Environmental Due Diligence Report

September 2014

CAM: Urban Water Supply Project – Sihanoukville Subproject

Prepared by Ministry of Industry and Handicraft for the Asian Development Bank.

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ABBREVIATIONS

ADB	Asian Development Bank
CAP	Corrective Action Plan
CC	Construction Contractor
CEMO	Contractor Environmental Management Officer
DDR	Due Diligence Report
DE	Design Engineer
DPWS	Department of Potable Water Supply
DSC	Design and Supervision Consultant
ES	Environmental Specialist
GMS	Greater Mekong Subregion
IEE	Initial Environmental Examination
MIH	Ministry of Industry and Handicraft
MOE	Ministry of Environment
MOH	Ministry of Health
MPWT	Ministry of Public Works and Transport
PEMO	PMU Environmental Management Officer
PIU	Project Implementation Unit
PMU	Project Management Unit
PPTA	Project Preparation Technical Assistance
REA	Rapid Environmental Assessment (Checklist)
SPS	Safeguard Policy Statement (2009)
SWSU	Sihanoukville Water Supply Utility
UWSP	Urban Water Supply Project
WTP	Water Treatment Plant

Units

Cm	centimeter
Km	kilometer
L	liter
M	meter
m^3/day	cubic meters per day
Masl	meters above seal level
MCM	million cubic meters
mg/L	milligrams per liter
ROW	right of way
Φ	diameter

I. INTRODUCTION

1. The Urban Water Supply Project (the Project)[1] financed by the Asian Development Bank (ADB) provides for rebuilding, retrofit and extension of water supply systems at nine towns in Cambodia. Proposed improvements in four towns are of sufficient magnitude to merit full feasibility study reports, whereas the feasibility studies for the remaining five towns (Kampong Thom, Kampot, Pursat, Sihanoukville and Stoung) are prepared according to an abbreviated format.

2. The Project is classified as a Category B Project according to the ADB Safeguard Policy Statement (2009). Environmental impacts are generally minor for the Sihanoukville subproject. Improvements are confined to the area within the boundary of the water treatment plant property, and involve only retrofit of equipment. Accordingly, a due diligence review has been prepared for the subproject.

II. SUBPROJECT DESCRIPTION

3. The Feasibility Study Report contains a description of the existing system. The water is sourced from the 14 ha Beung Preak Tubp Reservoir and transferred some 3 km in a raw water transmission line to the treatment plant that operates on the basis of a conventional flocculation-sedimentation-rapid sand filtration process. The 8,000 m^3/day design capacity treatment system was rehabilitated and expanded under a WB loan but is undersized for the current peak demand periods. The proposed improvements are aimed at increasing the efficiency of the water treatment plant, improving grit removal with dry and wet season watergates, adding storage for security of supply, and simplifying operation and maintenance. Further, the existing filters will be retrofitted with backwash systems, and chemical dosing facilities will be improved.

4. The inventory of improvements is as follows:

1. Rehabilitation of filters with introduction of mixed air/water backwash
2. Install additional 500 m^3 clear water storage with necessary slope protection
3. Install raw water flow meter
4. Improve control panel for raw water pump security
5. Replace 200 mm dia intake pump gate valve
6. Improve chlorine, lime and alum dosing facilities

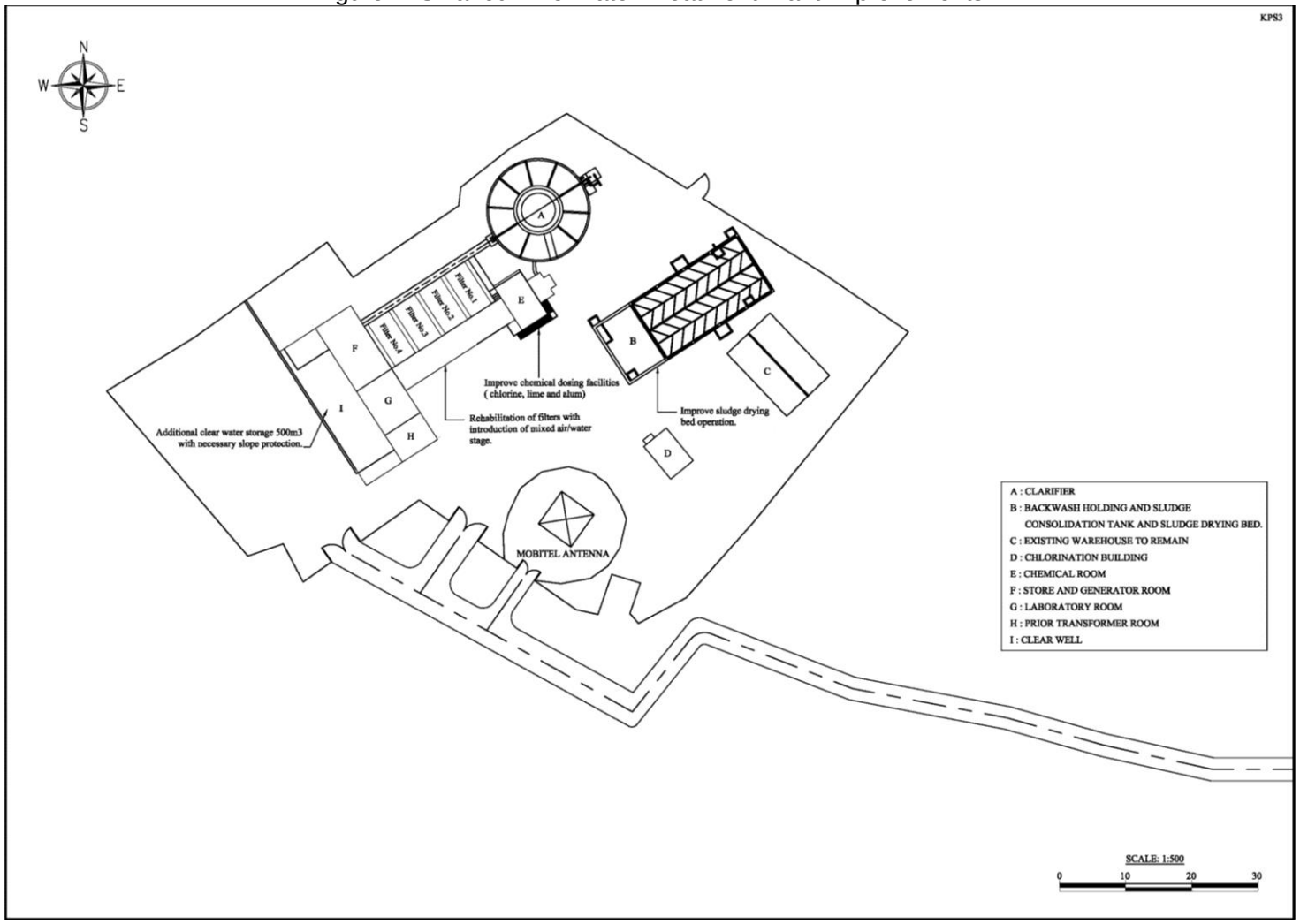
5. The layout of the water treatment plant is shown in Figure 1.

Sanitation

6. The sanitation component aims to provide a basis for defining needs and response within the subproject area regarding sanitation and drainage as a basis for a future sector loan. Various ministries have overlapping responsibilities related to sewerage and sewage/wastewater treatment in urban sanitation, and the sector loan will attempt to define responsibilities for implementing sanitation improvements in any future loan project. The outcome will be a set of interventions to improve sanitation and drainage that will be linked to expansion of water supply coverage. No actual sanitation works are provided under the present Scope for the Project and the Sihanoukville Water Supply Subproject.

[1] ADB, 2013; "Project Data Sheet"; Project Number 41403-013; Urban Water Supply and Sanitation Project; at . http://www.adb.org/projects/41403-013/main.

Figure 1: Sihanoukville Water Treatment Plant Improvements



III. BRIEF DESCRIPTION OF THE ENVIRONMENT

A. Site Visit

7. The environmental and social teams of the PPTA conducted a site visit of the Sihanoukville Water Treatment Plant facilities on 16 August and interviewed the director of the water supply agency. Problems and constraints faced by the director were noted, including those described above. The proposed interventions were reviewed with the director to understand clearly the works to be undertaken. The team conducted a site inspection, visited the various locations within the plant boundary, both inside and outside of buildings, and observed the locations where equipment is to be replaced in the treatment system.

B. Rapid Environmental Assessment Checklist and Categorization

8. Based on discussions with the director, onsite inspection and prior knowledge of the surrounding area, the rapid environmental assessment checklist (REA Checklist) was completed and is found in Appendix 1. In addition, an audit was conducted of the existing facilities to determine the presence of discarded and unused chemicals, waste oil and other materials that pose a hazard to human health and environment to determine if a Corrective Action Plan (CAP) is needed (SPS Appendix 1, Para 10).

