
Investigation on the negative impacts and risks associated with fleet operation & maintenance activities in the city of Abu Dhabi

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This study discusses the impacts and risks associated with fleet operation and maintenance activities and remedial actions in the city of Abu Dhabi as the corporate social responsibility of a professional engineer. Emissions with air pollutants, risk of fuel, lubricant and toxic material spillages, hazardous waste produced, and depletion of natural resources by operating numerous internal combustion engine driven machineries and risks and impacts associated with human life by utilizing, operating or maintaining above fleet were the main concerns identified.

Ongoing practices, waste management, mitigating and preventive activities with regards to risks, impacts and aspects associated with health, safety and environment were reviewed. Available company literature on Safety, Health, Environment and Quality (SHEQ) policy, code of conduct, sustainability policy, risks and impacts assessment, and corrective action plans were assessed. Internal and external audit reports were appraised for recommendations and set of proposals were made, while observing local statutory obligations with the guidance of ISO 14001:2004 and OHSAS 18001:2007 management systems, for the senior management's consideration as an environmental and ethical responsibility of a professional/ chartered engineer.

Keywords: fleet-maintenance, risks, pollutants, hazardous waste, environment

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1. INTRODUCTION

Al Naboodah National Plant & Equipment (NP) is a classified plant hire and maintenance company owning little over 3,000 units of equipment, within the Al Naboodah Construction Group (ANCG), based in Dubai, United Arab Emirates (UAE). The group undertakes all type of civil constructions in Middle East, North Africa and South Asia, thus NP is to provide machinery back up for aforesaid ANCG activities utilizing its own fleet, which consists of all types of construction plant, machinery, equipment and vehicles, light and heavy, which are powered by diesel or petrol driven internal combustion engines (ICEs).

Aligned with above scope, NP has established several branches in key regions to support its operation and maintenance activities and NP Abu Dhabi is one of them, a branch situated 160 kilometers southwest of Dubai, the capital city of UAE.

Emissions added to the atmosphere with a number of pollutants in addition to the carbon footprint

appended by operating more than 3,000 units powered by ICEs and waste produced (both hazardous and nonhazardous) within their workshops and sites' activities while maintaining above fleet to meet clients' targets are the foremost environmental concerns. NP needs to address these concerns considering the risks and impacts associated with their operations to the wider society. Consequently, the aim of this project is to investigate on the impact and the risks encompassed with the fleet operation and maintenance practices and to implement best possible procedures to eliminate those in ethical manner with following objectives:

- Observe the environmental impacts associated with fleet maintenance and operation practices and the best possible solutions to remove or reduce those;
- Investigate the risks involved with operational and workshop practices and set up a mechanism for risk mitigation planning, implementation and a progress monitoring system;

- Identify ethical responsibilities associated with the above work environment and workout a system to avoid negative social effects from the organization.

Remainder of the paper is structured as follows: Section 2 – contains a literature review associated with legislative requirements; Section 3 – defines the methodology utilized in this study; Section 4 – comprises the results and observations; Section 5 – explores the ongoing Health Safety and Environmental practices; Section 6 – for the waste management; Section 7 – explains the identified environmental and ethical responsibilities within the activities and section 8 – discusses the risks, hazards and impacts associated with fleet maintenance and operation activities with suggestions to mitigate or improve outcomes for the betterment for the society, followed by section 9 – for the references used in this evaluation.

2. LEGISLATIVE REQUIREMENTS

Guidelines from subsequent Integrated Management Systems (IMS) and from regional legislative establishments were followed in this investigation, such as:

- Integrated Management Systems (IMS); EMS 14001:2004 & OHSAS 18001:2007
- Environment Agency - Abu Dhabi (EAD)
- Centre of Waste Management – Abu Dhabi (CWM)
- Department of Municipal Affairs – Abu Dhabi (DMA)
- Dubai Municipality – Government of Dubai (DM)

The fourth chapter of the above IMS manuals: EMS (Environmental Management System) 14001: 2004 and OHSAS (Occupational Health and Safety Management System) 18001:2007, elaborates the requirements with guidance for use with following subsections: General requirement, Environmental or OHS policy, Planning, Implementation and preparation, Checking, and Management review

Detailed correspondence between both management systems, ISO 14001:2004 and OHSAS 18001:2007 is given in the Table 2.

In general, the organization should establish, document, implement, maintain and continuously improve an environmental and occupational health & safety management system in accordance with the above international standards while adhering to regional legislative obligations.

Moreover, following federal and local directives were referred as Guidelines to have best possible occupational health & safety and environmental protection practice within above endeavors:

- Federal law no. (24) of 1999 for the protection and development of the environment (Environment Agency – Abu Dhabi (EAD), 2016)
- Federal law no. (21) of 2005 for the waste management in the emirates of Abu Dhabi (EAD, 2016)
- Technical guidance document for storage of hazardous materials, EAD – EQ – PCE – TG – 16 (EAD, 2014)
- Cabinet decree no. (12) of 2006 regarding the regulation concerning the protection of air from pollution (EAD, 2016)

Complying with the above, the organization's Safety, Health, Environmental and Quality (SHEQ) policy, Code of Conduct and sustainability policy were established and latest revisions could be browsed through at the company website: www.alnaboodah.com.

3. METHODOLOGY

In this investigation, below mentioned methodology had been followed to achieve the objectives mentioned above.

