JOSOP 530 – Potable Water Procedure

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Contents

1.0 Purpose and Scope

Purpose

Access to safe and adequate potable water is essential to human health. The purpose of this Joint Operations (JO) SHEERS Procedure is to ensure safety of potable water in JO. It covers the requirements for a systematic approach to assess potential risks throughout potable water supply system in JO to consumers of potable water, ensure control measures are in place and effective to manage incidents that present health risk, and prevent recurrence of such incidents.

The SOP complies with Kuwait Environmental Public Authority (KEPA) and Kuwait Government's requirements with regards to Potable water, Chevron Occupational Hygiene – Potable Water Standard, and World Health Organization Guidelines for Drinking Water Quality.The most stringent of these standards/ regulations shall be applied.

Scope:

This Standard applies to potable water system/s on JO sites where potable water is delivered to end users via potable water systems. It covers water meant for human consumption, food service operations (water used for food processing, cooking and making ice), safety eye wash fountains and emergency showers, and for hygienic purposes (e.g., hand and face washing, bathing, and sanitizing).

Only branded bottled water approved by Kuwait Government for sale in Kuwait shall be used in JO and its purchase by JO is covered under by JOSOP 520 - Food Safety standard. Since manufacture and sale of bottled water in Kuwait is regulated by the Kuwait Government and risk of water borne hazards to consumers from drinking of bottled water is practically nil, routine testing of bottled water is not covered under this SOP. However any specific complaints/incidents will be investigated under this SOP.

2.0 Definitions

Disinfection of Water: Destruction of harmful microorganisms in water. Chemical agents like chlorine/ ozone, or ultraviolet rays are used to disinfect water.

Microbiological testing of Potable Water: It is a method used by laboratory to grow bacteria present in a water sample on a nutrient medium, and estimate the number of bacteria and type of bacteria present. Coliform bacteria are present in large intestines of human beings and animals, and if detected in water sample, suggest the contamination of water with sewage. Water sample positive for coliform are further tested for the presence of E. coli, which is a type of coliform that is present only in large intestines of human beings and animals, and if detected, confirms the water has been contaminated with sewage.

Potable Water: Water intended to be consumed by humans (drinking water). In the context of this SOP, it refers to water that is required to meet potable water quality standard. Water used for drinking, food service operation, eye wash and showers, and for hygienic purposes is considered potable water.

Residual chlorine: It is chlorine that remains in water, minimum 30 minutes after addition of chlorine dose to water. Residual chlorine provides a safe guard against any microbial contamination that may occur in future after disinfection.

Total Dissolved Solids (TDS): It is measure of the combined content of all inorganic and organic substances present in a liquid (water).TDS in fresh water indicate salinity. Bottled water typically contains lower TDS levels than tap water.

3.0 Requirements

The following potable water management plan must be followed at Joint Operations sites where potable water is delivered to end users via potable water systems. The potable water management plan shall include the following elements:

3.1 Potable Water Quality Standard

Potable water system shall be operated and maintained to ensure that constituents in water that have potential to cause adverse effect on health or affect acceptability of water by consumers do not exceed the Permissible Maximum Value mentioned in Appendix 16 of K-EPA and World Health Organization's Guideline values mentioned in "Guidelines for Drinking Water Quality", 4th edition, both presented in Appendix-A. The more stringent of the two values shall apply.

3.2 Characterization of potable water supply

Characterization of the existing source of potable water supply, water treatment, and water supply system in JO is presented in Appendix- B. The characterization shall be updated when the potable water source, water treatment or supply system is changed or modified.

3.3 Hazard Assessment of the potable water system

Potential risks to consumers throughout potable water supply system in JO Wafra should be assessed initially and thereafter every 3 years or early if a change in any part of water supply system has occurred. Hazard assessment should cover sources of water, water treatment, and water distribution system including storage, and plumbing. Water sampling and laboratory analysis should also be reviewed. The purpose is to identify possible points where hazards/ contamination enter into the water supply, sources and types of hazards/contamination, and identify control measures to control the risk. Results of Risk assessment carried out in May 2014 are presented in Appendix-C.

3.4 Potable Water Control Plan: The plan shall consist of:

3.4.1 Water quality monitoring Program: The water sampling program shall cover the entire water supply system. The following sampling plan will be followed in JO. It is based on the strategy that parameters that indicate hazards that are likely to be significant or frequent, like microorganisms, residual chlorine, and turbidity will be analyzed more often, and at least the minimum number of samples recommended by a health authority will be collected. Water samples must be collected by trained persons using methods recommended by "World Health Organization". Selected parameters in water samples must be analyzed in an accredited laboratory, or laboratory approved by Kuwait Government and the laboratory shall use analytic methods given in "Standard Methods for the examination of Water and Waste Water", or equivalent.