C. Description of Surrounding Environment

9. The treatment plant is located on the highest hill in the City, on a plot of land of approx. 1.5 ha next to the Angkor Brewery. There is little or no residential or commercial activity visible to or close by the area of the treatment plant. Generally the site is surrounded and somewhat buffered by canopies of trees and foliage. Disturbances due to project activities are not anticipated due to the unusual placement of the treatment plant.

IV. GENERAL ISSUES RELATED TO THE ENVIRONMENT

10. All improvements take place within the confines of the waterworks property and involve installation or replacement of mechanical equipment and piping/fittings. A 500 m^3 at-grade storage tank will be constructed from reinforced concrete on the grounds. Mechanical improvements do not entail hazardous operations, and will engage a limited number of skilled workers. None of the works involves entering enclosed spaces. The construction of the at-grade storage tank will involve some limited site preparation, but since the subgrade conditions at the site are said to be monolithic rock, little disturbance of soils is needed.

11. The potential environmental impacts are minor. These are reviewed in the following bullet points, but as can be seen, none pose any serious concern:

- Movement of materials to and decommissioned equipment from the site will require that trucks pass along the entrance road of the plant, but the level of traffic is negligible.
- A minor amount of construction materials (about 95 m^3 of sand, gravel or ready mix and rebar) will need to be conveyed to the plant site
- Disposal or salvaging of decommissioned equipment poses no threat because the equipment parts will not contain or be contaminated with hazardous materials.
- Noise and dust will not be generated during the mechanical installation activities undertaken by the subproject, nor are there businesses or residences nearby.
- There is no requirement to excavate soils, so sediment runoff does not occur.
- The very few numbers of skilled workers required to complete the installations will likely be housed in guest houses within the town of Sihanoukville and pose no impact on the community. Concrete workers are likely to be hired locally and have their own homes in the area.

12. The means by which safety and health risks may arise onsite are as follows:

- Direct injury of workers in the course of the work is highly unlikely. Still, use of cutting torches, working-at-height and lifting and removing/installing heavy equipment needs to be undertaken with due regard for the necessary safeguards.

13. Provisions are set out in the following paragraphs for mitigating any potential impacts.

14. Movement of construction materials and equipment to and from the site should be restricted to daylight hours, and trucks should be equipped with fully functioning exhaust mufflers. Trucks should observe traffic rules and travel at safe speeds, especially in congested areas. Loads of sand and gravel should be covered. Excess ready mix concrete should not be disposed of in drainage channels.

15. Decommissioned equipment should be inspected before disposal or salvaging to assure no contamination of oily materials, chemical compounds or residuals built up within the cavities of the elements. In the event such materials are present, the contractor should consult with the PMU and DSC on the best means for handling the residual materials.

16. Work should be limited to daylight hours, and use of noise-generating equipment should be confined to short time periods.

17. Construction workers will be housed offsite at a location approved by the PMU. Housing of workers at commercially available guest houses is the most likely option; however if a worker camp needs to be set up, a signed consent from the owner of the property is necessary, which will set out terms of payment, if any, for use of the site. Suitable temporary housing, bathing and sanitation facilities, and a canteen for preparation of food should be in place before occupancy. Rudimentary site drainage and access should be prepared for the site. The site should be sufficient distance from markets, schools, temples, and neighborhoods to avoid any adverse impact thereto.

18. The building contractor's safety and health program should be sufficient to prevent accident, injury and ill-health among workers. Suitable and effective personal protective equipment (PPE) should be provided for workers, including protective footwear, hearing protection, eye protection and dust masks. The use of any protective device depends on the work being performed; regardless of PPE, workers should not be required to perform hazardous tasks which could result in injury and exposure. External means of preventing exposure should be pursued wherever possible, including alternative means of performing similar work.

19. Workers-at-height should be equipped with and required to wear safety harnesses. The entry of workers into enclosed spaces such as vacated tanks or sumps should be preceded with and accompanied by forced air ventilation. Tasks requiring use of high decibel equipment should be performed over short stretches by alternating workers. Workers should be provided with easy access to clean drinking water and modern sanitation facilities at the construction site, given suitable work breaks, and time for midday meals. The contractor should conform to the laws of Cambodia governing hiring, payment and treatment of labor.

V. EXISTING FACILITIES AUDIT

20. Appendix I of the ADB SPS (2009) requires that, "when the project involves existing activities or facilities, relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts." The rapid environmental assessment checklist (Appendix 1)

includes a section in which the existing facilities have been audited to identify the presence of waste, spent, out-of-spec and discarded water treatment chemicals, oils, cleaning fluids and solvents, as well as contaminated soils that have or have the potential for causing environmental impacts or risks, with the exception of chlorine gas, which is currently used in the water treatment process for disinfection/chlorination of the treated water. Current chlorine gas dosing equipment is either broken or not functioning correctly, and handling procedures are improper. Corrective action is needed to improve the chlorination facilities and use of chlorine gas or change to a safer system of disinfection.

21. As a result of the audit, discarded and unused water treatment chemicals were identified at the facility, including the following[2]:

Chemical	Container type	Nos.	Qty per container	Total estimated Qty
Potassium Permanganate	Sealed Canisters	~100	50 kg	5,000 kg
Hydrochloric Acid	Crates containing 24 -- ½ kg glass bottles	136	12 kg	1,632 kg
Sodium Tripolyphosphate	Bags	2	50 kg	100 kg
Sodium Acetate	Plastic bottles	~10	0.5 kg	5 kg

22. A corrective action plan (CAP) has been prepared (Appendix 4). The conclusions reached through the CAP are as follows:

- There are four or more types of chemicals at the plant site that are old, unused and unsafely secured. Two types are there in bulk quantities: about 5,000 kg of permanganate, and about 1,600 kg of hydrochloric acid in ½ kg glass bottles. Some of this latter amount is likely to be sulfuric acid and sodium hydroxide. The remaining materials are present in small quantities and pose an insignificant threat.

- Various options have been evaluated for securing the chemicals. Reduction of the permanganate or shipment outside the country for treatment and disposal are difficult and cost-prohibitive (around $12,000). Reuse elsewhere within the country or returning the materials to the supplier in China, while likely cost-effective, need further consideration. The permanganate can be secured onsite in the present containers, an option that poses insignificant environmental risk and can be done at little or no cost.

- The HCl may also be used elsewhere in the country (the preferred option) or neutralized using a simple process. The resulting mineralized water of neutral pH can be disposed of with no environmental effect. The cost of this option is expected to be around $2,000. Otherwise the material will need to be re-crated and sent to an in-country location where it can be used. Whether this is entirely feasible is questionable due to the condition of the screw tops and stoppers on the glass bottles.

- The conclusions related to hydrochloric acid are generally applicable to sulfuric acid and sodium hydroxide.

- In general the chemical stores at the Sihanoukville Water Treatment Plant are in poor condition and should be improved through arranging the physical contents, in-

[2] The Water Supply Utility reports other chemicals and quantities; see the CAP for details.

ventorying the chemicals, keeping records of use, age of materials and length of time in inventory, doing away with materials that are not planned to be used, and assuring that workers are equipped with personal protective gear and trained in the handling and use of materials.

23. The recommendations from the CAP are as follows:

- Removal or reduction on-site of the permanganate is likely to be difficult and costly. Reuse in-country or reprocessing in China may not be feasible. It is recommended that the stores of permanganate be secured onsite by placement on pallets in a dry location, with any open containers sealed. The DPWS and Sihanoukville Utility should then look for an opportunity in the future to reuse or reprocess the material at another location.

- HCl (inclusive o H_2SO_4 and NaOH) should be used at other facilities within Cambodia, with shipments to be manifested properly and monitored by MOE. If this is not possible due to the highly degraded condition of containers, the HCl (inclusive of H_2SO_4 and NaOH) could be neutralized onsite and the resulting water disposed of without harm to the environment. Glass containers could then be triple rinsed, the rinse water also neutralized, the glass bottles broken into shards, and the glass landfilled. The wooden crates and packing material should be taken to a remote location (the landfill for instance) and burnt.

- Handling of these materials poses some risk. Employees or contract workers should be equipped with personal protective gear, acid resistant suits, respirators, eye protection and other equipment depending on the application. The equipment used to handle and process the materials (for instance to neutralize the HCl) needs to be specified such that exposure to fumes, exothermic reaction or skin contact is prevented.

- Chemical stores should be improved at Sihanoukville to conform to good practice, with inventory and recordkeeping, personal protective gear and training in safe handling, and regular inspection of stores to assure safekeeping.

