



Office of Inspector General
Report of Audit

EPA PROCEDURES TO ENSURE
DRINKING WATER DATA INTEGRITY

E1HWE5-23-0001-5100516

September 29, 1995

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

September 29, 1995

OFFICE OF
THE INSPECTOR GENERAL

MEMORANDUM

SUBJECT: EPA Procedures to Ensure
Drinking Water Data Integrity
Audit Report No. E1HWE5-23-0001-5100516

FROM: Michael Simmons *Michael Simmons*
Deputy Assistant Inspector General
for Internal and Performance Audits

TO: Robert Perciasepe
Assistant Administrator for Water

Attached is our final report titled EPA Procedures to Ensure Drinking Water Data Integrity. This audit report contains findings that describe the results of our nationwide audit of regions' and states' procedures for reviewing the validity of drinking water test data.

We appreciate the opportunity to respond to the Office of Water's request for a nationwide review of drinking water data integrity issues. We hope that the results of our review will be useful to your office as you continue your work to assure a safe drinking water supply throughout the nation.

This report represents the opinion of the Office of the Inspector General. Final determinations on matters in this report will be made by EPA managers in accordance with established EPA audit resolution procedures. Accordingly, the findings described in this audit report do not necessarily represent the final EPA position and are not binding upon EPA in any enforcement proceeding brought by EPA or the Department of Justice.

Your response to our draft report is included as Appendix 1. Based on the Office of Water's response and discussions at the exit conference, we made appropriate changes to this final report, including the revision of text and recommendations contained in the draft report.

Action Required

In accordance with EPA Order 2750, we have designated you as the Action Official for this report. The Action Official is required to provide this office with a written response to the audit report within 90 days of the final audit report date. The response should address



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all recommendations. For corrective actions planned but not completed by the response date, reference to the specific milestone dates will assist us in deciding whether to close this report. We have no objection to the release of this report to the public.

Should you or your staff have any questions regarding this report, please contact Leah Nikaidoh, Audit Manager, Northern Audit Division, at (513) 366-4365.

Attachment

Executive Summary

PURPOSE

The Environmental Protection Agency's (EPA) Office of Ground Water and Drinking Water (OGWDW) officials requested a nationwide audit of drinking water data integrity issues: (1) because of their concern that falsified data might be going undetected and could result in potential threats to human health, and (2) to aid them in planning how to use limited resources efficiently and effectively.

The Centers for Disease Control and Prevention (CDC) estimated that over 940,000 people become ill every year from drinking contaminated water. Of those, CDC estimated 900 people die each year.

The objectives of the audit were to determine:

- the frequency with which operators of community, surface public water systems (PWSs) throughout the nation reported invalid or potentially falsified drinking water test data, and
- what procedures EPA regions and states used to detect invalid or potentially falsified data.

BACKGROUND

OGWDW, the regions, and the primacy states are responsible for ensuring that the water the public drinks is safe and free of harmful contaminants. EPA delegates "primacy" authority to states meeting the Safe Drinking Water Act's and EPA's implementing regulations.

OGWDW guidance published in 1991 to assist regions and states in detecting falsified data stated that the problem of data falsification may be larger than originally suspected. It also stated that:

Executive Summary

...with the promulgation of new regulations under the Safe Drinking Water Act, there is an increased incentive for water systems to purposely submit invalid compliance data. This is due to the cost of compliance with the new regulations and an increased complexity in the monitoring and reporting requirements.

According to the guidance, sanitary surveys are likely the best vehicle for detecting erroneous test data. A sanitary survey is an on-site review of the water sources, facilities, equipment, and operation and maintenance of a PWS to evaluate the adequacy of those elements for producing and distributing safe drinking water.

This audit was a follow-on effort to work we conducted in Region 5 from January through June 1994. During that audit, we found that operators at about 4 percent of all surface water systems within Region 5 reported invalid or potentially falsified data.

RESULTS IN BRIEF

Overall, the results of our nationwide review showed that operators at community, surface PWSs generally reported valid data. Based on our statistical sample review, we projected nationwide that about 12 percent of PWSs reported erroneous data one or more times from 1991 through 1994. Although these PWSs served only about 0.1 percent of the population, some improvements would provide further assurance that operators are accurately reporting test data. Very small and small-sized PWSs most often reported erroneous data, and about 58 percent of the erroneous data cases involved invalid data, rather than data which might have been deliberately falsified. Operators reported invalid data because of:

- (1) a lack of training and knowledge on how to properly

Executive Summary

test water samples, and record and report results; or
(2) improperly functioning equipment.

According to OGWDW's Appendix G guidance, sanitary surveys are likely the best vehicle for detecting instances of invalid or falsified data. However, states' sanitary survey procedures generally did not include data quality review steps, nor did state officials require PWS operators to certify to the validity of reported data. Because most states did not (1) use sanitary surveys to review the quality of reported operational test data and (2) have operators certify to the authenticity of reported data, officials missed opportunities to identify and correct testing and reporting problems.

RECOMMENDATIONS

Our detailed recommendations follow the findings in Chapter 2. However, in summary, we are recommending that the Assistant Administrator for Water require the Director of EPA's Office of Ground Water and Drinking Water to:

1. request that the regions coordinate with the states to follow up on the 48 PWSs, or operators, which we found reported invalid or potentially falsified test data and consider providing training to, or taking enforcement actions against, them;
2. revise EPA's Appendix G guidance to include additional steps to identify erroneous data and provide updated examples to illustrate the types of data patterns indicative of erroneous data, and redistribute this revised guidance to the regions;
3. update EPA's sanitary survey training materials to include reviews of data quality [for example, comparison of monthly operational reports (MORs) with on-site logs and bench sheets];

Executive Summary

4. establish schedules, with the regions, for providing sanitary survey training to state officials; and,
5. discuss with EPA regions and state officials the feasibility of including a certification block on MOR forms for PWS operator to sign and certify to the accuracy of the reported data.

AGENCY COMMENTS AND ACTIONS

We provided the draft report to the Office of Water on August 7, 1995. The Assistant Administrator for Water provided a written response to our draft report on September 27, 1995. This response is included as Appendix 1 of the report. The audit report has been modified to incorporate the Office of Water's comments, concerns, and perspectives, where appropriate.

The Office of Water generally agreed with the audit report recommendations. However, the Assistant Administrator stated that his office could not commit to implementing all of our recommendations due to significant resource constraints they are facing. The Assistant Administrator's responses to our recommendations are included following the detailed recommendations in Chapter 2, along with additional comments from the Office of Inspector General.

OIG EVALUATION

Although the future of drinking water funding levels is uncertain, the program office needs to provide specific target dates for implementing recommendations 1 through 4, and 6, once EPA's fiscal 1996 budget is approved.

Table of Contents

Executive Summary	i
Chapters	
1 Introduction	1
Purpose	1
Background	2
Scope and Methodology	9
Prior Audit Coverage	12
2 Data Integrity Enhancements Needed	15
Twelve Percent Of PWSs Reported Erroneous Data	16
Site Visits Confirmed Problems With Some PWSs	18
Data Falsification Issues Not A Priority For EPA Or States	19
Conclusion	26
Recommendations	29
Agency Comments and Actions	30
OIG Evaluation	32
Exhibits	
Exhibit 1 Region 1 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	35
Exhibit 2 Region 2 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	36

Exhibit 3	Region 3 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	37
Exhibit 4	Region 4 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	38
Exhibit 5	Region 5 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	39
Exhibit 6	Region 6 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	40
Exhibit 7	Region 7 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	41
Exhibit 8	Region 8 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	42
Exhibit 9	Region 9 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	43
Exhibit 10	Region 10 Surface Water Systems the OIG Reviewed That Submitted Erroneous Data	44
Exhibit 11	Calculation of Sample Results Projected to the PWS Universe	45
Exhibit 12	Site Visits Summary	47
Appendices		
Appendix 1	Office of Water Response to Draft Report	51
Appendix 2	Abbreviations	55
Appendix 3	Distribution	57

Chapter 1: Introduction

PURPOSE

U.S. Environmental Protection Agency (EPA) Office of Ground Water and Drinking Water (OGWDW) officials requested a nationwide audit of drinking water data integrity issues: (1) because of their concern that falsified drinking water data may be going undetected resulting in potential health threats, and (2) to aid them in planning how to use limited resources efficiently and effectively. If water system operators report invalid or falsified test results, serious health risks could go undetected. Moreover, if a state does not detect invalid or falsified test data and investigate the situation, the state's ability to take proactive measures to prevent contamination of the water supply is negated.

