

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 06/00/78	3. REPORT TYPE AND DATES COVERED
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4. TITLE AND SUBTITLE DETAILED SAMPLING AND QUALITY CONTROL PROCEDURES FOR THE CALGON WATER TREATMENT FACILITY AT ROCKY MOUNTAIN ARSENAL	5. FUNDING NUMBERS
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6. AUTHOR(S) PRUSINSKI, D.	
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ROCKY MOUNTAIN ARSENAL (CO.) COMMERCE CITY, CO	8. PERFORMING ORGANIZATION REPORT NUMBER 81356R61
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER
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11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED	12b. DISTRIBUTION CODE
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13. ABSTRACT (Maximum 200 words) THIS PAPER IS INTENDED TO COVER THE SAMPLING AND QUALITY CONTROL PROCEDURES FOR THE CALGON CARBON ADSORPTION SYSTEM WHICH TREATS THE GROUND WATER AT THE NORTH BOUNDARY OF RMA.

DTIC QUALITY INSPECTED 3

14. SUBJECT TERMS GROUNDWATER, CHEMICALS	15. NUMBER OF PAGES
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
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~~81356R61~~
~~Original~~

DETAILED SAMPLING AND QUALITY CONTROL PROCEDURES

FOR THE CALGON WATER TREATMENT FACILITY

AT

ROCKY MOUNTAIN ARSENAL

81356R61
original

IN SUPPORT OF PROGRAM

UNDER ITARMS 1.05.12

By

Process Development and Evaluation Division of

The Contamination Control Directorate

ROCKY MOUNTAIN ARSENAL
Commerce City, Colorado 80022

June 1978

19950127 092

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INTRODUCTION:

This paper is intended to cover the sampling and quality control procedures for the Calgon Carbon Adsorption System which treats the ground water at the north boundary of Rocky Mountain Arsenal. The samples frequency and their location are given below.

LOCATION	SAMPLE FREQUENCY (OR READING)	PHASE
Influent to filter	Up to 15/day with random grab samples	Start-up
Filter effluent	Up to 15/day with random grab samples	
Adsorber effluent	Up to 15/day with random grab samples	
Differential pressure across filters	1/hr. during 8 hr. work day	
Totalizer flow	1/hr. during 8 hr. work day	
Instant flow	Up to 15/day with random readings taken at times of grab samples	
Influent to filter	2/day and 1 random grab sample	Pseudo Steady State (Stabilization Period)

Reasons for control charts:

- (1) Early warning* of DIMP breakthru.
- (2) Records of plant operation.
- (3) Verification of experiments leading to plant.
- (4) Early warning* out of control conditions.
- (5) Plant problems pinpointed thus trouble-shooting simplified.
- (6) Day-to-day operation can be monitored and changes made studied.

The levels of certain materials in the ground water in the vicinity of the Calgon Plant have been closely ranged and can be used for an initial baseline. This baseline will be altered by the new information so as to maintain a realistic and current baseline. For the materials (contaminates) which have no prior

* The control chart is an excellent indicator of when the contaminate levels have exceeded standards set by the Project MANAGER'S OFFICE.

history a baseline can be started using the first 8-10 analyses samples and updated as new analyses are reported. Both inputs of data, prior history and no prior history contaminates, will be loaded into the SIAO computer to generate control charts on the applicable chemicals and water qualities. Thus, not only will a bookkeeping of these materials be made but a monitoring of plant operations can also be made.

LOCATION	SAMPLE OR READING FREQUENCY	PHASE
Filter Effluent	2/day and 1 random grab sample/week	Stabilization Phase
Differential Pressure	1/day during 8 hr. work day	
Totalizer Flow	1/day during 8 hr. work day	
Instant Flow	2/day	
Influent to Filter	1/day and 1 random grab sample/week	
Filter Effluent	1/day and 1 random grab sample/week	Steady State Phase
Adsorber Effluent	1/day and 1 random grab sample/week	
Differential Pressure Across Filters	1 week	
Totalizer Flow	1 week	
Instant Flow	1/day and 1 random reading/week	

Chemicals similar to those being tested for will have an effect on the control charts. Thus, some of the new unknown chemicals can be detected from control chart variations. Periodic testing of samples for all constituents plus control chart monitoring should enable unknown and/or new chemical compounds to be reliably found when the chemical compounds first make their appearance.