22. In addition, the potential presence of unexploded ordinance (UXO) and mines has been evaluated within the subproject area based on survey maps and discussion with provincial authorities. It has been determined that there is no basis for suspecting that UXO or mines are present.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Review of Impacts

24. Table 1 summarizes the impacts in the approximate order that they have been discussed in the previous section, exclusive of issues raised in the CAP. The table also summarizes the required mitigation measures, institutional responsibilities for assuring the mitigation action is carried out and costs, which are in all cases included in previously identified budgets for design, construction and operation of the systems.

Table 1: Potential Environmental Impacts and Mitigation Measures

Project Activity	Potential Negative Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Construction				
Movement of construction materials and decommissioned equipment to and from the site	Dust and roadside grit hazardous to pedestrians and motorcyclists	- Movement of construction materials and equipment restricted to daylight hours - Trucks to be equipped with fully functioning exhaust mufflers - Trucks hauling sand and gravel should be covered in transit - Trucks to observe traffic rules and travel at safe speeds, especially in congested areas	Construction Contractor (CEMO)	Included in bid price for work
Disposal of demolition debris	Degraded land uses and precedent for disposal of other forms of solid waste	- Decommissioned equipment to be inspected before disposal or salvaging to assure it is free of contamination by oily materials, chemical compounds or residuals - In the event such materials are present, the contractor should consult with the PMU and DSC on the best means for handling the residual materials.	Construction Contractor (CEMO)	Included in bid price for work
Onsite demolition and construction works	Noise and dust generated during construction activity	- Work limited to daylight hours, or to conform to the preference of surrounding users - Use of noise generating equipment confined to short time periods	Construction Contractor (CEMO)	Included in bid price for work
Construction worker offsite housing	Community social and sanitation impacts	- Housing of workers at commercially available guest houses is a suitable option. - If worker camp is needed, a signed consent from the owner of the property, to set out terms of payment, if any, for use. - Suitable temporary housing, bathing and sanitation facilities, and canteen for preparation of food erected at site and rudimentary site drainage and access in place before occupancy - Sufficient distance from markets, schools, temples, and neighborhoods to avoid impact	Construction Contractor (CEMO)	Included in bid price for work
Onsite demolition and construction works	Direct injury of workers in the course of demolition of existing structures	- Personal protective equipment (PPE) provided for workers - Workers not required to perform hazardous tasks which could result in injury and exposure - External means of preventing exposure to be pursued wherever possible, including alternative means of performing similar work. - Workers-at-height equipped with and required to wear safety harnesses.	Construction Contractor (CEMO)	Included in bid price for work

Project Activity	Potential Negative Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
		- Entry of workers into enclosed spaces such as vacated tanks or sumps to be preceded with and accompanied by forced air ventilation.		
Onsite demolition and construction works	Chronic injury from prolonged exposure to persistent noise, fumes, dust and heat	- Tasks requiring use of high decibel equipment to be performed over short stretches by alternating workers.	Construction Contractor (CEMO)	Included in bid price for work
Onsite demolition and construction works	Dehydration and fatigue and lack of sufficient onsite sanitation facilities	- Workers to be provided with easy access to clean drinking water and modern sanitation facilities at the construction site, given suitable work breaks, and time for midday meals.	Construction Contractor (CEMO)	Included in bid price for work

B. Institutional Arrangements

25. The Department of Potable Water Supply at central level under Ministry of Industry and Handicraft (MIH) is the executing agency, and will establish the Project Management Unit (PMU) to execute the Project. The PMU will assign responsibility for environmental aspects to a particular individual as staff PMU Safeguard Management Officer (PSMO) who is engaged full time with implementation of the project to monitor implementation of mitigation measures.[3] The Sihanoukville Water Supply Utility (SWSU) is the implementation agency for the subproject. SWSU will establish a Project Implementation Unit (PIU) to undertake construction of the Subproject at Sihanoukville.

26. The PMU will engage Contractors for specific works, based on the subcontract packages considered most suitable for execution. Legal clauses regarding mitigation measures are required to be included in construction contract bidding documents and become part of contract agreements; a set of specifications are provided in Appendix 2 that reflects the mitigation measures foreseen for the current subproject. For the main construction contracts, the Contractor will be required to appoint a staff Construction Environmental Management Officer (CEMO) responsible for supervising implementation of mitigation measures during the execution of the contract. The contractor will be required to prepare a Construction Management Plan (CMP) to ensure construction, demolition and excavation that take place at building sites do not adversely affect health, safety, amenity, traffic or the environment in the surrounding area. The CEMO working with the Contractor's Site Manager is responsible for preparing this plan prior to the start of construction and receiving approval for the plan from the PMU before the start of construction. The CEMO will serve as a point of contact that is accountable for environmental aspects of the construction work. For smaller construction contracts or subcontracts, the (sub-)contractor will still be held accountable for implementation of mitigation measures through a system of quality assurance supervised by the PMU[4].

27. The PMU has direct responsibility for monitoring the implementation of the mitigation measures. The PSMO will be assisted in tasks by the Environmental Specialists (ES), consultants[5] who are part of the Design and Supervision Consultant (DSC) and support all the subprojects undertaken through the loan. Work will commence with updating and finalizing IEEs and DDRs and their respective environmental mitigation measures and monitoring plans, submitting the environmental reviews on behalf of MIH to the Ministry of Environment, incorporating legal clauses regarding mitigation measures into construction contract bidding documents, assisting the PSMO in monitoring the implementation of those measures during the progress of construction, and preparing the environmental sections of semi-annual reports to be provided to ADB. The ES also will provide training to PMU and PIU staff. Table 2 describes the functions of various agencies engaged in the project, and a diagram illustrating the institutional arrangement is provided in Figure 2.

28. For the present project, RGC/Client approval for Environment Clearance from the Ministry of Environment involves revision of the DDR during the design phase, coincident with detailed design preparation, and translation of the DDR into Khmer. The DDR is submitted to the Department of EIA within MOE, which has a period of 30 days to review and respond with comments, or approve, the DDR. A timeline for updating the DDR as well as for inclusion of the EMP and special conditions in contract and/or bidding documents is as follows:

- Project design proceeds over a period of 5 months (anticipated)

[3] While the PEMO is engaged fulltime with subproject execution, duties related to environmental management may constitute only a portion of his/her responsibilities.

[4] Subcontractors hired by the general contractor, or minor contracts undertaken at the site are required to be managed under the provisions of the main contract and in conformance with the CMP.

[5] Both international and national ES will be engaged. It is recommended that the international ES be engaged for two months over the project duration, and the national ES be engaged fulltime, to provide support to the PEMOs for this and other subprojects.

- Monitoring of water quality over first two months
- Concurrently, DDR is updated with new design data
- By end of month 2, expected that issues related to design are resolved
- DDR undergoes translation (2 weeks)
- DDR submitted to DOE by mid-month 3 of design period
- DOE has 30 days to review/approve DDR
- DDR approved by mid-month 4 of design period
- ADB review runs concurrently with DOE review
- Final approval from ADB and the Government obtained before detailed design finalized in time for inclusion in procurement package

29. The Ministry of Environment (MOE) and the provincial Departments of Environment (PDOEs) play a role in submittal, review, and approval of DDRs, and monitoring and reporting. This work takes place during the implementation phase. The ES will revise and update the DDR based on final designs, and the document should be translated into Khmer prior to submittal to MOE DEIA, which will engage in the review process the provincial PDOE where the subproject takes place. Once DEIA approves the subproject, implementation can proceed with construction mitigation measures mostly in the hands of the contractor, and the ES, PDOE, PIU and PSMO working together to perform monitoring and reporting. It will be the job of the PIUs supported by the ES to compile quarterly reports, which then are compiled into semi-annual safeguard monitoring reports by the PMU and DSC, supported by the ES. A sample environmental monitoring reporting form is shown in Appendix 3. The PSMO and PMU Project Director will be responsible for submittal of reporting to ADB.

