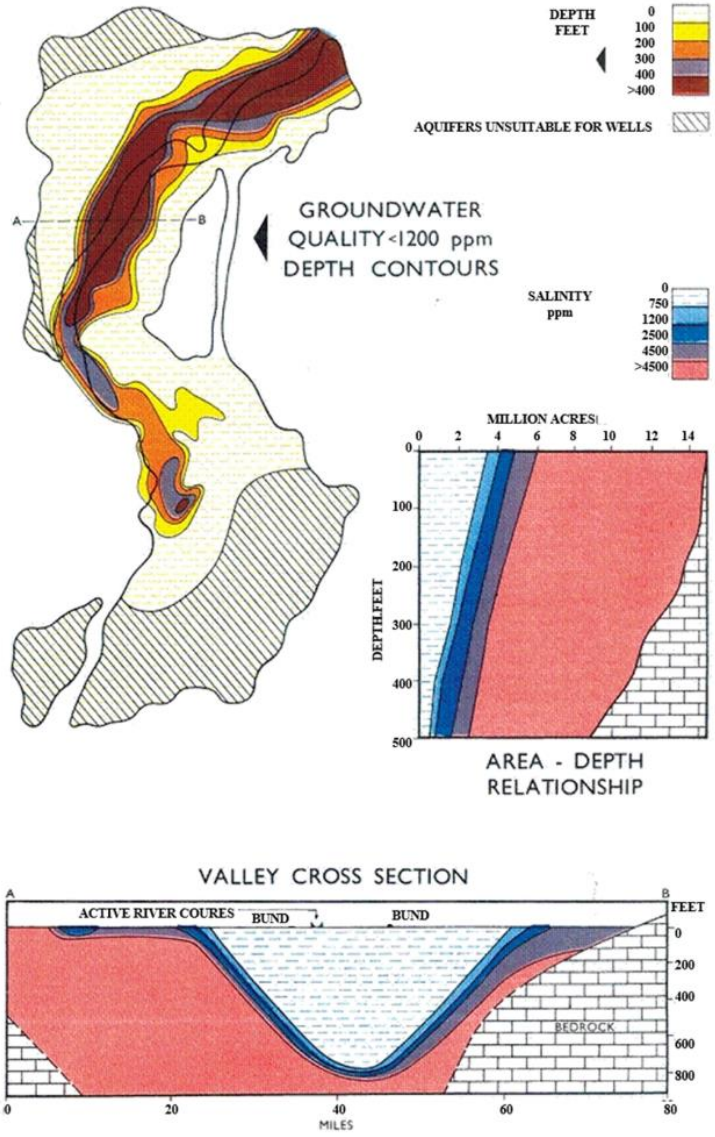


Figure 4.3: Vertical and horizontal extent of groundwater salinity in Lower Indus (Source: Ahmad, N. Groundwater Resources of Pakistan (Revised); Shahzad Nazir: Lahore, Pakistan, 1995)

Waterlogging Situation after 2011 floods

The most prominent element explaining the limited use of groundwater in Lower Indus is the high surface irrigation allowances in several of the canal commands in Sindh (8 to 17 cusecs per 1000 acres). The situation of high allowance is more amplified because in several canal commands, water is diverted in excess of the allowances. The picture is further distorted within the canal commands by unregulated direct outlets, tampered off-takes or in some areas, extensive canal seepage, creating local overabundance of water.

These high surface water deliveries have given rise to widespread waterlogging. In October 2011, for instance, 36% of the command area had a depth to water table of less than 1.0 m, and another 33.6%, a water table within the range of 1.0 to 1.5 m. Thus, in about 70% of the command area in the province, the root zone is waterlogged. This means only about 30.4% area was not waterlogged during October 2011. The extent of waterlogging conditions usually only drops off just before monsoon, due to less canal supplies during the Rabi season. In acreage, the affected area is colossal: 2.19 M ha in post monsoon 2011, with major impacts on the sowing of Rabi crops, especially wheat.

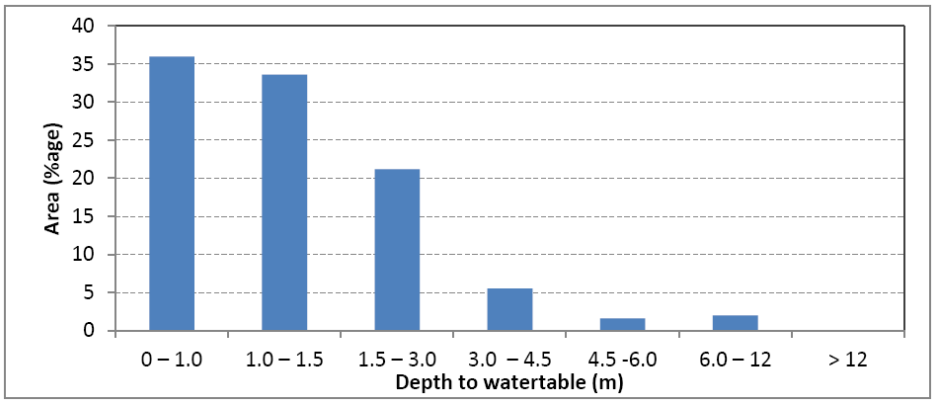


Figure 4.4: Percentage areas under different depth to watertable in Lower Indus, as on October 2011 (Source: IWASRI Publication No. 299, WAPDA)

The overgenerous surface irrigation supplies, especially in some canal commands, reduce the need for additional groundwater irrigation. Several studies have also argued that in many areas of Northern Sindh, a layer of fresh water is present over the more saline water that could be exploited more extensively by skimming wells. Some small tube wells and dug wells already use these lenses along canals and distributaries in several parts of Sindh, where water is relatively short in supply (canal tail ends in the area with low surface irrigation supplies). In many areas, however, surface water supplies in the canals fed from Guddu Barrage are so high that there is little incentive to pump. In the post-monsoon period the entire area is waterlogged, as shown in Figure 4.10. Moreover, within the canal commands, there is no difference in water allowance for fresh and saline areas, which can encourage groundwater pumping.

Waterlogging situation during drought period in Lower Indus

Drought prevailed for four years (1998-2002) in Indus Basin, response of irrigation and drainage in Lower Indus is important in that context. The general pattern of groundwater distribution in the Lower Indus Plains is one of good quality water immediately adjacent to the river with increasing salinity away from the river. A lesser quantity of good quality water is available on the right bank of the river than on the left. This is due to the proximity of limestone hills on the right bank and to the poor aquifers associated with piedmont plains. Another feature of importance is the complete absence of usable groundwater in the deltaic area, south of Hyderabad, except in some shallow pockets in the fairly recently abandoned river beds of the Gaja command. Some of the most saline groundwater of the region is found in the delta where the water samples with salinities twice as high as sea-water have been obtained. Throughout the region the salinity of groundwater increases with depth and no case has been recorded where saline water overlies fresh water. A brief discussion of the groundwater quality in the commands of Guddu, Sukkur and Kotri Barrages are gives below:

Guddu Barrage: In the Guddu Barrage command, Lower Indus Project (LIP) drilled about 52 bore holes on the right and left banks (WAPDA, 1966). Boreholes drilled on the right bank of Indus River showed good quality water at shallow depths and that too near the river. As the distance increases away from the river, the water quality even at shallower depths worsens along with deeper bad quality water. On the left side of the River, most of the area of Ghotki canal command is fresh.

Sukkur Barrage: In Sukkur Barrage command, LIP drilled 38 test holes on the right bank of Indus River (WAPDA, 1966). The behavior of water quality is not altogether un-expected because of the reason of the proximity of limestone hills. Good quality groundwater is available near the Indus River and that too at a

shallow depth. LIP drilled about 119 test holes on the left bank of Indus River in Sukkur Command. Here the water quality is good throughout, in the holes located near the protection bund of the Indus river. Water quality is good throughout up to 350 feet depth generally but it worsens with distance away from the river. The Indus river acts as the main source of recharge.

Kotri Command: LIP drilled about 49 test holes in Kotri command. This is deltaic area and groundwater quality throughout is so bad, that at places the TDS content is twice the TDS of Sea water. The reason for this high salinity of groundwater is the presence of high water tables and concentration of salts because of high rates of evaporation. Only pockets of fresh water are found in Kotri command, which is due to the recently abandoned flood courses of Gaja River. The Lower Indus alluvium is saturated with groundwater, often to within a few feet of ground surface. The quality of this water varies a great deal, both vertically and horizontally. According to Ahmad (1995), there are many sites, where shallow useable groundwater exists.

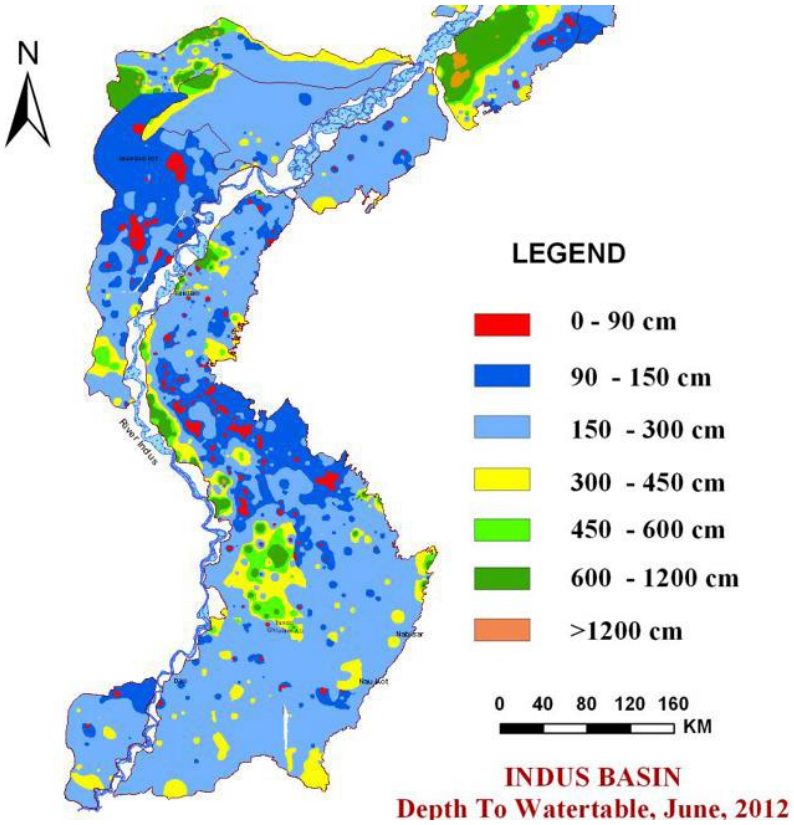


Figure 4.5: Depth to water table map of Lower Indus, pre-monsoon June 2012 (Reference: Basharat M., Hassan D. and Bajkani AA and Sultan S.J. 2014. Surface water and groundwater nexus: groundwater management options for Indus Basin Irrigation System. IWASRI Publication No. 299, WAPDA)

Water table is reported to be low resulting in shallow depths of water wells. Elevated concentrations of arsenic in the soil and groundwater may be linked with the abandoned courses of Indus River, and confined to Holocene fine grained, silty, clayey organic rich sediments. The bacterial contamination of groundwater is causing heterogeneous local reducing conditions in the aquifers which may trigger the mobilization of arsenic in groundwater.[6] The results indicate comparatively better quality of Ghulamullah area however TDS and chloride limits exceed the drinking water standard defined by EPA. Arsenic concentration is found greater in Ghulamullah area as compare to Gujjo but still in limits.

[6] Findings of groundwater analysis reported by Ghazala et al. 2014

Table 4.1: Status of Groundwater quality in district Thatta					
S. No	**Parameters**	**Unit**	**NSDWQ**	**Gujjo (Thatta)**	**Ghulamullah (Thatta)**
1	pH	…	6.5-8.5	7.3	7.5
2	Total Dissolved Solids	mg/l	<1000	2442	839
3	Calcium	mg/l	…	130	62
4	Magnium	mg/l	…	94	47
5	Potassium	mg/l	…	15	7.7
6	Sodium	mg/l	…	517	218
7	Chloride	mg/l	<250	904.5	218
8	Bicarbonate	mg/l	…	340.6	259
9	Sulphate	mg/l	…	249.5	95
10	Iron	mg/l	…	0.26	0.21
11	Arsenic	µg/l	<50	2.39	47

Source: Ghazala et al. 2014

Source: Distribution and sources of arsenic contaminated groundwater in parts of Thtatta district, Sindh (Journal of Himalayan Earth Sciences Voulme 47, No. 2, 2014, pp. 175-183. Ghazala Rubab, Sadaf Naseem, Adnan Khan, Viqar Husain and Ghulam Murtaza Arain)

Groundwater Contamination

Concentrations of most fecal microorganism's decline after excretion, but these microorganisms may still impair groundwater quality. Several approaches have been used to define the quantities and transport distances of latrine-derived microbial contaminants. The extent to which microbes from pit latrine wastes may be transported and contaminate groundwater largely depends on the environmental context of the area, particularly hydrological and soil conditions.

In a study of 12 pour/flush latrines, Banerjee (2011) found that transport of total and fecal coliforms increased during the monsoon period and in sandy soils. The author noted that the maximum travel distance of bacteria was 10 m from pits (Figure 4.6).

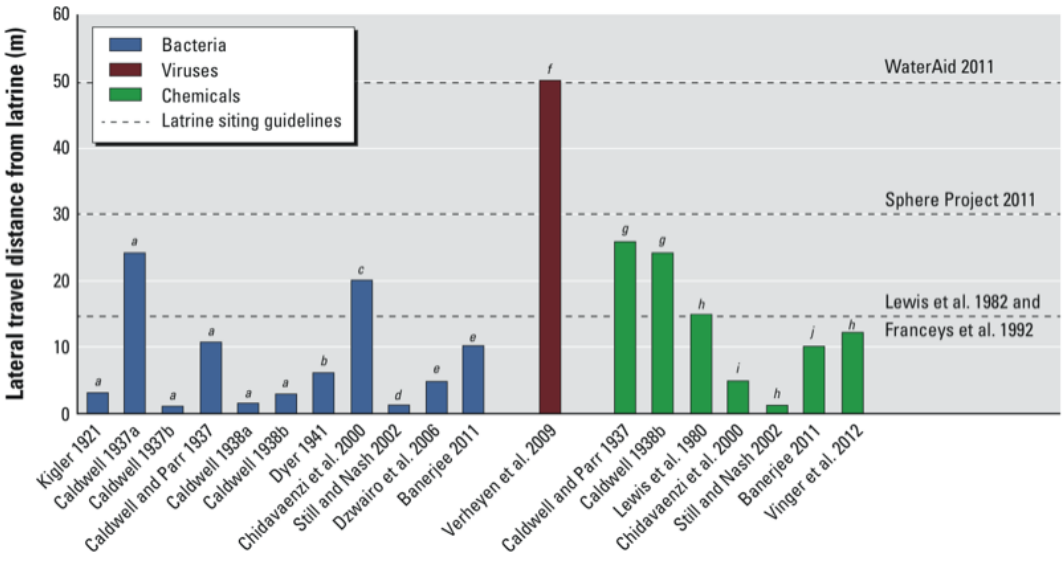


Figure 4.6: Lateral travel distances of different contaminants emanating from pit latrines in relation to select latrine/water-point siting guidelines. Verheyen et al. (2009) and Vinger et al. (2012) used existing wells to approximate distances, whereas all other studies used test wells to measure distances. a) B. coli; b) total coliforms; c) coliforms; d) fecal coliforms; e) total and fecal coliforms; f) adenovirus and rotavirus; g) chemical stream (nitrate, nitrite, and chloride); h) nitrate; i) nitrogen; j) salt tracer (Reference: Banerjee G. 2011. Underground pollution travel from leach pits of on-site sanitation facilities: a case study. Clean Technol Environ Policy 13(3):489–497)

4.1.7. Extreme Rainfall

High evaporation over the Indian Ocean (Pakistan Meteorological Department 2010) and the oceanic phenomenon La Niña caused severe monsoon weather in 2010 (National Oceanic and Atmospheric Administration [NOAA] 2010b; Riebeek 2010). Wildfires in the Russian Federation and precipitation in Pakistan also coincided with an unusually strong polar jet stream that generated unprecedented levels of moisture over the Himalayas (Marshall 2010; NOAA 2010a, as cited in Mustafa and Wrathall 2011). This resulted in widespread high rainfall in the Indus Basin in July and August 2010, with rainfall recorded in all four provinces.

A 24-hour rainfall on 29 July 2010, for instance, ranged from 21 mm to 280 mm at 18 stations in the Indus Basin, with an average of 128 mm. Rainfall was recorded at 143 mm in the city of Mirpur Khas, in Sindh Province, and at 73 mm in Zhob, Balochistan. The next day, a 24-hour rainfall of 240 mm was recorded in the city of Kamra, Punjab, and 189 mm in Ghari Dopatta, Northeast Pakistan. The average rainfall for the 18 Indus Basin stations on 30 July was estimated at 290 mm in July and 189 mm in August. The July and August rainfall was almost double the historical levels for the same months[7].

4.1.8. Drought[8]

Sindh geographically can be divided into four zones namely eastern desert, western hilly / mountainous area, coastal area in the south and irrigated agriculture area in the middle. Its 60% area is arid receiving rainfall on average of 5 inches during monsoon and very little in December & January. The arid area people depend upon the scanty rainfall raising livestock and millet crops. The failure of rainfall and global climatic effects reduce the water supplies in Indus River System (IRS). Sindh being at the far end of the system usually takes the brink. Besides, two-third of ground water is brackish and 80% agricultural land is affected by water logging and salinity.

Arid area people usually move to canal commanded area but low flow in the river Indus from 1998-2002 created havoc in the entire province. Historically, Sindh faced the worst drought situation during 1871, 1881, 1899, 1931, 1942 and 1999.

The last one persisted till the year 2002. Around 1.4 million people, 5.6 million cattle head and 12.5 million acres cropped area were affected. The ground water depleted to 30-40 feet, and the quality became poor. As a result of malnutrition, disease erupted. The cultivated area reduced in 1998 from 3.415 million acres to 2.611 million acres. There was tremendous drop out (about 27%) in schools, due to drought situation.

4.1.9. Meteorology & Air Quality

4.1.9.1. Climatic regions of Sindh

Sindh is divided into three climatic regions: Siro (the upper region, centered on Jacobabad), Wicholo (the middle region, centered on Hyderabad), and Lar (the lower region, centered on Karachi). The thermal equator passes through upper Sindh, where the air is generally very dry. Central Sindh's temperatures are generally lower than those of upper Sindh but higher than those of lower Sindh. Dry hot days and cool nights are typical during the summer. Central Sindh's maximum temperature typically reaches 43–44 °C (109–111°F). Lower Sindh has a damper and humid maritime climate affected by the southwestern winds in summer and northeastern winds in winter, with lower rainfall than Central Sindh. Lower Sindh's maximum temperature

[7] Indus Basin Floods: Mechanisms, Impacts, and Management - ADB
[8] PDMA 2011

reaches about 35–38 °C (95–100 F). In the Khirthar range at 1,800 m (5,900 ft) and higher at Gorakh Hill and other peaks in Dadu District temperatures near freezing have been recorded and brief snowfall is received in the winters.

Table 4.2: Mean Monthly Temperature & Rainfall

Months	Mean Annual Temperature	Mean Annual Rainfall
Jacobabad	27	110.4
Dadu	26.7	133
Shikarpur	27.1	124
Badin	26.6	221.64
Thatta	26.8	210
Tharparkar	26.5	35
Sanghar	27.3	215
Sujawal	26.8	213
Umerkot	26.8	183

Source: Climate-Data.org

4.1.9.2. Ambient Air Quality and Noise

A comprehensive seasonal air quality assessment was conducted by Coal and Energy Development Department GOS in whole of Tharparkar region in order to establish the ambient air quality baseline conditions. In general, ambient air quality analytical results carried out in the district showed average values of NO, NO2, NOx, SO2 and CO below SEQS limits for both seasons except for CO that was slightly above the limits during winter at three points. The pollutants; CH4, Pb and O3 remained undetected for all points except for one (a very low value of O3 was recorded). Large differences in the concentration of respirable particulate matter was reported, with five points exceeding SEQS limit for PM10 and seven points exceeding the limit for PM2.5. The noise level monitored for day and night during summer and winter seasons were within the prescribed limits except for one point during winter.

EMC conducted ambient air quality monitoring along Sujawal Bypass for EIA study of "Upgradation of road network from Sujawal (Thatta) to Wango Mor via Badin (Phase-I)". The results depicted that the air quality parameters (SO2, NO2, NO, CO and PM10) are within the prescribed SEQS limits. Another ambient air quality study has been conducted by EMC in Gharo in Mirpur Sakro, District Thatta in 2015. The results of this study shows that the air quality parameters (SO2, NOx, SPM, CO and Noise) were within the prescribed SEQS limits. EMC conducted ambient air quality monitoring along Badin Bypass for EIA study of "Upgradation of road network from Sujawal (Thatta) to Wango Mor via Badin (Phase-I)". The results were well within the limits of SEQS.

Another Environmental study has been conducted under the project of "Sindh Barrages Improvement Project – Guddu Barrage Rehabilitation" in Kashmore District in December 2014. The results of Air quality near Guddu Barrage was well within prescribed limits except noise near road side.

No anthropogenic sources of air pollution exist in the immediate vicinity of the site; therefore the ambient air of the area is likely to be free from the key pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO_2) and particulate matter (PM).

As per initial assessment of the sub-projects by the EMC field team, the air and noise levels are likely to be within the permissible limit of Sindh Environmental Quality Standards (SEQS).

4.1.10. Tropical Cyclones

Tropical cyclone is a generic term used for defining cyclonic activity originating over tropical or sub-tropical waters with a definite cyclonic surface wind circulation. Such storms generally occur in South West and East Indian Ocean and also in the South Pacific. Tropical cyclones tend to occur in May – June or October – December periods.

Cyclone Occurrences in Pakistan

Over the past years cyclones tend to recur frequently though, most did not seriously impact Pakistan's coast. However, cyclone of 1999 seriously impacted Thatta and Badin districts of Sindh and affected 0.6 million people and caused loss of 202 lives. Cyclone Yemyin in 2007 had a much wider imprint affecting 26 districts of Balochistan / Sindh and 2.5 million people, causing 400 fatalities. History of cyclone occurrence along Pakistan coast is given in table 4.3.

Table 4.3: History of cyclone occurrence along and on the Pakistan coast

Name / Year	Impact	Losses	Response
Yemyin (June 2007)	Sindh & Balochistan coastal and adjoining regions	2.5 million affected 7 districts of Balochistan and 2 of Sindh severely affected	Required National Response
Gonu 15 June 2007	Rains along Sindh coast and impacted in Oman	Nil	Mild
Onil Oct 2004	Sindh – Thatta and Badin	Local. Cyclone impacted with a reduced impact resulting in heavy local precipitation	Local response
Cyclone of May 1999	Seriously impacted Sindh coast and Districts of Thatta and Badin	202 died, Houses fully / partially damaged 138,719	Major multi agency relief operation was launched
15 Dec 1965	Karachi and Thatta	10,000 affected	Severe

Source: Cyclone Contingency Plan for Karachi City, NDMA

4.2. Ecological Baseline

Sindh is unique in its biodiversity due to its diverse range of landscapes and ecosystems and its location on the flyway of Central Asia, giving it the opportunity to host a multitude of migratory species. The variety of ecosystems is evident as Sindh is home to riverine, scrub, and mangrove forests, deserts, coastal areas, wetlands, and agri-ecosystems. The province is also rich in diverse species of flora and fauna. Plant species play an integral role in the biodiversity of the province, are a source of fodder, and an important source of raw material. Sindh also has a variety of medicinal plants, which are used in healthcare products, traditional medications, dyeing, as culinary spices, and in natural cosmetics and perfumes.

Wildlife species diversity is also apparent throughout Sindh. Migrating birds from the South Asian subcontinent, East Africa, Europe, and much of Asia use the wetlands as wintering grounds. Some fly in to stay for the winter and breed here, while the rest fly through. Therefore, besides Sindh's endemic species, these migrating birds also depend on these important wildlife habitats over the course of a year. Some significant wildlife species, which have come under threat due to loss of habitat, expansion of human settlements, lack of water supplies, and unregulated hunting, include the Houbara bustard, the Sindh urial,

the Sindh ibex, the Indus blind dolphin, the marsh crocodile, the Indian cobra and python, and the Oliver Ridley turtles (Lepydochelys olivacea), to name just a few[9].

4.2.1. Flora of Sindh

The variation in climate between Upper and Lower Sindh is not reflected in any difference in the flora of the two zones. The vegetation is characteristic of edaphic conditions of the region viz. arid climate and sandy and calcareous soil, largely impregnated with salts. A notable feature is the predominance of plants and trees with small leaves, or none at all, and the large proportion of thorny species. The apparent contrast between the verdure of the riverine and irrigated tracts on the one hand, and the hilly and desert tracts on the other; is largely a matter of its intensity and distribution. The dwarf palm, Kher (*Acacia ruprstris*), and Lohirro (*Techoma undulata*) are typical of the western hill region as are Khip (*Periploca aphylla*) and Phog (*Calligonum polygonides*) of the eastern sandy desert. In the central valley, the Babbur (*Acacia nilotica*) tree is the most dominant and occurs in thick forests along the Indus banks. The Nim (*Azadirachta inidica*), Ber (*Ziziphus vulagaris*) or Jujuba, Lai (*Tamarix orientalis*), Kirrir (*Capparis aphyla*) and Kandi (*Prosopis cineraria*) are the more common trees. Mango, date palms, banana, guava, orange and chiku are the typical fruit bearing trees. The coastal strips and the creeks abound in semiaquatic and aquatic plants, and inshore deltaic islands have mangrove forests of Timmar (*Avicennia marina*) and Chaunir (*Ceriops tagal*) trees. Water lilies grow in abundance in the numerous lakes and ponds, particularly in the Lower Sindh region[10].

Table 4.4: Flora of Sindh

Sr.	Technical Name	Local Name
1.	*Azadirachta indica*	Neem
2.	*Alternanthera sessilis*	Bengroo
3.	*Acacia nilotica*	Babul
4.	*Acacia jacquemontii*	Bhaori
5.	*Acacia senegal*	Kumbat
6.	*Aerva javanica*	Bhooh
7.	*Asparagus officinalis*	Kootri
8.	*Achyranthes aspera*	Ubbat kandi/Charchitah
9.	*Aloe barbednsis*	Kunwaar Bhooti/Ghee kuwar
10.	*Albizia lebbeck*	Sireenhun
11.	*Alhagi maurorum*	Kandaira
12.	*Cressa cretica*	Unn
13.	*Capparis decidua*	Kirer
14.	*Citrullus colocynthis*	Trooh
15.	*Corchorus depressus*	Mudairi
16.	*Cuscuta compestris*	Bay Paari
17.	*Cordia dichotoma*	Giddori/Lessori
18.	*Calotropis procera*	Akk
19.	*Cordia gharaf*	Liyaar
20.	*Citrus aurantifolia*	Lemun/Nimbu

4.2.2. Fauna of Sindh

Among the wild animals, the Sareh or Sindh ibex (*Capra aegagrus blythi*), Urial or Gadh or wild sheep (*Ovis orientalis vignei*), and black bear (*Ursus americanus*) are found in the western rocky range, where the leopard is now rare. The Pirrang (large tiger cat or fishing cat) (*Prionailurus viverrinus*) of the eastern desert plains is also disappearing. Deer (Cervidae) live in the lower rocky plains and in the eastern region, as do the Charakh or striped hyena (*Hyaena hyaena*), jackal (*Canis aureus*), fox (*Vulpes vulpes*), porcupine

[9] Sindh Strategy for Sustainable Development - IUCN
[10] Forest Department - GOS

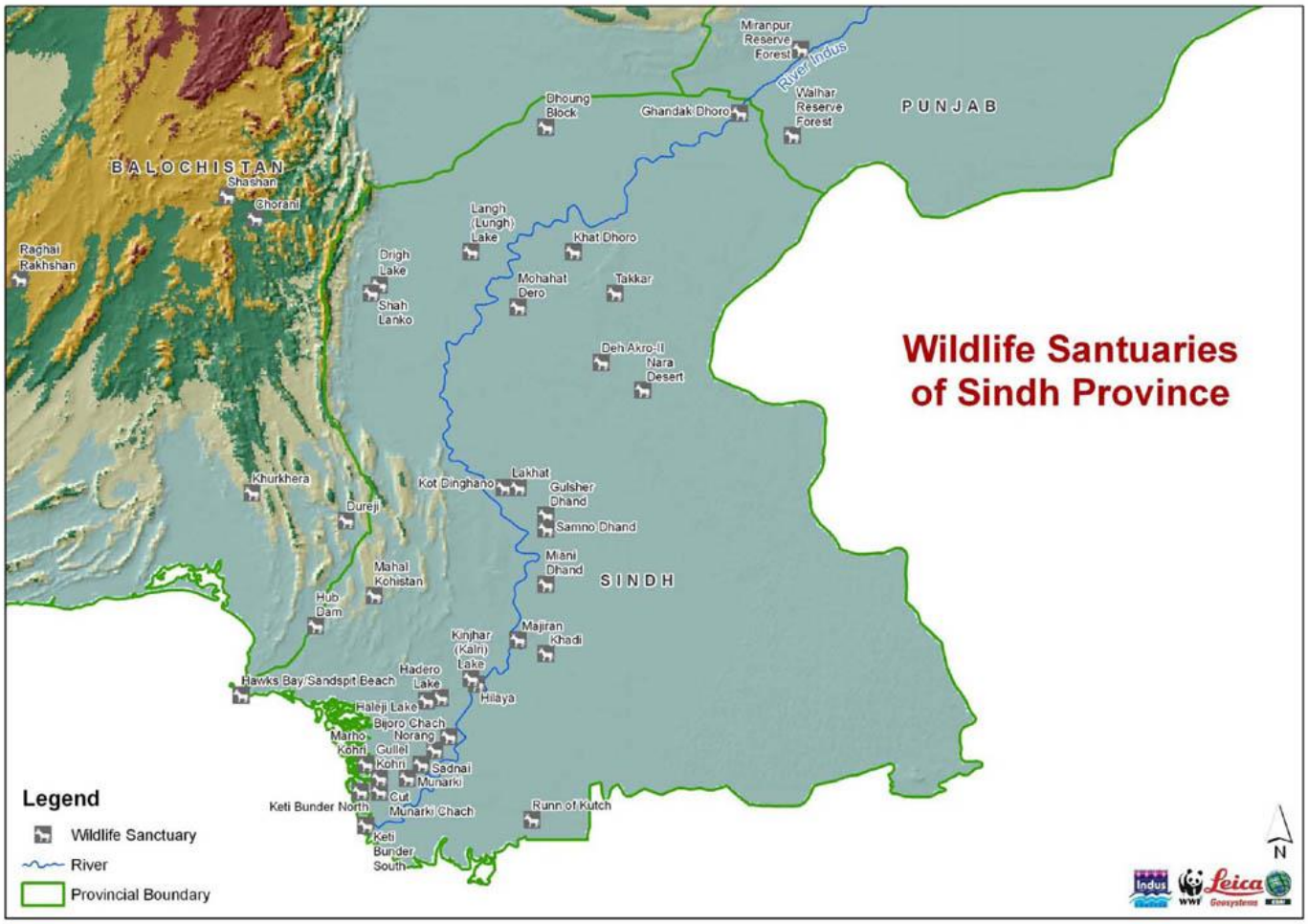
(*Erethizon dorsatum*), common gray mongoose (*Herpestes edwardsii*), and hedgehog (*Erinaceinae*). The Sindhi phekari or red lynx or caracal cat (*Caracal caracal*) is encountered in some areas. Pharrho or hog deer (*Axis porcinus*) and wild boar (*Sus scrofa*) occur particularly in the central inundation belt. There is a variety of bats, lizards, and reptiles, including the cobra (*Ophiophagus Hannah*), Lundi or viper (*Viperidae*), and the Peean, the mysterious Sindh krait (*Bungarus caeruleus*) of the Thar region, which is supposed to suck the victim's breath in his sleep. Crocodiles (*Crocodylinae*) are rare and inhabit only the backwaters of the Indus and its eastern Nara channel. Besides a large variety of marine fish, the plurnbeous dolphin (*S. plumbea*), the beaked dolphin (*Lagenorhynchus albirostris*), rorqual or blue whale (*Balaenoptera physalus*), and a variety of skates frequent the seas along the Sindh coast. The Pallo sable fish (*Anoplopoma fimbria*), though a marine fish, ascends the Indus annually from February to April to spawn and returns to the sea in September. The Bulhan or Indus dolphin (*Platanista gangetica minor*) breeds in the Rohri-Sukkur section of the river[11].

4.2.3. Forests, Habitats and Ecologically Sensitive Areas

4.2.3.1. Protected areas

Wildlife Sanctuaries[12]

There are thirty-three wildlife sanctuaries in Sindh. The list of wildlife sanctuaries is presented in **Annex K**:



[11] Forest Department - GOS
[12] Sindh Wildlife Department - GOS

Figure 4.7: Locations of Wildlife Sanctuaries located in Sindh

Game Reserves

The Sindh Wildlife Department recognizes 13 game reserves present in the province of Sindh. The list of these site is presented in **Annex K**.

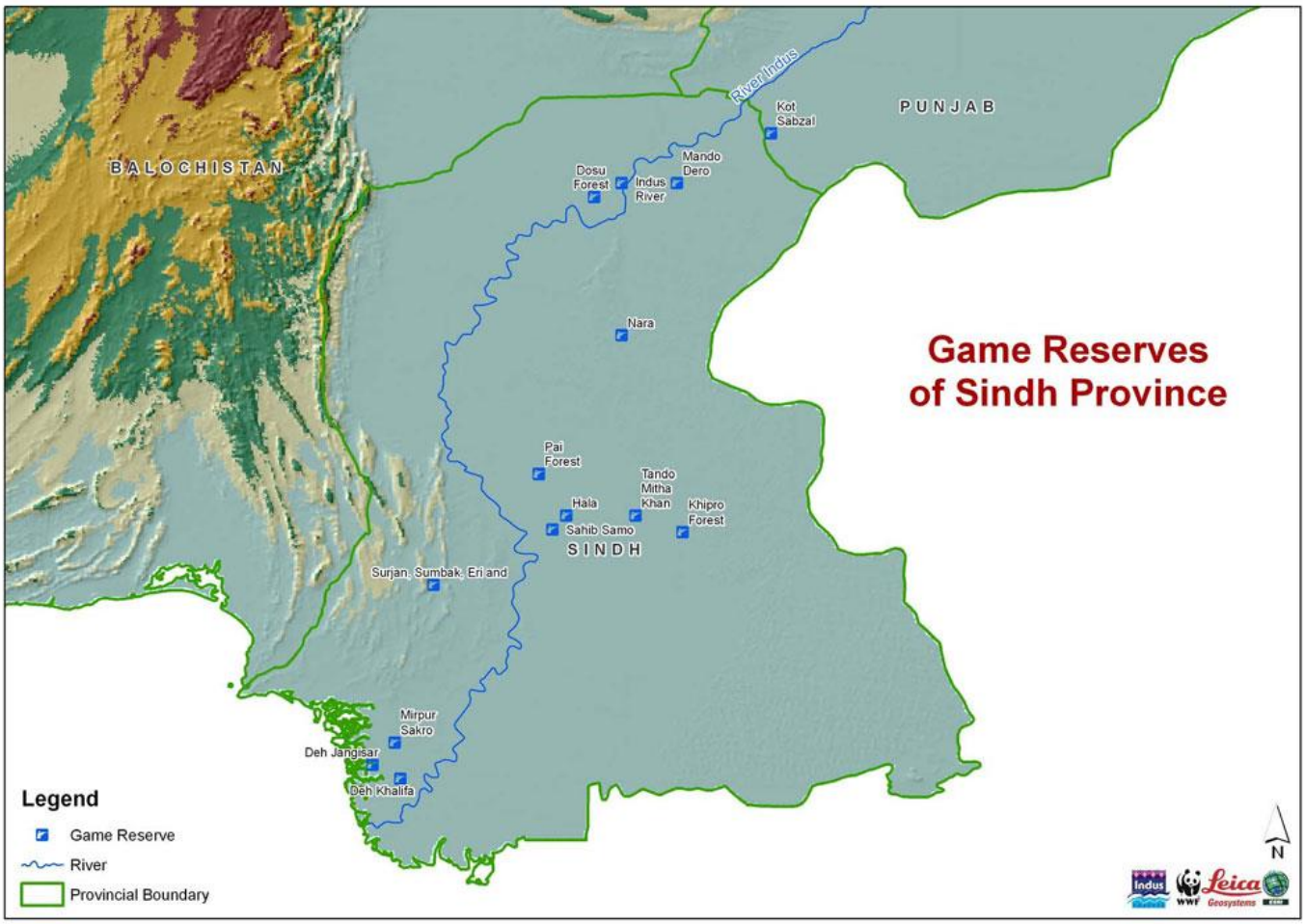


Figure 4.8: Locations of Game Reserves located in Sindh

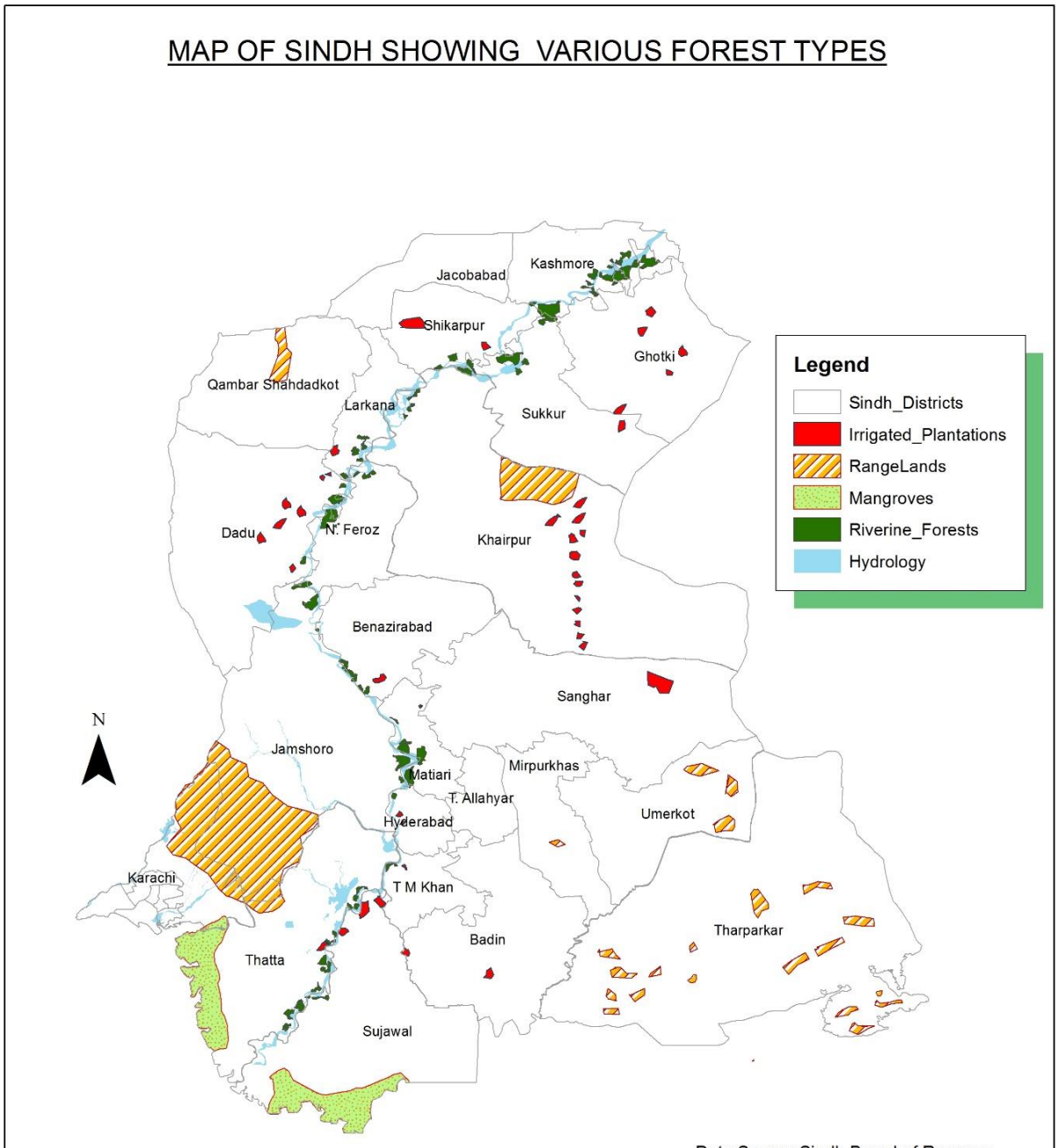
4.2.3.2. Ramsar Sites

The Ramsar Convention on Wetland protection has been signed in Ramsar, Iran in 1971. As of March 2013, there are nineteen Ramsar sites, covering an area of 1,343,627 hectares (3,320,170 acres) in Pakistan in which 10 are located in Sindh. The list is provided in **Annex K**.

4.2.3.3. Forest Area

In Sindh, forests are under protection of Government of Sindh. The forestry resources of Sindh are classified in four different categories viz. Riverine Forests, Irrigated Plantations, Protected Forests and Mangrove Forests. The Riverine Forests of Sindh are confined to riverine tract of Indus within the protective embankments on both sides of the river. They are stretched from Northeast of the province to South near Arabian Sea where Indus falls in the sea. Irrigated Plantations are the main features of manmade plantations raised on canal irrigation system of river Indus. These plantations were raised mainly to meet the ever increasing demand of wood and wood products in the country in general and the province in particular. The

grazing fields and unclassified wastelands of the province were declared as Protected Forests where the rights of the people are allowed more than that of reserved forests. The Indus delta mangroves, also categorized as protected forests, have great environmental value as they protect the coastal population from sea intrusion and serve as shield against cyclones which hit the coasts of Sindh occasionally.



Area Statement

Land area of Sindh Province	34.84 million acres
Riverine Forests	600,000 acres
Irrigated Plantations	180,000 acres
Mangrove Forests	700,000 acres
Rangelands	1,080,000 acres
Total	2785000 acres (2.785 million acres)
or	8% of total land area of Sindh Province

Figure 4.9: Forest areas located in Sindh Province (Source: Website of Forest Department (GOS))

4.3. Socioeconomic Profile

This Chapter presents a broad profile of the prevailing socioeconomic situation in the project districts of Sindh. This baseline has been prepared based upon the secondary literature resources as well as reconnaissance survey conducted in all thirteen (13) districts. Safeguard instrument (ESMP or Checklist) to be prepared for each subcomponent will include district-specific baseline conditions. The subsequent section will include the existing conditions of sanitation, agriculture, poverty, education, health, available infrastructure, demography, labor and employment etc.

Table 4.5: District-wise administrative profile

District	Area (sq.Km)	No of Talukas	No of Union Councils	No of Mouza
Jacobabad	2,796	3	40	214
Kashmore	2,682	3	37	177
Kambar-Shahdadkot	5,676	7	40	283
Larkana	1,930	4	44	184
Tharparkar	19800	6	48	235
Badin	6,726	5	44	497
Sanghar	10,608	6	55	364
Tando Muhammad Khan	1,831	3	16	161
Umerkot	5,608	4	27	235
Shikarpur	2,589	4	47	222
Dadu	8,098	4	52	351
Thatta and Sujawal	17,355	9	55	655

Source 1: District, Pakistan Emergency Situation Analysis program, by USAID; Source 2: Development Statistics of Sindh 2013 prepared by the Bureau of Statistics, Government of Sindh, Source

4.3.1. Demographic Profile

The average population density of the 13 districts is 292 persons per square km, based on population projection 2012. The population of the selected districts constitutes 35.14 percent of province's total population (2012). The population of the Sindh province, which was 30.44 million in the 1998 Census, stands at an estimated 44.8 million (2012). The average population growth rate for the Sindh province was 2.8 percent per annum, as of 1998 census. Table OA1 in **Annex O** provide the district specific data.

4.3.2. Poverty

Poverty is increasing with passage of time in Sindh rural areas. In case of urban areas, poverty is more evident in slums and katchi abadies. The main causes of poverty are traditional agricultural practices, fragmented landholdings, non-availability of safe drinking water and sanitation facilities, low literacy rate, inadequate institutional arrangements for addressing social sector problems, and lack of access to social justice system. Table OB1 in **Annex O** provide the district specific data.

4.3.3. WASH Indicators

In the MICS survey, mothers or caretakers were asked whether their child under age five years had an episode of diarrhoea in the two weeks prior to the survey. In cases where mothers reported that the child had diarrhoea, a series of questions were asked about the treatment of the illness, including what the child had been given to drink and eat during the episode and whether this was more or less than what was usually given to the child.

The overall period-prevalence of diarrhoea in children under 5 years of age for selected district is 25.5 percent (Table 4.6). The highest period-prevalence is seen among children age 12-23 months which grossly corresponds to the weaning period.

Table 4.6: Percentage of children age 0-59 months for whom the mother/caretaker reported an episode of diarrhea, fever, and/or symptoms of acute respiratory infection (ARI) in the last two weeks, by district, Sindh, 2014;

District	Children (age 0-59 months) with diarrhea (%)
Jacobabad	19.9
Kashmore	32.4
Kambar-Shahdadkot	22.9
Larkana	14.3
Tharparkar	23.4
Badin	38.7
Sanghar	26.9
Tando Muhammad Khan	31.2
Umerkot	35.9
Shikarpur	22.4
Dadu	25.0
Thatta	24.5
Sujawal	14.1

Source: Multiple Indicator Cluster Survey (MICS) Sindh 2014, Bureau of Statistics, Government of Sindh

The distribution of the population by main source of drinking water is shown in Table 4.7. The population using improved sources of drinking water are those using any of the following types of supply: piped water (into dwelling, compound, yard or plot, to neighbor, public tap/standpipe), tube well/borehole, protected well, protected spring, and rainwater collection. Bottled water is considered as an improved water source only if the household is using an improved water source for hand washing and cooking.

Overall, 87.5 percent of the population of selected districts is using an improved source of drinking water. Access to improved drinking water sources is higher for the population whose household head has higher education and is generally higher amongst those living in richer households.

Table 4.7: Percentage distribution of household population with improved and unimproved sources of drinking water

District	HH population with improved sources[13] (%)	HH population with unimproved sources[14] (%)
Jacobabad	80.6	19.4
Kashmore	98.5	1.5
Kambar-Shahdadkot	86.3	13.7
Larkana	100.0	0.0
Tharparkar	53.7	46.3
Badin	91.0	9.0
Sanghar	94.7	5.3
Tando Muhammad Khan	93.0	7.0
Umerkot	71.1	28.9
Shikarpur	100.0	0.0
Dadu	93.4	6.6
Thatta	86.1	13.9
Sujawal	89.4	10.6

[13] Include piped water, tubewell/bore-hole, hand pump, protected well, rain-water collection, filtration plant, bottled water.
[14] Include unprotected well, tanker truck, cart with tank/drum, surface water, bottled water.

Source: Multiple Indicator Cluster Survey (MICS) Sindh 2014, Bureau of Statistics, Government of Sindh

In Sindh, 48.5 percent of the population is living in households of selected districts using improved sanitation facilities (Table OC1 in **Annex O)**. The table indicates that use of improved sanitation facilities is strongly correlated with education of household head, wealth and is profoundly different between urban and rural areas. In Sindh, the most common facility is a flush toilet with connection to a sewage system (57.6 percent); this is the most common facility in both urban and rural areas although prevalence is much higher in urban areas (90 percent) than rural areas (22.1 percent). Open defecation is not uncommon in Sindh as a fifth (20.2 percent) of the population has no access to toilet facilities or does not use it. In rural areas, the percentage of the population practicing open defecation is 39.9 percent. Table OC1 and OC2 in **Annex O** provide the district specific data.

4.3.4. Nutrition Status

More than four out of ten children under the age of five in Sindh are underweight (42 percent) and 17 percent are classified as severely underweight[15].