1. Identified and documented all ongoing fleet operation and maintenance activities, the risks involved with those events and both hazardous and nonhazardous waste produced in workshop practice, thus possible impact to the environment.
2. Reviewed legislative requirements by local authorities for above maintenance and operation activities and for hazardous waste produced in workshop practice. In addition, guidelines of, ISO 14001:2004; environmental management system for safe handling of above waste produced, and guidelines of OHSAS 18001:2007; occupational health and safety management system were appraised and followed for a better solution.
3. Scrutinized ongoing health, safety and environmental protection practices to safeguard all employees involved with workshop practice, fleet operation and the environment as far as reasonably practicable, from potential hazards in the performance of their duties and a waste management and reduction plan to handle the disposables to minimize, mitigate and eliminate environmental impacts created by producing hazardous waste in workshop practice.
4. Acknowledged all possible ethical responsibilities associated with above operations and prepared a feasible action plan to implement including employee welfare.

CLAUSE	EMS 14001: 2004	CLAUSE	OHSAS 18001: 2007
4	Environmental management system requirements	4	Occupational Health and Safety management system requirements
4.1	General requirements	4.1	General requirements
4.2	Environmental policy	4.2	OH & S Policy
4.3	Planning	4.3	Planning
4.3.1	Environmental aspects	4.3.1	Hazard identification, risk assessment and determining controls
4.3.2	Legal and other requirements	4.3.2	Legal and other requirements
4.3.3	Objectives, targets and programmes	4.3.3	Objectives, targets and programmes
4.4	Implementation and presentation	4.4	Implementation and presentation
4.4.1	Resources, roles, responsibility and authority	4.4.1	Resources, roles, responsibility, accountability and authority
4.4.2	Competence, training and awareness	4.4.2	Competence, training and awareness
4.4.3	Communication	4.4.3	Communication
4.4.4	Documentation	4.4.4	Documentation
4.4.5	Control of documents	4.4.5	Control of documents
4.4.6	Operational control	4.4.6	Operational control
4.4.7	Emergency preparedness and response	4.4.7	Emergency preparedness and response
4.5	Checking	4.5	Checking
4.5.1	Monitoring and measurement	4.5.1	Performance measurement and monitoring
4.5.2	Evaluation of compliance	4.5.2	Evaluation of compliance
4.5.3	Nonconformity, corrective and preventive actions	4.5.3	Incident investigation, nonconformity, corrective and preventive actions
4.5.4	Control of records	4.5.4	Control of records
4.5.5	Internal audits	4.5.5	Internal audits
4.6	Management review	4.6	Management review

TABLE 1. EMS 14001: 2004 – Environmental management system & OHSAS 18001: 2007 – Occupational health and safety management system - requirements with guidance for use

5. Formulated a set of recommendations with regards to environmental and ethical responsibilities involved with above mentioned activities and presented to the senior management to consider as a part of the NP's corporate social responsibility.

4. RESULTS AND OBSERVATIONS

The observations of this appraisal is segregated into 4 subsections, i.e. 4.1) Operation and maintenance activities associated with NP Abu Dhabi; 4.2) waste produced, both hazardous and nonhazardous during above activities; 4.3) risks and hazards identified within above actions and 4.4) significant environmental aspects identified with the ongoing practices and elaborated below for enhanced interpretation.

4.1. *Operation and maintenance activities of NP Abu Dhabi*

I Maintenance activities related to plant equipment and vehicles.

- i Periodical preventive maintenance activities
- ii Day to day running repairs

iii Major overhauls

iv Site maintenance activities, daily checkups, routine maintenance

v Lifting and working at height operations involved with above activities

II Paint booth and associated activities

III Wash bay and associated activities

IV Fabrication and associated activities

V Bulk diesel fuel storage and handling activities

VI Diesel fuel dispensing to machinery, equipment and vehicles at site

VII Material handling and transportation

VIII Other transport activities and plant and machinery operations at sites

IX Managing waste created by above activities.

X Office and stores, communication, documentation and material handling activities



FIGURE 1. Hazardous waste collection at NP workshop, Abu Dhabi

4.2. *Hazardous and non-hazardous waste produced during above activities*

- I Waste crankcase oil, lubricants and fluids
- II Used batteries/ battery acid
- III Used tires
- IV Contaminated rags
- V Used/ contaminated filters
- VI Waste sludge, contaminated soil
- VII Waste/ contaminated water
- VIII Paint material waste, tins/ cans
- IX Food waste
- X General waste/ road sweeping
- XI Paper and office waste
- XII Metal scrap
- XIII Used plastics
- XIV Paper cartons

Figure 1 illustrates the storage of hazardous waste collection; used crank case oil, contaminated rags and filters, paint wastes, and likes within a bund wall at NP workshop, Abu Dhabi.

4.3. *Risks/ hazards identified with above activities*

Risks and hazards associated with above activities were identified and documented in Table 2.