Americans drink over one billion glasses of water a day. The Centers for Disease Control and Prevention (CDC) estimated that over 940,000 people become ill every year from drinking contaminated water. Of those, CDC estimated 900 people die each year. Moreover, controversy has recently been generated amongst the public regarding the overall quality of our nation's drinking water supply and the technology of the systems that provide it.

The objectives of this audit were to determine:

- the frequency with which operators of community, surface public water systems (PWSs) throughout the nation reported invalid or potentially falsified drinking water test data, and
- what procedures EPA regions and states used to detect invalid or potentially falsified data.

This is a consolidated report which includes the results of our 1994 pilot audit of Region 5, as well as our most recent review of the other nine EPA regions. During our

Chapter 1: Introduction

1994 audit of Region 5's program¹, we found that operators at about four percent of the surface water systems in Region 5 reported erroneous drinking water test data that the states did not detect.

BACKGROUND

Responsibilities Of EPA And States

The Safe Drinking Water Act of 1974 (the Act), as amended, required that EPA ensure that PWSs monitor and test the quality of drinking water and distribute water to consumers that is safe to drink. EPA's OGWDW, the regions, and the states are all responsible for achieving the goals of the Act.² Over the last decade statutory monitoring and testing requirements increased, but, according to EPA officials, only limited EPA and state resources were available for reviewing the validity of reported drinking water test data.

Under the current safe drinking water program, all states and Federal territories, except Wyoming and the District of Columbia, are responsible for ensuring that the water within their jurisdiction is safe for consumption. EPA delegates this authority, called "primacy", to states meeting the Act's and EPA's implementing regulations. To maintain primacy, states must adopt regulations at least as stringent as the Federal Government's, and demonstrate that they can effectively execute program requirements.

In 1991, OGWDW's Enforcement and Program Implementation Division published its Public Water System Supervision Data Verification Guidance.

¹Region 5 Procedures to Ensure Drinking Water Data Integrity (EPA Report No. 4100540, issued September 30, 1994).

²The Act applies to all 50 states, the District of Columbia, Puerto Rico, Indian lands, the Virgin Islands, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the Republic of Palau. Currently, EPA administers public water system supervision programs on all Indian lands.

Chapter 1: Introduction

Appendix G of this guidance, entitled "Guidance on Detecting Invalid or Fraudulent Data" presents ways to identify systems that may be submitting invalid or falsified data and outlines the correct procedures for investigating and prosecuting systems suspected of falsifying data. This guidance states that EPA regions and states with primacy should identify and prosecute systems suspected of falsifying data, as part of their oversight of drinking water programs.

According to the guidance, the problem of data falsification may be larger than originally suspected. It explains that:

...with the promulgation of new regulations under the Safe Drinking Water Act, there is an increased incentive for water systems to purposely submit invalid compliance data. This is due to the cost of compliance with the new regulations and an increased complexity in the monitoring and reporting requirements.

OGWDW maintained an automated database called the Federal Reporting Data System (FRDS) as a centralized repository for information about PWSs nationwide and their compliance with monitoring requirements, maximum contaminant levels, and other requirements of the Act. State officials are required to assess monitoring results and submit quarterly reports to OGWDW for input to FRDS. FRDS was an "exception-based" database with nearly all data being provided by states.

Responsibilities Of Public Water Systems

The majority of community PWSs treat the drinking water they distribute to the public to ensure that the water customers drink is safe. Some sources of drinking water contamination include turbidity (or "cloudiness") of water due to suspended matter such as clay, silt, and microscopic organisms; bacteria from human or animal sources; pesticide run-off; underground injections of

Chapter 1: Introduction

hazardous wastes; disinfection by-products; and lead, copper, and asbestos from corroding pipes.

PWSs must test their water supply for various contaminants and report the results to their states. Generally, the larger the population a system serves, the more often that system is required to test and report. The type of PWS (community or noncommunity) and the water source (surface or groundwater) determine what contaminants must be monitored. The four basic contaminant groups PWSs must test for and report on are: (1) inorganic chemicals, (2) organic chemicals, (3) radionuclides, and (4) microbiological contaminants.

PWSs generally either contract with an independent certified laboratory or a state-owned laboratory to analyze water samples from their systems involving complex tests, such as those for bacteria, most inorganic and organic chemicals, and radionuclides. Many states require independent labs to report the results of their tests directly to the state before reporting the results to the water system, their client.

While PWSs generally contract out their complex tests, they conduct other tests in-house. Water system personnel conducting these operational tests are normally required to report the results of these tests to their state once per month. Water operators submit this data on monthly operational report (MOR) forms.

At least three measures are important indicators of water quality: turbidity, chlorine residual, and pH.

- Turbidity measurements indicate how well filtration systems are removing particulates from drinking water. As turbidity levels increase, the efficiency of a water treatment plant in filtering particulates in water decreases. If turbidity levels are too high, health risks from microbes increase.

Chapter 1: Introduction

- Chlorine measurements, including the time chlorine is in contact with water in the distribution system, are very important also. Although chlorine can kill microbes and prevent the regrowth of any bacteria that make it through the filtration system, microbes may not be inactivated by chlorine if the time chlorine is in contact with the microbes is too short.
- A measure of the acidity or alkalinity of a liquid is referred to as its pH. Improper pH levels affect the efficiency of disinfectants and also affect the types and levels of disinfection by-products generated. In addition, pH levels that are too acidic increase the leaching of metals, such as lead, from within the distribution system into the water supply.

Many PWS operators are certified to perform operational-type tests on drinking water samples, including those for turbidity, chlorine residual, and pH. Each state has an operator certification program, which is responsible for ensuring that operators are properly trained on PWS monitoring requirements. According to regional officials, state training is available for all operators, certified or not. The requirements for certified operators vary by state. These requirements are based on the type and size of the PWS, its water source and quality, and the population affected. If operators do not continue to meet these requirements, their certifications can be revoked. This could result in the loss of their jobs. Falsification of test data is also grounds for revocation of an operator's certification.

Potential For Invalid Or Falsified Data

PWS operators are in the business of providing drinking water to the public. Thus, it is in the best interest of operators to provide a safe, reliable, and high quality drinking water product to their customers. However, the increased cost of new regulations and the increased complexity in monitoring and reporting requirements might be an incentive to submit falsified data.

Chapter 1: Introduction

Because PWS operators and staff are directly involved with recording and reporting results of operational tests, there is an increased chance that these results might be erroneous (either invalid or falsified). Operators might report invalid test data because of malfunctioning equipment, improper testing procedures, or a misunderstanding of how to properly record and report test readings. Also, PWS personnel might falsify test data in several different ways. For example, PWS personnel could: (1) report fabricated data without taking required tests; (2) boil or microwave samples, thereby killing harmful organisms; (3) submit samples from sources outside the PWS; or (4) collect all samples from one location within the PWS.

Potential Health Risks

If PWS operators report invalid or falsified test results, serious health threats could go undetected. Moreover, if a state does not detect and investigate questionable test data, the state's ability to take proactive measures to prevent contamination of the water supply is negated.

Drinking water regulations combined with improved water treatment practices over the past twenty years have significantly reduced the occurrence of many waterborne diseases. As a result, water in the U.S. is considered very safe to drink. However, despite increased monitoring and testing requirements, contaminated drinking water still remains a serious health threat. The CDC estimated that over 940,000 people in the U.S. become ill every year from drinking contaminated water. Of those, they estimated 900 people die each year.

