

TEXAS LUNG INSTITUTE

Qarmat Ali and Sodium Dichromate

The Science vs. The Myth

Gary K. Friedman M.D.

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EXECUTIVE SUMMARY

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Introduction: The Qarmat Ali water facility water treatment facility located in Basra, Iraq has been a functioning water treatment plant in operation for many years. It receives its water from the Tigris River. In the normal course of the operations of the facility, a chemical known as sodium dichromate was added to the water as an anti-corrosive. The chemical continues to be sold worldwide by industrial supply companies and chemical manufacturers for this purpose.

There are no known reports of illness among workers intimately exposed to this material during the years the water treatment plant (WTP) was in operations.

A search of the worldwide peer reviewed medical literature has failed to find a single epidemiologic study where use of Sodium Dichromate in a water treatment facility has caused a significantly increased risk of cancer or any other chronic illness or injury of any type. Even more remarkable a search of the data base of the U. S. National Library of Medicine and the

National Institutes of Health (NIH) fails to report an epidemiologic study that documents significant increased risk of cancer of any type caused by crystalline Sodium Dichromate (“SD”) (Source: search of Entrez Pub Med: Search terms 1. Sodium Dichromate and cancer, 2. Sodium Dichromate and lung cancer. Date of search 5-09-09).

During Iraqi hostilities, insurgents pillaged and vandalized the facility. Some of the bags of sodium dichromate were broken and the Sodium Dichromate (hereafter abbreviated as S.D.) spilled onto the ground. S.D. was present in pumps and other pieces of equipment. Residual ground contamination as a result of the normal operations of the plant while it was online was present. Some ground contamination as a result of the looting of the facility also may have occurred. The water treatment facility included numerous buildings and covered approximately 50 acres. Only two buildings and limited portions of the ground have been proven to be contaminated by S.D. It is probable that much of the ground contamination had been present for a prolonged period as a result of the normal operations of the facility. The latter is of importance as Hexavalent chromium is converted to nontoxic trivalent chromium in soil.

Air sampling has failed to document any hazardous levels of S.D. in the air during the time KBR employees have worked at the facility. Air sampling is the most important measurement in this matter, as allegations in this case center on inhalation as the means of exposure.

In the interest of national security it was deemed a priority to repair the water treatment facility. While ongoing hostilities from Iraqi insurgents threatened the immediate surrounding area, contractors from the United States were employed to supervise Iraqis who were repairing the facility. There is no dispute that work conditions were harsh and posed risks unlike those commonly experienced by workers in the United States. Workers described ambushes on convoys bringing them into the worksite. American contractors had been ambushed, killed and mutilated. There were descriptions of mortar attacks, booby traps and sniper attacks on the facility and active combat in the areas surrounding the plant. To protect the facility, U.S. and British military troops were deployed.

The workers had to initially be bussed in from Kuwait entailing a dangerous lengthy commute before reaching the worksite. The climatic conditions were equally harsh with low humidity, temperatures in excess of

130 degrees and periodic sandstorms. Desert insects and other desert conditions added to the discomfort.

Several hundred workers were employed to repair the water treatment facility. Ten of these workers have filed a lawsuit alleging vague complaints of injury and fear of future cancer risk as a result of alleged exposure to sodium dichromate.

The plaintiffs in this suit have seen numerous physicians of their own choosing or physicians retained by their attorneys. According to the plaintiffs, no doctor has ever advised them that they have ever suffered any illness or injury as a result of exposure to sodium dichromate.

Summary of findings - Medical:

1. There were 10 civilian contractor plaintiffs in litigation concerning alleged exposure to Sodium Dichromate. All 10 had seen physicians of their own choosing. Some had seen specialists specifically to determine if they had any illness or injury from Sodium Dichromate.
2. All 10 plaintiffs have testified that none of their physicians have ever advised them that they suffer from any illness or injury as a result of alleged exposure to Sodium dichromate.