Initial and Annual Water sampling and Laboratory testing of water samples: Water samples should be collected from the entire water supply system in JO initially and thereafter every year, and analyzed for parameters/ constituents pertaining to all 7 categories mentioned in Appendix - A. However constituents/ parameters selected for analysis should be based on recent hazard assessment and should be relevant to potable water supply in JO. Water samples shall be collected from all water tankers and fresh water storage tanks/overhead

reservoirs. Constituents/ Parameters to be analyzed initially and yearly, location of sampling points, and numbers of samples are mentioned in Appendix – D. In addition, JO shall obtain results of laboratory analysis of water supplied to Distribution Station in Wafra, by the Ministry of Electricity and Water (MEW), which serves as source of water supply to JO.

Monthly Water Sampling and Laboratory Testing of Water samples: Water samples should be collected regularly from the entire water supply every month as per plan to cover water tankers, water reservoirs, building tanks, and water taps in buildings and locations in the field. Samples shall be collected every month from every potable water tanker and water reservoirs in Admin campus, Main Gathering Centre, and Industrial camp, and from a water tap in buildings. Every month, 25% of building should be covered by rotation (total 16 buildings; Admin campus: 5, Main Gathering Centre: 3, Industrial camp: 2, Buildings supplied by contractor under contract with Heavy Equipment: 6). Constituents/ Parameters to be analyzed every month, location of sampling points, and numbers of samples are mentioned in Appendix – E.

Water samples should be sent to laboratory for analysis of color, turbidity, odor, pH, total dissolved solids, residual chlorine and microbiological testing for total plate count, and coliform count. The laboratory should also carry out confirmatory test for the presence of E.coli on a water sample in which coliforms are detected.

Water samples for microbiological testing should be collected from a water tap/ tank in a glass bottle sterilized by autoclaving process. The sample should be collected aseptically using guidelines on the subject by World Health Organization.

Weekly checks and Field Testing: All potable water tankers (7 in numbers), fresh water storage tanks/reservoirs (8 in numbers), and a water tap in two buildings at each of 4 supply locations in JO, should be visually inspected for color, and turbidity, residual chlorine, pH, and total dissolved solids should be measured using portable kits (Appendix - F).

Daily checks: Each time a water tanker is filled, on-site visual inspection of water for color and turbidity should be done. Measure turbidity of water filled in tanker using a portable kit, if water appears turbid. Water should be clear, and free of color and odor. Residual chlorine of water in water tanker should be measured at least once a day (Appendix – G).

Daily visual inspection of water filled in fresh water (potable water) storage tanks in Admin campus, Main Gathering Centre and Industrial camp should be carried out for color and turbidity. Turbidity should be measured using a portable kit if water appears turbid on visual check. Water should be clear, and free of color and odor. Residual chlorine of water in tanks should be measured at least once a day (Appendix – G).

3.4.2 Contingency Plan to deal with contamination and upsets in water supply system

The supervisor or person in-charge for supply of water should be notified when water analysis result shows that sample contains E.coli, or one or more chemical constituents (parameters) exceed the maximum or Guideline value, and when potable water system upsets occur. The following measures should be followed:

Water analysis report shows E.coli was detected in the water sample:

Notify consumers of water in the building/ distribution system considered to be at risk. Inform at risk consumers not to use that water for drinking, brushing teeth, food preparation, eye wash and safety shower, until further notification. Make adequate arrangements for supply of drinking water to affected consumers.

Investigation should be undertaken to identify the cause. Additional water samples for bacteriological testing can be collected. Based on the results of investigation, response plan should be prepared and implemented to eliminate the cause and restore safety of water. The tank should be emptied, cleaned, flushed and disinfected with calcium hypochlorite, and disinfectant water should be drained out of the tank. Restart the water supply into the building plumbing system. Measure residual chlorine in water and collect and send water samples from the same water tap and adjoining taps for bacteriological testing. Allow personnel to use the water only after results are reported to be satisfactory.

Constituents in water that exceed the maximum value

The supervisor or person in-charge for supply of water should review the result and make judgment whether the constituent's presence above the maximum value constitutes hazard to health of consumers, and make appropriate decisions. Often such incidents can be foreseen, and management plan can specify resulting action. Action may include, for example, using sedimentation, filtration or increasing concentration of chlorine in the distribution system.

Water system upsets/ emergencies

The supervisor or person in-charge for supply of water in JO should develop plans to be invoked in the event of water system upset or emergency, for example, interruption in water supply from distribution station, non-availability of potable water tankers, interruption in electricity supply, or breakage of water distribution pipeline. Emergency plans should clearly specify measures to be taken, responsibilities for coordinating measures, a communication plan to alert and inform users of the drinking-water supply and plans for providing supplies of drinking water. Key areas to be addressed in emergency response plan should include: (a) response actions, including increased monitoring;(b) responsibilities of authorities internal and external to the organization; (c) plans for emergency drinking-water supplies; (d) communication including notification. Response plans for emergencies and unforeseen events involving microorganisms or chemicals should also include the basis for issuing use bottled water or boil water advisories and water avoidance advisories. The advisory should be issued after rapid, but careful, consideration of available information and conclusion that there is an ongoing risk to public health that outweighs any risk from the advice to use bottled water/ boil or avoid water.