Table 2: Roles and Responsibilities

Agency	Role
MIH—DPWS Project Management Unit (PMU)	Supervision and guidance; assist to appoint staff of PMU; recruit competent national environmental specialist (NES) as part of the DSC to assist design team and PMU; submit DDR to Ministry of Environment (MOE) for approval; consolidate and submit semi-annual reports to ADB.
Sihanoukville Provincial Waterworks PIU	Appoint Project Environmental Management Officer (PEMO) to PMU, who will work with the ES to ensure EMPs are satisfied in the design and construction of the subproject; review and approve CMP; supervise and monitor DDR/CMP implementation; prepare and conduct public consultations, administer the grievance redress mechanism, monitor subproject activities and prepare quarterly environmental reporting at the subproject level.
Design and Supervision Consultant (DSC) National Environmental Specialist (ES)	Assist the PEMOs and the PMO to review, update and submit DDR for approval by MOE; incorporate EMP requirements into design, specifications and construction contract; coordinate with other government agencies regarding environmental issues; organize and implement public consultation and grievance redress mechanism; monitor activities of design engineer and construction contractors to assure mitigation measures are implemented; incorporate environmental reporting into semi-annual progress reports.
MOE DEIA and PDOE	Review of DDR; PDOE to support monitoring of mitigation measures during construction
Construction contractors	Implement environmental requirements related to construction; incorporate environmental costs into bid estimate; prepare a Construction Management Plan (CMP); appoint the Construction Environmental Management Officer (CEMO); assure all environmental requirements are followed.
DPWS/MIH Lab	Implement water quality monitoring of raw and treated water supplies during operations

C. Environmental Monitoring Plan

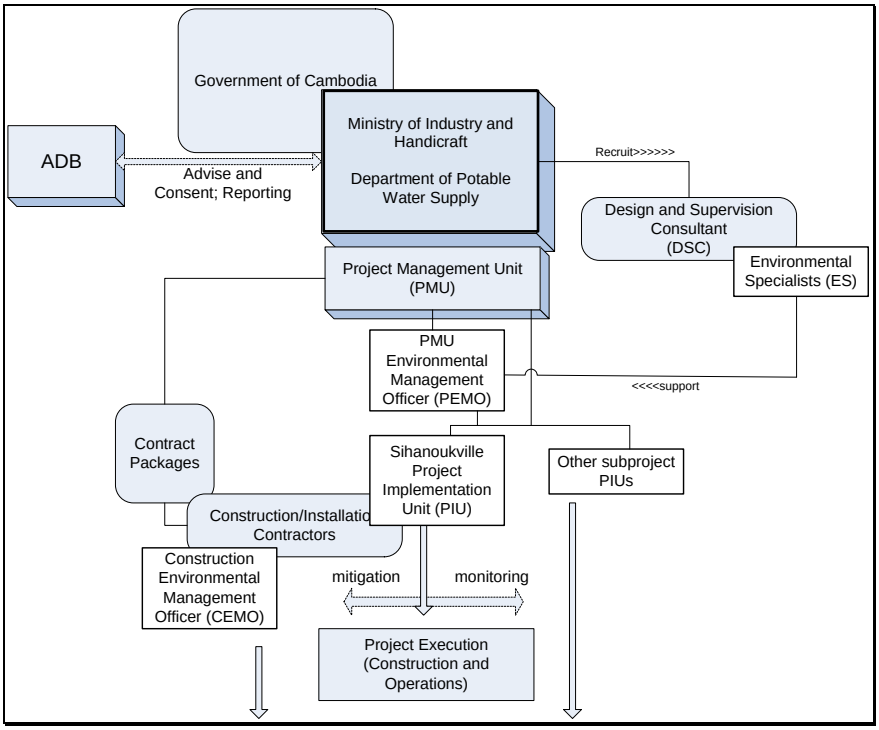
30. Environmental monitoring extends during the implementation of the loan and engages the previously identified groups. Table 3 identifies the monitoring to be undertaken in respect to the mitigation measures previously identified, exclusive of issues raised in the CAP. The PEMO is responsible for the bulk of the monitoring being undertaken during the design and construction periods. During operations, the SWSU is responsible.

Table 3: Environmental Monitoring Plan

Mitigation Measure	Parameters to be Monitored	Location	Measurements	Monitoring Frequency	Responsibility for Monitoring	Cost to Monitor
Construction						
- Movement of construction materials and equipment restricted to daylight hours - Trucks to be equipped with fully functioning exhaust mufflers - Trucks hauling sand and gravel should be covered during transit - Trucks to observe traffic rules and travel at safe speeds, especially in congested areas	Field Conditions	Sihanoukville roadside environment	Visual inspection	Over duration of work	PSMO, ES, PDOE	No extra cost.
- Decommissioned equipment to be inspected before disposal or salvaging to assure it is free of contamination by oily materials, chemical compounds or residuals - In the event such materials are present, the contractor should consult with the PMU and DSC on the best means for handling the residual materials.	Field Conditions	Plant site	Visual inspection of decommissioned equipment	At time equipment is available for inspection	PSMO, ES, PDOE	No extra cost.
- Work limited to daylight hours - Use of noise generating equipment confined to short time periods	Field Conditions	Construction site and environs	Visual inspection	Over duration of work	PSMO, ES, PDOE	No extra cost.
- Housing of workers at commercially available guest houses is a suitable option. - If worker camp set up, signed consent from the owner of the property, to set out terms of payment, if any, for use. - Suitable temporary housing, bathing and sanitation facilities, and canteen for preparation of food erected at site and rudimentary site drainage and access in place before occupancy - Sufficient distance from markets, schools, temples, and neighborhoods to avoid impact	Field Conditions	Labor Camps	Visual inspection	At start of contract; quarterly	PSMO, ES, PDOE	No extra cost.
- Personal protective equipment (PPE) provided for workers - Workers not required to perform hazardous tasks which could result in injury and exposure - External means of preventing exposure to be pursued wherever possible, including alternative means of performing similar work. - Workers-at-height equipped with and required to wear	Field conditions	Construction site	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.

Mitigation Measure	Parameters to be Monitored	Location	Measurements	Monitoring Frequency	Responsibility for Monitoring	Cost to Monitor
safety harnesses. - Entry of workers into enclosed spaces such as vacated tanks or sumps to be preceded with and accompanied by forced air ventilation.						
- Tasks requiring use of high decibel equipment to be performed over short stretches by alternating workers.	Field conditions	Construction site	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
- Workers to be provided with easy access to clean drinking water and modern sanitation facilities at the construction site, given suitable work breaks, and time for midday meals.	Field conditions	Construction site	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.

Figure 2: Organization for Environmental Management on Sihanoukville Subproject



A. Water Quality Monitoring

1. Types, Frequency and Timing

31. Concerns about surface water quality impacts during construction will be met by observing site conditions and no direct water quality monitoring of surface water is needed. No data are needed regarding the source of supply for the subproject, since the subproject does not address augmented supplies or treatment. Hence there is no water quality monitoring necessary on the project preliminary to construction.

32. Recommended protocols for monitoring raw water quality used in production operations (the raw water source) and finished water quality are already in place by DPWS in which a number of parameters are monitored (Table 4). Treated water quality should be within the limits set by the DPWS/MIH. It is important to consistently monitor raw and finished water quality, produce consistent data outputs, and analyze data for the purpose of maintaining and improving operations.

33. Other operations monitoring may be required. For instance, some operators measure select parameters downstream of the sedimentation tank in order to track performance of flocculation and settling in response to adjustments in chemical addition rate. Sampling and analysis may be performed at greater or lesser frequencies than specified herein to adjust performance. Actual parameters may differ depending on the source of supply (ground or surface water). The monitoring proposed herein is part of the operating unit's protocols, and is supported by MIH's Water Quality Lab, hence there is no additional cost associated with the proposal.

1. Sampling Locations

34. The location of raw water quality sampling is at the raw water intake. Treated water quality monitoring takes place at the end of the treatment plant. Monitoring chlorine residual is done at various locations in the distribution system.

Table 4: Drinking Water Quality Parameters and Frequency

Parameter	*Raw Water*	*Treated*	*Notes*
Essential Items (Analyze Daily)	✓		
-Color	✓	✓	
-Turbidity	✓	✓	
-pH	✓	✓	
-TDS	✓	✓	Or conductivity
-Residual Chlorine		✓	Multiple locations in pipeline
Important Items (Analyze every 3 months)			
-Taste		✓	
-Odor		✓	
-Mn	✓	✓	
-Zn	✓	✓	
-SO_4	✓	✓	
-Cu	✓	✓	
-H_2S	✓	✓	
-Hardness	✓	✓	
-Al	✓	✓	
-Cl^-	✓	✓	
-Fe	✓	✓	
-NH_3-N	✓	✓	
-E. Coli	✓	✓	
-Total Coliform	✓	✓	
Other possible analyses			
-Alkalinity	✓	✓	Some ops measure daily
-Organic carbon content	✓	✓	Permanganate test (COD)
-arsenic	✓	✓	Until satisfied none is present exceeding 50 µg/L

VII. PUBLIC CONSULTATION AND DISCLOSURE

A. Public Consultation

35. Public consultation should be held at the outset of procurement for the construction of civil works under the project. This is in order to notify the homes and businesses in the immediate vicinity of the site that work will commence on the project, to review environmental issues of concern, and to inform the public of the grievance redress mechanism established under the project.

B. Disclosure

36. Details of the subproject will be disclosed through a process of public consultation described above. Further to that, MIH will provide the relevant environmental information for this subproject, including information from the DDR to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them by providing a copy of the DDR in Khmer language at the PWW office for review by interested parties. In addition, ADB will post on its website the subproject DDR, updates prepared during the project implementation period, and environmental monitoring reports prepared during the implementation period.

