Summary of Environment and Social Impacts for Activates Associated with Petroleum Refining and the Storage of Petroleum Products

Introduction:
The following table should be read in conjunction with the Sub-Sectoral Environmental and Social Guidelines for Petroleum Refineries and the Storage of Petroleum Products prepared by the EBRD. This table presents a summary of the potential environment, social and community impacts associated with refining and storage of petroleum and petroleum products within the Oil and Gas Industry. The table identifies potential mitigation measures to control and limit the risk of unmitigated environment and social impacts such that any residual impact can be effectively managed. Specific mitigation measures and implementation assessment methodologies should always should follow host country laws and regulations or in their absence international or best practice guidelines such as US National Environmental Protection Agency (NEPA) process for undertaking Environmental Impact Assessment.

Specialism / Discipline		**Potential Impact Risks (Unmitigated Impact)**			**Potential Mitigation Measures and Improvements**	**Mitigation Specification Best Practice Resource / Guidance**
Environment Specialism	**Sub-Specialism**	**Environment**	**Health & Safety**	**Labour Employment and Community Impacts**		
Air Emisions	Release of VOCs during operational activities (filling, withdrawal, additive blending, loading/unloading, tank cleaning and degassing Release of CO_2, CO, VOC, oxides of sulphur and nitrogen, ammonia. These may arise from: • Exhaust gases from the combustion of duels to generate power, heat and steam • Flue gas • Venting and flaring • Fugitive emissions	Potential risk of ground contamination and contamination of surface, and sub-surface water bodies during operational activities (soil and groundwater)	Potential risk of respiratory irritation, discomfort, or illness to workers	Potential risk of contamination of water bodies and community drinking water	Above Storage Tanks (ASTs) should have a secondary containment area that contains spills and allows leaks to be more easily detected. The containment area surrounding the tank should hold 110 percent of the contents of the largest tank plus freeboard for precipitation. Secondary containment for ASTs must be impermeable to the materials being stored. Methods include berms, dikes, liners, vaults, and double-walled tanks. A manually controlled sump pump should be used to collect rain water that may accumulate in the secondary containment area. Any discharge should be inspected for petroleum or chemicals prior to being dispensed. Deployment of vapour recovery systems to collect the VOCs emitted during transfer process operations. Equipment for transferring the product into and out of storage will consist of aboveground piping, hoses/loading arms, valves, pumps, instrumentation and alarms.	US Environment Protection Agency Industry Standard Emission Factors US DOE's Energy Information Administration (Ethanol vs MTBE) API standards 653, Tanks Inspection, Repair, Alteration, and Reconstruction. WHO Guidelines for Drinking-Water Quality

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					Oxygenative additives maybe added to improve the performance of fuel such as Ethyl tert-butyl ether (ETBE). ETBE's lack of toxicity is not different from other Oxygenate additives such as MTBE, but as a polar solvent, it drives off nonpolar hydrocarbons from the gasoline, a problem that MTBE does not cause. Potable and non-potable quality standards should comply with national acceptability standards or international standards such as WHO Drinking Water Guidelines. Water requirements for site workers and staff can be utilised through groundwater and surface water abstraction and should be property assessed using testing techniques/lab analysis and water drawdown modelling. Guidelines for water availability should follow World Health Organization (WHO) Standards of 100litres/day as the amount required to meet all consumption and hygiene needs.	
Air Emissions	Volatile Organic Compound (VOC) and Non-methane Volatile Organic Compounds NMVOCs) Emissions resulting from fuel For all tanks, the total emission of VOC is the result of two types of losses: Breathing / Standing Losses & Withdrawal Losses	Potential risk of ground contamination due to condensation from evaporative VOC losses in Aboveground Storage Tanks (AST) *The greater the variations in temperature of the fuel, the greater the potential loss and the larger the risk of contamination due to condensation.*	Potential risk of dermal contact and inhalation		• Installing an internal or external floating roof tank to minimize evaporation losses of the product being stored. • Efficiencies of primary seals may be improved through the use of weather shields. Additional controls may be added through a secondary seal. • Evaporative losses from the external floating roof design are limited to losses from the seal system and roof fittings (standing storage loss) and any exposed liquid on the tank walls (withdrawal loss). • Using a pressure-ventilated cap can reduce evaporation losses a further 50% Direct venting of the tank fumes is restricted until a	American Petroleum Institute Processes in Petroleum Industry, Emission Inventory Handbook, European Environment Agency, December 2006 *"Emissions from the storage and handling of intermediaries and products typically contribute between 1% - 6% of a Country's total NMVOC emissions from anthropogenic sources."* American Petroleum Institute (API) Standards 650, 653 and 620 are the primary industry