According to the Associate Director of EPA's Health Effects Research Laboratory in Research Triangle Park, North Carolina, testing for the presence of microbes in drinking water is very important in ensuring harmful microbes that can cause sickness are not present. Microbes include parasites, bacteria, and viruses. Such organisms, if ingested, can result in varying degrees of sickness from mild gastrointestinal illness to death. He further stated that a recent outbreak of cryptosporidiosis in

Chapter 1: Introduction

Milwaukee, Wisconsin, shows the significance of turbidity measurements.³ He said that the high turbidity measurements that were reported were good indicators that microbes may have passed through the filtration system and into the water supply.

Types, Sizes, And Number Of PWSs

A PWS, as defined by EPA, provides piped water for human consumption to at least 15 service connections or serves an average of at least 25 people for at least 60 days each year. PWSs are classified as either community or noncommunity systems. Community systems provide water generally to the same population year-round, such as in residential areas.⁴

OGWDW categorizes the size of PWSs by the number of people each serves. There are five size categories as shown in figure 1.

Figure 1: PWS Size Categories

<u>Population Served</u>	<u>Size Category</u>
25 - 500	Very Small
501 - 3,300	Small
3,301 - 10,000	Medium
10,001 - 100,000	Large
More than 100,000	Very Large

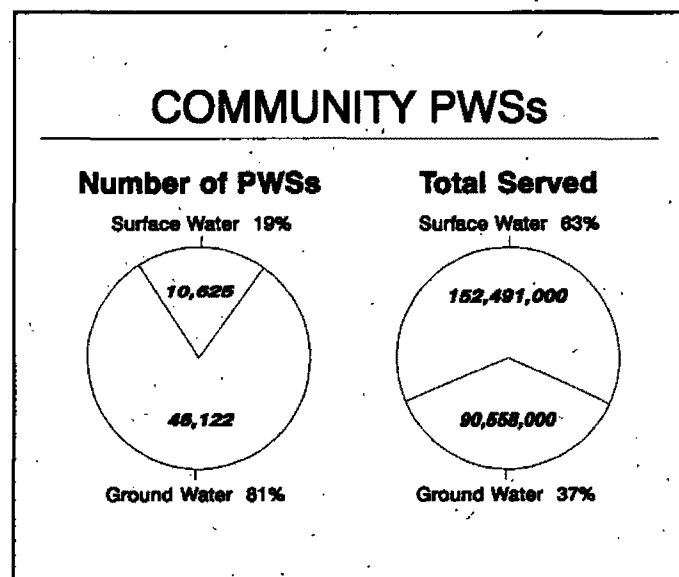
³According to EPA, in 1993, over 370,000 people in the Milwaukee area were affected by the parasitic microorganism *Cryptosporidium* in the water supply. Reports indicated that at least 100 people in the Milwaukee area died as a result of the parasite. Although the Milwaukee PWS operators did not report invalid or falsified data, the outbreak highlighted the potential health effects associated with turbidity violations.

⁴Noncommunity systems are either institutions such as schools, hospitals, and work places that regularly serve at least 25 of the same people at least 6 months a year, or establishments such as campgrounds and motels that supply water to people at non-residential facilities.

Chapter 1: Introduction

As of January 1995, there were about 186,800 PWSs in the United States and its territories. An estimated 56,700 PWSs of the total number of PWSs were community systems--about 46,100 were ground water PWSs while the remaining 10,600 were surface PWSs. Although surface community PWSs comprised only about 19 percent of all community systems, those PWSs served about 63 percent of the population which received their drinking water from community PWSs.

Figure 2: Community PWSs



PWSs obtain the water that they distribute to the public from either: (1) groundwater sources--such as springs and aquifers⁵, or (2) surface water sources--such as rivers, lakes, and reservoirs. Both types of water sources are subject to contamination. However, because surface water sources are exposed to the air and are accessible to human and animal use, these water sources require more extensive treatment before they can be used for human consumption.

⁵An aquifer is an underground geological formation containing usable amounts of groundwater that can supply wells and springs.

SCOPE AND METHODOLOGY

Our audit was national in scope, intended to provide OGWDW officials with the comprehensive observations and projections that they requested. As a result, although our audit work focused primarily on the efforts of each EPA region and its states to detect questionable test results reported by community surface water systems, we did not draw any conclusions regarding specific regions or states. We also interviewed OGWDW officials in Washington, D.C., and obtained information regarding OGWDW's efforts in the data integrity area. We focused only on community surface systems. Therefore, throughout this report "PWS" refers only to those community systems with surface water sources.

OGWDW officials requested that we concentrate our efforts on community systems because those PWSs distribute drinking water to most of the nation's population. OGWDW provided the Office of Inspector General (OIG) with a random sample of 271 community surface PWSs from FRDS for review. OGWDW used the automated random sampling capability of FRDS to select the 271 PWSs⁶. The sample was selected from the total of 4,417 community surface PWSs, located in the continental United States, excluding Region 5 states.⁷ To determine the sample size, we used a 95 percent confidence interval, an error discrepancy rate of 25 percent, and an error tolerance level of 5 percent. FRDS randomly generated PWSs for every state except Delaware, Mississippi, Nebraska, and Rhode Island.

⁶The statistical sampling technique used for this review is the same approach--random sampling without replacement--used by data verification teams to make inferences about the number of discrepancies that exist between the FRDS database and PWS records. This approach is described in the PWSS Data Verification Guidance, Appendix B. The sample size calculation formulae selected for this audit were based on recent OGWDW data verification audits.

⁷We reviewed all 452 community surface PWSs in Region 5 during our 1994 audit of that Region.

Chapter 1: Introduction

We did not conduct a separate review of FRDS to validate the accuracy of its data. However, we did identify 19 PWSs in our original sample that were incorrectly coded in FRDS and, therefore, needed to be replaced with systems meeting our criteria. For example, some systems were categorized in FRDS as surface systems when, in fact, they were groundwater systems. Other PWSs in the sample were either not active, served less than 25 people, or purchased water from another PWS and were, therefore, dropped from our original sample.

We replaced all PWSs discarded from the original sample with substitute PWSs. OGWDW provided an additional list of randomly selected PWSs for our use in case of coding errors in FRDS. We used this list and replaced PWSs from the state from which they were dropped.⁸ For example, we replaced a PWS in North Dakota which had been a groundwater system since 1991--but was coded in FRDS as a surface system--with another North Dakota PWS from the substitute list of randomly selected systems.

We performed audit work within every EPA region and all 44 states within our sample. We reviewed PWS files and interviewed officials at each state's environmental or public health agency responsible for oversight of its drinking water program. Because some states maintained PWS files at several different district offices throughout their states, and because of limited OIG resources, we were unable to travel to every state. As a result, for the states of Montana, North Dakota, South Dakota, Utah, and Virginia, state officials sent either the original files or copies of the files to us to review and certified to the authenticity of any copies.

We reviewed MORs, where available, for a four year period--January 1991 through December 1994. While

⁸For Arkansas PWSs, we randomly selected seven PWSs from a list supplied directly by Arkansas officials, rather than the additional list provided by OGWDW. All seven Arkansas PWSs on the original sample list were miscoded, as were five of the seven Arkansas PWSs on OGWDW's replacement list.

Chapter 1: Introduction

reviewing these MORs, we attempted to answer the following question:

How probable was it that the test values reported by this surface water system appeared valid and were based on actual tests?

We looked specifically for operational test readings--such as those for turbidity, chlorine residual, and pH--that did not fluctuate at all or fluctuated very little over the course of several consecutive months. We also looked for any other obvious patterns in reported data over time. We considered such data to be questionable and suspect, in accordance with OGWDW's Appendix G. We also looked for additional indicators of potential data falsification, such as correction fluid on MORs or the use of pre-printed forms to record results. Because we looked for obvious cases of invalid or potentially falsified data, there may be other cases of such data that we did not identify.