VIII. GRIEVANCE REDRESS MECHANISM

37. Grievances related to both environmental and resettlement issues are addressed through the Grievance Redress Mechanism (GRM). In order to ensure that complaints from all affected persons (APs) on any aspect of environment, land acquisition, compensation and resettlement are addressed in a timely and satisfactory manner, and that all possible avenues are available to APs to air their grievances, a well defined grievance redress mechanism will be established. All APs can send any questions to the implementing agency about their rights in relation with redress of environmental problems and entitlements. APs are not required to pay any fee in order to file a complaint at any level.

The GRM has been explained in the public information booklet distributed to all APs, and is explained here in relation to complaints related to environmental impacts.

38. Stage 1 - Complaints from APs on any aspect of environmental impacts or the resettlement program shall first be lodged verbally or in written form to the commune leader. The commune leader along with the members of the provincial resettlement subcommittee working group (PRSC-WG) will meet to decide on a course of action within 15 days from the day it is lodged.

39. Stage 2 - If no understanding or amicable solution can be reached, or if no response from the commune chief is received by the AP within 15 days of registering the complaint, he/she can appeal directly to the PRSG-WG. APs will be heard in person by the vice chairman of the PRSC-WG and APs will be invited to produce documents which support his/her claim. The complaint must be settled within 60 days of registering the original complaint. The PRSC-WG will provide a decision within 30 days of the registering of the appeal.

40. Stage 3 - If the AP is not satisfied with the decision of the PRSC-WG, or in the absence of any response, the AP can appeal to the Interministerial Resettlement Committee-Resettlement Department (IRC-RD). The IRC-RD has 30 days to provide a resolution of the problem from the day it is lodged.

41. Stage 4 - If the AP is still not satisfied with the decision of the IRC-RD on appeal, or in absence of any response from the IRC-RD within the stipulated time, the AP, as a last resort, may submit his/her case to court of law, whose judgment is final. APs may also ask for resolution from ADB's responsible project officer consistent with the provision of the ADB's accountability mechanism. They can file their complaint through the ADB resident mission in Phnom Penh for transmittal to the ADB headquarters in Manila.

42. At each stage the governing official is responsible for recording the minutes of meetings, maintaining files on all complaints, and for distributing copies of all decisions to the PMU and lower level bodies, including commune/village officials and affected parties and households.

IX. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

43. The Sihanoukville Water Supply and Sanitation Subproject is a small-scale remediation of an existing facility that takes place wholly at the location of the existing water treatment plant and involves replacement or installation of mechanical equipment and above-grade piping, and construction of a single, at-grade storage tank. The type and scale of work presents no potential for significant environmental impact. A due diligence review was conducted and is reported on in this document.

44. Unused chemicals have been identified at the site, and a corrective action plan (CAP) has been prepared for the facility.

45. The Sihanoukville Water Supply and Sanitation Subproject is an important intervention to assure the supply of potable water in the Sihanoukville service area over the near term. No environmental constraints exist for implementing the project.

B. Recommendations

46. Potential environmental impacts stem from the transport of materials, the decommissioning of equipment, and typical health and safety risks posed when installing mechanical equipment. Measures have been set out to mitigate these potential impacts, reinforced by a set of environmental specifications for the construction contractor. These measures should be implemented in order to minimize any adverse effects.

47. The CAP should be implemented either by the DPWS and the Utility prior to undertaking the subproject, or with the assistance of the DSC while the loan is underway. Reuse of the chemicals at other facilities in the country is the preferred option.

48. Institutional measures are also in place to obtain compliance from the construction contractor, to monitor the implementation of mitigation measures and to fulfill reporting functions related to loan implementation. These institutional measures that constitute the environmental management framework should also be implemented. Costs related to mitigation and monitoring were considered, and no special costs have been identified, other than those described in the CAP.

Appendix 1: Rapid Environmental Assessment Checklist

Country/Project Title:	Cambodia Urban Water Supply and Sanitation (Sihanoukville)
Sector Division:	Water Supply

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…			
▪ Densely populated?		✓	
▪ Heavy with development activities?		✓	
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		✓	
• Protected Area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
B. Potential Environmental Impacts Will the Project cause…			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		✓	
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	
▪ hazard of land subsidence caused by excessive ground water pumping?		✓	
▪ social conflicts arising from displacement of communities ?		✓	
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		✓	
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	✓		**Water is treated using conventional treatment approach.**
▪ delivery of unsafe water to distribution system?		✓	
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		✓	

Screening Questions	Yes	No	Remarks
▪ over pumping of ground water, leading to salinization and ground subsidence?		✓	
▪ excessive algal growth in storage reservoir?		✓	
▪ increase in production of sewage beyond capabilities of community facilities?		✓	
▪ inadequate disposal of sludge from water treatment plants?		✓	
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		✓	
▪ impairments associated with transmission lines and access roads?		✓	
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		✓	
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?	✓		**Capacity building plan for handling chlorine; prior experience of workers (existing system has chlorine gas delivery system)**
▪ dislocation or involuntary resettlement of people?		✓	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	
▪ noise and dust from construction activities?	✓		**Moderate effects; mitigated through standard means**
▪ increased road traffic due to interference of construction activities?		✓	
▪ continuing soil erosion/silt runoff from construction operations?	✓		**Moderate effects; mitigated through standard means**
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		✓	
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		✓	
▪ accidental leakage of chlorine gas?	✓		**Capacity building in safe handling of chlorine gas provided under the project**
▪ excessive abstraction of water affecting downstream water users?		✓	
▪ competing uses of water?		✓	
▪ increased sewage flow due to increased water supply		✓	
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant		✓	

Screening Questions	Yes	No	Remarks
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	
▪ social conflicts if workers from other regions or countries are hired?		✓	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		✓	
▪ 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 construction, operation and decommissioning?		✓	

Preliminary Climate Risk Screening Screening Questions		Score	Remarks[6]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Design to consider sustainability of the water sources.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium

[6] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Appendix 2: Environmental Specifications for Contract Tender Documents

General

1. The contractor will post a public notice regarding the nature, extent and cost of the project at the start of the construction zone; and post notices announcing the grievance redress mechanism in local government offices and in strategic places of the subproject's area of influence.

Worker Provisions

2. GOC criteria for minimum age, wage and living provisions, benefits, hours of work, overtime arrangements and overtime compensation, and leave for illness, maternity, vacation or holiday should be met for all workers. The Contractor will conform to national law in relation to hiring and employment; and will comply with the principle of equal opportunity, fair treatment, and nondiscrimination with respect to the employment relationship; except that hiring of project-affected persons, residents of project-affected administrative units and disadvantaged groups is encouraged.

3. The contractor shall implement a safety and accident prevention program involving provision, training and use of safety equipment; minimum skills qualifications for operators and drivers; and record keeping related to accidents.

4. The Contractor will provide Personal Protective Equipment (PPE) to workers that offer adequate protection to the worker without incurring unnecessary inconvenience in its use[7]. Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out; and proper use of PPE should be part of training programs, as appropriate.

5. The contractor will maintain first aid kits onsite along with instructions for use, and personnel trained in basic first aid emergency response measures; and emergency care should be available on call.
6. Laborers and others resident at the site will be provided with lodging in a camp setting, potable water supply, food service facilities, adequate means for maintaining personal hygiene and solid/liquid waste disposal, and onsite facilities for preparing food, or food service contracted.
7. The contractor will provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and soakaway, or holding tank with removal by vacuum truck. Solid waste should be collected at waste bins and disposed of properly offsite.
8. The public should be barred from the site as well as from worker housing areas.

9. HIV/AIDS awareness should be incorporated into the contractor's policy and outreach toward workers.

Use of Land for Construction Purposes

[7] Depending on the application PPE may include safety glasses with or without side-shields, and protective shades; plastic helmets with top and side impact protection; hearing protectors (ear plugs or ear muffs); safety shoes and boots for protection against moving & falling objects, liquids and chemicals; gloves made of rubber or synthetic materials; facemasks with appropriate filters for dust removal and air purification; single or multi-gas personal monitors; portable or supplied air; on-site rescue equipment, and insulating clothing, body suits and aprons of appropriate materials.

10. The contractor will obtain approval from landowners for temporary use of land for labor camps and construction yards. Local authorities will be consulted on locations, which will in no case be close to sensitive receptors such as hospitals, schools and residential communities.

11. The contractor will not encroach upon vacant land or cause damage to adjacent properties. The Contractor will execute a plan for preventing firewood gathering in the project area and prohibit among workers possession of instruments or poisonous substances for killing or capturing fish or wildlife.