3. None of their personal physicians have informed them they had a future significant risk of cancer.
4. Six of the ten plaintiffs were referred to an Occupational physician and toxicologist by the plaintiffs' attorney. This physician was retained as a plaintiffs' expert in this case. He found no objective evidence for any illness or injury caused by Sodium dichromate in any of the plaintiffs that he examined. He did not diagnose any of the claimants with any illness or injury attributable to S.D.
5. The plaintiffs' medical expert (see #4) could not perform a risk assessment for future risk of cancer because of the brevity and diminimus nature of the exposure. He noted that peer review medical literature has required lengthier durations of exposure, etc.
6. The majority of the plaintiffs had ordinary diseases of life preceding their assignment in Iraq that mimic the symptoms that they are currently alleging.
7. The majority of the 10 plaintiffs had histories of alcohol abuse or the use of illicit drugs. Substance abuse occurring during and following the course of their employment at the WTP is responsible for the symptoms in some of the claimants.

8. Several plaintiffs had preceding diagnoses of anxiety, depression, bipolar disorder and other psychiatric diagnoses prior to their deployment to Iraq.
9. At least 3 of the 10 claimants have been involved or are concurrently involved as plaintiffs in litigation or seeking compensation alleging that toxic agents other than chromium (asbestos or Agent Orange) were responsible for their symptoms.

The named plaintiff (Langford) had 2 separate lawsuits for asbestos. At the time of his pre-employment physical for KBR, when specifically asked about a prior history of asbestosis, he did not reveal his prior diagnosis. Approx. 3 months after his return from Iraq, Mr. Langford gave a deposition in his asbestos litigation attributing many of his symptoms to asbestos rather than chromium.

10. The above claimant testified before the Senate Democratic Policy Committee and did not disclose his diagnosis of asbestosis, concurrent litigation, and claims of symptoms attributable to that disease. Rather, he attributed his symptoms to Sodium Dichromate. He was only in Iraq at the WTP for a few weeks. This same plaintiff reported receiving chelation therapy to treat his chromium exposure.

This therapy is of no proven value and is not indicated in the treatment of bona fide chromium exposures. The doctor administering the treatment was later sanctioned by the Texas State Board of Medical Examiners.

11.A Safety man for KBR was a plaintiff and disgruntled employee. He only served at the WTP for 19 days before he engaged in disruptive behavior at a safety meeting. He disseminated information about S.D. to coworkers outside of normal channels. The reliability of the information is unknown. After his return to the United States and termination of employment, he maintained communication with prior coworkers, exchanging information about S.D. and other possible exposures.

He declined all offers of medical testing for chromium or medical surveillance as offered by KBR. His physician attributed his symptoms to anxiety and other emotional causes. He was described as a recovering alcoholic.

It is the opinion of this consultant that this individual's actions were the nexus of what his physician later described as mass psychogenic illness.

He informed the Senate Democratic Policy Committee (SDPC) that he had entered into the “chronic” stages of chromium poisoning. This was not true. No doctor ever diagnosed him with any illness or indicated he had ever been exposed to hazardous levels of chromium. His claims of “chronic stages of chromium poisoning” before the Senate Committee were fabricated. His doctor opined that his symptoms were due to anxiety and somatization. This physician later opined the man was malingering. A malingerer is one who falsifies or fakes an illness, usually for secondary gain.

12. The military USACHPPM found no evidence of injury in troops who were deployed to guard Qarmat Ali. Hexavalent chromium was tested in red blood cells in over 100 of the troops and found to be normal. The military opined that there was no evidence of injury from SD and that it was unlikely that any future illness or injury would occur.

Summary of findings - Exposure

Lack of proof of exposure to toxic levels of sodium dichromate - No one should have claimed they were hurt.