3.4.3 Regular monitoring of operation and maintenance of water supply system

Regular monitoring of operation and maintenance of water supply system should be carried out to ensure risks are under control. It should include:

(1) Water tankers: (a) Each time a tanker is filled, visually inspect water for color and turbidity. Measure turbidity using a portable kit if water appears turbid. Measure residual chlorine of water filled in water tanker at least once a day.(b) Measure turbidity, pH, total dissolved solids and residual chlorine in water of water tankers every week (c) Ensure operation and maintenance requirements mentioned in Appendix – C under item 2.1- action required, are followed and records are maintained. (d) Filling of water tanks should be supervised.

(2) Storage of potable water: Maintain records of water received through pipe line and tankers, and level of water in fresh water tanks. Ensure adequate quantity of water is received and anticipate and have a plan to overcome shortage in water supply. Every week visually inspect color, and measure turbidity, pH, total dissolved solids and residual chlorine in water of fresh water storage tanks.

(3) Distribution system: Maintain positive pressure in the piped distribution system, and ensure continuous water supply in the distribution system.

(4) Inspect water storage tanks on roofs of building every three months. Check physical condition of tank, presence of tight cover, ball valves, non-return valves, and inside surface of tank.

If slime, algal growth, or deposits on the floor of the tank are detected, the tank should be emptied, cleaned, flushed, and disinfected with calcium hypochlorite and disinfectant water should be drained out of the tank. The tank should then be re-connected to potable water and water supply to building restarted. Notify employees and consumers of water in the building before cleaning the tank and after restarting the water supply. Make adequate arrangements for potable water supply when during the period of disconnection.

(5) Inspect, repair and maintain building plumbing to prevent backflow, stop leakages and replace affected pipes and plumbing fixtures.

(6) Inspect and maintain water filters, ultraviolet lamp, and reverse osmosis units installed at the point of use, as recommended by manufacturer.

(7) Every week visually inspect color, and measure turbidity, pH, total dissolved solids and residual chlorine in tap water from two buildings, at each of 4 supply locations in JO. Maintain residual chlorine in tap water in 0.2 to 0.5 PPM range.

3.5 Training and Competency requirements

General Service Division and Mechanical Maintenance Division should develop tasks for personnel who operate and maintain potable water supply, collect water samples, and or use equipment and ensure that the staff are competent to perform the tasks. Requirements given in this SOP should be reviewed with and understood by JO and Contractor persons who are authorized to operate and maintain potable water supply system and collect and transport water samples.

Water samples must be analyzed in an accredited laboratory, or laboratory approved by Kuwait Government and the laboratory shall use analytic methods given in "Standard Methods for the examination of Water and Waste Water", or equivalent.

4.0 Contractor Potable Water Program

Requirements of this SOP are also applicable to contractors required to provide water to their employees in camps and areas assigned to them. Contractors who carry potable water in portable containers to field for their employees must follow the requirements mentioned under item # 5 in Appendix-B.

5.0 Roles and Responsibilities

5.1 JO EHS Division

JO-Environment, Health and Safety (EHS) Superintendent is designated as Process Sponsor, owner and competent person to administer, coordinate, and maintain elements of this SOP to ensure safety of water supplied in JO.

JO-Industrial Hygienist shall assist the competent person in coordinating implementation of the requirements given inthis SOP. He will provide subject matter expertise such as collection of water samples and interpretation of results.

5.2 General Services and Mechanical Maintenance Divisions:

They are responsible for: (a) planning water supply system, (b) ensure adequate and safe water supply, (c) operation and maintenance of water supply System, (d) Inspection and sampling of water supply as per plan. (e) Contingency plan to investigate and deal with water hazard/ and water system upsets.

5.3 Building custodians: Ensure plumbing in the building, water storage tanks and drinking water coolers area properly maintained. Report problems related to water supply to Superintendent

General Services/ MMD, as appropriate using Hazard report/ Work order as appropriate, and follow up and ensure that water supplied to consumers in the building/ area is safe.

5.4 Employees: Employees shall observe their work areas and report any water leaks and any issue related to water supply and quality of water to Building custodian. Use disposable cup or a cup that is used for drinking water and has been sanitized after last use, or sealed bottle containing potable water. Obtain drinking water from a drinking water point, or a sealed potable water bottle with original label on it. Do not share cups or water bottles.

6.0 References

- Guidelines for Drinking-water Quality. World Health Organization, 4th edition, 2011.
- K-EPA Appendices related to Potable Water. Regulations Implemented under Law No. 21. Environmental Public Authority Kuwait, 2001.
- Chevron Occupational Hygiene – Potable Water Standard, 2013.

7.0 Management Systems

7.1 Support resources

JO EHS is available to assist with implementation of this JOSOP. Support resources include Chevron GUG COP for Occupational Hygiene, and Ministry of Electricity and Water Supply, Kuwait.

7.2 Document control and record keeping

General Service and Mechanical Maintenances Divisions shall maintain auditable records to document its compliance with applicable clauses of this document. Records should include (a) Annual Water Sampling Plan. (b) Daily checks on water and findings. (c) Weekly checks and field testing of water samples and results. (d) Monthly and yearly sampling of water samples and results of laboratory analysis. (e) Periodic inspection and cleaning of Water tankers and water storage tanks. (g) Records of quantities of water received and water pressure in distribution system. (h) Records of investigation of incidents of water contamination and upsets in water supply and action taken.