12. Cutting trees is prohibited except inside the construction zone. Trees to be removed must be specified in the Project plans and specifications.

13. No fuel, oil, or parts cleaning fluids shall be spilled, wasted or disposed of at the project site. Secondary containment (earth or concrete berm) at least equal to the capacity of the fuel storage tank shall be provided at fueling stations.

14. After completion of occupancy, all affected areas within the general project boundary shall be graded to the original or specified elevation that allows positive drainage. Machinery, equipment, structures, contaminated earth, plant matter and waste or unused materials shall be removed and disposed of properly.

Conduct of Work

15. The workplace should be kept orderly to reduce accidents. Deep excavations in unstable soils need to be shored, and below grade construction brought to grade quickly, then excavations closed. The contractor will:

    a. Restrict use of heavy equipment and material receipts to daylight hours. Apply water to suppress dust where needed.

    b. Exercise caution to prevent erosion losses, close excavations rapidly and stabilize soils once the pipeline is in place.

    c. Return land to the original condition on completion.

    d. Complete work on a segment according to a progressive sequence of activity. Provide access by bridging trenches.

    e. Store bedding materials outside trafficked areas. Cover materials and/or suppress dust with water. Remove excess.

    f. Avoid stockpiling materials, equipment and supplies at the site.

    g. Avoid trenching in locations where damage might occur. If needed, provide shoring to assure no subsidence occurs.

    h. Excavations should be barricaded and marked. Workers should not be allowed to enter trenches greater than waste deep unless they are properly shored.

    i. Use tarpaulins to cover truck beds or avoid overfilling and spillage along roadways, plan routes to avoid congested areas and narrow roads, and schedule transportation to avoid peak traffic periods.

    j. Plan construction to avoid repeated excavation in roads and easements.

k. Provide movable sanitary facilities at the work site and maintain the site clean, free of odors and usable.

l. Plan work to minimize duration of shutdown. Limit shutdown to less than four hours. Notify public in advance and advise to store water as necessary.

m. Increase work force to complete construction quickly in affected areas. Minimize dust / avoid obstruction of pedestrians and vehicles

Sediment Controls

16. Areas to be cleared and excavated are limited to areas where construction will take place. Areas will be protected from flowing water including sheet runoff. The contractor will limit sediment loss from exposed surfaces. Existing drainage patterns should be maintained during construction.

17. Discharge of wastewater into water bodies is prohibited as is the discharge of wash water from concrete trucks to waterways. . Land clearing activity will be suspended during rains to limit sediment loss.

Community Values

18. Vehicles will operate within the legal speed limits in populated areas. The operation of moving equipment in locations accessible to the public will be done in a manner so as to prevent the occurrence of incidents and accidents.

19. The contractor is responsible for regular spraying of roadway surfaces in use as haul routes and of sites under construction where these locations are accessed by the public. The contractor will remove excess debris during construction and after completion of the item of work.

20. The Contractor will post flagmen at intersections of transit paths for construction vehicles and local traffic, and along traffic lanes where work is in progress. Traffic detours will be clearly marked.

21. For work in public right-of-way, the contractor will provide a path for transit of pedestrians and vehicular traffic through the construction area; and barricade open excavations to prevent injury to the public.

22. The contractor will provide temporary access to affected properties and reinstate permanent access on completion of work; minimize the area under construction at any one time and the duration of works at any one location; and minimize impacts on infrastructure, access and services.

23. The contractor will install signs and lighting, where there is nighttime traffic, in the vicinity of works on public roads, and restrict access to the construction site to the public.

Site Conditions and Haul Routes

24. At the start of construction, the contractor will provide a Construction Management Plan for development of the construction zone, worker camps, equipment yards, and haul roads.

25. Haul routes will minimize interference with ongoing activity in the area. Routes shall be approved by the PMU. Haul roads and transport/equipment routes shall be kept within the construction zone, unless authorized by the PMU.

Disinfection of Pipes, Tanks and Equipment

26. The Contractor will disinfect water mains, tanks and reservoirs by chlorination and include a bid item for disinfection in piping installation contracts.

Appendix 3: Sample Environmental Monitoring Reporting Form

TEMPLATE/FORMAT

Safeguard Monitoring Report

Summary:
(to be included as part of the *main* Report)

- **Summary of EMP/RP Implementation**
- **Description of monitoring activities** carried out (e.g. field visits, survey questionnaire, public consultation meetings, focus group discussions, etc)
- **Key issues**, any **corrective actions** already taken, and any **grievances**
- Recommendations

Safeguards Monitoring Report
(to be included in the annex/appendix of the *main* Report)

1. Introduction and Project Overview

Project Number and Title:		
Safeguards Category	Environment	
	Indigenous Peoples	
	Involuntary Resettlement	
Reporting period:		
Last report date:		
Key sub-project activities since last report:	This section can include, among others, the following: • Activities of Proponent • Progress of Work (% physical completion) • Changes of Surrounding Environment • Status of Permits / Consents	
Report prepared by:		

2. Environmental Performance Monitoring

a. Summary of Compliance with EMAP Requirements (Environmental Performance)

EMAP Requirements	Compliance Status (Yes, No, Partial)	Comment or Reasons for Non-Compliance	Issues for Further Action
Use environmental impact as main heading and EMAP as listing (see example below)	Use EMoP list as basis for rating/evaluating compliance (see example below)		
Rise of employment opportunities: • Job openings of the project should give priority to local communities. • Recruitment of local laborers should be stipulated in the	• Field inspections and interviews with communities - DONE • Note each complaint case in the field – 3 COMPLAINTS RECEIVED		

contract for construction	• Set up grievance centre and report as part of monitoring action plan – NOT DONE		

b. Issues for Further Action

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
List of EMoP measures or activities not completed (last column of previous table)			
New Issues from This Report			

c. Other activities

- Other issues not covered by EMAP/EMoP
- Environmental monitoring as required by GOI (e.g., air quality, water sampling)

3. Involuntary Resettlement Performance Monitoring

a. Summary of Compliance with RP Requirements

RP Requirements	Compliance status Yes/No/Partial	Comment or Reasons for Compliance, Partial Compliance/Non-Compliance	Issues for Further Action[8]
Establishment of personnel in PMU/PIU			
Public consultation and socialization process		Provide information on: • Public consultation, participation activities carried out • Inclusive dates of these activities To be elaborated on in Item 5	

[8] To be elaborated further in table 3.b (Issues for Further Action)

Land area to be acquired is identified and finalised			
Land acquisition completed			
Establishment of Resettlement Site(s)		Please state: • Number of AHs to be relocated as per agreed RP • Number of AHs already relocated • Number of houses built • Status of installation of community facilities to be provided as per agreed RP	
Compensation payments for affected assets is completed		Please state: • Total Number of Eligible AHs and APs (as per agreed RP) • Number of AHs and APs compensated as of this monitoring period • Total Budget allocation as per agreed RP • Total budget disbursed to AHs as of this monitoring period	
Transport assistance for relocating affected households		As above	
Additional assistance to vulnerable affected household		Please state: • Total Number of vulnerable AHs and APs (as per agreed RP) • Agreed forms of assistance as per RP • Number of AHs and APs assisted as of this monitoring period	
Income Restoration Program		Please state progress per income restoration feature/activity and actual period of implementation	
Temporary impacts have been addressed (affected properties restored to at least pre-project conditions)		Please state: • Total Number of AHs affected by temporary impacts as per agreed RP • Actual Number of AHs and total area affected by temporary impacts (if this differs from the projected number, such as in cases of unforeseen project impacts) • Status of restoring affected property	
Capacity building activities			

b. Issues for Further Action

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
List of RP activities not completed (last column of previous table)			
New Issues from This Report			

4. Occupational, Health and Safety (OHS) Performance Monitoring

a. OHS for worker

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

b. Public Safety

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

5. Information Disclosure and Socialization including Capability Building

- Field Visits (sites visited, dates, persons met)
- Public Consultations and meetings (Date; time; location; agenda; number of participants disaggregated by sex and ethnic group, not including project staff; Issues raised by participants and how these were addressed by the project team)
- Training (Nature of training, number of participants disaggregated by gender and ethnicity, date, location, etc.)
- Press/Media Releases
- Material development/production (e.g., brochure, leaflet, posters)

6. Grievance Redress Mechanism

Summary:

- Number of new grievances, if any, since last monitoring period: ____
- Number of grievances resolved: _____
- Number of outstanding grievances: _____

Type of Grievance	Details (Date, person, address, contact details, etc.)	Required Action, Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

7. Conclusion

- Important results from the implementation of EMAP/EMoP and RP monitoring
- Recommendations to improve EMAP/EMoP and RP management, implementation, and monitoring

8. Attachments

- Consents / permits

- Monitoring data (water quality, air quality, etc.)
- Photographs
- Maps

Appendix 4 Sihanoukville DDR
Corrective Action Plan

Background

As part of the field work related to the Sihanoukville due diligence, a procedural audit was conducted of buildings, sheds and process areas at the Sihanoukville Water treatment Plant. A storage shed (see Figure 1) made up of three separate lockable storage areas was found to contain old, unused chemical products alongside water treatment chemicals currently in use. Because the unused chemicals pose a potential threat to human health and environment when no longer in use, a Corrective Action Plan (CAP) is necessary to manage and secure the chemicals.