1. The allegations were exposure to air borne chromium through the route of inhalation.
2. Multiple air samples obtained at the WTP failed to disclose significantly elevated levels of chromium in the air.
3. Hexavalent chromium causes several common injuries to the skin, mucus membranes and other organs. No doctor ever reported finding any objective evidence of exposure on physical examination of any claimant.
4. The claimants alleged nosebleeds. No doctor ever reported witnessing a nosebleed or finding evidence of same. There are multiple causes of nosebleeds. The most common cause in a desert environment is desiccation (drying) of the nasal mucosa due to extreme heat and micro-trauma from sand and its digital extraction.

Increased risk of cancer – There is none:

1. **No evidence of risk assessment supporting plaintiff's claim:** The plaintiffs' counsel has alleged in the media that the plaintiffs have a 1 in 5 chance of getting cancer as a result of S.D. exposure. The plaintiffs are unable to provide any epidemiological studies,

reproducible mathematical calculations or formula that can be used to substantiate that claim. The claim is false.

2. **Circumstance of exposure:** IARC and plaintiff's expert Max Costa, PhD. have stated that increased risk of cancer ONLY occurs in the occupational setting of chromate production facilities and possibly electroplating. Neither IARC nor Max Costa, PhD. has ever reported increased cancer risk due to S.D. exposure in a water treatment plant (WTP) or under the circumstances alleged in this case.
3. **Nature of exposure:** The plaintiffs have never provided an epidemiologic study showing increased cancer risk in a water treatment facility or any other industrial site where the alleged exposure was due to crystalline sodium dichromate being used as an anti-corrosive.
4. Crystalline Sodium Dichromate continues to be sold world wide as an anticorrosive. There are no known epidemiologic studies demonstrating increased cancer risk among long-term users of the product.

5. **Level of exposure:** IARC reports exposure to Hexavalent chromium at levels of 1mg/m³ or greater for several years duration in reaching a determination that Hexavalent chromium was a human carcinogen. The worst-case exposures alleged but not proven by plaintiffs in this case are only a tiny fraction of those used by in IARC in determining carcinogenicity for Hexavalent chromium in production facilities.
6. **Duration of exposure:** There are no epidemiologic studies that show increased cancer risk with less than a 2-year exposure (even to high levels). The military cites similar thresholds of exposure in computing cancer risk.
7. **Carcinogenicity:** The plaintiffs have erroneously equated the carcinogenicity of sodium dichromate to other forms of Hexavalent chromium. Differences in levels of carcinogenicity have been documented for different Hexavalent compounds. In part, this relates to degree of solubility. In experimental animals, S.D. is less carcinogenic than other Hexavalent compounds, according to IARC and plaintiffs' expert.

8. **No objective measurement of exposure:** The plaintiffs have opined levels of air borne exposure that are logarithmic levels above those which have actually been measured. The actual levels of airborne chromium which have been documented at Qarmat Ali.
9. **Unreliable methodology:** The methodology the plaintiffs have used to opine the levels of exposure (see #8) has never been employed by other scientists and appears unique to the plaintiffs' expert. The methodology has never been endorsed or confirmed by independent scientists. The plaintiffs' expert himself has expressed uncertainty concerning his estimates. The plaintiffs' experts' estimates of exposure are exponentially higher than those that actually have been measured at the site.
10. **OSHA permissible limits:** Even using the plaintiffs' erroneous worse case scenario estimates of exposure, the plaintiffs would have been working far below the OSHA permissible exposure limits for CrVI applicable at that time.

Nosebleeds:

The claimants have claimed to have experienced nosebleeds while in Iraq.

1. No nosebleed has ever been confirmed by a physician on the plaintiffs return to the United States.
2. Nosebleeds secondary to chromium would be expected to persist, as would the underlying ulcer, perforation of the nasal septum, atrophy, or scarring from same.
3. No doctor has ever documented nasal ulcer, atrophy, scarring or perforation of the type that occurs after corrosive effects of Hexavalent chromium.
4. There is no written report or log documenting treatment of nosebleed from any source while the plaintiffs were in Iraq.
5. The KBR EMT in Iraq indicated he saw no increase in incidence or severity of nosebleeds at Qarmat Ali compared to other facilities where he served.
6. Nosebleeds are common and have many causes:
 - a. The most common cause in the desert is heat and drying (desiccation) of the nasal mucosa

- b. Cocaine use
 - c. Hypertension
 - d. Micro trauma (sand)
7. Several plaintiffs (including the lead plaintiff) had the inside of their noses carefully inspected by their personal physicians and were found to be normal.

