Mr. Price

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23 MAY 1986

From: Commander, Atlantic Division, Naval Facilities Engineering Command
To: Commanding General, Marine Corps Base, Camp Lejeune

Subj: TRANSMITTAL OF SURVEY OF POTABLE WATER TREATMENT PLANTS AND SWIMMING POOL WATER TREATMENT

Ref: (a) NAVFAC INSTRUCTION 5090.1 of 21 Jun 83

Encl: (1) Survey of Potable Water Treatment Plants and Swimming Pool Water Treatment

1. In compliance with reference (a), the subject survey for your Activity was conducted during the week of 14 April 1986. Results of the survey for potable water treatment plants and swimming pools are forwarded as enclosure (1) for your retention and use.

2. Point of contact concerning this matter is Mr. Jim Chen, AUTOVON 565-2930.

J. R. Bailey
J. R. BAILEY
By direction

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SURVEY OF POTABLE WATER TREATMENT PLANTS AND SWIMMING POOLS WATER TREATMENT AT MARINE CORPS BASE, CAMP LEJEUNE

MAY 1986

UTILITIES, ENERGY, AND ENVIRONMENTAL DIVISION
ATLANTIC DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA 23511-6287

Prepared by:

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SURVEY OF POTABLE WATER TREATMENT PLANTS
AND SWIMMING POOLS WATER TREATMENT
AT
MARINE CORPS BASE, CAMP LEJEUNE

I. INTRODUCTION

In accordance with NAVFAC INSTRUCTION 5090.1 of 21 June 1983, a survey of all the potable water treatment plants and swimming pools at Marine Corps Base, Camp Lejeune (MARCORB Camp Lejeune), was conducted between 14 and 18 April 1986. The survey objectives are to ensure that these treatment plants and swimming pools are operated in conformance with applicable standards and drinking water regulations adopted by the Environmental Protection Agency (EPA) and the state regulatory agency.

II. OBSERVATION AND DISCUSSIONS

A. POTABLE WATER TREATMENT PLANTS

1. MARCORB Camp Lejeune currently operates eight potable water treatment plants as follows:

Name	Capacity (MGD)
Hadnot Point WTP	5
Holcomb Boulevard WTP	2
Tarawa Terrace WTP	1
Camp Johnson WTP	0.75
Courthouse Bay WTP	0.8
Air Station WTP (New River)	3.5
Rifle Range WTP	0.6
Onslow Beach WTP	0.25

2. There are approximately 100 existing wells scattered around the Base supplying raw water to the above eight water treatment plants. The Plants are operated three shifts a day. Additional 14 new wells (four for Hadnot Point WTP and 10 for Holcomb Boulevard WTP) will be constructed in the near future. Attachment A is a list of all wells and their capacity. Twelve of the existing wells have been shutdown due to the high Volatile Organic Carbon (VOC) levels in the water. In addition, seven wells at New River Air Station were shutdown because of excessive chloride. The seven wells also caused high Trihalomethane (THM) in the Air Station distribution system.

3. Hadnot Point WTP consists of five 1 MGD spiractors, five 1 MGD rapid sand filters, and a recarbonation system. Well water is collected into a 750,000 gallon underground concrete raw water reservoir. The water is chlorinated prior to entering the reservoir. From the reservoir raw water is pumped into the bottom of the spiractors. Hydrated lime is dissolved in two lime feeders and then fed into the spiractors via a separate inlet adjacent to the raw water inlet. Inside the spiractor intimate mixing of the water, lime, and the catalyst takes place. As the water rises in the conical shell, its velocity is gradually reduced and it is softened and clarified.

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The softened water then receives carbonation to adjust the pH followed by rapid sand filtration. Filter effluent is fluoridated with sodium fluoride and then pumped into 0.75 MG and 2.0 MG finished water storage tanks. The finished water is then pumped into the Hadnot Point distribution system. The spiractors use beach sand as the catalyst. The sand is replaced every 1,500 hours of operation. In addition, the operator draws off a dump truck of catalyst twice a week from each spiractor. It is reported that each rapid sand filter is backwashed once every 48 hours of operation. The newly installed recarbonation system uses propane gas and a submerged burner to generate carbon dioxide for pH adjustment of the softened water. The recarbonation system also has a control panel for monitoring pH and propane feed rate, etc. Two existing old chlorinators are located in the water treatment plant building with chlorine cylinders housed in the adjacent chlorine room. The chlorine room is provided with a leak detector but does not have a ventilation system. There is a plan to replace the existing chlorinators. New chlorinators will be located in the chlorine room and chlorine cylinders will be placed outside the chlorine room. Every two hours, the operator tests the treated water and the stored water in the tanks for hardness and chlorine. Also, P&MO alkalinity tests are performed on the spiractor effluent every two hours. pH and fluoride on the treated water are tested once a shift. Once a week, a sample is forwarded to the Base laboratory for further testing.