Figure 1: Storage Shed with Three Lockable Compartments

ADB Safeguard Policy

The basis for this action is as follows: Appendix 1 of the ADB Safeguard Policy Statement (2009) states that:

> "When the project involves existing activities or facilities, relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts. If the project does not foresee any new major expansion, the audit constitutes the environmental assessment for the project. A typical environmental audit report includes [a] corrective action plan that provides the appropriate corrective actions for each area of concern, including costs and schedule."

ADB Operational Procedures (OM F1/OP, 2009) related to "Existing Facilities" requires the following:

> "52. For projects involving facilities and/or business activities that already exist or are under construction before ADB's involvement, ADB requires the borrower/client to conduct an environment and/or social compliance audit to determine

> their safeguard compliance status. The project team confirms that the audit by the borrower/client includes on-site environmental and social assessments to identify past or present safeguards concerns related to the impacts on the environment . . . . Where noncompliance is identified, ADB and the borrower/client agree on a CAP, implementation schedule, and sufficient funds to bring the project into compliance with the safeguard policy requirements. . . . [T]he requirements for environmental and social assessments . . . apply in addition to the audit."

By this definition the CAP is prepared in addition to, and as an appendix to, the environmental due diligence conducted for the facility and described in the main report.

Relevant National Law

Relevant national law is contained in the Sub-decree on Solid Waste Management. Chapter 3 on Hazardous Waste, and Chapter 4 on Monitoring and Inspection of Hazardous Waste Management, refer to an annex on Types of Hazardous Waste. It is unclear whether the chemicals (all or in part) should be considered hazardous wastes (see further sections on this issue). If the chemicals can be reused, they are not waste. One item in the annex is "Waste from Expired Products", taken to mean unused and discarded chemicals that fit other descriptions in the annex, inclusive of "acid waste", "alkali waste" and waste produced from treating any of the other types of wastes listed in the annex.

Parts of the law are relevant to disposition of the material as waste, including responsibility of the owner for temporary storage, quarterly reporting on quantities to the MOE, movement or disposition of waste, need for a license from the Ministry of Trade and agreement from the Ministry of Environment for export to a third country, and compliance with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Unused Chemical Inventory

The unused chemicals found in storage during the field visit were identified as follows:

Chemical	*Container type*	*Nos.*	*Qty per container*	*Total estimated Qty*
Potassium Permanganate	Sealed Canisters	~100	50 kg	5,000 kg
Hydrochloric Acid	Crates containing 24 -- ½ kg glass bottles	136	12 kg	1,632 kg
Sodium Tripolyphosphate	Bags	2	50 kg	100 kg
Sodium Acetate	Plastic bottles	~10	0.5 kg	5 kg

The inventory is based on a visual count of boxes and containers found in storage; however the containers described as "crates" are labeled in Russian. Crates that were already open were found to contain 0.5 kg glass bottles containing hydrochloric acid (labeled in English). Later, the Provincial Utility reported an inventory that includes sulfuric acid, oxalic acid and sodium hydroxide. The material described in the above as hydrochloric acid may be in part these chemicals contained in the unopened crates. The inventory of chemicals as reported by the Provincial Utility is as follows:

Item	*Chemical name*	*Amount*	*Net wt*	*Function*	*Imported from*	*Date*
1.	Hydrochloric Acid	192 bottles	0.9 kg	TOC	Russia	1990
2.	Sulfuric Acid	1128 bottles	0.9 kg	TOC	Russia	1990
3.	Sodium Acetate	120 bottles	0.8 kg	Iron standard	Russia	1990
4.	Sodium Tripoly-	648 bottles	0.9 kg		Russia	1990

	phosphate					
5.	Alum	120 bottles	0.9 kg		Russia	1990
6.	Sodium Hydroxide	840 bottles	0.9 kg		Russia	1990
7.	Oxalic Acid	945 packs (?)	0.9 kg		Russia	1990
8.	Potassium Permanganate	90 containers	50 kg	Iron removal	WB project	2002

The following analysis is based on the visual counts made during the field visit, since there are discrepancies between our observations and the reported amounts (for instance, the bottles of hydrochloric acid are clearly labeled as 0.5 kg net wt., whereas the Utility reports these at 0.9 kg). We make some allowances for the differences in the analysis, but since the substances are acids, bases and buffering compounds, the approaches for disposition of the materials are similar.

Properties of chemicals and Disposal Options

General: All of these materials are held at the Utility for use in the water treatment process and in laboratory analyses. *To the extent possible, the materials should be put to use at other water treatment plant facilities in Cambodia.* But there are potential problems with this approach, which cannot be resolved during the PPTA. The permanganate, mostly in sealed containers, may be solidified and unusable in a chemical feed unit. Acids (and bases) while generally not degradable (e.g. infinite shelf life) may be difficult to use because bottle caps and stoppers may be degraded. Sodium acetate and tripolyphosphate in storage may have exceeded their shelf lives. The CAP takes the position that these are not wastes until it is ascertained clearly that all or part of any particular chemical cannot be used. The Utility should exercise its right to redistribute the materials to other plants where the chemicals can be put to use, but should keep clear records of the activity, including formal shipping orders and manifests, in order to verify the disposition of the materials.

The following sections evaluate disposition of the two types of chemicals identified in the field visit (permanganate and hydrochloric acid) in order to derive comparative costs and target options.

Potassium Permanganate ($KMnO_4$) is a strong oxidizer used in water treatment to control taste and odors, remove color, control biological growth in treatment plants, and remove iron and manganese. It was for the latter purpose that it was used at Sihanoukville during the time the plant utilized groundwater as its raw water source (prior to 2005). It is not listed under applicable US hazardous waste law, but is considered a hazardous substance under the Clean Water Act. Under transport and occupational health laws, it has various restrictions on use, shipment and disposal and may be hazardous under various conditions of high temperature, incompatible materials, due to dust generation, and in the presence of combustible materials and reducing agents.

The material at Sihanoukville (see Figure 2) was likely placed there around the year 2002 and has not been used since 2005. It is likely solidified in the canisters and may not be useable; however this needs to be evaluated closer and reuse at another water treatment facility is the best option for disposition of the material. If the material is no longer usable, it can be deactivated through a process of reduction and the resulting sludge and containers disposed of in a landfill. The material may be disposed of at a hazardous waste facility in a third country, but as shown below, both these options are costly. Another option is to ship the material back to the supplier for reprocessing, but this is likely not possible. A final option is to secure the material in storage at the present location, since it is not a hazardous waste and is in solid form, thus does not pose a direct threat to the environment or human health.

]

Figure 2: Permanganate in Storage

General approach and Cost

We have not been able to determine whether the first option, reuse, will be possible due to the age and condition of the material; however the material could be re-ground or dissolved in solution and still remain useful. Depending on the outcome of other options, this needs further investigation.

The second option, reduction of permanganate, might be done onsite, but would involve purchase of reducing chemicals and would involve significant amounts of materials handling. Reduction can be achieved in aqueous solutions with sodium thiosulfate, sodium bisulfite or ferrous salt solution. The thiosulfite or ferrous salt may require some dilute sulfuric acid to promote rapid reduction. Ferrous ammonium sulfate (FAS) is used for the reduction. The material should be decanted or filtered, and the sludge mixed with sodium carbonate and deposited in a landfill.

The cost of the second option is based on the quantity of FAS needed to reduce the permanganate at a cost of $180 per ton obtained from the web[9]. Potassium permanganate reacts with iron(II) salts (generally ferrous ammonium sulfate (FAS) according to the following oxidation-reduction equation:

$$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$$

It is the +2 charge on the ferrous ion that reacts and neutralizes the permanganate. It takes five moles of Fe2+ to react with one mole of KMnO4 (molecular weight of 158) according to the balanced chemical equation for the reaction. The molecular weight of iron (55.85) provides the basis for calculating stoichiometric quantities. FAS (anhydrous) has a molecular weight of 285. Hence 9 gm of FAS is required to neutralize one gm of permanganate. Considering there are 5,000 kg (our field estimate) of permanganate, 45 tons of FAS is required, costing around $9,000 in chemicals. Safety equipment, materials handling and final disposal of reduced materials, a neutralized sludge, adds to this

[9] Other chemicals may be used, and prices may vary depending on suppliers.

price. Achieving thorough reduction of the material is also problematic, since the material has solidified. This is likely an infeasible option.