5. **SIGNIFICANT ENVIRONMENTAL ASPECTS IDENTIFIED WITH ONGOING PRACTICES**

- Combustion of fuels during transportation and offloading materials and maintenance of equipment
- Chemical spillage releases to land and water (abnormal operation)
- Consumption of fresh water (excessive use)
- Contaminated washout/ waste water during washing and maintenance of plantequipment in undesig-nated areas. (abnormal operation)
- Depletion of natural resources during operation of plant, equipment and vehicles, fabrication processes and all other related activities
- Diesel spillage while filling or dispensing from bulk tanks, dispensing at sites or leakage or spillage from bulk storage or mobile tanks
- Dust accumulation during moving and passing of mobile equipment or operation of plant & equipment
- Emission of fumes or gases during painting activities, fire, maintenance of equipment, transport and offloading, fabrication processes, use of defective equipment, using of vehicles and equipment
- Excessive noise emissions
- Excessive use of paper
- Fire at diesel/ oil storage areas, work environment
- Generation of contaminated washout/ waste water

ACTIVITY	RISK/ HAZARD
Workshop activities	Machine guards/ screen covering rotating parts not on equipment Contacts with moving and mechanical parts Machinery left unattended and running Inadequate ventilation No safety signs Obstructed emergency shut - off switches Chemical substances in unmarked containers Trailing wires, cables No barriers on inspection pits Top heavy shelving Missing, damaged or misused machinery guards Fire and explosion Contact with hot machinery parts Excessive noise Manual handling Chemical hazards Slips, trips and falling hazards Unsafe person and practices Electric shocks Use of improvised tools and improper use of tools Gas cylinders not chained on trolley or wall Flickering lights Missing or inadequate covers on inspection pits Tire changing
Welding and cutting	Gas cylinders not fitted with flash-back arrestors Free standing high pressure gas cylinders Not fitted with protection cap Buildup of combustible material Personnel without correct personal protective equipment (PPE)
Painting works	Inhalation of fumes Poor visibility Contamination of environment Skin contacts with hazardous substances Fire hazard
Vehicle, plant & equipment high pressure washing	Electric shock hazard due to malfunctioning of electric power plant, short circuited wires, etc. Falling from heights Manually handling, spraying, cleaning degreaser Heat stress Poor visibility Congested washing area High pressure washing hazard, skin contacts Wash bay blind corners Slippery floor Hit injuries due to improper body posture
Driving related	Speeding, impact with other vehicles, stationary objects Poor visibility Unauthorized driving

TABLE 2. Risks and hazards identified within fleet maintenance and operations activities of NP Abu Dhabi

- Hazardous chemicals/ waste, generation, storage and disposal
- Inefficient use of electrical equipment
- Leaks; from delivery trucks, treatment plant facility (abnormal)
- Solid waste, mixed (paper, plastic, bottles, food waste, aluminum cans, etc.)
- Release of substances from accidental puncturing and damage of buried services, releases to land and water (abnormal operation)
- Sludge waste generation
- Storage and handling of diesel fuel and oils/ lubricants, hazardous chemicals
- Ultra violet light emissions
- Workers exposure to chemicals at diesel filling area, at maintenance of equipment, during painting activities

6. ONGOING HSE PRACTICES IN THE NP BASE WORKSHOP, MAFRAQ, ABU DHABI

The base workshop of NP Abu Dhabi was inaugurated in March 2011. During early stages, in 3rd quarter of 2012, following facilities were designed and established as requested by the NP general manager, while obtaining and adhering to all necessary regional legislative requirements:

- Service inspection pits and vehicle lifts to service and maintain vehicles and plant & machinery in all categories.
- Bulk oil (lubricant) storage tanks with dispensing mechanism including air compressors, dispensing pumps, guns, associated plumbing, electrical works, etc.
- Bulk diesel fuel storage facility for around 172,000 liters (38,000 IGL) capacity.
- Vehicle and machinery wash bay.
- Paint booth for painting and preparation activities for all vehicles and equipment.
- Other necessary installations, security cabin, waste management arrangements, traffic control, operators/ drivers rest area, car park and similar other facilities.

From above tasks, item numbers 1, 2 and 6 were freely established since there were no additional legal compliances required by authorities to install within a premises approved by the Abu Dhabi municipality

for the said purposes. Albeit rest; item no.3, 4 and 5 required serious consideration, followed by the approval from Abu Dhabi Civil Defense, prior installation and subsequent commissioning of the facilities.

6.1. Bulk Diesel fuel storage for 38,000 Imperial Gallons (IGL) capacity

This facility consists of 3 tanks: two of them with 14,000 IGL and one with 10,000 IGL capacities. The requirements of Abu Dhabi Civil Defense for bulk diesel storage are as follows:

- Bund wall around the tanks to contain more than 110% of the storage capacity of the containers within the confined area, in case of emergency.
- No electrical cables or connections inside the encircled area except earth rods or cables.
- No building, erection or structure with fire hazard within 6 meters distance.
- All tanks/ containers should be painted white with red colour strap in middle, clearly indicating the storage capacity with all recommended safety and permit stickers.
- All pipes carrying diesel fuel should be painted yellow and connections or joints with black to identify leaks and with arrow mark to indicate the fluid flow direction.
- Adequate drip trays, spill kits and fire extinguishers to prevent possible diesel leaks and sudden fire and manual siren for emergency.

Figures 2 and Figure 3 below indicate arrangements of bulk diesel storage at NP workshop, Abu Dhabi.

6.2. Vehicle and machinery wash bay

The legislative requirement for a wash bay is to dispose waste water in accordance with the requirements of the Centre of Waste Management, Abu Dhabi.