4. Holcomb Boulevard WTP is a 2 MGD plant consisting of two 1 MGD spiractors, and two 1 MGD rapid sand filters. This plant is currently undergoing expansion and will become a 5 MGD plant. The underway construction will provide a 2 MG raw water storage, a 2 MG finished water storage, three 1 MGD spiractors, three 1 MGD rapid sand filters, a sulfuric acid feed system for stabilization, and pumps, etc. After the expansion is completed, the plant will serve both Camp Johnson and the Tarawa Terrace systems in addition to the Holcomb Boulevard system. The current operation involves operating eight deep wells simultaneously. The raw water softening process is identical to the Hadnot Point WTP. Fluoridation is accomplished by dissolving sodium fluoride and feeding it into the filter effluent. After every 1,500 hours of operation, all the catalyst in the spiractor is replaced. Also, a dump truck of the catalyst is drawn off from each spiractor twice a week. Once a day, the operator backwashes the sand filters. Although a new exhaust fan has just been installed in the chlorination room that houses three chlorinators and chlorine cylinders as part of expansion, there is no appropriate air inlet available. Same procedures as Hadnot Point WTP are used by the operator on the testing of water samples.

5. New River Air Station WTP (3 MGD capacity) consists of two 1,200 gpm spiractors (usually only one is used), three 1 MGD rapid sand filters that use anthracites and sands as media, and a recarbonation system. Raw water is pumped from 10 wells out of the total of 25 wells into the bottom

of the spiractors. Operation is identical to the Hadnot Point WTP. Chlorination is achieved by adding gas chlorine to the raw water just before lime feed and to clearwell effluent. Effluent from spiractors receives recarbonation and flows to sand filters and clearwell. Water in clearwell is pumped to a 200,000 gallon and a 225,000 gallon finished water storage tanks that are interconnected for feeding the distribution through another set of pumps. Because naturally occurring fluoride is present in some of the wells, fluoridation is achieved by blending the high fluoride well water with the low fluoride wells. The catalyst in the spiractors is changed at the same frequency as Holcomb Boulevard WTP. Once every two days, the operator backwashes the sand filters. The in-plant water samples testing practices are identical to Holcomb Boulevard WTP. The chlorination room that houses the two Pennwalt chlorinators is equipped with a small exhaust fan but there is no air inlet.

6. Rifle Range WTP is a 600,000 gpd capacity softening plant consists of a Permutit aerator, three 10-foot diameter multi-media pressure filters, and two 6-foot diameter zeolite softeners (150,000 gallon per regeneration each unit). Raw well water (normally only two out of the four wells are used at one time) is pumped to the aerator for removing hydrogen sulfide and oxidizing iron and then falls into a detention tank located underneath the aerator. A small amount of hydrated lime is dissolved in a steel tank and pumped into the detention tank for pH adjustment and settling out impurities. Effluent from the detention tank is chlorinated and then pumped through the pressure filters and zeolite softeners and into a 300,000 gallon storage tank for distribution. Only 70 percent of the water from the pressure filters passes through the zeolite softeners. The effluent from the softeners is then blended with the remaining 30 percent of unsoftened water to achieve the desired hardness. The zeolite softeners, installed four years ago, are equipped with automatic regeneration equipment controlled by a flow meter. Because automatic regeneration is not operational, the softeners are regenerated manually based on the hours of operation. Pressure sand filters, also installed four years ago, are provided with automatic backwash based on loss of head. But they are also backwashed manually after every so many hours of operation. The chlorination room houses two gas chlorinators (one is spare) and is equipped with an exhaust and leak detector. Fluoridation is not available at this plant. Once every two hours, the operator tests for hardness, chlorine, and chloride on samples from softener effluent and delivered water.

