

<b>TEAM RIO</b>	<b>Trip Date:</b> 7 & 9 August 2003	<b>Issue Date:</b> Revision 0
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**Trip Description/Location:** Qarmat Ali Water Treatment Plant

**Attendees:** Rod Kimbro\* KBR  
Stacey Stewart, KBR  
**\* Prepared By** Johnny Morney, KBR  
John Dipple, IRC  
Steve Kegelman, IRC

**CC:** Attendees and Standard Distribution of RIO Project

**Purpose of Trip:** Limited Environmental Assessment of Soils Potentially Contaminated with Sodium Dichromate at the Qarmat Ali Water Treatment Plant

**Observations/Findings:**

On 7 August 2003, Stacey Stewart(KBR) and Rod Kimbro (KBR) traveled to the Qarmat Ali Water Treatment Plant (WTP) in response to a request from Chuck Adams, Manager H&S, Project RIO, to perform a limited environmental assessment and to collect samples of soils potentially contaminated with sodium dichromate. Additional soil samples as well as one air sample were collected on 9 August 2003. Sodium dichromate was historically added to the water processed in the WTP as a corrosion inhibitor.

Sodium dichromate is a very toxic chemical and has been shown to have caused cancer in humans. Casual exposure has been shown to cause a number of health effects, chest pains and skin burns. Chronic exposure has been shown to cause lung damage, liver damage, tooth decay, digestive disorders and cancer. A copy of an MSDS for sodium dichromate is presented below.

Based on visual observations, large areas of the eastern side of the WTP have been impacted by releases of aqueous solutions of sodium dichromate in and around the "chemical injection building." Historically, crystalline sodium dichromate was delivered in bags to the northern end of the chemical injection building. The bags were placed on a conveyor in the mixing room of the chemical injection building and transported to a platform on the top of the mixing tanks. There, the bags were manually cut and emptied into one of two dichromate mixing tanks for mixing of the crystalline dichromate with water. (There are two additional mixing tanks where zinc sulfate was similarly loaded and mixed. (KBR personnel formerly utilized portions of the mixing room as an "office" prior to the delivery of the modular building currently used as the office, medical station and storage area for arms, munitions and associated riot control gear and chemical dispersants by the British armed forces stationed at the WTP.)

From the mixing tanks, the concentrated sodium dichromate in the mixing tanks was pumped to two large concrete tanks in a room directly adjacent and south of the mixing room in the chemical injection building. Sodium dichromate solution from these tanks was injected into the water prior to pumping into the distribution system. Three other injection tanks are located adjacent to the sodium dichromate tanks. These tanks were reportedly used to hold zinc sulfate.

A sump in the mixing room was used to collect spills and route them through the wall separating the mixing room from the concrete tank room. The sump continues through the concrete tank room and exits the chemical injection building at the southern end of the concrete tank room. From this point, leaks and spills were routed in a chemical sewer and open drainage ditch to a large containment/evaporation pond east of and immediately adjacent to the WTP. The containment/evaporation pond appears to be approximately 3 to 5 acres in size. No fencing or signs are present around the perimeter levies of the containment/evaporation pond.

The conveyor platform, the floor around the mixing tanks, and the sump in the mixing room are stained dark orange and contain piles of dark orange crystalline material (most likely pure sodium dichromate). The remainder of the mixing room floor, and in some places, the walls are stained yellow, indicating the presence of spills of a dilute solution of sodium dichromate.

The sump in the concrete tank room in the area adjacent to the mixing room contains approximately one foot of yellow sludge. The rest of the sump contains orange colored water. The drainage ditch leading from the chemical injection building to the containment pond contains yellow sediment. Yellow stained soils extended into the containment pond.

On both 7 August 2003 and 9 August 2003, Southern Oil Company (SOC) personnel were observed working in both the mixing room and concrete tank room. On 7 August 2003, SOC personnel were observed eating lunch on the floor adjacent to the mixing tanks. On 9 August 2003, SOC personnel were observed shoveling sludge from the sump in the concrete tank room into wheel barrows. The excavated sludge was wheeled into the southern portion of the chemical injection building and dumped in piles. No SOC personnel were equipped with any personal protective equipment or clothing. The SOC person who was shoveling the sludge from the sump showed us ulcers on his chest and abdomen.

Signs warning of the presence of sodium dichromate were posted at all entrances to the chemical injection building. Signs were also posted in the concrete tank room. The warnings were posted in both English and Arabic.

It was reported that the SOC WTP manager had been notified of the potential existence and hazards of sodium dichromate by KBR. It was also reported that he had responded to this notification by insisting that sodium dichromate posed no hazard.

Yellow stained soils were observed from the outside wall of the chemical injection building to the property boundary on the north and east of the building. East of the building yellow stained soils were observed under the two SOC trailers and the KBR trailer. Yellow stained soils were observed under the thin gravel layer of the KBR parking area and the Halliburton office container and equipment areas.

To the west of the chemical injection area, yellow stained soils were observed extending approximately 50 feet from the walls of the building. Additional trailers and equipment storage trailers were located in this area. In addition, a sump, reported to have previously contained "orange water" was located in this area. KBR personnel reportedly pumped the orange water from this sump. Yellow stains are present on the walls of the sump.

Yellow stained soils extend outside the WTP fence. To the north of the intake canal on the eastern side of the WTP, a large area (estimated to be at least 200' X 200') of yellow stained soils was observed. In this yellow stained soil area were two orange-red areas, indicating the possible presence of crystalline sodium dichromate.

Yellow stained soils were observed extending approximately 100 feet by 10 feet along the north-south portion of the WTP road, immediately south of the of the entrance gate on the east side of the WTP. Yellow crystalline material was observed on the walls and floors of the pump building located to the east of the chemical injection building. The crystalline material was associated with seeps of ground water entering the walls and pooling on the floor of the building under and around equipment and piping. (WTP personnel were also observed eating in this building.)

Between the chemical injection building and the chlorination building, a loading area containing a large amount of a white crystalline material was observed. Overflow from the pile of white crystalline material was present in the road adjacent to the area.

On 7 August 2003, four samples of the yellow stained soils and sump materials were collected. One sample was collected from the fined grained material mixed with the gravel in the KBR "parking area." A second sample was collected of the soils located between the KBR office trailer and the SOC trailers (in front of the generator) on the east side of the chemical injection building. A third sample was collected of the fine grained material from the sump in the concrete tank room in the chemical injection building. A fourth sample was collected from the concrete drainage ditch which conveyed process water from the chemical injection building to the containment pond.