The wash bay was designed with 24 x 8 meter washing area with washed water to drain naturally into a tank with a capacity of 15,000 IGL, which consists of 3 stage sedimentation process: 1st tank with sloped bed thus all remains will deposit in the bottom and when the tank is full with washed water above 2/3rd of capacity, water will spill into 2nd tank. Second tank is connected to the third through goose neck, 1/3rd above the bottom level of 2nd and 2/3rd above in between 2nd and 3rd tanks to spill when 2nd tank is filled up to the 2/3rd of its capacity. This allows the oil films, emulsions, sludge etc., to float on 2nd tank surface and could be removed by an oil skimmer or manually. When the 3rd tank is full, the content will go through a 3 stage filtering process before it pumps into reusable storage tank with the capacity of 5,000 IGL. The filtering process consists of stages as follows

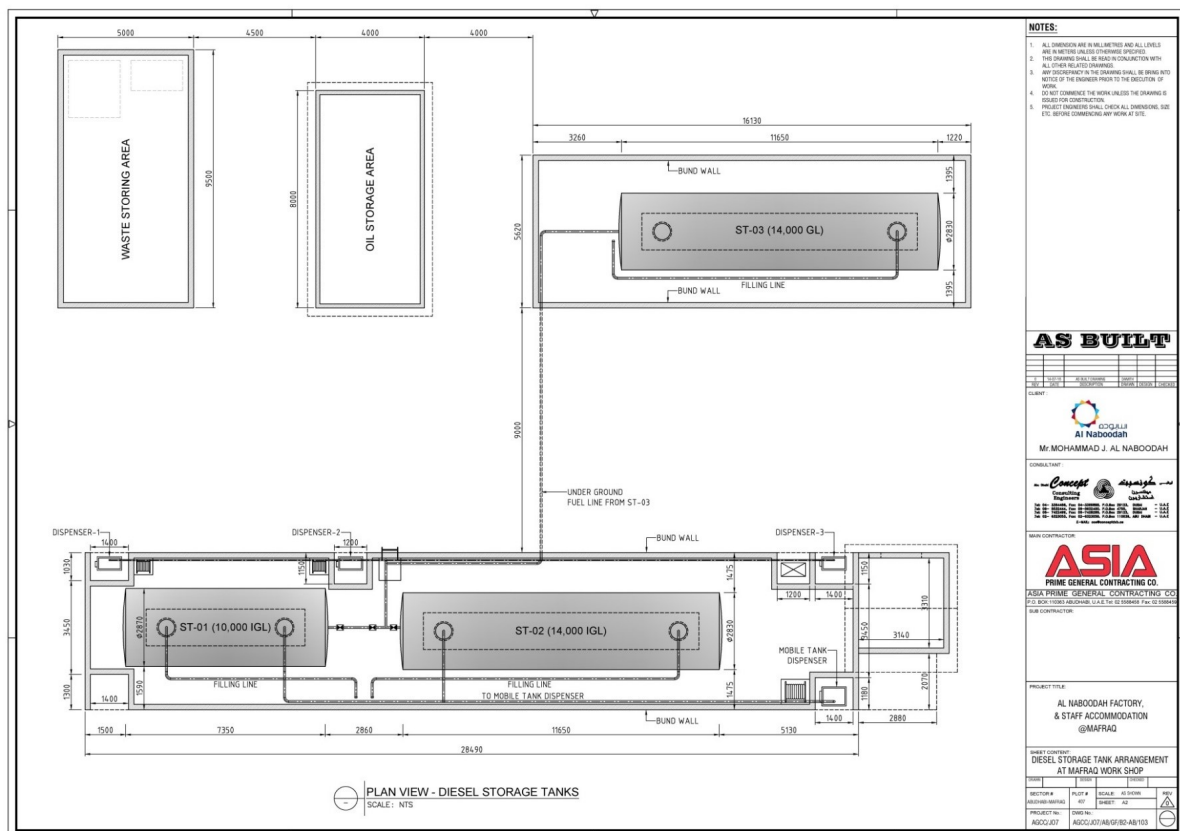


FIGURE 2. Diesel bulk storage tank arrangement at NP workshop, Mafrag, Abu Dhabi



FIGURE 3. Bulk diesel fuel storage at NP workshop, Abu Dhabi

1. Filtering through gravel sand filter
2. Through gravel coal filter
3. Through paper filter

Figures 4 and 5 illustrate the detailed wash-bay arrangements.

6.3. *Monitoring and disposal of waste water*

- A filtered water sample is analyzed monthly by a competent third party, authorized by the Center of Waste Management (CWM) in Abu Dhabi.
- Authorized hazardous waste transporter is called and disposed through the city hazardous liquid disposal facility when the test report indicates that the allowed limits were exceeded.

From the past analysis it was observed that the filtering system effects to reuse the used water for a period of six months before it exceeds allowed limits and it is observed that the total dissolved solids (TDS) is the parameter, which exceeds the allowed limit always. Hence disposing in every six months is the procedure followed at present, after producing current lab report and obtaining permission to dispose. Figure 6, below unveils the general operational view of the wash bay at NP Abu Dhabi.

6.4. *Paint booth for vehicle and machinery painting and preparation activities*

This facility was constructed by partitioning last bay of the main workshop using corrugated fire rated sandwich panels creating a room with the dimensions of 24mx6mx7m as length, breadth, and height respectively. This was done considering the size of the heavy earthmoving machinery, which need to be accommodated for above activities. Main features of the paint booth are the fumes extraction filter installed at the end of the room with the filtering area of 19.24 M², and suction filters created on front door with 3.25 M² area (Figure 7). The extraction filters are backed with two suction fans, powered by 22 HP electric motors. In addition, essential lighting, heating and air supply arrangements were done as necessary. Finally, before commencing, the inspection and certification was done by a competent third part organization authorized by the regional and federal authorities, adhering to USEPA EMC Method 2. The results indicated that they were exceeding the required minimum levels.