Of the 94 PWSs we identified as having reported suspect test data, we conducted unannounced site visits at 14 PWSs and an announced visit at 1 PWS. An OIG engineer accompanied us on each site visit, while state officials accompanied us on all but two of the visits. We judgmentally selected these 15 PWSs, based on the size and location of the systems, and the data patterns reported. We visited three PWSs in Ohio, two in Colorado, Illinois, and Indiana, and one in California, Louisiana, New Mexico, North Carolina, Oregon, and Tennessee. We visited 9 small PWSs, 4 medium-sized PWSs, 1 large PWS, and 1 very large PWS. During the site visits, we: (1) interviewed PWS personnel, (2) examined original test records, (3) inspected the equipment and overall condition of the facility, and (4) observed water plant operators conduct certain water tests we requested.

We conducted our national fieldwork from November 4, 1994 to July 14, 1995. Each OIG audit division which performed work provided its respective region or regions

Chapter 1: Introduction

with a written summary document at the completion of their work. Regional comments to those summaries have been provided to OGWDW.

We performed our audit in accordance with the Government Auditing Standards issued by the Comptroller General (1994 revision). As part of our audit, we also reviewed OGWDW's and regions' recent Federal Managers' Financial Integrity Act reports. Neither OGWDW nor any of the regions cited data falsification as a material weakness. During our audit, we did not detect any internal control weaknesses significant enough to be reported as material risks to program operations. However, we have identified opportunities to strengthen the management controls over the reporting and review processes for drinking water data.

PRIOR AUDIT COVERAGE

The OIG issued a report on September 30, 1994, which addressed Region 5's procedures to ensure the integrity and validity of drinking water test data (EPA Report No. 4100540). The report stated that Region 5 and state officials placed a low priority on reviewing reported data for falsification, and states within that Region did not have formal procedures to do so. Operators at about four percent of all Region 5 surface water systems reported invalid or potentially falsified test data.

The OIG issued a report on July 30, 1993, which addressed Region 1's enforcement of the Act, including its data falsification efforts. Region 1 and its states did not routinely conduct data falsification reviews or follow-up on cases of questionable data that were identified.⁹

⁹Audit Report of Region I's Enforcement of The Safe Drinking Water Act (SDWA) (EPA Report No. 3100291).

Chapter 1: Introduction

The U.S. General Accounting Office (GAO) issued two reports related to drinking water quality and data integrity. An April 1993 report focused on the importance of sanitary surveys as a way to ensure the quality of drinking water distributed to the public. The report stated that: (1) the frequency of sanitary surveys by the states had declined and that many states were not conducting surveys as often as EPA recommended, (2) inadequate training of state inspectors might have contributed to survey flaws, and (3) EPA placed limited emphasis on sanitary surveys.¹⁰

According to a June 1990 GAO report, most EPA and state officials GAO interviewed did not believe data falsification was extensive. These officials also told GAO that falsifying test results was relatively easy and incentives for doing so would increase in the future.¹¹

¹⁰Drinking Water: Key Quality Assurance Program is Flawed and Underfunded, (GAO/RCED-93-97).

¹¹Drinking Water: Compliance Problems Undermine EPA Program as New Challenges Emerge, (GAO/RCED-90-127).

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Chapter 2: Data Integrity Enhancements Needed

Primacy states are responsible, under 40 Code of Federal Regulations (CFR) Part 142, for administering and enforcing drinking water regulations, and reviewing PWS-reported test data. In turn, all PWS operators are required, under the Act and 40 CFR Part 141, to ensure that all appropriate drinking water tests are conducted and test results are accurately reported. Accurate test data are necessary to assure that the quality of drinking water provided to the public meets all drinking water standards. According to OGWDW's Appendix G guidance, sanitary surveys are likely the best vehicle for detecting instances of invalid or falsified data.

Overall, the results of our nationwide review showed that operators at community, surface PWSs generally reported valid data. Based on our statistical sample review, we projected nationwide that 11.6 percent (566 of 4,869) of PWSs reported erroneous data one or more times from 1991 through 1994, with 95 percent confidence and a tolerance level of ± 5.0 percent. These PWSs served about 0.1 percent of the population. Very small and small-sized PWSs most often reported erroneous data, and about 58 percent of the erroneous data cases involved invalid data, rather than data which might have been deliberately falsified.

Operators at small PWSs most often reported invalid data because of: (1) a lack of training and knowledge on how to properly test water samples, and record and report results and (2) improperly functioning equipment. According to OGWDW, regional, and state officials, data falsification issues were not a priority because of limited resources and other public health-related priorities. State officials generally did not believe data falsification was a widespread problem. In addition, states' sanitary survey procedures generally did not include data quality review steps, nor did state officials require PWS operators to certify to the validity of reported data. Because most

Chapter 2: Data Integrity Enhancements Needed

states did not use sanitary surveys to review the quality of reported operational test data, officials missed opportunities to identify and correct testing and reporting problems.

TWELVE PERCENT OF PWSs REPORTED ERRONEOUS DATA

Based on our statistical sample review, we projected nationwide that 18.3 percent (890 of 4,869) of PWSs reported data that was questionable in accordance with EPA guidance, with 95 percent confidence and a tolerance level of ± 5.0 percent. (For further discussion of this projected percentage, see exhibit 11.) Files for 94 of the 723 PWSs we reviewed nationwide contained test data that were questionable in accordance with OGWDW's Appendix G guidance. We referred these cases to the regions which, in turn, required the states to follow-up. We accepted PWS data as valid if state officials: (1) visited or contacted the PWSs and (2) provided reasonable explanations for the data patterns we identified. Based on this follow-up, we determined that 46 of the 94 PWSs which we originally questioned, appeared to have reported accurate test readings.

Data for the remaining 48 PWSs, which statistically represented 11.6 percent (± 5.0 percent of the total number of community, surface PWSs nationwide) continued to be questionable. Of these 48, operators at 28 PWSs reported invalid data, while operators at 20 PWSs reported data that we believe might have been deliberately

Chapter 2: Data Integrity Enhancements Needed

falsified.¹² According to FRDS, these 48 PWSs served about 140,000 people. Very small and small PWSs reported erroneous data in 34 of the 48 cases. However, several medium-sized and large systems also reported erroneous data.¹³

The following table shows details about the projected 11.6 percent of PWSs that reported invalid or potentially falsified data. We identified PWSs within each EPA region--except Regions 1, 7, and 8--that submitted erroneous data. Among the regions, the percentages ranged from a low of 3.1 percent in Region 5 to a high of 28.6 percent in Region 3. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed. For more information regarding the percentages among the states in each region, see exhibits 1 through 10.

¹²We classified cases as invalid if we obtained evidence from state officials, or concluded via our own site visits, that data were improperly measured or reported due to equipment malfunction or a lack of operator training. We classified cases as potentially falsified if state officials provided information that was insufficient to convince us that the reported data were accurate and the cases were not classified as invalid. We did not find any instances where operators knowingly reported test measurements from malfunctioning equipment. Had this occurred, we would have considered such cases as potentially falsified.

¹³There were no very large systems which reported invalid or potentially falsified data.

Chapter 2: Data Integrity Enhancements Needed

Table 1
Percentage Of Community Surface Water Systems,
By Region, That Submitted Erroneous Data

Region	Reviewed	Invalid	Potentially Falsified	Total	Percent
I	22	0	0	0	0.0
II	18	2	0	2	11.1
III	42	6	6	12	28.6
IV	46	3	1	4	8.7
V	452 ¹⁴	8	6	14	3.1
VI	49	4	6	10	20.4
VII	16	0	0	0	0.0
VIII	22	0	0	0	0.0
IX	40	3	0	3	7.5
X	16	2	1	3	18.8
Total	723	28	20	48¹⁵	11.6¹⁶

SITE VISITS CONFIRMED PROBLEMS WITH SOME PWSs

We visited 15 of the 94 PWSs that we identified as having reported questionable data. Six of the 15 PWSs

¹⁴We reviewed these community, surface PWSs during our 1994 audit of Region 5.

¹⁵We do not contend that this number includes all possible PWSs reporting erroneous data. Rather, it is the number of PWSs we identified based on our review criteria.