Table 4.8: Percentage of children under age 5 by nutritional status according to three anthropometric indices: weight for age, height for age, and weight for height, by district, Sindh, 2014

District	Underweight[16] (%)	Stunting[17] (%)	Wasting[18]
Jacobabad	50.1	63.7	13.9
Kashmore	55.5	66.2	15.1
Kambar-Shahdadkot	48.8	60.2	13.7
Larkana	39.0	51.6	9.8
Tharparkar	68.8	63.0	32.9
Badin	61.1	66.9	21.7
Sanghar	47.1	53.1	17.6
Tando Muhammad Khan	58.9	59.2	21.5
Umerkot	63.5	66.2	22.9
Shikarpur	39.0	56.2	9.4
Dadu	44.6	57.9	14.5
Thatta	55.4	59.5	20.4
Sujawal	51.5	55.6	20.1

Source: Multiple Indicator Cluster Survey (MICS) Sindh 2014, Bureau of Statistics, Government of Sindh

In Sindh province, Global Acute Malnutrition (GAM) rate of 17.5% and Severe Acute Malnutrition (SAM) rate of 6.6% was recorded in the NNS 2011[19].

[15] MICS 2014, Sindh
[16] MICS indicator 2.1a and MGD indidcator 1.8 – Underweight prevalence (moderate and severe), percentage below – 2 SD,
[17] MICS indicator 2.2a - Stunting prevalence (moderate and severe), percentage below – 2 SD,
[18] MICS indicator 2.3a - Wasting prevalence (moderate and severe), percentage below – 2 SD,
[19] SQUEAC – Province Sindh, Pakistan; April – May 2013

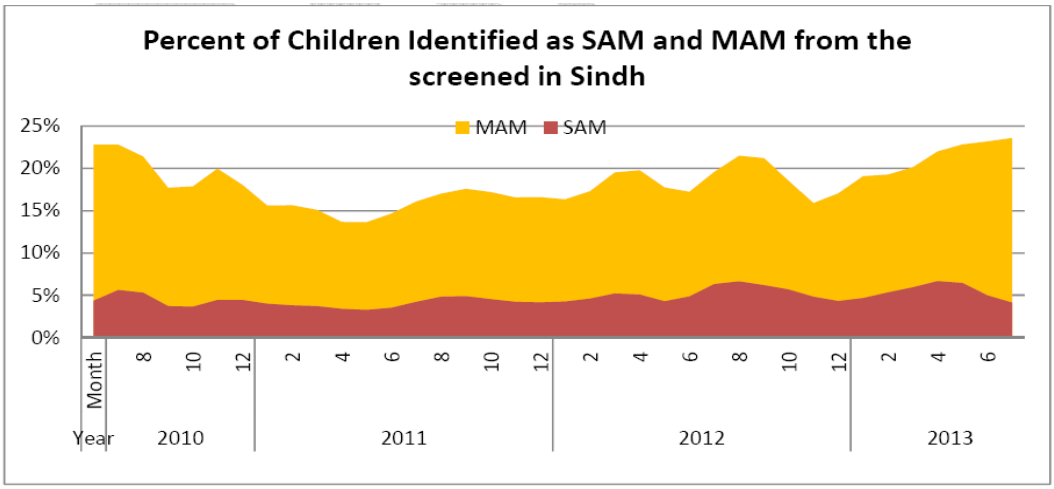


Figure 4.10: Percent of Children Identified as SAM and MAM in Sindh

Table OD in **Annex O** provide the district specific data.

4.3.5. Healthcare Facilities

These districts do not have a satisfactory network of healthcare services in the public sector. Tables OE1 and NE2 present overall status of healthcare facilities in the districts. As for infrastructure, staff residences were not available at the number of BHUs and Taluka Headquarter (THQ) hospitals. There is a shortage of blood banks and adequate number of pediatric nurseries at the THQ hospitals. There is a shortage of human resources at many of the health facility levels. There are severe shortages of general items. Most health facilities do not have the required supplies of drugs, vaccines, etc. Table NE in **Annex O** provide the district specific data.

In Sindh, almost half of children (48 percent) are moderately stunted or too short for their age and 15.4 percent are moderately wasted or too thin for their height. Only 1 percent of children are overweight or too heavy for their height. Table 4.8 depicts that in selected districts, 52.5 percent of children under the age of five are underweight, 60 percent stunted and 18 percent wasted. Proper feeding of infants and young children can increase their chances of survival; it can also promote optimal growth and development, especially in the critical window from birth to 2 years of age. Breastfeeding for the first few years of life protects children from infection, provides an ideal source of nutrients, and is economical and safe. However, many mothers don't start to breastfeed early enough, do not breastfeed exclusively for the recommended 6 months or stop breastfeeding too soon. There are often pressures to switch to infant formula, which can contribute to growth faltering and micronutrient malnutrition and can be unsafe if hygienic conditions, including safe drinking water are not readily available. Studies have shown that, in addition to continued breastfeeding, consumption of appropriate, adequate and safe solid, semi-solid and soft foods from the age of 6 months onwards leads to better health and growth outcomes, with potential to reduce stunting during the first two years of life.[20]

4.3.6. Educational Facilities

The education status is quite poor in these districts. There are primary, middle, matric and higher secondary schools in these districts. Most of the schools are understaffed and lack adequate facilities. Low literacy rates in the districts are alarming. Table NF in **Annex O** provide the district specific data.

[20] Bhuta Z. et al. (2013). Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? The Lancet June 6, 2013.

4.3.7. Labor and Employment

The labor force is divided in rural and urban areas. Migration of people from rural to urban areas for employment opportunities and better socioeconomic conditions is an unending phenomenon in the districts. Growth of urban centers and establishment of some industrial estates / enterprises have all contributed towards increased urban employment opportunities in the districts. The number of unemployed people has recorded unprecedented increase over the years, mainly because of high population growth rate. Investments in social sectors such as education, health, housing, water and sanitation, agriculture, transport, infrastructure, and communications, etc. have not kept pace with rapidly growing population. District specific data for Sources of Employment has been extracted from the Report on Mouza Census 2008 (Sindh Province), published by Pakistan Bureau of Statistics (PBS) and is presented in Table NG in **Annex O**.

4.3.8. Agriculture, Livestock Activities and Use of Pesticide in Sindh

Agriculture is the predominant economic activity of most of the rural population of the districts. The principal sources of irrigation are the surface channels supplemented by tube-wells. Rainfall accounts only for a small proportion of the irrigation sources. Horticulture and aviculture are gaining popularity. Investments in sheep-, goat-, fish-, poultry-, and dairy-farming also exist.

The major field crops sown in Sindh consist of wheat, cotton, rice, and sugarcane which utilize 68% of the total cropped area. Sindh also produces horticulture crops of mango, banana, and chillies are the primary crops grown in this area. Among the horticultural crops, 73% bananas, 34% mangoes, and 88% of chilies are produced in Sindh.

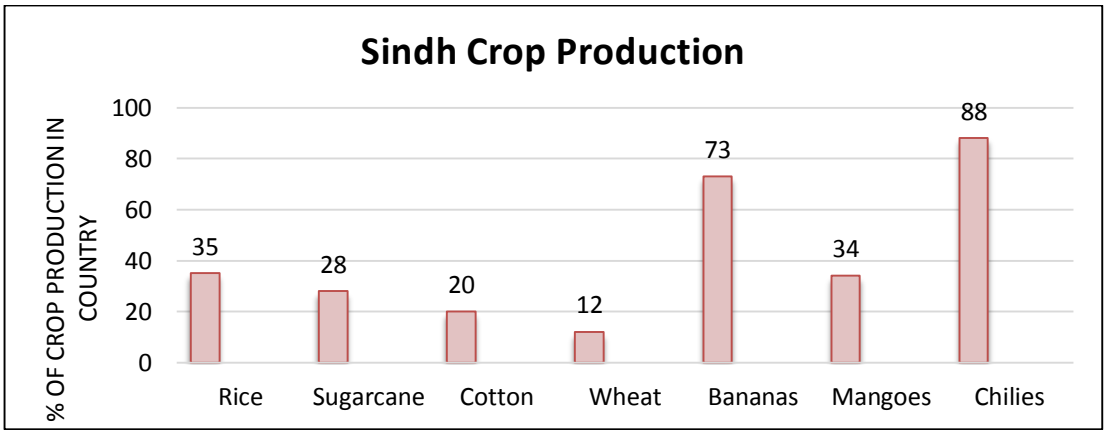


Figure 4.11: Percentage of Crops Production in Sindh

Table 4.9: Crops area and production (2011) in target districts

Crop / Area Production	Jacobabad	Umerkot	Sanghar	Tharparkar
Jawar (Sorghum)				
Area (H)	……..	273	590	19
Production (MT)	…….	189	408	11
Bajra				
Area (H)	…….	481	287	1,41,637
Production (MT)	…….	238	142	68,600
Maize				
Area (H)	…….	207	149	40
Production (MT)	…….	133	74	24
Gram				
Area (H)	3,291	……	…….	……..
Production (MT)	3,513	…….	…….	……..
Barley				

Area (H)	292	……	……	……..
Production (MT)	176	……	…..	……..
Rapeseed & Mustard				
Area (H)	1,633	1,418	8,627	1,042
Production (MT)	1,453	1,346	8,527	927

Note: Area (Hectare = H) and Production (Metric Tons = MT): Data for vegetables and pulses on Province Basis could not be segregated; The year 2011 remained abnormal due to heavy monsoon rains in Sindh, mainly in lower Sindh that affected the area under cultivation and production. Source: Development Statistics of Sindh 2012.

Agriculture in Arid Zones of Sindh

Since rain is the main source of water and therefore agriculture and livestock activities are dependent on rainfall, the failure of monsoon means no fodder for the cattle and livestock. The dug well is the only source of drinking water in the area. The underground water is largely brackish with limited spots of sweet water.

The population of cattle, buffaloes, sheep, goats and camels has become steadily more important in the livestock economy of Sindh during the last two livestock census as compared to other provinces.

Sindh is the major agricultural province after Punjab. The productivity of most of the crops of Sindh is higher as compared to Punjab. The population of cattle, buffaloes, sheep, goats and camels increased by more percentage in 1996 as compared to NWFP and Baluchistan. Sindh has a larger percentage of small and medium farmers as compared to Punjab. Since majority of the small and medium farmers are poor therefore they kept their own livestock for draught and milk purposes. Due to small holdings neither they can use machinery nor afford it[21].

Due to the increased population pressure from both (human and livestock) erratic pattern of rainfall, absence of road network, water, electricity, food shortage and its isolation from the rest of Pakistan is adding to the sense of impending doom. With the passage of time land management has become less effective resulting in increased desertification and degradation.

The main crops sowed immediately after the rain in arid zones, are sorghum, Bajra (millet) and guwar. These crops require at least three rains of 100-150 mm in intensity are required in a one month interval for the crops to reach maturity. A good year in the arid zones is considered when it rains a minimum of three times during the monsoon season. Population in rural areas of arid zones, the major source of Income is rain-fed agriculture and livestock. According to the 1998 census the population of Arid Zones of Sindh is 2.041, arid zones and livestock population of 5.053 million and has a land area of 68,000 sq. km.

In economic terms the livestock sector in the Arid Zone is already significant, contributing about 30% to the value of the provincial livestock sector - mostly in meat, and meat by-products, hides and wool. The annual value of livestock and livestock products marketed each year from the Arid Zone is estimated at Rs. 750 million, contributing nearly 30% of wool production, 55% of meat and10% of all milk production in the province[22].

[21] Indus Journal of Management & Social Sciences Vol. 1, No. 1, (Spring, 2007)
[22] Assessment Report on Drought in Arid Zones Of Sindh - TRDP

Use of Pesticides

Pesticide use is widely practiced in Sindh, intended to assist farmers in getting rid of pests, extended and indiscriminate has resulted in pest outbreaks as well as negative effects on people working in the agricultural fields and the surrounding environments. It has also disturbed the agro-ecosystem and killed non-target bio-control agents and environment friendly organisms including birds. Such a disturbance in agro-ecosystem has induced pest resurgence and increased the resistance in resident pest populations. Natural enemies of persistent common pests have been decreasing due to widespread and unchecked pesticide use. Some of other side effects of increased pesticide use have included the contamination of soil and water and chemical residues in the food chain.

In Sindh, ground plant protection measures (mostly pesticide sprays) are employed on 24% of the cropped area of all field crops including vegetables and orchards as compared to 21% on the national basis. However, plant protection on cotton and sugarcane account for 69% and 15% respectively of their cropped area in the province.

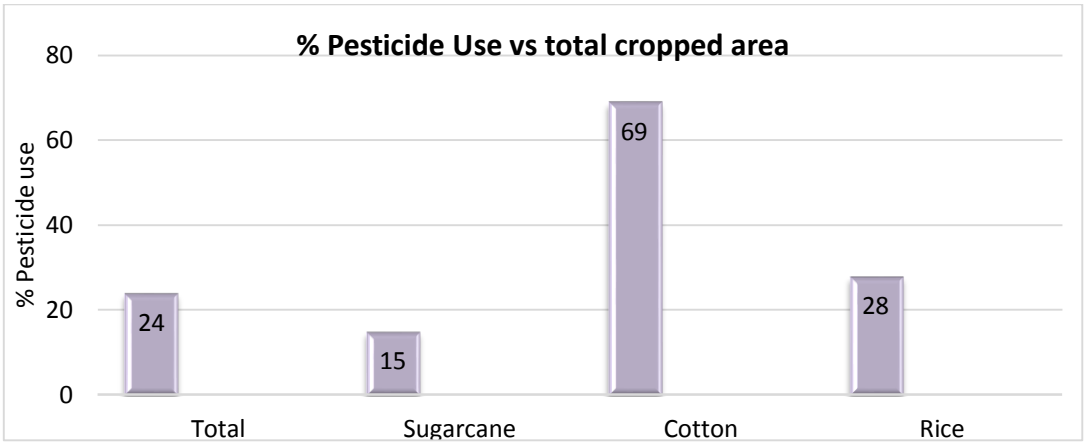


Figure 4.12: % Pesticide Use vs. total cropped area in Sindh

The indiscriminate use of pesticide, in addition to the health hazards, increased the cost of production. Considering the situation, various research organizations including Agricultural Research Institutes and Nuclear Institute of Agriculture recommended alternative techniques to control insect pests and diseases. Government and non-government institutes are involved in pursuing the farmers to reduce the use of pesticide and to adopt sustainable measures such as Integrated Pest Management (IPM) practices.

High dependence on pesticides for pest control by untrained farmers has increased health hazards and polluted the rural environment. Pesticide use poses a threat to farmers, children, and women workers in fields who are at high risk of being poisoned (UNDP, 2001). The chronic poisoning due to pesticide can cause adverse immune functions, peripheral neuropathies, and allergic sensitization reactions, particularly of skin. The acute poisoning may vary from skin irritation to complex systematic illness resulting in death. Accidental exposure in homes from inappropriate storage of pesticides, poisoning caused due to the use of empty container of pesticides for carrying water are quite common (Yasmin, 2003).

Chemical-based pest control programs have disturbed the agro-ecosystem and killed the non-target and environment friendly organisms such as parasitoids, predators and birds. Besides, as many as 10,000 farmers are poisoned annually by indiscriminate use of pesticides in cotton growing areas of Pakistan (PARC, 1999). Besides, an excessive inappropriate use has induced pest resistance and resurgence. Studies showed that the

populations of natural enemies in cotton growing areas have declined as much as 90% during the last decade (Hasnain, 1999).

The health cost of pesticide use is much higher than the cost of the pesticide itself. The social cost is enormous which is generally disregarded while determining the economic gains in terms of higher crop yields. These costs include: occupational poisoning, food residues, drinking water contamination, pest resistance, loss of biodiversity, cost of prevention and abatement measures and the cost of awareness campaigns. Further, there are health related issues; such as (a) Sickness Incidence of Pesticide Applicators, pesticide-related sickness is very common in the cotton zone as about 63% of households report sickness during the spraying season, mortalities are about 1 per 400 households while main reported ailments were vomiting, dizziness, and breathing problems; (b) Sickness in Women Cotton Pickers, about 87% women pickers complain of a variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness, stomach pain, and blisters; (c) Industrial Worker Poisoning, about half of the labor force, working in the pesticide plants report sickness by inhaling pesticide emissions; and (d) Pesticide Residue in Food Chain, fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL).

Pesticide residues also found in irrigation and drinking water, cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated.

Use of Fertilizers, Manures, Pesticides and Herbicides by Size of Farm

Following table provides the data on use of pesticides of overall Sindh and selected districts. The highest use of pesticides is in Jacobabad comprising 58 % of the total farms. The highest use of herbicide is in Umerkot comprising 16 % of total farms.

Area	Total Farms	Farms reporting use of									
		Fertilizers & Manures		Fertilizers Only		Manures Only		Pesticides		Herbicides	
		Number	%	Number	%	Number	%	Number	%	Number	%
Sindh	*1115285*	*187513*	*17*	*671206*	*60*	*13587*	*1*	*412430*	*37*	*196495*	*18*
Umerkot	90617	7971	9	62779	69	13	*	39711	44	14052	16
Tharparkar	35529	5124	14	411	1	-	-	-	-	-	-
Sanghar	73149	18110	25	46660	64	47	*	38708	53	9727	13
Jacobabad	33570	1306	4	30067	90	-	-	19391	58	515	2
* value less than 0.5											
Source: Agricultural Census 2010: Government of Pakistan, Statistics Division, Agricultural Census Organization											

4.3.8.1. Agro-Ecological Zones

The irrigated areas of the province have been divided into three major agro-ecological zones, two of which are further divided into sub-zones, as given below:

Zone A: Rice/wheat zone of the right bank of river Indus (upper Sindh) Sub-zone A1 Main area Sub-zone A2 Piedmont soil region

Zone B: Cotton/wheat zone of the left bank of river Indus Sub-zone B1 Guddu Barrage command area Sub-zone B2 Sukkur Barrage command area

Zone C: Rice/wheat/sugarcane zone of lower Sindh.

In addition to the above three zones, there are two more zones in Sindh. Zone D is a desert area in the east of Sindh, and Zone E is the western hilly zone. Main agricultural activities are, therefore, concentrated in the Zones A, B and C.

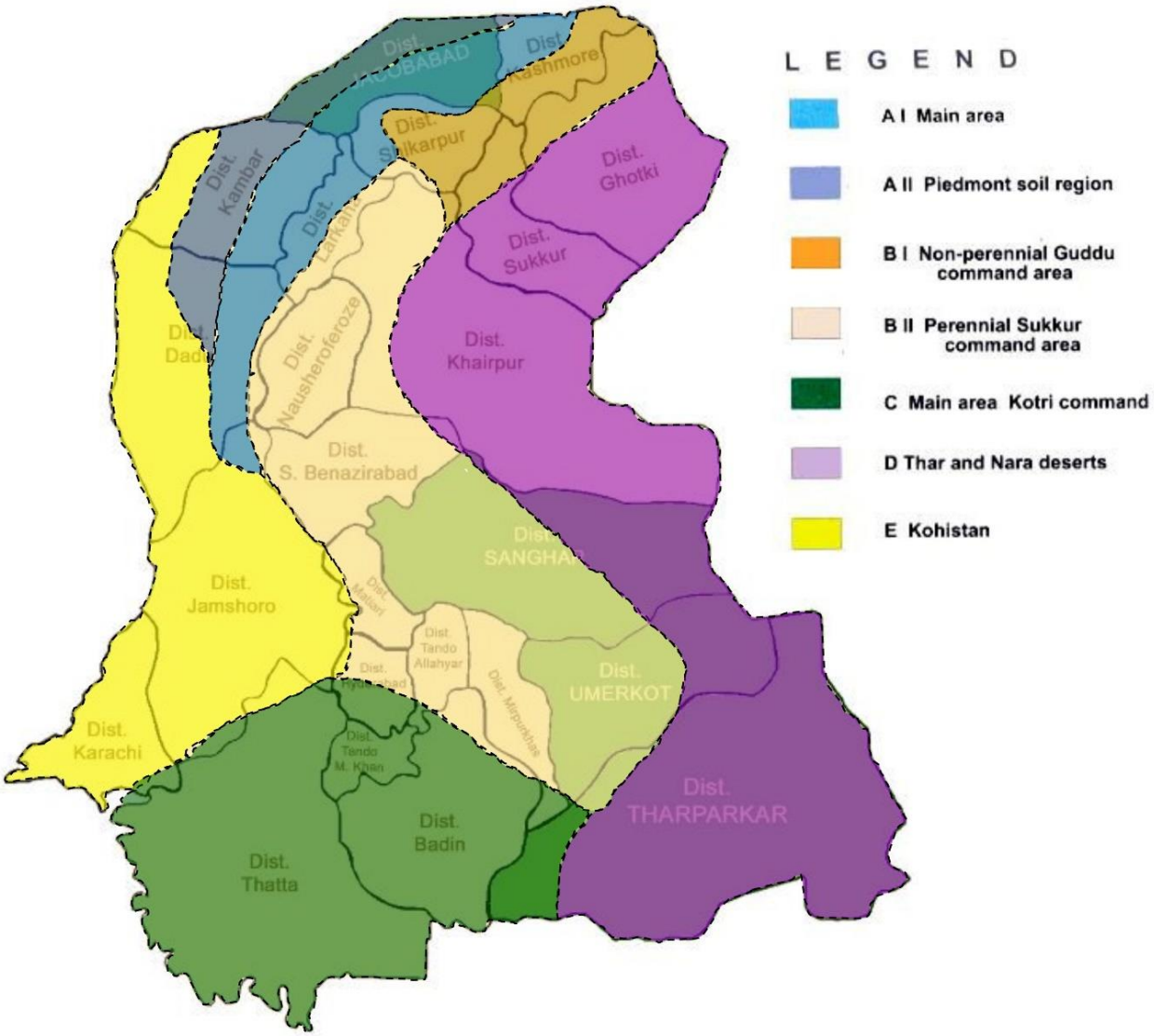


Figure 4.13: A4N Component Districts with overlapping of Agro-ecological Zones

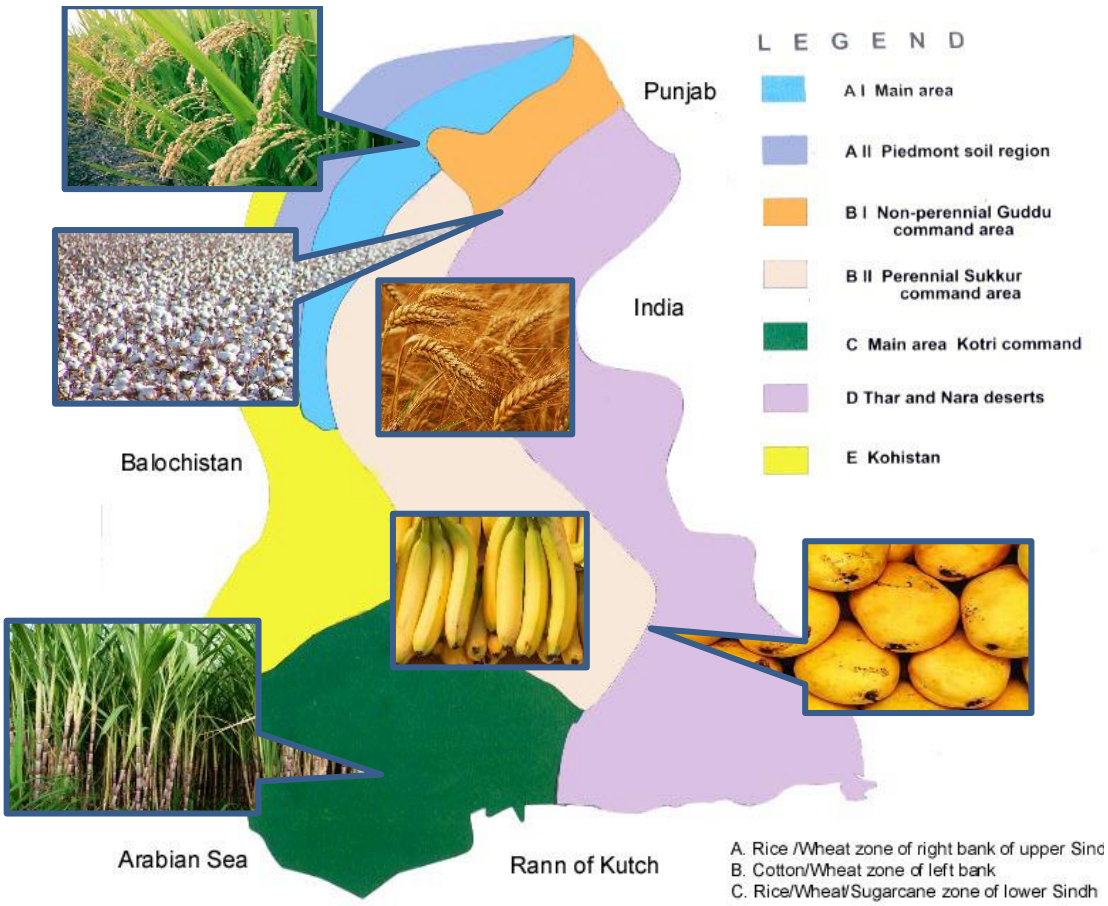


Figure 4.14: Agro-ecological Zones of Sindh[23]

4.3.9. Culture, Religion, Customs

These districts are rich with magnificent cultural heritage of ancient times and of early Islamic period, reflected through specimens of art, craft, literature, and architect. The population predominantly consists of Muslims. Sindhi is the native language and spoken widely, particularly in rural areas. However, other languages like Urdu, Balochi, Saraiki and Punjabi are also spoken in certain areas.

4.3.10. Indigenous People

Pakistan does not have any separate policy to define indigenous peoples or to protect their rights and cultural identities. However, the World Bank's Policy OP 4.10 on `Indigenous Peoples' defines indigenous peoples, in a generic sense of the term, to a distinct, vulnerable, social and cultural group possessing the following characteristics:

- Self-identification as member of a distinct indigenous cultural group and recognition of this identity by others;
- Collective attachment to geographically distinct habitat or ancestral territories in the project area and to the natural resources in these habitats and territories;
- Customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and

[23] Pakistan Agricultural Research Council (PARC)

- An indigenous language, often different from the official language of the country of region.

There are no indigenous people in the project area.

4.3.11. Gender Issues

Generally, women in Pakistan are among the poorest and the most vulnerable sections of the society. Women's access and control over productive resources is limited, which ranks Pakistan amongst the countries with high maternal and infant mortality rates[24]. According to WB, the maternal mortality ration (MMR) was 178 per 100,000 live births in 2015, down from 431 in 1990[25]. Vulnerability of women to discriminatory treatment varies across classes, region, and the urban / rural populations. The indicators for Gender Issues are concerned with gender parity in wage employment, political representation and education[26].

Presently, women comprise a small percent of the public sector employees in the province; the quota for women in government jobs was 7%, as of 2015[27]. Those who are employed have limited horizontal mobility and are limited to social sector departments like education and health. Labor force participation rates remain low for women overall, at just 15.88 percent for the province as whole, compared to 70.3 percent for men[28]. Representation of women at the decision making level is also low. The provincial assembly of Sindh has 168 members, of which 29 are women; all of the women legislators have been nominated against seats reserved for women[29].

There is high evidence of gender disparity across the province of Sindh. The problem is more acute in rural areas, which needs to be addressed. GPIs for rural areas are likely to be much lower than those recorded for urban areas[30]. Gender disparity in education is a considerable and complex challenge for the Government of Sindh. The problem persists across all education indicators (literacy, net primary enrolment, and particularly primary school completion). Furthermore, Gender Parity Index (GPI[31]) for primary and matric schools (high school) for the province consistently fall below the national average, and the extreme variation across the districts requires policy measures to address these disparities and even out the progress.

Table 4.10: GPIs at Different Levels of Education (Females per Male)

District	GPI Primary	GPI Middle	GPI Matric
Jacobabad	0.66	0.50	0.72
Kashmore	0.61	0.36	0.81
Kambar-Shahdadkot	0.76	0.60	0.58
Larkana	0.78	0.76	0.61
Tharparkar	0.70	0.42	0.21
Badin	0.70	0.61	0.47
Sanghar	0.66	0.63	0.95
Tando Muhammad Khan	0.61	0.64	0.42
Umerkot	0.81	0.58	0.60
Shikarpur	0.80	0.78	0.45

[24] World Bank Indicators - Data
[25] Maternal mortality ratio (modeled estimate, per 100,000 live births) by World Bank
[26] Report On The Status Of Millennium Development Goals Sindh – October 2012 UNDP
[27] Sindh increases women's job quota to 7pc – The News
[28] Report On The Status Of Millennium Development Goals Sindh – October 2012 UNDP
[29] Members by District – Provincial Assembly of Sindh, 2013 till Date
[30] Report On The Status Of Millennium Development Goals Sindh – October 2012 UNDP
[31] Gender Parity Index (GPI) primary or secondary is defined as net enrolment rate of females at primary or secondary level divided by net enrolment rate of males in primary or secondary level

Dadu	0.94	0.76	0.35
Thatta and Sujawal	0.71	0.72	0.14

Source: Pakistan Social and Living Standards Measurement survey 2014-2015

The Gini index of education which measures the Educational inequality, was found to be highest at 0.808 for Jacobabad district for rural population and to be highest at 0.623 for district Qambar-Shahdadkot for urban population in 2011 (as reported by Saeed. N and Fatima. A (2012): *Educational Inequality in Rural – Urban Sindh, PIDE*). About 47 percent of the population of the Sindh in age group 15 and above is illiterate and just 7.5 percent have obtained Graduation and higher degree. There is a clear disparity in educational attainments of the population in rural and urban areas, and across the districts in Sindh. Although, inequality declined between 2004-05 and 2010-11 but the extent of inequality remains high (above 58 percent in 2010-11). The Gini index is higher for rural areas as compare to the urban areas across districts indicating rural – urban disparity in education attainment[32].

4.3.12. Infrastructure Profile

There are wide variations in the availability of infrastructure facilities in the urban and rural areas as well as in different regions of the districts. Whereas availability and condition of roads in the cities is fair, it is quite deplorable in rural areas. As a part of its development agenda, the Government of Sindh is focusing attention on building of infrastructure. Construction of roads under various programs has somehow improved access to the most remote locations in these districts.

Jacobabad	The only major road passing through this district is N-65, which enters in this district from Shikarpur and exits towards Dera Murad Jamali with a total length of 25 Km in this district. There exist provincial and local roads connecting the surrounding cities like Sukkur, Shahdadkot, Larkana and Shikarpur.
Kashmore	The only major road passing through this district is Indus Highway (N-55), which enters in this district from Rajanpur and exits towards Shikarpur having a total length of 73 Km in this district. As far as provincial and local roads are concerned, no authenticated data is available, which can provide details of the road lengths and directions.
Kambar-Shahdadkot	The district has a good network of roads connecting the towns and villages. From Kamber (district headquarters), roads lead to Larkana (east), gharhi Badero (west), Shahdadkot, Qubo Saeed Khan and Khuzdar (north), Miro Khan and Sajawal Junejo(north west), Ratodero (northeast) and Khair Pur Juso (south west). Most roads are metalled and, where needed, bridges and culverts have been constructed.
Larkana	Larkana district has only 632 kilometers of good quality roads, which are inadequate for the area and its population. A National Highway (Indus Highway, N-55) connects Larkana with other major cities of the province. The district headquarter of Larkana is linked with its taluka headquarters of Dokri, Rato Dero and Bakrani through metaled roads.
Tharparkar	Tharparkar district covers an area of 19,638 sq. kilometers yet it has only 743 kilometers of good quality roads, which are inadequate for the area and its population. A Highway connects Tharparkar with other major cities of the province. The district headquarters Mithi is linked with its taluka headquarters of Diplo, Nagarparkar, Chachro through metaled roads.
Badin	There are 7 main road networks, which connect Badin District to the rest of the country. These routes can be taken in to account in case of Emergency or disaster situations. According to the National Highway Authority, a total of 105 road schemes are present in Badin district with the longest being Sajawal-Badin road with a length of 77 km. The main points of the road are Badin, Golarchi, Khorwah Chowk and Sajawal.
Sanghar	Sanghar district has only 868 kilometers of good quality roads, which are inadequate for the area and its population. Just like most of the So uthern districts of Sind, there is no national highway which could connect Sanghar with other major cities of the province,

[32] Noman Saeed and Ambreen Fatima - Educational Inequality in Rural – Urban Sindh

	only a metaled road exist, which serves this purpose. The district headquarter of Sanghar is linked with its taluka headquarters of Sinjhoro, Shahdadpur, TandoAdam and Khipro through metaled roads.
Tando Muhammad Khan	The existing road network in Tando Muhammad Khan district is fairly good. Although there is no national highway passing through this district, yet the provincial highways connected the whole district quite well. The district headquarter of Tando Muhammad Khan is connected with its taluka headquarters of Bulri Shah Karim and Tando Ghulam Hyder through metaled roads.
Umerkot	Umerkot has only 631 kilometers of good quality roads. A provincial highway connects Umerkot with rest of the districts of Sindh through Mirpur Khas. The district headquarter of Umerkot is linked with its taluka headquarters of Pitharo, Kunri and Sumaro through metaled roads.
Shikarpur	Indus Highway (N-55) passes through this district, with a total length of 127 km within the district. The existing road network, in Dadu district, is fairly good. The district headquarter, Dadu, is connected with other taluka headquarters of Johi, Meharand K.N Shah through metalled roads. Two provincial highways, comprising of a total length of 124 km, are mentioned in official statistics, provided by the government of Sindh. Also, there is a comprehensive network of access roads, comprising of 250 km, inter connecting the whole district.
Dadu	Indus Highway (N-55) passes through this district, with a total length of 127 km within the district. The existing road network, in Dadu district, is fairly good. The district headquarter, Dadu, is connected with other taluka headquarters of Johi, Meharand K.N Shah through metalled roads. Two provincial highways, comprising of a total length of 124 km, are mentioned in official statistics, provided by the government of Sindh. Also, there is a comprehensive network of access roads, comprising of 250 km, inter connecting the whole district.
Thatta and Sujawal	Thatta city is situated, 98 kilometers east of Karachi, on the national highway (N-5). This highway passes through district Thatta for a length of 112 kilometers. Super Highway (M-9), which connects Karachi and Hyderabad, also passes through this district for a length of 40 kilometers. District headquarters of Thatta is connected with other talukas through well-built roads. Although these roads are single but are of good quality.

4.3.13. Protected Archeological Sites and Monuments

A list of archaeological sites protected under Antiquities Act 1975 is presented in "Guidelines of Sensitive and Critical Area developed by Pak-EPA in 1997". The list is a 1996 Publication by the Pakistan Heritage Society Peshawar-Lahore and has been prepared by Mr. M. Rafique Mughal. There are a total of 91 archaeological sites situated in the project districts. The number and district wise location is summarized in **Annex L**. None of these sites are likely to be affected by the proposed interventions under SSS and A4N.

4.4. Reconnaissance Surveys

After initial information was collected and reviewed, Reconnaissance Survey (RS) in each district was conducted by ESMF team members to collect primary information for the sub-projects. The brief methodology of conducting RS and detailed results are presented in **Annex J**.

4.4.1. Findings of RS

Profiles of each district were made during the RS depicting varied baseline conditions. Northern part of target area of MSAN project is subjected to water logging and salinity as well as the deltaic area of river Indus. Consequently, in desert region, extreme drought conditions prevail throughout the year which make it difficult for agriculture.

The depth of fresh groundwater decreases with distance from the river. There is a very wide range of groundwater quality distribution in Sindh i.e. 0.5 dS/m to 7.1 dS/m. The native groundwater of the Lower Indus Plain is very saline being of marine origin. The depth and quality is variable in all districts of Sindh especially in target districts also varied in pre- and post-monsoon seasons. Water logging prevails in most of the districts especially in Kashmore, Jacobabad, Kambar-Shahdadkot, Badin, Shikarpur, Sujawal and South of Thatta. The water scarce areas are, Thatta North, Dadu, Umerkot, Tharparkar comprising desert land with water table below 60 ft.

The A4N components will be implemented in some areas where water is scarce and bad groundwater quality prevails. Agriculture activities use pesticides and chemical fertilizers. In Jacobabad, the use of pesticides and fertilizers is the highest due to the prevalence of agriculture activities through irrigation and higher cropping intensities. The lowest use of pesticide and chemical fertilizers is in Tharparkar District due to low dependence on agriculture and water scaricity.

High dependence on pesticides for pest control by untrained farmers has increased health hazards and polluted the rural environment. Pesticide use poses a threat to farmers, children, and women workers in fields who are at high risk of being poisoned (UNDP, 2001).

Pesticide residues are also found in irrigation and drinking water, cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated.

Reconnaissance Survey also revealed that the use of pesticide has continued in cash crops e.g. rice, wheat, bananas, mangoes and cotton in Jacobabad and western parts of Sanghar and Umerkot. Recently Pesticide manufacturing companies' especially multinational manufacturers has reached out local farmers and provide awareness to apply fertilizers and pesticides at proper time to increase the yield and save the crops. However, due to inflation and increase in the prices of imported fertilizer and pesticides in recent years, farmers switching over to conventional methods like manure and locally made pesticides. Supply of substandard and adulterated pesticides and fertilizers is also affecting the crop yields and the cost of production. Due to extreme weather conditions, the cropping pattern has also been changed. Increase Floods, droughts and waterlogging and salinity after 2010 impacted the agriculture practices and changed the cropping pattern in Jacobabad and western parts of Sanghar and Umerkot districts.

Chapter 5 Stakeholder Consultation

5.1. Context

Stakeholder engagement is part and parcel of the development process. Without meaningful consultation with relevant stakeholders, the effectiveness and sustainability of any project is at stake. The participation of project stakeholders is therefore considered an essential component for the preparation of a robust ESMF. Local communities, their representatives, government and national and international NGOs and the civil society at large may all be able to contribute to, and benefit from, the dialogue directed at identifying and resolving key project-related issues. Stakeholder consultation presents an opportunity for mutual information-sharing and dialogue between the project proponent and stakeholders. An effective public consultation process provides concrete suggestions that can help improve project design, resolve conflicts at an early stage, identify management solutions to mitigate potentially adverse consequences and enhance positive impacts, and develop guidelines for effective monitoring and reporting of project activities throughout the project cycle.

In preparation for the ESMF, two major groups of stakeholders were identified: (i) local communities who are the direct beneficiaries of the project interventions and therefore identified as the primary stakeholders (ii) institutions who have an important role in enabling the realization of the project interventions and therefore identified as the secondary stakeholders.

This chapter provides an overview of the stakeholder consultation process that was adopted by the consultants and presents the findings of the stakeholder engagements with primary and secondary stakeholders. The key aspects, including consultation objectives, consultation tools/methodologies and stakeholders' feedback are discussed in the following sections.

5.2. Consultation with Local Communities

Local communities are the direct beneficiaries of the SSS and A4N projects. Community perceptions of the expected outcomes and the implementation process are necessary ingredients for ascertaining project success and adjustments to planned interventions. Moreover, organized community groups (VOs, VDOs, etc.) have an important role in promoting the program concepts, identifying target households, and monitoring project activities at the local level.

Consultations with local communities were carried out in line with the following objectives:

- Inform the local communities of the project concepts and planned project interventions
- Ascertain the community's perceptions of the project concepts and planned project interventions
- Identification of potential positive and negative social and environmental impacts

Communities were of the view that the NGOs can work in the fields and will implement the subprojects fully. The methodology and detailed consultation feedback from communities with photos is presented in **Annex M**. Consultation with communities revealed the following summary:

S#	Comments from Community	Demographic Group
1.	- Improved employment opportunities and skill set trainings for women were identified as the priority areas for future interventions. Once the villagers especially women are secured a respectable and constant source of income, then would be in a better position to participate in other activities.	Women (in water scarce areas of Tharparkar, Sanghar, Umerkot and Badin)

	- Villagers are very poor facing a lack of regular livelihood opportunities. They are aware of the need for proper hygiene for improved health, but due to lack of resources, construction and maintenance of latrines is not their priority - Water scarcity and water quality is another issue in the village that severely affects agricultural productivity, therefore villagers are more reliant to livestock rearing. - Unemployment is quite high in this area and local communities usually do not have enough skills and education to qualify for non-labor employment opportunities. - Need the improvement of Health and education facilities especially for women. - 70-90 % of the population in the villages openly defecate. - NGOs are working diligently in the villages and working in WASH, health and education - Unemployment is the also a main problem for females in villages. In fact, not a single female is educated in the some villages.	
2.	- There is a strong feudal system in the village and farmers have little control over their income and working hours. - Majority of the villagers are associated directly or indirectly to farming activities and therefore, water scarcity is considered the most important issue for these villagers. - Due to saline groundwater quality, agriculture activities are limited to monsoon season. Farmers mainly relying on livestock as the major source of income.	Farmers (in water scarce areas of Sanghar and Umerkot)
3.	- Floods affects the most to the agriculture activities. Waterlogging also destroyed most agriculture lands. - Due to waterlogging situation, fish farming becomes a good source of livelihood and many farmers have switched their lands into fish farms. - Farmers are keen to learn good agriculture practices (GAP) because they are unaware of them. - Poultry farming is another source of livelihood of women.	Farmers (in irrigated areas of Jacobabad, western Sanghar and Umerkot)
4.	- Construction of schools and basic health facilities are more important to villagers than latrines - Villagers have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers. The disputes are also resolved by these committees. - Compared to open defecation, the villagers view latrine use as time-consuming and troublesome. - Villagers are fully aware of the diseases due to unhygienic conditions and believe that healthy practices can improve the overall village environment. - Villagers showed the support of SSS program and asked if any organization would provide all the facilities in constructing the toilets, they will definitely use the toilets and stop open defecation. - Even some houses have latrines, children usually go for open defecation. - Illnesses in children and women are more frequent than males and young; common diseases in this village are Skin diseases, Malaria and Diarrhea.	Key informants / notables of villages / Doctors
5.	- Villagers affirmed that SSS programme can change villagers' health and environment and can save children from diseases. Proper monitoring is main factor in improving the overall environment that must be consider. - People were aware that diseases are cause due to unhygienic conditions but find it very difficult for them to build latrines and enclosed washrooms.	Men in all selected districts

5.3. Consultation with Institutions

Secondary stakeholders play an important role in enabling the implementation of planned project interventions. Their understanding of the proposed interventions and the role they are expected to play in the project increases their ownership of the project and minimizes the risks of project derailment and delays. In light of this context, stakeholder engagement with relevant governmental and non-governmental actors was carried out with the following objectives:

- Appraise the stakeholders of the role of the ESMF Study and the planned project interventions for SSS and A4N components
- Identify opportunities, challenges and limitations of the proposed project interventions
- Identify potential environmental and socio-economic impacts of the proposed project interventions

A Stakeholder Consultation Meeting was held on 30th August, 2016 at Pearl Continental Hotel, Karachi inviting relevant secondary stakeholders from academia, relevant provincial and local government departments, local and international NGOs and development agencies. Project Directors of both the SSS and A4N projects were also invited to the meeting. Relevant project background information was shared with the participants prior to the meeting. Over 40 participants representing over 20 different departments and institutions participated in the meeting. The methodology and detailed consultation feedback with photos is presented in **Annex N**.

Consultation with institutions revealed the following summary:

S#	Comments from Institutions	Area where applicable
6.	- Apart from improving the nutritional status of local communities, by involving both male and female family members regardless of age group, kitchen gardens have the potential for strengthening family bonds and intra-community relations. - Best Management Practices (BMP)s in the areas of organic farming should be incorporated. - Local fruit trees provide a viable option for improving the nutritional status of villagers, plantation of such trees should be promoted on a larger scale and made part of the nutrition projects.	Agricultural Practices and Kitchen Gardening (Agriculture for Nutrition A4N)
7.	- Pakistan Agriculture Research Council (PARC) was identified as a national research-based institution with extensive experience in improved agricultural practices. Similarly, other relevant departments and institutions with exposure to the planned project activities should be consulted for kitchen gardening, mobilization of Farmer Field Schools, choice of seeds and the like. - Even after a village attains ODF Certification, maintaining this status is a challenge and arrangements should be made to minimize fallout. Trained District, Taluka-level administration and other trained personnel such as LHVs can be play an instrumental role in helping communities maintain ODF status post-project.	Coordination among Institutions (SSS and A4N)
8.	- As the SSS project places a strong emphasis on behavior change, the root causes for existing undesirable behavioral practices need to be examined thoroughly. This may lead to adjustment of planned project interventions. - Age-old traditions of defecating in open areas or within natural surroundings will be a challenge for the project, especially with the elder folk. Moreover, in some rural areas, proper latrines are still considered taboo.	Behavior Change Communication (Saaf Suthro Sindh SSS)

	- Behavior change also requires time, more than a couple years at least, if not more. Therefore, the existing project should be designed to ensure rigorous periodic awareness and sensitization sessions.	
9.	- Many water-borne diseases are common in the project districts and result in severe malnourishment of women and children. Therefore, nutrition programs in Sindh should also place emphasis on availability of clean water in these areas. With respect to the SSS project, this clean water should be ensured in schools as part of the health and hygiene awareness component. - On the other hand, environmentally safe disposal mechanisms need to be devised to ensure human excreta does not contaminate local water storage/supplies. - In latrine design, septic tanks provide a viable option for use by all households, schools and other local institutions. However, mismanagement of septic tanks can lead to severe environmental problems. Both construct, operation and management aspects need to be carefully reviewed.	Clean Water and Safe Disposal (Saaf Suthro Sindh SSS)
10.	- UNICEF has conducted a Knowledge Attitude and Practices (KAP) study in certain areas of rural Sindh for the WASH Sector. Similar studies can provide profound knowledge on the social component of sanitation projects for the Multi-Sectoral Action for Nutrition Project. - Lesson learning from previous projects and ground realities must be incorporated for both the SSS and A4N projects to ensure result-oriented and long-lasting solutions to combat malnutrition in Sindh's rural areas.	Integration of Ground Realities and Lessons Learnt (SSS and A4N)
11.	- The role of women both for the promotion of health and sanitation awareness and nutrition-sensitive agriculture practices is essential in rural areas of Sindh. Often, women from these areas are not only engaged in domestic chores, but also work on farms and partake in other income-earning activities. At the same time, it is the women that suffer the most from malnourishment and other health problems. - Intensive sensitization and awareness campaigns focused on women of all ages should be part of both projects. - Participation of certain vulnerable groups, including the elderly, handicapped persons and widows should be ensured in both project.	Gender and Vulnerable groups (SSS and A4N)

Chapter 6 IMPACT ASSESSMENT AND RECOMMENDED MITIGATION MEASURES

This Chapter assesses the potential impacts of the proposed project on environment and people. Also provided in the Chapter are the generic mitigation measures to minimize if not eliminate the potentially negative impacts, in order to ensure that the interventions under the proposed project do not cause environmental and/or social impacts beyond the acceptable level.

6.1. Positive Socio-economic and Environmental Impacts of MSAN project

Most of the Project's environmental and social impacts will be beneficial, including for example the positive effect on health caused by the reduction in Diarrhea and sanitation related diseases and the associated socio-economic benefits, considerable behavior change activities at community and district levels, and improved productivity (particularly benefiting females) generated by taking nutritious diet and good sanitation and hygiene conditions. The beneficial impacts of both components i.e. SSS and A4N under MSAN project are described briefly hereunder:

Saaf Suthro Sindh (SSS)

- The Economics of Sanitation Initiative highlights seven diseases among others which attribute to a loss of 3.9% of GDP due to non-action in sanitation. These diseases include Diarrhea, Typhoid, ALRI, Malaria, Hepatitis, etc. The cost due to sanitation issues in health contribute to 87% of the total loss which in the case of Sindh is estimated to be 262 billion rupees. Reduction of such losses will contribute to improved nutritional status.
- Employment generation would only be for the period of project implementation for establishment of hub. The job will be implemented through NGOs, therefore there will be job opportunities for social mobilizers and other staff during implementation phase of the program.
- Health education for adopting hygiene practices would definitely improve the living pattern in the poor and disadvantaged section of society at rural, sub-urban and urban pockets of poverty.
- Specifically, the proposed SSS program will directly benefit school going children especially girls with i) behavior change ii) better sanitary conditions in toilets iii) good hygiene practices iv) hand washing practices with soap and v) motivation to implement same toilet model in their homes where open defecation is practiced.
- The component directly responds to the World Bank Group's (WBG) twin goals of ending extreme poverty and promoting shared prosperity by reducing open defecation and improving food security and health and nutrition status of poor and vulnerable population.
- The component will also support the INSS by improving access to and use of sanitation and proper hygiene behavior through 'open defecation free' jurisdictions to reduce infection and disease.

