City of Grand Island

Tuesday, February 22, 2011
Council Session

Item G8

#2011-43 - Approving Consideration to Proceed with Uranium Removal Installation System

Staff Contact: Gary R. Mader

Council Agenda Memo

From: Gary R. Mader, Utilities Director

Meeting: February 22, 2011

Subject: Municipal Water System Uranium Removal

Item #'s: G-8

Presenter(s): Gary R. Mader, Utilities Director

Background

In 2003, a new EPA regulation established a Maximum Contaminate Level (MCL) for uranium in drinking water. Uranium is a naturally occurring element in the aquifers of Nebraska and other states across the nation. Implementation of the new MCL began with the sampling of the state's municipal water systems in accordance with the EPA specified testing protocol. Samples of the Grand Island water supply for regulatory compliance were first taken in 2004. The sampling protocol requires testing on a rolling average, quarterly basis with the average of the most recent four tests being the number by which compliance is determined.

Sampling and testing of the Grand Island water system thus far show full compliance with the EPA regulation. Uranium is naturally occurring in the aquifer in central Nebraska. Uranium is not an acute concern but rather is a concern over a lifetime of exposure. According to the *Neb-Guide from the University of Nebraska, "....uranium in water supplies produces very little radioactivity, the health effects from exposure to uranium are primarily thought to be associated with the chemical properties of soluble uranium. Studies suggest that ingestion of high levels of uranium may be associated with an increased risk of kidney damage…Exposure to soluble uranium in drinking water has not been shown to increase the risk of developing cancer."*

The City's municipal water system is supplied primarily from its Platte River Well Field. This well field is comprised of 21 wells and a pumping station. Recent testing for State regulatory requirements has indicated composite uranium levels to be approaching the Maximum Containment Level (MCL) established by the EPA. Testing of individual wells for uranium has indicated most wells exceed this MCL. To allow use of these wells during high water system demand periods, additional piping was installed in the past year for blending with lower uranium concentration wells.

As a proactive measure, in case uranium levels cannot be controlled below the new MCL by well blending, the Department, with our consultant for this project, HDR Engineering of Lincoln, has undertaken a more detailed investigation to determine uranium removal methods and evaluate those best suited for the Grand Island system. Factors in the evaluation included; the review of available technologies; amount of uranium removal; capital costs; operational costs; and waste disposal.

HDR recently completed this evaluation of treatment options. The evaluation screened known water treatment methods and focused on coagulation/filtration, ion exchange, and adsorptive media as the most viable options for radionuclide removal. The recommendation of the evaluation was an adsorptive media system, and was presented at a meeting with Nebraska Health and Human Services, Nebraska Department of Environmental Quality, HDR, and City Utilities Staff in attendance. The use of this type of technology has been shown to be very effective in radionuclide removal, but its use has not been used in an application as large as would be required to treat Grand Island's water demand. The consensus at the meeting was that it may be useful to perform a large scale pilot program on selected wells at the Platte River Well Field. It is anticipated that a full capacity treatment system would be comprised of several modules the size of a pilot plant, therefore, utilization of the pilot plant could be incorporated into the final design solution. Based on the multiple phase structure of the uranium engineering services RFP, HDR was requested to provide a proposal for preparing specifications to issue for bids for an adsorptive media pilot plant. These specifications are for the components and accessories of an integrated treatment system. The suppliers for these systems are very specialized and details for the systems are not standard, therefore, the bidders may be required as part of the bidding process to perform small pilot demonstrations of their system's effectiveness in radionuclide removal from Grand Island's water. It is anticipated that the next phase would be to design facilities and infrastructure modifications for installing the removal system and prepare specifications to issue for bids for installation contractors.

Discussion

The presentation of the results of the evaluation of the uranium options was made at the Council Study Session of January 18, 2011. A copy of the Executive Summary from the Engineer's report is attached for reference. At the Study Session the Council had a number of questions regarding the issue and the Utilities Staff provided additional information after the initial presentation. Copies of the supplementary information are attached for reference. The matter is brought to the Council at this meeting for additional discussion and proposed action. The recommendation resulting from the HDR analysis is to install an absorptive media uranium removal system to treat the discharge from three of the 21 wells located at the City's Platte River Wellfield. The reduction of uranium in those wells will provide a margin of safety in meeting the revised uranium MCL utilizing the current process of blending the waters prior to discharge to the municipal water distribution system.

Alternatives

It appears that the Council has the following alternatives concerning the issue at hand. The Council may:

1. Move to approve
2. Refer the issue to a Committee
3. Postpone the issue to a future date
4. Take no action on the issue

Recommendation

It is the recommendation of City Administration that the Utilities Department be directed to proceed with final design, development of specifications and solicitation of bids for an absorptive media uranium removal system and the installation of said system, in accordance with the City Purchasing Codes.