7.3 Audit Requirements:

Water Supply system in JO must be audited as part of JO first party HSE audit to ensure compliance with operations and SHEERS Self-Assessment. Audit findings must be documented and a system established to ensure that findings are appropriately addressed. The plan shall be reviewed during Annual SHEERS Self-Assessment.

7.4 Standard renewal process

- This procedure shall be reviewed and approved by JO SHEERS Leadership Team.
- The latest approved version of this procedure shall be maintained on JO Intranet.
- This document will be reviewed and revised every 3 years from the date of issue, or earlier if work conditions or regulatory requirements change.
- JOSOP validity can be extended for another term if work conditions or regulatory requirements have not changed within the validity period. The JOSOP shall be endorsed on the cover page.

7.5 Deviation process

Deviation from this document requirement must be authorized by the SHEERS Leadership Team. Deviations must be documented, and the documentation must include the relevant facts supporting the deviation decision. Deviation authorization must be renewed every 3 years.

7.6 Document Control Information

Description	J0-Common	JO-Owner
Approval Date	16 December 2014	EH&S
Next Revision Due	16 December 2017	
Control Number	1.0	

Table 1: Document History

Version Number	Date	Notes
1.0	16 December 2014	Initial Release

Appendix – A

Kuwait EPA Maximum Values and World Health Organization (WHO) Drinking Water Guideline Values

I. Physical Parameters that may affect Acceptability of Potable water

Physical Quality	Kuwait EPA Maximum Value	WHO Guideline Values	Unit
Color	15	-	True color unit
Turbidity	5	-	Nephelometric Turbidity Units
Taste	Acceptable	Acceptable	-
Odor	Acceptable	Acceptable	-

II. Inorganic Chemical Constituents that may affect Acceptability of Potable water

Constituent	Kuwait EPA Maximum Value	WHO Guideline Values	Unit
pH	6.5 to 8.5	6.5 to 8.0	-
Total Dissolved Solids (TDS)	1000	1000	mg/L
Total Alkalinity as CaCO3	100	-	mg/L
Total Hardness	500		mg/L
Chloride	250		mg/L
Sulfate	250		mg/L
Sodium	200		mg/L
Potassium	10		mg/L
Calcium	200		mg/L
Iron	0.3		mg/L
Magnesium	150		mg/L
Aluminum	0.2		mg/L
Zinc	3.0	4.0	mg/L
Anionic Detergents	0.2		mg/L
Ammonia	1.5		mg/L
Hydrogen Sulfide	0.050		mg/L

III. Inorganic Chemicals of Health Significance in drinking water

Constituent	Kuwait EPA Maximum Value	WHO Guideline Values	Unit
Antimony	0.005	0.02	mg/L
Arsenic	0.010	0.01	mg/L
Barium	0.700	0.7	mg/L
Boron	0.300	0.5	mg/L
Cadmium	0.003	0.003	mg/L
Chromium	0.05	0.05	mg/L
Copper	2	2	mg/L
Cobalt	-	-	mg/L
Cyanide	0.07	0.07	mg/L
Fluoride	1.5	1.5	mg/L
Lead	0.01	0.01	mg/L
Manganese	0.5	0.4	mg/L
Mercury	0.001	0.006	mg/L
Molybdenium	0.070	0.070	mg/L
Nickel	0.020	0.070	mg/L
Nitrate	50	50	mg/L
Nitrite	3	3	mg/L
Selenium	0.010	0.01	mg/L
Strontium	-	-	mg/L
Silver	-	-	mg/L
Vanadium	-	-	mg/L

IV. Organic Chemicals of Health Significance

Constituent	Kuwait EPA Maximum Value	WHO Guideline Values	Unit
1,2-Dichloroethane	30	30	ug/ L
1,2-Dichloroethene	50	50	ug/ L
Vinyl Chloride	5	3	ug/ L

Pesticides:			
Aldrin / Dieldrin	0.030	0.030	ug/ L
Lindane	2	2	ug/ L
Methoxychlor	20	20	ug/ L
2.4 – D	30		ug/ L
Chlorodane	0.2	0.2	ug/ L
Heptachlor & Heptachlor Epoxide	0.030		ug/ L
Hexachlorobenzene	1		ug/ L
D.D.T	2	1	ug/ L
Aromatic Hydrocarbons:			
Benzene	10	10	ug/ L
Toluene	700	700	ug/ L
Xylene	500	500	ug/ L
Styrene	20	20	ug/ L
Ethylbenzene	300	300	ug/ L
Benzo (a) Pyrene	0.700	0.700	ug/ L
Chlorinated Benzene:			ug/ L
Monochlorobenzene	300		ug/ L
1,2 Dichlorobenzene	1000	1000	ug/ L
1,4 Dichlorobenzene	300	300	ug/ L
Trichlorobenzenes (TotaL)	20		ug/ L
Halogenated Hydrocarbon compounds:			
Chloroform	200	300	ug/ L
Bromoform	100	100	ug/ L
Dibromochloromethane	100	100	ug/ L
Bormodichlormethane	60	60	ug/ L
Phenolic Compounds:			
Pentachlorophenol	9	9	ug/ L
2, 4, 6 – Trichlorophenol	200	200	ug/ L