On August 9 2003, duplicate samples of soil/sediment were collected from the locations described above. In addition, a sample of the crystalline material precipitated on the walls of the 1<sup>st</sup> Stage Pump House east of the chemical injection building was collected. A sample of the white crystalline material located in the loading area south of the chemical injection building was also collected.

One particulate air sample was collected on 9 August 2003. The sample was collected for one hour at a capture volume of 2 liters/min. The sample was collected from a height of approximately 5 feet above ground level at the door of the KBR office trailer. The environmental team left the area due to reports of rioting in Basrah; otherwise, the air sample would have been collected for four hours instead of one hour.

The soil/sediment/precipitate samples collected 7 August 2003 will be analyzed for total chromium and other metals (arsenic, barium, chromium, cadmium, lead, mercury, selenium and zinc) at the Kuwait Institute for Scientific Research. Two of the samples collected on 9 August 2003 and the air sample collected on 9 August 2003 will be express shipped to Southern Petroleum Laboratories, Inc (SPL) in Houston, TX for analysis. SPL is a USEPA certified laboratory and participates in the National Environmental Laboratory Accreditation Conference (NELAC) certification process. SPL will analyze the samples for hexa-valent chromium in addition to total chromium and other metals.

Pictures taken 7 Aug 2003 and 9 August 2003 of the yellow stained soil areas described above are shown below.

In addition to the potential chromium contamination issue, there are other issues which possibly could impact KBR personnel and KBR subcontractor personnel assigned to the WTP.

A power house east of and adjacent to the chemical injection building contains a looted and burned transformer. Residues of PCBs and of its low temperature combustion products, dioxins and dibenzofurans, are most likely present in the building and in the soot on the building walls.

Leaking chlorine cylinders, along with four unidentified gray-blue cylinders are stored south of the chlorination building. Recommendations for the safe storage of these cylinders off the property were previously submitted.

A transformer room which has been looted exists on the western side of the WTP. A sump containing a red, oily material drains into the adjacent 2<sup>nd</sup> Stage Pump House. The 2<sup>nd</sup> Stage Pump House was previously flooded. The water from the 2<sup>nd</sup> Stage Pump House was pumped out. KBR personnel and KBR subcontractor personnel are working in the 2<sup>nd</sup> Stage Pump House at the present time. There is a potential that the water which was present in the 2<sup>nd</sup> Stage Pump House was contaminated with PCBs.

#### **Recommendations:**

1. Until such time as the laboratory analyses are received, KBR personnel and KBR subcontractor personnel entry into the areas described above should be restricted to critical personnel performing critical operations necessary for continuing operations of the WTP.
2. Until such time as the laboratory analyses are received and evaluated, KBR personnel and

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KBR subcontractor personnel entering the area should wear personal protective equipment (PPE), which, at a minimum should be consistent with USEPA Level C PPE. Personnel entering the conveyor and mixing tank areas should wear PPE consistent with USEPA Level B.

3. A complete Environmental Health and Safety assessment should be performed at the WTP to verify that all existing potential environmental health issues are identified and addressed. This should also apply to all facilities in which KBR personnel are present.

**Follow-Up/Action Items:**

1. The results of the analyses will be forwarded as soon as received.
2. Based on the results of the analyses, more extensive soil and air sampling may be required.
3. Based on the results of the analyses, remedial actions may be required.

**Assumptions:**

**Additional/Misc:**

## **MATERIAL SAFETY DATA SHEET**

### **SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

**SUBSTANCE: SODIUM DICHROMATE**

**TRADE NAMES/SYNONYMS:**

CHROMIC ACID (H<sub>2</sub>CR<sub>2</sub>O<sub>7</sub>), DISODIUM SALT; DICHROMIC ACID (H<sub>2</sub>CR<sub>2</sub>O<sub>7</sub>), DISODIUM SALT;

CHROMIUM SODIUM OXIDE (CR<sub>3</sub>NA<sub>2</sub>O<sub>7</sub>); DISODIUM DICHROMATE; SODIUM CHROMATE

(NA<sub>2</sub>CR<sub>2</sub>O<sub>7</sub>); SODIUM DICHROMATE (NA<sub>2</sub>CR<sub>2</sub>O<sub>7</sub>); SODIUM DICHROMATE(VI); SODIUM CHROMATE; SODIUM BICHROMATE; CR<sub>2</sub>NA<sub>2</sub>O<sub>7</sub>; MAT21190; RTECS HX7700000

**CHEMICAL FAMILY:** inorganic, salt

**CREATION DATE:** Jan 24 1989

**REVISION DATE:** Dec 16 2002

### **SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS**

**COMPONENT: SODIUM DICHROMATE**

**CAS NUMBER:** 10588-01-9

**PERCENTAGE:** 100.0

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**SECTION 3 HAZARDS IDENTIFICATION**

**NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=0**

**EMERGENCY OVERVIEW:**

**COLOR:** orange or red

**ODOR:** odorless

**MAJOR HEALTH HAZARDS:** potentially fatal if swallowed, harmful on contact with the skin, respiratory tract burns, skin burns, eye burns, mucous membrane burns, allergic reactions, cancer hazard (in humans)

**PHYSICAL HAZARDS:** May ignite combustibles.

**POTENTIAL HEALTH EFFECTS:**

**INHALATION:**

**SHORT TERM EXPOSURE:** irritation (possibly severe), allergic reactions, loss of voice, chest pain,

difficulty breathing, headache, dizziness, lung congestion, kidney damage

**LONG TERM EXPOSURE:** lack of sense of smell, lack of sense of smell and taste, tooth decay, digestive

disorders, asthma, lung damage, liver damage, cancer

**MATHESON TRI-GAS, INC. EMERGENCY CONTACT:**

**959 ROUTE 46 EAST CHEMTREC 1-800-424-9300**

**PARSIPPANY, NEW JERSEY 07054-0624 INFORMATION CONTACT:**

**973-257-1100**

**SKIN CONTACT:**

**SHORT TERM EXPOSURE:** irritation (possibly severe), allergic reactions, nausea, vomiting, kidney

damage, coma

**LONG TERM EXPOSURE:** same as effects reported in short term exposure

**EYE CONTACT:**

**SHORT TERM EXPOSURE:** burns, eye damage

**LONG TERM EXPOSURE:** tearing, red bands around the cornea

**INGESTION:**

**SHORT TERM EXPOSURE:** allergic reactions, burns, vomiting, digestive disorders, dizziness, kidney

damage, liver damage, convulsions, coma, death

**LONG TERM EXPOSURE:** same as effects reported in short term exposure

**SECTION 4 FIRST AID MEASURES**

**INHALATION:** If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

**SKIN CONTACT:** Remove contaminated clothing, jewelry, and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes).

**EYE CONTACT:** Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

**INGESTION:** If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

**ANTIDOTE:** dimercaprol, intramuscular.

**NOTE TO PHYSICIAN:** For inhalation, consider oxygen. For skin contact, consider sodium hyposulfite scrub, calcium disodium edetate ointment, ascorbic acid solution, aluminum acetate wet dressing. For ingestion, consider gastric lavage. Consider oxygen.