7. Courthouse Bay WTP is a newly renovated plant with a capacity of 800,000 gpd. This plant has similar layout as the Rifle Range WTP. Raw water (normally from five wells) goes through a Permutit aerator, detention tank, six 10-foot diameter pressure filters and four 6-foot diameter zeolite softeners with 30 percent bypass. Small amount of lime is also used. Effluent from the softeners is pumped into a 360,000 gallon ground storage tank which feeds the distribution system. Chlorination room and water sample testing procedures are identical to the Rifle Range WTP.

8. Onslow Beach WTP is a 250,000 gpd plant consisting of two 4-foot diameter zeolite softeners and two 5-foot diameter pressure filters. Raw water is obtained from two wells. Part of the water flows to a small aerator and the remaining part is bypassed. Seventy percent of the effluent flows through the zeolite softeners, and 30 percent goes through the pressure filters. Effluents from both softeners and pressure filters are blended, chlorinated and pumped into a 200,000-gallon ground storage tank. Water is then pumped into the distribution system. The chlorination room contains two chlorinators, an exhaust, and a leak detector.

9. Tarawa Terrace WTP is a 1 MGD lime softening plant equipped with a 1 MGD spiractor. This plant is scheduled to be abandoned as soon as Holcomb Boulevard WTP expansion is completed. Water from Holcomb Boulevard WTP will supply Tarawa Terrace distribution system. All the existing wells at Tarawa Terrace can be pumped back to Holcomb Boulevard plant if they are needed.

10. Camp Johnson WTP is a zeolite softening plant with 750,000 gpd capacity. This plant will also be abandoned when Holcomb Boulevard plant is expanded. This distribution system is to receive water from Holcomb Boulevard plant. All the existing wells at Camp Johnson area will be shutdown.

11. Once a week, operators collect the required number of bacteriological water samples and forward them to the Base's Environmental Laboratory for bacteriological analysis. Chlorine residual is tested by the operator on site at the same time. As required by State regulatory agency, inorganic analyses on water samples are performed by a contracting lab once every three years. At present, five water samples from New River Air Station system and one sample from Hadnot Point system are taken quarterly for THM analyses. Industrial and Environmental Analysis, Incorporated handles all the THM analyses for the Base. It is expected that THM analyses will also be required on the Holcomb Boulevard since more than 10,000 people will be served by this system when the expansion is completed. All the wells on the Base were sampled for volatile organic carbon (VOC) a year ago with JTC lab performing all the analyses. Some wells at Hadnot Point system were found to contain trichloroethylene, dichloroethylene, perchloroethylene, and methylene chloride. The only contaminant found in some Tarawa Terrace wells was perchloroethylene while the contaminant in Rifle Range area was trichloroethane. As a result, all the wells containing high VOC have been shutdown.

B. SWIMMING POOLS

1. MARCORB Camp Lejeune operates six swimming pools as follows:

Name	Capacity (gallon)
Tarawa Terrace	300,000
Camp Johnson	440,000
Area 2 Training	440,000

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Name	Capacity (gallon)
Area 5 Training	440,000
Air Station Officer's	188,000
Air Station Enlisted	288,000

2. The Tarawa Terrace Pool is equipped with a 10-foot diameter sand filter, a caustic soda feed system using 50 percent liquid NaOH for pH adjustment and a Pennwalt gas chlorinator. The caustic soda feed system consists of a 55-gallon drum of caustic soda and a metering pump sitting on top of the drum. In the chlorine room, a leak detector and exhaust are provided.

3. Camp Johnson pool, Area 2 Training Pool and Area 5 Training Pool are identical in terms of both capacity and layout. Each pool is equipped with three 10-foot diameter sand filters, pH adjustment, and gas chlorination. Caustic soda feed is used on Area 2 and Area 5 pools while hydrochloric acid is used on Camp Johnson Pool for pH adjustment. A Pennwalt chlorinator, two chlorine cylinders, a scale, a leak detector, and an exhaust fan are available in each chlorine room. It was discovered that none of the three exhaust fans were operational.

4. New River Air Station Officer's Pool is provided with two small sand filters, a caustic soda feed system for pH adjustment and a gas chlorinator. The chlorinator was temporarily removed during the winter. The small chlorine room is equipped with a leak detector and an exhaust fan.