7. WASTE MANAGEMENT AND REDUCTION PLAN

Waste management and reduction plan was made with overall objective of minimizing the waste produced with reference to the section 4.2, by using the sequence of avoid, reduce, reuse, recycle and dispose as per the

directives of the CWM and DMA of Abu Dhabi with the guidance of aforesaid IMS procedures.

The general manager, plant manager, SHEQ manager and regional manager are the personnel acknowledged with key responsibilities to implement the program.

The risks involved with waste generation, handling, segregation, recycling, storage, transportation and disposal were identified and documented with counter measures in the "Environmental aspects and impacts evaluation form" prepared by the SHEQ department.

Current waste generation sectors were identified as; i) by manpower (office/ workshop), ii) workshop practice, iii) site maintenance activities; and quantified for minimizing efforts.

Authorized waste transporters were identified as illustrated in the Table 7.

At present the stated services are being used to handle the waste generated to meet the objectives mentioned and also to meet the targets set in the "Waste Management Duty of Care Checklist" as illustrated in the Figure 8.

Minimizing printing, printing both sides of papers, using LED lighting as much as possible instead of CFL, florescent or element type lightings, switching off unnecessary appliances, switching off engines rather than idling, avoiding surplus orders, order in bulk, paper works through network were some measures implemented and are in continuous action to minimize the waste. Progress will be monitored and submitted to senior management annually with measures to control further as much applicable and practical as possible.

8. ENVIRONMENTAL AND ETHICAL RESPONSIBILITIES

With this study following environmental and ethical responsibilities were acknowledged throughout aforesaid fleet maintenance and operation activities:

- Mitigate and control the emissions created while operating numerous ICE driven equipment by annual inspections of emission levels through annual registration renewal procedure.
- Manage the waste generated by above activities as per the 3R waste hierarchy by reducing, reusing and recycling as practical as possible to minimize the effects on the sustainability of the environment.
- Planting necessary green plants around the boundary of workshop and other probable areas as applicable to compensate as much as possible the contribution of carbon footprint to the environment due to operating of many ICE driven machinery & equipment and vehicles by the company.
- Providing safe working environment for the workforce by maintaining good housekeeping, clearing unwanted material around, providing

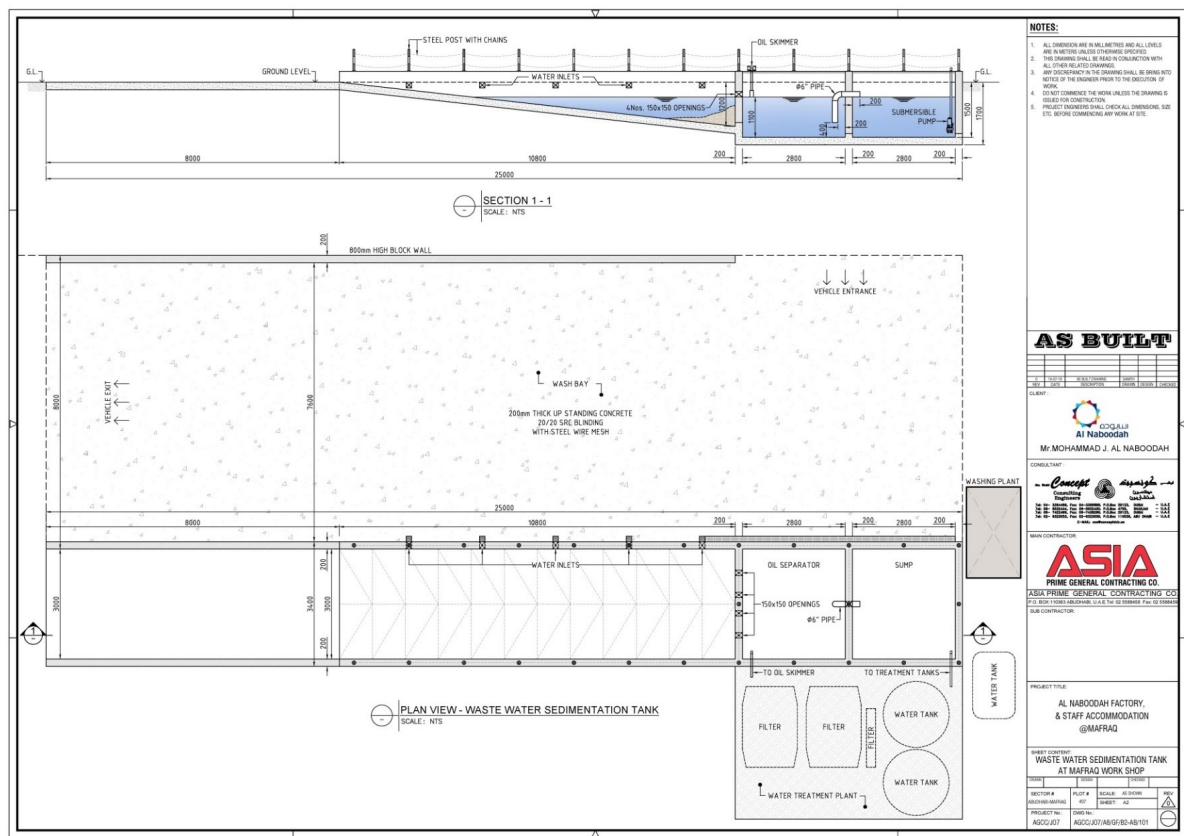


FIGURE 4. Wash bay, layout plan with details of waste water sedimentation tanks at NP workshop Abu Dhabi