V. **Disinfection of Water**

Constituent	Kuwait EPA Value	WHO Guideline Values	Unit
Free Residual Chlorine*	0.2 to 0.5	0.5 or more	PPM
Treatment by Ozone or Ultraviolet rays**			

* Concentration of Free Residual chlorine in potable water after 30 minutes of contact time. The concentration of chlorine can be increased in case of water borne epidemic or at the instructions of Ministry of Health.

** Treatment with ozone or ultraviolet rays should be enough to kill microbes, and that microbial quality of treated water must reach the quality of drinking water.

VI. **Biological and Microbiological Quality of Potable Water (Both Kuwait EPA and WHO Guideline Values):**

Potable Drinking Water must be completely free of algae, fungi, parasites, insects/ animals, including their eggs, larvae, cysts, or parts.

Microbiological Quality: Drinking water must be free of E. coli or Thermo tolerant coliform in any 100 ml sample. Although E.coli is the more precise indicator of fecal pollution, the count of thermo tolerant coliform bacteria is an acceptable alternative.

Microbiological Quality in the distribution network:
95% of water samples tested throughout the year should be free of total coliform bacteria. Samples positive for coliform should be further tested for E. coli or Thermo tolerant coliform. E. coli or Thermo tolerant coliform must not be detectable in any 100 ml sample.

VII. Radiation qualities:

Radionuclides	Kuwait EPA Maximum Value	WHO Guideline Values
Alpha Particles	0.37 Bq/l	0.5 Bq/l
Beta Particles	3.7 Bq/l	1.0 Bq/l
Radium 226 and 228	0.186 Bq/l	Concentration of individual radionuclides shall be performed if gross alpha and gross beta activity is exceeded, and compared with WHO individual Guideline values.

Appendix – B
Characterization of the Potable Water Supply System in Joint Operations Wafra

Details of the current source of potable water supply, water treatment and water supply system in JO from source to the final point of use is as follows:

1.0 Source of Potable Water Supply:

Joint Operations receives potable water supply from the Ministry of Electricity and Water (MEW)'s Distribution Station in Wafra. The MEW desalinates sea water, blends it with the ground water, chlorinates it to ensure potable water that is produced meets WHO Drinking Water standard, and it is then pumped into water distribution system to reach different locations that include Distribution Station in Wafra.

2.0 Water Supply System in JO:

The potable water from Distribution station is received at 4 locations in JO Wafra. It is fed into Potable piped water supply system maintained by JO to provide continuous piped water to different buildings/ locations, as follows:

2.1 Administration campus: Potable water is received into fresh water storage tanks TK-222 (capacity 150000 gallons) and TK-223 (capacity 250000 gallons) from Distribution Station of MEW through piped water line and tankers. Potable water from these tanks is pumped into an overhead reservoir tank TK-221 (capacity 50000 gallons). Water from this overhead reservoir tank then flows into storage tanks located on roofs of the following 14 buildings: Main office building, Mess Hall building, Building numbers 3, 4, 13, 17, and 21, KOC clinic, Instrument workshop, Electrical Service, Light transport building, Heavy transport building, Mosque outside Admin Campus, and Car park outside Admin Campus. Two buildings namely, Training center building and Building # 10 do not have storage tank and they directly receive water from overhead reservoir tank TK-221.

2.2 Main Gathering Center: Potable water is received from Distribution Station of MEW through tankers into a fresh water storage tank T-1000A. Potable water is then pumped into an overhead reservoir tank located close to tank T-1000A. Water from this overhead reservoir tank then flows into storage tanks located on roof of the following 5 buildings: Building # 39 (Laboratory), Mosque, PCR pump, Ratawi unit, and Old operations building. In addition, roof tanks of the following 6 buildings are supplied water by tankers: PCR # 8, PCR # 9, PCR # 10, Building # 35, and Building # 44 (fire station), and Building 33 (Bulk chemical store).

2.3 Industrial Camp: Potable water is received from Distribution station of MEW through tankers into Fresh water storage tanks # 1 and 2, and it is then pumped into an overhead reservoir tank. Water from the overhead reservoir tank then flows into water storage tanks located on roofs at the following 8 locations: Warehouse building (Building # 29), Welding and Machine shop, Mechanical Maintenance pump shop (roof tanks at 2 locations), Pump shop Work over division, Security gate, Wafra control center (Building # 34), Sub-Centre Operators building (Building # 55).