¹⁶Total percent refers to the statistically projected percentage of PWSs reviewed which reported erroneous data. We calculated this percentage as follows:

- Step 1. $\frac{\text{Number of PWSs with Erroneous Data (National)}}{\text{Number of PWSs in Sample (National)}} = \frac{34}{271} = 0.125$
 Step 2. $0.125 \times 4,417 \text{ (Universe of National Sample)} = 552$
 Step 3. $552 + 14 \text{ (Region 5's PWSs With Erroneous Data)} = 566$
 Step 4. $566 \div 4,869 \text{ (Total Universe)} = 0.1162 \text{ or } 11.6 \text{ percent}$

Chapter 2: Data Integrity Enhancements Needed

seemed to be conducting and reporting test results accurately. At the remaining 9 PWSs (60 percent), we found indicators that data were either invalid (40 percent) or potentially falsified (20 percent). Of the nine PWSs we visited and found problems, one each was in California, Illinois, Indiana, Louisiana, New Mexico, North Carolina, Ohio, Oregon, and Tennessee. Operators at these PWSs: (1) recorded and reported test readings improperly, (2) obtained readings using improper procedures or malfunctioning equipment, or (3) lacked documentation regarding tests taken or recorded test readings before tests were taken. Our site visits also disclosed some weaknesses in states' oversight of data review and reporting. In all cases except our visits to the systems in California and New Mexico, state inspectors or EPA regional officials accompanied us and verified our observations. For specific examples of issues we identified during our site visits to water treatment plants, see exhibit 12.

DATA FALSIFICATION ISSUES NOT A PRIORITY FOR EPA OR STATES

EPA and state officials placed low priority on reviewing records for invalid or falsified data primarily because they did not believe that falsification was widespread. State officials generally trusted that data reported to them was valid. According to OGWDW guidance, states should try to identify and prosecute PWSs suspected of falsifying data.

States Did Not Review Data To Identify Invalid Or Falsified Results

Although some states might review data during field inspections, only four states (Alabama, Missouri, South Carolina, and Tennessee) out of 44 we reviewed had formal, documented procedures for reviewing reported test data for invalid or falsified data. Also, when state officials reviewed data for reported compliance violations, in most cases, the data was not reviewed with the idea that it could be invalid or falsified. State officials generally agreed that unusual or repetitive patterns in reported data

Chapter 2: Data Integrity Enhancements Needed

should be questioned. However, according to state officials, they: (1) generally did not believe data falsification was widespread, and (2) had limited resources to review reported data even if falsification was occurring.

Further, state officials generally were not aware that Federal guidance (OGWDW's Appendix G) existed which: (1) detailed ways to detect falsified data, and (2) discussed the importance of reviewing data for falsification. Also, they had not received any training on how to detect falsified data or how to recognize basic fraud indicators. As a result, state officials were generally unaware of the best indicators to look for, and techniques to use, to detect erroneous data.

According to OGWDW's Appendix G, "A sanitary survey is likely our [EPA and states] best vehicle for detecting instances of data falsification. Every sanitary survey should include an investigation of data quality." However, states did not have specific procedures to identify falsified data while conducting sanitary surveys. In addition, the frequency with which states conducted sanitary surveys varied greatly.

According to state officials, only two states--South Carolina and Missouri--had formalized sanitary survey procedures which included reviews of data quality.¹⁷ A third state, Tennessee, is in the process of revising its survey procedures to include data quality review steps. Generally, states' sanitary survey procedures did not include reviews of test data to identify potential falsification. Most states did not review monthly reports for data falsification prior to conducting sanitary surveys. Moreover, they did not review on-site PWS records during surveys to verify the validity of reported data. For example, Arizona officials maintained that field inspectors reviewed and compared data during inspections of PWSs. However, we reviewed their inspection procedures and

¹⁷Alabama's written policy to ensure data integrity was a general memo and was not specific to its sanitary survey procedures.

Chapter 2: Data Integrity Enhancements Needed

found that inspectors were not required to: (1) reconcile backup PWS documentation with the summary data sheets sent to the State, or (2) observe PWS operators taking routine water samples and tests. When we pointed this out to State officials and explained that the normal inspection process might not allow an inspector to detect invalid or falsified data, they agreed that their procedures needed revision.

Based on our audit, we believe reviewing MORs and on-site records would enable state officials to focus on suspect areas during sanitary surveys. In addition, state field inspectors should analyze water samples during the surveys to determine if readings are similar to historical data (or data recorded earlier in the day). Operators should also be made to conduct tests to demonstrate their competency to accurately test samples. We believe these tasks would require minimal use of additional resources.

According to current Federal requirements in 40 CFR 141.21, states must conduct a sanitary survey once every five years at each surface PWS that does not collect five or more bacteriological samples each month. However, EPA has issued guidance recommending that states conduct comprehensive sanitary surveys of PWSs at least once every three years. We found that the frequency with which states conducted sanitary surveys varied. Although states had to perform surveys only once every 5 years to meet the minimum Federal requirements, more frequent and complete sanitary surveys may be useful to ensure effective protection against data falsification.

OGWDW and state officials met in June 1994 to discuss the need for national guidance on conducting sanitary surveys. Their meeting included a discussion on how often states should conduct sanitary surveys. According to an OGWDW Education Specialist, OGWDW is in the process of preparing a document called "EPA/State Joint Guidance on Sanitary Surveys." It is intended to be used primarily by state officials who conduct sanitary surveys. According to the specialist, EPA and state officials

Chapter 2: Data Integrity Enhancements Needed

established eight elements, at a minimum, that should be addressed during sanitary surveys. He stated that one of the eight elements is entitled, "Monitoring, Reporting, and Data Verification." According to OGWDW's Safe Drinking Water Branch Chief, the guidance will not include specific data quality review steps; however, it will recommend that states conduct a data quality/falsification review as part of its sanitary survey program. OGWDW intends to formally issue this guidance during the first quarter of fiscal 1996. OGWDW also accepted the OIG's offer to help rewrite and supplement the information in Appendix G.

As a result of our 1994 audit of Region 5, OGWDW also added a one-hour data falsification module to its 4-day sanitary survey training course it and the regions provide to the states. In addition, OGWDW has included its Appendix G guidance as an attachment to the sanitary survey training manual they distribute to course participants. However, according to the Safe Drinking Water Branch Chief, OGWDW did not conduct or sponsor any sanitary survey training in fiscal year 1995. Instead, funds were spent on developing: (1) a "learning video" for inspecting wells, and (2) a how-to booklet for states to use when conducting sanitary surveys of small PWSs.

Regions Did Not Closely Monitor States' Efforts

Most Federal environmental statutes, including the Safe Drinking Water Act, embrace the concept that states should have primary responsibility for operating regulatory and enforcement programs. In 1994, EPA and the states issued a policy statement describing a new framework for their partnership.¹⁸ According to the statement, an effective relationship between EPA and the states depends on mutual dedication to shared responsibility and accountability for implementing environmental programs. While recognizing this concept, the statement continues to

¹⁸Joint Policy Statement on State/EPA Relations, State/EPA Capacity Steering Committee, July 14, 1994.

Chapter 2: Data Integrity Enhancements Needed

call for EPA to perform its mandated statutory mission, including constructive program review.

Regional oversight of drinking water data falsification issues was minimal. According to regional officials, reviewing data for falsification was not a high priority because they: (1) had limited program resources to manage increasing drinking water program responsibilities, (2) did not believe data falsification was widespread, and (3) relied on their states to detect questionable data.

Regional officials did not closely monitor states' efforts to detect invalid or falsified data. Moreover, officials in most regions did not evaluate states' efforts in detecting such data during their annual review of each state's drinking water program. For example, Region 6 had developed its own specific "protocol" (guidance) related to data falsification as a result of a material internal control weakness identified in 1990. However, we found that Region 6 did not implement the guidance because officials believed that taking enforcement actions against PWS operators on potential data falsification cases was not a productive use of resources.