Sample Motion

Make a motion to direct the Utilities Department to proceed with the final design, development of specifications and solicitation of bids for an absorptive media uranium removal system and the installation of said system.

0.0 EXECUTIVE SUMMARY

0.1 Introduction

The City of Grand Island (City) Water Supply System includes twenty-one wells, located in 1200-acre well field. The twenty-one wells have been tested for high uranium concentrations. The scope of this study is to examine uranium removal for these twenty one wells. The wells supply raw water to an onsite collection and pumping station for delivery to three reservoir/pumping stations in the City. The onsite collection system consists of North collection Basin (165,000 gallons) and the South collection basin (85,000 gallons). Wells 1 and 13-21 pump to the South Collection Basin and Wells 2-12 pump to the North Collection Basin. Three high pressure pumping stations provide water as required for residential, commercial and industrial use and fire protection through out the distribution grid.

Raw water from the well field is drawn from a 1200 acre island in the Platte River. The wells are classified as a groundwater supply, approximately 130-ft to 140-ft deep, yielding up to 2 mgd each of generally good quality water. Uranium is the parameter of concern (Maximum Contaminant Level (MCL) of 30 ug/L), for the wells under Permit A-10266, with composite levels ranging from 20 ug/L to a maximum of 50 ug/L dependent upon the wells in operation.

0.2 Study Objective

The study objective is to define the nature and extent of the regulatory issue, analyze the alternatives, to address the problems and define the recommended improvements and implementation plan.

This study report is comprised of the following two technical memorandums:

- Water Demand, Water Quality, and Technology Screening
- Uranium Removal Evaluation

0.3 Study Results

Current (Year 2010) average daily, maximum daily and maximum hour water demands are 12 mgd, 25.9 mgd and 43 mgd. Future (Year 2030) average daily, maximum daily and maximum hour water demands are expected to be 14.4 mgd, 31.1 mgd and 52.5 mgd respectively. Water quality data suggests that Uranium and gross alpha are the only contaminants of concern in raw water. Total Dissolved Solids (TDS), sulfate and manganese levels have approached secondary MCL levels on few occasions but are not a major cause of concern when evaluating for treatment technologies.

The treatment technologies of coagulation/filtration, ion exchange and adsorptive media (Water Remediation Technologies (WRT)) were screened as viable technologies to be investigated and evaluated further for recommended improvements and implementation plan. The technology of reverse osmosis was screened and eliminated because of high capital costs and high waste stream. Lime Softening was eliminated for the reasons of high chemical usage, high solids production and a labor intensive process.

Screened technologies were evaluated on several issues such as process viability, system configuration, finished water quality, residuals management and capital and O&M costs.

Bench scale and pilot scale testing results show that all the three processes are capable and viable alternatives for uranium and gross alpha removal. A central water treatment facility located at the well field is recommended for this application for operational ease and lowest expected capital costs. The finished water quality goal for uranium is recommended to be set at 22 ug/l, which is approximately 75% of the MCL. Based on removal efficiencies of the treatment technologies and finished water quality goals, only a portion of the maximum day demand needs to treated and then blended with raw water. To meet the future maximum day demand of 31.1 mgd, the required size of the WTP is 14 mgd – coagulation/filtration, 11 mgd – ion exchange and 12 mgd – adsorptive media.

For the coagulation filtration process, discharging the waste stream (backwash decant) directly to surface water is the preferred option. Disposal of the 1-percent residual solid stream to the WWTF is the preferred option. Due to high concentrations of uranium, arsenic, chloride, and conductivity, deep well injection is the only acceptable method for discharging residuals from the ion exchange process. The residuals from the adsorptive media process (WRT) would be the responsibility of the manufacturer.

Capital Costs for coagulation filtration are expected to be $18.2 million, adsorptive media - $17.9 million and ion exchange - $27.2 million.

Coagulation/Filtration and adsorptive media are suitable alternatives that can be implemented for the City's application. Implementation of a coagulation/filtration process will involve several confirmation steps such as a pilot scale testing to fine tune the design criteria and a study at the WWTF to determine the effect on the sludge by discharging of the treatment residuals. The coagulation/filtration process will also most likely have greater monitoring requirements for residual management. Adsorptive media (WRT) is more of a plug and play type of system and additional conformation steps aren't required.

It is recommended that a adsorptive media (WRT) treatment plant be implemented for this application in phased construction approach. A five (5) MGD plant is recommended to be implemented at this time. The plant would treat flows from a few selected wells. Future phases will be constructed when required to meet the regulatory requirements.