2.4 Supply under Heavy Equipment, Mechanical Maintenance Division: Potable water is received form Distribution station of MEW using three tankers of capacity 5000 gallons each, and supplied to fresh water storage tanks located on roofs at the following 26 locations: Power Generation Plant (PGP), Access Control office, SF First and Second Gate, Humma Third Gate, SF Kuwait Gate, Sub-Centre # 20, Pressure Maintenance Plant (PMP), New Production Offices (POD), HOT offices, Sub-Centre office, Cater pillar shop, Welding shop, Pump unit Yard, Inspection Pipe Yard, Welding Yard, Painting Yard, SUG, SUG Power house, SUG Fire station, SUG Security gate, SUG Access control gate, SUG Welding Yard, Sub-center 1,3, and 5, New Laboratory.

3.0 Potable Water Storage and Distribution within buildings/ onsite.

As described above under item 2.0, potable water is received into roof tanks of some buildings from overhead reservoir tank by distribution cast iron pipes, whereas roof tanks of some other buildings are periodically, usually daily, filled with potable water using potable water supply tankers. Water from roof tanks then flows to plumbing fixtures via building plumbing to various plumbing fixtures, such as: (a) wash basins, water closets and bath showers in toilet blocks, (b) drinking water taps with water filters and water coolers in pantries and other suitable locations, (c) water taps in sinks in pantries, kitchen and mess hall, and (d) eye wash and shower in units with chemicals.

Roof tanks are made up of either fiberglass or polyethylene of capacities varying from 200 gallons to 10000 gallons; capacity of most tanks is either 500 or 1000 gallons. Ball valve is provided in tanks to prevent overflow of water from tanks and also overflow pipe is provided in case ball valve does not function. To prevent back flow of water, water distribution pipes and plumbing fixtures like water closets have been provided with non-return valves.

4.0 Treatment of Potable Water: Potable water received in Joint Operations from the Ministry of Electricity and Water (MEW) is already desalinated, blended and chlorinated and contains residual chlorine to take care of any contamination if it occurs in MEW distribution system or in distribution system maintained by client (JO). MEW has system in place to ensure the MEW water supply meets WHO drinking Water Standard. Hence JO does not carry out treatment of water received from MEW.

5.0 Drinking Water to consumers:

JO has made the following arrangements for drinking water: (1) Four gallon bubble top branded drinking water bottles from approved vendors mounted on plumbed-in water coolers. (2) Drinking water taps with filter, chiller, reverse osmosis unit with ultraviolet lamp that produces ultraviolet rays to kill bacteria and viruses. (3) In addition, potable water in sealed branded water bottles is available for sale in JO pantries and mess hall, and made available free in official meetings.

Employees including contractors should drink water using disposable cup or a cup which is sanitized after each use, or drink directly from sealed branded water bottle. Use of common cup for drinking water is prohibited in JO. Employees/ contractors must not drink bottled water from a water bottle which is without an original label from manufacturer, or a bottle which is not in

sealed condition. Further, bubble top and other plastic water bottles or containers should not be re-filled or used to store drinking water.

Contractors required to carry drinking water to field for their employees should either provide water in four gallon bubble topbranded drinking water bottles from approved vendors mounted on a dispenser tap to draw water, or carry potable water in thermo cool, stainless steel, or polyethylene food grade plastic containers. The containers should be cleaned, washed and sanitized each time prior to filling potable water for storing, then filled with potable water without touch or contamination, and finally lid should be closed tightly. The container should carry label "Drinking water". The water should be dispensed using commercially available water dispenser or containers with a tap.

Appendix – C

Hazard Assessment of the Potable Water Supply System in Joint Operations Wafra: Carried out in May 2014

Purpose: To assess type and severity of hazards that can enter the water supply system in JO and recommend control measures to control the risk.

The key factors that affect potable water quality are its source, treatment, storage and distribution, and point of use.

1.0 Source of Potable Water Supply:

Desalinated sea water, blended with ground water and chlorinated: It is received at Distribution station in Wafra from a Desalination Plant. It is supplied by the Ministry of Electricity and Water (MEW).

Risk Assessment:

Water received at Distribution station has received adequate treatment. MEW has system in place to check quality of water at every stage of treatment and prior to pumping into the distribution system. Water analysis reports available with MEW show that the water supply is safe, potable, and meets WHO Drinking Water Guidelines.

Possible sources of contamination: Sewage from nearby sewers during underground flow. The contamination is unlikely as water is maintained under positive pressure, and water has residual chlorine.

Risk category: Insignificant.

Action required: Periodically obtain and review results of laboratory analysis of water supplied to Distribution Station from the MEW.

2.0 Water Supply in JO:

Potable water is received from Distribution station into fresh water receiving tanks in Admin campus, though piped water line and tankers, and by tankers to Main Gathering Centre (MGC), Industrial Camp, and Area supplied under contract with Heavy Equipment.

Risk Assessment:

2.1 At point of filling water tankers and discharge water into receiving tank and into roof tanks:

Possible source of contamination: Contamination of water in tankers and receiving tanks due to use of unclean tankers, nozzles, couplings and hoses, and contamination from labor/ driver who handle hoses, and fill tanks. Though water contains residual chlorine, the risk of contamination remains.

Source of contamination: Human waste, foreign debris and dust.