Laboratory Studies:

Several plaintiffs were reported to have had questionably elevated blood chromium levels in Iraq – but normal urine chromium levels.

1. Because the laboratory could not identify specifically what type of blood test was performed, the significance of the blood test is unknown.
2. The normal urine indicates that a recent exposure had not occurred in Iraq.
3. Because blood tests remain positive for 120 days, a positive blood test could reflect exposure in the U.S. prior to deployment.
4. The lead plaintiff had a urine test positive for CrVI eight months after leaving Iraq proving his exposure to CrVI occurred in the U.S. –

unrelated to KBR employment in Iraq. This test was ordered by his personal physician and performed by a laboratory of his (or his doctor's) choosing. The test was performed seven months after his return to the U.S. It would indicate exposure in the preceding 48-72 hours.

Summary of KBR consultants' opinion concerning Qarmat Ali:

There were allegations of exposure to hazardous or toxic levels of sodium dichromate. The latter is a chemical commonly used as an anticorrosive worldwide. The alleged route of exposure was through inhalation. No hazardous level of exposure ever occurred.

Based on the above the author has the following opinions:

1. No claimant has sustained any injury or illness attributable to alleged exposures to sodium dichromate. All plaintiffs have acknowledged that no doctor has ever advised them of a causative role for sodium dichromate as the etiology of any illness or injury.

2. Base on our current knowledge of crystalline sodium dichromate and

the circumstances of exposure, no plaintiff is at significant risk for future development of cancer or any other disease due to alleged S.D. exposure at Qarmat Ali.

3. Other more probable cause exists for the symptoms alleged by the claimants. These include pre-existing medical conditions, alcohol and substance abuse, psychiatric conditions, and ordinary diseases of life present prior to assignment to Iraq or occurring following their return. In one key plaintiff, a diagnosis of malingering was rendered by his doctor.

4. Plaintiff retained expert has opined levels of exposure to Hexavalent chromium that are thousands of times higher than those documented by actual air sampling. His estimates are based on a flawed and unproven methodology.

5. Even using flawed worst case scenario, exposure levels opined by plaintiffs' retained expert Max Costa, PhD., the plaintiffs in this litigation would have been working in a permissible work environment for Hexavalent chromium based on the operative OSHA standard at the time.

- i. All air sampling levels were far below the acceptable limits.

- ii. No claimant was ever found by any physician to have objective evidence of injury to any exposure.
- iii. Plaintiffs' worse case scenario of **theoretical** levels of exposure was far below OSHA permissible levels.

6. The OSHA permissible levels of exposure are based on a cumulative dose estimate which will result in less than 1 in a thousand workers experiencing disease over the course of a working lifetime (45 years). The plaintiffs retained expert opine that the exposure was below the OSHA permissible level with a duration of exposure of only 3 months (mean).

7. A thorough review of the peer reviewed medical literature, ATSDR, OSHA, EPA, NIOSH etc. published reports and studies confirms that sodium dichromate at this intensity and duration of exposure (dose) would not cause a significantly increased risk for cancer:

- a. **Agent:** The plaintiffs have produced no epidemiologic study demonstrating that crystalline sodium dichromate when used as an anticorrosive causes a significant excess risk of cancer of any type.
- b. **Duration:** There is no epidemiologic study which documents a significant increased risk of cancer of any type for Hexavalent

chromium exposure of less than 2 years (even to Hexavalent chromium compounds which are proven carcinogens at exposure levels present in production facilities greatly exceeding those present or opined by the plaintiffs to have been present at Qarmat Ali).