**SECTION 5 FIRE FIGHTING MEASURES**

**FIRE AND EXPLOSION HAZARDS:** Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials.

**EXTINGUISHING MEDIA:** water

Do not use dry chemicals, carbon dioxide or halogenated extinguishing agents. Large fires: Flood with water.

Apply water from a protected location or from a safe distance.

**FIRE FIGHTING:** Move container from fire area if it can be done without risk. Cool containers with water

spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool

containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is

impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny

entry. Let the fire burn. Flood with water. Cool containers with water spray until well after the fire is out.

Apply water from a protected location or from a safe distance. Avoid inhalation of material or

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combustion by-products. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 800 meters (1/2 mile).

## SECTION 6 ACCIDENTAL RELEASE MEASURES

### WATER RELEASE:

Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

### OCCUPATIONAL RELEASE:

Avoid contact with combustible materials. Do not touch spilled material. Small dry spills: Move containers away from spill to a safe area. Small liquid spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

## SECTION 7 HANDLING AND STORAGE

**STORAGE:** Store and handle in accordance with all current regulations and standards. NFPA 430 Code for the Storage of Liquid and Solid Oxidizing Materials. Protect from physical damage. Store in a cool, dry place. Keep separated from incompatible substances. Avoid storage on wooden floors. Collect spilled material in appropriate container for disposal. Do not return to original containers. Keep separated from incompatible substances.

## SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

### EXPOSURE LIMITS:

#### SODIUM DICHROMATE:

#### CHROMIC ACID AND CHROMATES:

0.1 mg(CrO<sub>3</sub>)/m<sup>3</sup> OSHA ceiling

0.01 mg(Cr)/m<sup>3</sup> ACGIH TWA (insoluble compounds)



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0.05 mg(Cr)/m3 ACGIH TWA (soluble compounds)

0.001 mg(Cr(VI))/m3 NIOSH recommended TWA 10 hour(s)

**VENTILATION:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**EYE PROTECTION:** Wear splash resistant safety goggles with a faceshield. Provide an emergency eye

wash fountain and quick drench shower in the immediate work area.

**CLOTHING:** Wear appropriate chemical resistant clothing.

**GLOVES:** Wear appropriate chemical resistant gloves.

**RESPIRATOR:** The following respirators and maximum use concentrations are drawn from NIOSH and/or

OSHA.

Measurement Element:

Chromium (Cr)

**At any detectable concentration -**

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or

other positive-pressure mode.

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure

mode in combination with a separate escape supply.

**Escape -**

Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter.

Any appropriate escape-type, self-contained breathing apparatus.

**For Unknown Concentrations or Immediately Dangerous to Life or Health -**

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure

mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

## SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

**PHYSICAL STATE:** solid

**COLOR:** orange or red

**ODOR:** odorless

**MOLECULAR WEIGHT:** 261.90

**MOLECULAR FORMULA:** NA<sub>2</sub>-(O-CR-O<sub>2</sub>-O-CR-O<sub>2</sub>-O)

**BOILING POINT:** 752 F (400 C)

**MELTING POINT:** 675 F (357 C)

**DECOMPOSITION POINT:** 752 F (400 C)

**VAPOR PRESSURE:** Not applicable

**VAPOR DENSITY (air=1):** 10

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**SPECIFIC GRAVITY (water=1):** 2.348 @ 25 C  
**WATER SOLUBILITY:** soluble  
**PH:** 4.0 (1% solution)  
**VOLATILITY:** Not applicable  
**ODOR THRESHOLD:** Not available  
**EVAPORATION RATE:** Not applicable  
**COEFFICIENT OF WATER/OIL DISTRIBUTION:** Not available

#### SECTION 10 STABILITY AND REACTIVITY

**REACTIVITY:** Stable at normal temperatures and pressure.  
**CONDITIONS TO AVOID:** Avoid contact with combustible materials. May ignite or explode on contact with combustible materials. Keep out of water supplies and sewers.  
**INCOMPATIBILITIES:** combustible materials, reducing agents, amines  
**HAZARDOUS DECOMPOSITION:**  
 Thermal decomposition products: chromium compounds  
**POLYMERIZATION:** Will not polymerize.

#### SECTION 11 TOXICOLOGICAL INFORMATION

##### SODIUM DICHROMATE:

##### TOXICITY DATA:

338 mg/kg skin-guinea pig LD50 (Dow); 50 mg/kg oral-rat LD50

**CARCINOGEN STATUS:** NTP: Known Human Carcinogen; IARC: Human Sufficient Evidence, Animal

Limited Evidence, Group 1; ACGIH: A1 -Confirmed Human Carcinogen (Hexavalent chromium compounds); EC: Category 1

##### LOCAL EFFECTS:

Corrosive: inhalation, skin, eye, ingestion

##### ACUTE TOXICITY LEVEL:

Highly Toxic: ingestion

Toxic: dermal absorption

**TARGET ORGANS:** immune system (sensitizer), kidneys

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** blood system disorders, heart or cardiovascular disorders, liver disorders, respiratory disorders, skin disorders and allergies

**TUMORIGENIC DATA:** Available.

**MUTAGENIC DATA:** Available.

**REPRODUCTIVE EFFECTS DATA:** Available.

**ADDITIONAL DATA:** May be excreted in breast milk.

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## SECTION 12 ECOLOGICAL INFORMATION

### ECOTOXICITY DATA:

**FISH TOXICITY:** 10000 ug/L 96 hour(s) LC50 (Mortality) Mosquitofish (*Gambusia affinis*)

**INVERTEBRATE TOXICITY:** 0.8-3.2 ug/L 7 hour(s) MATC (Reproduction) Water flea  
(*Ceriodaphnia dubia*)

**ALGAL TOXICITY:** 4 ug/L 8 hour(s) (Population Growth) Blue-green algae (*Anacystis aeruginosa*)

### FATE AND TRANSPORT:

**BIOCONCENTRATION:** 956 ug/L 12 week(s) BCFD (Residue) Common bay mussel, blue mussel  
(*Mytilus edulis*) 5.05 ug/L

**ENVIRONMENTAL SUMMARY:** Toxic to aquatic life.

## SECTION 13 DISPOSAL CONSIDERATIONS

Hazardous Waste Number(s): D007. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations

at or above the Regulatory level. Regulatory level- 5.0 mg/L. Dispose in accordance with all applicable regulations.

## SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

**PROPER SHIPPING NAME:** Toxic solid, corrosive, inorganic, n.o.s. (SODIUM DICHROMATE)

**ID NUMBER:** UN3290

**HAZARD CLASS OR DIVISION:** 6.1

**PACKING GROUP:** II

**LABELING REQUIREMENTS:** 6.1; 8

**CANADIAN TRANSPORTATION OF DANGEROUS GOODS:**

**SHIPPING NAME:** Toxic solid, corrosive, inorganic, n.o.s. (SODIUM DICHROMATE)

**ID NUMBER:** UN3290

**CLASSIFICATION:** 6.1, 8

**PACKING GROUP:** II

## SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

**CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):**

**SODIUM DICHROMATE:** 10 LBS RQ

**SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):** Not regulated.

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**SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40):** Not regulated.

**SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):**

ACUTE: Yes

CHRONIC: Yes

FIRE: Yes

REACTIVE: No

SUDDEN RELEASE: No

**SARA TITLE III SECTION 313 (40 CFR 372.65):**

**Chromium Compounds**

**OSHA PROCESS SAFETY (29CFR1910.119):** Not regulated.

**STATE REGULATIONS:**

**California Proposition 65:**

Known to the state of California to cause the following:

**Hexavalent Chromium Compounds**

Cancer (Feb 27, 1987)

**CANADIAN REGULATIONS:**

**WHMIS CLASSIFICATION:** Not determined.

**NATIONAL INVENTORY STATUS:**

**U.S. INVENTORY (TSCA):** Listed on inventory.

**TSCA 12(b) EXPORT NOTIFICATION:**

**HEXAVALENT CHROMIUM CHEMICALS**

**SECTION 6**

**CANADA INVENTORY (DSL/NDSL):** Not determined.

**SECTION 16 OTHER INFORMATION**

**MSDS SUMMARY OF CHANGES**

**SECTION 15 REGULATORY INFORMATION**

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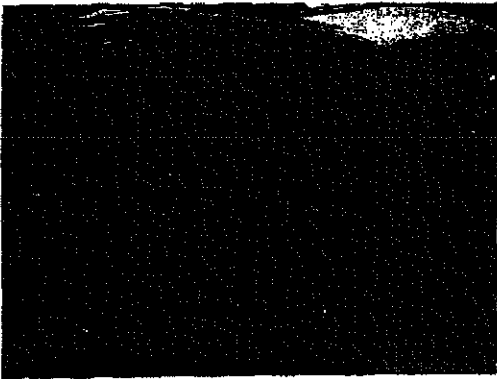
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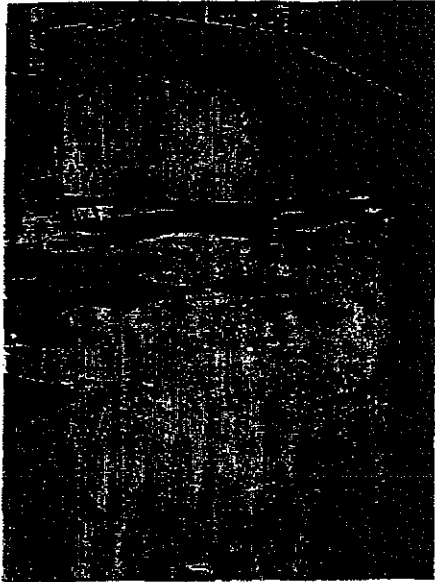
**PHOTOS:**



**Yellow Stained Soils in Parking Area**



**Yellow Stained Soils Under Thin Gravel Layer**



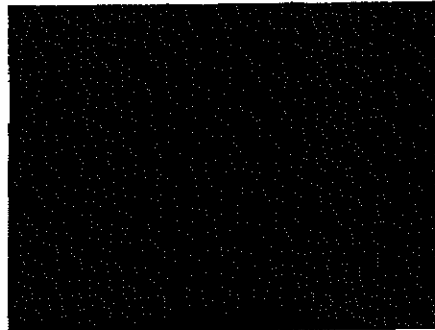
Yellow Stained Soils in Office Trailer Area



Orange Water in Concrete Tank Room Sump

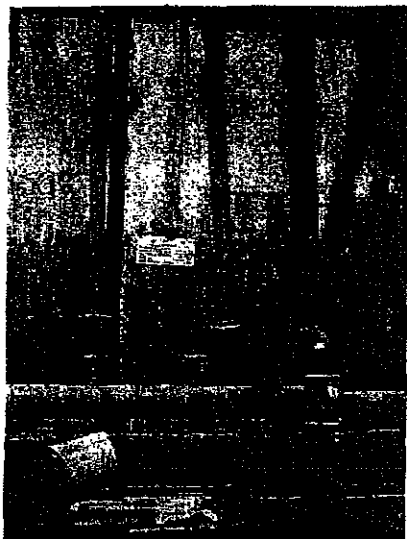


Yellow Sediment in Sump in Concrete Tank Room



Sodium Dichromate Warning Sign

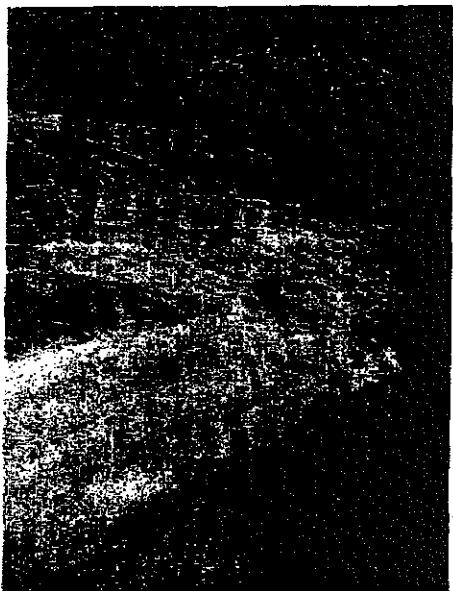
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Dichromate Warning Sign in Concrete Tank Room