Agriculture for Nutrition (A4N)

The A4N component's primary aim will be to increase food supply for producing households. Although a direct financial return is not anticipated; it will provide avenues to poor farming community, landless and women-headed households involved in agriculture including livestock to support improved supply of nutrients. In this way, the health of households will be promoted. In addition, the potential for producing a marketable surplus may lead to increased incomes for the households.

- The nutritional intervention will enhance health, stamina of very poor household by addressing nutritional deficiencies/gaps. This project will support poor segment of society and lead to increase in agriculture productivity. It will help address stunting in children and improve their health status. The project would increase food availability which would lead to improvement in health especially women and children, reduction in school dropout, and increase the earning potential.
- The project is expected to directly generate about 250 jobs, involving about 10,000 households in agriculture activities in 20 union councils of selected 4 districts. It will also provide employment opportunities in directly and at secondary level to about 5000 persons/ household along with service providers[33].
- The component will address following sustainable development goals (SDGS) and frame work of National Climate Change Policy (NCCP) of Pakistan:
    - **SDG-1 - End poverty in all its forms everywhere**: The project objective is to improve the quality and diversity of diets in target households through Nutrition Sensitive Agriculture. Therefore, project would reduce poverty and hunger and assist in achieving food security.
    - **SDG-2 - End hunger achieve food security and improved nutrition and promote sustainable agriculture**: This project would focus on boosting production such that it not only meets year round needs of household but also earns income from profitable sale in the market. As proposed, the Program would contribute towards sustainable economic growth through increase in food crops, and also imparting creation of new jobs.
    - **SDG-13 - Take urgent action to combat climate change and its impacts**: While the project does not anticipate negative environment impacts, it will promote climate friendly interventions such as the FFS/F35 that will promote integrated pest management and integrated soil nutrient management. Livestock training will promote appropriate animal waste management as well. Interventions that can help combat climate change include the following:
- Integrated pest management.
- Trainings to be provided to minimize waste generation in activities such as packaging and processing.
- Proper waste disposal related to agriculture and livestock value chain activities
- Occupational health and safety aspects related to agriculture and livestock value chain activities such as packaging and processing
- Awareness of environmental degradation caused by intensification of cultivation caused by value chain development, and ways and means to avoid/counter this undesirable consequence.
- Promotion of sustainable and judicious usage of natural resources.
- Awareness, adaptation, and mitigation for climate change and its implications for agriculture sector in the Province.

6.2. Environmental Screening

The Components of the project will include activities for sanitation by constructing washrooms in 200 schools in each district and agriculture interventions by developing demo plots (refer section 3.4). These components can potentially cause negative environmental and social impacts. However, exact nature, extent, and location of these subprojects is not known at this stage, as stated in *Chapter 1* also. These potential

[33] A4N PC-I Document

impacts of generic nature have nonetheless been screened using the modified checklist from Asian Development Bank's (ADB's) Rapid Environmental Assessment Checklist for agro-industrial projects and sanitation as given in **Annex C**.

6.3. Analysis of Alternatives

The analysis of the alternatives is a part of this ESMF process to select the best among all possible project options. The alternatives of a project are defined as the options that can help to meet the objectives of a project by different means including alternative project sites, technology or material, design or inputs. The key criteria when identifying alternatives is that they should be feasible and reasonable.

Selection of preferred alternative is based on scores of factors including cost, schedule of delivery, environmental and social impact and the cost for their redressal. The drivers that affect potential alternative options and scenarios include: availability of project sites, current technologies; design changes that need to be introduced, operational situation, capital & recurrent costs, environmental & social issues, their potential impacts, and costs of mitigation.

The "No Action" alternative situation is taken into account to demonstrate the need of the Project. In consideration of the different drivers, potential alternatives within the Project are restricted to the following aspects:

- No Action alternative;
- Toilet Design Alternatives under SSS;
- Irrigation methods under A4N.

6.3.1. The 'No Action' Alternative

Under this alternative, the project would not be undertaken in any form. The main potential negative impacts associated with the adoption of a null alternative include the following:

- Open Defecation will persist in the target districts leaving only 19% of rural households have access to safe excreta disposal facilities, and 16.93 million people in rural areas without access to these facilities.
- Stunting will persist in the target district which is 60% in children under age 5 (MICS survey 2014).
- The behavior of the people to defecate in the open will not be changed.
- The overall nutrition status of the province remains same
- The INSS program will not be successful
- Outward migration of the local and regional population, especially young families seeking viable employment and career opportunities.

The "null" or "no action" alternative is not preferred as the project will benefit more in conjunction with fulfilling goals of sanitation and nutrition sensitive agriculture (NSA) under Inter-Sectoral Nutrition Strategy for Sindh (INSS).

6.3.2. Toilet Design Alternatives under SSS

6.3.2.1. Selection of Best suited technology for MSAN Project

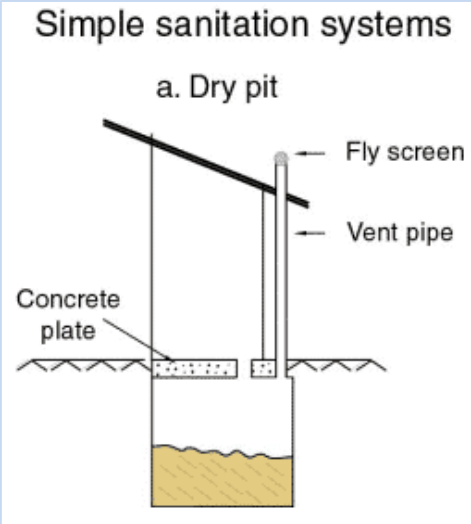
Keeping in consideration the factors like i) water table persist in project districts, ii) community acceptability iii) cost of construction iv) soil structure, v) area of construction and water availability, the following two types of toilet designs are selected:

1. Offset double pit toilet with pour flush – Also recommended in areas where water table is high if raised. Toilet is connected with leaching pits (stone lined) which act as a partial trickling filter and hence the water that escapes is bacteriologically less/not harmful. Once a pit is filled, the second one comes in use and the first is emptied over time.
2. Pit latrine – Only recommended where water is scarce and pour flush technique cannot be utilized and also water table is deep like in desert area.

The brief description of these two design is described below. However, guidelines for construction of toilets are presented in **Annex I**.

Pit Latrines

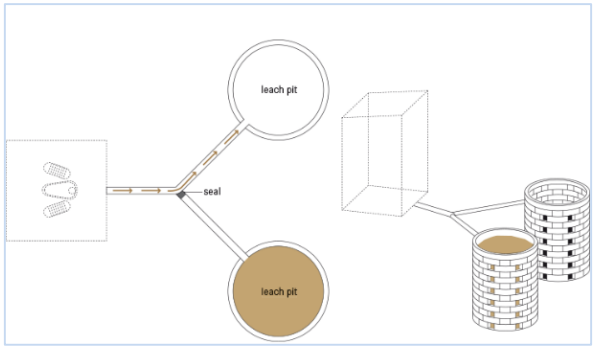
A pit latrine or pit toilet is a type of toilet that collects human feces in a hole in the ground. They use either no water or one to three liters per flush with pour-flush pit latrines. The World Health Organization recommends they be built a reasonable distance from the house balancing issues of easy access versus that of smell. The distance from groundwater and surface water should be as large as possible to decrease the risk of groundwater pollution.



When the pit fills to within 0.5 meters (1.6 feet) of the top, it should be either emptied or a new pit constructed and the shelter moved or re-built at the new location. Fecal sludge management involves emptying pits as well as transporting, treating and using the collected fecal sludge. If this is not carried out properly, water pollution and public health risks can occur.

This option of is not preferred due to its environmental consequences in water logged or shallow groundwater areas. Also the fecal sludge should be removed after filling the pit and there is a chance of spreading vector from the pit and odor problems. Also the construction of the latrines has to be outdoor due to odor and vector problems.

Offset double pit toilet with pour flush



An offset double pit toilet with pour flush is an offset single pit toilet with a second pit added. The double offset system enables alternating use of the two pits.

When the first pit is full it should be left for at least twelve months, the period required for adequate pathogen destruction. After this period, the decomposed contents of the first pit can safely be removed by hand and used as organic fertilizer. The first pit can be used again while the contents of the second pit decompose.

Suitability

The offset double pit toilet with pour flush is suitable

- For areas where the water table is high, if the toilet is raised and connected to a soak-pit.
- In areas prone to freshwater or tidal flooding, if raised.
- For loose soils, if fully lined.
- For soils with low permeability, if built with a soak pit.

Advantages

- It is easy to construct, operate, and maintain:
  - ✓ Operation consists of regular water cleansing of the slab (with soap or detergent, if available) to remove any excreta and urine, and daily cleansing of the floor, squatting pan, door handles and other parts of the superstructure.
  - ✓ Maintenance consists of monthly inspections to check for cracks in the floor slab and damage to the vent pipe and fly screen, and digging out of part of the feces at the end of the dry season. These feces should be handled with care and buried in a pit covered with soil. After at least a year, when the contents of the pit have decomposed into harmless humus, the humus can be can be used as fertilizer.
- It is relatively inexpensive to construct, operate, and maintain.
- The pit sludge is safe.
- The toilet can be connected to a soak pit.

Disadvantages

- The U-trap can easily become blocked because of bad design or improper use, or damages by improper unblocking.
- Pour-flush toilets are unsuitable where it is common practice to use bulky materials for anal cleansing which cannot be flushed through the U-trap. Unless those materials are separately collected and safely buried or burned.
- The contents of the pit may not decompose safely when the double pits are too close to each other without an effective seal between them, allowing liquids to percolate from one pit to the other.

6.3.3. Irrigation Method

Unfortunately, in many cases there is no single best solution: all methods have their advantages and disadvantages. Testing of the various methods - under the prevailing local conditions - provides the best basis for a sound choice of irrigation method.

6.3.3.1. Surface or Sprinkler Irrigation

The suitability of the various irrigation methods, i.e. surface or sprinkler depends mainly on the following factors:

- natural conditions
- type of crop
- type of technology
- previous experience with irrigation
- required labor inputs
- costs and benefits.

Natural Conditions

The natural conditions such as soil type, slope, climate, water quality and availability, have the following impact on the choice of an irrigation method:

Soil type: Sandy soils have a low water storage capacity and a high infiltration rate like in desert areas. They therefore need frequent but small irrigation applications, in particular when the sandy soil is also shallow. Under these circumstances, sprinkler irrigation are more suitable than surface irrigation. On loam or clay soils both irrigation methods can be used, but surface irrigation is more commonly found. Clay soils with low infiltration rates are ideally suited to surface irrigation.

Slope: Sprinkler irrigation are preferred above surface irrigation on steeper or unevenly sloping lands as they require little or no land levelling.

Water availability: Water application efficiency is generally higher with sprinkler irrigation than surface irrigation and so these methods are preferred when water is in short supply.

Water quality: Surface irrigation is preferred if the irrigation water contains much sediment. The sediments may clog the drip or sprinkler irrigation systems.

Type of Technology

The type of technology affects the choice of irrigation method. In general, drip and sprinkler irrigation are technically more complicated methods. The purchase of equipment requires high capital investment per hectare. To maintain the equipment a high level of 'know-how' has to be available.

Surface irrigation systems - in particular small-scale schemes - usually require less sophisticated equipment for both construction and maintenance (unless pumps are used). The equipment needed is often easier to maintain and less dependent on the availability of foreign currency.

Previous Experience with Irrigation

The choice of an irrigation method also depends on the irrigation tradition within the region or country. Introducing a previously unknown method may lead to unexpected complications. The servicing of the equipment may be problematic and the costs may be high compared to the benefits.

Often it will be easier to improve the traditional irrigation method than to introduce a totally new method.

6.4. Assessment of Potential Impacts and Generic Mitigation

The potentially negative impacts identified with the help of environmental screening discussed in Section 6.2 are assessed in the subsections below. The generic mitigation measures have also been provided here; additional measures may be added as a result of the subproject-specific environmental assessments to be carried out during the Project implementation.

6.4.1. Subprojects Siting and land issues (financed under MSAN project)

It will be ensured through screening checklist (sample presented in **Annex C & D**) that the subproject avoids any sensitive locations as well as land acquisition.

In case of SSS, Sub-project sites will be located within school compound. However, preliminary screening will be undertaken to ensure that the land used for toilets does indeed belong to the school, there is no dispute over it and that there are no squatters/encroachers using this land. In case of A4N, Sub-project sites will be located on agriculture department land. If joint / community cattle shed will be built for demonstration, it will be acquired through Voluntary Land Donation (VLD).

6.4.1.1. Voluntary Land Donation Protocol

Directorate of Agriculture will completely avoid land acquisition. Whenever there is additional land requirement, the directorate will interact with the land owners and facilitate voluntary donation of land required for taking up sub-projects under A4N. This use of voluntary donation option will be limited to small piece of land for demonstration plots. Under no circumstances, shall the titleholder be subjected to any pressure, directly or indirectly, to part with the land. These actions are expected to minimize adverse impacts on the local population and help in project benefits reaching all sections of community. The MSAN project will ensure that the process of voluntary donation of land is meticulously documented to avoid confusions, misunderstandings, litigations, etc. at a later stage. Original copies of all documentation of voluntary donation of land will be kept with the Directorates of Sanitation and Agriculture. Complete documentation along with a copy of the final document will be sent to Directorate for records and for inspection at a later date.

VLD is only suitable for community driven projects where the landowner and/or community wish to 'gift' land parcels or small areas for small-scale community infrastructure that will be of direct benefit to the donor's community.

1. When VLD is Applicable

For land donation the following rule will apply:

- Alternatives and the viability of other locations or sites have been considered;
- The Titleholder should not belong to the vulnerable sections. i.e.

- households (with a valid proof), as per provincial poverty line for rural/urban areas;
- households without a proof of the same and belonging to the following social categories
- Women headed households with women as sole earner
- minority /Handicapped persons, and is subject to any of the following impacts; Loses land holding, Loses shelter and Loses source of livelihood.
- The Titleholder should be holding more than the minimum prescribed land,
- The impacts must be minor. The voluntary donation should not be more than 10 percent of the area of that particular holding of the Titleholder.
- This should not require any physical relocation of the Titleholder.
- The land must be jointly identified by the Revenue Department/Project Affected Committee / Directorates Representative or project authorities. However the project technical authorities should ensure that the land is appropriate for sub-project purposes and that the sub-project will not invite any adverse social, health, environment, safety, etc. related impacts by procuring this land.
- The land in question must be free of squatters, encroachers, or other claims or encumbrances.
- Verification of the voluntary nature of land donations must be obtained from each of the persons donating land. This should be in the form of notarized witnessed statements.
- In case of any loss of income or physical displacement is envisaged, verification of voluntary acceptance of community devised migratory measures must be obtained from those expected to be adversely affected.
- The Titleholder donating land should have made to understand that they will have equal access to the infrastructure built on the donated land like any other community member and that they cannot claim for any priority treatment.
- Grievance Redress Mechanism must be available.
- The donations and the process followed is documented, monitored and reflected in the monitoring reports.

2. When VLD is NOT Applicable

VLD is not applicable under the following scenarios:

- Where inadequate consultation with donors results in lack of understanding about the terms and conditions of the donation;
- In lieu of formal procedures for land acquisition where these do not exist;
- Where donor property owners, landowners or customary rights holders do not support, or will not directly benefit from, the Project;
- Where conflicts over land exist, including customary collective ownership;
- Conflicting land titling that make it difficult to establish with certainty who has a right to own, donate and use a specific parcel of land;
- Where donors did not provide their informed consent and were subject to political or social pressure and coerced into making the donation.

3. Process for Voluntary Donation

This section provides guidance on the process for VLD, namely on how to:

- Determine and document the appropriateness of VLD in the project context;
- Verify the requirements of the donation and the formalization of the donation;
- Carry out due diligence on the owners and users of land donated;
- Ensure appropriate consultation and disclosure;
- Establish informed consent of the person donating the land; and
- Establish grievance redress mechanism.

This section outlines the process that should be followed once the threshold considerations set out in Section 1 have been considered, and it has been determined that it is appropriate for the land to be provided to the project by voluntary donation.

It is necessary to follow a clear process for the donation, and to prepare and maintain documents that demonstrate such process. Each step set out below should be addressed in the context of the specific project, and fully documented.

(i) Determine and document that VLD is appropriate in the circumstances of the project.

The team should record the reasons why it thinks that the donation of land is appropriate for the project. In certain cases, only some of the land the project requires will be donated or alternatives to land donation exist. The project team should identify (in as much detail as possible):

- What the land will be used for;
- How much land the project will require on both a permanent and temporary basis;
- How much of the land will be donated;
- What alternatives to donation exist (e.g., right of use, right of way);
- The terms of the donation;
- The identities of the parties who intend to donate;
- The beneficiary of the donation; and
- Any details that are relevant to why donation may be appropriate.

(ii) Verify the requirements to transfer, and formalize the transfer of the land

It is important to understand the process that should be followed to transfer the land, and appropriate ways to formalize the transfer so as to achieve certainty for both the transferee of the land and the project. An important consideration will be how transparent the process and the decision making process actually is, and what can be done to enhance the process.

(iii) Conduct due diligence on who owns and uses the land

Given the specific issues surrounding land ownership, it is important that the project team carries out careful due diligence to understand the type of land rights that exist in the project area, and to identify any particular

issues relating to land ownership and use. Thereafter, a more specific due diligence must be conducted on each parcel of land proposed for donation to identify:

- The owner or owners of the land;
- The users of the land, or any parties that occupy the land (either physically or through ownership of an asset or conduct of livelihood or business activities on the land);
- Any competing claims of ownership or use;
- Structures and assets on the land;
- Any encumbrances on the land.

(iv) Disclosure and Consultation

The decision to donate must be taken on the basis of a full understanding of the project and the consequences of agreeing to donate the land. Accordingly, the parties that will be affected by the donation (the owners and users of the land) must be provided with accurate and accessible information regarding what the land will be used for, for how long, and the impact the donation will have on them and their families. It is important that prior written notification indicating the location and amount of land that is sought be provided and that its intended use for the project is disclosed.

There should be a clear agreement as to which party will pay the costs associated with the donated land. This could include measurement costs, documentation and notarial fees, transfer taxes, registration fees. It should also include the costs of re-measuring/re-titling the transferee's remaining land and any new documentation relating to it.

(v) Establishing Informed Consent

It is crucial that the project team is confident that the decision to donate was taken in circumstances of informed consent or power of choice. As discussed earlier, this means being confident that the owner(s) or user(s) of the land understand:

- What the land is going to be used for, by whom and for how long;
- That they will be deprived of the ownership or right to use the land, and what this really means;
- That they have a right to refuse to donate the land;
- Whether there are alternatives to using this land;
- What they will need to do to donate the land (e.g., execute documents, get spousal consents, pay taxes);
- The effect of the donation on their family, and what they can do if they (or their family or heirs) want the land back.
- The exact demarcation of land boundary for the project's use;
- Whether there are proposals which would allow other land to be used;
- What they will need to do to donate the land;
- The intergenerational effect of the donation on their family, what they can do if they (or their family or heirs) want the land back.

The terms and conditions of the land donation must be mutually agreed upon and detailing in a written agreement.

(vi) Documentation

It is necessary to distinguish between: (a) the agreement to donate the land; and (b) the document that carries out and evidences the legal transfer of the land. While it is important to have evidence of an intention and agreement to donate the land, it is equally important to ensure, where required and appropriate, that the land is legally transferred. While the process relating to the legal transfer of the land is frequently complicated and time consuming, it must be addressed.

The Format of VLD form is attached in **Annex Q**.

Community consultations will also be carried out before establishing the sites.

6.4.2. Impact for Anticipated Subprojects (financed under MSAN project) and Mitigation Measures

Anticipated Subprojects (financed under MSAN project) include implementation of hard components in the field like procurement of material, Toilet construction/rehabilitation, drilling of borehole and installation of hand pumps, establishment of kitchen gardens, livestock sheds and fisheries ponds in demonstration plots and procurement of supplies under A4N fund. The impacts associated with these activities are water/groundwater contamination; solid waste management; air quality issues, primarily related to dust generation; noise; and occupational and community risks. As part of ESMF, generic impact assessment has been conducted in the following sections:

Following a description of impacts on each environmental and social components is described along with mitigation measures:

Anticipated Impacts	Mitigation Measures
Land Issues	
Land on which toilets are to be built may be disputed/not belong to the school or be used by people for accommodation or livelihoods.	- Involuntary Resettlement Screening Checklist as presented in **Annex D** to be used to check the land belong to the school or free from any disputes. - Village Organizations and LGD officials will be taken onboard for the identification construction site in schools.
land may be acquired for small-scale interventions that cannot be acquired through Voluntary Land Donation (VLD) procedures	- The subprojects will be established on the land owned by Agriculture department. However, private land if acquired will be through VLD procedure. If VLD will not be possible, the RPF as part of this report will be applied. - It will be ensured that no involuntary resettlement takes place for these subprojects. - Complete documentation will be maintained for VLD. - Valuation and compensation of affected assets of community should be in line with RPF/Sub-projects RAPs and considered before the field activities.
Impediment to access of residents and students	
Any construction in schools can lead to blockage of access for students as well as it may block residents to commute their homes.	- Screening Checklists as presented in Annex C&D to be used to check the access. - Adequate monitoring of construction site will ensure that the construction material will not be stacked in the routes of commuting
Labor Issues	

Anticipated Impacts	Mitigation Measures
Conflict may arise between construction labor and community if labor not hired locally.	- Preference will be given to labor from locally skilled and unskilled workers of community for the construction of toilets in schools.
Also there could be a possibility that labor is forced to work on the site without providing wages or delayed in payments while performing their job.	- PD and SS under directorates will ensure that certain clauses will be added in the contract documents of IPs i.e. not to force labor to work and official minimum wages to be paid if the laborers are contracted by the community. - Consultation with labor will be ensured by IPs and ESFPs.
Impacts on Women, Children, and Vulnerable Groups	
Impact on vulnerable groups like Women, poor households, women headed households.	- Women's participation is already included in project interventions like development Female farmer field schools (F3S), construction of girl toilets, focusing on women as the main agriculture producers. - Lady Extension Workers (LEW) will be engaged as contingent staff for short period, so as, to work with women beneficiaries. (PC-I of A4N) - Environmental screening checklist will provide first stage information about impacts on poor, women and other vulnerable groups including needs and priority for social and economic betterment; - IPs and TSPs will ensure the active participation of women in project interventions as well as adequately consulted. - In awareness raising under SSS, women share should be more compared to men. - Ensure participation of vulnerable groups in project activities through consultations, to ensure planned investments take the well-being of such groups into consideration
Conflicts	
It is anticipated that conflicts among communities may arise during project implementation.	- Conflicts resolution will be done through implementation of Grievance Redress Mechanism (GRM) as presented in section 7.10 and 8.13.
Consultation	
It is anticipated that stakeholders and communities may not be participated or consulted in project interventions	- Consultation with stakeholders should be undertaken at project design, inception and implementation stages and as per consultation framework provided in table 7.8.
Air Quality Deterioration	
Handling of cement and other dusty materials and handling and storage of aggregates in concrete plants; during construction of structure of Latrines in schools may lead to dust generation and nuisance to the school children and nearby households. However, localized and relatively minor air quality impacts will occur.	- Soil and temporary spoil piles should be covered or sprayed with water if generating dust. - Latrine Construction sites including Soil piles in schools should be barricaded to avoid material escape, generation of dust and access to children. - Construction machinery, generators, and vehicles will be kept in good working condition, minimizing exhaust emissions. - Tractor loads should be covered with any suitable material.
In Food Production and Management (component B of A4N), it is envisaged that there will be no generation of air emissions caused by the development of Demonstration plots, localized and relatively minor vehicular emissions will occur if vehicles will be used to prepare demo plots but the emissions will be dispersed in open rural environment.	- No measures required.
Water Consumption and Conservation	

Anticipated Impacts	Mitigation Measures
Construction activities in case of SSS can have insignificant impact on hydrology and ground water levels of the area due to low water requirements in case of toilet/hand washing station construction.	- No measures required.
Water availability should be considered as key factor while implementing interventions under A4N sub-project. Water Conservation is another component that should be introduced in the program.	- In Jacobabad, western parts of Shanghar and Umerkot districts, water logging persisted due to availability of plenty of water due to the presence of IBIS. Interventions supporting water availability should be considered like fish farming, agriculture through irrigation. However, in water scarce areas like Tharparkar and eastern parts of Umerkot and Sanghar districts, careful planning will be required while implementing interventions under A4N. Livestock is the main livelihood of these areas and it should be promoted through better practices. However, to support the Nutrition Sensitive agriculture (NSA), crops which requiring less water and are saline water tolerant may be introduced. This idea will support the scarcity of water in the arid region. - Use of compost, or decomposed organic matter as fertilizer, has been found to improve soil structure, increasing its water-holding capacity.
Surface and Ground Water Quality	
The construction of Toilets and installation of boreholes for water supply can have following impacts: - Inadequate design of Latrines resulting in contamination of groundwater e.g. in case of pit latrines developed in high water level areas. - Inadequate design of Latrines resulting in contamination of nearby water wells / dug wells. - The contamination chances will be increase in conditions like post-monsoon season, flood conditions, waterlogging, shallow water table and sandy soils - Inadequate disposal of sludge material after filling of pit/septic tank will result in contamination of land, surface water resources, generation of vector and spread of disease; - Sediment laden runoff resulting from borehole drilling; - Groundwater contamination from backfilling of unsuccessful boreholes.	- Guidelines for Construction of Latrines should be followed as presented in **Annex I**. - It will be ensured that the wastes are not released into any drinking water source, cultivation fields, or critical habitat.
- Under A4N, use of harmful pesticides and chemical fertilizer in demo plots leading to water pollution, pesticide residues in crops - contamination of local water body from animal faeces generated via livestock sheds - Inadequate pesticides use and chemical fertilizers in demo Kitchen gardens may contribute in water contamination. Runoff from all categories of agriculture leading to surface and groundwater pollution. Pesticide leaching occurs when pesticides mix with water and move through the soil, ultimately contaminating groundwater. The amount of leaching is correlated with particular soil and pesticide characteristics and the degree of rainfall	- *Promotion of the use of Bio-pesticides*: Bio-pesticides are pesticides derived from natural materials (animals, plants, microorganisms, certain minerals). As an alternative to traditional pesticides, bio-pesticides can reduce overall agricultural pollution because they are safe to handle, usually do not strongly affect beneficial invertebrates or vertebrates, and have a short residual time. - *Use of Organic fertilizer*: Organic fertilizers are fertilizers derived from animal matter, human excreta or vegetable matter (e.g. compost, manure). There's little to no risk of toxic buildups of chemicals and salts that can be deadly to plants. Organic fertilizers are renewable, biodegradable, sustainable, and environmentally friendly.

Anticipated Impacts	Mitigation Measures
and irrigation. Leaching is most likely to happen if using a water-soluble pesticide, when the soil tends to be sandy in texture, if excessive watering occurs just after pesticide application, if the adsorption ability of the pesticide to the soil is low. Leaching may not only originate from treated fields, but also from pesticide mixing areas, pesticide application machinery washing sites, or disposal areas. - Runoff of nutrients, especially phosphorus, leading to eutrophication causing taste and odor in public water supply, excess algae growth leading to deoxygenation of water and fish kills. - Agriculture contributes greatly to soil erosion and sediment deposition through intensive management or inefficient land cover. - The environmental impact of Fish farming is primarily a function of feed composition and feed conversion (fecal wastes), plus assorted chemicals used as biocides, disinfectants, medicines, etc. Waste feed and fecal production both add substantial nutrient loadings to aquatic systems.	- *Integrated Pest Management (IPM)*: Agriculture and Livestock Departments, Government of Sindh has developed Integrated Pest Management Plan (IPMP) for "Sindh Agricultural Growth Project (SAGP)" in August 2013. The SAGP is focused on horticulture crops because these commodities have a small farmer focus, have significant involvement of women in production and processing. The IPMP of SAGP covers features including a) minimize pesticide usage while increase the productivity of agricultural crops targeted in the SAGP through Integrated Pest Management (IPM), Integrated Plant and Soil Nutrient Management (IPSNM) and Good Agricultural Practices (GAP), b) monitor the pesticides management such as their usage before, during and after, and the level of pesticide residues on targeted crops in normally-treated and IPM-treated areas and to disseminate information to stakeholders on the usefulness of undertaking IPM practices, and c) raise awareness of all stakeholders about the IPM approach to crop management, and train extension agents and farmers through FFS system to become practitioners of IPM. - A model IPMP has been prepared under MSAN Project (**Annex G**) which is based on principals devised in SAGP IPMP which is the principal document of Agriculture and Livestock Departments for horticulture crops as well as based on the provisions of WBG OP 4.09. This model IPMP will be helpful for Directorate of Agriculture to prepare project specific IPMP and to mitigate and include the rational use of pesticides. - Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. Crops are arranged to that a strip of grass or close-growing crop is alternated with a clean-tilled crop or fallow. - Organic debris produced by harvesting is easily mineralized into leachable Nitrogen. Steps to reduce leachable Nitrogen includes planting of "green manure" crops, and delaying ploughing of straw, roots and leaves into the soil.
Solid Waste Management	
Typical solid waste generated during construction include waste concrete, empty cement bags, excavated soil (especially soil from drilling of borehole), etc. This waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It is likely to block nearby drainage channels that can ultimately cause localized flooding during the monsoon. Windblown debris is a nuisance to the nearby community. Poor waste management practices would result in short term negative impact on the aesthetics of the surrounding. Inadequate disposal of sludge material after filling of pit/septic tanks connected with the toilets will result in contamination of land, surface water resources, generation of vector and spread of disease;	- Construction sites should be equipped with temporary refuse bins. - Wastes should be routinely collected from the designated area and disposed at waste disposal facilities. - The subprojects will be designed employing technologies that minimize generation of solid wastes - Recycling of solid waste will be carried out as far as possible and practical. - Composting of biodegradable waste will be considered and adopted if practicable. - Disposal of solid waste will be carried out in a manner that does not negatively affect the drinking water sources, cultivation fields, irrigation channels, natural drainage paths, the existing waste management system in the area, local routes, and general aesthetic value of the area.

Anticipated Impacts	Mitigation Measures
Establishment of ponds for fish farming will generate excavated soil. Generation of biological solid waste generated from livestock sheds and kitchen gardens (demo plots) may pollute land and water bodies if not handled properly.	
Noise	
During the construction and drilling of borehole, noise will be generated from the operation of machinery. These construction activities may cause discomfort to local residents. Besides the construction works will be encouraged during daytime and the noise would be generated temporarily. Therefore any adverse impact on residents and fauna is negligible.	- Machinery operation and high noise activities should be carefully planned and scheduled. - Where that is not possible, high noise activities should cease between 22:00 and 06:00 hrs.
Occupational Health and Safety	
The construction of civil works such as toilet construction, tilling of demo plots, installation of livestock sheds etc. poses an inherent risk of injury to labor from accidents. Poor housekeeping practices will lead to stagnant water as breeding grounds for insect vectors (causing malaria etc.). Hazards from handling equipment, ergonometric stress, lifting heavy materials etc. may cause injury to the labor.	To mitigate these potential H&S impacts prior to the commencement of civil works, following measures will be adopted: - Identify and minimize, so far as reasonably practicable, the causes of potential hazards to workers, including communicable diseases such as HIV/AIDs and vector borne diseases; - Avoid stagnation of water and initiate drainage/cleanup of stagnant water. - Provide for the provision of appropriately stocked first-aid equipment at work sites; - Provide for the provision of appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets; - Provide training for workers for the use of PPE; - WB Group's Environment, Health and Safety (EHS) Guidelines (attached at the end of this document) will be implemented; - Include procedures for documenting and reporting accidents, diseases, and incidents; and - All safety precautions will be taken to address safety hazards for the nearby community. These precautions may include safety/warning signage, safety barrier around the construction site. - The construction contracts will include appropriate clauses to protect environment and public health. The present ESMF will be included in the bidding document.
Investment for the procurement of supplies and farm implements may contribute to affect environmental components e.g. Procurement and use of adulterated pesticides; Excessive use of chemical Fertilizer; Congregation of livestock near water point and risk of nitrate pollution from their droppings.	Following measures shall be employed to ensure sustainability of the interventions: - Judicious use of the irrigation water, chemical inputs and use of alternate techniques (such as integrated pest management, using disease-resistant seeds, and mulching) will be promoted through awareness raising and capacity building initiatives. - Crop rotation practices will be promoted to avoid soil fertility degradation. - The capacity building program will also include safe handling of hazardous substances such as pesticides. - Banned and adulterated pesticide list will be disseminated to farmers and awareness will be given via FFS.

6.4.3. Impact related to Subproject Exclusions (Not financed under MSAN) and Mitigation Measures

Subproject Exclusions (i.e. not financed under MSAN) are mostly comprising soft components i.e.:

- Toilets constructed by communities after awareness raising program
- Sludge management by communities using the toilets
- Use of farm implements including pesticides and fertilizers by communities
- Kitchen Gardens / Livestock pens / Fish ponds commercially developed by communities

Following Potential cases may occur which will compromise the sustainability of the interventions and may impact the environment:

Impacts	Mitigation Measures
Saaf Suthro Sindh (SSS)	
After behavior change activities, households willing to construct toilets may not build such structures which are environmentally/socially suitable and pose more threat/impact to the locality as compared to open defecation e.g. 1. uncovered open pits attracting vector; 2. after filling of pit/septic tank, it will not be emptied and drainage pipe from the latrine will be diverted in the open land contaminating nearby property and attract vector; 3. Sludge from emptied pit/septic tank will be dumped in the open, water body or someone's property leading to contamination / conflict; 4. septic tank/pit/drainage field will be constructed on another property creating a conflict situation; 5. drainage fields / soakage pits located too close to water bodies/ water table etc. 6. Groundwater depletion caused due to over pumping of water used in flush toilets 7. Public health risks may arise from system failure for example, from excessive visits, and high sludge build up requiring removal and disposal Constructed/Rehabilitated toilets in schools may not be maintained properly and left unattended from repair / emptying the tanks etc.	Following measures shall be employed to ensure sustainability of the interventions: - During behavior change activities in the communities, environment friendly designs of toilets (suitable for that specific area) will be disseminated within the communities as a guide and unfriendly design impacts shall be communicated (see **Annex I**). - Monitoring shall be made during project life cycle to check the sustainability of implemented interventions. - Flush toilets should not be encouraged in areas under the project where water is scarce and in dry season. - Sludge Management should be made part ESMPs of each sub-project. Sludge after emptying the tanks/pits should be landfilled at proper location and left for degradation. - During behavior change activities in the communities, this aspect will be communicated and awareness raising workshops will be conducted with the communities.
Agriculture for Nutrition (A4N)	
Health and Safety Hazards for farmers	- Awareness and capacity building regarding Material Safety Data Sheet (MSDS) for each hazardous substance (pesticides and fertilizers) will be promoted. - WB Group's EHS Guidelines will be implemented as appropriate.
Employment	- Preference will be given to the landless farmers. - The capacity building component of the project will include trainings for operation and maintenance of

	the subproject facilities for supply chains and post-harvest loss control. - GRM will be put in place to amicably resolve any disputes or conflicts related to employment and service provision.
Impacts on Women, Children, and Vulnerable Groups	- The project will generally benefit the households, in addition to improve the sanitary conditions as well as access to nutritious diet. Also supporting for the local community (landless farmers) in agriculture under A4N investment fund. - Women's participation is already included in project interventions like development Female farmer field schools (F3S), focusing on women as the main agriculture producers. - Lady Extension Workers (LEW) will be engaged as contingent staff for short period, so as, to work with women beneficiaries. (PC-I of A4N) - Environmental screening checklist will provide first stage information about impacts on poor, women and other vulnerable groups including needs and priority for social and economic betterment; - IPs and TSPs will ensure the active participation of women in project interventions as well as adequately consulted. - Ensure participation of vulnerable groups in project activities through consultations, to ensure planned investments take the well-being of such groups into consideration

Chapter 7 ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

This Chapter presents the Environmental and Social Management Framework (ESMF) for the proposed project.

7.1. Environmental Safeguards Processing Steps

Implementation of environmental requirements will follow the following steps closely linking with activity planning, design and implementation steps.

- Step 1: Preliminary Environmental Information and Analysis
- Step 2: Preparing Environmental Assessment/or Environmental Management Plan
- Step 4: Environmental Clearances
- Step 5: Inclusion of Environmental Specifications and Environmental Management Plan in bid documents
- Step 7: Environmental Method Statements (for large investments)
- Step 6: Compliance and Monitoring

Based on type of construction required, all preliminary information analysis, Environmental Assessments, Environmental Management Plans must be completed prior to awarding of contracts for construction.

7.2. Subproject Screening

All activities proposed for the project shall undergo initial screening through a number of filters that include screening environmental and social impacts. Generally, subprojects with any significant, long-term or medium term, irreversible environmental and social negative impacts will have avoided to the extent possible.

The ESMF categorizes subprojects on the basis of their nature of activities, and potential impacts on environment and or people. The ESMF specifies a different type and extent of environmental and social assessment that will need to be carried out before initiating each category of subprojects.

Since exact extent, and precise location of individual interventions (subprojects) to be implemented under the Multi-Sectoral Action for Nutrition (MSAN) Project are not known at this stage, a framework approach has been adopted for the present environmental and social assessment. Under this approach, each subproject will be screened for the severity and extent of environmental and social impacts. Subprojects having negligible environmental and or social impacts will be assessed with the help of a rapid assessment checklist included in **Annex C & D**. Subprojects having some negative but localized environmental and or social impacts will require a generic Environmental and Social Management Plans (ESMPs) to be prepared as presented in **section 7.4**. Also the RPF will only apply to interventions where land may be acquired for small-scale interventions if land (other than agriculture department land) will be needed that cannot be acquired through VLD procedures. Please refer Chapter 8.

7.3. Institutional Arrangements

Project Directors (PD) of SSS and A4N will be overall responsible for the implementation of ESMF compliance throughout the project. Project Coordinator/ Deputy Director will coordinate with the

Implementing Partners / technical support partners (IPs/TSPs) and the District Coordination Committee (DCC) of each district will take the prime responsibility to ensure the ESMF implementation across the district and reports to the PD. Environmental Specialists (ES) and Social Specialists (SS) will be hired by the PD under Sanitation / agriculture Directorates, who will assist PD to implement ESMF in letter and spirit (The TORs of ES/SS are presented in **Annex P**). Both specialist will directly be responsible for subproject screening, development of subproject specific ESMPs and their implementation, internal monitoring and progress reporting. Environmental and Social Focal Persons (ESFPs) will be designated by the DCC for each district for the implementation of Environmental and social/resettlement issues, addressing grievances, conduct stakeholders consultations and coordination and reporting to Project Coordinator/ Deputy Director. IPs/TSPs will support community participation, consultations and other social activities from the sub-project identification to completion stage.

Table 7.1 shows each position and its responsibilities under proposed implementation framework:

Table 7.1: SSS implementation framework Responsibilities

S#	Position	Responsibilities
1.	Directorate of Sanitation	- PD will be overall responsible for ensuring the ESMF compliance throughout the project - PD will ensure transparent and cost effective monitoring - PD can engage other specialists and/or firms to carry out external monitoring as third party validation
2.	Project Coordinator	- Coordinate with the IPs and the District DC/ESFP to ensure the proper ESMF implementation across the board and reports to the PD
3.	Environmental and Social Specialists	- The Environmental specialist & Social specialist will be directly responsible for subproject screening, development of subproject specific ESMPs and RAPs and their implementation, internal monitoring and progress reporting - Environmental specialist and Social specialist will assist district ESFP in monitoring the effective ESMF implementation - Environmental specialist and social specialist will also execute the training programs under capacity building - They will also be responsible for preparing the reports for each training conducted by various project units
4.	District Coordination Committee (DCC)	- **An Environmental and Social Focal Person (ESFP)** will be designated by the DCC for the implementation of Environmental and social/resettlement issues, addressing grievances, conduct stakeholders consultations and coordination and reporting to Project Coordinator/DC - ESFP will be responsible for the implementation of capacity building training plan - ESFP will document the implementation of training plan and ESMF process
5.	District Monitoring Unit (DMU)	- District Monitoring & Evaluation Unit will responsible for effective monitoring in the district - ESFP will carry out monitoring of ESMF in the district and will conduct regular field visits
6.	Village Development Committee	- Village Officer (VO) will responsible for mobile monitoring. Mobile monitoring will be linked to NGOs, ADLG, DC and PD.
7.	Implementing Partners	- Supports community participation, consultations and other social activities from the sub-project identification to completion stage - ES and SS hired by IPs, under the supervision of ESFPs, will ensure the ESMF adherence and monitoring at field level - IP will be responsible to provide capacity building trainings to their field staff and workers - IP will document the trainings

Figure 7.1 presents the overall ESMF implementation framework for SSS.

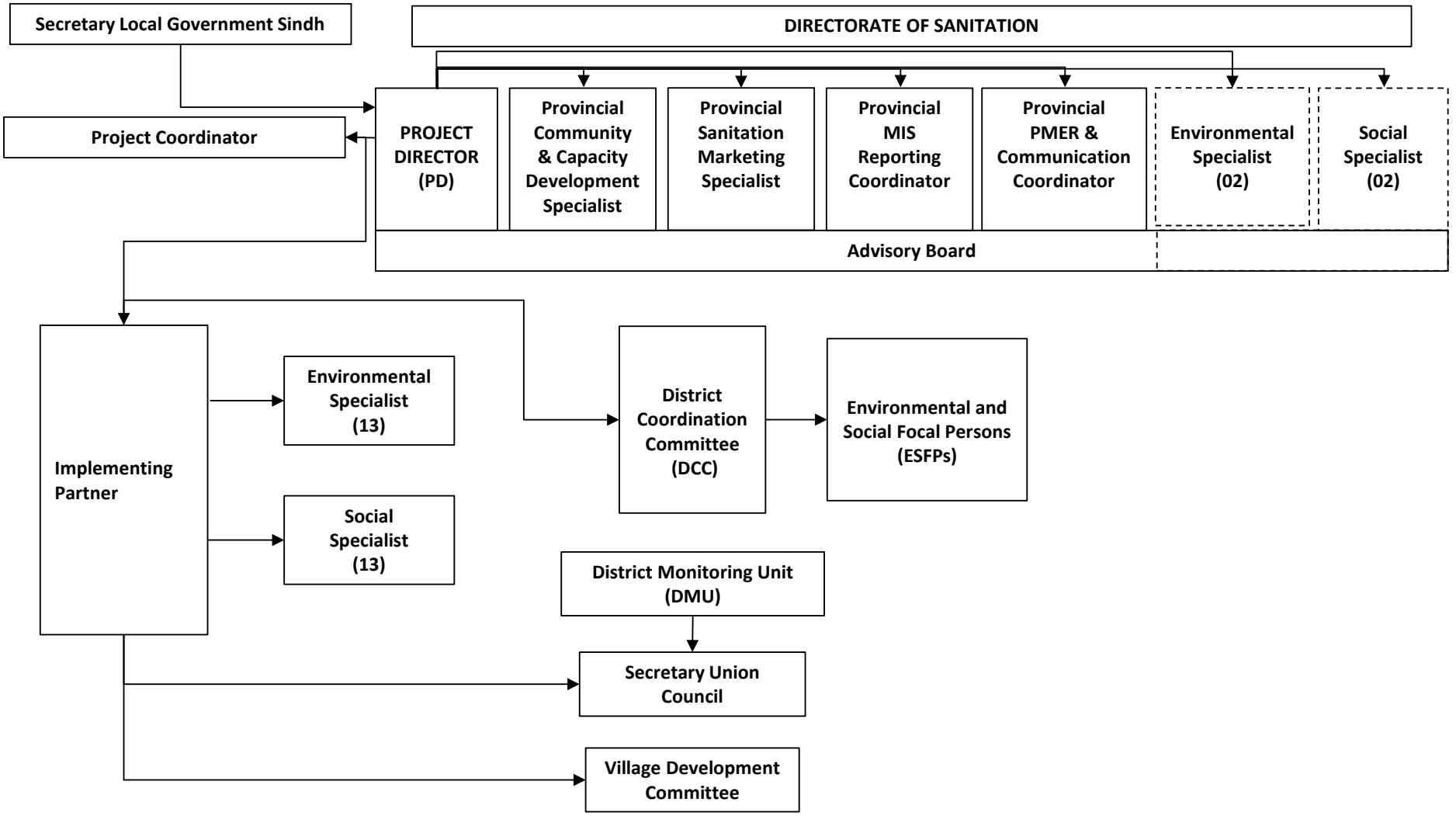


Figure 7.1: Overall ESMF Implementation Framework for SSS

Table 7.2 shows each position and its responsibilities under proposed implementation framework:

Table 7.2: A4N implementation framework Responsibilities

S#	Position	Responsibilities
1.	Project Director (PD)	- PD will be overall responsible for ensuring the ESMF compliance throughout the project including IPMP - Oversee preparation of annual, monthly and quarterly monitoring reports - PD will ensure transparent and cost effective monitoring - PD can engage other specialists and/or firms to carry out external monitoring as third party validation - Prepare Project specific IPMP with assistance of D. Director (Agriculture)
2.	District Nutrition Coordination Committee (DNCC)	- An Environmental and Social Focal Person (ESFP) will be designated by DNCC for the implementation of Environmental and social/resettlement issues, addressing grievances, conduct stakeholder's consultations and coordination and reporting to Project Coordinator/DC - ESFP will be responsible for the implementation of capacity building training plan for agriculture section - ESFP will document the implementation of training plan and ESMF process
3.	D. Director (Agriculture)	- Coordinate with the TSP and the District agriculture officer/ESFP to ensure the proper ESMF implementation across the board and reports to the D.PD (agri.)
4.	D. Director (Livestock & F.)	- Coordinate with the TSP and the District livestock officer/ESFP to ensure the proper ESMF implementation across the board and reports to the D.PD (livestock)
5.	Environmental and Social Specialists (Agriculture)	- The Environmental specialist & Social specialist will be directly responsible for subproject screening, development of subproject specific ESMPs and RAPs and their implementation, internal monitoring and progress reporting for the Agriculture section of A4N - Environmental specialist and Social specialist will assist district ESFP in monitoring the effective ESMF implementation - Environmental specialist and social specialist will also execute the training programs under capacity building - They will also be responsible for preparing the reports for each training conducted by various project units
6.	Environmental and Social Specialists (Livestock)	- The Environmental specialist & Social specialist will be directly responsible for subproject screening, development of subproject specific ESMPs and RAPs and their implementation, internal monitoring and progress reporting for the Livestock section of A4N - Environmental specialist and Social specialist will assist district ESFP in monitoring the effective ESMF implementation - Environmental specialist and social specialist will also execute the training programs under capacity building - They will also be responsible for preparing the reports for each training conducted by various project units
7.	IPM Managers	- placed at the district headquarters level for each district to for the implementation of IPMP
8.	Technical Support Partner (TSP)	- Supports community participation, consultations and other social activities from the sub-project identification to completion stage - ES and SS hired by TSP, under the supervision of ESFPs, will ensure the ESMF adherence and monitoring at field level in each district. - ES and SS hired by TSP will be responsible to provide capacity building trainings to their field staff and workers - ES and SS will document the trainings

Figure 7.2 presents the overall ESMF implementation framework for A4N.