c. **Intensity:** There is no epidemiologic study which has ever documented a significant increase risk of cancer of any type following exposure to S.D. at levels which were documented by air sampling at Qarmat Ali.

d. **Nature:** IARC, EPA and other federal agencies as well as Max Costa, PhD. PhD. (retained plaintiff's expert) have reported that Hexavalent chromium is carcinogenic in chromate manufacturing processes, pigment manufacturing and electroplating. Max Costa, PhD. states in his published work that Hexavalent chromium has been proven to be carcinogenic **ONLY** in such processes or under such circumstances of exposure. There is no epidemiologic study that has opined that Hexavalent chromium (including sodium dichromate) causes any type of cancer in occupational setting such as the WTP at Qarmat Ali.

8. Methodology employed by plaintiffs' experts in regard to alleged illness or injury or future risk is fatally flawed. The scientific methodology employed by the experts retained by the claimant's attorneys in evaluating the effects of an irritant inhalation are inconsistent with the methodology which they themselves have set forth in their own publications. An Occupational physician retained as an expert by the plaintiffs, has published on the necessity of reviewing medical records and other data in the assessment of alleging inhalation injury from an irritant.

In a text edited by Harber, et.al. (*Occupational and Environmental Respiratory Disease*, Chapter 30), plaintiffs' medical expert emphasized the need to review the patients' pre-existing medical condition, smoking history, examinations, laboratory and clinical findings by other doctors who have examined the patient. Such review is essential for evaluation of the patient. **None of the plaintiffs' experts ever reviewed a single medical record in regard to any of the plaintiffs.**

9. Laboratory testing: Chromium existing as Chromium III and Chromium VI can be detected in blood and urine in human beings. It is difficult to distinguish between the two forms of chromium and only a

limited number of reference laboratories can perform the test. Chromium III is considered either non-toxic or far less toxic than Chromium VI.

Chromium is only present for 48 to 72 hours in the urine following exposure. It is useful for monitoring recent exposures and is the most widely used test to monitor occupational exposures. It was absent from the urine in every one of the claimants tested in Iraq.

Chromium may be detected in the plasma component of the blood. It may also be detected in whole blood which includes the serum, red blood cells, white blood cells and platelets. Chromium may also be measured in the red blood cell itself. The chromium in the red blood cell is sometimes used as a surrogate for CrVI. Chromium VI can enter the red blood cell where it is converted to Chromium III. The red blood cell (RBC) chromium can be detected for the life of the red blood cell, which is 120 days.

Neither OSHA, EPA, ATSDR nor NIOSH specify that measurement must be made for RBC chromium or speciate urine or other specimens for Hexavalent chromium. Most regulations simply state that “blood” or urine samples can be submitted for measurement for chromium.

“Blood chrome”:

The initial samples obtained in Kuwait at the Pasteur Cerba laboratory were simply identified as “blood”. Several “blood” samples were positive. Pasteur Cerba laboratory was contacted and they could not state whether the “blood” test was whole blood, serum, plasma or RBCs that were measured. Thus the results of the blood tests performed in Kuwait at Pasteur Cerba laboratory are of unknown significance:

- a. If the specimen was whole blood, the results would be normal and could reflect CrIII, CrVI, or total chromium
- b. If the specimen was serum or plasma, the results could be normal and again reflect CrIII, CrVI or total chromium.
- c. If the specimen was RBC measurement, then it would be abnormal and presumed to reflect CrVI in the RBC, but could represent an exposure that occurred in the United States prior to departure for Iraq. The test remains positive for 120 days and in most cases the study was drawn within 120 of departure from the U.S.
- d. There is a possibility that the elevated results in Iraq represent contamination. The literature is replete with warnings to not collect

or store the specimen in any stainless steel instrument. There is testimony from Mr. Blacke claiming that the laboratory was using reusable syringes which then would be sterilized. This would indicate the probable use of stainless steel syringes. Stainless steel contains chromium and nickel and could contaminate the specimens.