In 1991, Region 8 conducted a project related to identifying falsified data. Region 8--which had primacy of Wyoming's drinking water program--analyzed turbidity reporting trends of 41 Wyoming community, surface PWSs from 1987-1990. Using a computer model, Regional officials evaluated three factors in predicting the potential for falsified reporting: (1) violation of precipitation-based turbidity limit predictions, (2) seasonal turbidity pattern abnormalities, and (3) lack of variation in daily turbidity values. Officials found that 4 of the 41 PWSs reported suspect turbidity data based on two of three factors. Region 8 officials believed that this project, if used by other regions and states, could be a successful and reliable enforcement tool.

In 1992, OGWDW formulated its plan to automate PWS information and began developing the Safe Drinking Water

Chapter 2: Data Integrity Enhancements Needed

Information System (SDWIS). SDWIS provides a comprehensive automated data system for EPA and states to manage public drinking water programs, and is intended to replace FRDS. The objective of the SDWIS modernization effort is to make quality data accessible to managers at both the state and Federal levels. The data requirements and systems design for each component of SDWIS are based on a facilitated series of meetings with the states, regions, and OGWDW. The end product is a state-level data system (called SDWIS/LAN) that has the same data model as the counterpart Federal system (SDWIS/FED), thus ensuring that the data that EPA has access to is of the same quality as the counterpart state data. According to the SDWIS Project Manager, the conversion to SDWIS from FRDS was completed, and SDWIS became OGWDW's official database on August 15, 1995.

As of August 28, 1995, the SDWIS Project Manager stated that nine states and two Regional Indian land programs had installed SDWIS components. He projected that by the end of fiscal 1996, 25 states will have installed SDWIS.

Based on this review, we believe the computer model developed by Region 8, or a comparable model, should be considered in the design and implementation of SDWIS to assist regions and states in identifying PWSs that report erroneous data. According to the SDWIS Project Manager, states will be able to download data from SDWIS and use a report generator capability to evaluate PWS data integrity. Considering the modular design of SDWIS for use by states, we believe that a computer model is a more cost-effective approach for evaluating PWS data integrity than states expending limited resources to develop alternative techniques.

Chapter 2: Data Integrity Enhancements Needed

Regions Need To Reemphasize Appendix G's Significance

Regions needed to reemphasize the importance of OGWDW's Appendix G guidance on detecting invalid and falsified data to its states and redistribute copies to the states. Most state officials we spoke with were not aware that Federal guidance existed addressing data falsification. In fact, according to both Region 7 and Region 8 officials, those two regions had not distributed Appendix G to its respective states. In Appendix G, OGWDW advised the regions to work with their states to identify and prosecute PWSs suspected of falsifying data.

According to officials in some regions, they have not conducted any training for regional staff on how to detect potentially falsified data using the guidance in Appendix G. Reemphasizing the Appendix G guidance would require minimal resources.

PWS Operator Certification Statements Might Deter Some False Data Reporting

Even though the Act does not address the issue of falsified test data or potential penalties for those caught reporting it, any deliberate submission of false information to the Federal government is a crime under 18 United States Code (USC) 1001. Section 1432 of the amended Act addresses potential penalties for anyone found tampering with a PWS to intentionally harm the public. This would cover, for instance, a terrorist who purposely added harmful contaminants to the water supply. EPA's regulations which implement the Act do not contain provisions addressing data falsification.

Although some states had specific drinking water regulations prohibiting the submission of falsified test results, and most states had general statutes outlawing false claims, only six states (Arizona, Illinois, Maryland, Oklahoma, Tennessee, and Utah) required PWS operators to certify by signature that reported MOR data were accurate and true. However, we also found that Oklahoma accepted unsigned, uncertified MORs.

We believe that PWS operators should be held accountable in cases when they intentionally report erroneous data, and

Chapter 2: Data Integrity Enhancements Needed

Operational Reporting Requirements Could Be Reduced

be required to certify by signature to the validity and authenticity of the data they report. Such a certification requirement would reinforce the fact that deliberate reporting of false data is a crime.

Many states required PWS operators to report more operational test data to them than EPA required. We identified some states that required monthly reporting of daily test results for tests including, but not limited to, alkalinity, hardness, iron, manganese, and polyphosphate. Although operators reported this additional data, state officials generally reviewed operational data almost exclusively to identify compliance related violations, and did not review such data to identify unusual reporting patterns.

On March 16, 1995, the President announced the establishment of ten principles for reinventing environmental regulation. Under these principles, Federal, state, tribal, and local governments must work as partners to achieve common environmental goals, with non-Federal partners taking the lead when appropriate. Currently, EPA is reviewing its priorities for drinking water regulations based on an analysis of public health risks and discussions with stakeholders. OGWDW initiated a 25 percent regulatory paperwork burden reduction project and held state and regional workgroup meetings to identify candidates in CFR Parts 141 and 142 for elimination or simplification. Among ideas being considered are the streamlining of: (1) non-violation information that states are currently required to report to OGWDW, and (2) chemical monitoring requirements.

CONCLUSION

Improvements are needed to prevent and detect erroneously reported drinking water test data. Based on our statistical sample review, we projected nationwide that 18.3 percent of the PWSs reported questionable test data, and that 11.6 percent of the PWSs reported erroneous test

Chapter 2: Data Integrity Enhancements Needed

results. Although the percentage of the population served by those PWSs that reported erroneous data was extremely small, some improvements would provide further assurance that operators are accurately reporting test data. The reporting of invalid data could be corrected through increased operator training or the purchasing of better test equipment. The regions should take necessary corrective actions, such as recommending that the states provide training to those operators in need, or take enforcement actions against those who intentionally falsified data.

OGWDW should consider the computer model developed by Region 8, or a comparable model, in the development and implementation of SDWIS. Such a model, we believe, would enable regions and states to efficiently identify PWSs that reported erroneous data.

OGWDW needs to reemphasize the importance of its Appendix G guidance and the role sanitary surveys can play in detecting erroneous data. State officials need to be made more aware that data falsification does, in some cases, occur and that they need to improve their capabilities for detecting questionable data. State officials told us that they rely on PWS operators to report valid test results and, therefore, do not believe they need to review reported data for potential falsification. Our audit has shown, however, that the data reported to them was not always valid. Even though the data reporting process is based on self-monitoring, states should not presume that oversight or review of the data for reasonableness is unnecessary.

Although there is a movement towards less Federal oversight of state programs, regions should be aware of what each state is doing to detect or prevent invalid and falsified data. The regions should also, as a good management practice, continue to distribute relevant guidance to their states to heighten awareness of the potential for data falsification and to aid them in detecting invalid and falsified data.

Chapter 2: Data Integrity Enhancements Needed

Small and very small PWSs most often reported invalid data. States could detect or prevent the reporting of invalid data by these small systems by conducting more thorough sanitary surveys, including comparing on-site records with MORs sent to states. States should examine water system records during sanitary surveys to verify that previously reported data were based on actual tests. OGWDW sanitary survey training materials should include data quality/falsification review steps.

Submission of falsified data is a crime under 18 USC 1001. However, because the Act itself does not provide criminal penalties for falsifying data, many operators may not realize that there are Federal criminal penalties for such an offense. Many states have either specific drinking water regulations or, at a minimum, more general false claims statutes in place as legal authority for taking enforcement actions against those who falsified data. However, most states do not currently require PWS operators to certify on MORs that the data they are submitting is accurate and true. We believe that state reporting forms should include a certification block to be signed by PWS operators. This certification requirement would make it clear that deliberate false reporting is a crime. For example, operators could certify to the following:

"I certify that this report is true. I also certify that the statements I have made on this form and all attachments thereto are true, accurate, and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under 18 USC 1001 and other applicable laws."

Finally, given the resource constraints that states are experiencing, we believe OGWDW, through its regulatory reduction project, should encourage states to determine the

Chapter 2: Data Integrity Enhancements Needed

testing and data reporting requirements that are most critical to protecting public health and adjust the reporting requirements accordingly.