The City, however, should be aware that there are some risks associated with the implementation of an adsorptive media (WRT) system. These include supplier stability over the lifespan of the system; minimal competition among the various manufacturers; long term reliability of the disposal scenario; and large quantity of uranium stored on site prior to disposal. To mitigate these risks, it is recommended that the City employ a thorough procurement process where these risks are addressed/mitigated by the manufacturer of the system.

Pat Gericke

From: Gary Mader
Sent: Monday, January 31, 2011 8:25 AM
To: Pat Gericke
Subject: FW: Background Information for Uranium
Attachments: Nebraska Treatment Systems - Uranium.docx; MAP - Uranium Concentrations 1978-1983.pdf; WATER RATE COMPARISON 2011.doc

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From: Gary Mader
Sent: Friday, January 28, 2011 5:11 PM
To: Mayor Vavricek; Council C Haase; Council Carney; Council Donaldson; Council Dugan; Council Gard; Council Gericke; Council Gilbert; Council Niemann; Council Ramsey; CouncilNickerson
Cc: Mary Lou Brown; 'Tim Luchsinger'; 'Emily Muth'
Subject: Background Information for Uranium

Mayor and Council Members,

Upon completion of the review of uranium treatment options at the Study Session of January 18th, the Council requested additional background information regarding uranium in the waters of the state. Attached is background information as follows;

1. A report of treatment systems currently being used in the state as the impacts of the new uranium rule require water systems to implement removal/reduction systems. Most of the systems currently in service are for communities much smaller that Grand Island.

2. A map of the uranium concentrations found in the central Platte region. This map is dated but is the latest available at this time. You will note that uranium concentrations in ground water generally decrease as distance is increased from the Platte River. However, much of the area away from the river has been under heavy agricultural use for decades, and nitrate levels above drinking water standards are common in many areas. We have made initial contact with the Central Platte NRD and are informed that there are areas of the aquifer to the north that may have sufficient water supply and quality to be suitable for potable water. Developing that supply would require construction of a new well field and water transmission system similar to the Platte River Well Field, but at a greater distance from the City Of Grand Island.

3. A water rate comparison of Nebraska cities. Also, in response the Council's comments regarding rates for large customers, the costs of water for the JBS plant in Greeley Colorado are also included in the comparison.

It is currently planned that this item would be brought before the City Council for additional discussion and possible action at the regularly scheduled meting of Feb. 8th.

Gary R. Mader
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Recent Nebraska Treatment Systems

General Note: The MCL for Nitrate is 10 ppm. It is considered an acute (immediate) health hazard, primarily for infants and nursing mothers. The Administrative Order for nitrates usually includes the requirement for the water system to provide bottled water to customers.

Location: Bridgeport
River Basin: North Platte
Treatment: MCL violations for nitrates, arsenic, and uranium. The city's consultant recommended an ion exchange system for treatment system. They were allowed to discharge the waste to the North Platte River instead of the sewer system. The City has a 5-year permit to discharge to the river and is currently discharging over 30 ug/L. System serves approximately 1,500 people. Ion exchange was evaluated to be a higher cost option for GI in the HDR study. Utility sampling of the Platte River at Grand Island shows uranium levels near 30 ug/L.

Location: Clarks
River Basin: Platte
Treatment: MCL violation for uranium. Opted to drill new wells as an alternative source. Test wells were low or non-detect for uranium. However, after pumping for production the system began to pull in uranium. The city will install an Adedge absorptive treatment system, which can be used as either an adsorptive media with disposal or regenerated as an ion exchange system. The system will be used as ion exchange and the NDEQ has approved construction of a retention lagoon to hold 100% of the liquid waste. System serves 350. Ion exchange was evaluated to be a higher cost option for GI in the HDR study.

Location: Benkelman
River Basin: Republican
Treatment: MCL violation for arsenic and uranium. Arsenic will first be removed by Oxidation/Filtration followed by Ion exchange to treat for uranium. Proposed waste is to be sent to the city lagoon. All plans and specifications are currently under review by NDEQ and DHHS. System serves 1,000. Ion exchange was evaluated to be a higher cost option for GI in the HDR study.

Location: Gering
River Basin: North Platte
Treatment: MCL violation for arsenic, gross alpha, and uranium. Developed a new well field five miles from town along North Platte River to be blended with in-town wells. Current blending has uranium levels around 27-28 ppb. Should uranium levels rise in the future, the city has planned a lime softening plant with disposal of solids going to the landfill. The HDR study eliminated lime softening after the preliminary screening because of high chemical costs and labor requirements for a system of GI's size ($0.52 to $0.64/100cf).