Service provider	Service type	Permit Number
Veolia Environmental Services	Recyclables, papers, cardboard, plastic	PMT - 13 - 15982
Veolia Environmental Services	General & nonhazardous waste	PMT - 13 - 15982
Oasis Environmental Solutions	Hazardous waste	PMT - 15 - 16118
Aafaq Bela Hudood Used Lubricants	Waste/ Used oil	PMT - 13 - 16196
Green Mountains Environment & Transport Services	Waste water	PMT - 16 - 15677
Mazoon Used Spare Parts	Metal scrap	PMT - 13 - 16164
Mazoon Used Spare Parts	Used batteries	PMT - 13 - 16164

TABLE 3. Waste contractors/ transporters

proper tools and risk-free space with appropriate PPE for the workforce to perform in a secured manner.

- Providing safe to work plant, equipment, machinery and vehicles at all times by inspecting, testing or load testing and certifying all above periodically, including lifting equipment annually and all lifting gears semi-annually. This is in addition to daily, routine and periodical inspections and preventive maintenance activities by maintenance staffs.
- Improving employee skills by educating and providing required training where necessary to meet aforesaid management standards established

by the organization.

- Providing a glass of milk daily for the personnel involved with painting activities.
- Adhere to midday summer break law and prohibit working during the banned hours and avoid working under direct sunlight as much as possible.
- Provide adequate drinking water, energy drinks and temporary shelters in case of necessary emergency site activities especially during summer season.
- Promoting safety by conducting safety suggestion competition and awarding winners with cash prize,