Risk category: Medium

Action required: (1) Water tankers for transporting potable water should be exclusively used for this purpose and should have label on outside surface of the tank stating "Potable water only". The tanker must not be used for carrying untreated water or any other liquid. (2) Water tanks of water tankers should be made up of steel and inside lined with non-toxic epoxy coating approved by the Ministry of Electricity and Water (MEW). (3) Water tankers including inside surface of tank, hoses, nozzles and coupling should be inspected once a week and record of inspection should be maintained. Inside surface should be free of any slime. If slime or algal growth is detected, inside surface should be emptied, cleaned, flushed, and disinfected with calcium hypochlorite. Hoses and pump should also be disinfected. After disinfection is completed, empty disinfectant

water solution out of the tank. Fill the tank with drinking water and allow it to stand for 30 minutes then empty the tank again. The tank then can be used for transporting potable water. (4) Drivers and labor should fill water into the tankers/ tanks hygienically, and protect hoses, nozzles and couplings from contamination. Hose ends must be capped and safely stowed with the ends capped when not in use. Keeper chains must be used to prevent misplacement of caps. (5) There should be a proper drainage to drain spilled water. (6) Restrict access in filling/ transfer area to authorized persons, and maintain sanitary conditions in the area. (7) Check water quality; daily, weekly, monthly, and yearly as mentioned under item 3.4.1 of this SOP. (8) Drivers and labor undergo medical examination every year, similar to food handlers, and be medically fit. (9) Driver and labor should be trained and supervised to fill the tanker and tanks hygienically.

2.2 Potable water storage tanks on roofs of buildings: Possible source of contamination: (a) Contamination received from water tankers during filing. (b) Foreign debris, including algae, dust, excreta of birds if cover of the roof tank is left open. (c) Dust and particles received due to corrosion of pipes.

Source of contamination: Human and bird excreta, foreign debris and dust.

Risk category: Medium

Action required: Water storage tanks must have impermeable covers/ tank hatches and must remain closed. Carry out regular visual inspection, at least quarterly. Check physical condition of tank, presence of tight cover, ball valves, non-return valves, and inside surface of tank. If slime, algal growth, or deposits on the floor of the tank are detected, the tank should be emptied, cleaned, flushed, and disinfected with calcium hypochlorite and disinfectant water should be drained out of the tank. The tank can be filled again with potable water and used. Monitor bacteriological quality of water in tanks or in water taps part of building water supply plumbing.

2.3 Potable water plumbing within buildings: Possible source of contamination: (a) Contaminated water from roof tanks. (b) Back flow of water from plumbing fixtures or cross contamination.

Risk category: Medium

Action Required: Ensure roof tanks and plumbing fixtures are provided with non-return valves and other means to prevent back flow/ overflow returning to potable water plumbing. Ensure non-potable water does not flow into the potable water supply.

3.0 Water sampling and Laboratory analysis: While water samples are collected from different locations in JO, there is no annual plan to cover all locations. Sterilized bottles are not used for collection of water samples. Under chemical analysis, only pH and residual chlorine tests are done and for microbiological tests, only coliform count is done. Coliform test carried out is not as per methods given in "Standard Methods for the examination of Water and Waste Water" 2006 edition, and results are reported either 0 or 1000. Counts between 0 to 1000 are not analyzed. Samples reported positive for coliform are not further tested to confirm presence of E.coli as required by WHO and K-EPA.

Risk category: High, as parameters are not analyzed in accredited laboratory and the minimum necessary parameters are not tested.

Action Required: Prepare annual sampling plan to cover source to end users and collect water samples using method recommended by World Health Organization. Selected physical, chemical, bacteriological and other applicable parameters must be analyzed in an accredited laboratory, or laboratory approved by Kuwait Government and the laboratory shall use analytic methods given in "Standard Methods for the examination of Water and Waste Water", or equivalent.

Appendix – D

Initial and Yearly Analysis of Water Samples

A. Parameters/ constituents to be analyzed in water sample initially and yearly

I. Physical Parameters: Color, Turbidity, Odor

II. Inorganic Chemical Constituents that may affect Acceptability of Potable water

pH, Total Dissolved Solids (TDS), Total Alkalinity as CaCO3, Total Hardness, Chloride, Sulfate, Sodium, Potassium, Calcium, Iron, Magnesium, Aluminum, Zinc, Ammonia, Hydrogen Sulfide.

III. Inorganic Chemicals of Health Significance in drinking water:

Antimony, Arsenic, Bromate, Barium, Boron, Cadmium, Chromium, Copper, Cobalt, Cyanide, Fluoride, Lead, Manganese, Mercury, Molybdenium, Nickel, Nitrate, Nitrite, Selenium, Strontium, Vanadium.

IV. Organic Chemicals of Health Significance:

1,2 -Dichloroethane, 1,2-Dichloroethene, Vinyl Chloride.