ADDITIONAL INFORMATION:

1. Compounds tested for with prior level history and the approximate ranges of contaminate levels.

1.1. Those compounds having known prior levels will have the previous levels incorporated into the statistical baseline with the new data updating the control chart parameters. This method of updating leads to accurate and stable control chart levels.

2. Compound tested for with no prior level history (baseline).

2.1. The first ten inputs of data will be used to set the initial control chart point. The data from the samples which follow ~~which are to~~ ^{will} be used to update the control chart parameters. Again, accuracy and stability of the control chart levels will be continually improved.

CALGON PLANT OPERATIONS (QC PROGRAM)

Some notes: Use of control charts

\bar{x} - Mean

$\pm 3\sigma$ - ^{MEANS} Gives only .3% of all values fall outside by random change--
99.7% that fall outside ~~otherwise~~ are significant deviations
and indicate process exceeding limit.

How \bar{x} values shown -- baseline from history and computation of similar operations in same industrial environment.

SAMPLE GRAPH - See attached.

What should be plotted:

DIMP
pH
TOC
Suspend Sol

DCPD (monitor only)
Conductivity
Fls
Differ. press. filter

Data flow: Samples to MALD -- analysis for compounds listed.

Results to SIAO -- plot of control charts

Results to PDE -- record and control of equipment

Partial results to Calgon --- contract requirements

Special Note: Some compounds / qualities have no statistical baseline, therefore, running baseline statistics will be generated using the formulation below:

(1) Subgroup averages method:

$$\bar{x} \pm 3\sigma_{\bar{x}} = x + \frac{3\sigma}{\sqrt{n}}$$

\bar{x} = sub group average

$\sqrt{\bar{x}}$ = std. dev. of population of average of sub group

\sqrt{s} = std. dev. of population of individ. values

n = number of values in each sub group

(2) Series subgroup method (better):

\bar{x} = average of subgroup

R = Range = maxi - min value of subgroup

$\bar{\bar{x}}$ = Average of all subgroups taken

\bar{R} = Average range of all subgroups

Statistics Calculated:

Averages $\bar{x} + A_2\bar{R}$ $\bar{x} - A_2\bar{R}$

Ranges $D_4\bar{R}$ $D_3\bar{R}$

Upper limit Lower limit

A_2, D_4, D_3 From charts of Control Limit Factors

(Juran
Sect. 23-9
"Q.C. Hdbk.")

SAMPLE FREQUENCY AND SIZE: Rationale

It was determined after a technical and statistical analysis that the sample frequency could be reduced to one sample per day of 2 liter size. The size of the sample was set by MALD and Calgon Technical Department -- each group needed a liter sample to perform the indicated analyses. The sample frequency was set from two constraints: (1) the concentration levels from one hour to the next hour will not significantly vary since the influent water is well mixed*, and (2) the dewatering wells concentration levels change very little from one week to the next week. The first constraint indicates the concentration levels of contaminants will not build-up nor dilute over a period of time at any point except where the adsorption process is taking place or at the filter. The second constraint indicates the feed (influent) water contaminate levels to the Calgon Plant can be expected to remain fairly constant over long periods (months) of time. With these two constraints, well-mixed and pseudo-steady contaminates' levels, it was decided to take samples at the following frequencies:

Start-up Phase⁺ = 15 samples and/or readings per day

(Stabilization) Pseudo-steady State = (1 month-6 months) 2 samples and/or readings per day

Steady State = (6 months - indefinitely) 1 sample and/or reading per day

NOTE: Adjustments in the number of samples and/or readings per day may have to be made if influent water to the Calgon Plant varies greater than previous history has indicated.

* - Due to turbulent flow and changes in pipe diameter & direction.

+ - A certain amount of grab samples will be pulled during the plant start-up.

X AND R DATA SHEET AND CONTROL CHART

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				TEST																	CLOUDY				
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AMP Ltr		X2	1428	1118	888	763	663	881	888	1158	2857	885	1585	2413	3108	2588	3434	3885	2719	3878					
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