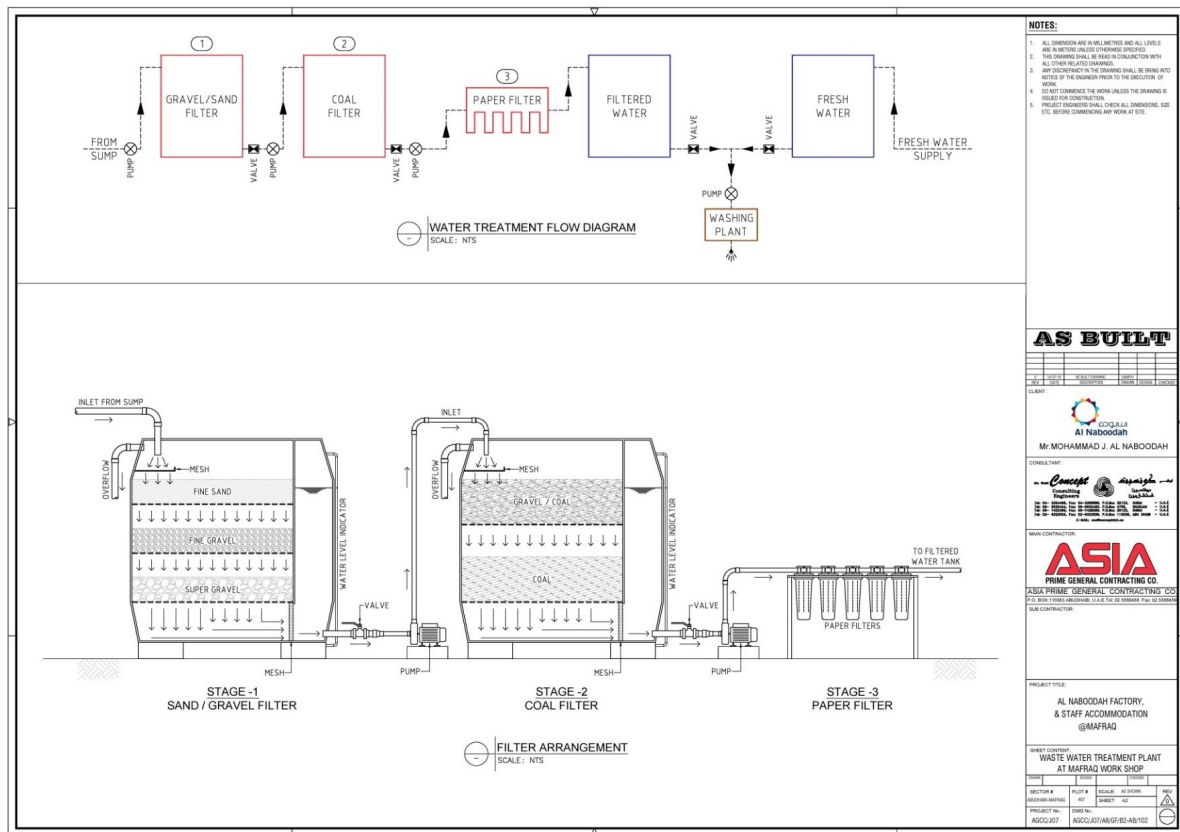


FIGURE 5. Waste water treatment process at NP workshop, Abu Dhabi



FIGURE 6. Wash bay at NP workshop, Mafraq, Abu Dhabi

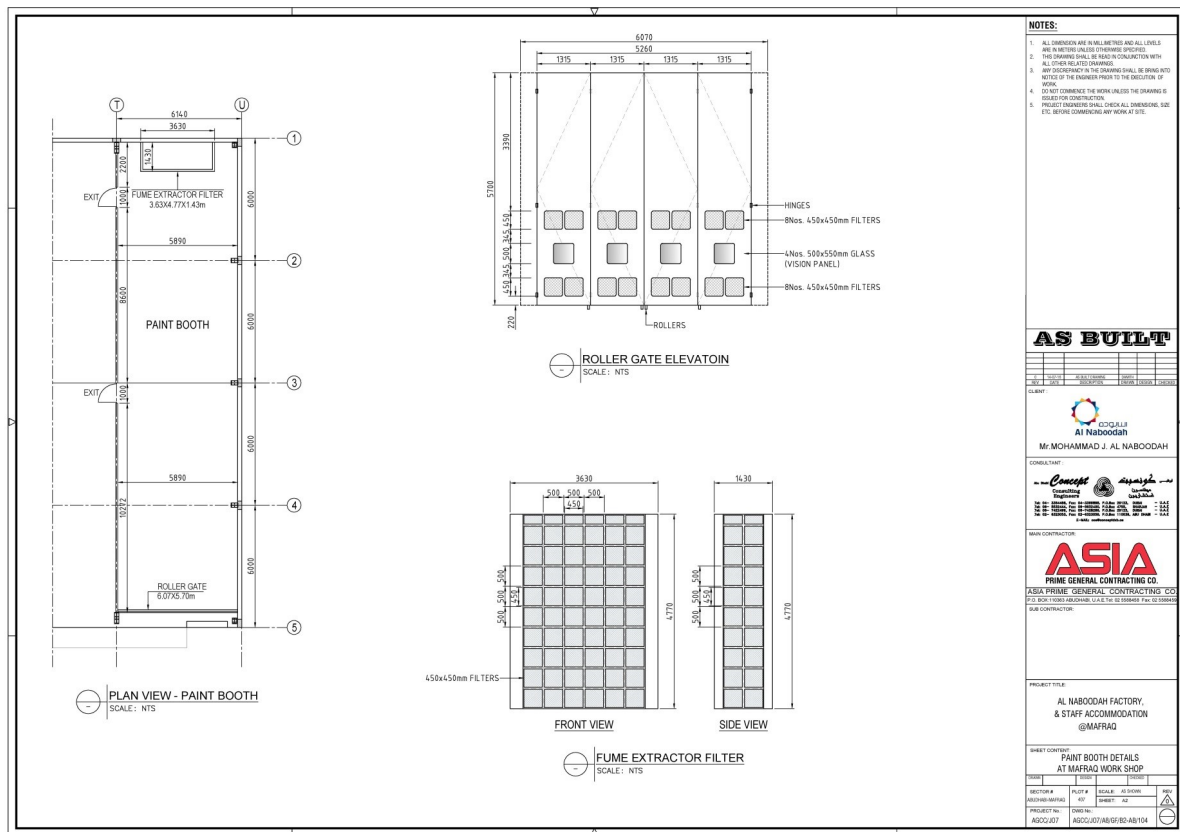


FIGURE 7. Paint booth filter arrangements at NP workshop, Mafrag. Abu Dhabi

bump cap and a certificate.

9. DISCUSSION AND CONCLUSION

This research has investigated the risks, hazards and impacts associated within fleet maintenance and operation activities towards the environment and human life. Emissions with many pollutants, risks of diesel fuel, lubricants or chemical spillages and contamination with soil or water, hazardous and nonhazardous waste produced with workshop practices, depletion of natural resources by operating numerous equipment and vehicles powered by an ICE and risks associated with various maintenance endeavors were the main issues identified.

Aligned with the above, control measures or corrective actions with risk and significance ratings (SR) were documented as:

- Environmental aspects and impacts evaluation form
- Significant environmental aspects, action list
- Waste management, duty of care check list (Table 4), etc.

This investigation is within the spirit of “National Plant workshops and associated plant yards HSE plan” and implementations are in action for prevention or mitigation as practical as possible to protect the environment for the future generation.

The HSE plan is a live document, prepared according to the group SHEQ policy with the guidance of OHSAS 18001: 2007, ISO 14001:2004 and ISO 9001:2008, while adhering to regional and federal legislative requirements.

With ongoing practices in wash bay, purifying waste water through gravel, sand, coal and paper filtering process is used instead of bioreactor method, This has reduced the use of chemicals during maintenance of bioreactors, power consumption and initial installation cost to save natural resources in addition to reuse of same water for the washing.

Bulk diesel storage tanks with bund wall above the specified capacity, static plants with inbuilt drip trays, service trucks and mobile fuel tankers with spill kits and dip trays are some ongoing measures to prevent environmental contaminations.