Pesticides: Aldrin / Dieldrin, Lindane, Methoxychlor, 2.4 – D, Chlorodane, Heptachlor & Heptachlor Epoxide, Hexachlorobenzene, D.D.T

Aromatic Hydrocarbons: Benzene, Toluene, Xylene, Styrene, Ethylbenzene, Benzo (a) Pyrene,
Chlorinated Benzene: Monochlorobenzene, 1,2 Dichlorobenzene, 1,4 Dichlorobenzene, Trichlorobenzenes (TotaL)
Halogenated Hydrocarbon compounds: Chloroform, Bromoform, Dibromochloromethane, Bormodichlormethane.
Phenolic Compounds: Pentachlorophenol, 2, 4, 6 – Trichlorophenol

V. Free Residual Chlorine

VI. Microbiological Quality: Total Coliform count per 100 ml of water sample using membrane filtration, and E.coli test on water samples in which Coliforms are detected.

VII. Radionuclides: Initial screening for both gross alpha activity and gross beta activity should be done on a water sample. If the measured activity concentrations are below the screening levels of 0.5 Bq/l for gross alpha activity and 1 Bq/l for gross beta activity, no further action is required. However, if either of the screening levels is exceeded, the concentrations of individual radionuclides should be determined and compared with the guidance levels.

B. Location of sampling points in water supply and number of samples

Location of sampling point	Number of samples
All water tankers	7
Fresh water storage tanks and overhead reservoirs	8

Appendix – E

Monthly analysis of water samples

A. Parameters/ constituents to be analyzed

1. Color, Turbidity and Odor
2. pH, total dissolved solids
3. Residual chlorine
4. Microbiological testing:
    - Total plate count
    - Coliform count
    - E. Coli on samples tested positive for coliforms

B. Location of sampling points in water supply and number of samples

Location of sampling point	**Number of samples**
All water tankers	7
Overhead reservoirs	3
Buildings:	
Admin Campus	5
Main Gathering Centre Campus	3
Industrial Camp	2
Buildings under Heavy Equipment Contract	6
Total	26

Appendix – F

Weekly Checks and Field Testing of water samples

A. Parameters to be checked/ tested

1. Color: Check by Visual Inspection
2. Turbidity: Measure using Field Kit
3. pH: Measure using Field Kit
4. Total dissolved solids (Conductivity): Measure using Field Kit
5. Residual chlorine: Measure using Field Kit

B. Recommended Field Test kits:

Parameter	Range of test	Name of Field kit/ Equipment	Company *	Model/ Product Number
Turbidity	0 – 1000 units	Portable Turbidity meter	Hach	Model 2100 Q Product # 2100 Q01
pH	5.6 – 8.4	pH Test Kit	Hach	Model 17 Product # 147006
Total Dissolved Solids	0 – 1990 ppm	TDS Eco Testr	Hach	Product # 252240
Free and Total Residual Chlorine	0.1 to 3.5	Chlorine Test Kit	Hach	Model CN 66 Product # 223101

Note *: Field kit of Hach/other company compliant with USEPA is acceptable for use in JO.

C. Location of sampling points in water supply and number of samples

Location of sampling point	Number of samples
All water tankers	7
Fresh water and Overhead reservoirs	8
Buildings:	
Admin Campus	2
Main Gathering Centre Campus	2
Industrial Camp	2
Buildings under Heavy Equipment Contract	2
Total	23

Appendix – G

Daily Checks on Water

A. Visual checks:

Color: Check by Visual Inspection.

Turbidity: Check by Visual Inspection. Measure it using field kit if turbidity is noticed on visual inspection.

B. Residual chlorine: Measure using Field Kit

C. Location of points in water supply to be checked/ tested and number of samples

Location of sampling point	Number of samples
All water tankers	7
Fresh Water Storage tanks	5

Appendix H
Responsibilities Chart

S. No	Activity	Superintendent - EH&S	Superintendent –Gen Services	Superintendent –MMD	Building Custodian/ Area Owner	Employees/ Occupants
1	Owner and Competent Authority to administer and maintain elements of this SOP.	X				
	Operation& Maintenance of Water Supply System					
2	Operate and maintain Water Supply systems in JO to meet requirements of this SOP.		X	X		
3	Develop tasks for personnel who operate and maintain potable water supply systems in JO and ensure the staff are competent to perform the task		X	X		
4	Review requirements for tankers, building plumbing and ensure the system is in compliance		X	X		
5	Develop water sampling plan that includes annual, monthly and weekly sampling of water.		X	X		
6	Select laboratory for analysis of water samples.		X	X		
7	Ensure samples are collected as per plan and samples are collected using World Health Organization guidelines, and records of sampling and results are maintained		X	X		
8	Review results of laboratory analysis.		X	X		
9	Investigate incidents of water contamination and upsets in water supply.		X	X		
10	Take appropriate action and ensure incidents of water contamination and upsets in water supply are resolved, and prepare action plan to prevent recurrence of such incidents.		X	X		
11	Carry out weekly tests on water as mentioned in Appendix F		X	X		
12	Carry out daily checks on water as mentioned in Appendix G		X	X		
13	Carry out periodic inspection and cleaning of water tankers and storage water tanks		X	X		
14	Ensure plumbing installation and repair work is done according to plumbing and building code.		X	X	X	
15	Ensure piped water is supplied at pressure		X			
16	Report problems related to water supply				X	X