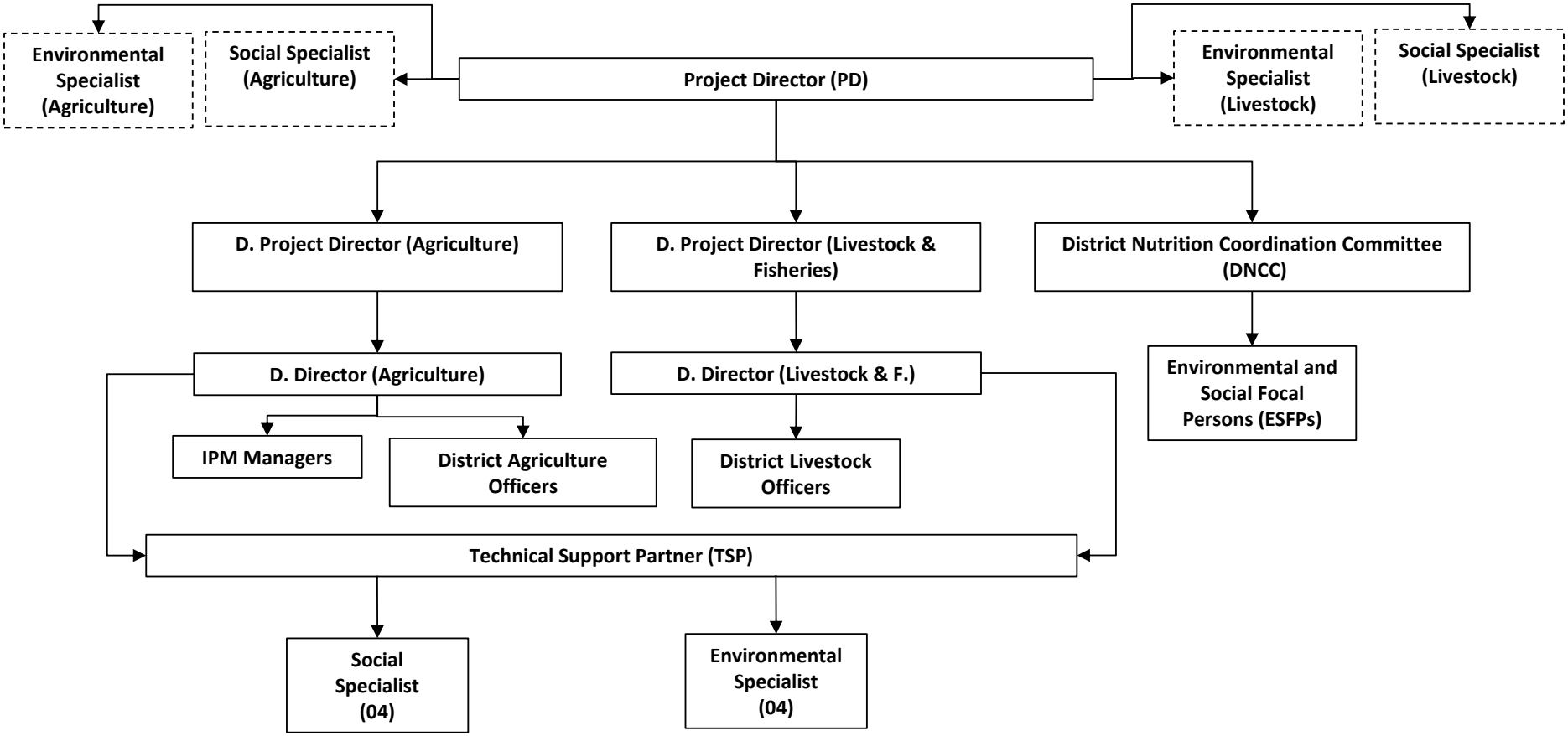


Figure 7.2: Overall ESMF Implementation Framework for A4N

7.4. Generic Environmental and Social Management Plan

The subproject-specific ESMP shall form part of the project contract specifications. However the below table (Table 7.3) will separately present generic ESMPs for subproject for which anticipated environmental impact may occur 1) Improvement/rehabilitation/construction of toilets/pit latrines in 2600 schools with hand washing facilities, 2) Toilet constructed and managed by communities and 3) Introduction and use of farm implements by communities.

1. Improvement/rehabilitation/construction of toilets/pit latrines in 2600 Schools

Table 7.3: Generic Environmental and Social Management Plan

S#	Anticipated Effect	Mitigation Measure(s)	Monitoring	Responsibility	Schedule	Cost and Source of Funds
1.	Air Quality deterioration due to dust emissions	✓Tractor loads should be covered with any suitable material.	Inspect Truck/tractor mobility	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
		✓Soil and temporary spoil piles should be covered or sprayed with water if generating dust.	Inspect construction site	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
		✓Latrine Construction sites including Soil piles in schools should be fenced to avoid material escape, generation of dust and access to children.	Inspect fencing	ES/SS of IPs report to ESFPs	During Construction of toilets	Rs.2,000 per fencing x 2,600 schools = Rs.5,200,000
2.	Surface and Ground Water Quality deterioration due to runoff from school toilets during operation	✓It will be ensured that the wastes are not released into any drinking water source, cultivation fields, or critical habitat.	Inspect discharge points of school toilets	ES/SS of IPs report to ESFPs	During operation of toilets and hand washing facilities	Nil
		✓Effluents from the construction sites will not be released to drinking water sources, cultivation fields, irrigation channels, and critical habitats. Appropriate effluent treatment arrangements such as settling tanks will be made at the site.	Inspect construction site	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
3.	Solid Waste Management for school toilets during construction and operation	✓Construction sites should be equipped with temporary refuse bins.	Inspect placement of refuse bins	ES/SS of IPs report to ESFPs	During Construction of toilets	Rs.1,000 x 2,600 schools = Rs.2,912,000
		✓Disposal of solid waste will be carried out in a manner that does not negatively affect the drinking water sources, cultivation fields, irrigation channels, natural drainage paths, the existing	Inspect waste disposal	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil

Table 7.3: Generic Environmental and Social Management Plan

S#	Anticipated Effect	Mitigation Measure(s)	Monitoring	Responsibility	Schedule	Cost and Source of Funds
		waste management system in the area, local routes, and general aesthetic value of the area.				
		✓Wastes should be routinely collected from the designated area and disposed at waste disposal facilities.	Inspect waste disposal	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
4.	Possible Noise emissions from running of construction machinery	✓Machinery operation and high noise activities should be carefully planned and scheduled.	Inspect construction activities near communities	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
		✓Where that is not possible, high noise activities should cease between 22:00 and 06:00 hrs.	Inspect working hours	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
5.	Occupational Health and Safety	✓WB Group's Environment, Health and Safety (EHS) Guidelines (attached at the end of this document) will be implemented	Audit WB EHS guidelines provisions	ES/SS of Directorate	During Construction of toilets	Nil
		✓The construction contracts will include appropriate clauses to protect environment and public health. The present ESMF will be included in the bidding document.	Inspect bidding documents	ES/SS of Directorate	During Construction of toilets	Nil
		✓Avoid stagnation of water and initiate drainage/cleanup of stagnant water.	Inspect construction site	ES/SS of IPs report to ESFPs	During Construction of toilets	Nil
		✓Provide for the provision of appropriately stocked first-aid equipment at work sites;	Inspect First aid provision	ES/SS of IPs report to ESFPs	During Construction of toilets	Rs.1,000 x 2,600 schools = Rs.2,912,000
		✓Provide for the provision of appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets;	Inspect PPE provision	ES/SS of IPs report to ESFPs	During Construction of toilets	For each school site, 5 workers will be utilized, so 5 x 2,600 = 13,000 PPE, each sets = Rs.6,000

Table 7.3: Generic Environmental and Social Management Plan						
S#	**Anticipated Effect**	**Mitigation Measure(s)**	**Monitoring**	**Responsibility**	**Schedule**	**Cost and Source of Funds**
		✓Provide training for workers for the use of PPE;	Check training records	ES/SS of Directorate	During Construction of toilets	Biannually, 4-day workshop @ Rs.15,000 per workshop inc. expenses
		✓Include procedures for documenting and reporting accidents, diseases, and incidents.	Check procedures	ES/SS of Directorate	During Construction of toilets	Nil

2. Toilet construction and management by communities

	Anticipated Effect	**Mitigation Measure(s)**	**Monitoring**	**Responsibility**	**Schedule**	**Cost and Source of Funds**
1.	Unsuitable toilet construction may lead to water contamination	✓During behavior change activities in the communities, environment friendly designs of toilets (suitable for that specific area) will be disseminated within the communities as a guide and unfriendly design impacts shall be communicated. ✓Monitoring shall be made during project life cycle to check the sustainability of implemented interventions. ✓Flush toilets should not be encouraged in areas under the project where water is scarce and in dry season.	Check and Inspect sustainability	IPs/VOs	During course of project	Behavior change activities included in project cost
2.	Pit/septic tank Sludge Management	✓Composting of biodegradable waste will be considered and adopted. Sludge after emptying the tanks/pits should be landfilled at proper location and left for degradation. ✓Sludge will not be disposed of into open land ✓During behavior change activities in the communities, this aspect will be communicated and awareness raising workshops will be conducted in communities.	Check and Inspect sustainability	IPs/VOs	During course of project	Behavior change activities included in project cost

	Anticipated Effect	Mitigation Measure(s)	Monitoring	Responsibility	Schedule	Cost and Source of Funds
3.	Surface and Ground Water Quality deterioration due to runoff from community toilets	✓It will be ensured through consultation and awareness that the wastes are not released into any drinking water source, cultivation fields, or critical habitat.	IP/VO	ESFP	During course of project	Awareness raising activities are included in project cost
4.	Impacts on Women, Children, and Vulnerable Groups	✓It will be ensured that the subprojects do not have any negative impacts on women, children and vulnerable groups.	FFS/IP/VO/ beneficiary	ESFP	During course of project	Nil

3. Introduction and use of farm implements by communities

	Anticipated Effect	Mitigation Measure(s)	Monitoring	Responsibility	Schedule	Cost and Source of Funds
1.	Use of Adulterated/ banned Pesticide	✓Banned and adulterated pesticide list will be disseminated to farmers and awareness will be given via FFS. ✓Judicious use of the irrigation water, chemical inputs and use of alternate techniques (such as integrated pest management, using disease-resistant seeds, and mulching) will be promoted through awareness raising and capacity building initiatives. ✓Crop rotation practices will be promoted to avoid soil fertility degradation. ✓The capacity building program will also include safe handling of hazardous substances such as pesticides.	Inspect community areas where farm implements are applied	TSPs report to ESFPs	During course of project	Capacity building and training to farmer through FFS included in project cost
2.	Water Conservation	✓High efficiency irrigation technologies (e.g. tunnel farming) will be promoted to conserve already scarce irrigation water.	Inspect water scarce areas	TSPs report to ESFPs	During course of project	Cost of farm implements included in project cost
3.	Health and Safety Hazards for the farmers	✓Awareness and capacity building regarding Material Safety Data Sheet (MSDS) for each hazardous substance will be promoted.	Inspect community areas where farm implements are applied	TSPs report to ESFPs	During course of project	Rs.15,000 per workshop inc. expenses included in ESMF budget

	Anticipated Effect	Mitigation Measure(s)	Monitoring	Responsibility	Schedule	Cost and Source of Funds
		✓Awareness and capacity building for use of appropriate personal protective equipment (PPE) will be mandatory while using pesticides.	Inspect community areas where farm implements are applied	TSPs report to ESFPs	During course of project	As above.
		✓WB Group's EHS Guidelines will be implemented as appropriate.	Inspect community areas where farm implements are applied	TSPs report to ESFPs	During course of project	Nil
4.	Surface and Ground Water Quality deterioration due to runoff	Following measures will be disseminated to Farmers via FFS and F3S: ✓Waste effluents will be released in irrigation channels only if they do not negatively affect the irrigation water quality. ✓Use of Bio-pesticides will be encouraged ✓Use of Organic fertilizer will be encouraged ✓IPM as part of A4N subcomponent will be implemented ✓Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. Crops are arranged to that a strip of grass or close-growing crop is alternated with a clean-tilled crop or fallow. ✓Organic debris produced by harvesting is easily mineralized into leachable N. Steps to reduce leachable N includes planting of "green manure" crops, and delaying ploughing of straw, roots and leaves into the soil.	Inspect community areas where farm implements are applied	TSPs report to ESFPs	During course of project	Nil
5.	Impacts on Women, Children, and Vulnerable Groups	✓It will be ensured that the subprojects do not have any negative impacts on women, children and vulnerable groups.	FFS/IP/VO/ beneficiary	ESFP	During course of project	Nil
6.	Employment	✓Preference will be given to the landless farmers. ✓The capacity building component of the project will include trainings for operation and maintenance of the subproject facilities for supply chains and post-harvest loss control. ✓GRM will be put in place to amicably resolve any disputes or conflicts related to employment and service provision.	FFS/IP/VO/ beneficiary/ Contractor	ESFP	During course of project	Nil

7.5. Environmental and Social Mitigation and Monitoring Plan

The generic mitigation plan prepared on the basis of impact assessment discussed in the previous section is presented in Table 7.4. The subproject-specific mitigation plans will be implemented in combination with the generic mitigation plan. These mitigation plans will be expanded if needed and finalized once the subproject location is known. These plans will also be included in the subproject ESMPs. The relevant mitigation plans and also the site-specific ESMP will be included in the design of each subproject, and included in the bidding documents in case contracting is involved.

Table 7.4: ESMF Mitigation and Monitoring Plan

	Environmental /Social Impact/Issue	Potential Significance	Location	Mitigation Actions	Frequency of Intervention	Responsibility	
						Implementation	Monitoring
Anticipated Subprojects (financed under MSAN project)							
1.	Subproject Siting to any sensitive area	Medium	At subproject location under SSS and A4N	✓It will be ensured through screening checklist (sample presented in **Annex C&D**) that the subproject avoids any ecologically sensitive areas, PCRs and involuntary resettlement. ✓Involuntary Resettlement Screening Checklist as presented in **Annex D** to be used to check the land belong to the school or government land and free from any disputes. ✓Village Organizations and LGD officials will be taken onboard for the identification construction site in schools. ✓The subprojects will be established on the land owned by Agriculture department. However, private land if acquired will be through VLD procedure. If VLD will not be possible, the RPF as part of this report will be applied. ✓Complete documentation will be maintained for VLD. ✓Valuation and compensation of affected assets of community should be in line with RPF/Sub-projects RAPs and considered before the field activities. ✓Community consultations will be carried out before establishing the sites.	Before the start of each subproject	ES and SS from IPs/ TSPs	ES and SS Directorate
2.	Air Quality deterioration due to dust emissions	Low	Toilet construction site in schools	✓Construction machinery, generators, and vehicles will be kept in good working condition, minimizing exhaust emissions.	During Construction of toilets	Contractor under supervision of Directorates	ESFP

Table 7.4: ESMF Mitigation and Monitoring Plan

	Environmental /Social Impact/Issue	Potential Significance	Location	Mitigation Actions	Frequency of Intervention	Responsibility	
						Implementation	Monitoring
				✓Truck/tractor loads should be covered with suitable material. ✓Soil and temporary spoil piles should be covered or sprayed with water to avoid generating dust. ✓Latrine Construction sites including Soil piles in schools should be barricaded to avoid material escape, generation of dust and access to children.			
3.	Water Consumption and Conservation	Low	At demonstration plots under A4N	✓Use of compost, or decomposed organic matter as fertilizer, has been found to improve soil structure, increasing its water-holding capacity.	During development of demonstration plots	FFS/IP/VO	ESFP
4.	Surface and Ground Water Quality deterioration	Low	Toilet construction site in schools & at demonstration plots under A4N	✓It will be ensured that the wastes are not released into any drinking water source, irrigation channels, cultivation fields, or critical habitat. ✓Effluents from the construction sites will not be released to drinking water sources, cultivation fields, irrigation channels, and critical habitats. Appropriate effluent treatment arrangements such as settling tanks will be made at the site. ✓Use of Bio-pesticides will be encouraged ✓Use of Organic fertilizer will be encouraged ✓IPM as part of A4N sub-component will be implemented ✓Growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. Crops are arranged to that a strip of grass or close-growing crop is alternated with a clean-tilled crop or fallow. ✓Organic debris produced by harvesting is easily mineralized into leachable Nitrogen. Steps to reduce leachable N includes planting of "green manure" crops, and delaying ploughing of straw, roots and leaves into the soil.	During development of toilets and hand washing facilities and demonstration plots	FFS/IP/VO	ESFP

Table 7.4: ESMF Mitigation and Monitoring Plan

	Environmental /Social Impact/Issue	Potential Significance	Location	Mitigation Actions	Frequency of Intervention	Responsibility	
						Implementation	Monitoring
5.	Solid Waste Management	Low	Pits connected with Toilet in schools & at cattle pens in demonstration plots under A4N	✓Recycling of solid waste will be carried out as far as possible and practical. ✓Composting of biodegradable waste will be considered and adopted. ✓Disposal of solid waste will be carried out in a manner that does not negatively affect the drinking water sources, cultivation fields, irrigation channels, natural drainage paths, the existing waste management system in the area, local routes, and general aesthetic value of the area. ✓Construction sites should be equipped with temporary refuse bins. ✓Wastes should be routinely collected from the designated area and disposed at waste disposal facilities.	after toilet development and demonstration plots	Contractor under supervision of Directorates	ESFP
6.	Noise	Low	Toilet construction site in schools	✓Machinery operation and high noise activities should be carefully planned and scheduled. ✓Where that is not possible, high noise activities should cease between 22:00 and 06:00 hrs.	During development of toilets and hand washing facilities	Contractor under supervision of Directorates	ESFP
7.	Occupational Health and Safety	Low	Toilet construction site in schools & at demonstration plots under A4N	✓WB Group's Environment, Health and Safety (EHS) Guidelines (attached at the end of this document) will be implemented ✓The construction contracts will include appropriate clauses to protect environment and public health. The present ESMF will be included in the bidding document. ✓Avoid stagnation of water and initiate drainage/cleanup of stagnant water. ✓Provide for the provision of appropriately stocked first-aid equipment at work sites; ✓Provide for the provision of appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets; ✓Provide training for workers for the use of PPE;	Construction phase	Contractor under supervision of Directorates / IP	ESFP

Table 7.4: ESMF Mitigation and Monitoring Plan

	Environmental /Social Impact/Issue	Potential Significance	Location	Mitigation Actions	Frequency of Intervention	Responsibility	
						Implementation	Monitoring
				✓WB Group's Environment, Health and Safety (EHS) Guidelines (attached at the end of this document) will be implemented; ✓Include procedures for documenting and reporting accidents, diseases, and incidents.			
8.	Labor Issues	Low	Toilet construction site in schools & at demonstration plots under A4N	✓Preference will be given to labor from locally skilled and unskilled workers of community for the construction of toilets in schools. ✓PD and SS under directorates will ensure that certain clauses will be added in the contract documents of IPs i.e. not to force labor to work and official minimum wages to be paid if the laborers are contracted by the community. ✓Consultation with labor will be ensured by IPs and ESFPs.	Construction phase	Contractor under supervision of Directorates / IP	ESFP
Subproject Exclusions (Not financed under MSAN)							
9.	Unsuitable toilet construction may lead to water contamination	Low	All project districts	✓During behavior change activities in the communities, environment friendly designs of toilets (suitable for that specific area) will be disseminated within the communities as a guide and unfriendly design impacts shall be communicated. (See **Annex I**) ✓Monitoring shall be made during project life cycle to check the sustainability of implemented interventions. ✓Flush toilets should not be encouraged in areas under the project where water is scarce and in dry season. It will be ensured to provide these site specific provisions in toilets construction guidelines by the project implementation unit. (See **Annex I**)	During course of project	FFS/IP/VO	ESFP
10.	Pit/septic tank Sludge Management	Medium	All project districts	✓Sludge Management should be made part ESMPs of each sub-project. Sludge after emptying the tanks/pits should be landfilled at proper location and left for degradation. ✓During behavior change activities in the communities, this aspect will be communicated and awareness raising workshops will be conducted in communities.	During course of project	FFS/IP/VO/ beneficiary	ESFP

Table 7.4: ESMF Mitigation and Monitoring Plan

	Environmental /Social Impact/Issue	Potential Significance	Location	Mitigation Actions	Frequency of Intervention	Responsibility	
						Implementation	Monitoring
11.	Use of Adulterated/ banned Pesticide	Medium	All project districts under A4N	✓Judicious use of the irrigation water, chemical inputs and use of alternate techniques (such as integrated pest management, using disease-resistant seeds, and mulching) will be promoted through awareness raising and capacity building initiatives. ✓Crop rotation practices will be promoted to avoid soil fertility degradation. ✓The capacity building program will also include safe handling of hazardous substances such as pesticides.	During course of project	FFS/IP/VO/ beneficiary	ESFP
12.	Excessive use of chemical Fertilizer	Low	All project districts under A4N	✓High efficiency irrigation technologies (e.g. tunnel farming) which is included one of the interventions of A4N component will be promoted to conserve already scarce irrigation water. ES of IP and ES from directorates will ensure to promote it in above areas after filling environmental checklists and incorporated in the FFS scope.	During course of project	FFS/IP/VO/ beneficiary	ESFP
13.	Health and Safety Hazards for the farmers	Low	All project districts under A4N	✓Awareness and capacity building regarding Material Safety Data Sheet (MSDS) for each hazardous substance will be promoted. ✓WB Group's EHS Guidelines will be implemented as appropriate. ✓Use of appropriate personal protective equipment (PPE) will be mandatory while using pesticides.	During course of project	FFS/IP/VO/ beneficiary	ESFP
14.	Impacts on Women, Children, and Vulnerable Groups	Low	All project districts	✓Women's participation is already included in project interventions like development Female farmer field schools (F3S), construction of girl toilets, focusing on women as the main agriculture producers. ✓Lady Extension Workers (LEW) will be engaged as contingent staff for short period, so as, to work with women beneficiaries. (PC-I of A4N) ✓Environmental screening checklist will provide first stage information about impacts on poor, women and other vulnerable groups including needs and priority for social and economic betterment;	During course of project	FFS/IP/VO/ beneficiary	ESFP

Table 7.4: ESMF Mitigation and Monitoring Plan

	Environmental /Social Impact/Issue	Potential Significance	Location	Mitigation Actions	Frequency of Intervention	Responsibility	
						Implementation	Monitoring
				✓IPs and TSPs will ensure the active participation of women in project interventions as well as adequately consulted. ✓In awareness raising under SSS, women share should be more compared to men. ✓Ensure participation of vulnerable groups in project activities through consultations, to ensure planned investments take the well-being of such groups into consideration			
15.	Employment	Low	All project districts	✓Preference will be given to the landless farmers. ✓The capacity building component of the project will include trainings for operation and maintenance of the subproject facilities for supply chains and post-harvest loss control. ✓GRM will be put in place to amicably resolve any disputes or conflicts related to employment and service provision.	During course of project	FFS/IP/VO/ beneficiary/ Contractor	ESFP

7.6. Monitoring Framework

7.6.1. Internal Monitoring

ESMF monitoring will be carried out to ensure that the mitigation plans are regularly and effectively implemented. It will be carried out at three levels. The directorate level, district level and at field level. At the directorate level, the environment and social specialists will carry out ESMF monitoring to ensure that the mitigation plans are being effectively implemented, and will conduct field visits on a regular basis. The district monitoring unit (DMU) and District nutrition coordination committee (DNCC) will also be responsible for ESMF implementation monitoring and evaluation. Monitoring checklists will be prepared and the subproject-specific mitigation plans included in the ESMPs. IPs and TSPs will carry out monitoring at field level.

The DMU and DNCC will also conduct consultation with communities especially women. Monitoring checklists will be prepared and the subproject-specific mitigation plans included in the ESMPs.

Table 7.5: Monitoring Levels and Responsibility

Level	Responsibility	Monitoring Tasks
Internal Monitoring		
Directorate Level	Environment and social specialists	ESMF monitoring to ensure that the mitigation plans are being effectively implemented, and will conduct field visits on a regular basis
District Level	ESFPs supervised by District monitoring unit (DMU) and District nutrition coordination committee (DNCC)	ESMF implementation monitoring and evaluation Consultation with communities especially women
Field Level	ES and SS hired by IPs/TSPs	Field level environmental and social aspects

7.6.2. Third Party Validation (TPV)

The project will engage Independent Environmental and Social Monitoring Consultant (IESMC) (specialists/firms) as third party to conduct external monitoring as third party validation throughout the project execution. The IESMC scope includes but not limited to review the implementation status of mitigation measures in the ESMF, ESMPs, and Checklists, and the related documentation and to review the environmental and social monitoring regime as specified in the ESMF and ESMPs, review reports of monitoring carried out by ES/SS/ESFPs, identify non-compliances/gaps, and recommend changes, to improve monitoring mechanisms, if any. This will include providing feedback to improve integration of ESMF in the overall project implementation. IESMC will report on quarterly basis to the Directorates for further submission to WBG and other agencies. The ToRs of IESMC as presented in **Annex P**.

Below table presents the measures/activities to be monitored internally and externally during project lifecycle:

Table 7.6: ESMF Monitoring Framework

S#	Measures/Activities to be monitored	Monitoring						
		Internal						TPV (IESMC)
		Directorate Level	Freq.	District Level	Freq.	Field Level	Freq.	Freq.
Anticipated Subprojects (financed under MSAN project)								
1.	Subproject Siting to any sensitive area ✓Subproject siting ✓VLD procedures if applied and valuation and compensation of affected assets in line with RPF/Sub-projects RAP.	ES/SS of Directorate	Before siting of sub-project	ESFPs	Before siting of sub-project			Quarterly
2.	Air Quality deterioration due to dust emissions ✓Condition of construction machinery, generators, and vehicles in terms of exhaust emissions. ✓Covering and spraying of soil and temporary spoil piles. ✓Access to students of schools and disruption.			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
3.	Surface and Ground Water Quality deterioration ✓Wastewater disposal. ✓IMP measures			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
4.	Solid Waste Management ✓Collection, disposal and management of solid waste.			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
5.	Noise ✓Planning and scheduling of machinery operation and high noise activities.			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
6.	Occupational Health and Safety ✓Provisions of WB Group's Environment, Health and Safety (EHS) Guidelines ✓Signs of stagnation of water if any and site housekeeping. ✓Provision of appropriately stocked first-aid equipment and personal protective equipment (PPE); ✓Check Training records ✓Check accidents records.	ES/SS of Directorate	Monthly	ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
Subproject Exclusions (Not financed under MSAN)								
7.	Unsuitable toilet construction may lead to water contamination ✓Dissemination of environment friendly designs of toilets			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
8.	Pit/septic tank Sludge Management ✓Sludge Management by communities. ✓Awareness raising in communities.			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly

Table 7.6: ESMF Monitoring Framework

S#	Measures/Activities to be monitored	Monitoring						
		Internal						TPV (IESMC)
		Directorate Level	Freq.	District Level	Freq.	Field Level	Freq.	Freq.
9.	Use of Adulterated/ banned Pesticide ✓IPMP implementation.	ES/SS of Directorate	Monthly	ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
10.	Health and Safety Hazards for the farmers ✓Awareness and capacity building for farmers. ✓Use of PPE by the farmers.			ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
11.	Impacts on Women, Children, and Vulnerable Groups ✓Women's participation during project preparation and execution ✓Participation of vulnerable groups	ES/SS of Directorate	Monthly	ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly
12.	GRM Implementation	ES/SS of Directorate	Monthly	ESFPs	Weekly	ES/SS of IPs/TSPs	Daily	Quarterly

7.7. Training

To ensure the successful implementation of the environmental and social precautions and mitigation measures, a strengthening of relevant and fundamental competencies is essential. These trainings will lay the foundation of a self-sustainable outreach for the MSAN program and its facilitators.

The objectives of the environmental and social trainings include providing basic knowledge and information on the key environmental and social issues associated with the proposed interventions to the key project personnel including the ESFPs, Village Officers (VOs), and general project staff. Trainings of the project staff and project beneficiaries will be carried out for the environmental and social management of the subprojects.

7.7.1. Saaf Suthro Sindh (SSS)

A district wise overhauling of sanitation will require comprehensive trainings & demonstrations for successful implementation of both components under MSAN project & long-term sustainability. The environmental & social aspects identifications and mitigations integrated with the SSS training effort will equip the project facilitators for a keen sight of project component related environmental issues and their solutions. The trainings will include but not be limited on the subject of responsible social mobilization and eco-friendly approach for appropriate and feasible toilet construction with immediate and long term solutions for waste and waste water disposal.

Environmental specialist and social specialist under Sanitation Directorate will actually execute the training programs. They will also be responsible for preparing the reports for each of the trainings conducted by various project units. ESFPs will be responsible for the overall implementation of training plan at district level and will also ensure proper relevant documentation.

Additionally, IPs will be responsible to provide trainings to their field staff and workers under supervision of ESFPs and they will also document the trainings.

Table 7.7: Framework for Training under SSS

Description	Aspects to be Covered	Participants	Responsibility	Frequency
Environmental and social trainings	Environmental and social awareness; Key environmental and social issues associated with the project and subprojects ESMF findings; Subproject-specific ESMPs and their components; ESMP implementation; Subproject screening; Subproject monitoring and reporting; GRM; Community consultations.	ESFPs, district project staff	ESFPs with the assistance of Environment Specialist and Social Specialist	Quarterly
	ESMP implementation, OHS aspects	IP staff and workers	ESFPs	Biannually
Awareness raising	Best available techniques for construction of toilets; Environmentally sustainable toilet designs; Sludge management;	Subproject beneficiaries	ESFPs, Environmental/ Social Specialist	Monthly

	Wastewater management; Water Conservation; Waste disposal; Community mobilization.			

7.7.2. Agriculture for Nutrition (A4N)

The Components of A4N subproject presently include provisions for Training of the DOA and DOLF staff for promotion and implementation of nutrition sensitive agriculture (NSA). The Environmental and Social trainings can be synergized with the existing training programs of the subproject for a cost-effective and comprehensive exercise. The Subproject includes the development of an institutional capacity assessment building with framework, of which the Environmental and Social Aspects will be made an integral part of.

An institutional capacity assessment building with framework at the provincial district and union council levels will be developed for defining and implementing a capacity development plan. This is envisioned as a single contract to a technical service agency that would provide hand-holding support to DOA and DOLF throughout project implementation.

Environmental specialists and social specialists will also execute the training programs. They will also be responsible for preparing the reports for each of the trainings conducted by various project units.

ESFPs will be responsible for the implementation of capacity building training plan for agriculture & livestock sections and they will document the implementation of training plan.

TSP will be responsible to provide trainings to their field staff and workers under supervision of ESFPs. TSP will document the trainings.

Table 7.8: Framework for Training under A4N

Description	Aspects to be Covered	Participants	Responsibility	Frequency
Environmental and social trainings	Environmental and social awareness; Key environmental and social issues associated with the project and subprojects ESMF findings; Subproject-specific ESMPs and their components; Involuntary resettlement; GRM; Community consultations; ESMP implementation.	ESFPs, district project staff	ESFPs with the assistance of Environment Specialist and Social Specialist	Quarterly
	ESMP implementation, occupational health and safety (OHS) aspects of A4N subproject;	TSP staff and workers	TSP	Biannually
Awareness raising	Judicious use of fertilizers, pesticides and herbicides; Use of alternate techniques (such as IPM, using better seeds) to reduce the application of chemical inputs; Tunnel farming; Drip irrigation;	Subproject beneficiaries	ESFPs, Environmental Specialist	Monthly

	Safe handling and application of pesticides and herbicides and use of protective gear; Waste disposal; Community mobilization.			

Table 7.9: Key Aspects/Requirements of Trainings for various Group of Participants under ESMF-MSAN (SSS & A4N)

Training Aspects/Requirements for Various Groups of Participants	*Project Director(s), Deputy Project Director(s), Deputy Director(s)*	*Environmental and Social Specialist(s)*	*District Officer(s)/Deputy Commissioner(s)/District Coordination Committee(s)*	*Environmental and Social Focal Person(s)*	*Implementing Partners (IPs)/Technical Support Partners (TSPs)*	*Secretary Union Council(s)/Village Development Committee(s)*	*Project Beneficiaries*
Key environmental and social issues associated with the project and subprojects	**A**	**C**	**A**	**T**	**T**	**A**	**A**
Subproject-specific ESMPs and their components	**S**	**C**	**A**	**T**	**T**	**A**	**S**
ESMP implementation	**A**	**C**	**T**	**T**	**T**	**S**	**-**
Subproject screening	**S**	**T**	**A**	**T**	**T**	**A**	**-**
Subproject monitoring and reporting	**A**	**C**	**A**	**T**	**T**	**A**	**-**
GRM; Community consultations	**S**	**T**	**T**	**T**	**T**	**A**	**A**
Best available techniques for construction of toilets	**S**	**A**	**A**	**T**	**A**	**T**	**A**
Waste disposal and Water management	**S**	**A**	**T**	**T**	**T**	**A**	**A**
Judicious use of fertilizers, pesticides and herbicides, IPM and other techniques	**A**	**C**	**T**	**T**	**T**	**A**	**A**
Ability to identify and incorporate mitigation measures provided in ESMF	**A**	**C**	**A**	**T**	**T**	**A**	**-**
Ability to oversee the supervision and monitoring to ensure compliance with ESMF	**A**	**T**	**T**	**T**	**S**	**S**	**-**
Ability to review environmental/social reports (Progress reports)	**A**	**C**	**T**	**A**	**A**	**S**	**-**
Ability to monitor and supervise work at the district level	**S**	**S**	**T**	**T**	**T**	**S**	**-**
Ability to capture and report on environmental/social issues outlined in ESMF	**S**	**S**	**T**	**T**	**T**	**A**	**S**
Assessment of Environmental and Social Progress in accordance with ESMF	**A**	**C**	**T**	**T**	**T**	**S**	**-**

*Legend: **T** = Detailed training, **C** = Capacity-strengthening, **S** = Sensitization to the issues, **A** = Awareness-raising*

7.8. Disclosure of subprojects Information

The ESMF shall be uploaded on the project websites, hard copies shall be sent to all institutional stakeholders and all regional offices. The ESMF shall be disclosed internally within the Bank and shall be released in InfoShop. Before start of physical works on the project, the ESMF shall be translated in national / local

languages and shall be communicated to stakeholder communities and will be uploaded on the Project Directorates websites. The subproject specific ESMPs, RAPs and PMPs will also be disclosed and available on official websites of Project Directorates.

7.9. Reporting and Documentation

A robust reporting mechanism can enable project progress to be followed up, any prevalent hindrances to program implementation to be identified and rectification measures to be setup if so required. Such a system will allow project IPs/TSPs along with the Directorates to track the advancement of the program and reconcile these with the overall objectives and targets of the MSAN Project.

7.9.1. Reporting & Documentation for SSS

Regular and comprehensive reporting will be conducted during the course of the SSS subproject execution. The ESFPs will ensure a constant surveillance of the project progress and deliverables through preparation and submittal of these reports. This will include the following:

Table 7.10: Reporting Requirements under each component

S#	Type of Reporting	Frequency	Responsibility
1.	Visit Reports and consultation with communities including women (with photographs)	Weekly	Field staff and ESFPs
2.	environmental and social monitoring checklists	Weekly	Field staff and ESFPs
3.	Progress Reports	Quarterly	ESFPs
4.	TPV Reports	Quarterly	IESMC
5.	Training reports	Quarterly	ESFPs /
6.	Annual Reviews	Annually	ES/SS
7.	Project completion report	End of project completion	ES/SS

7.9.2. Reporting & Documentation for A4N

A reporting & documentation protocol is included in the A4N project cycle under Component D "Monitoring & Evaluation". The ESFP under supervision of ES/SS will integrate Environmental & Social review/ assessment in these reports. The table 7.7 will be used for reporting requirements under A4N.

7.9.3. Annual Reports

Local authorities are normally required to report annually on their Project activities during the preceding year. The ESMF specifies information to be included in these annual reports to capture experience with implementation of the ESMF procedures. The purpose of these reports is to provide:

- A record of Project and subproject transactions;
- A record of experience and issues running from year-to-year throughout the Project that can be used for identifying difficulties and improving performance; and
- Practical information for undertaking an annual review (see below).

7.9.4. Annual Reviews

This section of the ESMF describes the scope of work and procedures for carrying out annual reviews of the implementation of the ESMF and Project. It is expected that these reviews will be carried out by IESMC. The purpose of the reviews is two-fold:

- to assess compliance with ESMF procedures, learn lessons, and improve future ESMF performance; and
- to assess the occurrence of, and potential for, cumulative impacts due to Project-funded and other development activities.

The third-party annual reviews will be a principal source of information to Project management for improving performance, and to Bank supervision missions. Thus, they should be undertaken after the annual report has been prepared and before Bank supervision of the Project.

7.10. Consultation Framework

The stakeholder consultation is a continuous process, and should be carried out throughout the life of project. The consultations carried out during the present study and reported in this Chapter are essentially among the initial steps in this process. During the subsequent project phases as well, participation of the project stakeholders need to be ensured.

Table 7.8 charts out the proposed consultation framework during different project phases, while Figure 7.3 provides the conceptual framework employed during the stakeholder's consultation carried out as part of the present study. While the different stages identified in the figure are conceptually separate, in actual effect, many of them, (say individual and group consultations) often merge.

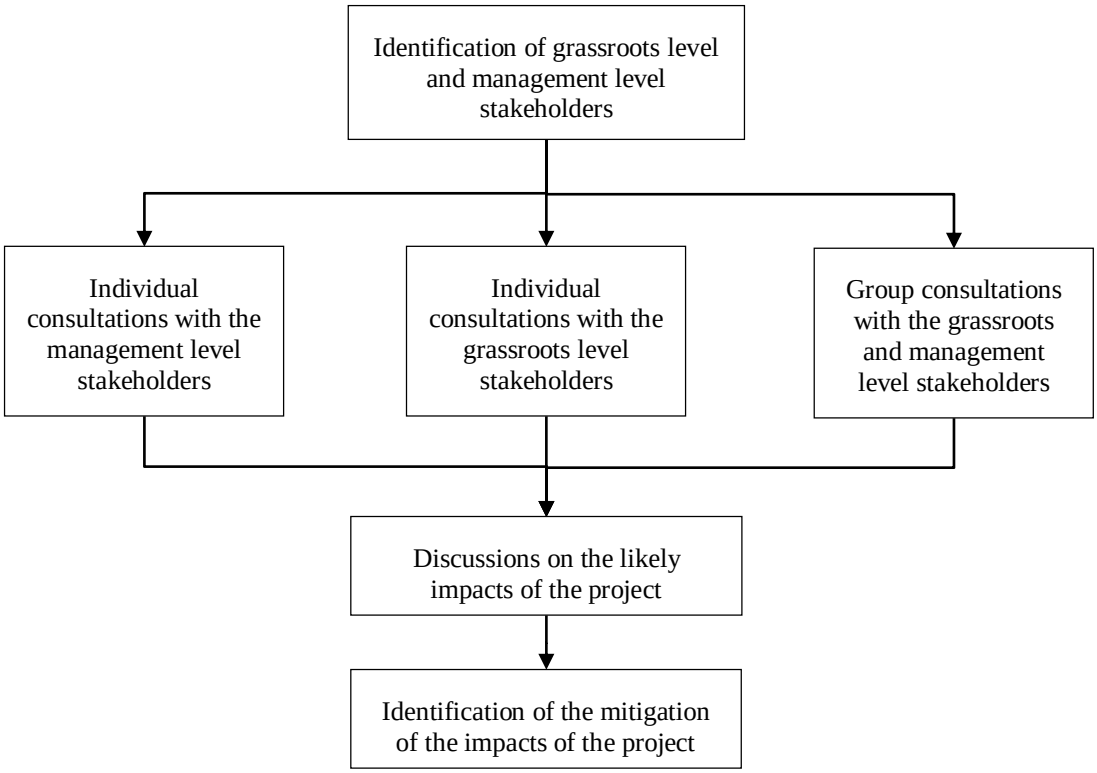


Figure 7.3: Conceptual Framework for ESMF Stakeholder Consultations

Table 7.11: Consultation Framework

Project Stage	Stakeholders	Consultation Tools	Responsibility
Project Design	Institutional Stakeholders: PDs, relevant provincial and local government departments, academia, bonafide development agencies, NGOs and subject experts in A4N and WASH)	Scoping Meeting with Institutional Stakeholders to deliberate on the planned project interventions and potential environmental and social risks	ESMF/ESMP Consultant
	Selected Local Communities from Low-Income backgrounds (including women)	Focus Group Discussions in all districts with Community Representatives on potential environmental and social risks	ESMF/ESMP Consultant
Project Inception	Institutional Stakeholders incuding implementation partners: District Coordination Committees, NGOs, and development agencies	Inception Workshop for: • Discussion on Implementation Plan • Finalization of roles and responsibilities for implementation partners • Finalization of Documentation, M&E, Reporting requirements	SSS Directorate Social Specialist (SS) A4N Directorate Social Specialist (SS)
	Target Communities/VOs (including representation from women and vulnerable groups where relevant)	Focus Group Discussions in all 13 districts: • Information disclosure using BID and Implementation Plan • Community Feedback regardingImplementation Plan, including role of VOs, GRM, Institutional Coordination, and M&E	SSS Directorate Social Mobilizers and ODF District Coordination Committee A4N Directorate Social Mobilizers and A4N District Coordination Committee
Project implementation	Beneficiaries at Local-level and Implementation Parnters	Project Launching Workshop providing all relevant project details as per WB's information disclosure requirements	SSS Directorate PD A4N Directorate PD
	Beneficiaries and field-level implementation teams	Weekly Village-level monitoring and reporting of field-level activities using pre-designed monitoring templates	SSS: Village Officers from the Village Development Committees A4N: Village Officers from the Village Development Committees
	Beneficiaries and field-level implementation teams	Bi-monthly District-level monitoring and reporting for compliance of ESMF and environmental and social issues identified through GRM procedures	SSS: Environmental and Social Focal Person (ESFP) designated by DCC A4N: Environmental and Social Focal Persons (ESFP)s designated by District Agriculture and Livestock Officers

7.11. Grievance Redress Mechanism (GRM)

7.11.1. Overview and Scope

The Grievance Redressal Mechanism proposed here spans the entire project implementation and will cater to both the directly and indirectly affected population. Though the GRM proposed here has been designed to address environmental and social problems identified during implementation, it will also cater to manage any disconnects that emerge from the field level and that has significant implications for effective implementation of the sub-project interventions.

In an effort to deter fraud and corruption, the use of a dedicated mobile application has been proposed for reporting of grievances from field level to district and provincial headquarters. This will not only provide a coherent system of checks and balances but will also enable swift redressal and effective monitoring of complaints.

The Directorates for both the SSS and A4N projects will serve as the secretariat for the Grievance Redressal Committee (GRC-Directorate) that will be responsible for providing oversight on the entire GRM process at a strategic level and monitoring of complaints management.

7.11.2. Objectives of Grievance Redress Mechanism

The grievance redressal mechanism (GRM) will be consistent with the requirements of the World Bank safeguard policies to ensure mitigation of community concerns, risk management, and maximization of environmental and social benefits. The overall objective of the GRM is therefore to provide a robust system of procedures and processes that provides for transparent and rapid resolution of concerns and complaints identified at the village level.

The GRM will be accessible to diverse members of the community, including women, senior citizens and other vulnerable groups. Culturally-appropriate communication mechanisms will be used at all sub-project sites both to spread awareness regarding the GRM process as well as complaints management.

7.11.3. Communication & Awareness

The final processes and procedures for the GRM will be translated in to local languages (Sindhi and Urdu) and disseminated at all sub-project locations. These shall be made available (in both leaflet and poster format) to all sub-project locations through the offices of each DCC. Dedicated male and female Grievance Focal Persons for each sub-project location will play an instrumental role in spreading awareness regarding the GRM, including the use of information technology for reporting and monitoring of complaints.

7.11.4. Records and Monitoring

The Project Director's Offices for SSS and A4N will maintain an electronic database at the Directorate that will provide a summary of complaints received and mitigations. The PDs office will also provide an analysis of the grievances at each sub-project location using a pre-designed M&E template that will give insight in to the type of complaints received and qualitative and quantitative review of grievance redressal. The PD's office will also be responsible for uploading the actions and results for each grievance for each sub-project location on a periodic basis to the Project website. The dedicated mobile application that will be used to communicate grievances will provide the basis for recording complaints both at the provincial and district levels.

Apart from the electronic database that will be maintained at the Directorate level, a manual register of all complaints and actions taken will be maintained by the Environmental and Social Focal Persons for each District at the Office of the District Coordination Committee.

7.11.5. Proposed Institutional Mechanisms

It is proposed to establish the following prior to commencing project implementation activities including pre-construction activities:

- Grievance Focal Points (GFPs), which will be the ambassador of change and educated people from each community on each sub-project site. Two GFPs (1 male and 1 female) will be selected for each sub-project locations and will be community members who are easily approached by the community
- A Public Complaints Center (PCC), which will be responsible to receive, log, and resolve complaints;
- A Grievance Redress Committee (GRC-District) will be established for each district that will manage GRM aspects for all sub-project locations in each district including decisions to be taken, actions and monitoring of complaints resolution at sub-project level. The ESFPs will play an instrumental role in steering the GRC functions at the district levels.
- A Grievance Redress Committee (GRC-Directorate), responsible to oversee the overall function of the GRM at a strategic level including monthly review.

Grievance Focal Points (GFPs)

The GFPs will be literate people from each community that will assist and facilitate the community members in reporting grievances resulting from project activities. The GFPs will use **smart phones** for lodging and reporting of grievances by any members of the local community. The GFPs will be provided training by the directorate (through ES/SS) in facilitating grievance redress.

Public Complaints Center (PCC)

PD-A4N & PD-SSS will establish a Public Complaints Centers (PCC) in their offices. The Directorate and the local government bodies will issues public notices to inform the public within the project area of the Grievance Redress Mechanism. The PCC's phone number, fax, address, email address will be disseminated to the people through displays at the respective DC offices of target district.

The PCC will be staffed by a full-time officer from the Directorate and will be independent of the ESFPs and IPs/TSPs. The officer will be provided training in dealing with complaints and mediation of disputes. The PCC officer will have resources and facilities to maintain a complaints database and communicate with ESFPs, IPs/TSPs, and DC offices and also with complainants.

The PCC will be responsible to receive, log, and resolve grievances. Given that the female community members have restricted mobility outside of their villages and homes, the female PD office staff will be required to undertake visits to the local communities. The frequency of visits will depend on the nature and magnitude of activity in an area and the frequency of grievances.

- The PCC will log complaint and date of receipt onto the complaint database and inform the ESFP;

- The PCC will instruct IPs/TSPs and ESFPs to refer any complaints that they have received directly to the PCC. Similarly, the PCC will coordinate with local government to "capture" complaints made directly to them;
- The PCC, with the IPs/TSPs and ESFPs, will investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project activities, and identify appropriate corrective measures. If corrective measures are necessary, PCC, through the ESFPs, will instruct the IP/TSP to take necessary action;
- The PCC will inform the Complainant of investigation results and the action taken;
- If complaint is transferred from local government agencies, the PCC will submit interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned by the above agencies;
- The PCC will review the Contractors response on the identified mitigation measures, and the updated situation;
- The PCC will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not recur.
- During the complaint investigation, the PCC should work together with the IPs/TSPs and ESPFs. If mitigation measures are identified in the investigation, the IPs/TSPs will promptly carry out the mitigation. ESFPs will ensure that the measures are carried out by the IPs/TSPs.

Grievance Redress Committee (GRC-District)

A Grievance Redress Committee will be notified under the project for all participating districts. The GRC-District will be chaired by the Assistant Commissioner (AC) for each district and will include proportionate representation from district government, community representatives, civil society organizations and project team.

Grievance Redress Committee (GRC-Directorate)

Two separate GRCs will be developed at the Directorate levels for both SSS and A4N components. The GRC would be notified by Project effectiveness date. The PD offices will be the secretariat of the GRC. The GRC will function as an independent body that will regulate the grievance redress process. It will comprise of, ES and SS of Directorates, Senior Engineers from LGD/DOA/DOLF, Representative of DC offices of concerned districts and senior members from civil society in sub-project areas.

7.11.6. Procedures

The tracking and documenting of grievance resolutions will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) systems with the capacity to analyze information so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the IPs/TSPs and into the monthly ESMP Compliance monitoring report to the World Bank.

- Grievance Focal Persons will be trained to address grievances on the spot to discourage lengthy procedures and inconvenience to the local community. However, where the case cannot be dealt with

by GFPs on an ad-hoc basis, GFPs will use smart phones to lodge and communicate those complaints at the district and directorate levels. The Grievance Redress Committee at the district level will review and identify actions to be taken to address the complaints at its weekly meeting.