Sludge From Sump Stored in Chemical Injection Building



White Salt South of Chemical Injection Building

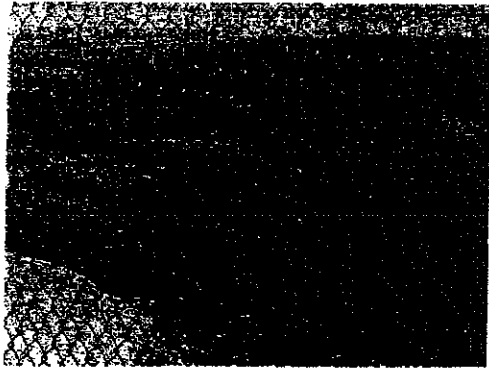


Air Sample Collection Point

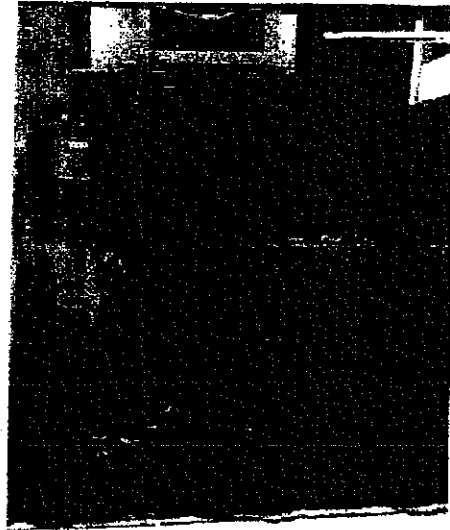
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**Yellow/Orange Stained Area North of Canal**



**Groundwater Seep into 1<sup>st</sup> Stage Pump House**

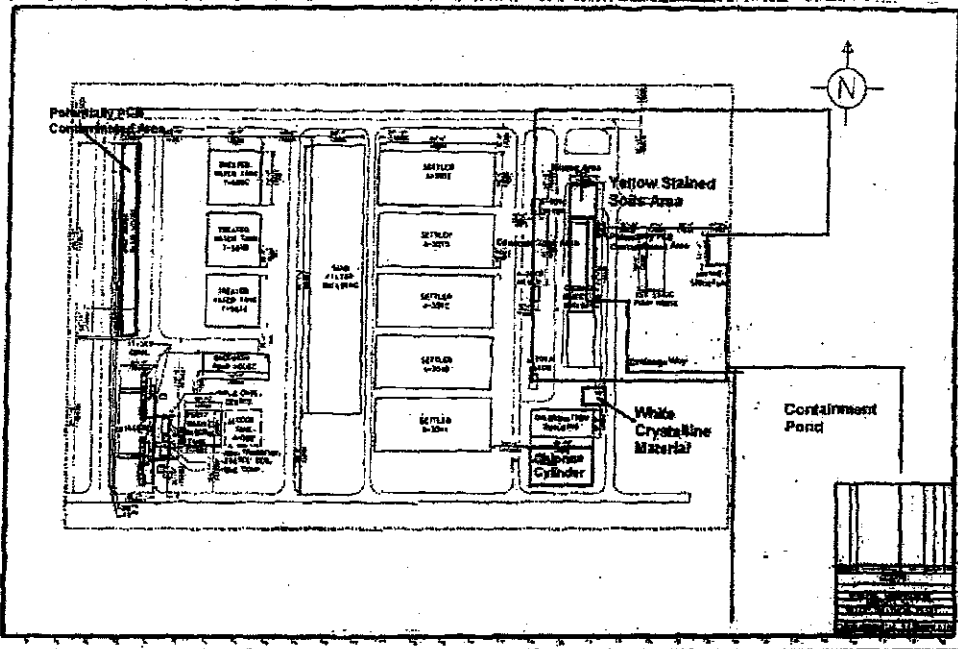


**Yellow Stained Soils South of Main Security Gate**



**Burned Electrical Room Adjacent to Chemical Injection Building**





Location of Potentially Contaminated Areas at the Qarmat Ali Water Treatment Plant Identified as of 10 August 2003

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### **Medical Surveillance**

Medical evaluation for all employees who worked at the water treatment plant was initiated on September 15, 2003 at the Ministry of Health (MOH) Occupational Health clinic of Kuwait. Dr. Sudhir Desai, CIH of KBR is coordinating activities under direction of Dr. Robert Conte, Medical Director of Halliburton.

Medical evaluation of all employees who worked at the site will also be conducted after 3-months and 6-months at the MOH clinic to determine excretion of elevated chromium levels in blood. Dr. Rao of MOH and Dr. Conte & Dr. Desai of KBR will be responsible for coordinating efforts.

Dr. Sudhir Desai will evaluate QA/QC protocols for both laboratory facilities used for blood and urine testing in Kuwait prior to his departure to Houston. He will also evaluate Inter laboratory and intra-laboratory QA/QC protocol with split samples to document quality of data. Split samples will also be tested by an accredited and certified laboratory in US for the validity of data.

Management and oversight of Medical Surveillance program will be coordinated by Sudhir Desai. He will also coordinate records management and documentation between MOH clinic and KBR.

### **Industrial Hygiene Issues**

Sudhir Desai and Jason Allen of Houston Industrial Hygiene group will conduct Industrial Hygiene assessment for Chromium and other health hazards like Chlorine, ammonia on site.

Jason Allen, Industrial Hygienist will conduct air monitoring for total Chromium & Chromium VI under various ambient conditions. All samples will be mailed daily via FedEx/DHL to an AIHA accredited laboratory for analysis. Laboratory will be directed to analyze samples with immediate turnaround. He will also collect water samples to determine Chromium levels in water.

Two industrial hygienists will be hired for the RIO project to conduct health hazard assessment for current and new RIO projects. Chuck

Adams & Rick Hopper of the project will work with Sudhir Desai on this issue. Both new Industrial Hygienists will report to HSE Manager of the RIO project, with dotted line reporting to Sudhir Desai, HSE Manager-IH/OH of Houston for technical support, guidance, and direction.

### **PPE Assessment**

Jason Allen and Sudhir Desai will evaluate all Personal Protective Equipment (PPE) like Gloves, Respirators, body coveralls, boots, and goggles. All employees will use PPE determined by the industrial hygienists and HSE department.

### **Engineering Controls:**

Industrial Hygienists and RIO project HSE department will develop adequate engineering controls to minimize Sodium Dichromate emissions. This may include sealing of partial site of the water treatment plant, and other dust control methods to minimize or eliminate Sodium Dichromate exposure to site occupants. Project Management support will be essential to implement this option.