Hand and finger injuries, mostly because of the use of power hand tools, metal partials’ prick in hands and legs while hammering due to use of improper (mushroom headed) tools and hammers were the most regular



 Al Naboodah		Al Naboodah Construction Group LLC						Document Reference ABCG-HSE-FRM-018	
		Al Naboodah Building and Civil Engineering Group						Rev. No. Rev. Date 01 12/13	
		Waste Management Duty of Care Checklist						Page 1 of 1	
Contract/CC: MAFRAQ WORKSHOP				Completed By: Print Name: Melwyn Loy Rodrigues Signature: 				Location Management Agreement: Print Name: Hettiarachchi Signature: 	
Item	Waste Type	Expected Quantities Tonnage Time Span	Disposal Option	Waste Carrier	Carriers Registration Checked Expiry Date	Waste Disposal Site	Notes		
1	Office Waste	20 kg 1 month	Disposal	VEOLIA	YES 16.08.2016	Abu Dhabi			
2	Food Waste	25 kg 1 month	Disposal	VEOLIA	YES 16.08.2016	Abu Dhabi			
3	Waste Oil	5 ton 1 month	Recycling	AFAQ BELA HUDOOD	YES 07.01.2016	Abu Dhabi			
4	Used Batteries	500 kg 1 month	Recycling	MAZOON	YES 08.12.2015	N/A			
5	Old Tires	3 ton 1 month	Recycling	AL FARWANIA	YES 08.09.2016	N/A			
6	Waste Sludge/ Contaminated Soil	1 ton 3 months	Disposal	AL ZELAL	YES 16.12.2015	Abu Dhabi			
7	Paper Cartons	1 ton 3 months	Recycling	VEOLIA	YES 16.08.2016	Abu Dhabi			
8	Plastics	5 kg 1 month	Recycling	VEOLIA	YES 16.08.2016	Abu Dhabi			
9	Tin Cans / Paint cans	150 kg 1 month	Recycling	VEOLIA	YES 16.08.2016	Abu Dhabi			
10	Contaminated Rags	300 kg 1 month	disposal	AL ZELAL	YES 16.12.2015	Abu Dhabi			
11	Metal Scarp	1000kg 3 months	Recycling	EXPEDIA SCRAP	YES 13.06.2016	Abu Dhabi			
12	Waste Water	5000 gals 3 months	Recycling	GREEN MOUNTAINS	YES 15.02.2016	Abu Dhabi			

FIGURE 8. Waste management duty of care checklist

injuries witnessed, thus dealer training for safe handling of power hand tools, tool box talks for appropriate tool use were conducted.

Carrying out testing, inspection and certification periodically on all plant machinery & equipment, vehicles and special tools by competent and ratified third parties will ensure that the fleet is safe to operate with minimum emission levels as sanctioned.

Personnel were given outside training for basic and advance first aid, firefighting or banksman/ lifting applications besides the ongoing in-house education by day to day work based instructions and toolbox talks.

With this study the practitioner has demonstrated an engineer's ability to protect human life and the nature within his professional deeds with the guidance of IMS, while observing regional and federal decrees, with reference to the required chartered engineer's competency category E3 as stated in UK Standard for Professional Engineering Competence (UK – SPEC, 2014).

Moreover, ethical principles cited in the Statement of Ethical principles (SEP) (raeng.org.uk, 2011) were met with reference to UK – SPEC, E5 competence and continuing within this work based engineering built environment, such as:

- Accuracy and rigor – by investigating and troubleshooting machinery defects accurately, minimizing down time and spare parts/ repair costs.
- Honesty and integrity – Public, the employer or the professional body of the individual should comment on his ethical behavior to recommend on this virtue.
- Respect for life and the public good – by providing safe to work machinery or vehicles to work and providing safe work environment to the workforce.
- Responsible leadership: listening and informing - by directing this multinational workforce to the achievements demonstrated in this analysis.

Some organizations may use not only ISO certification but also Corporate Social Responsibility (CSR) and sustainability events for green washing as noted by Robinson (Robinson, M., 2007) as a propaganda media to keep their banners high and as well as to be on top of the competitive market. However, the organizations who maintain those international standards are under obligation to continue, thus, the organization and the responsible personnel will be under scrutiny until the organization holds the certification by conducting

weekly safety tours, tool box talks, quarterly internal and annually external audits in additions to various inspections and tests to come by in-between. The audit findings or recommendations; nonconformities, observations or opportunities for improvements will create ample openings for advancements for really competitive organizations to be in the market. Therefore, practicing ISO standards will certainly enhance an engineer's efforts towards fulfilling his/ her responsibilities for the sustainability of the environment in an ethical manner.

ABOUT AUTHOR

Sunil Jayantha Hettiarachchi is a Sri Lankan mechanical engineer working as a maintenance manager attached to Al Naboodah National Plant & Equipment in Dubai, United Arab Emirates (UAE); a classified plant hire and maintenance company having more than 3,000 equipment to cater construction projects undertaken by the Al Naboodah Construction Group. After the college studies since 1964 to 1977, he joined the University of Moratuwa, Sri Lanka from June 1977 to Jan 1981 for higher studies, Jan 2007 to Oct 2007 with City and Guilds, UK for PGD, May 2015 to Jan 2018 with University of Derby for MSc and presently with London South bank University for doctoral research. Sunil's first employment was in February 1981 as an engineering assistant with the River Valleys Development Board of Sri Lanka, left the board on September 1987 to join with Al Mawarid Services in Riyadh, Kingdom of Saudi Arabia (KSA) and left KSA as an assistant workshop manager in March 1999 to take up present occupation on May 1999 where he is continuing to date. In 2002, he attained first professional affiliation through the Institution of Incorporated Engineers, Sri Lanka (IIESL) with abbreviations MIIESL, IEng, followed by fellowship FIIESL in 2012 and MIET in Mar 2018. Sunil is engaged with many CSR and CPD developments through activities associated with IIESL – UAE branch as an elected committee member, secretary and at present as the serving branch chairman since 2012.

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