- Also Public Complaints Center (PCC), which will be responsible to receive, log, and resolve complaints via its number(s) disseminated in local DC offices.
- If not satisfactorily resolved by the Grievance Redress Committee-District, the grievance will be referred to consideration by GRC at the Directorate level within one week.
- Every effort will be made to address or resolve grievances within the following fixed time-lines, which will be an indicator against the performance of the handling system. Acknowledgement of a written submission will be issued to the complainant within three working days. If not resolved earlier by the IP/TSP/ LGD/DOA/DOLF officers on site, grievances will be tabled for discussion/resolution during Committee meeting within one week of receipt of the written submission.
- If the complainant is not satisfied, the complaint will have the option to seek redress through court of law.

7.12. ESMF Implementation Budget

The cost estimates to implement ESMF is provided in Table 7.10 below. This cost will be included in the overall project cost. Additional costs could be included in the sub-project specific ESMPs.

Table 7.12: ESMF Implementation Budget for 3 year Project ('000s)

Activity	*Year*			*Total*	*Notes*
	1	*2*	*3*		
Implementation of IPMP					
Annual Pesticide Residue Survey (3)	1,000	1,000	1,000	3,000	Each survey will costs around 1 million rupees including sampling, preservation and teating of pesticide residue.
Soil Testing for IPSNM	300	300	300	900	Each survey will costs around 0.3 million rupees including sampling, preservation and teating of soil nutrients.
Mitigation Measures					
Provision of PPEs for Toilet construction	7,800	-	-	7,800	For each school site, 5 workers will be utilized, so 5 x 2,600 schools = 13,000 PPE each sets = Rs.6,000
Barricade for school toilet construction site	5,200	-	-	5,200	Rs.2,000 x 2,600 schools
Temporary refuse bins	2,912	-	-	2,912	Rs.1,000 x 2,600 schools Rs.1000 x 312 demo plots
First Aid Box	2,912	-	-	2,912	Rs.1,000 x 2,600 schools Rs.1,000 x 312 demo plots
Trainings					
Environmental and Social awareness	48	48	48	144	Quarterly, 2-day workshop @ Rs.12,000 per workshop inc. expenses
ESMF implementation and OHS aspects (PPE, MSDS)	30	30	30	90	Biannually, 4-day workshop @ Rs.15,000 per workshop inc. expenses
Awareness raising	96	96	96	288	Monthly, 2-day workshop @ Rs.8,000 per workshop inc. expenses
Capacity Development					
Environmental Specialist (21)	6,300	6,300	6,300	18,900	Total 21 ES (15 for SSS and 6 for A4N) will be hired for 3 years contract period @ 25,000 /month

Social Specialist (21)	6,300	6,300	6,300	18,900	Total 21 SS (15 for SSS and 6 for A4N) will be hired for 3 years contract period @ 25,000 /month
IPM Managers (04)	1,200	1,200	1,200	3,600	Total 04 IPM managers will be hired for 3 years contract period @ 25,000 /month
IESMC	1,200	1,200	1,200	3,600	Rs.100,000 per month
Reporting					
ESMP Preparation	600	-	-	600	60 days at 1st year @ Rs. 10,000/day
IPMP Preparation	600	-	-	600	60 days at 1st year @ Rs. 10,000/day
Environmental and social monitoring checklists	25	-	-	25	5 days at 1st year @ Rs. 5,000/day
Progress Reports	420	420	420	1,260	7 days per month @ Rs. 5,000/day
Training Reports	200	200	200	600	5 days per quarter @ Rs. 5,000/day
Annual Reviews	100	100	100	300	30 days per year @ Rs. 10,000/day
Project Completion Report	600	-	-	600	60 days at last year @ Rs. 10,000/day
Total	**37,843**	**17,194**	**17,194**	**72,231**	

Chapter 8 Resettlement Policy Framework (RPF)

This Resettlement Policy Framework (RPF) has been prepared under MSAN project where land may be acquired for small-scale interventions if land will be needed that cannot be acquired through VLD procedures.

Voluntary Land Donation: Directorate of Agriculture will completely avoid land acquisition. Whenever there is additional land requirement, the directorate will interact with the land owners and facilitate voluntary donation of land required for taking up sub-projects under the project. This use of voluntary donation option will be limited to demonstration plots used by Farmer Field Schools (FFS). Under no circumstances, the titleholder shall be subjected to any pressure, directly or indirectly, to part with the land. These actions are expected to minimize adverse impacts on the local population and help in project benefits reaching all sections of community. The directorate will ensure that the process of voluntary donation of land is meticulously documented to avoid confusions, misunderstandings, litigations, etc. at a later stage. A protocol and format for this purpose is enclosed as **Annex-Q**.

8.1. Purpose of Resettlement Policy Framework

The purpose of this RPF is to provide policy and legal framework and procedures to mitigate unavoidable resettlement impacts. These procedures are in conformity to the World Bank OP/PB 4.12 on Involuntary Resettlement, as well as the applicable laws and regulations of Government of Sindh.

8.2. World Bank Resettlement Policy

The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. The OP 4.12 provides safeguards to address and mitigate these impoverishments risks. The overall objectives of the Policy are:

The policy guidelines for resettlement process for the Project are principally derived from the World Bank OP 4.12, "Involuntary Resettlement". Summary of general policy guidelines, which are being adopted for the Project, is as follows:

- Involuntary resettlement is to be dealt with from the earliest stages of the Project preparation.
- Involuntary resettlement should be avoided or minimized wherever feasible; exploring all viable alternate Project designs.
- Where unavoidable, resettlement plans should be conceived, developed and executed as development programs, with resettled people provided sufficient investment resources and opportunities to share in the Project benefits.
- Persons to be displaced should have their former living standards and income earning capacity improved, or at least restored, and should be provided adequate support during the transition period.
- Community participation in the planning and implementation of resettlement should be encouraged and facilitated. The compensation process should be fully transparent.

- Given the complexity of resettlement in development projects, the concerned government agencies and departments should upgrade their institutional capacity to design and implement Resettlement Action Plans.

The key principles of World Bank Involuntary Resettlement Policy are:

- The need to screen the project early on in the planning stage;
- Carry out meaningful consultation;
- At the minimum restore livelihood levels to what PAPs were before the project, improve the livelihoods of affected vulnerable groups;
- prompt compensation at full replacement cost is to be paid;
- Ensure that PAPs who have no statutory rights to the land that they are working, are eligible for resettlement assistance and compensation for the loss of land or assets; and
- Disclose all reports.

Scope and Triggers: OP 4.12 is triggered in case the project needs to acquire small pieces of land for certain interventions (e.g. storage facilities). A Resettlement Policy Framework (RPF) has been prepared, and Resettlement Action Plans will be prepared where land is acquired. In most other cases, small pieces of land for interventions will be taken using Voluntary Land Donation (VLD) with appropriate screening to ensure that land is donated without any pressure. This will be monitored to ensure that VLD procedures are properly documented and accepted by the community. This section describing involuntary resettlement is provided to address these concerns.

8.3. Resettlement Processing Requirements

- identify possibility of land acquisition and resettlement during screening of sub-projects;
- minimize resettlement through relocation of the sub-project site, where possible;
- Acquire land through Voluntary Land Donation (VLD) process (see **Annex Q**)
- If resettlement is unavoidable, prepare a Resettlement Action Plan (RAP) in line with World Bank OP 4.12;
- undertake meaningful consultation with project affected persons (PAPs);
- ensure PAPs are clearly identified including those with no formal rights;
- restore their livelihood;
- pay compensation in time before land is acquired, and;
- disclose all relevant information.

8.4. Criteria for Eligibility of PAPs

The criteria for eligibility of Project Affected Person (PAPs) in accordance with the World Bank OP 4.12 are:

- those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country);
- those who do not have formal legal rights to land at the time the census begins but have a claim to such land or assets--provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan; and;

- those who have no recognizable legal right or claim to the land they are occupying.

All of the above categories of the PAPs will be eligible for compensation under the RAPs.

8.5. Compensation Eligibility and Entitlements for Affected Persons

8.5.1. Eligibility

The project-affected persons, including displaced persons, eligible for compensation or rehabilitation provisions under A4N are:

(i) All land owning displaced persons losing land or non-land assets, i.e., crops and trees whether covered by legal title or traditional land rights, whether for temporary or permanent acquisition.
(ii) Tenants and share-croppers, whether registered or not; for all non-land assets, based on prevailing tenancy arrangements.
(iii) Displaced persons losing the use of structures and utilities, including titled and non-titled owners, registered, unregistered, tenants and lease holders plus encroachers and squatters.
(iv) Displaced persons losing business, income and salaries of workers, or a person or business suffering temporary effects, such as disturbance to land, crops, and business operations both permanently and also temporarily during commencement.
(v) Loss of communal property, lands and public infrastructure.
(vi) Vulnerable PAPs identified through the social impact assessment (SIA).
(vii) The affected persons will be eligible for rehabilitation subsidies and for the compensation of lost land, structures and utilities along with re-establishment of livelihood.
(viii) There will also be special provisions for vulnerable displaced persons i.e. very old, physically or mentally handicapped, poor below the poverty line, widows, and women headed household, and socially isolated.

The following entitlements are applicable for displaced persons losing land, houses and incurring income losses. Compensation and rehabilitation entitlements are summarized in the Entitlement Matrix in table below:

Table 8.1: Entitlement Matrix

Asset	Specification	Affected People	Compensation Entitlements
Permanent land acquisition	The landowner will have a title to the land.	Landowner	• Full compensation for land to be acquired accordance to the latest market rate. • Compensation will be at replacement cost[38] WITHOUT any deductions on depreciation
Arable Land Temporary land use during project commencement	Access is not restricted and existing or current land use will remain unchanged	Farmer/Titleholder	• Monthly Rent is accordance to the latest market rate; • Compensation, in cash, for all damaged crops and trees as per item below plus 15% compulsory acquisition surcharge
		Leaseholder *(registered or not)*	• Monthly Rent is accordance to the latest market rate; • Compensation, in cash, for all damaged crops and trees as per item below
		Sharecroppers *(registered or not)*	• Monthly Rent is accordance to the latest market rate; • Compensation, in cash or kind, for all damaged crops and trees as per item below

		Agricultural workers	• Compensation, in cash or kind, for all damaged crops and trees as per item below
		Squatters	• Compensation, in cash, for all damaged crops and trees as per item below
Arable Land where access is restricted and/or land use will be affected	All adverse effects on land use independent of severity of impact	Farmer/Titleholder	• Land for land compensation with plots of equal value and productivity to the plots lost; or; • Cash compensation for affected land at replacement cost[34] based on market value free of taxes, registration, and transfer costs
		Leaseholder *(registered or not)*	• Renewal of lease in other plots of equal value/productivity of plots lost, or Cash equivalent to market value of gross yield of affected land for the remaining lease years (up to a maximum of 3 years).
		Sharecroppers *(registered or not)*	• Cash compensation equal to the market value of the lost harvest share once (temporary impact) or twice (permanent impact)
		Agricultural workers losing their contract	• Cash indemnity corresponding to their salary (including portions in kind) for the remaining part of the agricultural year.
		Squatters	• 1 rehabilitation allowance equal to market value of 1 gross harvest (in addition to crop compensation) for land use loss.
	Additional provisions for severe impacts (More than 10% of land loss)	Farmer/Titleholder Leaseholder	• 1 severe impact allowance equal to market value of gross harvest of the affected land for 1 year (inclusive of winter and summer crop and additional to standard crop compensation)
		Sharecroppers *(registered or not)*	• 1 severe impact allowance equal to market value of share of harvest lost (additional to standard crop compensation)
		Squatters	• 1 severe impact allowance equal to market value of gross harvest of the affected land for 1 year (inclusive of winter and summer crop and additional to standard crop compensation)
Houses and Structures		All relevant APs (including squatters)	• Cash compensation at replacement rates (to be determined by Agriculture Dept, Sindh) for affected structure and other fixed assets free of salvageable materials, depreciation and transaction costs. In case of partial impacts full cash assistance to restore remaining structure.
Crops	Crops affected	All APs (including squatters	• Crop compensation in cash at full market rate for one harvest (either winter or summer). • All other crop losses will be compensated at market rates based on actual losses.
Trees	Trees affected	All APs (including squatters)	• Where trees are cut down, the rate for wood and loss of income from tree products e.g. fruit will be provided.

[34] Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

			• Cash compensation shall reflect income replacement
Ruminants/ Livestock Sheds	Sheds affected	All PAPs (including squatters and encroaches)	• Cash compensation at replacement cost for affected structure and other fixed assets free of salvageable materials, depreciation and transaction costs. In case of partial impacts full cash assistance to restore remaining structure. No compensation for land will be provided if land is not acquired.
Business Employment	Temporary or permanent loss of business or employment	All PAPs including squatters and encroachers	• Business owner: (i) Cash compensation equal to one year income, if loss is permanent based on type of business; (ii) cash compensation for the period of business interruption, if loss is temporary. • Worker/employees: Indemnity for lost wages for the period of business interruption up to a maximum of 3 months. • Temporary workers e.g. Hawkers/street vendors: Opportunity cost compensation equivalent to 2 months net income, or the relocation allowance, whichever is higher. Relocation assistance (costs of shifting) Assistance to obtain alternative site to re-establish the business
Relocation	Transport and transitional livelihood costs	All PAPs affected by relocation	• Provision of allowance to cover transport expenses based on the latest transportation rates and livelihood expenses (based on type and nature of livelihood) for one month.
Community assets		Any community structures will be rebuilt at a community-agreed location	• Rehabilitation/substitution of the affected structures/utilities (i.e. mosques, footbridges, roads, schools, health centers, etc.)
Vulnerable AP livelihood			• Subsistence grants to displace, poor /vulnerable families like (i) female headed households with dependents, (ii) disabled household heads, (iii) households falling under the generally accepted indicator for poverty, and (iv) ethnic minorities and indigenous peoples. • Subsistence grants will be equal to official Minimum Wage per month for the fiscal year per earning member in the household. Additionally, those with no earning members will be compensated according to the Official Poverty Line per person per month.
Unforeseen / unanticipated impacts			• Any unanticipated consequence of the project will be documented and mitigated based on the spirit of the principles agreed upon in this policy framework.

8.6. Cut-off Date

The cut-off date shall be set to prevent false claims for compensation or rehabilitation appearing after disclosure of the resettlement action plan. Compensation eligibility for non-land losses will be limited by a cut-off date for each subproject on the day of the beginning of the census survey for the impact assessment in order to avoid an influx of outsiders. The cut-off date will be announced through local means of communication including face-to-face communication with communities. Any persons who would settle/or build assets on encroached lands in the affected areas after the cut-off date will not be eligible for compensation.

8.7. Valuation and Replacement of Assets

The following methodology will be adopted for assessing unit compensation rates:

- Land will be valued at replacement cost based on current market values by carrying out a survey of transactions.
- Rent for temporary use of land will be fixed as per prevailing market rate in agreement of affected person.
- Houses, buildings and other structures will be valued at replacement cost plus labor cost based on the area, type and material of the affected item. No deductions will be made for depreciation, salvageable materials or transaction costs and taxes Rates for building structures will be evaluated by the Works and Services Department where relevant using the latest/current Composite Schedule Rates that are regularly published by the Works and Services Department, Government of Sindh.
- Crops will be valued at current market rates of gross value of harvest as valued by the Agricultural Department.
- The loss of fruit and non-fruit bearing trees will be compensated for based on their type, productive age and the market value of the produce for the remaining period of its average life. The value of younger fruit trees will be based on the expenditure made to bring the tree to its current state. This will be assessed by the Horticultural Wing of the Agriculture Department.
- The value of trees that would have been used for timber will be calculated based on the average volume and quality of wood produced and taking into consideration the size classes as determined by girth, diameter at breast, height and volume as assessed by the Forest Department, Government of Sindh.

8.8. RAP Preparation

The RAP preparation activities will be initiated as part of the preparation of each new sub-project involving resettlement impacts. The procedures will be to take the land requirements for each proposed sub-project and carry out a measurement survey and enumeration. The SS/Directorate staff will acquire map of the land from the Revenue Department and overlay sub-project site requirements with clear demarcation of government and private land, and also carryout demarcation on the ground in the presence of local community representatives in a transparent manner to avoid any confusion. The appraisal will entail the following studies and investigations:

- **Socioeconomic Survey**: A socio-economic survey will be carried out to provide a detailed socio-economic profile of the population in the project areas. The information gathered will include but not be restricted to the following aspects:
    i. household composition;
    ii. demography and ethnicity;
    iii. health and education;
    iv. community assets;
    v. livelihood patterns and income baseline;
    vi. land ownership patterns;
    vii. affected persons income levels and expenditure patterns;

viii. affected persons views on the subproject and various resettlement and rehabilitation options;

ix. specific impacts on the poor, women and other vulnerable groups.

- **Census Survey**: A census of all people/households to be displaced or resettled will be undertaken based on the categorizations in the entitlement matrix. The Census will determine the exact number of PAHs/PAPs and how they will be affected by the specific impacts of a subproject. The Census will also identify all severely and vulnerable PAHs.
- **Social Impact Assessment and Inventory**: This task will be based on a Detailed Measurement Survey (DMS) which identifies the nature and magnitude of loss. The survey will include all losses including encroached land (residential and agricultural), immovable structures, communal, public and cultural/religious facilities, crops, trees and business incomes and wages. The impact assessment will also include a survey of compensation rates as detailed above and also the incomes of the PAHs.
- **Mitigation of Impacts**: The project will endeavor to avoid resettlement by changing the sub-project site locations. If unavoidable, a RAP or ARAP shall be prepared in line with this RPF, World Bank OP 4.12 and LAA (1894) and will cover all resettlement related impacts. The ARAP/RAP shall be implemented and monitored by the project proponent before contractor mobilization or physical works commencement.
- **Gender Impacts, Social Inclusion and Mitigation Measures**: RAP will include measures ensuring that the socio-economic needs and priorities of women are identified, addressed and mitigated. The following gender provisions will be incorporated to safeguard the specific needs and problems of women displaced persons during subproject implementation. The socio-economic data gathered will be gender-disaggregated. Female staff will be hired to collect data and assist women in resettlement activities. Female household heads will be registered as the recipients of compensation and rehabilitation measures due to their households. Women will be included in the consultation process through meetings held with women and will be encouraged to participate in the RAP planning and implementation process.
- **RAP Preparation**. All RAPs will be based on the provision outlined in this RPF. The RAPs may need to be updated to take into account changes in the final site locations. If needed, the RAPs should be updated (i) on finalization of sub-project site location but prior to the mobilization of TSP/FFS/F3S in the field and (ii) during the subproject operations (imparting training packages) where changes result in changes to the resettlement impacts.
- **RAP Approval**. Land will not be possessed until all RAPs are approved by the World Bank, payments made, replacement land found, replacement structures provided and displaced persons relocated. All RAPs/ARAPs are subject to final review and approval by the World Bank in order to ensure compliance with Bank safeguards. At its sole discretion the World Bank may delegate through the Government to the Local Governments this responsibility to ensure compliance with the provisions in this RPF after it is satisfied that effective monitoring of this process is in place.

8.9. Consultation, Participation and Disclosure/ Access to Information

8.9.1. Stakeholder Consultation

Consultations with potential affected persons and beneficiaries were carried out including communities, potential affectees, district governments and provincial line departments, and further consultations will be carried out particularly with affected persons and other key stakeholders during preparation and

implementation of RAPs as mentioned in this RPF. The timing and nature of these consultations will vary depending upon the implementation program. Stakeholders will be identified through the initial social impact assessment for subprojects.

Table 8.2 charts out the proposed consultation framework for this RPF during different project phases.

Table 8.2: Consultation Framework for RPF

RPF Stages	Stakeholders	Consultation Tools	Responsibility
Project Design	Institutional Stakeholders: PDs, relevant provincial and local government departments, academia, bonafide development agencies, NGOs and subject experts in Agriculture and WASH)	Scoping Meeting with Institutional Stakeholders to deliberate on the planned project interventions and potential risks regarding land acquisition and resettlement	RFP Consultant
	Selected Local Communities from Low-Income backgrounds (including women)	Focus Group Discussions in all districts with Community Representatives on potential risks regarding land acquisition and resettlement	RFP Consultant
Project Inception (determining compensation entitlements, eligibility criteria)	Institutional Stakeholders incuding implementation partners: DCO, Revenue department of GOS, Patwari, Land Acquisition Collector	• Scoping Meetings at directorate level and district level	SSS Directorate Social Specialist (SS) A4N Directorate Social Specialist (SS)
	Affected Persons	• Focus group discussions and informed consultation meetings • Provision of information dissemination brouchures	SS/ESFPs of Directorate/DCC & DNCC
Project implementation (land and asset acquisition process, income restoration measures and delivery of compensation)	Affected Persons	Focus group discussions and informed consultation meetings Provision of information dissemination brouchures	SS of IPs and TSPs
	Institutional Stakeholders incuding implementation partners: DCO, Revenue department of GOS, Patwari, Land Acquisition Collector	Scoping Meetings at directorate level and district level	SSS Directorate Social Specialist (SS) A4N Directorate Social Specialist (SS)

8.9.2. Information Disclosure Plan

The entire RPF, after its clearance from the World Bank, as well as sub-project RAPs will be translated into Urdu/Sindhi and disclosed to the public through websites of the DOA/LGD, the World Bank InfoShop and shared with institutional stakeholders, APs and beneficiary communities.

Before the socio-economic baseline surveys are mobilized, the PD-A4N will need to have developed a workable strategy for public consultation and information disclosure, the Social Specialist of the project will take lead in assuming this responsibility. During the census and DMS, each affected household will be directly informed about the subproject entitlements and procedures.

The consultation process will need to outline the legal procedures that are to be followed for land acquisition and relocation. The details of the process will have to be clearly communicated to any displaced/affected people and in a form that can be easily understood. The information given should also include the provisions of the OP 4.12 principles and outline the rights and obligations of PAPs.

8.10. Institutional Arrangements and Implementation Mechanism

A Resettlement Unit will be formed under each Directorates. The Directorate of Agriculture under A4N component will have the overall responsibility for implementation of all resettlement tasks. The Directorate will be assisted by SS for implementation of RAPs. The SS under Directorate of Agriculture will oversee and direct all the activities during the implementation of RAPs. ESFPs at the district level will be responsible for implementing the RAP according to the agreed principles and procedures.

The Executive District Officer of Revenue Department, along with his staff, will be responsible for the acquisition of private land under Land Acquisition Act of Pakistan. The ESFPs will be responsible for coordination with the Revenue Department.

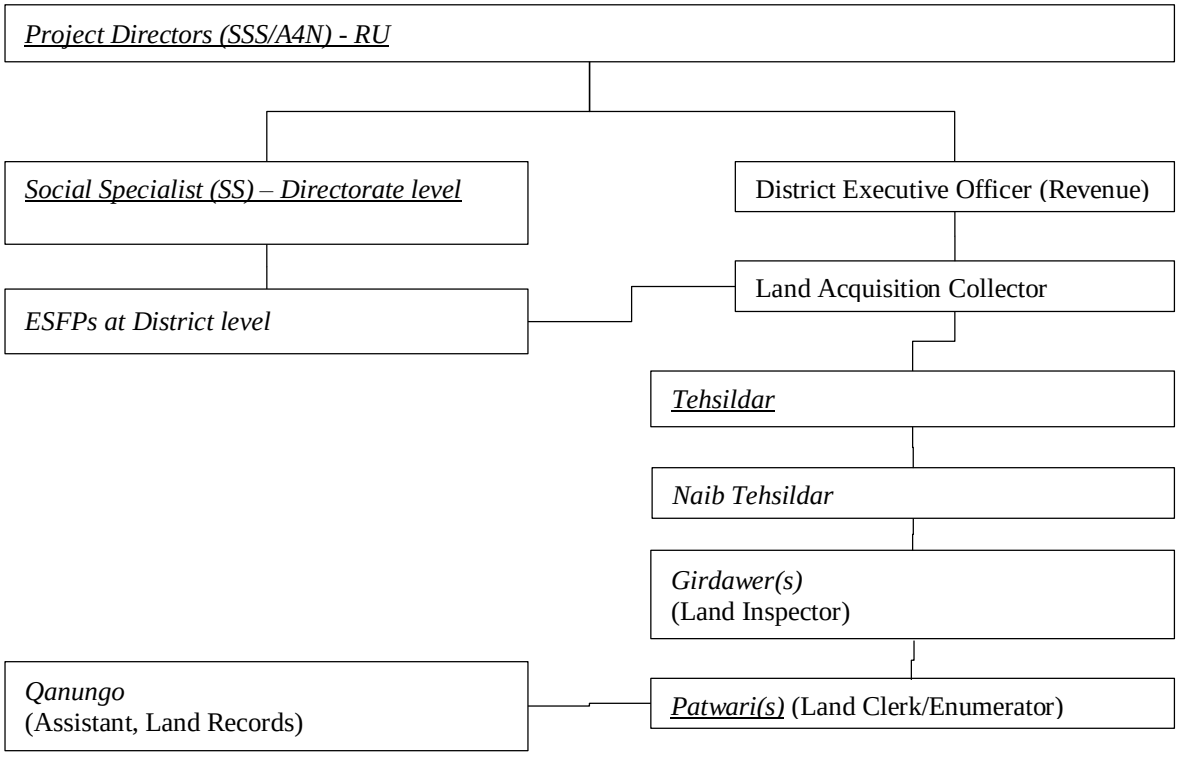


Figure 8.1: Institutional Organization of Resettlement Unit (RU)

LAR Process

Step	Action	Responsibility	Monitoring
1	Initial screening indicating for a specific subproject whether LAR is needed.	SS of Directorates with the assistance of ESFPs	PDs of Directorates

2	Proposal to Revenue Department with Brief Description of subproject including LAR.	SS of Directorates	PDs of Directorates
3	Prepare impacts/AP surveys forms and establish coordination with relevant local government agencies.	ESFPs with the assistance of SS of IPs and TSPs	SS of Directorates
4	Verify land records in affected areas, conduct DMS and carry out impacts and valuation surveys, identify land classification for affected areas	LAC, Patwari, ESFPs	
5	Conduct public consultations and negotiations	SS of IPs and TSPs	
6	Preparation and Finalization of sub-project RAPs/ARAPs	SS of Directorates	
7	RAPs/ARAPs disclosure to Aps	SS of IPs and TSPs	
8	Compensation Disbursement	LAC/ SS of IPs and TSPs	
9	Relocation	IPs/TSPs	

8.11. Resettlement Budget and Financing

All RAP preparation and implementation costs, including cost of compensation, various eligible allowances, monitoring, evaluation, grievances redress, as well as contingencies, will be estimated and included as an integral part of each subproject cost. RAPs of each subproject will include a budget section indicating (i) unit compensation rates for all affected items and allowances, (ii) methodology followed for the computation of unit compensation rates, and (iii) a cost table for all compensation expenses including administrative costs and contingencies.

Financing for each subproject specific RAP cost, including compensation, allowances, and administration of RAP preparation and implementation, will be provided by the Government of Sindh as counterpart funds. Costs for external monitoring tasks can be allocated under the loan. In order to ensure that sufficient funds are available for RAP tasks, the local governments will have to allocate 100% of the cost of compensation at replacement cost and expected allowances estimated in each RAP plus 5% of contingencies before RAP implementation.

Allocations will be reviewed twice a year based on the budget requirements indicated in RAPs. Regarding the flow of RAP finances, it is noted that the budget for land, crops, trees, structures compensation will be disbursed by DOA/DOLF, through the ESFPs will be responsible to disburse the compensation to the PAPs with assistance from the field offices. A timetable will be set within RAP and the compensation will be done before award of contract, commencement of the physical works or acquiring the land.

8.12. Monitoring and Reporting

RAP tasks under each sub-project will be subjected to both internal and external monitoring. Internal monitoring will be conducted by the SS, assisted by the ESFPs. External monitoring will be assigned to Independent Environmental and Social Monitoring Consultant (IESMC) to be hired by Directorate under A4N, and approved by WB. The IESMC will be chosen among local consultants.

8.12.1. Internal Monitoring

Internal monitoring will be carried out routinely by the ESFPs at the district level their results will be communicated to concerned Affected People, SS and to WB through the quarterly project implementation reports. The monthly reports will be quarterly consolidated in the standard supervision reports to WB. Specific monitoring benchmarks will be:

a) Information campaign and consultation with PAPs;

b) Status of land acquisition and payments on land compensation;
c) Compensation for affected structures and other assets;
d) Payments for loss of income;
e) Selection and distribution of replacement land areas; and
f) Income restoration activities
g) People's views and feedback on RAP implementation process
h) Other relevant aspects

8.12.2. External Monitoring

External monitoring will be carried out twice a year, and its results will be communicated to all concerned PAPs, the Agriculture Directorate and WB through semi-annual reports. Subprojects whose implementation time-frame will be under 6 months will be monitored only once. Indicators for External Monitoring tasks include:

a) Review and verify internal monitoring reports prepared by ESFPs and its field offices;
b) Review of the socio-economic baseline census information of pre-displaced persons;
c) Identification and selection of impact indicators;
d) Impact assessment through formal and informal surveys with the affected persons;
e) Consultation with PAPs, officials, community leaders for preparing review report; and
f) Assess the resettlement efficiency, effectiveness, impact and sustainability, drawing lessons for future resettlement policy formulation and planning.

The IESMC will also assess the status of project affected vulnerable groups such as female-headed households, disabled/elderly and families below the poverty line. The IESMC will carry out a post-implementation evaluation of the RAP after completion of its implementation. The compelling reason for this study is to find out if the objectives of the RAPs have been attained or not. The benchmark data of socioeconomic survey of severely affected PAPs conducted during the preparation of the RAPs will be used to compare the pre and post project conditions. The IESMC will recommend appropriate supplemental assistance for the PAPs should the outcome of the study show that the objectives of the RAPs have not been attained.

8.13. Grievances Redress Mechanism

The key objectives of the grievance redress mechanisms are to establish procedures for filing any grievances and disputes on social safeguards and other entitlement issues arising out of the implementation of the project. It outlines the modalities and mechanisms for resolution of grievances within a defined timeline.

Affected persons may disputes over entitlement processes due to issues associated with – for example, (i) lack of land record systems in selected districts; (ii) titles over communal lands; (iii) Delay in payment for permanent land acquisition, (iv) delay in payment of compensation to APs.

The GRCs will deal with grievances and disputes to resolve such cases locally to facilitate smooth implementation of the social and environmental action plans. As a result, the GRC system will make the project accountable to the local people. Further, it will also democratize the development processes at the local level.

The GRCs are to ensure accessibility, fairness and independence of the procedures. The GRCs will be built on a "bottom up" system that would include: (i) Village-level GRC, (ii) Union Council level GRC, (iii)

District-level GRC and (iii) Project-level GRC. First, GRC at the village level consisting of local representatives of the affected people and maliks of village elders, project staff, and local government representatives and will receive cases and resolve locally within a defined timeline. Cases which are not satisfactorily resolved or affected persons have still grievances will be forwarded to the Union Council GRC for disposal. The District level GRC with review cases unresolved at the UC Level GRC. Finally, an independent GRC headed by a retired civil judge will review cases sent to the project level GRC.

The Directorates for both the SSS and A4N projects will serve as the secretariat for the Grievance Redressal Committee (GRC-Directorate) that will be responsible for providing oversight on the entire GRM process at a strategic level and monitoring of complaints management.

The committee is responsible for the facilitation of resolution of disputes and grievances which may arise during the implementation. The committee shall be formed of the following members:

Table 8.3: Grievance Redress Committee (GRC-Directorate)

Representative	Members
Assistant Commissioner	Chairman
Project Directors, SSS and A4N	Member
Land Acquisition Collector	Member
SS under Directorates	Member
Grievance Focal Points (GFPs)	Member
Patwari(s)	Member
PCC Officer	Member
Grievance Focal Points (GFPs)	Member

The GRM will be accessible to APs. Culturally-appropriate communication mechanisms will be used at all sub-project sites both to spread awareness regarding the GRM process as well as complaints management.

It is proposed to establish the following prior to commencing LAR implementation activities:

- Grievance Focal Points (GFPs), which will be the ambassador of change and educated people from APs on each sub-project site. Two GFPs (1 male and 1 female) will be selected from APs;
- A Public Complaints Center (PCC), which will be responsible to receive, log, and resolve complaints;
- A Grievance Redress Committee (GRC-District) will be established for each district that will manage GRM aspects for all sub-project locations in each district including decisions to be taken, actions and monitoring of complaints resolution at sub-project level. The ESFPs will play an instrumental role in steering the GRC functions at the district levels;
- A Grievance Redress Committee (GRC-Directorate), responsible to oversee the overall function of the GRM at a strategic level including monthly review.

8.13.1. Procedures

- GFPs will be trained to address grievances on the spot to discourage lengthy procedures and inconvenience to the APs. However, where the case cannot be dealt with by GFPs on an ad-hoc basis, GFPs will use smart phones to lodge and communicate those complaints at the district and directorate

levels. The Grievance Redress Committee at the district level will review and identify actions to be taken to address the complaints at its weekly meeting.

- Also Public Complaints Center (PCC), which will be responsible to receive, log, and resolve complaints via its number(s) disseminated in local DC offices.
- If not satisfactorily resolved by the Grievance Redress Committee-District, the grievance will be referred to consideration by GRC at the Directorate level within one week.
- Every effort will be made to address or resolve grievances within the following fixed time-lines, which will be an indicator against the performance of the handling system. Acknowledgement of a written submission will be issued to the complainant within three working days. If not resolved earlier by the IP/TSP/LAC/Patwari on site, grievances will be tabled for discussion/resolution during Committee meeting within one week of receipt of the written submission.
- If the complainant is not satisfied, the complaint will have the option to seek redress through court of law.

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Annexures

Annex A: ESMF Study ToRs and Detailed Methodology

Terms of Reference

The study component as per TORs consists of:

- Study the overall project details and also details of the subprojects under Sanitation and A4N their including design, location, nature, key interventions supported by project/subprojects
- Review the national and provincial legislation and regulations related to environmental and social aspects and determine relevance for the proposed activities under the project. Review the WB Operational Policies on environmental and social assessment and determine relevance and subsequent requirements if any defined by these Policies.
- Carry out reconnaissance survey of the subprojects under sanitation and A4N components and collect broad baseline data on physical, biological and socio-economic conditions prevailing in the area of each sub-project. Determine environmental and social sensitivity of the area and also environmental and social hot spots;
- Carry out screening of the subprojects and determine the environment category of the subprojects strictly in accordance with the criteria defined in OP 4.01.
- Undertake stakeholder consultations with a select sample of communities and institutions;
- Identify and assess generic environmental and social impacts of project interventions; (xvi) Propose generic mitigation measures for impacts identified;
- Prepare environmental and social management framework (ESMF) including monitoring program and institutional strengthening program, and course of action for further assessment.
- Prepare the checklist for certification of ODF village

Study Methodology

Methodology for the ESMF comprise a series of integrated tasks and this was based on a combination of field and desktop assignments.

Legislative Review: A legislative review has been conducted for the project and selected all the legislations, guidelines and WB OPs which are relevant to the project and applicable in conducting ESMF study.

Project Description: Several meetings held with Directorate of Urban Policy, Project Director SSS and relevant officers and PC-Is of both Sub-projects has been acquired reflecting the proposed interventions in the sub-projects, institutional arrangements, hard and soft components of each sub-projects, M&E responsibilities etc. This information is collected and analyzed as part of ESMF process. However, a detailed review of information is presented in the Project description section of ESMF study.

Background Information & Literature Review: Prior to conducting detailed reconnaissance surveys (RS), a review of literature, and all relevant documents available specific to the project components in districts and UCs were arranged to collect/explore background information of the project area. This was reconfirmed during Reconnaissance Surveys.

Baseline Surveys / Reconnaissance Surveys: After initial information has been collected and reviewed, site surveys were conducted by experts to collect primary information for the sub-projects. These site surveys were focused on collection of broad baseline picture on various environmental and social aspects including but not limiting to physical, biological, hydrological, health and social environment.

Stakeholder Consultation and Participation: Stakeholder consultations were carried out while preparation of ESMF. A series of focus group discussions were carried out with communities in all 13 project districts during visits. Meetings will be held with the institutional stakeholders and key environmental and social issues discussed.

Identification and Assessment of Environmental Impacts and Mitigation Measures: Environmental aspects and their associated impacts were considered for anticipated sub-projects and sub-project exclusions. Mitigation measures were identified where required to minimize the significant environmental impacts. An environmental management framework was also developed in the form of an ESMF for the implementation of the mitigation measures identified during the study.

ESMF Study Team

S#	Name of Expert	Position in the Team	Ranking
1.	Syed Nadeem Arif	Team Leader/**Environmental & Social Sciences Specialist**	Team Leaders
2.	Shujaat H Zaidi	Team Leader/**Environmental & Social Sciences Specialist**	
3.	Mashhood A Siddiqui	Agriculture Specialist	Key Experts
4.	Khurram Shams	WASH Specialist	
5.	Zubair Ahmed Abro	Legal & Grievance Compliance Expert	
6.	Ahmed Zohair	Environmental Engineer	Support Staff
7.	Muhammad Haseeb	Environmental Specialist	
8.	Sohaib Tariq	Environmental Engineer	
9.	Dayal Das	Env. & Social Surveyors and Enumerators	
10.	Abid Khan	Env. & Social Surveyors and Enumerators	
11.	Irfan Ali	Env. & Social Surveyors and Enumerators	
12.	Imdad Brohi	Env. & Social Surveyors and Enumerators	

Annex B: Sindh Environmental Quality Standards (SEQS)

Sindh Environmental Quality Standard for Ambient Air			
Pollutant	**Time-weighted average**	**Concentration in Ambient Air**	**Method of measurement**
Sulfur Dioxide (SO_2)	Annual Average*	80 μgm^3	Ultraviolet Fluorescence Method
	24 hours**	120 μgm^3	
Oxides of Nitrogen as (NO)	Annual Average*	40 μgm^3	Gas Phase Chemiluminescence
	24 hours**	40 μgm^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40 μgm^3	Gas Phase Chemiluminescence
	24 hours**	80 μgm^3	
O_3	1 hour	130 μgm^3	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	360 μgm^3	High volume Sampling, (Average flow rate not less than 1.1m^3/minute)
	24 hours**	500 μgm^3	
Respirable Particulate Matter (PM10)	Annual Average*	120 μgm^3	B Ray absorption method
	24 hours**	150 μgm^3	
Respirable Particulate Matter (PM2.5)	24 hours**	75 μgm^3	B Ray absorption method
Lead (Pb)	Annual Average*	1 μgm^3	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5μgm^3	
Carbon Monoxide (CO)	8hours**	5mg/m^3	Non Dispersive Infra Red (NDIR) method
	1hours	10mg/m^3	
*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.			
**24 hourly / 8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.			

Sindh Environmental Quality Standard for Noise			
S. No.	**Category of Area / Zone**	**Effective from 1st January, 2015**	
		Limit it in dB(A) Leq*	
		Day Time	Night Time
1	Residential area (A)	55	45
2	Commercial area (B)	65	55
3	Industrial area (C)	75	65
4	Silence Zone (D)	50	45
Note: 1	Day time hours: 6.00 a. m to 10.00 p. m		
2	Night time hours: 10.00 p. m to 6.00p. m		
3	Silence zone; Zone which are declared as such by competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.		
4	Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.		
***dB(A)Leq**	Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.		

Sindh Environmental Quality Standard for Municipal & Liquid Industrial Effluents					
S. #	Parameter	Into Inland Waters	Into Sewage Treatment	Into Sea	unit
1	Temperature or Temp. increase	<3	<3	<3	^oC
2	pH value (H^+)	6-9	6-9	6-9	
3	Biological Oxygen Demand $(BOD)_5$ at 20^oC	80	250	80	mg/l
4	Chemical Oxygen Demand (COD)	150	400	400	mg/l
5	Total Suspended Solids (TSS)	200	400	200	mg/l

Sindh Environmental Quality Standard for Municipal & Liquid Industrial Effluents					
S. #	Parameter	Into Inland Waters	Into Sewage Treatment	Into Sea	unit
6	Total Dissolved Solids (TDS)	3500	3500	3500	mg/l
7	Oil and Grease	10	10	10	mg/l
8	Phenolic Compounds (as Phenol)	0.1	0.3	0.3	mg/l
9	Chloride (as Cl^-)	1000	1000	SC	mg/l
10	Fluoride (as F^-)	10	10	10	mg/l
11	Cyanide (as CN^-)total	1.0	1.0	1.0	mg/l
12	An-ionic detergents (as MBAS)	20	20	20	mg/l
13	Sulphate(SO_4^{2-})	600	1000	SC	mg/l
14	Sulphide (S^{2-})	1.0	1.0	1.0	mg/l
15	Ammonia (NH_3)	40	40	40	mg/l
16	Pesticides	0.15	0.15	0.15	mg/l
17	Cadmium	0.1	0.1	0.1	mg/l
18	Chromium (trivalent and hexavalent)	1.0	1.0	1.0	mg/l
19	Copper	1.0	1.0	1.0	mg/l
20	Lead	0.5	0.5	0.5	mg/l
21	Mercury	0.01	0.01	0.01	mg/l
22	Selenium	0.5	0.5	0.5	mg/l
23	Nickel	1.0	1.0	1.0	mg/l
24	Silver	1.0	1.0	1.0	mg/l
25	Total toxic metals	2.0	2.0	2.0	mg/l
26	Zinc	5.0	5.0	5.0	mg/l
27	Arsenic	1.0	1.0	1.0	mg/l
28	Barium	1.5	1.5	1.5	mg/l
29	Iron	8.0	8.0	8.0	mg/l
30	Manganese	1.5	1.5	1.5	mg/l
31	Boron	6.0	6.0	6.0	mg/l
32	Chlorine	1.0	1.0	1.0	mg/l

The Motor Vehicle Noise (SEQS)		
Parameter	Standards (maximum permissible limit)	Measuring method
Noise	85dB(A)	Sound-meter at 7.5meter from the source

Sindh Environmental Quality Standards for Drinking Waters (mg/l)					
S.#	**Properties / Parameters**	**Standard Values for Pakistan**	**S.#**	**Properties / Parameters**	**Standard Values for Pakistan**
Bacterial			Chemical		
1	All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Essential Inorganics (mg/liter)		
			3	Aluminum (Al) mg/l	≤ 0.2
			4	Antimony (Sb)	≤ 0.005
2	Treated water entering the distribution system (Ecoli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	5	Arsenic (As)	≤ 0.05
			6	Barium (Ba)	0.7
			7	Boron (B)	0.3
3	Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform bacteria)	Must not be Detectable in any 100 ml sample. In case of large supplies, where sufficient samples are examined, must not be	8	Cadmium (Cd)	0.01
			9	Chloride (Cl-)	< 250
			10	Chromium (Cr)	≤ 0.05
			11	Copper (Cu)	2
			Organic (mg/L)		

Sindh Environmental Quality Standards for Drinking Waters (mg/l)					
S.#	**Properties / Parameters**	**Standard Values for Pakistan**	**S.#**	**Properties / Parameters**	**Standard Values for Pakistan**
Bacterial			Chemical		
		resent in 95% of the samples taken throughout any 12 month period.	12	Phenolic compounds	<0.0002
			Toxic Inorganics (mg/liter)		
			13	Cyanide (CN)-	≤ 0.05
			14	Fluoride (F)	≤ 1.5
			15	Lead (Pb)	≤ 0.05
			16	Manganese (Mn)	≤ 0.5
Physical			17	Mercury (Hg)	≤ 0.001
4	Color	< 15 TCU	18	Nickel (Ni)	≤ 0.02
5	Taste	Non objectionable/ Acceptable	19	Nitrate (NO_3)-	≤ 50
6	Odor	Non objectionable/ Acceptable	20	Nitrite (NO2)-	≤ 3
7	Turbidity	< 5 NTU	21	Selenium (Se)	≤ 0.01
8	Total Hardness as $CaCO_3$	< 500 mg/l	22	Residual Chlorine	0.2-0.5 At consumer end 0.5-1.5 at source
9	TDS	<1000			
10	pH	6.5-8.5			
Radioactive					
11	Alpha Emitters bq/L	0.1	23	Zinc (Zn)	5.0
12	Beta emitters	1			

Annex C: Environmental Screening checklist

The below checklist used is largely subjective, and may be overruled by site specific considerations. (Description in red is for guidance and may be deleted before using the checklist)

Name of Enumerator:_____ Date: _____
Province:_____ District:_____ Project:_____ Sector:_____
Project Categorization: A B C

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting **Is the project area…**			
Presence of any environmentally sensitive areas? (This aspect will be confirmed for each individual sub-project under SSS & A4N)			
- Protected area			
- Wetland			
- Mangrove			
- Estuarine			
- Buffer zone of protected area			
- Special area for protecting biodiversity			
- Cultural / Heritage sites			
B. Potential environmental impacts **Will the project cause…**			
Pollution of raw water supply from wastewater discharge from communities, agriculture activities? (This aspect will be assessed while designing specific subprojects under SSS & A4N. It will be ensured that the subprojects do not cause significant degradation of water bodies)			
Alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site? (This aspect will be confirmed for each individual sub-project under SSS & A4N)			
Serious contamination of soil and groundwater due to use of Pesticides? (The project interventions can potentially increase the usage of pesticides and fertilizers. Use of IPMP and appropriate awareness raising and capacity building initiatives will be included in the project design to address the potential impacts)			
Aggravation of solid waste problems in the area? (This aspect will be assessed while designing specific subprojects under SSS & A4N. It will be ensured that solid waste generated from SSS sub-projects and A4N will be handled carefully and disposed in environmental friendly way while avoiding contamination to local waterways and groundwater.)			
Social conflicts arising from displacement of communities? (This aspect will be confirmed for each individual sub-project under A4N)			
Impediment to access of residents and students (This aspect will be confirmed for each individual sub-project under SSS during construction of toilets in schools)			
Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters? (This aspect will be confirmed for each individual sub-project under SSS & A4N. If applicable, the subproject design will include water conservation practices and less water consuming designs to address water scarcity.)			
Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents) resulting in increased cases of diarrhea and making the program objectives unachievable?			

SCREENING QUESTIONS	Yes	No	REMARKS
(This aspect will be confirmed for each individual sub-project under SSS & A4N.)			
Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents? (It is likely that due to project interventions, the water may accumulate at one place or waste disposal is not adequate. The subproject design will include mitigation measures for proper waste disposal and wastewater discharge.)			
Inadequate protection of sewage collection, leading to pollution of water supply? (It is likely that due to project interventions, the existing water supply may get contaminated. The subproject design will include mitigation measures for proper waste disposal and wastewater discharge.)			
Over pumping of ground water, leading to salinization and ground subsidence? (Unlikely, however this aspect will be confirmed for each individual sub-project under SSS.)			
Environmental degradation (e.g. erosion, soil and water contamination, loss of soil fertility, disruption of wildlife habitat) from intensification of agricultural land use to supply raw materials for plant operation; and modification of natural species diversity as a result of the transformation to monoculture practices? (Unlikely, however this aspect will be confirmed for each individual sub-project under A4N.)			
Dislocation or involuntary resettlement of people? (This aspect will be confirmed for each individual sub-project using involuntary resettlement checklist)			
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?			
Potential social conflicts arising from land tenure and land use issues? (This aspect will be confirmed for each individual sub-project under A4N as it will require land acquisition.)			
Impediments to movements of people and animals? (Unlikely, however this aspect will be confirmed for each individual sub-project under A4N.)			
Noise and dust from construction activities? (This aspect will be assessed while designing specific subprojects under SSS. It will be ensured that the noise/dust emissions from subprojects' construction remains within acceptable limits.)			
Excessive abstraction of water affecting downstream water users? (Unlikely, however this aspect will be confirmed for each individual sub-project under SSS and A4N.)			
Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project commencement? (Unlikely, however this aspect will be confirmed for each individual sub-project under SSS and A4N.)			
Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?			