Location: Schuyler
River Basin: Platte
Treatment: MCL violation for nitrates and uranium. Constructed three new wells primarily to remedy the nitrate issue. New wells currently have uranium concentrations in the low 20's. System serves approximately 5,000.

Location: Village of Sutherland
River Basin: North Platte
Treatment: Construction of new well field located south of I-80 and the Platte River to remedy nitrate and uranium issues to replace in-town wells. System serves 1,200.

Location: City of Laurel
River Basin: Platte, via Logan Creek to the Elkhorn River
Treatment: Construction of a new well outside of town to remedy selenium and uranium issues. System serves 870.

Location: McCook
River Basin: Republican
Treatment: The water system had historical violations for nitrates, arsenic, and uranium. Ion exchange selected instead of reverse osmosis system or new well field. The city purchased property next to a former air force base for the well field, but the public had concerns regarding future groundwater contaminants. The liquid waste stream from the ion exchange system was not allowed to be discharged to the Republican River because of high salinity. The selected disposal option was a deep earth injection well constructed at a cost of $1,000,000 with annual operating costs of $50,000. The cost of the injection well added $0.14/1000 gal ($0.10/100 cf) to the water rates. System serves 7410. Ion exchange was evaluated to be a higher cost option for GI in the HDR study.

Location: Alda
River Basin: Platte
Treatment: Multiple violations of uranium MCL led to construction of a pumping station and pipeline for connection to the City of GI water system. Considered construction of new wells. System serves 650.

WATER RATE COMPARISON January 20, 2011							
	Residential 1" Meter Per 100 cubic feet (ccf)		Commercial 2" Meter Per 100 cubic feet (ccf)	Industrial 6" Meter Per 100 cubic feet (ccf)		Industrial 10" Meter Per 100 cubic feet (ccf)	
	5	**50**	**100**	**500**	**8,000**	**68,422**	**76,484**
Lincoln	$9.66	$116.94	$151.81	$983.83	$14,568.31	$83,275.80	$93,071.13
MUD -							
*Winter	$19.62	$64.57	$134.66	$721.58	$7,866.33	$60,051.90	$66,977.16
*Summer	$19.62	$88.90	$164.43	$870.43	$7,866.33	$60,051.90	$66,977.16
North Platte	$16.60	$76.52	$192.60	$814.39	$7,837.85	$63,614.24	$71,043.52
Norfolk	$14.50	$69.97	$152.39	$733.83	$7,558.83	$62,542.85	$69,879.27
Fremont	$15.32	$43.28	$163.78	$518.25	$6,168.25	$51,484.75	$57,531.25
Hastings	$16.35	$62.25	$110.07	$626.74	$6,176.74	$50,889.02	$56,854.90
Columbus	$10.60	$58.30	$121.45	$624.00	$7,599.00	$64,027.46	$71,525.12
Kearney	$13.25	$69.50	$135.00	$674.91	$10,049.91	$85,619.31	$95,696.81
Grand Island – *Current rates	$7.83	$41.10	$76.75	$338.35	$4,449.35	$36,775.12	$41,088.29
*Increase$0.23 per ccf	$8.98	$52.60	$99.75	$453.35	$6,289.35	$52,512.18	$58,679.61
*Flat Increase (29%)	$10.00	$53.03	$99.02	$436.55	$5,740.66	$47,448.15	$53,013.10
Greeley CO	$23.71	$133.94	$245.74	$945.01	$13,960.21	$118,836.93	$132,803.33

R E S O L U T I O N 2011-43

WHEREAS, in 2003, EPA implemented a new regulation establishing a maximum contaminate level (MCL) for uranium in drinking water; and

WHEREAS, the City of Grand Island's water system thus far is in full compliance with the EPA regulation, but uranium levels are close to the new standard; and

WHEREAS, the consulting firm of HDR was hired to evaluate uranium reduction methods to ensure the City of Grand Island's water system remains in full compliance with the EPA regulation; and

WHEREAS, the proposed uranium reduction system engineering report was presented to Council at the Study Session of January 18, 2011; and

NOW, THEREFORE, BE IT RESOLVED BY THE MAYOR AND COUNCIL OF THE CITY OF GRAND ISLAND, NEBRASKA, that the Utilities Department is hereby directed to proceed with procurement and installation of an absorptive media uranium removal system to treat three wells at the Platte River Wellfield.

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Adopted by the City Council of the City of Grand Island, Nebraska, February 22, 2011.

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Jay Vavricek, Mayor

Attest:

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RaNae Edwards, City Clerk

Approved as to Form ¤ _____
February 18, 2011 ¤ City Attorney