The cost for the third option, shipment to and disposal in a third country is based on costs obtained from the web for treatment and neutralization of 55 gal drum lab packs, and best estimates for packaging, handling and shipment, as follows:

Specific gravity	1.01	
qty	5000	kg
vol	4950	lit
	1309	gal
(assume 90% fill)	26	drums
element	*unit price ($)*	
packaging	30	
handling	40	
shipment	60	
neutr/trtmt	300	
Residual disposal	50	
	480	$12,700

This is an excessive cost that would unnecessarily burden the Utility given the low exposure risks posed by the material.

Reprocessing of the permanganate is a possible option. A inquiry[10] has been sent to the supplier (Groupstars Chemical, Yunnan China). It is not possible to estimate costs of this option at the present. Shipment and manifests for the material may pose difficulties. This is unlikely to be feasible.

The final option is to secure the canisters at the present location. The steel canisters are intact, with only a few having been opened. The materials can be placed on pallets, free from corrosion at their base, the roof checked for leaks, and left in place. There is no significant cost for this option.

Further work is needed to determine whether the material can be used elsewhere in-country or returned to the supplier for reprocessing. At present there is no cost-feasible means for disposing of this material within country or elsewhere. The two disposal options (onsite treatment and shipment to a third country) are expensive options not likely to be pursued by the DPWS/SWSU. Securing the material in place is the best option. Risks are minor, as the material is not considered hazardous unless it enters the environment. This however defers the disposal of the material to a future time, and may be considered a liability of the Sihanoukville utility.

Hydrochloric Acid (HCl) is a corrosive liquid. Upon release to air, there is the potential for generation of toxic hydrogen chloride gas. As a strong, corrosive acid, HCl reacts with many metals producing flammable hydrogen gas that can become an explosion hazard. HCl is produced in solutions up to 38% (concentrated grade), with higher concentrations up to just over 40% chemically possible. The material at Sihanoukville is labeled as "chemically pure" HCl, which is used in the pharmaceutical and food industries, for preparation of drinking water and as a raw material for consumable products. The molarity of the HCl is not stated on the container label. We expect it to be concentrated grade,

[10] "We have 100 drums (5,000 kg) of permanganate shipped by your company to Cambodia sometime between 2000 and 2005. It is no longer usable (solidified) and we have to clear it out. Will you accept the material for reprocessing?"

The material at Sihanoukville (see Figure 3) was placed there in 1990 and is of Soviet origin. The material was likely used to reduce pH at the treatment plant during the time of groundwater use. It is contained in 0.5 kg glass vials packaged 24 to the case in wooden crates that are partially disintegrated. While many of the vials are scattered at random and the wooden cases are likely not moveable, some of the materials may possibly be reused; this needs to be evaluated closer and reuse at another water treatment facility remains an option. If the material is no longer usable, it can be deactivated through a process of neutralization, and the containers rinsed, crushed and disposed of in a landfill. The material may be sent to a hazardous waste facility in a third country. A final option is to secure the material in storage at the present location.

Figure 3: HCl in storage

In order to exercise the reuse option, the vials will need to be cleaned and repackaged for shipment. According to suppliers, HCl properly stored has an infinite shelf life and will remain intact until it is reacted with other chemicals. It is not subjected to any form of decomposition or ageing. Given the condition of the wooden crates, shipment could be problematical, and the vials need to be handled with care, as the material is extremely corrosive. Screw tops and stoppers on some of the glass bottles could be in poor condition. A cost of around $2,000 is estimated for repackaging and shipment to another facility where some or all of the HCl might be put to use.

The material may be neutralized by dilution to 5% HCl or less and addition of sodium bicarbonate to a neutral pH, leaving a highly mineralized but neutral pH water, which can be safely disposed of.

$$HCl + NaHCO_3 > NaCl + H_2O + CO_2$$

One mole of HCl (36 gm/mole) reacts with one mole of sodium bicarbonate (84 gm/mole), so the approximate resulting amount of NaHCO3 is ~ 3.8 tons to neutralize the amount of 1.6 tons of HCl in inventory. The amount of neutralized solution will be approximately 12,000 liters. $NaHCO_3$ costs around $200/ton, hence the cost for chemicals is estimated at $800. Other costs are incurred for safety equipment, an apparatus to titrate the HCl into water and mixing of the $NaHCO_3$. Final handling and disposal of the resulting water is also a cost. Total cost is estimated at ~$2,000.

Securing the materials onsite requires repackaging similar to the reuse option. All considered, repackaging the material for use at another water treatment plant in Cambodia appears the preferred option.

Remaining Chemicals include sodium tripolyphosphate and sodium acetate. These are present in small quantities. Sodium acetate is used as a buffering chemical in water treatment. Sodium tripolyphosphate is used to prevent "red" (from iron) and "black" (from manganese) water; to prevent and/or retard scale formation (from minerals depositing) and corrosion (from low pH and/or dissimilar metals) in water distribution systems. These materials should be rehabilitated and used in the treatment process, or shipped to another location within Cambodia where they can be put to use.

Other materials reported by the Utility include sulfuric acid oxalic acid, and sodium hydroxide. The analysis above for hydrochloric acid is generally applicable: the preferred option is repackaging and use at another facility within Cambodia.

Other Issues

The condition of the chemical storage facility at Sihanoukville is what gives rise to concern about these chemicals. Chemical storage needs to be improved, with materials stacked on pallets, and inventories reduced to supplies that can be used within a few months. Materials not used in treatment or lab should be put to use elsewhere. Inventories of chemicals should be kept and usage monitored and recorded. MSDS should be kept on hand for all types of chemicals, and safety procedures in handling and use reviewed regularly with plant staff. Having on hand the necessary personal protective gear is also a prerequisite for storage and use of hazardous materials.

Conclusions

There are four or more types of chemicals at the plant site that are old, unused and unsafely secured. Two types are there in bulk quantities: about 5,000 kg of permanganate, and about 1,600 kg of hydrochloric acid in ½ kg glass bottles. Some of this latter amount is likely to be sulfuric acid and sodium hydroxide. The remaining materials are present in small quantities and pose an insignificant threat.

Various options have been evaluated for securing the chemicals. Reduction of the permanganate or shipment outside the country for treatment and disposal is difficult and cost-prohibitive (around $12,000). Reuse elsewhere within the country or returning the materials to the supplier in China, while likely cost-effective, need further consideration. The permanganate can be secured onsite in the present containers, an option that poses small risk and can be done at little or no cost.

The HCl may also be used elsewhere in the country (the preferred option) or neutralized using a simple process. The resulting mineralized water of neutral pH can be disposed of with no environmental effect. The cost of this option is expected to be around $2,000. Otherwise the material will need to be re-crated and sent to an in-country location to be used. Whether this is feasible is questionable due to the condition of the screw tops and stoppers on the glass bottles.

The conclusions related to hydrochloric acid are generally applicable to sulfuric acid, oxalic acid and sodium hydroxide.

In general the chemical stores at the Sihanoukville Water Treatment Plant are in poor condition and should be improved through arranging the physical contents, inventorying the chemicals, keeping records of use, age of materials and length of time in inventory, doing away with materials that are not planned to be used, and assuring that workers are equipped with personal protective gear and trained in the handling of hazardous materials.

Recommendations

Removal or reduction on-site of the permanganate is likely to be difficult and costly. Reuse in-country or reprocessing in China may not be feasible. It is recommended that the stores of permanganate be secured onsite by placement on pallets in a dry location, with any open containers sealed. The DPWS and Sihanoukville Utility should then look for an opportunity in the future to reuse or reprocess the material at another location.

HCl (inclusive of H_2SO_4 and NaOH) should be used at other facilities within Cambodia, with shipments manifested properly and monitored by MIH If this is not possible due to

the highly degraded condition of containers, the HCl (inclusive of H_2SO_4 and NaOH) could be neutralized onsite and the resulting water disposed of without harm to the environment. Glass containers could be triple rinsed, rinse water neutralized, glass bottles broken into shards, and glass landfilled. Wooden crates and packing material can be burnt at a remote location (the landfill for instance).

Handling of these materials poses some risk. Employees or contract workers should be equipped with personal protective gear, acid resistant suits, respirators, eye protection and other equipment depending on the application. The equipment used to handle and process the materials (for instance to neutralize the HCl) needs to be designed such that exposure to fumes, exothermic reaction or skin contact is prevented.

Chemical stores should be improved at Sihanoukville to conform to good practice, with inventory and recordkeeping, personal protective gear and training in safe handling, and regular inspection of stores to assure safekeeping.