Annex D: Involuntary Resettlement Screening Checklist

Name of Enumerator:_____ Date: _____
Province:_____ District:_____ Project:_____ Sector:_____
Project Categorization: A B C

SECTION 1	Yes	No	Expected	Remarks
Does the project require land acquisition? Yes/No				
If yes, then describe the type of land being acquired from the categories below:				
Land (Quantify and describe types of land being acquired in "remarks column".				
Government or state owned land free of occupation (agriculture or settlement)				
Private land				
• Residential				
• Commercial				
• Agricultural				
• Communal				
• Others (specify in "remarks").				
• Name of owner/owners and type of ownership document if available.				
If land is being acquired, describe any structures constructed on it				
Land-based assets:				
• Residential structures				
• Commercial structures (specify in "remarks")				
• Community structures (specify in "remarks")				
• Agriculture structures (specify in "remarks")				
• Public utilities (specify in "remarks")				
• Others (specify in "remarks")				
If agricultural land is being acquired, specify the following:				
Agriculture related impacts				
• Crops and vegetables (specify types and cropping area in "remarks).				
• Trees (specify number and types in "remarks").				
• Others (specify in "remarks").				
Affected Persons (DPs)				
Will any people be displaced from the land when acquired? Yes/No				
• Number of DPs				
• Males				
• Females				
• Titled land owners				
• Tenants and sharecroppers				
• Leaseholders				
• Agriculture wage laborers				
• Encroachers and squatters (specify in remarks column)				
• Vulnerable DPs (e.g. women headed households, minors and aged, orphans, disabled persons and those below the poverty line). Specify the number and vulnerability in "remarks".				
• Others (specify in "remarks")				
• How will people be affected?				

Section 2				
Will land be donated voluntarily? Yes/No				
If yes, does the owner been made aware of VLD nature and procedure?				
Has the landowner agreed to sign the VLD documents?				
Can the owner produce land title deeds/documents of ownership?				
Are there any tenants on the land?				
If yes, describe number of tenants, gender and type of tenancy and length of residence.				
If yes, are tenants willing to move?				
Will there be adverse impacts on tenants? Describe in remarks column				
Are there people using the land for livelihoods, cultural activities? Yes/No				
If yes, how many people? Gender? Type of activity?				
How will voluntary land donation effect people using the land?				

Annex E: Model Environmental and Social Management Plan

The subproject-specific ESMP shall form part of the project contract specifications.

EMP Contents:

- Description of adverse effects: The anticipated effects of each sub-project will be identified and summarized in this section.
- Description of mitigation measures: Each measure will be described with reference to the effect(s) it is intended to deal with. As needed, detailed plans, designs, equipment descriptions, and operating procedures will be described.
- Description of monitoring program: Monitoring provides information on the occurrence of environmental effects. It helps identify how well mitigation measures are working, and where better mitigation may be needed. The monitoring program will identify what information to be collected, how, where and how often. It will also indicate at what level of effect there will be a need for further mitigation. How environmental effects will be monitored is discussed below.
- Responsibilities: The people, groups, or organizations that will carry out the mitigation and monitoring activities will be defined, as well as to whom they report and will be responsible. There may be a need to train people to carry out these responsibilities, and to provide them with equipment and supplies.
- Implementation schedule: The timing, frequency and duration of mitigation measures and monitoring are specified in an implementation schedule, and linked to the overall subproject schedule.
- Cost estimates and sources of funds: These are specified for the initial subproject investment and for the mitigation and monitoring activities as a subproject is implemented. Funds to implement the EMP may come from the subproject grant, from the community, or both. Government agencies and NGOs may be able to assist with monitoring.

Monitoring Methods:

Methods for monitoring the implementation of mitigation measures or environmental effects should be as simple as possible, consistent with collecting useful information, so that community members can apply them themselves. For example, they could just be regular observations of subproject activities or sites during construction and then use. Are fences and gates being maintained and properly used around a new water point; does a stream look muddier than it should and, if so, where is the mud coming from and why; are pesticides being properly stored and used? Most observations of inappropriate behavior or adverse effects should lead to commonsense solutions. In some cases (e.g. unexplainable increases in illness or declines in fish numbers), there may be a need to require investigation by a technically qualified person. A model ESMP is presented below:

Model Environmental and Social Management and Monitoring Matrix

Description of adverse effects	***Description of Mitigation Measure(s)***	***Responsibility***	***Implemnetation Schedule***	***Monitoring***	***Responsibility***	***Cost and Source of Funds***
Air Quality deterioration due to dust emissions	*Tractor loads should be covered with any suitable material.*	*IPs/Contractor(s)*	*During Construction of toilets*	*Inspect Truck/tractor mobility*	*ES/SS of IPs report to ESFPs*	*Nil*
	Soil and temporary spoil piles should be covered or sprayed with water if generating dust.	*IPs/Contractor(s)*	*During Construction of toilets*	*Inspect construction site*	*ES/SS of IPs report to ESFPs*	*Nil*
	Latrine Construction sites including Soil piles in schools should be fenced to avoid material escape, generation of dust and access to children.	*IPs/Contractor(s)*	*During Construction of toilets*	*Inspect fencing*	*ES/SS of IPs report to ESFPs*	*Rs.2,000 per fencing x 2,600 schools = Rs.5,200,000*
Pit/septic tank Sludge Management	*Composting of biodegradable waste will be considered and adopted. Sludge after emptying the tanks/pits should be landfilled at proper location and left for degradation.*	*VOs*	*During course of project*	*Check and Inspect sustainability*	*IPs/VOs*	*Behavior change activities included in project cost*
	Sludge will not be disposed of into open land	*VOs*	*During course of project*	*Check and Inspect sustainability*	*IPs/VOs*	*Behavior change activities included in project cost*
	During behavior change activities in the communities, this aspect will be communicated and awareness raising workshops will be conducted in communities.	*VOs*	*During course of project*	*Check and Inspect sustainability*	*IPs/VOs*	*Behavior change activities included in project cost*

Annex F: Outline for Resettlement Action Plan (RAP) as per World Bank OP 4.12

1. Project description, including design alternatives considered
2. Socioeconomic baseline.
3. Project impacts and affected population, including the Project's Impact Zones and details from the inventory and census surveys.
4. Project resettlement policy framework, including summary of the legal framework in Nepal, ii) a comparison with World Bank OP 4.12 and proposed measures to fill in any gaps, and iii) a project entitlement policy;
5. Compensation rates and their evaluation basis and methodology, and resettlement and rehabilitation packages;
6. Compensation and resettlement approach and action plan.
7. Community consultation and participation, descriptions of consultations carried out during project preparation and plans to continue consultations during implementation
8. Institutional framework and arrangement for implementing resettlement
9. Grievance redress mechanisms
10. Costing and budget
11. Monitoring and evaluation.

Annex G: Model Integrated Pest Management Plan (IPMP)

Introduction

Agriculture and Livestock Departments, Government of Sindh has developed Integrated Pest Management Plan (IPMP) for "Sindh Agricultural Growth Project (SAGP)" in August 2013. The SAGP is focused on horticulture—particularly chilies (92 percent of national production), onions (33 percent), dates (about 50 percent), and milk production because these commodities have a small farmer focus, have significant involvement of women in production and processing. This model IPMP has been prepared for A4N component of MSAN project which is based on principals devised in SAGP IPMP which is the principal document of Agriculture and Livestock Departments for horticulture crops as well as based on the provisions of WBG OP 4.09.

This model IPMP will be helpful for Directorate of Agriculture to prepare project specific IPMP and to mitigate and include the rational use of pesticides.

25 percent of Pakistan's fruits and vegetables produced annually go to waste between the farm and the consumer. Only four percent of Pakistan's total fruit and vegetables are exported and at far lower prices due to poor quality and the reliance on traditional low end markets. In milk production, losses climb to about 30 percent in the summer due to lack of infrastructure and equipment. The introduction of good agricultural practices (GAP) and modest investments in relatively simple technology could substantially increase the quality of production and the potential for increased trade and higher incomes.

As the overall impacts of the MSAN project on the environment were expected to be positive and accordingly MSAN was classified as a category B project under its operational policies (OP 4.01). The EMP as part of ESMF recommended measures to mitigate possible adverse impacts on the environment, including the potential induced impacts of increased pesticide use, an Integrated Pest Management Plan (IPMP) was prepared in compliance of the Bank's procedures (BP 4.01 - Annex C).

Current Pest and Pesticide Management Approaches

The weedicides/herbicides are not usually used to control weed in IPM program because in Sindh majority of small farms remove weeds and feed to farm animals as cheap fodder. This is best method to control weeds in Sindh conditions. However, pest and disease control needs attention. In chilies pests may be effectively controlled through plain water sprays/ neem oil-water sprays. However, in rare instances third generation eco-friendly insecticides such as Acetamiprid, and diafenthiuron that could be used, In some literature, Imidacloprid, and Emamectin are wrongly categorized as eco-friendly, but in fact these are not eco-friendly and should not be used; particularly the latter Emamectin which is highly toxic to bees and aquatic arthropods. Similarly, third generation fungicides such as Difenoconazole, mancozeb, could also be used as last option. In Onion plain water spray or neem-oil spray is best to control thrips. However, occasionally onion crop is attacked by bulb fly, and certain lepidopterous pests then the pesticides of chloropyrophos, Imidacloprid or any third generation pyrethroid available in the market may be used. There are implications of these crop pests the on pesticide use patterns in vegetables particularly onions. Aphids, mites and thrips are all notorious for developing resistance to most insecticides which tends to put farmers on a "Pesticide Treadmill" with high concentrations and more frequent uses. Therefore it is desirable for an IPM strategy to include a pesticide resistance management strategy as well.

Use of Fertilizers, Manures, Pesticides and Herbicides by Size of Farm

Following table provides the data on use of pesticides of overall Sindh and selected districts. The highest use of pesticides is in Jacobabad comprising 58 % of the total farms. The highest use of herbicide is in Umerkot comprising 16 % of total farms.

Area	Total Farms	Farms reporting use of									
		Fertilizers & Manures		Fertilizers Only		Manures Only		Pesticides		Herbicides	
		Number	%	Number	%	Number	%	Number	%	Number	%
Sindh	*1115285*	*187513*	*17*	*671206*	*60*	*13587*	*1*	*412430*	*37*	*196495*	*18*
Umerkot	90617	7971	9	62779	69	13	*	39711	44	14052	16
Tharparkar	35529	5124	14	411	1	-	-	-	-	-	-
Sanghar	73149	18110	25	46660	64	47	*	38708	53	9727	13
Jacobabad	33570	1306	4	30067	90	-	-	19391	58	515	2
* value less than 0.5											
Source: Agricultural Census 2010: Government of Pakistan, Statistics Division, Agricultural Census Organization											

Externalities of Pesticide Use

The cost of pesticide use is much more than the cost of the pesticide itself. The social cost is enormous which is generally disregarded while determining the economic gains in terms of higher crop yields. These costs include: occupational poisoning, food residues, drinking water contamination, pest resistance, loss of biodiversity, cost of prevention and abatement measures and the cost of awareness campaigns. Further, there are health related issues; such as (a) Sickness Incidence of Pesticide Applicators, (b) Sickness in Women Cotton Pickers, (c) Industrial Worker Poisoning, and (d) Pesticide Residue in Food Chain.

Other externalities. Pesticide residues also found in irrigation and drinking water, cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated. Some examples are: pollinator damage (honey bee poisoning), soil fauna, wildlife and birds.

Integrated Pest Management (IPM)

No single method of pest control is adequate to give satisfactory results in all situations. Therefore an integrated approach needs to be adopted. For this purpose, Integrated Pest Management (IPM) is the best available alternative. IPM has no standard definition, but is commonly referred as a diverse mix of approaches to manage pests; keep them below damaging levels by using control options that range from cultural practices to chemicals. Technologies involved, such as use of bio-pesticides (derived from *neem*, *dhatura* and *aak* that are local tree/bushes and tobacco), augmentation releases of predators/parasites, development of pest resistant species, crop rotation, cultural practices, and balanced use of fertilizers.

Integrated Plant and Soil Nutrient Management (IPSNM)

The concept of Integrated Plant and Soil Nutrient Management (IPSNM) entails the management of both organic and inorganic plant nutrients for optimal production of the cultivated crop, forage, and tree species while conserving the natural resource base that is essential for the long-term sustainability of the agro-ecosystems and the environment. Organic fertilizers bring about many useful changes in the chemical,

microbiological and physical properties of soil that enhance soil fertility. The effect is long-term and not immediate, and, therefore, farmers hesitate to use organic fertilizers. High levels of organic residue incorporation especially in fine textured soils, improves its structure as indicated by several of the parameters such as soil porosity, pore size distribution, bulk and particle densities, aggregate stability, water holding capacity, aeration, infiltration, and hydraulic conductivity. The recycling of soil derived nutrients is also improved through proper organic residue management.

Policy, Regulatory Framework, and Institutional Capacity

The first law called The Agricultural Pesticide Ordinance, 1971 was promulgated. The Agricultural Pesticide Rules under the law were framed in 1973. The 1971 Ordinance is a comprehensive law for regulating imports, formulation, sale, distribution, and use, and establishing of institutions, ensuring quality control, and prescribing penalties for offences. It was amended in 1979 to let pesticide business transition from public sector to private sector, thereafter in 1992 to allow pesticide imports under generic names, and lastly in 1992 to strengthen the punishment provisions for adulteration.

Banned Pesticides. In 1994, twenty three (23) pesticides were deregistered and their use banned in the country (Appendix 1).

Proposed IPMP for MSAN Project

The Agriculture Department, Sindh has prepared a PC-1 for the Agriculture for Nutrition (A4N) which is one of the component of MSAN project. The "Pest Management Plan (PMP)" is embedded in the A4N component only. Integrated Pest Management (IPM) and Integrated Plant and Soil Nutrient Management (IPSNM) are the core capacity building measures of the technical service providers (TSPs) for promoting of good agriculture practices (GAP) that include both IPM and IPSNM. The IPMP presented here highlights activities designed in the A4N component including training packages delivered using FFS approachon demonstration plots and A4N invesment fund which would finance purchase of supplies by farmers needed to start interventions. Thses activities will have substantial relevance to the IPM.

Objectives

The main objectives of the Pest Management Plan are threefold:

- *Promotion of IPM*: To minimize pesticide usage through Integrated Pest Management (IPM), Integrated Plant and Soil Nutrient Management (IPSNM) and Good Agricultural Practices (GAP), because they include the rational use of chemical pesticides, promote cultural practices and the use of nutrients from organic resources;
- *Management of Pesticides*: To monitor the pesticides management such as their usage before, during and after, and the level of pesticide residues in normally-treated and IPM-treated areas and to disseminate information to stakeholders on the usefulness of undertaking IPM practices.
- *Capacity Building*: To raise awareness of all stakeholders about the IPM approach to crop management, and train extension agents and farmers through FFS system to become practitioners of IPM.

Strategy

The main elements of the strategy would be to promote IPM practices under A4N component of MSAN project, which do not absolutely exclude the use of pesticides yet it promotes an integrated approach to use all available options for controlling pest population with no adverse effect on human beings, animals and the environment that eventually results in attaining sustainable productivity. The strategy calls for sensitizing the farmers and Extension staff also on the importance of IPM, particularly on the promotion of GAP and the rational use of pesticides.

The Farmers Field Schools (FFS) approach as part of A4N includes the promotion and implementation of GAP and IPM approaches. The key elements of FFS entail farmers are trained by facilitators through group participation, known as FFS and F3S in kitchen gardens, small-scale vegetable farming, small-scale livestock rearing (poultry, ruminants, fisheries), and small-scale food storage and preservation. Therefore it is essentially a field-based participatory training where farmers and extension staff work together for the duration of the project. The latter group carries out dialogues with farmer on public interest issues, including environmental conservation and health.The expected output of such training is that farmers/female farmers become self-reliant to NSA and are able to make their own nutritious food.

The concept of Integrated Plant and Soil Nutrient Management (IPSNM) would complement the IPM practices. The strategy for IPSNM would include:

a) maximizing organic matter production through green manure and cover crops;
b) enhancing natural processes of nutrient recycling through managing plant-soil-pest-predator interactions; and
c) providing soil cover (mulch, cover crops) to supply nutrients, reduce weeds, and enhance functions of soil biota and plant roots.

Activities Proposed for the IPMP

Awareness Programs: To disseminate awareness programs through FFS and Demonstration plot method, adequate resources are provided in the A4N component as well as the the sub-component i.e. Inter-Sectoral Coordination (component D(ii))which will provide a common platform for harmonization, and multi-sector synergies for effective nutrition response. The main areas that would be covered for the promotion of IPM and IPSNM practices would relate to human health, like pesticide handling, usage, storage and disposal, other health hazards, types of pesticide application.

Technical Transfer Aspects. Department of Agriculture and Department of Livestock and Fisheries (DOLF), with the support of the technical service provider (TSP), will develop information and guidelines on the technology and information needs of communities/households who will participate in the project. The TSP will lead multi-sector teams from DOA, DOLF and DOH to mobilize the villages around nutrition awareness. Information on required technology will be used in the mobilization process to generate informed demand among project beneficiaries, who can receive a grant to purchase the goods that they need. Each target village will form a procurement committee to receive the grant from the government and purchase the technical assets. The government will schedule the FFF/F3S to provide the necessary training to the beneficiaries.

DOA and DOLF have a system of staff within the district and UCs that will provide front-line support of the beneficiaries with support of the TSP. There are some vacant sanctioned positions in all three departments that could be filled to meet the needs of the project. DOA can reassign staff to be dedicated to the

implementation of this project as needed, and fill some vacant position on contingency basis with women to meet the outreach needs of the project.

Successful IPM consists of, but not limited to, following key aspects to be included in the curricula for the FFS/F3S:

- Identify pests and monitor progress
- Set action thresholds
- Prevent
- Control
- Documentation
- Responsibility

Integrated Plant and Soil Nutrient Management (IPSNM). The IPSNM approach uses both organic and inorganic fertilizers in proper proportion accompanied by sound cultural management practices and seeks to both increase agricultural production and safeguard the environment for future generations. The application of organic fertilizers needs to be encouraged to increase the soil water holding capacity in view of the ever increasing water scarcity.

Pilot Demonstrations on IPSNM. Training packages on demonstration plots delivered through FFS/F3S would include promotion of the use of organic fertilizers/residues, composting and mulching.

Pesticide Residue. Under the FFS system, samples of pesticide residue on vegetables/pulses would be collected from the control and IPM treated plots and the quantity of pesticide residue determined. The control plots are where prevalent practices of pesticide use are undertaken (i.e. included under IPMP of SAGP Project of Agriculture department) and demonstration plots where farmers practice of IPM are carried out. This would help establish the usefulness of adopting IPM practices. The work of pesticide residue determination would be contracted out to existing research laboratories that possess the desired facilities (National Centre of Excellence in Analytical Chemistry, University of Sindh, Jamshoro,). Monitoring of pesticide residue would be carried out throughout the project period and information disseminated widely to help bring down the level of residue to below the Maximum Residue Limit (MRL). Annual monitoring will be conducted for all project interventions that focus on on-farm productivity enhancements. An analytical study on the work done would be prepared in the last year of the project period.

Curriculum development for the FFS/F3S

DOA and DOLF staff will lead the technical assistance and training of beneficiaries through FFS, F3S, and FBS. The curricula, which will be developed by departmental staff with support of the TA provider, will cover topics relevant to small scale food production, including (but not limited to):

- General information on the link between food and nutrition;
- Elements of a healthy diet;
- Food for complementary feeding;
- Garden preparation and vegetable cultivation methods;
- Integrated pest management (including reducing pesticide residues);

- How to purchase good seeds and breeds in the market;
- Animal nutrition and health;
- Livestock waste management;
- Tunnel farming techniques;
- Food storage techniques;
- Home based preservation of vegetables and fruits (canning, pickling, drying, etc.);
- Storage of food grain and fodder for animals, etc.

Implementation Responsibility and Institutional Arrangements

The Director General (DG), Agriculture Extension Sindh will be responsible for activities of the A4N with major focus on FFS/F3S approach, in which IPM and IPSNM activities would be the principal capacity building measures. The Directorate of agriculture under the DG will help implementing the IPM related activities.

The same structure of Agriculture Department as adopted for IPMP of SAGP will be proposed in this IPMP of A4N component which is as follows:

The Director who is assisted in his work by a Plant Protection Officer and one Agricultural Officers at the Directorate level will prepare Project specific IPMP. The directorate will have additional support of 4 IPM Managers under the A4N, who would be placed at the district headquarters level for each district. In the field, District Governments handle this work through a hierarchical setup: Deputy Director, Agricultural Extension at District level; Assistant Director at Taluka level, Agricultural Officer at Sector level, and Field Assistant at the Union Council level. On the other hand, the actual frontline player who would implement the activities is TSP.

Monitoring and Evaluation

Monitoring would involve agronomic practices particularly cropped area sprayed (number of sprays and quantity of pesticides used), knowledge and adoption of IPM measures; and observing the adoption rates IPM/IPSNM and measuring the impact of project interventions on the kitchen gardens disaggregated by farm type and gender, by over the project period. Mid-term and post-project evaluations would also be carried out. The following key monitoring indicators are suggested: quantity of pesticide used; number of sprays and area sprayed by crop; pesticide residues on vegetables; and the use of banned pesticides, if any. Pesticide residue studies would be carried out for crops where on-farm productivity enhancements are planned on an annual basis.

Cost

The following costs associated with implementation of this IPMP in terms of pesticides usage and residue monitoring shall be included as part of the A4N component of the project. The awareness raising activities shall be streamlined with the capacity building components of the project.

Item	Amount (USD)
Annual Pesticide Residue Survey (3)	3,000,000
Soil Testing for IPSNM	900,000
Total	**39,000,000**

Appendix 1

Banned Pesticides (Active Ingredients)[35]

1. BHC
2. Binacryl
3. Bromophos ethyl
4. Captafol
5. Chlordimeform
6. Chlorobenzilate
7. Chlorthiophos
8. Cyhexatin
9. Dalapon
10. DDT
11. Dibromochloropropane + Dibromochloropropene
12. Dicrotophos
13. Dieldrin
14. Disulfoton
15. Endrin
16. Ethylene dichloride + Carbontenachloride
17. Leptophos
18. Mercury Compound
19. Mevinphos
20. Toxaphene
21. Zineb
22. Heptachlor
23. Methyl Parathion

[35] Source: Sindh Agricultural Extension Department

Annex H: Checklist for Verification and Certification of ODF & Total Sanitation Communities[36]

Village:…… Taluka:…… District:……

GENERAL INFORMATION		
S#	**Description**	**Responses**
1.	Total No. of Households in the Community	
2.	No. of Households with latrines	
3.	If not all the households have latrines, where do the households without latrine defecate?	
4.	When was the community triggered?	
5.	Has the community been certified ODF?	
6.	If Yes, when was the community certified ODF?	
7.	Who certified the community ODF?	
8.	Does the Community have hand washing stations?	

General Observation of the Community

GENERAL OBSERVATION OF THE COMMUNITY				
S#	**Description**	**yes**	**No**	**Remarks**
1.	Are the household latrines being used?			
2.	Are the latrines well maintained?			
3.	Are hand washing facilities available near the latrines?			
4.	Are anal cleansing materials properly disposed?			
5.	Are children faeces properly disposed?			
6.	Are there any traces of human faeces in former open defecation sites?			
7.	Apart from former open defecation sites, are there faeces deposited in the open anywhere in the community?			
8.	Are there latrines with hand washing facilities in schools available?			
9.	Are water points (boreholes, dug wells) located 30m from latrines?			

Any other observations and additional comments on the ODF status of the Community:

……
……

Recommendations (Give your recommendations on the ODF Status of the Community)

……
……

Name of Evaluator: Signature: Date:

[36] The ODF Checklist will be modified as required during the implementation phase of the project

For Verification and Certification for Total Sanitation, observe the following;

S#	Description	yes	No	Remarks
1.	households use hygienic latrines			
2.	All households always keep latrines clean			
3.	Schools (where available) have latrines, hand washing facilities and urinals			
4.	Health Centers (where available) have latrines and hand washing facilities			
5.	Markets (where available) have latrines			
6.	Hand washing facilities close to the latrines			
7.	People keep food covered			
8.	People keep drinking water covered			
9.	Community water point surroundings clean			
10.	Proper disposal of solid waste			
11.	Proper disposal of liquid waste			
12.	Proper disposal of animal waste			
13.	Location of water points (borehole, dug well) 30m from latrines			
14.	Community environment generally clean			

Any other observations and additional comments on the ODF status of the Community:

……
……

Recommendations (Give your recommendations on the ODF Status of the Community)

……
……

Name of Evaluator: Signature: Date:

Annex I: Guidelines for Construction of Latrines

1. Selecting the proper location

Effluent passing into the soil from a latrine pit contains large amounts of micro-organisms this may include disease causing bacteria. It also has high nitrates and other salts. There is a possibility for underlying aquifers to be polluted by the effluent infiltrating into the soil from the latrine pits. Hence a number of factors need to be taken into consideration when siting the pit of the latrine in addition to factors such as convenience and privacy of users.

- A latrine pit should be located outside a radius of 15m from a water source such as a well, stream etc.
- It should not be located upstream or up-hill from any water source
- It should not be located in a low-lying area
- Whenever possible a latrine pit should be located at least 4 m from the nearest house or building
- The bottom of the latrine pit should be a minimum of 2 m above the maximum ground water table to minimize the threat of contamination. (this is the groundwater table during peak wet weather)
- The latrine should be oriented in such a way that it receives adequate sunlight

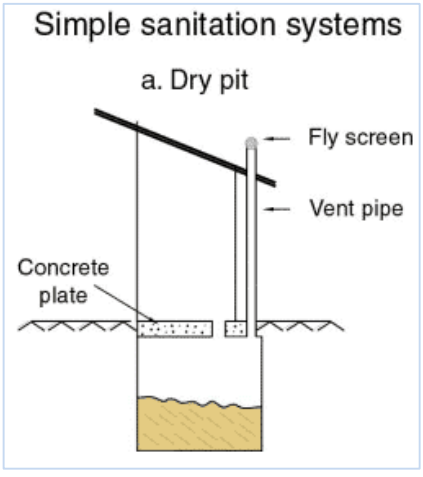
2. Selecting the proper latrine type

Selection of the most appropriate latrine type is equally important as the siting. There are number of factors that are generally considered when selecting the type of sanitation.

- Groundwater situation - The most important consideration here is groundwater pollution. This can particularly be a problem if groundwater is used for drinking purposes and the groundwater table is naturally high.
- The texture of soil, stability, permeability and the general structure of the terrain.
- Affordability
- Cultural acceptance
- Means of disposal of sludge and waste water

Following latrine designs are discussed hereunder:

8.13.1.1. Pit Latrines



A pit latrine or pit toilet is a type of toilet that collects human feces in a hole in the ground. They use either no water or one to three liters per flush with pour-flush pit latrines. The World Health Organization recommends they be built a reasonable distance from the house balancing issues of easy access versus that of smell. The distance from groundwater and surface water should be as large as possible to decrease the risk of groundwater pollution.

When the pit fills to within 0.5 meters (1.6 feet) of the top, it should be either emptied or a new pit constructed and the shelter moved or re-built at the new location. Fecal sludge management involves

emptying pits as well as transporting, treating and using the collected fecal sludge. If this is not carried out properly, water pollution and public health risks can occur.

This option of is not preferred due to its environmental consequences in water logged or shallow groundwater areas. Also the fecal sludge should be removed after filling the pit and there is a chance of spreading vector from the pit and odor problems. Also the construction of the latrines has to be outdoor due to odor and vector problems.

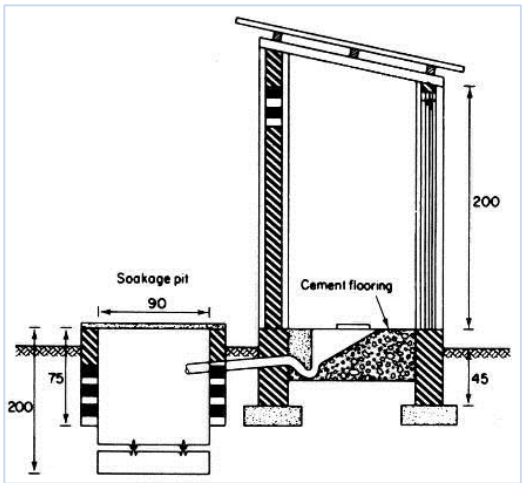
8.13.1.2. Water Flush Toilets[37]

Flush toilets use water to flush human excreta into a leach pit, tank, or sewer. After the toilet is used, a minimum of 2.5 liters of water is poured into the pan to flush the toilet. Flush toilets normally have a U-shaped conduit partly filled with water (U trap) under the pan. The U trap overcomes the problems of flies, mosquitoes, and odor by serving as a water seal. Flush toilets discharge wastewater directly into open water courses. If no specific measures are taken, this can result in pollution of neighboring surface water, which in many cases is also used as a household water source.

The water flush toilet technologies presented in this section are:

- Offset single pit toilet with pour flush
- Offset double pit toilet with pour flush
- Pour-flush toilet with two chamber septic tank with soak-pit
- Pour-flush toilet with two chamber septic tank with drainage field
- Pour-flush toilet with two chamber septic tank with evapo-transpiration mound

Offset single pit toilet with pour flush



The superstructure of an offset single pit toilet with pour flush is half a meter away from the leach pit. A short length of sufficiently sloping (1:10) PVC leads from the U trap down to the pit.

Suitability

The direct single pit toilet with pour-flush is suitable

- For areas where the water table is high, if the toilet is raised and connected to a soak-pit.
- For loose soils, if fully lined.
- For soils with low permeability, if built with a soak pit.
- In areas prone to freshwater or tidal flooding, if raised.

Advantages

- It is relatively inexpensive to construct, operate, and maintain:

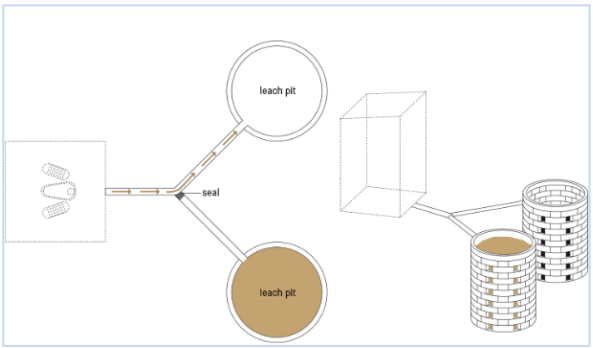
[37] Hygiene-Sanitation-Water-Toolkit - WSP

- ✓ Operation consists of regular water cleansing of the slab (with soap or detergent, if available) to remove any excreta and urine, and daily cleansing of the floor, squatting pan, door handles and other parts of the superstructure.
- ✓ Maintenance consists of monthly inspections to check for cracks in the floor slab and damage to the vent pipe and fly screen, and digging out of part of the feces at the end of the dry season. These feces should be handled with care and buried in a pit covered with soil. After at least a year, when the contents of the pit have decomposed into harmless humus, the humus can be can be used as fertilizer.

Disadvantages

- The U-trap can easily become blocked because of bad design or improper use, or damages by improper unblocking.
- Pour-flush toilets are unsuitable where it is common practice to use bulky materials for anal cleansing which cannot be flushed through the U-trap. Unless those materials are separately collected and safely buried or burned.
- The pit sludge is not safe until it has been left to decompose for at least a year.

Offset double pit toilet with pour flush



An offset double pit toilet with pour flush is an offset single pit toilet with a second pit added. The double offset system enables alternating use of the two pits.

When the first pit is full it should be left for at least twelve months, the period required for adequate pathogen destruction. After this period, the decomposed contents of the first pit can safely be removed by hand and used as organic fertilizer. The first pit can be used again while the contents of the second pit decompose.

Suitability

The offset double pit toilet with pour flush is suitable

- For areas where the water table is high, if the toilet is raised and connected to a soak-pit.
- In areas prone to freshwater or tidal flooding, if raised.
- For loose soils, if fully lined.
- For soils with low permeability, if built with a soak pit.

Advantages

- It is easy to construct, operate, and maintain:

- ✓ Operation consists of regular water cleansing of the slab (with soap or detergent, if available) to remove any excreta and urine, and daily cleansing of the floor, squatting pan, door handles and other parts of the superstructure.
- ✓ Maintenance consists of monthly inspections to check for cracks in the floor slab and damage to the vent pipe and fly screen, and digging out of part of the feces at the end of the dry season. These feces should be handled with care and buried in a pit covered with soil. After at least a year, when the contents of the pit have decomposed into harmless humus, the humus can be can be used as fertilizer.

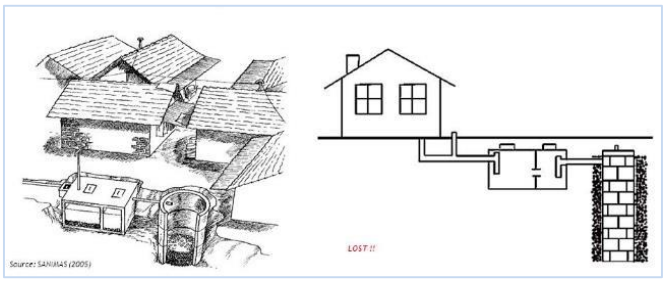
- It is relatively inexpensive to construct, operate, and maintain.
- The pit sludge is safe.
- The toilet can be connected to a soak pit.

Disadvantages

- The U-trap can easily become blocked because of bad design or improper use, or damages by improper unblocking.
- Pour-flush toilets are unsuitable where it is common practice to use bulky materials for anal cleansing which cannot be flushed through the U-trap. Unless those materials are separately collected and safely buried or burned.
- The contents of the pit may not decompose safely when the double pits are too close to each other without an effective seal between them, allowing liquids to percolate from one pit to the other.

Pour flush toilet with 2-chamber septic tank with soak pit

This type of pour flush toilet is like the offset single pit toilet, but with a septic tank in place of the pit.



A septic tank is a watertight settling tank to which wastes are carried by water flushed down a short PVC pipe. A septic tank does not dispose of wastes; it only helps to separate and digest the solid matter. The liquid effluent flowing out of the tank is as dangerous as raw sewage from a health point of view and must be dispersed by soaking into the ground through the soak pit. The sludge accumulating in the tank must be removed regularly, usually once every one to five years, depending on site, number of users, and kind of use.

In double-compartment septic tanks the first compartment has twice the volume of the second. The total volume of the tank should be at least three times the average volume of water used daily. Every tank must have a ventilation system to allow explosive gases to escape. Septic tanks are more expensive than other on-site sanitation systems and require sufficient piped water.

A soak pit is a pit into which the liquid effluents from the septic tank flow to be filtered into the ground. The capacity of the pit should not be less than that of the septic tank. The pit may be filled with stones or broken bricks, in which case no lining is needed, or lined with pre-cast reinforced cement concrete rings. The top 0.3 m (the topmost ring) should be a non-perforated ring. If no lining is used, the top 0.5 meter should be lined to provide a firm support for the reinforced concrete cover slab.

Suitability

The pour flush toilet with 2-chamber septic tank with soak-pit is suitable

- Where the water table is high, if the toilet is raised.
- In areas prone to freshwater or tidal flooding, if raised.
- For loose soils.
- For soils with low permeability.

Advantages and Disadvantages

The main advantage of the pour flush toilet with septic tank and soak pit is that it is easy to operate. This type of toilet has a number of disadvantages:

- It is relatively expensive and difficult to construct.
- It is relatively expensive and difficult to maintain. On a monthly basis, the floor, squatting pan and U-trap need to be checked, and if necessary small repairs must be carried out.
- Regular cleaning of the toilet with a bit of detergent is unlikely to be harmful, but the use of large amounts of detergents or chemicals may disturb the biochemical process in the tank. The tank must be emptied when solids occupy between one half and two thirds of the total depth between the water level and the bottom of the tank (at least once every five years).
- The sludge is not safe to handle. Removal is best done mechanically; if done manually, the sludge must be handled with extreme care. The sludge must be buried in a pit and covered with soil.
- Many problems are caused by too much disposed liquid. Large flows entering the tank may cause a temporarily high concentration of suspended solids in the effluent owing to disturbance of the solids that have settled out.
- This type of toilet is unsuitable for areas where water is scarce and where financial resources are insufficient for construction of the system, or where emptying of the tank is too expensive or cannot be carried out safely.

Pour flush toilet with 2-chamber septic tank with drainage field

This type of toilet is the same as the pour flush toilet with septic tank and soak pit, but with a drainage field in place of the soak pit.

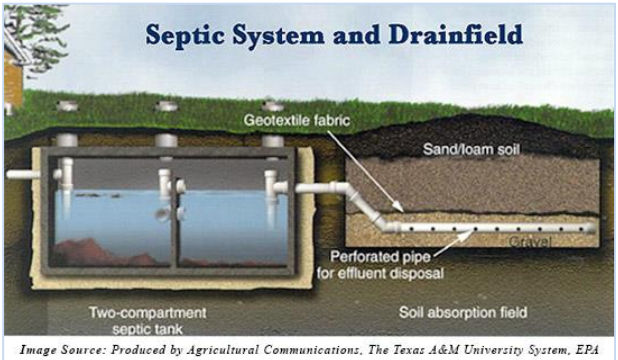


Image Source: Produced by Agricultural Communications, The Texas A&M University System, EPA

A drainage field is often used where larger quantities of liquid effluents are produced. A drainage field consists of gravel-filled underground trenches, into which the liquid effluents coming from the septic tank are led through open-joint (stoneware) or perforated (PVC) pipes, allowing the effluents to filter into the ground. Initially the infiltration into the ground may be high, but after several years the soil will clog and an equilibrium infiltration rate will be reached. If the sewage flow exceeds the equilibrium rate of the soil, eventually the sewage will surface over the drainage field.

Suitability

The pour flush toilet with drainage field is suitable

- In areas prone to freshwater or tidal flooding, if raised.
- For loose soils.
- For soils with low permeability where normal septic tanks cannot work.
- For toilets that require water for flushing.

The pour flush toilet with drainage field is not suitable where the water table is high.

Advantages

- It is easy to operate.
- The drainage field is easy to maintain. The maintenance activities for the drainage field consist of cleaning the tank outflow and ensuring that it is still in order, unblocking the delivery pipe if necessary, cleaning the diversion boxes from time to time, controlling plant growth to prevent roots from entering the trenches, and carrying out any necessary repairs.

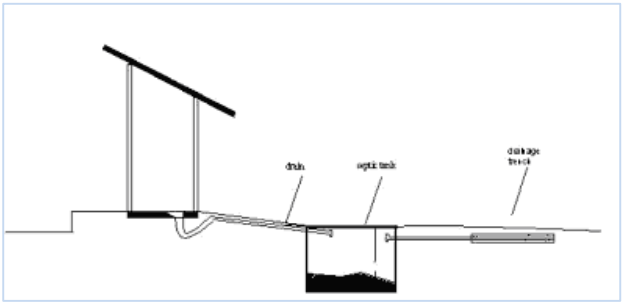
Disadvantages

- On a monthly basis, the floor, squatting pan, and U-trap must be checked, and small repairs carried out if necessary.
- Regular cleaning of the toilet with a bit of detergent is unlikely to be harmful, but the use of large amounts of detergents or chemicals may disturb the biochemical process in the tank.
- The tank must be emptied when solids occupy between one half and two thirds of the total depth between the water level and the bottom of the tank (at least once every five years).
- The sludge is not safe to handle. Removal is best done mechanically; if done manually, the sludge must be handled with extreme care. The sludge must be buried in a pit and covered with soil.
- The problems that can occur are overflowing leach lines, unpleasant odor, groundwater contamination, and social conflict over location of the drainage fields.
- A drainage field is unsuitable where insufficient space, water or financial resources for construction are available, or where bedrock or groundwater are at shallow depth.

Pour flush toilet with 2-chamber septic tank and evapo-transpiration mound

This type of toilet is the same as the pour flush toilet with septic tank and soak pit, but with an evapo-transpiration mound in place of the soak pit. The evapo-transpiration mound is shown in figure 6.6.

Where the soil is impermeable or difficult to excavate, or where the water table is near the surface, a possible solution is the use of an evaporation mound. An evaporation mound is filled with sand and gravel into which the liquid effluents coming from the septic tank are led through perforated laterals allowing the effluents to filtrate into the ground or to evaporate.



This ensures a greater depth and wider dispersion of the effluent and removes much of its water content

through evaporation from the plants growing on top of the mound.

Suitability

The pour flush toilet with evapo-transpiration mound is suitable

- Where the water table is high, if the toilet is raised.
- In areas prone to freshwater or tidal flooding, if raised.
- For loose soils.

Advantages and Disadvantages

The pour flush toilet with evapo-transpiration mound has the same advantages as the pour flush toilet with drainage field, and the same disadvantages with respect to the need to empty the tank and dispose of the sludge with care. The principal advantage of a transpiration mound over a drainage field is that a transpiration mound can be constructed where bedrock or the water table are at a shallow depth.

3. Construction of latrine pits to replace existing latrine pits:

If new latrine pits are being constructed to replace existing latrine pits then following needs to be followed:

- Old latrine pits must be demolished and unsuitable debris disposed of in sites assigned by the local authority in a manner that does not cause harm or will spread waterborne diseases.
- If asbestos roofing has been used, proper removal and disposal of sheets are required. Workers involved in removal, should wear proper masks to minimize inhalation.
- All material that can be re-used and re-cycled should be done in a manner that is environmentally friendly. Re-use debris, except top soil where ever possible from the approval of engineers for the construction activities.
- If material is not to be used within a few days, it should be moved to a pre- identified site for storage until needed.
- Debris should not be disposed to water bodies, agricultural lands, marsh lands or any environmentally sensitive areas.
- Pits should be sealed off to prevent the spread of waterborne diseases.
- Once area is cleared of all debris, it is advisable to landscape area.

4. Selection of Best suited technology for MSAN Project

Keeping in consideration the factors like i) water table persist in project districts, ii) community acceptability iii) cost of construction iv) soil structure, v) area of construction and water availability, the following two types of toilet designs are selected:

1. Offset double pit toilet with pour flush – Also recommended in areas where water table is high if raised. Toilet is connected with leaching pits (stone lined) which act as a partial trickling filter and hence the water that escapes is bacteriologically less/not harmful. Once a pit is filled, the second one comes in use and the first is emptied over time.
2. Pit latrine – Only recommended where water is scarce and pour flush technique cannot be utilized and also water table is deep like in desert area.

Annex J: Reconnaissance Survey Methodology and Results

RS was focused on collection of information on various environmental and social aspects including but not limiting to physical, biological, hydrological, health and social environment. The survey comprised collection of information on:

- Air quality and noise
- Water & ground water resources;
- Community water sources
- Community issues such as disturbance, health, etc.;
- Archaeological aspect;

Selection of Sample Villages

Due to the limitation of time for conducting the study, in each target district, a minimum of 02 Villages were taken as sample villages to represent the environmental and social conditions. The villages were chosen on the basis of poverty and sanitary conditions.

Environmental Reconnaissance Survey

A checklist method was used for environmental reconnaissance survey. Following information was collected:

District: _____ Union Council: _____ Date of Survey: _____

Name of Nearby Village: _____ Lat/Long: _____

Social Reconnaissance Survey

The other component of the survey would attempt to assess the social and economic status of the sample villages in the target districts. The following aspects were identified to highlight the social and economic profiles of beneficiaries.