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					slight pressure has built up in the tank. • Having a painted and pressure vented tank has a 75% evaporation loss reduction compared to a dark tank. • Placing a painted and pressure vented tank in the shade will further reduce the evaporation losses by over 40%. The roof also helps reduce weathering of hoses and valves. • Accumulated water in tanks should be regularly drained off and separated from the oil which is recoverable, while the water is sent for treatment.	standards by which most aboveground welded storage tanks are designed, constructed and maintained. These standards address both newly constructed and existing aboveground storage tanks used in the petroleum, petrochemical and chemical industries.
Wastewater	Process waster water arising from: 1. Tank Bottom draining 2. Tanker vehicle washing 3. Vapour Recovery processes 4. Contaminated storm water runoff 5. Leaks and spills Process waste oily “sour” water arising from distillation, fluid catalytic cracking and catalytic reforming processes	Potential damage of tanks due to increased corrosion from wastewater in tanks. Potential risk of contamination to water bodies from wastewater runoff	Potential risk of dermal contact and inhalation from spill sand leaks		• Oily water should be passed through appropriately selected and designed oil interceptor. Interceptors are only designed to remove some oils and fuels from water. They do not remove other pollutants, such as heavy fuel oils, chemicals or dust. • An API oil-water separator should also be used to separate gross amounts of oil and suspended solids from the wastewater effluents/storm water runoff. • Other treatment methods such as Reprocessing, and Emulsion Breaking for treating Oil and Water waste Types; stabilisation, bio-remediation and sediment washing for Oil and Sediments waste types should also be considered • Using steam and sour water strippers to remove hydrocarbons and ammonia • Biological treatment or aerobic biological treatment (activated sludge or aerated basins) to reduce wastewater organic carbon (BOD and COD) load. Biological treatment can also remove phenolic compounds	Standards published by the American Petroleum Institute (API). Guidelines for Oil Spill Waste Management and Minimisation, IPIECA Discharge permits are normally required for discharges to a municipal treatment plants or directly to surface water bodies. Discharge limits vary according to local country permit regimes. The US EPA defines a normal discharge limit of 10 mg/L for Oil and Grease by concentration. A site management plan addressing drainage, water runoff and discharge requirements would be developed. The plan would also establish the procedure for seeking discharge consents from local / federal authorities.

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Hazardous Materials, Fire & Explosion		Risk of fire and explosions due to the flammable and combustible nature of petroleum products. Risk of leaks and accidental releases from equipment, tanks, pipes etc during loading and unloading (handling)	Potential risk of loss of life or injury due to fire		• Storage equipment should meet standards for structural design and integrity. *American Petroleum Institute (API) Standards are the primary industry standards by which most aboveground welded storage tanks are designed, constructed and maintained. These standards address both newly constructed and existing aboveground storage tanks used in the petroleum, petrochemical and chemical industries. The standards prescribe leak detection, leak prevention, and leak containment with emphasis on leak or spill detection and containment*	Specific changes and additions with regards to leak or spill prevention, detection or containment have been made to API standards most often used for the construction and maintenance of aboveground petroleum storage tanks, namely: API Standards 650 – Welded Steel Tanks for Oil Storage; API 653 – Tank Inspection, Repair, Alteration and Reconstruction; API 652 – Lining of Aboveground Storage Tanks Bottoms; API 2610 – Design, Construction, Maintenance and Inspection of Terminal and Tank Facilities.
Hazardous Waste	Hazardous waste produced include: 1.Tank bottom sludge composed of water residual product, sand, scale rust, inorganic slats and additives 2.Sludge from oil/water separations systems 3.Spill cleanup material 4.Contaminated equipment and protective clothing	Risk of site contamination from hazardous waste and Risk of contamination to water bodies.			• Dewatering technologies can be used to significantly reduce the volume of sludge, and recycle oil and water for the refinery. After a solidification process it can be transported to and disposed of at an appropriately designated landfill or properly incinerated. In some cases where after dewatering, a high concentration of TPH and/or heavy metals remains in the sludge. Hazardous sludge can be further treated to make it non-hazardous and recycle the maximum amount of oil by using thermal "vaporization- condensation" treatment. • A Spill Response Plan should be prepared, and the capability to implement the plan should be in place. The Spill Response Plan should address potential oil, chemical, and fuel spills from facilities, transport vehicles, loading and	US Department of Labor – Occupation, Safety and Health Administration, IFC, Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development

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					unloading operations, pipeline ruptures, and proximity of water bodies and other festive receptors. • Conduct a spill risk assessment for the facilities and design, drilling, process, and utility systems to reduce the risk of major uncontained spills. • Conduct a Hazard Risk Assessment using Internationally-accepted methodologies such as Hazardous Operations Analysis (HAZOP), Failure Mode and Effects Analysis (FMEA), and Hazard Identification (HAZID). The management actions should be included in a Hazardous Material Management Plan. • Install shutdown valves to allow early shutdown or isolation in the event of a spill; Develop automatic shutdown actions through an emergency shutdown system for significant spill scenarios so that the facility may be rapidly brought into a safe condition. • Ensure adequate personnel training in oil spill prevention, containment, and response.	
Energy Security		Potential risk of fuel farms or oil refinery storage areas being targeted for criminal or terrorists attack. Potential Loss and injury to human life			• Site threat and vulnerability analysis should be undertaken and security countermeasures should be developed as part of site-risk-threat assessment.	US Energy Information Administration American Petroleum Institute, Security Guidelines for the Petroleum Industry, Washington DC: April, (2003). American Petroleum Institute and National Petrochemical Refiners Association, Security Vulnerability Assessment Methodology for the Petroleum and Petrochemical Industries, Washington DC, May (2003). Recommended Practice 752--Management of Hazards

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						Associated with Location of Process Plant Buildings (Methodology for assessing and evaluating the hazards associated with location of process plant buildings that should be considered in process hazard analyses) API Recommended Practice 74, Occupational Safety for Onshore Oil and gas Production Operations (Describes general occupational safety and emergency response plans)
Visual Amenity		Potential impact on views for sensitive receptors (residents, community)			• Installation of natural barriers such a vegetation. For sites with numerous storage tanks such as on fuel farms. Landscape management and site restoration plans should be in place with recommended mitigation measures such as replacement planting, and vegetation barriers. Recommendations should also form part site specific Environment Management Plan	Environmental Management in Oil and Gas Exploration and Production. UNEP