RECOMMENDATIONS

We recommend that the Assistant Administrator for Water require the Director of EPA's Office of Ground Water and Drinking Water to:

1. request that the regions coordinate with the states to follow up on the 48 PWSs, or operators, which we found reported invalid or potentially falsified test data and consider providing training to, or taking enforcement actions against, them;
2. consider incorporating the computer model developed by Region 8, or a comparable model, in the design and implementation of SDWIS to assist regions and states in identifying PWSs that report erroneous data;
3. revise EPA's Appendix G guidance to include additional steps to identify erroneous data and provide updated examples to illustrate the types of data patterns indicative of erroneous data, and redistribute this revised guidance to the regions;
4. request that the regions distribute the revised Appendix G guidance to the states;
5. update EPA's sanitary survey training materials to include reviews of data quality (for example, comparison of MORs with on-site logs and bench sheets);
6. establish schedules, with the regions, for providing sanitary survey training to state officials;

Chapter 2: Data Integrity Enhancements Needed

7. discuss with EPA regions and state officials the feasibility of including a certification block on MOR forms for PWS operators to sign and certify to the accuracy of the reported data; and,
8. continue to work with regional and state stakeholders to minimize operational data reporting in streamlining the regulatory paperwork requirements.

AGENCY COMMENTS AND ACTIONS

The Assistant Administrator (AA) for Water generally agreed with the recommendations, but stated his office could not commit to implementing all of the recommendations due to significant resource constraints they are facing. The AA provided the following comments:

...Recommendation 1. We agree that follow up is needed on the 48 systems which the Inspector General has identified as reporting invalid or potentially falsified data and we will ask the regions to encourage States to follow up on these cases and take appropriate action. Some states have already begun investigating these systems.

We would like to point out that training and enforcement may not be the only types of appropriate response. In some instances, the operators that were involved are gone, so the appropriate response may be no action. Further, it is difficult to take an enforcement action against systems which may have falsified data. Our regions are concerned that, even where they have evidence of potential criminal conduct, the criminal investigators often decline to investigate or

Chapter 2: Data Integrity Enhancements Needed

prosecute because the case is not a high priority. This is a clear disincentive for addressing cases of potentially falsified data.

...Recommendation 2. We would like to explore the feasibility of this recommendation, however, we cannot commit to this activity at this time given our budget constraints.

...Recommendation 3. Assuming we receive sufficient resources in next year's budget, we will review the Inspector General's specific suggestions for revising the Appendix G guidance and make any necessary revisions. If we revise the guidance, we will distribute it to our Regional Offices.

...Recommendation 4. If we revise the guidance, we will ask the Regions to distribute it to their states.

...Recommendation 5. We have already added a one-hour data falsification module to our 4 day sanitary survey training course which addresses the need to compare monthly operational reports (MORs) with on-site logs and bench sheets. We have also drafted "EPA/State Joint Guidance on Sanitary Surveys" that identifies eight recommended elements of a sanitary survey. One of these elements, "Monitoring, Reporting, and Data Verification" includes reviewing the validity of data reported to the State, reviewing bench sheets, on-site logs, and monthly operational reports, and the calibration of process control and compliance equipment. This guidance will be finalized in November.

...Recommendation 6. Because of significant travel and resource constraints, we cannot commit at this time to establishing schedules for providing sanitary survey training to States.

Chapter 2: Data Integrity Enhancements Needed

...Recommendation 7. We have discussed this recommendation with our regional counterparts at a national meeting that was held on September 19-21, 1995. Based on this discussion, we will send a memorandum to the Regions requesting them to inform their States of your findings and suggest that States consider including a certification block on the forms. Unfortunately, resource limits preclude us from following up with the States to track their progress in implementing this suggestion.

...Recommendation 8. We plan to continue this effort and appreciate the Inspector General's support.

In addition, the AA for Water stated that he and his staff were very surprised to learn that the Inspector General nominated drinking water data integrity as an Agency level weakness after the issuance of the draft report. He stated that he did not believe that data integrity was an appropriate candidate for such a nomination, and that this report does not support the nomination.

OIG EVALUATION

The proposed actions generally meet the intent of the recommendations. Although the future of drinking water funding levels is uncertain, the program office needs to provide specific target dates for implementing recommendations 1 through 4, and 6, once EPA's fiscal 1996 budget is approved. Regarding the difficulty of taking enforcement action against systems which may have falsified data raised by the AA, EPA's Office of Enforcement and Compliance Assurance (OECA) can direct EPA regional Offices of Criminal Investigations to assign data falsification cases a higher priority for investigation, if OECA believes that such cases are high

Chapter 2: Data Integrity Enhancements Needed

priority items, relative to their entire workload. To deter future data falsification, OECA management could work with Regional management to determine the priority necessary to ensure that enough cases are pursued to demonstrate the severity and consequences of such actions.

As stated above, the AA did not believe that data integrity was an appropriate candidate as a 1995 Agency level weakness. In response, the Office of Inspector General believes drinking water data quality is an appropriate candidate based on the results of this review, along with the results of another OIG review titled "Region 7 and States Improved Drinking Water Programs Through Alternative Measures" (Report No. 5100226, dated March 24, 1995). In that review, we found that states in EPA Region 7 needed automated data management systems for more consistent and efficient data management and that EPA relied upon disjointed and manual or partially automated state systems to update FRDS, its primary water management automated database. Ineffective data management systems have impacted States' abilities to provide Region 7 with accurate enforcement data and to obtain small and very small systems' timely compliance with Safe Drinking Water Act requirements. We believe that this adverse condition is representative of states in other regions based on our nationwide review of data integrity. Also, as of August 28, 1995, only nine states and two Regional Indian land programs had installed components of SDWIS, which replaced FRDS on August 15, 1995.

We have concluded that the Agency should consider drinking water data quality as a 1995 weakness candidate for its annual assurance letter because: (1) SDWIS is not fully implemented by the Agency, (2) the 25 states that have agreed to install SDWIS have not done so, and (3) we identified data integrity weaknesses in this review.

In response to the Agency's request, the Inspector General provided input on the issues the OIG believed to be weakness candidates. The Inspector General included

Chapter 2: Data Integrity Enhancements Needed

drinking water data quality as one of the candidates for consideration as an Agency-level weakness. The Assistant Administrator for Water's response indicates they considered the OIG's input, but instead nominated other weaknesses they believed to be better candidates.

**REGION 1 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
CT	4	0	0	0	0.0
MA	8	0	0	0	0.0
ME	6	0	0	0	0.0
NH	1	0	0	0	0.0
RI	0 ¹⁹	N/A	N/A	N/A	N/A
VT	3	0	0	0	0.0
Total	22	0	0	0	0.0 ²⁰

This exhibit shows that of the 22 Region 1 PWSs reviewed, none reported invalid or potentially falsified data. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

¹⁹We did not review data for any Rhode Island PWSs because none were selected in the random sample.

²⁰Total percent refers to the percentage of PWSs reviewed which reported invalid or potentially falsified data. This percentage was derived by adding the number of PWSs that reported invalid data to the number that reported potentially falsified data and dividing by the number of PWSs reviewed.

**REGION 2 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
NJ	2	0	0	0	0.0
NY	16	2	0	2	12.5
Total	18	2	0	2	11.1

This exhibit shows that of the 18 Region 2 PWSs reviewed, two systems reported erroneous data. Both of the PWSs were located in the State of New York and reported invalid data. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

**REGION 3 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
DE	0 ²¹	N/A	N/A	N/A	N/A
MD	2	0	0	0	0.0
PA	25	3	5	8	32.0
VA	6	0	0	0	0.0
WV	9	3	1	4	44.4
Total	42	6	6	12	28.6

This exhibit shows that of the 42 Region 3 PWSs reviewed, 12 reported erroneous data. Six reported invalid data and six reported potentially falsified data. Eight of the PWSs were located in Pennsylvania, while the remaining four were in West Virginia. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

²¹We did not review data for any Delaware PWSs because none were selected in the random sample.