- Number and size of household
- Major Disease prevailing
- Source of Drinking water
- Monthly income / Employment status

Findings of Reconnaissance Survey

Jacobabad

Village Name: **Rehan Khan Jamali**	Union Council: **Allahabad**
Socioeconomic Indicators	***Description***
Number of Households	80
Average Household Size	7
Income Level	Medium (Rs.10,000 - 30,000 Monthly)
Major Occupations	Agriculture, Poultry Farming

Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Flood prone
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. Poor c. Poor
Existing Groundwater Table (ft)	30-40
Village Name: **Gul Hassan Khan**	Union Council: **Sher Khan**
Socioeconomic Indicators	***Description***
Number of Households	25-35
Average Household Size	10
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Agriculture, Farming, Labor, Livestock
Major Diseases	Fever/Common Cold, Diarrhea, Cholera, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: Air and Noise Quality Surface Water Quality Groundwater Quality	(ESMF Team/Locals perspective) Good N/A Poor
Existing Groundwater Table (ft)	30-40
Pictorial Overview of the Villages	
	
Signs of Salinity in the area	Housing conditions

Kashmore

Village Name: **Dad Muhammad Mirani**	Union Council: **Ghous Pure**
Socioeconomic Indicators	***Description***
Number of Households	110
Average Household Size	7
Income Level	Medium (Rs.10,000-30,000 Monthly)
Major Occupations	Fishing, Labor, Agriculture

Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria, Cataract/Eye Diseases
Source(s) of Drinking Water	Groundwater
Environmental Indicators	***Description***
General Land Use	Water Logged/Saline
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Fair b. N/A c. Fair
Existing Groundwater Table (ft)	40-45
Village Name: **Akbar Mirani**	Union Council: **Ghous Pure**
Socioeconomic Indicators	***Description***
Number of Households	20
Average Household Size	10
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Fishing, Labor, Agriculture
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Skin Disease, Cough, Malaria, Cataract/Eye Diseases
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Water Logged/Saline
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Fair b. N/A c. Fair
Existing Groundwater Table (ft)	40-45
Pictorial Overview of the Villages	
	
Open defecation near the stagnant water bodies	Latrine (non-functional)
Water wells	

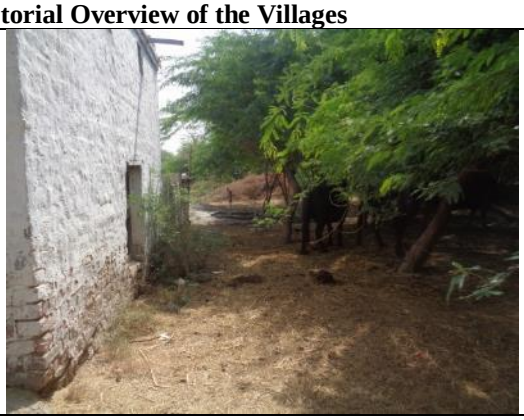
Kambar-Shahdadkot

Village Name: **Gharo Khan Brohi**	Union Council: **Aithar Chandio**
Socioeconomic Indicators	***Description***
Number of Households	15-20
Average Household Size	8-10/ persons
Income Level	Low (Rs. 5,000-20,000)

Major Occupations	Agriculture (rice field), Livestock
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Hand pump (well water)
Environmental Indicators	***Description***
General Land Use	Water Logged/Saline
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Salty in taste (Physically test)
Existing Groundwater Table (ft)	25-35
Village Name: **Gul Muhammad Brohi**	Union Council: **Aithar Chandio**
Socioeconomic Indicators	***Description***
Number of Households	10-15
Average Household Size	10-12 persons/ house
Income Level	low (Rs. 5,000-20,000)
Major Occupations	Agriculture, Livestock
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Hand pump (well water)
Environmental Indicators	***Description***
General Land Use	Water Logged/Saline
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	40-50
Pictorial Overview of the Villages	
	
Livestock for business	Latrine (non-functional)

Larkana

Village Name: **Ghulam Hyder Jalbani**	Union Council: **Jumo Agham**
Socioeconomic Indicators	***Description***
Number of Households	20
Average Household Size	10
Income Level	Medium (Rs. 10,000-30,000 Monthly)

Major Occupations	Agriculture, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	40-50
Village Name: **Jabal Khan Brohi**	Union Council: **Jum Agham**
Socioeconomic Indicators	***Description***
Number of Households	35-40
Average Household Size	10
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Livestock, Labor
Major Diseases	Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft.)	35-40
Pictorial Overview of the Villages	
	
Area for open defecation	Farming equipment

Tharparkar

Village Name: **Nenisar**	Union Council: **Malnhore Vena**
Socioeconomic Indicators	***Description***
Number of Households	20
Average Household Size	5
Income Level	Low (Less than Rs. 10,000 Monthly)
Major Occupations	Labor & Livestock
Major Diseases	Fever/Common Cold & Diarrhea

Source(s) of Drinking Water	Hand pump, well-water
Environmental Indicators	***Description***
General Land Use	Livestock
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	200
Village Name: **Mehro Bheel**	Union Council: **Mithi**
Socioeconomic Indicators	***Description***
Number of Households	200
Average Household Size	5
Income Level	Low (Less than Rs. 10000)
Major Occupations	Labor & Livestock
Major Diseases	Fever/Common Cold & Diarrhea
Source(s) of Drinking Water	Hand pump, well-water
Environmental Indicators	***Description***
General Land Use	Livestock
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	190
Pictorial Overview of the Villages	
	
Livestock in the area	Village surroundings

Badin

Village Name: **Ramji Kothi**	Union Council: **Saangi Faro**
Socioeconomic Indicators	***Description***
Number of Households	70
Average Household Size	9
Income Level	Low (Less than Rs. 10,000 Monthly)
Major Occupations	Peasant, Labor
Major Diseases	Diarrhea, Hepatitis, Cardiac Disease, Diabetes, Skin Disease, Cough, Malaria, Stomach Worms, Cataract/Eye Diseases
Source(s) of Drinking Water	Pipeline

Environmental Indicators	***Description***
General Land Use	Agriculture & Livestock
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	30-40
Pictorial Overview of the Village	
	
General village situation	

Sanghar

Village Name: **Haji Ammanullah Mari**	Union Council: **Roonjho**
Socioeconomic Indicators	***Description***
Number of Households	100
Average Household Size	7
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Peasant, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Cholera, Lungs Diseases, Skin Disease, Cough, Malaria
Source(s) of Drinking Water	Tanker, Boring
Environmental Indicators	***Description***
General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A d. Fair
Existing Groundwater Table (ft)	60-70
Village Name: **Hajir Ilyas Rajar**	Union Council: **Khaahi**
Socioeconomic Indicators	***Description***
Number of Households	150
Average Household Size	8
Income Level	Low (Less than Rs. 10,000 Monthly)
Major Occupations	Peasant, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Cholera, Hepatitis, Skin Disease, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***

General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	40-50

Tando Muhammad Khan

Village Name: **Haji Chotto Soomro**	Union Council: **Alo Katiyar**
Socioeconomic Indicators	***Description***
Number of Households	40
Average Household Size	13
Income Level	Low (Less than Rs. 10,000 Monthly)
Major Occupations	Landlords, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Lungs Diseases, Skin Disease, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Good
Existing Groundwater Table (ft)	N/A
Village Name: **Mubarak Solangi**	Union Council: **Alo Katiyar**
Socioeconomic Indicators	***Description***
Number of Households	100
Average Household Size	9
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Landlords, Farming
Major Diseases	Fever/Common Cold, Diarrhea, Lungs Diseases, Skin Disease, Cough, Malaria, Cancer
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture, Flood prone
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Good
Existing Groundwater Table (ft)	50-60
Pictorial Overview of the Villages	

	
Existing latrine condition	Soak-pit

Umerkot

Village Name: **Khunhar Bheel Parro**	Union Council: **Dhoronaro**
Socioeconomic Indicators	***Description***
Number of Households	800
Average Household Size	7
Income Level	Low (less than Rs. 10,000 Monthly)
Major Occupations	Peasant, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Cholera, Skin Disease, Cough, Stomach Worms, any other
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Mostly Agriculture & livestock grazing
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. fair
Existing Groundwater Table (ft)	-

Shikarpur

Village Name: **Haji Khan Abro**	Union Council: **Naushero**
Socioeconomic Indicators	***Description***
Number of Households	10
Average Household Size	10
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Agriculture, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Good
Existing Groundwater Table (ft)	30

Village Name: **Karamullah Bugrani**	Union Council: **Noshro**
Socioeconomic Indicators	***Description***
Number of Households	10
Average Household Size	10
Income Level	N/A
Major Occupations	Agriculture, Labor
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture (minor)
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Fair
Existing Groundwater Table (ft)	35-40
Pictorial Overview of the Villages	
	
General housing situation	Open defecation area

Dadu

Village Name: **Sahib Khan Balhro**	Union Council: **Bothro**
Socioeconomic Indicators	***Description***
Number of Households	130
Average Household Size	7
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Agriculture, Labor, Livestock
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Cough, Malaria
Source(s) of Drinking Water	Tanker, Boring
Environmental Indicators	***Description***
General Land Use	Water Logged/Saline
Environmentally Sensitive Areas	No
Environmental Components: Air and Noise Quality Surface Water Quality Groundwater Quality	(ESMF Team/Locals perspective) Good N/A Good
Existing Groundwater Table (ft)	70-80

Village Name: **Serahi Saban**	Union Council: **Bothro**
Socioeconomic Indicators	***Description***
Number of Households	10
Average Household Size	8
Income Level	Medium (Rs. 10,000-30,000)
Major Occupations	Agriculture, Labor, Livestock
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Typhoid, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Water Logged/Saline
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Poor
Existing Groundwater Table (ft)	70-80
Pictorial Overview of the Villages	
	
General housing situation	Rice fields

Thatta

Village Name: **Haji Ramzan Hajib**	Union Council: **Shato Chand**
Socioeconomic Indicators	***Description***
Number of Households	1000
Average Household Size	8
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Truck Driving, Landlords, Masons (skilled), Farming
Major Diseases	Fever/Common Cold, Diarrhea, Hepatitis, Kidney Disease, Skin Disease, Cough, Malaria, Cataract/Eye Disease
Source(s) of Drinking Water	Self-sustaining (hand carrying)
Environmental Indicators	***Description***
General Land Use	Agriculture, Hilly/Mountainous, Desert
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. Fair c. Poor
Existing Groundwater Table (ft)	40-50
Village Name: **Ubhoro Jakhro/Faqeer jo Goth**	Union Council: **Kalan kot**

Socioeconomic Indicators	***Description***
Number of Households	300
Average Household Size	8
Income Level	Low (Less than Rs. 10,000 Monthly)
Major Occupations	Agriculture, Shop-keeping, Livestock (Dairy)
Major Diseases	Fever/Common Cold, Kidney Disease, Skin Disease, Cough, Malaria, Cataract/Eye Disease
Source(s) of Drinking Water	Hand Pump (25 ft)
Environmental Indicators	***Description***
General Land Use	Agriculture, Water Logged/Saline, Flood prone
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. Fair c. Poor
Existing Groundwater Table (ft)	25
Pictorial Overview of the Villages	
	
Open-pit latrines (not functional)	Latrines in Unicef GPS Belo Darya School

Sujawal

Village Name: **Jaffar Malah**	Union Council: **Bello**
Socioeconomic Indicators	***Description***
Number of Households	35-40
Average Household Size	8
Income Level	Low (Less than Rs. 10,000 Monthly)
Major Occupations	Farming, Fishing, Labour, Poultry
Major Diseases	Fever/Common Cold, Diarrhoea, Hepatitis, Cough, Malaria
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture, Flood prone
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. Fair c. Good
Existing Groundwater Table (ft)	25
Village Name: **Noor Muhammad Konjro**	Union Council: **Ali Bhar**

Socioeconomic Indicators	***Description***
Number of Households	100
Average Household Size	13
Income Level	Medium (Rs. 10,000-30,000 Monthly)
Major Occupations	Labour, Farming, Wood Trade (sales)
Major Diseases	Fever/Common Cold, Diarrhoea, Hepatitis, Skin Disease, Cough, Malaria, T.B
Source(s) of Drinking Water	Boring
Environmental Indicators	***Description***
General Land Use	Agriculture, Flood prone
Environmentally Sensitive Areas	No
Environmental Components: a. Air and Noise Quality b. Surface Water Quality c. Groundwater Quality	(ESMF Team/Locals perspective) a. Good b. N/A c. Good
Existing Groundwater Table (ft)	15

Pictorial Overview of the Villages

Existing house structures

Stagnant water

Annex K: List of Ecologically Protected areas in Sindh

Wildlife Sanctuaries

S#	Protected Areas.	District	Area in Hectares
1	Takkar	Khairpur	43,513.334
2	Hudero Lake	Thatta	13,468.416
3	Keenjhar (Kalri) Lake	"	1,320.940
4	Haleji Lake	"	1,704.273
5	Lung Lake	Larkana	19.179
6	Drigh Lake	"	164.268
7	Mahal Kohistan	Dadu	70,577.090
8	Hab Dam	Karachi	27.219.151
9	Ghondhak Dhoro	Jacobabad	30.92
10	Miani Dhand	Hyderabad	56.66
11	Samno Dhand	Hyderabad	22.66
12	Gulsher Dhand	"	24.282
13	Dhounk Block	Shikarpur	2,097.965
14	Lakhat	Shaheed Benazirabad (formerly Nawabshsh)	101.175
15	Kot Dinghano	"	30.252
16	Mohabat Dero	"	16.188
17	Bijoro Chhach	Thatta	121.41
18	Norung	"	242.82
19	Cut Munarki Chhach	"	404.70
20	Sadnani	"	83.772
21	Shah Lanko	"	60.705
22	Hilaya	"	323.76
23	Majiran	"	24.282
24	Gullet Kohri	"	40.47
25	Marho Kotri	"	161.88
26	Munarki	"	12.141
27	Khadi	"	80.94
28	Keti Bander North	"	8,948.322
29	Keti Bander South	"	23,046.06
30	Khat Dhoro	Larkana	10.522
31	Runn of Kutch	Badin & Tharparkar	320463
32	Nara Desert	Sukkur, Khairpur 7 Sanghar	223590
33	Deh Akro - II	Shaheed Benazirabad (formerly Nawabshsh)	20243
Source: Sindh Wildlife Department - GOS			

Game Reserves

#	Protected Areas.	District	Area in Hectares
1	Deh Jangisar	Thatta	313.642
2	Deh Khalifa	Thatta	428.982
3	Dosu Forest	Larkana	2,312.212
4	Hala Forest	Hyderabad	953.473
5	Indus River (Dolphin Reserve) From Sukkur to Guddu Barrage	Jacobabad/Ghotki/Shikarpur &Sukkur	44.200
6	Khipro Forest	Sanghar	3,885.254
7	Mando Dero Forest	Sukkur	1,234.335
8	Mirpur Sakro Forest	Thatta	777.024

9	Nara	Khairpur	109,966.39
10	Pai Forest	Shaheed Benazirabad (formerly Nawabshsh)	1,969.270
11	Sahib Samo Forest	Hyderabad	348.473
12	Surjan, Sumbak, Eri & Hothiano Mountains	Dadu	40,631.88
13	Tando Mitho Khan Forest	Sanghar	5,343,294
Source: Sindh Wildlife Department - GOS			

Ramsar Sites in Sindh

S#	Name of Ramsar Site	District
1.	Keenjhar (Kalri) Lake	Thatta
2.	Haleji Lake	Thatta
3.	Drigh Lake	Larkana
4.	Indus Dolphin Reserve	Kashmore
5.	Jubho Lagoon	Badin
6.	Nurri Lagoon	Badin
7.	Deh Akro-II Desert Wetland Complex	Nawabshah
8.	Indus Delta	Thatta
9.	Runn Of Kutch	Tharparkar
10.	Hub Dam	Karachi
Source: Ramsar List		

Forest Areas

Sindh province, having a population of about 55.24 million, occupies land area of 14.091 million ha. (34.81 million acres). Out of above, an area of 1.125 million ha. (2.782 million acres) is under the control of Sindh Forest Department, which is 8% of the total area of the province. However, out of aforementioned total area, riverine forests and irrigated plantations which are categorized as productive forests cover only 2.29% area, clearly indicating that the province is deficient in forestry resources. The remaining area under the control of Sindh Forest Department (SFD) consists of mangrove forests and rangelands, which are classified as protective forests. The details of both productive and protective categories of forests are given as follows:

Protective categories of Forests of Sindh		
Type	**Area (Million ha.)**	**% of total land area of Sindh**
Riverine Forests	0.241	1.71
Irrigated Plantations	0.082	0.58
Mangroves	0.345	2.45
Rangelands	0.457	3.25
Grand Total	1.125	8.00

Annex L: List of Protected Archeological Sites and Monuments

Badin District

1. Ruins of old city at Badin, Badin

Dadu District

2. Tomb of Yar Muhammad Khan kalhora and its adjoining Masjid near khudabad, Dadu.
3. Jami Masjid, Khudabad, Dadu.
4. Rani Fort Kot, Dadu.
5. Amri, Mounds, Dadu.
6. Lakhomir-ji-Mari, Deh Nang opposite Police outpost, Sehwan, Dadu.
7. Damb Buthi, Deh Narpirar at the source of the pirari (spring), south of Jhangara, Sehwan, Dadu.
8. Piyaroli Mari, Deh Shouk near pir Gaji Shah, Johi, Dadu.
9. Ali Murad village mounds, Deh Bahlil Shah, Johi, Dadu.
10. Nasumji Buthi, Deh Karchat Mahal, Kohistan, Dadu.
11. Kohtrass Buthi, Deh Karchat about 8 miles south-west of village of Karchat on road from Thana Bula Khan to Taung, Dadu.
12. Othamjo Buthi Deh Karchat or river Baran on the way from the Arabjo Thano to Wahi village north-west of Bachani sandhi, Mahal, Kohistan, Dadu.
13. Lohamjodaro, Deh Palha at a distance of 30 chains from Railway Station but not within railway limits, Dadu.
14. Pandhi Wahi village mounds, Deh Wahi, Johi, Dadu.
15. Sehwan Fort, Sehwan, Dadu.
16. Ancient Mound, Deh Wahi Pandhi, Johi, Dadu.
17. Ancient Mound, Deh Wahi Pandhi, Johi, Dadu.

Larkana District

18. Jhukar mound, Mithadaro, Larkana.
19. Moenjodaro, Buddhist monastery and prehistoric remains around Moenjodaro, Larkana.
20. Moenjodaro, Buddhist Stupa and prehistoric remains underneath, Moenjodaro, Larkana.
21. Tajjar Building, Jinnah Bagh, Larkana.
22. Tomb of Shah Baharo, Larkana.
23. Square Tower, near Dhamrao, Larkana.
24. Dhamrao Dero (three groups), Deh Dhamrao, Deh 67 Nasrat, Larkana.

Sanghar District

25. Brahmanabad (Mansura) locally known as Dalo Raja-ji-Nagri, Jamara, Tehsil Sinjhoro. Deh Dalore, Sanghar.
26. Mound Thulh, Deh Kot Bujar, Sanghar.
27. Graveyard, Tehsil Shahdadpur, Sanghar.

Tharparkar District

28. Birth place of Akbar the Great (Small Building 9’ x 9’) near the town of Umerkot, Tharparkar.

29. Buddhist Stupa (Kahujodaro), Mirpurkhas, Tharparkar.
30. A stone mosque with white marble pillars, Bhodesar, Tharparkar.
31. Temple-I, Bhodesar, Tharparkar.
32. Temple-II, Bhodesar, Tharparkar.
33. Fort Naokot, Tharparkar.
34. Fort Umerkot, Tharparkar.
35. Gori Temple, 14 miles north-west of Virawah, Tharparkar.
36. Temple-IV, Bhodesar, Tharparkar.
37. Mound at Bhiro, Sherwah, Tharparkar.
38. Mound at Shadi Pali, Deh Khuda Bux, Tharparkar.
39. Jain Temple, Virawah, Tharparkar.
40. Brick Tomb of Arzi Khokhar, Ghitori, Goth, Deh No. 24, Tharparkar.
41. Tomb of Mir Khan s/o Karam Khan Talpur, Ghitori Goth, Deh No. 24, Tharparkar.
42. Tomb of Mir Jado, Ghitori Goth, Deh No. 24, Tharparkar.
43. Tomb of Mir Murad Khan, Ghitori Goth, Deh No. 24, Tharparkar.
44. Tomb of Musa Khan, Ghitori Goth, Deh No. 24, Tharparkar.
45. Tomb of Mir Raio, Ghitori Goth, Deh No. 24, Tharparkar.
46. Tomb of Shaheed Kapri Baloch, Ghitori Goth, Deh No. 24, Tharparkar.
47. A tomb (name not known) north-west of Shaheed Kapri Baluch, Ghitori Goth, Deh No. 24, Tharparkar.
48. Tomb of bricks, west of S.No. 81 above (name not known), Ghitori Goth, Deh No. 24, Tharparkar.
49. Stone tomb west of S. No. 82 above (name not known), Ghitori Goth, Deh No. 24, Tharparkar.
50. Tombs of Mir Fateh Khan and Mir Mirza Khan Ghitori Goth, Deh No. 24, Tharparkar.
51. Tomb of females of Mir dynasty, Ghitori Goth, Deh No. 24, Tharparkar.
52. Tomb of females of Mir dynasty, Ghitori Goth, Deh No. 24, Tharparkar.
53. Tomb of Aulia Pir Ghitori Badshah Qureshi, Ghitori Goth, Deh No. 24, Tharparkar.
54. Tomb and a Mosque, Ghitori Goth, Deh No. 24, Tharparkar.
55. Old ruined Mosque, Ghitori Goth, Deh No. 24, Tharparkar.

Thatta District

56. Brick dome to the north-east of tomb of Mubarak Khan (tomb of Fateh Khan's sister), Makli Hill, Thatta.
57. Tomb of Mubarak Khan son of Jam Nizamuddin, Makli Hill Thatta.
58. Tomb and compound wall of yellow stone to the south of Jam Nizamuddin, Makli Hill, Thatta.
59. Tomb and enclosure to the south-west of S. No. 92. Makli Hill, Thatta.
60. Tomb and enclosure to the west of the above tomb S. No. 93, Makli Hill, Thatta.
61. Brick dome to the south of the tomb S. No 94, above Makli Hill, Thatta.
62. Sultan Ibrahim and other tombs also but wrongly known as Amir Khalil Khan's tomb, Makli Hill, Thatta.
63. Tomb and compound wall of yellow stone to the south of Mirza Muhammad Baqi Tarkhan tomb (wrongly called Mirza Isa Khan's tomb), Makli Hill.
64. Brick enclosure of Mirza Baqi Baig Uzbak's tomb, south of the tomb of Nawab Isa Khan the younger, Makli Hill.
65. Dabgir Masjid, Makli Hill.

66. Graveyard, Makli Hill.
67. Goth Raja Malik graveyard known as Maqam Qadar Shah, Deh Raja Malik, Thatta.
68. Sonda graveyard, village Sonda.
69. Jam Nizmuddin's tomb, Makli Hill.
70. Baradari, Makli Hill.
71. Tomb of Amir Sultan Muhammad son of Amir Hajika, Makli hill.
72. Tomb of Nawab Isa Khan, the younger Makli Hill.
73. Mirza Tughral Baig's tomb, Makli Hill.
74. Tomb of Mirza Jani and Mirza Ghazi Baig, Makli Hill.
75. Stone enclosure containing tombs of Nawab Isa Khan, Makli Hill.
76. Mirza Muhammad Baqi Tarkhan's tomb (wrongly called Mirza Isa Khan's tomb) Makli Hill.
77. Stone tomb with a dome on stone pillars by the side Mirza Jani Baig's tomb, Makli Hill Thatta.
78. Brick masjid and enclosure near Nawab Shurfa Khan's tomb (supposed to be the tomb of Sayyed Amir Khan), Makli Hill, Thatta.
79. Stone tomb with enclosure to the south of tomb of Mirza Muhammad Baqi Tarkhan, Makli
80. Hill, Thatta.
81. Tomb of Mirza Muhammad Isa Turkhan I, Makli Hill, Thatta.
82. Brick tomb near the tomb of Qulia pir, Makli Hill, Thatta.
83. Tomb with superstructure on stone pillars to the north of tomb of Jam Nizamuddin, Makli Hill, Thatta.
84. Brick structure to the north of tomb of Jam Nizamuddin, Makli Hill, Thatta.
85. Two pavilions on stone pillars over the tombs to the southwest of tomb of Jam Nizamuddin. One is the tomb of Jam Sikandar Shah, Makli Hill, Thatta.
86. Kalan Kot, Makli Hill, Thatta.
87. Nawab Amir Khan's mosque, Makli Hill, Thatta.
88. Building with two domes near the Civil Hospital, Thatta, Makli Hill, Thatta.
89. Jama Masjid, Makli Hill, Thatta.
90. Sasian-Jo-Takar (Mirpur Sakro, Thatta.
91. Jama Masjid, Thatta.

WORLD HERITAGE MONUMENTS ON UNESCO LIST.

1. Mohenjodaro, District Larkana.
2. Makli Hill, Thatta.

Annex M: Methodology and Feedback of Consultation with Communities

Methodology

Due to the limited time-frame of the study, selected villages in each of the target districts for SSS and A4N programs were targeted for consultation. Based on the project design, a few important aspects were used to identify the target villages:

- Low Poverty-level
- Implementation of previous WASH/Agriculture projects
- Poor Malnutrition Indicators

A pre-designed questionnaire was developed for both the projects that covered the project activities, the implementation mechanism, social acceptability, community readiness and other socio-economic aspects. Focus Group Discussions (FGDs) were used as the primary consultation tool for engaging stakeholders. In each district 1 or 2 FGDs were held with community representatives that were well-informed of local issues and were able to voice their concerns and suggestions. Various community representatives including village elders, farmers, women and youth were part of the consultation sessions. Three field teams supported by local community mobilizers were deployed to conduct the survey in all thirteen districts from 18-22 August, 2016.

A total of 21 FGDs were conducted in 13 Districts. The villages visited in each district, along with the respective coordinates are shown in following table:

Villages Consulted for SSS and A4N Projects				
S. No.	**Districts**	**Villages**	**Project Focus**	**Coordinates**
1.	**Thatta**	Haji Ramzan Hajib	SSS	24° 50’ 18.2” N 67° 56’ 41.6” E
2.		Ubhoro Jakhro	SSS	24° 44’ 27.1” N 67° 58’ 00.9” E
3.	**Sujawal**	Noor Muhammad Konjro	SSS	24° 35’ 55.9” N 68° 05’ 51.0” E
4.		Jaffar Malah	SSS	24° 41’ 48.5” N 68° 07’ 25.5” E
5.	**Tando M. Khan**	Haji Chotto Soomro	SSS	24° 58’ 53.2” N 68° 18’ 37.6” E
6.		Mubarak Solangi	SSS	24° 59’ 40.5” N 68° 18’ 42.5” E
7.	**Sanghar**	Haji Amanullah Mari	SSS and A4N	25° 38’ 11.5” N 69° 29’ 37.2” E
8.		Haji Ilyas Rajar	SSS and A4N	25° 35’ 20.5” N 69° 28’ 44.2” E
9.	**Umerkot**	Kunhaar Bheel	SSS and A4N	25° 30’ 41.5” N 69° 33’ 36.9” E
10.	**Tharparkar**	Nenisar Meghwar Parro	SSS and A4N	24° 47’ 04.4” N 69° 52’ 34.0” E
11.	**Badin**	Ramji Kolhi	SSS	24° 55’ 23.3” N 69° 12’ 12.1” E
12.	**Jacobabad**	Rehan Khan Jamali	SSS and A4N	27° 59’ 41.7” N 67° 58’ 49.3” E
13.		Gul Hassan Khan	SSS and A4N	27° 59’ 34.0” N

Villages Consulted for SSS and A4N Projects				
S. No.	**Districts**	**Villages**	**Project Focus**	**Coordinates**
				67° 57’ 38.6” E
14.	**Larkana**	Ghulam Hyder Jalbani	SSS	27° 49’ 53.30” N 68° 14’ 23.70” E
15.		Jabal Khan Brohie	SSS	27° 50’ 32.4” N 68° 14’ 08.0” E
16.	**Kashmore**	Akbar Mirani	SSS	28° 09’ 34.6” N 69° 07’ 15.4” E
17.		Dad Muhammad Mirani	SSS	28° 09’ 20.9” N 69° 07’ 23.1” E
18.	**Dadu**	Sahib Khan Balhro	SSS	27° 18’ 37.4” N 67° 54’ 09.6” E
19.		Serahi Saban	SSS	27° 18’ 37.0” N 67° 54’ 15.4” E
20.	**Qamber@Kandhkot**	Ghano Khan Brohi	SSS	27° 52’ 04.8” N 67° 58’ 05.6” E
21.		Gul Muhammad Brohi	SSS	27° 52’ 03.1” N 67° 57’ 58.9” E

Consultation Feedback

The comments and suggestions received from local community representatives have been detailed in this Annex. Feedback has been separately elucidated for each village. The list of participants and pictorial representation are also illustrated after each summary.

District: **SUJAWAL**	Union Council: Bello	Date: **21th August 2016**
Name of Village: **Jaffar Malah**		Deh: Muradpur
Coordinates: 24° 41’ 48.5” N 68° 07’ 25.5” E		
Interviewers: Mr. Abid Khan, Mr. Love Kumar, Mr. Hashim Palejo		

Discussion Summary:

- No recent development activities have been implemented by any Local Government Department or NGO. In fact, Local Government representatives are not actively involved in any aspects of the village affairs.
- There are no community-based organizations in the village.
- There are common conflicts due to land and water canals. These problems are solved through mutual consensus by village leaders.
- Local people want NGO’s for execution of SSS programme.
- 60% of population of this area defecate behind bushes and children defecate outside the house gates. Only 40% - 50% homes have open pit latrines.
- Poverty was identified as the main challenge for construction of toilets. Moreover, villagers said if govt. provides 30-40% of total cost they will construct toilets in their homes.
- Villagers commonly wash hands with soap after defecation.
- Children and women have Flu, Malaria and Diarrhea. Some Cases of Hepatitis are also recorded.
- Villagers identified construction of schools as their highest priority as there are no schools in the village.
- Villagers felt that SSS programme can improve overall environment of the village and positively influence the health of the community. The villagers were in agreement to the proposed interventions.

S.No.	**Name of Participants**	**Occupations**
Males		
01.	Hafeez	Fisherman
02.	Shareef	Farmer
03.	Ghulam hyder	Shopkeeper

04.	Hajji	Farmer
05.	Lateef	Farmer
06.	Lal Muhammad	Farmer
07.	Ameen	Farmer
08.	Ahammad	Farmer
09.	Muhammad Aslam	Shopkeeper
10.	Rasheed	Peon
11.	Vikeyo	Farmer
12.	Muhammad Urus	Peon

District: **SUJAWAL**	Union Council: Ali Bhar	Date: **21th August 2016**
Name of Village: **Noor Muhammad Konjro**		Deh: Bhotaro
Coordinates: 24° 35' 55.9" N 68° 05' 51.0" E		
Interviewers: Mr. Abid Khan, Mr. Love Kumar, Mr. Hashim Palejo		

Discussion Summary:

- Recent development activities in the village include under construction school by Sindh Education Foundation and few Kacha homes donated by an NGO.
- There are no community-based organizations in this village.
- According to villagers, there are no major conflicts or rivalry in this village and they solve their minor problems in consultation with community leaders.
- Local people want NGO's for execution of SSS programme.
- 100% population of this area defecate behind bushes or in water bodies and children defecate outside the home.
- None of the house have latrine in the village and they prefer open defecation because they have no funds to construct toilets. Poverty is the main challenge for them to construct toilets.
- The villagers said that if govt. provides 40-50% of total cost they will construct toilets. 95% participants agreed on this.
- According to villagers, they wash their hands with soaps. Flu, Diarrhea and fever are the common illnesses in the village.
- Previously there were no schools, but now one school is under construction and according to focal person from Sindh Education Foundation focal person there will be 2 washrooms there and will be monitored regularly. Villagers also agreed that hand-washing facilities in local schools will improve their environment.
- Villagers were positive regarding the SSS programme and feel that the proposed project components will change villagers' health and environment and it will save children from diseases. Monitoring should be done for proper implementation of these components.

S.No.	**Name of Participants**	**Occupations**
Males		
01.	Akram	Laborer
02.	Ajaz Ahmed	Govt. Servant
03.	Noor Muhammad	Farmer
04.	Ashraf	Farmer
05.	Muhammad Sharif	Farmer
06.	Ghulam	Peon
07.	Muhammad Hassan	Guard
08.	Asghar	Farmer
09.	Punhoon	Shopkeeper
10.	Arbab	Farmer
Females		
11.	Sakena	Housewives
12.	Sharifan	
13.	Soni	
14.	Samari	

15.	Zeenat	
16.	Aisha	
17.	Mithna	
18.	Parsna	
19.	Asoori	
20.	Kari	
21.	Noorjhan	
22.	Zarmeena	
23.	Hajoo	
24.	Shareefa	
25.	Haleema	
26.	Shaihda	
27.	Nahida	
28.	Samina	
29	Najima	
30.	Hamifa	
31.	Sona	
32.	Zabida	
33.	Samraan	
34.	Jewani	

District: **TANDO M. KHAN**	Union Council: Alo Katiyar	Date: **21th August 2016**
Name of Village: **Haji Chotto Soomro**		Deh: Somarki
Coordinates: 24° 58' 53.2" N 68° 18' 37.6" E		
Interviewers: Mr. Abid Khan, Mr. Love Kumar, Mr. Hashim Palejo		

Discussion Summary:

- No recent development activities have been implemented by any Local Government Department or NGO. In fact, Local Government representatives are not actively involved in any aspects of the village affairs.
- There are no community-based organizations in the village. Akbar Soomro is the only social worker of this village.
- According to villagers, there are no major conflicts in this village and village elder, Haji Deeno resolves village conflicts if any.
- Local people want NGO's for execution of SSS programme.
- 50% of the population practice open defecation. Children use empty areas outside their homes as a latrines and women go at night time behind bushes.
- 40-50% of houses have latrines. Out of these, about 10% are Pakka (made with brick) latrines with drains. Remaining of the villagers do not have money for latrine construction.
- Those who have bathrooms they all wash their hands with soaps and other just wash their hands with water due to unavailability of soap.
- Malaria, Diarrhea, skin problem and stomach worms are common illnesses amongst the villagers.
- Developing and monitoring of hand-washing facilities and latrines in local school will change environment of the village. A primary and middle school is available in this village but both are not functional due to unavailability of teachers.
- Villagers were positive regarding the SSS programme and feel that the proposed project components will change villagers' health and environment and it will save children from diseases. No adjustments were recommended from the participants.

List of Participants

S.No.	Name of Participants	Occupations
01.	Akbar Soomro	Landlord
02.	Ayaz Soomro	Landlord
03.	Abdul Kareem	Former
04.	Hazoor Bux	Former
05.	Abdul Jameel	Former

06.	Abdul Gani	Former
07.	Gulam Hyder	Shopkeeper
08.	Nadir Ali	Peon
09.	Vikeyoo Soomoro	Landlord

District: **TANDO M. KHAN**	Union Council: Alo Katiyar	Date: **21th August 2016**
Name of Village: **Mubarak Solangi**		Deh: Khalasi
Coordinates: 24° 59' 40.5" N 68° 18' 42.5" E		
Interviewers: Mr. Abid Khan, Mr. Love Kumar, Mr. Hashim Palejo		

Discussion Summary:

- 13 Latrines are under construction that are being built with collaboration of NGO (NRSP) and Villagers with 80 – 20% contribution respectively.
- Bellar Group is active in this village, this group works for village affairs and is led by a locally selected President and Vice-President.
- Most common conflicts in this village are because of land and usually people take assistance from the local Police and rarely approach the courts for solving their conflicts.
- Local people want NGOs for execution of SSS programme
- 40% houses of this area are Pakka and 60% are Kacha houses. 60% of total villagers do not have toilets and they defecate in gutters, behind bushes or in water bodies.
- Open-pit latrines are being used by villagers for defecation. Poverty is the main challenge for us to construct toilets.
- Villagers said that if govt. provides 40-50% of total cost they will construct toilets. They wash their hands with soaps on a regular basis.
- Children and women have malaria and Diarrhea. Some patients of hepatitis and TB are also recorded.
- Villagers agreed that developing and monitoring of hand-washing facilities and latrines in local schools will change environment of this village. A primary school is available in this village. There are no functional latrines in the school.
- Villagers were positive regarding the SSS programme and feel that the proposed project components will change villagers' health and environment and it will save children from diseases. No adjustments were recommended from the participants.

List of Participants

S.No.	Name of Participants	Occupations
01.	Wadero Hyder Bux	Land Lord
02.	Muhammad Ayoob	Farmer
03.	Ali Muhammad	Landlord
04.	Muhammad Suleman	NRSP (NGO)
05.	Muhammad Ibhraium	Farmer
06.	Haji Usman	Farmer
07.	Kadir Bux	Student
08.	Allah Dino	Farmer
09.	Abdul Shakoor	Farmer
10.	Noor Muhammad	Peon
11.	Gul Hasan	Farmer
12.	Kamal Machi	Landlord

District: **THATTA**	Union Council: Kalan Kot	Date: **20th August 2016**
Name of Village: **Ubhoro Jakhro / Faqeer Jo Goth**		Deh: Bao Poran Das
Coordinates: 24° 44' 27.1" N 67° 58' 00.9" E		
Interviewers: Mr. Abid Khan, Mr. Love Kumar, Mr. Hashim Palejo		

Discussion Summary:

- Cloth-made washrooms were provided by NGO's during the floods in 2014. Recently no developmental work has been done in this area, except by NRSP which provides loans to villagers for constructing homes.
- There is no community-based organizations in this village and no major conflicts occur.
- Only 2% of the population have latrines and 98% population of this area defecate in gutters, behind bushes or in water bodies, with no privacy and children defecate outside homes in open areas.
- Villagers don't view latrines as their priority. They do not have proper homes which is more important for them. Poverty is the main hurdle for villagers to construct toilets. They said first they need homes, then they would be willing to construct toilets.
- Majority of the villagers wash their hands with soaps.
- Skin, Eye diseases, Fever and Diarrhea are the main illness of this area. These diseases/illnesses occur because we do not have water drainage system even there is no potable water available. There is no doctor/hospital available in the village due to which illnesses are increasing the village.
- No school available in this area and the area have a very high illiteracy rate.

List of Participants

S.No.	Name of Participants	Occupations
Males		
01.	Rajib	Paan Maker
02.	Aziz	Shopkeeper
03.	Salahuldin	Former
04.	Javeed	Shopkeeper
05.	Aslam	Student
06.	Punnal	Peon
07.	Yaseen	Student
08.	Soofan	Shopkeeper
Females		
09.	Pehapy	Housewives and Handicraft Making
10.	Maryam	
11.	Zarmena	
12.	Khatoom	
13.	Haseena	
14.	Poorhay	
15.	Robina	
16.	Allah Rakhay	
17.	Mitham	
18.	Sallna	
19.	Karina	
20.	Kazoo	
21.	Khatija	
22.	Amna	
23.	Karema	
24.	Haseama	
25.	Gul Bauo	
26.	Abhorray	
27.	Samee	
28.	Kalsoom	
29.	Dadi	

District: **THATTA**	Union Council: Chatto Chand	Date: **20th August 2016**
Name of Village: **Muhammad Ramzan Hajib**		Deh: 7/3 Kohistan
Coordinates: 24° 50' 18.2" N 67° 56' 41.6" E		

Interviewers: Mr. Abid Khan, Mr. Love Kumar, Mr. Hashim Palejo

Discussion Summary:

- Recently a Water supply line was developed by an NGO but it is not yet functional. Similarly, about 12 years ago a school was constructed by the Government of Sindh. More recently, drinking water tanks were provided by Local Government about one year ago.
- No community-based organization exist in this village but Muhammad Ibhraim and Kareem Bux work voluntarily for the village.
- According to villagers, there are no major conflict or rivalry in this village. Moreover, there is no Wadera system in this village. Villagers said they believe in unity, live peacefully and solve problems amicably.
- There are 1000-1200 homes in this village out of them 5% have proper defecation and 95% population of this area defecate in gutters, behind bushes or in open water bodies, with no dignity or privacy and children defecate outside homes in open areas.
- Only 5% of houses have open pit latrines, even children of these 5% houses go for open defecation. All of 5% houses have Open-pit latrines for defecation.
- Poverty is the main challenge for villagers to construct toilets and there is also a lack of clean water. Villagers argued that if govt. provides 40-50% of total cost they will construct toilets. 95% villagers are agreed to this.
- There are no proper hand washing facilities in the village, they use water for hand washing after defecation, but children usually do not wash their hands after defecation due to lack of awareness.
- Doctor of Muhammad Ramzan Hajib's village said illnesses in children and women are more frequent than males and young; common diseases in this village are Malaria and Diarrhea. Some cases of Hepatitis are also recorded.
- Villagers believe that developing and monitoring of hand-washing facilities and latrines in local schools will change the environment of the village. Primary and middle schools are available in this village. Schools have 3 bathrooms but these are not functional. Washrooms are full of solid waste and excreta. No drainage or water tanks are found inside the school washroom and no proper drinking water facility is there.
- Villagers affirmed that SSS programme can change villagers' health and environment and can save children from diseases. Proper monitoring is main factor in improving the overall environment that must be consider. Monitoring, proper cleanness, training and awareness and availability of clean water will contribute towards meeting the overall goal of Open-Defecation Free (ODF) villages.

List of Participants

S.No.	Name of Participants	Occupations
01.	Haji Kareem Bux	Landlord
02.	Muhammad Hassan	Farmer
03.	Adnan	Teacher JST
04.	Abdul Qaheed	Hotel Waiter
05.	Asif Ali	Ranch hand-Mechanic
06.	Ghulam Shabeer	Driver
07.	Abdul Hasheed	Naib Qasid
08.	Haji Hasim	Retired Teacher
09.	Aslim	Former
10.	Abdul Lateef	Guard
11.	Abdul Saleem	Poultry farm owner
12.	Ghulam Mustifa	Driver
13.	Haneef	Stones Cutter
14.	Ali Nabi	Nothing
15.	Saffar	Stones Cutter
16.	Lateef	Farmer
17.	Muhammad Azim	Farmer
18.	Abdul Qauoom	Peon
19.	Allah Dinoo	Farmer
20.	Qayoom	Guard
21.	Riaz	Head master

District: **DADU**	Union Council: **Bothro**	Date: **21st August 2016**
Name of Village: **Sahib Khan Balhro**		Lat/Long: **27° 18' 37.4"N 67° 54' 09.6"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- Overall community is Muslim with the male ratio (55%) and female ratio (45%). Sindhi & Siraiki language are spoken in the area and villagers cast are Balhro & Babar.
- No recent developmental activities were carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited their village.
- They have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers.
- No major conflicts exist in the villages, but if minor dispute occurs such as family conflicts or livestock business, so it is easily resolved by the committee members without any external involvement.
- There is primary school available in the area and major occupations of villagers are agriculture & livestock. Average monthly household income is around 15,000 PKR to 18,000 RPS per house.
- There is Open Defecation in the village because of unavailability of enough latrines in the area. The villagers are well known with the problems associated with open defecation but cannot build latrines because of lack of funds.
- The common diseases among the villagers are Fever, Common Cold, Diarrhea, Hepatitis, Typhoid, Cough & Malaria etc. The villagers are fully aware of the diseases caused due to unhygienic conditions and unhealthy environment.
- Villagers were aware of the negative impacts of open defecation but find it very difficult for them to build latrines and enclosed washrooms. Villagers supported the SSS program and affirmed that if any organization would provide all the facilities in constructing the toilets, villagers would definitely use the toilets and eliminate the open defecation practices.

S.No.	Name of Participants	Occupations
01.	Gulzamban	Farmer
02.	Sadar-u-din	Farmer
03.	Amin	Labour
04.	Saban Khan	Farmer
05.	Rajib	Livestock business
06.	Deedar	Livestock business
07.	Ghulab Shabir	Livestock business
08.	Wajid	Poultry farming
09.	Kambar Khan	Poultry farming
10.	Shahnawaz	Poultry farming

District: **DADU**	Union Council: **Bothro**	Date: **21st August 2016**
Name of Village: **Serahi Saban**		Lat/Long: **27° 18' 37.0"N 67° 54' 15.4"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- Overall community is Muslim with the male ratio (50%) and female ratio (50%). Sindhi & Siraiki language are spoken in the area and villagers cast are Balhro.
- No recent developmental activities were carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited in their village. They have their own male and females committee which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers.
- No major conflicts are in the villages but if minor dispute occurs such as family conflicts or livestock business, so it easily resolved by the committee members without any external involvement.
- There is a primary school available in the area and major occupations of villagers are agriculture & livestock. Average monthly household income is around 10,000 PKR to 15,000 PKR per house.
- There is open defecation in the village because of unavailability of enough latrines in the area. The villagers are well known with the problems associated with open defecation but cannot build the latrine because of financial problems.
- The common diseases among the villagers are Fever, Common Cold, Diarrhea, Hepatitis, Typhoid, Cough & Malaria etc. The Villagers are fully aware the diseases cause due to unhygienic conditions.
- Villagers were aware of the negative impacts of open defecation but find it very difficult for them to build latrines and enclosed washrooms. Villagers supported the SSS program and affirmed that if any organization would provide all the facilities in constructing the toilets, villagers would definitely use the toilets and eliminate the open defecation practices.

S.No.	Name of Participants	Occupations
01.	Sahib Khaton	Housewife/ farmer
02.	Satberae	Housewife/ farmer
03.	Gulshan	Housewife/ farmer
04.	Afsbano	Housewife
05.	Arberly	Housewife
06.	Shabnim	Housewife
07.	Khanzadi	Housewife
08.	Noorbano	Housewife
09.	Asma	Housewife
10.	Naseem	Housewife

District: **JACOBABAD**	Union Council: **Sher Khan**	Date: **21st August 2016**
Name of Village: **Gul Hassan Khan**		Lat/Long: **27° 59' 34.06"N 67° 57' 38.6"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- Overall community is Muslim with the male ratio (55%) and female ratio (45%). Sindhi & Siraiki language are spoken in the area and villagers cast are Jamali.
- No recent developmental activities have been carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited in their village. They have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers. The village was also affected by the flood disasters in 2011-2012.
- No major conflicts are in the villages but if minor dispute occurs such as family conflicts or livestock business, so it easily resolved by the committee members without any external involvement. There is no primary school or Madarsa available in the area and major occupations of villagers are agriculture & poultry farming. Average monthly household income is around 15000 PKR per house.

- There is open defecation in the village because of unavailability of enough latrines in the area. The villagers are briefed with the problems associated with ODF. The common diseases among the villagers are Fever, Common Cold, Diarrhea, Hepatitis, Typhoid, Cough & Malaria etc.
- Villagers were aware of the negative impacts of open defecation but find it very difficult for them to build latrines and enclosed washrooms. Villagers supported the SSS program and affirmed that if any organization would provide all the facilities in constructing the toilets, villagers would definitely use the toilets and eliminate the open defecation practices.

S.No.	Name of Participants	Occupations
01.	Zuli han	Housewife & Farmworker
02.	Bibi nrz	Housewife & Farmworker
03.	Bachur	Housewife & Farmworker
04.	Horan	Housewife & Farmworker
05.	Hanal	Housewife & Farmworker
06.	Lal Khaton	Housewife & Farmworker
07.	Hakinzadi	Housewife & Farmworker
08.	Mahbano	Housewife & Farmworker
09.	Kazbano	Housewife & Farmworker
10.	Jmamzadi	Housewife & Farmworker

District: **JACOBABAD**	Union Council: **Allahabad**	Date: **21st August 2016**
Name of Village: **Rehan Khan Jamali**		Lat/Long: **27° 59' 41.7"N 67° 58' 49.3"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- Overall community is Muslim with the male ratio (65%) and female ratio (35%). Sindhi, Balochi & Siraiki language are spoken in the area and villagers cast are Jamali.
- No recent developmental activities have been carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited in their village. They have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers. The village was also affected by the flood disasters in 2011-2012.
- Local NGO's have developed a community learning center which was a joint project between UNDP and Al-Mehran Rural Development Organization (AMRDO).
- No major conflicts are in the villages but if minor dispute occurs such as family conflicts or livestock business, so it easily resolved by the committee members without any external involvement. There is a primary school available in the area and major occupations of villagers are agriculture & poultry farming. Average monthly household income is around 15000 PKR to 18000 PKR per house.
- The 2011-2012 flood destroyed all their crops and the land became saline & unproductive. Farmers have no any awareness regarding, agriculture crops and fertilizers. According to villagers if any institution provide training of agriculture, than they will implement in their agriculture fields.
- There is open defecation in the village because of unavailability of enough latrines in the area. The villagers are well known with the problems associated with open defecation but cannot build the latrine because of financial problems.
- Villagers were aware of the negative impacts of open defecation but find it very difficult for them to build latrines and enclosed washrooms. Villagers supported the SSS and A4N programs and affirmed that if any organization would provide all the facilities in constructing the toilets, villagers would definitely use the toilets and eliminate the open defecation practices.

S.No.	Name of Participants	Occupations
01.	Daad Muhammad	Driver in health department
02.	Bachal Khan	Farmer
03.	Irfan	Farmer

04.	Hameedullah	Farmer
05.	Aizaz	Farmer
06.	Akhtiar	Labour
07.	Farman	Labour
08.	Alam Khan	Poultry farming
09.	Kambar Khan	Poultry farming
10.	Shahnawaz	Poultry farming

District: **KASHMORE**	Union Council: **Ghouspur**	Date: **20th August 2016**
Name of Village: **Akbar Mirani**		Lat/Long: **28° 9'34.65"N 69° 7'15.41"E**
Interviewers: Ms. Shazia Mr. Abdullah Magsi, Mr. Imdad Brohi & Mr. Irfan		

Discussion Summary:

- The villagers of the Akbar Mirani were severely affected by the super flood that came in 2011-2012. Villagers have been living without basic necessities of life including electricity, latrine facilities and the like.
- The villagers were asked about their dependencies of life and living standards. No recent developmental or progressive activities were carried out by any government departments, local organization or NGO's. CRS (Catholic Relief Service) & GSF (Goth Seengar Foundation) have worked in the villages after the flood. They had provided the shelters, food and stipend money for a time being.
- Villagers depend mostly on the fisheries system and small-scale farming which fetches them meagre inconsistent income. Villagers do not have proper homes and they are living in sheltered houses provided by the NGO's.
- No major conflicts occur in the villages and for minor issues, community members resolve issues through consensus. There is no school or Madarsa available in the area. No local government is active in the area and no interaction between local government representatives and community occurred in the recent past.
- There are no latrines available in their village except one or two and majority of the people practice open defecation. Villagers agreed at a certain level about the negative impacts of open defecation but it is very difficult for them to adopt their existing latrine system. There is no culture to wash the hands after defecation.

S.No.	**Name of Participants**	**Occupations**
01.	Zarina Bai	Housewife
02.	Rasheeda	Housewife
03.	Noor Bano	Housewife
04.	Shahida	Housewife
05.	Mariyam	Housewife
06.	Haseena	Housewife
07.	Gul bao	Housewife
08.	Kulsoom	Housewife

District: **KASHMORE**	Union Council: **Ghouspur**	Date: **20th August 2016**
Name of Village: **Dad Muhammad Mirani**		Lat/Long: **28° 9'20.90"N 69° 7'23.10"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- The Dad Muhammad Mirani village was highly affected by the flood of 2011-2012 and they lost almost everything in the flood and villagers have been living without basic necessities of life since flood ruined their village.
- The villagers described their existing standard of living and told us the problems facing in daily life. No recent developmental or progressive activities have been carried out by any government departments, local organization or NGO's. However, in the past after the flood of 2011-2012, few NGO's had done work for providing shelters, wells for drinking purpose, post-disaster response trainings and the like.
- Mr. Nisar Ahmad is a respondent and had done a detailed collaborative worked with NGO's in the flood time. He told us the villagers are not living a decent lifestyle, most of the people migrated after the flood and have not come back.
- No major conflicts in the villages but if minor dispute occurs, generally over the livelihood or fishing business, it is easily resolved through mutual consensus within the community. There is no school or Madarsa available in the area.
- No local government is active in the area and no interaction between local government representatives and local communities have taken place in the recent past.
- There is open defecation in the village despite of availability of latrines which have been altered to storage areas. Villagers told us that using the existing latrines are a hassle as these only consist of wall boundaries and no other facilities. Poverty is rampant in this village and villagers struggle to meet their daily necessities and therefore latrines is not their priority.
- Villagers were not aware of the negative impacts of open defecation and with their current impoverished state, feel it would be very difficult for them to adopt a new latrine system. There is no culture to wash hands after defecation. The common diseases among the villagers are Fever, Diarrhea, Malaria & Typhoid etc.
- Villagers said they are willing to adopt a proper latrine system if any organization would provide all the facilities in constructing the toilets and execute the system with proper functions and continuous maintenance mechanism.