Opinion: KBR met or exceeded the requirements for biological monitoring that most employers would perform for chromium. Commonly, only the urine testing is obtained for monitoring work place exposures.

KBR exceeded testing performed or recommended by the plaintiffs' medical expert. It is noted that when the plaintiffs were tested by Dr. Carson at the request of their attorney, no blood testing for chromium was performed and only a urine chromium was recommended. Furthermore, there is no proof as to whether the urine study was ever performed. No laboratory results were present in Dr. Carson's medical record and there is no evidence that the doctor ever received or reported the results of such a test result.

The laboratory used by the clinic examining KBR employees, Pasteur Cerba, is a French laboratory founded in 1967. It functions as a reference laboratory and offers its services worldwide. It is presumed to be reputable.

Urinary chromium:

Urinary chromium is a widely used test to evaluate occupational exposures to chromium. Most occupational medicine textbooks recommend the urine test as the methodology of choice for monitoring workplace exposures. This test was performed on the claimants. ATSDR stated that examination of end-of-shift chromium levels “indicated a correlation between urinary chromium and exposure to soluble Chromium VI compounds but not to insoluble chromates or Chromium III compounds” (Minoia and Cavalleri, 1988).

It is important to note that **none** of the plaintiffs in the Qarmat Ali litigation had any evidence of urinary chromium. Urinary chromiums were obtained while the workers were still in Iraq. Thus, there was no evidence for recent exposure to chromium.

10. Military laboratory testing: CHPPM did perform tests on red blood cells of military personnel at Qarmat Ali. All results were within

normal limits. CHPPM opined that no injury occurred or was likely to occur in the future resulting from exposure to sodium dichromate.

11. A significant factor in the nexus of the S.D. issue at Qarmat Ali appears to result from the actions of a disgruntled employee. The latter only worked for 19 days at the WTP. During this time, there are reports he spread information concerning S.D. to coworkers outside of normal lines of communication. He engaged in a public confrontation with a superior at a safety meeting and shortly thereafter left Iraq. He refused offers of laboratory testing or medical surveillance from KBR.

On return to the United States and again outside of his job duties, he maintained contact with coworkers, warning of hazards of S.D. and other possible exposures. On return to the U.S., he sought private medical attention. No objective evidence of injury was found. No diagnosis of S.D.-induced illness or injury was made. To the contrary, his symptoms were attributed to anxiety, somatization, and other emotional issues. One of the physicians labeled him a malingerer (one who fakes an injury, usually for secondary gain). He was referred by plaintiffs' attorney for medical examination and no S.D.-related diagnosis was made. He later testified before the Senate Democratic Policy Committee that he was in the chronic

stages of S.D. poisoning. The latter was untrue and was a diagnosis that he fabricated.

12. The plaintiffs' claims in the media of a one in five risk of developing cancer are unsubstantiated. This risk has never been replicated by any authority or had any statistical substantiation. It is my opinion that such a statement of cancer risk is false. It may mislead the public and unnecessarily frighten the plaintiffs.

13. Prior experience in Iraq and Kuwait has shown that allergies and infections of the nose and respiratory tract are one of the most common complaints to local inhabitants and military personnel. Prior military experience reported frequent sinus and respiratory symptoms and asthma, independent of any toxic exposure. None of the troops had alleged exposure to sodium dichromate.

Symptoms caused by such desert exposures are short-lived and do not differ from similar upper respiratory symptoms common to the United States.

14. The Department of Veterans Affairs issued a statement concerning symptoms not supported by objective findings, factors leading to patient

distrust and media involvement. These may all play significant roles in Qarmat Ali. This information may enhance a reader's understanding of the dynamics of this event when combined with the facts contained herein.

Respectfully submitted,

Gary K. Friedman, M.D.

Texas Lung Institute