5. The water treatment equipment at the Air Station Enlisted Pool has exactly the same layout as the Officer's Pool except there are six small filters.

6. All six pools are provided with Strantrol Model 311B Automatic Pool Controllers connected to a computer located in Base Maintenance's Utilities Division. The controllers control chlorinator and pH pumps to maintain precise chlorine and pH values as selected by set level knobs on the control panel. The pH and chlorine residuals are shown on the computer printout which is monitored daily by the computer operator. In addition to the automatic control, the operator collects water samples twice a shift and analyzes for pH and chlorine residual.

III. RECOMMENDATIONS

A. POTABLE WATER TREATMENT PLANTS

1. Provide air inlet for chlorine room to create cross ventilation at Holcomb Boulevard WTP.

2. For the chlorine room at the Air Station WTP, provide air inlet and verify the exhaust fan capacity to ensure that it can provide one complete air change per minute.

3. For Rifle Range WTP, repair automatic regeneration on the softeners and automatic backwash on pressure filters.

4. Use the following equations to calculate the approximate lime and carbon dioxide dosage for spiractors:

Amount of 93 percent hydrated lime in pounds per million gallons water = (6.63 x mg/l MO alkalinity of raw water) + (15.1 x mg/l CO_2 in raw water)

Amount of carbon dioxide in pounds per million gallons water = 7.2 x (P-alkalinity of spiractor effluent)

B. SWIMMING POOLS

1. Repair the chlorine room exhaust fans at Camp Johnson, Area 2, and Area 5 Pools to provide adequate ventilation.

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WATER WELLS
AT
MARINE CORPS BASE, CAMP LEJEUNE

Holcomb Boulevard WTP

Well #	GPM
602	154 High VOC, Shutdown 30 Nov 84
603	140
606	183
608	207 High VOC, Shutdown 6 Dec 84
609	119
610	195
613	190
615	214
616	210
620	228
622	320
629	200
632	205
633	210
634	219, High VOC, Shutdown 14 Dec 84
635	146
636	119
637	130, High VOC, Shutdown 14 Dec 84
638	192
639	105
640	154
641	335+
642	128
651	242, High VOC, Shutdown 4 Feb 85
652	216, High VOC, Shutdown 8 Feb 85
653	197, High VOC, Shutdown 8 Feb 85
607	New Wells
628	New Wells
654	230
655	110
623	242
601	150, High VOC, Shutdown 6 Dec 84
661	280
662	168
4009	450
4007	200

4 New Wells Under Construction

Attachment A

WATER WELLS
AT
MARINE CORPS BASE, CAMP LEJEUNE

Hadnot Point WTP

Well #	GPM
643	190
644	210
645	192
646	133
647	200
648	267
649	257
650	349

10 New Wells Under Construction

Courthouse Bay WTP

Well #	GPM
43	100
44	128
220	104
221	240
43 (new)	-

Tarawa Terrace WTP

Well #	GPM
23	160, High VOC, Shutdown 8 Feb 85
25	130
26	128, High VOC, Shutdown 8 Feb 85
30	-
31	111
52	236
53	-
54	119
67	119

All these wells will be pumped to Holcomb Boulevard WTP if needed.

WATER WELLS
AT
MARINE CORPS BASE, CAMP LEJEUNE

Camp Johnson WTP

Well #	GPM
142	100
161	125
197	100
267	175
628	40
629	115
630	140

All these wells will be abandoned.

Onslow Beach WTP

Well #	GPM
164	159
190	210

New River Air Station WTP

Well #	GPM
100	50
201	60
325	100
502	400, High chloride
504	250?
600	162, High chloride
604	151
700	100
1,000	203
1,001	170
106	226, High chloride
131	287, High chloride
190	250
191	250, High chloride
1,251	190
1,253	125
1,254	154
1,255	100
1,256	104
4,140	100, High chloride
4,150	128, High VOC, Shutdown 8 Feb 85
5,001	137
5,009	115
203	207, High chloride

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WATER WELLS
AT
MARINE CORPS BASE, CAMP LEJEUNE

Rifle Range WTP

Well #	GPM
45	201
47	104
97	151
229	300, High VOC, Shutdown 8 Feb 85