S.No.	Name of Participants	Occupations
01.	Nisar Ahmed	Social Activist (work with NGO's)
02.	Gux Bukesh	Fisherman
03.	Noor Hassan	Fisherman
04.	Khuda Bux	Fisherman
05.	Mir Hassan	Fisherman
06.	Sarwar	Fisherman
07.	Amanullah	Fisherman
08.	Arbals	Fisherman
09.	Dhani Bux	Fisherman
10.	Abdul Khaliq	Fisherman
11.	Jannat	Health worker
12.	Bassi	Housewife
13.	Hazoori	Housewife
14.	Wasai	Housewife

District: **LARKANA**	Union Council: **Jume Agham**	Date: **21st August 2016**
Name of Village: **Ghulam Hyder Jalbani**		Lat/Long: **27° 49' 53.30"N 68° 14' 23.70"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		
Discussion Summary:		

- Overall community is Muslim with the male ratio (55%) and female ratio (45%). Sindhi & Siraiki language are spoken in the area and villagers are Jalbani & lolar in cast.
- No recent developmental activities have been carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited in their village. They have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers.
- No major conflicts are in the villages but if minor dispute occurs such as family conflicts or livestock business, so it easily resolved by the committee members without any external involvement. There is no school or madarsa available in the area and major occupations of villagers are agriculture activities. Average monthly household income is 16, 000 PKR per house.
- There is open defecation in the village because of unavailability of enough latrines in the area. The villagers are briefed with the problems associated with ODF. The common diseases among the villagers are Fever, Common Cold, Diarrhea, Hepatitis, Typhoid, Cough & Malaria etc.
- Villagers were aware of the negative impacts of open defecation but find it very difficult for them to build latrines and enclosed washrooms. Villagers supported the SSS program and affirmed that if any organization would provide all the facilities in constructing the toilets, villagers would definitely use the toilets and eliminate the open defecation practices.

S.No.	Name of Participants	Occupations
01.	Mehboob Ali	Agriculturist
02.	Abdul latif	Agriculturist
03.	Walid Bux	Farmer
04.	Fateh Muhammad	Farmer
05.	Ghulam Nasi	Labour
06.	Sajan	Labour
07.	Shahid khan	Labour
08.	Ghulam Muhammad	Labour
09.	Hassan	Labour
10.	Anwar Ali	Labour

District: **LARKANA**	Union Council: **Jume Agham**	Date: **21st August 2016**
Name of Village: **Jabal Khan Brohie**		Lat/Long: **27° 50' 32.47"N 68° 14' 08.05"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- Overall community is Muslim with the male ratio (50%) and female ratio (50%). Sindhi languages are spoken in the area and villagers are Brohi (Baloch).

  No recent developmental activities have been carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited in their village. They have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers.
- No major conflicts are in the villages but if minor dispute occurs such as family conflicts or livestock business, so it easily resolved by the committee members without any external involvement. There is no school or madarsa available in the area and major occupations of villagers are agriculture activities. Average monthly household income is around 15,000 PKR per house.
- There is open defecation in the village because of unavailability of enough latrines in the area. The villagers are briefed with the problems associated with ODF. The common diseases among the villagers are Fever, Common Cold, Diarrhea, Hepatitis, Typhoid, Cough & Malaria etc.
- Villagers were aware of the negative impacts of open defecation but find it very difficult for them to build latrines and enclosed washrooms. Villagers supported the SSS program and affirmed that if any

	organization would provide all the facilities in constructing the toilets, villagers would definitely use the toilets and eliminate the open defecation practices.	
S.No.	**Name of Participants**	**Occupations**
01.	Mehtab Khatoon	Housewife/ farmer
02.	Rukhsana	Housewife/ farmer
03.	Waheeda	Housewife/ farmer
04.	Maryam	Farmer
05.	Noor khatoon	Labour
06.	Susuhi	Labour
07.	Sakeena	Labour
08.	Noorbano	Labour
09.	Kazabano	Labour
10.	Raheema	Labour

District: **QAMBER@KANDHKOT**	Union Council: **Aitbar Chandio**	Date: **20th August 2016**
Name of Village: **Ghano Khan Brohi**		Lat/Long: **27°52'04.80"N 67°58'05.60"E**
Name of Village: **Gul Muhammad Brohi**		Lat/Long: **27°52'03.18"N 67°57'58.95"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- The villages of Ghano Khan Brohi & Gul Muhammad Brohi are situated close to each other with a distance of around 500m in district Kamber. The people of both villages were gathered at a same place.
- No recent developmental or progressive activities have been carried out by any government departments, local organization or NGO's. They are mainly dependent on the agriculture activities (rice fields), the villagers are largely engaged in farming activities.
- Villagers are living in abject poverty and far from the basic necessities of life include electricity, clean drinking water and natural gas. No major conflicts in the villages but if minor dispute occurs, generally over the agriculture business or family clash, it is resolved by mutually consensus and no external support is required to resolve the matters.
- There is no school or Madarsa available in the area. No local government is active in the area and no interaction between local government representatives and local communities have occurred in the recent past.
- Open defecation is common in the village; only one latrine (non-functional) is available for both the villages. Villagers are aware of the negative impacts of open defecation but it is very difficult for them to afford construction of latrine.
- There is no culture to wash the hands after defecation. The common diseases among the villagers are Fever, Diarrhea, Malaria & Typhoid etc. Villagers were not fully aware the diseases cause due to unhygienic conditions of the open defecation, but after heard some negative impacts of open defecation, villagers showed the positive response to eliminate the open defecation practices.

Name of Participants of Village Ghano Khan Brohi

S.No.	**Name of Participants**	**Occupations**
01.	Manzoor	Farmer & Livestock
02.	Abdul Khaliq	Farmer & Livestock
03.	Ghulam	Farmer
04.	Noor	Labor
05.	Fahmeeda	Farmer
06.	Rajib	Farmer
07.	Wajid	Labor

08.	Ali akbar	Labor
Name of Participants of Village Gul Muhammad Brohi		
S.No.	**Name of Participants**	**Occupations**
01.	Ghulam Mustafa	Farmer
02.	Mehboob	Farmer
03.	Alam rehan	Labor
04.	Asif	Labor
05.	Shahnawaz	Farmer
06.	Sarwar	Farmer
07.	Illahi bux	Labor
08.	Lal bux	Labor
09.	Bassra	Farmer
10.	Bachai	Farmer

District: **SHIKARPUR**	Union Council: **Nausharo**	Date: **20th August 2016**
Name of Village: **Haji Khan Abro**		Lat/Long: **27° 48' 14.30"N 68° 31' 34.40"E**
Interviewers: Mr. Abdullah Magsi, Mr. Imdad Brohi, Ms. Shazia & Mr. Irfan		

Discussion Summary:

- The Haji Khan Abro village is situated along the Larkana- Naudero highway and consists of around 10 households with average 10 peoples in each house. Overall community is Muslim with the male ratio (40%) and female ratio (60%). Major spoken language is Sindhi and cast is Abro.
- No recent developmental activities have been carried out by any government departments, local organization or NGO's. No Local Government representatives have ever visited in their village. They have their own male and female committees which resolve the village issues or matters and heads of the committee are selected by mutual consensus of villagers.
- No major conflicts are in the villages but if minor dispute occurs such as family conflicts or livestock business, so it easily resolved by the committee members without any external involvement. There is only Govt. Primary School available in the area which is about a half km away from the village. Major occupations of villagers are agriculture activities and labor. Average monthly household income is around 15000 PKR per house.
- Open defecation is common in the village because of unavailability of enough latrines in the area. There is only one latrine which is also not connected with any drainage system. The ultimate discharges of latrines are soaked into stagnant water pond situated in the village. Compared to open defecation, the villagers view latrine use as time-consuming and troublesome. There is a culture to wash the hands after defecation but not with soap.
- The common diseases among the villagers are Fever, Common Cold, Diarrhea, Hepatitis, Typhoid, Cough & Malaria etc. Villagers are fully aware of the diseases due to unhygienic conditions and believe that healthy practices can improve the overall village environment. Moreover they are very religious people and quite familiarized with the importance of cleanness in Islam.
- Villagers are agreed about the negative impacts of open defecation but it is very difficult for them to build the latrine and close washroom systems. Villagers showed the support of SSS program and asked if any organization would provide all the facilities in constructing the toilets, they will definitely use the toilets and stop open defecation.

S.No.	**Name of Participants**	**Occupations**
01.	Habibullah	Farmer
02.	Mola Bux	Farmer
03.	Jamal-ud-din	Farmer
04.	Haji Khan	Farmer
05.	Amir Jan	Labour
06.	Ali Jan	Labour

07.	Hazoor Bux	Farmer
08.	M. Ibrahim	Livestock & dairy business
09.	DiliJan	Livestock & dairy business
10.	Fide Hussain	Livestock & dairy business
11.	Mashoaq Ali	Farmer
12.	Khuda Pour	Farmer
13.	Qurban	Farmer

District: **SHIKARPUR**	Union Council: **Nousharo**	Date: **20th August 2016**
Name of Village: **Karamullah Burjani**		Lat/Long: **27°48'1.34"N 68°31'20.77"E**
Interviewers: Ms. Shazia Mr. Abdullah Magsi, Mr. Imdad Brohi & Mr. Irfan		
Mainly consultation with female villagers		

Discussion Summary:

- The villagers of the Karamullah Burjani were severely affected by the super flood that came in the year of 2011-2012. Villagers have been living without basic necessities of life including basic healthcare, electricity's, latrine facilities etc.
- The villagers were asked about their dependencies of life and living standards. No recent developmental or progressive activities were carried out by any government departments, local organization or NGO's.
- Villagers depend mostly on the fisheries system and small-scale farming which fetches them meagre inconsistent income. Villagers do not have proper homes and they are living in sheltered houses provided by the NGO's.
- No major conflicts occur in the villages and for minor issues, community members resolve issues through consensus. There is no school or Madarsa available in the area. No local government is active in the area and no interaction between local government representatives and community occurred in the recent past.
- There are no latrines available in their village except one or two and majority of the people practice open defecation. Villagers agreed at a certain level about the negative impacts of open defecation but it is very difficult for them to adopt their existing latrine system. There is no culture to wash the hands after defecation.

S.No.	Name of Participants	Occupations
01.	Fareeda	Housewife
02.	Zakia	Housewife
03.	Reema	Housewife
04.	Raheena	Housewife
05.	Hakeema	Housewife
06.	Zarina	Housewife
07.	Rahsheeda	Housewife
08.	Heeran	Housewife
09.	Shaheen	Housewife

District: **SANGHAR**	Union Council: **Roonjho**	Date: **19th August 2016**
Name of Village: Haji Ammanullah Mari		Lat/Long:
Interviewers: Mr. Dayal Das,Mr Ir hasan Mari , Ms Jhani		

Discussion Summary:

- The villagers do not have their own agricultural land, they usually work on farms of feudal/waderas who treat them quite poorly.
- People are generally poverty-stricken and the concept of proper latrines is considered a luxury for them. However, they are aware of the importance of proper hygiene for healthy living, but face acute shortage of resources.
- Water is more important to them than latrines as they need it for work on the farms and livestock.
- The village is governed by a strong feudal system with strong control over poor peasants. There are no schools and hospitals in the village.
- Unemployment is the main problem for male and females in this village with very high illiteracy rates. In fact, not a single female is educated in the entire village.

District: **SANGHAR**	Union Council: **Khaahi**	Date: **19th August 2016**
Name of Village: Haji Ilyas Rajar		Lat/Long:
Interviewers: Mr. Dayal Das, Mr Ir hasan Mari , Ms Jhani		

Discussion Summary:

- 100% Open defecation is practiced in the village. NGOs have been working on various development projects in the village.
- People are very poor, not able to invest in construction of latrines. They are aware of hygiene, however, limited purchasing power is a hurdle.
- Majority of the villagers are associated directly or indirectly to farming activities and therefore, water scarcity is considered the most important issue for these villagers.
- There is a strong feudal system in the village and villagers have little control over their income and working hours. Decision-making on village affairs is limited to feudals.
- Unemployment is the main problem for the villagers, they are highly indebted to their employers and due to lack of livelihood opportunities are struck in a debt-trap.
- Construction of schools and basic health facilities are more important to villagers than latrines.

District: **UMERKOT**	Union Council: Dhoronaro	Date: **19th August 2016**
Name of Village: : **Kunhaar Bheel**		Lat/Long:
Interviewers: Mr. Dayal Das, Mir Hassan Mari , Ms.Jhani		

Discussion Summary:

- This is a very old settlement with about 800 households, only one school and no basic health facilities.
- This village was affected by the floods of 2010 and 2011.
- The major health problems in the village include mostly fever, skin diseases, cough, and Tuberculosis.
- Open defecation is common practice with approximately 90% of the villagers having no latrines. Hygiene and malnourishment are major issues in the village with high incidence of child mortality. Generally, the villagers are not sensitized to the importance of healthy practices.
- Water scarcity is another major issue and given more importance by the villagers than latrines. Limited water supplies is a major reason for limited agricultural productivity, which significantly affects the villagers' income and availability of food and fodder.

• USAID has initiated projects in the area focused on the WASH sector.

District: **Tharparkar**	Union Council: **Malnhore Vena**	Date: **20th August 2016**
Name of Village: **Nenisar Meghwar Parro**		Lat/Long: 24° 47'04.4"N 069°52'34.0"E
Interviewers: Mr. Dayal Das, Raj Rahtore, Naresh Kumar , Ms. Lachhman		
Discussion Summary:		

- This residents of this village are very poor and currently suffering from acute water shortage.
- This village is affected by drought, they do not have easy access to water. They use boring water for drinking, and the water is not favorable for agriculture because it is salty.
- The Local Government has not made any significant achievements for improvement of education and health facilities.
- Only one primary school exists in the village, while the nearest college is about 10 kms away from this village.
- Approximately 50% of the population of this village practice open defecation. However, if resources are provided, villagers will construct latrines to improve the overall environment.
- Unemployment is quite high in this area and local communities usually do not have enough skills and education to qualify for non-labor employment opportunities.
- With respect to the SSS project, villagers are willing to participate as long as their other needs are also meet. While for the A4N project, only a very small proportion of villagers have their own farms, however water salinity limits their agricultural activities. For these reasons, villagers are unsure of how the A4N interventions can directly benefit them.

District: **BADIN**	Union Council: **Saangi faro**	Date: **20th August 2016**
Name of Village: Ramji Kolhi		Lat/Long:
Interviewers: Mr. Dayal Das, Mr Mamataz Khoso , Ms.Jhani		
Discussion Summary:		

- About 90 percent of the population defecate in the open. NGOs have been working since many years in this area supported by USAID.
- Villagers are very poor facing a lack of regular livelihood opportunities. They are aware of the need for proper hygiene for improved health, but due to lack of resources, construction and maintenance of latrines is not their priority.
- There is a mistrust of government institutions and the local community has not received any type of support from the government in the recent past, therefore villagers prefer projects from NGOs.
- Improved employment opportunities and skills trainings both for men and women were identified as the priority areas for future interventions. Once the villagers were secured a respectable and constant source of income, then would be in a better position to participate in other activities.
- Water scarcity is another issue in the village that severely affects agricultural productivity.
- As long as the villagers are not required to make any payments, they are willing to participate in the SSS program, but government should give due consideration to their basic needs.

Annex N: Methodology and Feedback of Consultation with Institutions

Methodology

Presentations were delivered on the context of the ESMF Study for the Multi-Sectoral Action for Nutrition Project and the scope of the various components under the study. Separate presentations were also made on the background and planned project deliverables for the SSS and A4N projects. A rigorous session of comments and suggestions from participants followed the presentations.

Institutions and Departments Represented at Stakeholders Consultation Meeting
Stakeholders
• Directorate of Urban Policy & Strategic Planning, P&DD, GOS • Economics Policy & Research, P&DD, GOS • Nutrition Support Programme, P&DD, GOS • Environment Section, P&DD, GOS • Health Section, P&DD, GOS • Sindh Environmental Protection Agency, GOS • Sindh Fisheries Department • Agriculture Extension, Agriculture Department, GOS • Local Government Department, GOS • Benazir Income Support Programme • Institute of Engineers, Pakistan • Thardeep Rural Development Programme • National Rural Support Programme, Sindh • The Change Organization • MCHIP Jhipego • HANDS • Institute for Research & Development • UNICEF • Plan International
Stakeholders Consultation Meeting (PC Hotel, Karachi)
 

Consultation Feedback

Agricultural Practices and Kitchen Gardening

- Apart from improving the nutritional status of local communities, by involving both male and female family members regardless of age group, kitchen gardens have the potential for strengthening family bonds and intra-community relations

- Lessons learnt from adoption of this concept in other countries and in other areas of Pakistan should be reviewed and incorporated. For instance, pesticides and synthetic fertilizers should not be used to minimize the risk of soil contamination and poisoning.
- Best Management Practices (BMP)s in the areas of organic farming and IPM should be incorporated.

Community-Based Environmental Protection

- The different environmental and socio-economic conditions of the target districts calls for localized management plans to implement the environmental and socio-economic targets. Moreover, to ensure ownership and sustainability of these plans, community-based environmental protection measures should be an essential part of these plans.
- Training and capacity-building components must be imparted for implementation and monitoring of community-based environmental protection. The focus should be both the local communities as well as the Local Government Departments responsible for facilitating and monitoring of the community interventions.

Definitions and Goal-Setting

- As Pakistan is committed to meeting the goals for sanitation, malnutrition and food security under the Sustainable Development Goals (SDG)s 2030, planned project interventions should be aligned with the overall national targets.
- Definitions of technical terms in WASH sector should be reviewed, especially those of UNICEF for ensuring uniformity with acceptable international standards.

Behavior Change Communication (BCC)

- As the SSS project places a strong emphasis on behavior change, the root causes for existing undesirable behavioral practices need to be examined thoroughly. This may lead to adjustment of planned project interventions, but it will result in management of the actions leading to unhygienic environments and malnutrition rather than symptomatic treatment of the undesirable behaviors.
- The various tools for BCC focus on imparting knowledge, in the case, for actions leading to a cleaner environment and defecation in latrines. However, there is no guarantee that providing knowledge to local communities will necessarily change their behaviors. A good example is that we all know smoking is harmful, but many still do not quit smoking.
- Age-old traditions of defecating in open areas or within natural surroundings will be a challenge for the project, especially with the elder folk. Moreover, in some rural areas, proper latrines are still considered taboo.
- Behavior change also requires time, more than a couple years at least, if not more. Therefore, the existing project should be designed to ensure rigorous periodic awareness and sensitization sessions. Furthermore, subsequent phases of the project should be designed to ensure a continuum of critical project activities that would help avoid recurrence of open defecation and other environmentally harmful practices.

Clean Water and Safe Disposal

- Many water-borne diseases are common in the project districts and result in severe malnourishment of women and children. Therefore, nutrition programs in Sindh should also place emphasis on

availability of clean water in these areas. With respect to the SSS project, this clean water should be ensured in schools as part of the health and hygiene awareness component.

- On the other hand, environmentally safe disposal mechanisms need to be devised to ensure human excreta does not contaminate local water storage/supplies.

Integration of Ground Realities and Lessons Learnt

- After the floods of 2011 and 2012, thousands of latrines were constructed by NGOs and donor agencies in many districts of Sindh. In one such project, approximately 45,000 latrines were constructed in 8 districts, however, within a few years, the study reported that over 50% of these latrines were not in use. This poses several important questions with regards to behavior change, adequate utilization of resources and sustainability.
- The project interventions and targets should not be limited to secondary data which may be old and out-of-context. It is more important to conduct baseline studies of the target areas for specific indicators of malnutrition (wasting, stunting, dietary habits and the like) prior to initiating the main project activities. Moreover, without establishing realistic benchmarks for malnutrition, monitoring and reporting will provide skewed and biased results.
- UNICEF has conducted a Knowledge Attitude and Practices (KAP) study in certain areas of rural Sindh for the WASH Sector. Similar studies can provide profound knowledge on the social component of sanitation projects for the Multi-Sectoral Action for Nutrition Project.
- Lesson learning from previous projects and ground realities must be incorporated for both the SSS and A4N projects to ensure result-oriented and long-lasting solutions to combat malnutrition in Sindh's rural areas.

Latrine Technologies

- The choice of latrine technologies is an important factor both in terms of environmental impacts and social acceptability. The available technologies should be carefully revised for social and environmental implications.
- The technology should ensure that soil and water contamination is eliminated from the system with the overall aim to ensure that the food chain is not contaminated. Moreover, construction, operation and management of latrines should be in line with the community values, skills and desires.
- Septic tanks provide a viable option for use by all households, schools and other local institutions. However, mismanagement of septic tanks can lead to severe environmental problems. Both construct, operation and management aspects need to be carefully reviewed.

Coordination at Local, Provincial and National Levels

- The participants' emphasized coordination amongst various stakeholders at all levels to enable knowledge-sharing, incorporation of lessons learnt and harmonization of project execution at the field level with monitoring and reporting at the district and provincial levels.
- For the A4N project, the Pakistan Agriculture Research Council (PARC) was identified as a national research-based institution with extensive experience in improved agricultural practices. Similarly, other relevant departments and institutions with exposure to the planned project activities should be consulted for kitchen gardening, mobilization of Farmer Field Schools, choice of seeds and the like.
- Since the proposed interventions will be managed by the District and Taluka Administration, they should be taken on-board and sensitized to the project concepts. Moreover, relevant government

servants should be trained and equipped both to monitor the project activities and provide post-project support to local community groups.

- Even after a village attains ODF Certification, maintaining this status is a challenge and arrangements should be made to minimize fallout. Trained District, Taluka-level administration and other trained personnel such as LHVs can be play an instrumental role in helping communities maintain ODF status post-project.

Integration of Gender and Vulnerable Groups

- The role of women both for the promotion of health and sanitation awareness and nutrition-sensitive agriculture practices is essential in rural areas of Sindh. Often, women from these areas are not only engaged in domestic chores, but also work on farms and partake in other income-earning activities. At the same time, it is the women that suffer the most from malnourishment and other health problems.
- Intensive sensitization and awareness campaigns focused on women of all ages should be part of both projects.
- Participation of certain vulnerable groups, including the elderly, handicapped persons and widows should be ensured in both project.

Miscellaneous

- Regarding the severity of water, sanitation and food security issues that emerge right after a natural disaster, it was stated that the existing project interventions were designed for non-emergency situations and will not be resilient to large-scale disasters.
- Previous projects have shown lack of personal funds as a major limiting factor for construction of latrines; parallel efforts to improve income-generation of local communities can contribute to the success of the proposed project interventions.
- Local fruit trees provide a viable option for improving the nutritional status of villagers, plantation of such trees should be promoted on a larger scale and made part of the nutrition projects.

Annex O: Socioeconomic Data Tables

Table OA1: Population figures district-wise				
Districts	**Population (based on 1998 census) (million)**			**Population (projected for 2012)**
	Male	**Female**	**Total**	
Jacobabad	382,363	359,547	741,910	984,323
Kashmore	361,651	322,011	683,662	952,886
Kambar-Shahdadkot	477,476	446,818	924,294	1,424,918
Larkana	516,100	486,672	1,002,772	1,545,902
Tharparkar	499,859	414,432	914,291	1,407,585
Badin	580,576	523,281	1,103,857	1,509,364
Sanghar	694,479	630,247	1,324,726	1,934,104
Tando Muhammad Khan	231,418	209,621	441,039	603,057
Umerkot	350,601	314,196	664,797	1,044,519
Shikarpur	460,125	427,213	887,338	1,223,340
Dadu	574,487	532,230	1,106,717	1,596,107
Thatta and Sujawal	589,341	523,853	1,113,194	1,522,131
Source: Development Statistics of Sindh 2013 prepared by the Bureau of Statistics, Government of Sindh				

Table OB1: Percentage of poor in Sindh districts		
District	**Poverty Classification**	**% Poor**
Jacobabad	Extremely poor	59.76
Kashmore	Very poor	44.49
Kambar-Shahdadkot	Extremely poor	58.79
Larkana	Very poor	55.04
Tharparkar	Very poor	54.16
Badin	Extremely poor	67.15
Sanghar	Very poor	50.57
Tando Muhammad Khan	Extremely poor	70.43
Umerkot	Extremely poor	66.00
Shikarpur	Extremely poor	65.93
Dadu	Very poor	50.20
Thatta and Sujawal	Extremely poor	72.97
Source: Poverty survey 2010-11, conducted under Benazir Income Support Program (BISP)		

Table OC1: Percent distribution of household population according to type of toilet facility used by the household, by district, Sindh, 2014			
District	**HHs population with improved sanitation facilities (%)**	**HH population with unimproved sanitation facilities (%)**	**Open defecation (no facility, bush, field) (%)**
Jacobabad	61.5	12.9	25.6
Kashmore	50.1	11.9	38.0
Kambar-Shahdadkot	58.0	22.9	19.1
Larkana	73.3	17	10.0
Tharparkar	19.9	3.0	77.1
Badin	39.6	15.7	44.7
Sanghar	59.0	12.9	28.1
Tando Muhammad Khan	27.7	11.2	61.1
Umerkot	36.2	5.6	58.2
Shikarpur	61.3	8.5	30.2
Dadu	66.5	10.6	22.9
Thatta	36.6	8.5	54.9
Sujawal	41.4	9.8	48.8

Source: Multiple Indicator Cluster Survey (MICS) Sindh 2014, Bureau of Statistics, Government of Sindh

Table OC2: Percent distribution of household population according to type of improved sanitation facility commonly used by the household, by district, Sindh, 2014

District	Piped sewage system (%)	Septic tank (%)	Soakage pit latrine (%)	Ventilated improved pit latrine (%)	Pit latrine with slab (%)	Compositing toilet (%)
Jacobabad	19.6	2.9	22.6	7.7	7.2	0.3
Kashmore	11.2	3.5	23.2	3.2	8.1	0.5
Kambar-Shahdadkot	36.5	1.3	4.2	2.3	13.6	0.1
Larkana	63.7	1.0	1.6	2.0	2.7	0.0
Tharparkar	5.9	0.1	8.8	0.8	3.6	0.5
Badin	10.3	2.0	22.8	2.9	0.6	1.0
Sanghar	41.8	1.1	11.7	0.4	2.7	0.0
Tando Muhammad Khan	13.8	7.5	2.7	0.7	2.4	0/0
Umerkot	9.8	5.1	9.9	2.7	3.1	5.6
Shikarpur	39.0	3.5	9.2	2.3	6.1	0.0
Dadu	51.3	0.3	2.4	5.6	6.4	0.0
Thatta	11.6	0.5	7.1	9.4	5.2	2.0
Sujawal	11.4	0.6	25.4	2.2	1.8	0.0

Source: Multiple Indicator Cluster Survey (MICS) Sindh 2014, Bureau of Statistics, Government of Sindh

Table OC3: Percent distribution of household population according to type of unimproved sanitation facility commonly used by the household, by district, Sindh, 2014

District	Flush/Pour flush (%)	Pit latrine without slab/Open pit (%)	Bucket (%)
Jacobabad	4.5	8.5	0.0
Kashmore	1.5	9.9	0.1
Kambar-Shahdadkot	1.3	16.3	0.0
Larkana	5.4	2.9	0.0
Tharparkar	0.1	1.6	0.0
Badin	1.0	2.6	0.0
Sanghar	2.5	6.8	0.0
Tando Muhammad Khan	5.7	3.5	0.0
Umerkot	0.0	0.1	0.0
Shikarpur	1.0	4.0	0.3
Dadu	0.2	6.7	0.9
Thatta	2.7	3.9	0.1
Sujawal	0.7	6.9	0.0

Source: Multiple Indicator Cluster Survey (MICS) Sindh 2014, Bureau of Statistics, Government of Sindh

Table OC4: Water and sanitation facilities in schools

District	No. of Schools with washrooms	No. of schools with drinking water facility
Jacobabad	639	518
Kashmore	411	573
Kambar-Shahdadkot	756	537
Larkana	916	941
Tharparkar	1382	634
Badin	1686	1047

Sanghar	1511	1567
Tando Muhammad Khan	540	564
Umerkot	1245	552
Shikarpur	762	811
Dadu	1136	924
Thatta	570	128
Sujawal	415	224
Source: Sindh Education Profile 2014-215, Reform Support Unit (RSU), Government of Sindh		

Table OD1: Malnutrition Prevalence in some Districts in Sindh Province						
District	Based on WHO reference			Based on MUAC (Mid Upper Arm Circumference)		
	Global acute Malnutrition (%)	Moderate acute Malnutrition	Severe acute Malnutrition	Global acute Malnutrition	Moderate acute Malnutrition	Severe acute Malnutrition
Shikarpur	13.8	10.4	3.4	12.8	10.0	2.8
Umerkot	28.8	-	10.1	19.1	-	5.8
Dadu	14.3	-	2.6	10.5	-	3.8
Thatta				17.2	10.3	6.9
Source: SMART Survey Reports 2013-2014						

Table OD2: Malnutrition Prevalence in Sindh		
Indicator	North Sindh[38] (%)	South Sindh[39] (%)
Global Acute Malnutrition (GAM)	22.9	21.2
Severe Acute Malnutrition (SAM)	6.1	2.9
Chronic Malnutrition	53.9	51.8
Maternal Malnutrition (moderate malnutrition)	11.2	10.1
Maternal Malnutrition (severe malnutrition)	1.9%	0%
Source: Flood-Affected Nutrition Surveys 2010, Department of Health, GoS		

Table OE1: District-wise health profile					
District	**Hospitals**	**Dispensaries**	**Mother Child Health Centers (MCHCs)**	**Basic Health Units (BHUs)**	**Rural Health Centers (RHCs)**
Jacobabad	15	44	6	27	3
Kashmore	5	30	2	21	4
Kambar-Shahdadkot	4	47	1	28	4
Larkana	32	227	8	28	5
Tharparkar	6	244	4	36	2
Badin	10	134	8	37	11
Sanghar	45	133	6	58	6
Tando Muhammad Khan	4	16	1	15	3
Umerkot	8	41	2	32	6
Shikarpur	19	102	6	35	7
Dadu	52	70	10	46	3
Thatta	8	91	6	22	6
Sujawal	7	67	2	29	2
Source: Health Profile of Sindh (District Wise) 2015, Bureau of Statistics, Planning and Development, Government of Sindh					

[38] Ghotki, Jacobabad, Kashmore, Khaipur, Larkana, Shahdadkot, Shikarpur and Sukkur districts
[39] Dadu, Hyderabad, Nawabshah, Jamshoro, Mitiari, Noushero Feroz and Thatta districts

Table OE2: District-wise medical staff profile			
District	**Population served per doctor**	**Population served per Nurse**	**Population served per Bed**
Jacobabad	4,701	85,417	1,952
Kashmore	5,911	83,250	5,149
Kambar-Shahdadkot	14,577	168,444	5,574
Larkana	1,897	9,564	471
Tharparkar	6,135	59,880	5,484
Badin	3,713	26,300	3,125
Sanghar	2,739	32,935	2,127
Tando Muhammad Khan	5,008	90,143	3,219
Umerkot	6,294	53,048	3,514
Shikarpur	3,578	34,622	2,355
Dadu	7,157	210,250	3,697
Thatta and Sujawal	5,727	49,750	3,635
Source: Health Profile of Sindh (District Wise) 2015, Bureau of Statistics, Planning and Development, Government of Sindh			

Table OF1:District-wise educational profile									
District	**No. of Schools**			**Enrolment**			**Teachers**		
	Functional	**Closed**	**Total**	**Boys**	**Girls**	**Total**	**Male**	**Female**	**Total**
Jacobabad	1,370	70	1,440	95,807	68,279	164,086	3,883	1,076	4,959
Kashmore	1,182	313	1495	85,565	39,053	124,618	2,916	516	3,432
Kambar-Shahdadkot	1,373	258	1631	105,785	66,184	172,662	4,343	1,146	5489
Larkana	1,144	24	1,168	128,924	90,002	218,926	4,977	2,109	7,086
Tharparkar	2,949	1,059	4,008	93,178	56,814	149,992	4,548	600	5,148
Badin	2,868	188	3,052	120,594	64,020	184,614	5,005	1,069	6,074
Sanghar	2,756	368	3,124	153,804	83,673	237,477	6,858	1,867	8,725
Tando Muhammad Khan	855	188	1,043	35,028	20,499	55,527	1,792	413	2,205
Umerkot	1,782	444	2,226	70,468	34,909	105,377	3,047	734	3,781
Shikarpur	1,030	270	1,300	90,088	50,883	140,971	3,758	1,063	4,821
Dadu	1,856	249	2,105	140,520	97,160	237,680	5,300	1,415	6,715
Thatta	1,127	388	1,515	45,728	26,499	72,227	2,176	690	2,866
Sujawal	1,197	446	1,643	44,154	25,306	69,460	2,331	365	2,696
Source: Reform Support Unit (2014-2015), Education and Literacy Department, Government of Sindh									

Table OF2: District-wise literacy rate			
District	**Literacy rate (%)[40]**		
	Male	**Female**	**Total**
Jacobabad	59	19	41
Kashmore	58	18	39
Kambar-Shahdadkot	59	23	42
Larkana	71	37	54
Tharparkar	-	-	46
Badin	50	21	24
Sanghar	70	35	54
Tando Muhammad Khan	57	31	45
Umerkot	-	-	44

[40] 10 years and above.

Shikarpur	44.95	18.04	31.9
Dadu	79	42	62
Thatta and Sujawal	48	23	36
Source: Pakistan emergency situation analysis 2014, district profiles, USAID			

Table OG1: The data for this section has been extracted from the Report on Mouza Census 2008 (Sindh Province), published by Pakistan Bureau of Statistics (PBS).

Sources of Employment - Jacobabad							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly[41]	2	178	-	-	2	4
	Some[42]	160	25	44	8	87	182
Female	Mostly	1	149	2	-	1	15
	Some	50	39	3	2	40	142
Sources of Employment - Kashmore							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	5	110	-	-	-	5
	Some	99	23	44	7	116	120
Female	Mostly	4	58	1	-	1	15
	Some	55	69	14	5	75	87
Sources of Employment - Kambar-Shahdadkot							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	5	146	-	-	3	38
	Some	244	112	38	8	107	224
Female	Mostly	-	81	-	-	-	82
	Some	139	116	2	2	43	132
Sources of Employment - Larkana							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	2	135	-	-	-	2
	Some	148	16	16	10	46	153
Female	Mostly	1	83	-	-	1	19
	Some	132	15	4	2	14	133
Sources of Employment - Tharparkar							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	-	87	-	-	1	62
	Some	159	70	21	7	87	98
Female	Mostly	-	52	-	-	-	60
	Some	64	69	5	6	51	96
Sources of Employment - Badin							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor

[41] Population of 50 percent and above.
[42] population between 1 percent and 50 percent

Male	Mostly	4	366	-	-	5	22
	Some	389	109	84	50	307	444
Female	Mostly	2	87	-	-	11	90
	Some	140	242	28	31	183	336
Sources of Employment - Sanghar							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	3	263	1	-	3	30
	Some	257	84	103	35	201	311
Female	Mostly	-	134	-	-	1	69
	Some	147	97	11	13	91	252
Sources of Employment - Tando Muhammad Khan							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	-	111	-	-	2	37
	Some	117	40	8	7	101	112
Female	Mostly	-	57	-	-	6	48
	Some	74	87	2	4	77	93
Sources of Employment - Umerkot							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	2	164	-	-	5	51
	Some	219	61	67	15	165	158
Female	Mostly	-	107	-	-	4	50
	Some	104	86	15	12	60	145
Sources of Employment - Shikarpur							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	2	182	-	-	1	7
	Some	170	51	70	4	109	180
Female	Mostly	1	114	-	-	-	11
	Some	43	104	1	3	91	141
Sources of Employment - Dadu							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	8	207	-	-	2	60
	Some	155	76	52	26	94	191
Female	Mostly	4	121	3	-	15	79
	Some	80	76	9	11	28	148
Sources of Employment - Thatta and Sujawal							
Gender	Quantification	Populated Rural Mouzas Reporting Sources of Employment					
		Service	Agriculture	Trade	Industry	Personal Business	Labor
Male	Mostly	2	315	1	1	2	106
	Some	325	179	80	28	269	373
Female	Mostly	-	208	1	-	7-	185
	Some	63	149	20	5	66	270

Annex P: Terms of Reference (TORs) for ESMF implementation and monitoring team

Independent Environmental and Social Monitoring Consultant

- A thorough review of the revised ESMF and ESMPs to assess their effectiveness.
- Review the implementation status of mitigation measures in the ESMF, ESMPs, and Checklists, and the related documentation including but not limited to the review of screening checklists and ESMPs, as envisaged in the ESMF. The consultant will need to assess how many interventions have complete documentation and how much of the documentation is accurate and reflective of facts on ground.
- Review the environmental and social monitoring regime as specified in the ESMF and ESMPs, review reports of monitoring carried out by ES/SS/ESFPs, identify non-compliances/gaps, and recommend changes, to improve monitoring mechanisms, if any. This will include providing feedback to improve integration of ESMF in the overall project implementation.
- The consultant will review the mechanism for the preparation of quarterly progress reports and recommend changes, if any, for improving the quality and presentation of these reports.
- Review the training regime as specified in ESMF, review the trainings carried out thus far, identify non-compliances/gaps, and recommend changes, if any. Assess usefulness and effectiveness of these trainings and recommend ways and means in consultation with PDs to make training program more effective.
- Identify any outstanding environmental and/or social issues/impacts associated with the subprojects already implemented, and recommend mitigation measures/ corrective actions where required.
- Based on the above, formulate recommendations for effective implementation of ESMF, overall management of the environmental and social aspects associated with the interventions under SSS and A4N.

Environmental Specialist

The Environment Specialist will be responsible for the supervision of implementation of ESMF as well as the ESMPs, Checklists and IPMP that would be prepared for the subprojects. The Environment will supervise the IP and TSP teams to ensure that all environmental commitments are incorporated into the hard-component activities and work processes. Specifically, the Environment Specialist(s)' responsibilities will include:

- Implementation of all aspects of ESMF including environmental screening and filling the screening checklists for each subproject to be undertaken under MSAN, except implementation of IPMP which will be scope of Directors and IPM managers present under Directorate of Agriculture and are experts in this field;
- Preparation of ESMPs and Checklists for subprojects;
- Supervising and supporting IP(s)/TSP(s) in achieving their responsibilities as outlined in the ESMF and subsequent ESMPs and Checklists;
- Carrying out frequent field visits and conduct monitoring for effective ESMF implementation as well as IPMP implementation;
- Identifying and preparing environmental induction and training materials;

- Conduct/manage ESMF trainings for the IP(s), TSP(s) personnel and ESFP(s) in accordance with the Training Plan given in ESMF;
- Responding to environmental incidents as required;
- Preparing quarterly progress reports for submission to World Bank and other stakeholders.

The Environment and Social Specialist will ensure that the project remains compliant to the World Bank operational policies and guidelines.

Qualification: The Specialist should at least have a master degree in Environmental Sciences or Engineering or Natural Resource Management with several years of relevant experience. Working experience on a World Bank project would be an advantage. Good communications skills, both oral and written, and ability to write well in English is also required. Knowledge of regional languages is an asset.

Social Specialist

The primary objective of the induction of is to help the DOA and DOLF in implementing the social components of MSAN over the project period. The specialist(s)' work will fall into the following areas: (i) ensuring compliance of the World Bank's projects with the Bank's social safeguard policies; (ii) assisting the Bank's work on social development; and (iii) assisting the Bank's work on social management, specifically focusing on strengthening institutional capacity.

The specific tasks of the Social Specialist will include:

- Supervise VLD and involuntary resettlement activities in projects under implementation;
- Initiate and review terms of reference for the conduct of social assessments required to inform project preparation;
- Ensure the proper implementation, execution and monitoring of GRM;
- Assess the robustness of the consultation process required for the preparation and implementation of the VLD;
- Provide basic orientation and training to IP(s)/TSP(s) potentially involved in projects preparation and implementation;
- Provide intensive on-site support to project IP(s), TSP(s) in VLD plans;
- Assist in policy dialogue with project stakeholders at all levels of project implementation;
- Participate in the review and clearance of project documents for compliance with the Bank's social safeguards policies.

Qualification: The potential specialist should have a master degree in a relevant field such as Sociology, Anthropology, or other Social Sciences. A minimum of 5 years relevant operational experience and proven track record in working on projects covering a broad range of social development issues. Good understanding of the World Bank's operational policies, processes and procedures including its safeguard policies is also mandatory. Field experience highly desirable. Specialist should have strong English communication skills, both written and oral, as well as knowledge of regional languages as an asset.

Annex Q: FORMAT FOR VOLUNTARY DONATION OF LAND

(Voluntary Donation of Land on Rs. -----/- Stamp Paper)

1. This deed of voluntary donation is made and executed on …..... day of ….....…… between Mr. ….....S/o W/ Mr. ---------- AND the Government of Punjab through Punjab Irrigation Department to render public service (Rehabilitation /strengthening /construction of new Flood protection embankment (project Title and Location). Herein after called the "Recipient" which term denotes to "for and on behalf of Project Management Unit, Saaf Suthro Sindh (SSS) or Agriculture for Nutrition (A4N), Government of Sindh" on the other part and shall mean and include his successors –in office, nominees and assignees etc.

2. Whereas, the details of the Location of the, land are given below:

Location Details

Land record No	Location /Village
Tehsil/UC	District
Title Holder/ Details	
Name and Father/ Husband's Name CNIC No,	Status: Title Holder
Age: occupation: Residence:	Gender:
Schedule –Land Details/structure	

Land in Question

Area	Location
North Boundary	East Boundary
West Boundary	South Boundary

Note: Detailed Map to the scale is appended.

3. Whereas the Title Holder is presently using/ holds the transferable right of the above mentioned piece of land in the village mentioned above. Whereas the encroacher does not hold any transferable rights of the above mentioned piece of land in the village mentioned above but has been a long standing encroacher, dependent on its usufruct hereditarily.

4. Whereas the Title Holder testifies that the land is free of Tenants, squatters or encroachers, not subject to other claims/ claimants and does not obstruct access to other people's land or livelihoods.

5. Whereas the Title Holder hereby voluntarily surrenders the land/structure without any type of pressure, influence, coercion or payment what so ever directly or indirectly and hereby surrender all his/her subsisting rights in the said land with free will and intention. He/she will transfer the property to the CSO/Project office its ownership and use.

6. Whereas the Recipient shall construct and develop infrastructure facilities under the project DCRIP Punjab and take all possible precautions to avoid damage to adjacent land/structure/other assets.

7. Whereas both the parties agree that the infrastructure so constructed/developed shall be for public purpose.

8. The land donated does not constitute more than 10% of the entire landholding of the donor/donors.

Signatories

Title holder		Tehsildar	
Name		Name	
NIC No.		Official Seal	
		Transfer registration No.	
Witnesses			
1. UC Nazim	Name		Signature
	CNIC		
2. Village Numberdar	Name		Signature
	CNIC		
3. Directorate Representative	Name		Signature
Director / D. Director	CNIC		

Annex R: International Laws/Treaties

UN Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty negotiated at the Earth Summit in Rio de Janeiro from 3 to 14 June 1992, then entered into force on 21 March 1994. The UNFCCC objective is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"[43]. The framework set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. Instead, the framework outlines how specific international treaties (called "protocols" or "Agreements") may be negotiated to set binding limits on greenhouse gases.

Kyoto Protocol

The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gas emissions, based on the premise that (a) global warming exists and (b) human-made CO_2 emissions have caused it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005[44].

The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Art. 2). The Protocol is based on the principle of common but differentiated responsibilities: it puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. It was agreed on 26 August 1987, and entered into force on 26 August 1989. The treaty is structured around several groups of halogenated hydrocarbons that deplete stratospheric ozone. All of the ozone depleting substances controlled by the Montreal Protocol contain either chlorine or bromine (substances containing only fluorine do not harm the ozone layer).

UN Convention to Combat Desertification

The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD) is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.

The Convention, the only convention stemming from a direct recommendation of the Rio Conference's Agenda 21, was adopted in Paris, France on 17 June 1994 and entered into force in December 1996. It is the only internationally legally binding framework set up to address the problem of desertification. The

[43] The United Nations Framework Convention on Climate Change. Retrieved 23 May 2016
[44] UN Treaty Database. Retrieved 27 November 2014

Convention is based on the principles of participation, partnership and decentralization—the backbone of Good Governance and Sustainable Development[45].

Stockholm Convention on Persistent Organic Pollutants (POPs)

Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs).

Key elements of the Convention include the requirement that developed countries provide new and additional financial resources and measures to eliminate production and use of intentionally produced POPs, eliminate unintentionally produced POPs where feasible, and manage and dispose of POPs wastes in an environmentally sound manner. Precaution is exercised throughout the Stockholm Convention, with specific references in the preamble, the objective, and the provision on identifying new POPs.

Cartagena Protocol

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international agreement on biosafety as a supplement to the Convention on Biological Diversity effective since 2003. The Biosafety Protocol seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology. The Biosafety Protocol makes clear that products from new technologies must be based on the precautionary principle and allow developing nations to balance public health against economic benefits. It will for example let countries ban imports of genetically modified organisms if they feel there is not enough scientific evidence that the product is safe and requires exporters to label shipments containing genetically altered commodities such as corn or cotton.

[45] United Nations Treaty Collection. Retrieved 26 May 2016

Annex S: World Bank Group's Environment, Health, and Safety Guidelines

Please see the next page.

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, 0°C.; 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)).

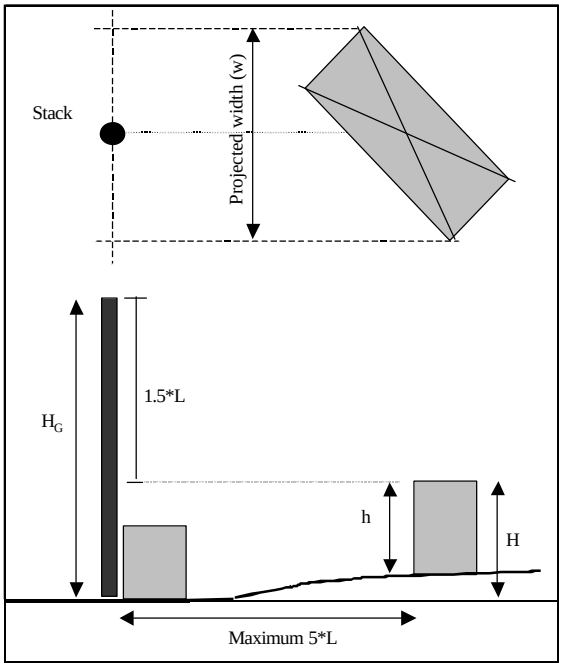
$H_G = H + 1.5L$; where

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

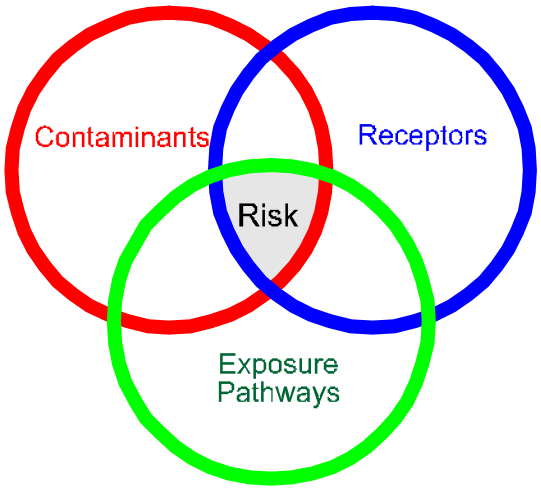


FIGURE 1.8.1: Inter-Relationship of Contaminant Risk Factors

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]

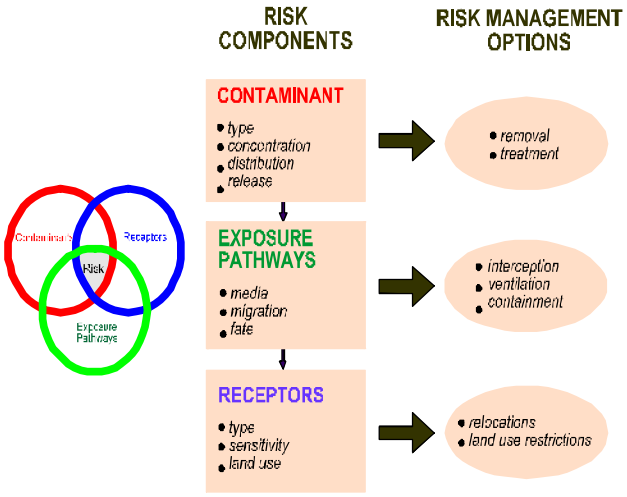


FIGURE 1.8.2: Inter-Relationship of Risk Factors and Management Options

[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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