### **Administrative Controls:**

A 3-stage decontamination trailer will be necessary at the site for all employees to maintain personal hygiene while on site. This trailer will need potable water for shower, and sewer line connection.

A temperature controlled "Cool Room" trailer will also be necessary as a rest area and break room for KBR employees. It will help manage Heat Stress induced from ambient conditions and PPE.

### **Employee Training**

RIO project HSE department will provide training to all employees working at the site for PPE, Hazard Communication, Personal Hygiene, and Heat Stress. No employee will be permitted on site, unless training is received.



**Site Control:**

All employees entering the site will be required to sign in the logbook.

**Sub-Contractors:**

All sub-contractors working at the site will be required to comply with all contractual terms to protect their employees and others on site. Project Management and HSE department will be responsible for the implementation of the contractual terms and oversight of the sub contractors.

Project sub-contract management and KBR legal department will be responsible for the review and interpretation of the contractual terms.

**Path Forward-PM & HSE**

Project Management, with assistance from the project HSE department, will communicate with all KBR employees on current status of this issue. This will include current and future plans for protecting employees while working on the site.

Project Management and HSE department will also establish Multi Employer hazard communication with the client, direct sub contractors, and other contractors on site. If water testing indicates Chromium contamination of the water, Project Management will inform the client to communicate with the habitants in the surrounding areas.

---

End 4

**LABORATORY ANALYSIS REPORT**



A & B Environmental Services, Inc.  
1843 Federal Road  
Houston, TX 77015

Report Date: 9/18/2003  
Total No. Pages: 5

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Client Project ID  
Kuwait-RIO-01

KBR RIO-01  
Attn: Bruce Keyston / KBR-Team RIO APO AE 09304  
4100 Clinton Dr. 03-405A  
Houston, TX 77020

Client PO #: Pending  
Date Received: 9/10/2003 14:30  
Collected by: Bruce Keyston

A & B Labs has analyzed the following samples ...

Your Sample ID  
WTP-A-05 Guards Sleeping Area

A & B Lab ID  
58891-11

This Laboratory is NELAC and AIHA certified. Thank you for choosing A & B Labs.

Approved By: \_\_\_\_\_

Analyst: \_\_\_\_\_

Title: \_\_\_\_\_

\_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_

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Job Number: 59891

LABORATORY TEST RESULTS

Date: 9/18/2003

CUSTOMER: KBR RIO-01

PROJECT: Kuwait-RIO-01

ATTN: Bruce Keyson / KB

Client Sample ID Parameter	Method	Flow Rate (LM)	Sampling Time(Min)	Volume (Liters)	ug Detected	D.F.	Det Limit (ug)	Concentration (mg/m <sup>3</sup> )	Analyst Initials	Analysis Date/Time	Lab ID Matrix	Q
WTP-A-05 Guards Sleeping Selenium	NIOSH 7300	3.5	252	882	BRL	1	2	< 0.002	SEC	9/18/2003 20:09	59891-11 Cassette	
Chromium	NIOSH 7300	3.5	252	882	BRL	1	2	< 0.002	SEC	9/18/2003 20:09	59891-11 Cassette	



A & B Environmental Services, Inc.  
 1843 Federal Road  
 Houston, Texas 77015

QUALITY CONTROL CERTIFICATE

Job Number: 58891

Report Date: 9/18/2003

QCType: LCS and LCSD

Parameter	Method	Spike Added	LCS Result	LCSD Result	LCS Rec %	LCSD Rec %	RPD	%RPD Climits	%Rec Climits	QCBatchID	Qual.
Selenium	NIOSH 7300	1	0.95	0.98	95	98	1.0	<25	75-125	Q091603mase	
Chromium	NIOSH 7300	1	0.97	0.99	97	99	2.0	<20	80-120	Q091603macr	

QCType: Method Blank

Parameter	Method	CAS #	Result	Units	D.F.	Rpt Limit	QCBatch ID	Qual.
Selenium	NIOSH 7300	7782-49-2	BRL	ug	1	2	Q091603mase	
Chromium	NIOSH 7300	7440-47-3	BRL	ug	1	2	Q091603macr	

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Encl 5.

## LABORATORY ANALYSIS REPORT



A & B Environmental Services, Inc.  
1643 Federal Road  
Houston, TX 77015

Report Date: 9/18/2003  
Total No. Pages: 8

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Client Project ID

**KBR-RIO-01- CPS 3,4 and 5**

KBR RIO-01  
Attn: Bruce Keyston / KBR-Team RIO APO AE 09304  
4100 Clinton Dr. 03-405A  
Houston, TX 77020

Client PO #: Pending  
Date Received: 9/10/2003 14:30  
Collected by: Jason McCaskill

A & B Labs has analyzed the following samples . . .

Your Sample ID	A & B Lab ID
CPS-3 Utility Trench Oil	59890-11
CPS-4 Utility Trench Oil	59890-12
CPS-5 Utility Trench Oil	59890-13

This Laboratory is NELAC and AIHA certified. Thank you for choosing A & B Labs.

Approved By: \_\_\_\_\_

Date: \_\_\_\_\_

Title: \_\_\_\_\_

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LABORATORY TEST RESULTS

A&B Job Number: 59890

Date: 9/19/2003

CUSTOMER: KBR RIO-01

PROJECT: KBR-RIO-01-CPS 3,4 and 5

ATTN: Bruce Keaton / KBR-Team RIO

Customer Sample ID: GPS-3 Utility Trench Oil

Lab Sample ID: 59890-11

Date Collected: 9/8/2003

Sample Matrix: Oil

Time Collected:

Sample Loc./Other Info:

Test Method	Parameter/Test Description	Result	Units	D.F.	Rpt Limit	Reg Limit	Q	Date	Time	Analyst
SW-846 8082	Polychlorinated Biphenyls (PCBs)									
	Aroclor - 1016	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1221	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1232	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1242	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1248	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1254	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1260	BRL	mg/Kg	5	2.5			09/12	9:23	HG



A&amp;B Job Number: 59890

## LABORATORY TEST RESULTS

Date: 9/18/2003

CUSTOMER: KBR RIO-01

PROJECT: KBR-RIO-01- CPS 3,4 and 5

ATTN: Bruce Keyson / KBR-Team RIO

Customer Sample ID: CPS-4 Utility Trench Oil

Lab Sample ID: 59890-12

Date Collected: 9/6/2003

Sample Matrix: Oil

Time Collected:

Sample Loc./Other Info:

Test Method	Parameter/Test Description	Result	Units	D.F.	Rpt Limit	Reg Limit	Q	Date	Time	Analyst
SW-846 8082	Polychlorinated Biphenyls (PCBs)									
	Aroclor - 1016	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1221	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1232	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1242	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1248	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1254	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1260	BRL	mg/Kg	5	2.5			09/12	9:23	HG



LABORATORY TEST RESULTS

A&B Job Number: 59890

Date: 9/18/2003

CUSTOMER: KBR RIO-01

PROJECT: KBR-RIO-01- CPS 3,4 and 5

ATTN: Bruce Keaton / KBR-Team RIO

Customer Sample ID: CPS-5 Utility Trench Oil

Lab Sample ID: 59890-13

Date Collected: 9/6/2003

Sample Matrix: Oil

Time Collected:

Sample Loc./Other Info:

Test Method	Parameter/Test Description	Result	Units	D.F.	Rpt Limit	Reg Limit	Q	Date	Time	Analyst
SW-846 8082	<b>Polychlorinated Biphenyls (PCBs)</b>									
	Aroclor - 1016	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1221	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1232	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1242	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1248	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1254	BRL	mg/Kg	5	2.5			09/12	9:23	HG
	Aroclor - 1260	BRL	mg/Kg	5	2.5			09/12	9:23	HG



A & B Environmental Services, Inc.  
1643 Federal Road  
Houston, Texas 77015

**SAMPLE SURROGATE RECOVERY REPORT**

Job Number: 59890

Report Date: 9/18/2003

Parameter	Method	CAS #	Spike Added	Spike Result	D.F.	%Rec	% Rec CLIMIT	Analysis Date/Time	Analyst	Lab ID	Q
Tetrachloro-m-xylene (Surrogate)	SM-946 8082	877-09-8	100	93	5	93	12-106	9/12/03 9:23	Hipolla	58890-11	
Tetrachloro-m-xylene (Surrogate)	SM-946 8082	877-09-8	100	75	5	75	12-106			58890-12	
Tetrachloro-m-xylene (Surrogate)	SM-946 8082	877-09-8	100	90	5	90	12-106			58890-13	



A & B Environmental Services, Inc.  
1643 Federal Road  
Houston, Texas 77015

QUALITY CONTROL CERTIFICATE

Job Number: 59890

Report Date: 9/18/2003

QCType: LCS and LCSB		Method		Spike Added		LCS Result		LCSD Result		LCS Rec %		LCSD Rec %		RPD		%RPD CLimits		%Rec CLimits		QCbatchID		Qual.	
Parameter	Method																						
Aroclor - 1016	SW-846 8082			2	2.031	2.034	102	102	0.1	<36	42-132		q091103pchs1										
Aroclor - 1260	SW-846 8082			2	2.005	2.024	100	101	0.9	<35	42-132		q091103pchs1										

QCType: Method Blank																						
Parameter	Method	CAS #	Result	Units	D.F.	Rpt Limit	QCbatch ID	Qual.														
Aroclor - 1016	SW-846 8082	12674-11-2	BRL	mg/Kg	1	0.5	q091103pchs1															
Aroclor - 1221	SW-846 8082	11104-28-2	BRL	mg/Kg	1	0.5	q091103pchs1															
Aroclor - 1232	SW-846 8082	11141-16-5	BRL	mg/Kg	1	0.5	q091103pchs1															
Aroclor - 1242	SW-846 8082	53469-21-9	BRL	mg/Kg	1	0.5	q091103pchs1															
Aroclor - 1248	SW-846 8082	12872-29-6	BRL	mg/Kg	1	0.5	q091103pchs1															
Aroclor - 1254	SW-846 8082	11097-69-1	BRL	mg/Kg	1	0.5	q091103pchs1															
Aroclor - 1260	SW-846 8082	11096-92-5	BRL	mg/Kg	1	0.5	q091103pchs1															



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End 6



A & B Environmental Services, Inc.  
1643 Federal Road  
Houston, TX 77015

Report Date: 8/27/2003  
Total No. Pages: 6

Client Project ID  
Kuwait-RIO-01

KBR RIO-01  
Attn: Bruce Keyston  
4100 Clinton Dr. 03-405A  
Houston, TX 77020

Client PO #: Pending  
Date Received: 8/25/2003 13:47  
Collected by: Bruce Keyston

A & B Labs has analyzed the following samples . . .

Your Sample ID	A & B Lab ID
LPG-PB-01/LPG-Outside Office	59588-11
WTP-A-01/Center of bldg	59588-12
WTP-A-02/North end of bldg	59588-13
WTP-A-03/South end of bldg	59588-14
WTP-A-04/Downwind of tanker	59588-15
WTP-P-01/Danny Langford	59588-16
WTP-P-02/Jake Duhon	59588-17

This Laboratory is NELAC and AIHA certified. Thank you for choosing A & B Labs.

Approved By: \_\_\_\_\_

Analyst: \_\_\_\_\_

Title: \_\_\_\_\_

\_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_

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Job Number: 59588

LABORATORY TEST RESULTS

Date: 8/27/2003

CUSTOMER: KBR R10-01

PROJECT: Kuwait-R10-01

ATTN: Bruce Kayatone

Client Sample ID Parameter	Method	Flow Rate (LM)	Sampling Time(Min)	Volume (Liters)	ug Detected	D.F	Det Limk (ug)	Concentration (mg/m <sup>3</sup> )	Analyst Initials	Analysis Date/Time	Lab ID Matrix
WP-PS-01/Le-Outside Off Lead	NIOSH 7300	3	400	1200	BRL	1	2	< 0.002	SS	8/26/2003 10:28	59588-11 Air Cassettes
WTP-A-01/Center of Bldg Selenium	NIOSH 7300	3.5	229	801.5	BRL	1	2	< 0.002	SS	8/26/2003 10:31	59588-12 Air Cassettes
Chromium	NIOSH 7300	3.5	229	801.5	BRL	1	2	< 0.002	SS	8/26/2003 10:31	59588-12 Air Cassettes
WTP-A-02/North end of bldg Selenium	NIOSH 7300	3.5	218	763	BRL	1	2	< 0.003	SS	8/26/2003 10:35	59588-13 Air Cassettes
Chromium	NIOSH 7300	3.5	218	763	2.3	1	2	0.003	SS	8/26/2003 10:35	59588-13 Air Cassettes
WTP-A-03/South end of bldg Selenium	NIOSH 7300	3.5	218	783	BRL	1	2	< 0.003	SS	8/26/2003 10:39	59588-14 Air Cassettes
Chromium	NIOSH 7300	3.5	218	783	BRL	1	2	< 0.003	SS	8/26/2003 10:39	59588-14 Air Cassettes
WTP-A-04/Downwind of fan Selenium	NIOSH 7300	3.5	203	710.5	BRL	1	2	< 0.003	SS	8/26/2003 10:43	59588-15 Air Cassettes
Chromium	NIOSH 7300	3.5	203	710.5	BRL	1	2	< 0.003	SS	8/26/2003 10:43	59588-15 Air Cassettes
WTP-P-01/Danny Langford Selenium	NIOSH 7300	3	280	840	BRL	1	2	< 0.002	SS	8/26/2003 10:46	59588-16 Air Cassettes
Chromium	NIOSH 7300	3	280	840	BRL	1	2	< 0.002	SS	8/26/2003 10:46	59588-16 Air Cassettes

\*\* BRL - Below Reporting Limit



Job Number: 59588

LABORATORY TEST RESULTS

Date: 8/27/2003

CUSTOMER: KBR RIO-01

PROJECT: Kuwait-RIO-01

ATTN: Bruce Keystone

Client Sample ID Parameter	Method	Flow Rate (L/M)	Sampling Time(Min)	Volume (Liters)	ug Detected	D.F	Det Limit (ug)	Concentration (mg/m <sup>3</sup> )	Analyt Initials	Analyt Date/Time	Lab ID Matrix
MTP-P-021/ako Dulton Selenium	NIOSH 7300	3	286	868	BRL	1	2	< 0.002	SS	8/26/2003 10:50	59588-17 Air Cassettes
Chromium	NIOSH 7300	3	298	868	BRL	1	2	< 0.002	SS	8/26/2003 10:50	59588-17 Air Cassettes

\*\* BRL -- Below Reporting Limit



A & B Environmental Services, Inc.  
 1843 Federal Road  
 Houston, Texas 77015

QUALITY CONTROL CERTIFICATE

Job Number: 59598

Report Date: 8/27/2003

Parameter	Method	Spike Added	LCS Result	LCS/D Result	LCS Rac %	LCS/D Rac %	RPD	%RPD Client's	%Rec Client's	QC Batch ID	Qual.
Selenium	NIOSH 7300	1	0.93	0.89	93	99	6.3	<25	75-125	Q082603A/rse	
Chromium	NIOSH 7300	0.5	0.51	0.54	102	108	5.7	<25	75-125	Q082603A/r	
Lead	NIOSH 7300	0.5	0.49	0.53	98	106	7.8	<25	73-127	Q082603A/r	

QCType: Method Blank

Parameter	Method	CAS #	Result	Units	D.F.	Rpt Limit	QC Batch ID	Qual.
Selenium	NIOSH 7300	7782-49-2	BRL	ug	1	2	q082603A/rse	
Chromium	NIOSH 7300	7440-47-3	BRL	ug	1	2	Q082603A/r	
Lead	NIOSH 7300	7439-92-1	BRL	ug	1	2	Q082603A/r	

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End 7.

To: Chuck Adams; Herbert E. Myers; Mike Sumpster; Kallash Singal; Bruce Habel; Jack Loveladdy  
 Cc: Douglas Fletcher; Greg Badgett; Donald Lippiatte Jr.; Paul Porter; Johnny Morney; Doug Wilson; Rod Kimbro; John Waterous; Don Kane  
 Subject: Qarmat Ali WTP Soil Sample-Results

Following are the test results for the soil sample collected at the Quarmat Ali Water Treatment Plant on 7 August, 2003.

Test Required	Unit	Soil Samples				Protective Concentration Levels (PCL) for Soil
		CHR 1 (Surface Soil)	CHR 2 Surface Soil)	CHR 3 Surface Soil)	CHR 4 (Sludge)	
Barium	mg /kg	5.58	7.98	1.57	20.7	2800
Cadmium	mg /kg	<1	<1	<1	8	52
Chromium	mg /kg	2681	3710	770	16459	23000
Lead	mg /kg	11.75	6.38	9.43	93	500
Arsenic	mg /kg	<1	<1	<1	8.28	24
Selenium	mg /kg	793	1031	220	5590	310
Zinc	mg /kg	126	332	1743	3881	9900
Mercury	mg /kg	<1	<1	<1	<1	2.1

250  
 10/1/03

Protective concentration levels (PCL) for soil media are defined as combined ingestion, dermal contact, inhalation of volatiles and particulates, and ingestion of above ground and below ground vegetables in soil per to the Texas Risk Reduction Program Tier 1 Residential Protective Concentration Levels.

High levels of the Chromium, Selenium and Zinc have been determined.

Chromium and Zinc were the resultants from use of chemicals, Sodium Dichromate and Zinc Sulfate, for corrosion inhibitors.

All analyzed concentrations are below PCL except the concentrations of selenium. The source of the high concentrations of selenium is unknown at this time, based on the process knowledge of the operation of the WTP currently available.

KISR Laboratory was unable to analyze the samples for hexavalent chromium (Cr6+). In sodium dichromate, chromium exists in the hexavalent state. Hexavalent chromium is the more hazardous form of chromium. The Tier 1 Residential PCL for hexavalent chromium in soils is 120 mg/kg.

Sludge samples collected from the concrete tank sump and from the groundwater seep in the 1<sup>st</sup> Stage Pump House 9 August 2003 have been express shipped to Southern Petroleum Laboratories,

An air sample collected at the door of the KBR office trailer on 9 August 2003 was sent to SPL for chromium analysis.

In the interim, based on the results of the KISR analyses, implementation of the recommendations for limited access and the wearing of PPE stated in the trip report dated 10 August 2003 should be initiated and enforced. Medical monitoring for blood levels of chromium, selenium, and zinc should be implemented for all KBR personnel and KBR subcontractor personnel assigned to the WTP. Notification of these analytical results should also be given to other personnel who have been at the WTP, including the US Army, British Forces, and SOC. *(Rad Kimmins did)*

Additionally planning should begin, to implement an interim corrective measure to seal the soils in the areas designated in the WTP Plot Plan attached to the Trip Report dated 10 August, to prevent additional KBR personnel and KBR subcontractor personnel exposure. At this time it is recommended that consideration be given to using a liquid asphaltic sealant covered with gravel (small rounded aggregate) to seal the contaminated areas.

A ROM for this corrective measure should be prepared and submitted to USACE for approval prior to taking any action.

For any questions, please contact me.

**Young I. Lee, P.E, PhD**  
**Team RIO**  
**Manager, Environmental Engineering**  
**(965) 989-2835**