**REGION 4 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
AL	4	0	0	0	0.0
FL	1	0	0	0	0.0
GA	7	0	0	0	0.0
KY	7	0	0	0	0.0
MS	0 ²²	N/A	N/A	N/A	N/A
NC	9	1	0	1	11.1
SC	7	1	0	1	14.3
TN	11	1	1 ²³	2	18.2
Total	46	3	1	4	8.7

This exhibit shows that four Region 4 systems reported invalid or potentially falsified data. Of the four, two were in Tennessee, one was in North Carolina, and one was in South Carolina. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

²²We did not review data for any Mississippi PWSs because none were selected in the random sample.

²³This Tennessee PWS also reported some invalid data. We classified this PWS within the potentially falsified category to prevent the system from being counted twice in the total and because actions to correct falsified data are typically more serious and resource-intensive.

**REGION 5 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
IL	129	3	1	4	3.1
IN	57	1	3	4	7.0
MI	70	1	0	1	1.4
MN	26	0	0	0	0.0
OH	149	2	2	4	2.7
WI	20	1	0	1	5.0
R5	1 ²⁴	0	0	0	0.0
Total	452	8	6	14	3.1

This exhibit shows that of the 452 Region 5 PWSs reviewed, 14 PWSs reported either invalid or potentially falsified test data. Of the 14, eight reported invalid data, while the remaining six PWSs reported potentially falsified data. We reviewed the entire population of community, surface PWSs in Region 5, which was not a part of the national random sample selection.

²⁴Region 5 was directly responsible for oversight of PWSs on Indian lands. This one PWS was an Indian land system in Michigan.

**REGION 6 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
AR	7	1	0	1	14.3
LA	3	1	1	2	66.7
NM	1	1	0	1	100.0
OK	19	0	4	4	21.1
TX	18	1	1	2	11.1
R6	1 ²⁵	0	0	0	0.0
Total	49	4	6	10	20.4

This exhibit shows that of the 49 Region 6 PWSs reviewed, 10 PWSs reported either invalid or potentially falsified test data. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

²⁵Region 6 was directly responsible for oversight of PWSs on Indian lands. This one system was an Indian land system in New Mexico.

**REGION 7 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
IA	4	0	0	0	0.0
KS	6	0	0	0	0.0
MO	5	0	0	0	0.0
NE	0 ²⁶	N/A	N/A	N/A	N/A
R7	1 ²⁷	0	0	0	0.0
Total	16	0	0	0	0.0

This exhibit shows that of the 16 Region 7 PWSs reviewed, none reported invalid or potentially falsified data. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

²⁶We did not review data for any Nebraska PWSs because none were selected in the random sample.

²⁷Region 7 was directly responsible for oversight of PWSs on Indian lands. This one system was an Indian land system in Kansas.

**REGION 8 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
CO	10	0	0	0	0.0
MT	3	0	0	0	0.0
ND	4	0	0	0	0.0
SD	1	0	0	0	0.0
UT	1	0	0	0	0.0
WY	3	0	0	0	0.0
Total	22	0	0	0	0.0

This exhibit shows that of the 22 Region 8 PWSs reviewed, none reported invalid or potentially falsified data. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

**REGION 9 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
AZ	4	0	0	0	0.0
CA	33	2	0	2	6.1
NV	1	0	0	0	0.0
R9	2 ²⁸	1	0	1	50.0
Total	40	3	0	3	7.5

This exhibit shows that of the 40 Region 9 PWSs reviewed, three reported erroneous data. Two were located in the State of California, while the third was an Indian land system in New Mexico. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

²⁸Region 9 was directly responsible for oversight of PWSs on Indian lands. One of these two systems was in California, while the other was in New Mexico. Region 9 officials had an agreement with Region 6 officials to oversee this New Mexico system, which normally would fall within Region 6's geographical coverage.

**REGION 10 SURFACE WATER SYSTEMS THE OIG REVIEWED
THAT SUBMITTED ERRONEOUS DATA**

State	Reviewed	Invalid	Potentially Falsified	Total	Percent
ID	2	1	0	1	50.0
OR	9	1	0	1	11.1
WA	5	0	1	1	20.0
Total	16	2	1	3	18.8

This exhibit shows that of the 16 Region 10 PWSs reviewed, three reported invalid or potentially falsified data. These results should not be used for statistical projection purposes by region/state because the statistical sample we used for our review was randomly selected on a national basis from the universe of 4,417 community surface PWSs located in the continental United States. The sample excluded Region 5 PWSs, which we previously reviewed.

**CALCULATION OF PWSs WITH QUESTIONABLE
DATA PROJECTED TO THE PWS UNIVERSE**

The 18.3 percent figure was derived by aggregating our prior results from our audit of Region 5 with our results from the national audit of the remaining regions. We calculated this percentage as follows:

$$\text{Step 1.} \quad \frac{\text{Number of PWSs with Data that} \\ \text{Appeared Questionable (National)}}{\text{Number of PWSs in Sample (National)}} = \frac{52}{271} = 0.192$$

$$\text{Step 2.} \quad 0.192 \times 4,417 \text{ (Universe of National Sample)} = 848$$

$$\text{Step 3.} \quad 848 + 42 \text{ (Region 5 PWSs with Questionable Data)} = 890$$

$$\text{Step 4.} \quad 4,417 \text{ (Universe of National Sample)} + 452 \text{ (Universe of Region 5 PWSs)} = 4,869$$

$$\text{Step 5.} \quad 890 \div 4,869 \text{ (Total Universe)} = 0.183 \text{ or } 18.3 \text{ percent}$$

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SITE VISITS SUMMARY

The following information relates to some of the 15 site visits we conducted. We visited these PWSs to further evaluate questionable test data reported by certain PWS operators we identified during our file reviews. This information includes two examples where we determined, upon completion of the site visit, that problems did not exist.

An Oregon PWS Operator Used Improper Procedures to Record Test Results

A PWS operator at a small-sized system in Oregon used improper testing procedures and equipment to record some test results. For example, he used his personal hot tub testing equipment to determine pH levels. The operator reported invalid test data for turbidity, pH, and water temperature.

The operator reported data to its state on MORs which showed little variation in values for turbidity, and no variation in pH and water temperature readings from September 1993 through July 1994. Our site visit showed that: (1) turbidity sampling and analysis was not done in accordance with proper laboratory techniques; and (2) the instruments, methodology, and monitoring practices for pH and temperature were unacceptable. Moreover, we found that the State of Oregon had not conducted a sanitary survey of this system since 1989.

Turbidity Testing Conducted Improperly

We found that turbidity sampling and analysis were not conducted in accordance with proper laboratory techniques.²⁹ According to the operator, a 1.0 nephelometric turbidity unit (NTU) primary standard was used once a week to standardize the machine. However, secondary standards were never used, and the machine was never calibrated prior to turbidity measurements. In addition, the operator collected and tested only one sample for turbidity each day, instead of every four hours, as required under the Surface Water Treatment Rule.

²⁹EPA Method 180.1

Testing for pH Was Also Conducted Improperly

For a period of eleven consecutive months, from September 1993 through July 1994, the operator reported a pH of 6.5 every day but one. Based on our site visit, we found that: (1) a pH measurement was taken on the first day of each month and the operator recorded and reported that same value for the rest of the days in the month; (2) pH was measured colorimetrically, which is not an approved method; and (3) the pH instrument at the system only had a range of 6.8 to 8.2; therefore, a reading of 6.5 was not possible. According to the operator, he used a color meter that he used for his own hot tub to come up with the readings of 6.5. He said that his personal hot tub colorimeter had a scale that included 6.5 and he would compare the color of the sample being tested with the colors on his meter. Region 10 officials agreed that this PWS's reported pH readings outside the 6.8 to 8.2 range were unacceptable. According to Regional officials, the PWS recently purchased an EPA-approved pH meter to obtain more accurate readings.

Temperature Testing Conducted Improperly

The operator also reported water temperature at 5 degrees Centigrade every day from October 1993 through July 1994. Based on our site visit, we found that: (1) a temperature measurement was taken on the first day of each month and the operator then recorded and reported that reading for the rest of the days in the month, and (2) temperature was measured using a non-scientific thermometer. According to the operator, when he was hired and trained, he was told to test for pH and temperature only on the first day of the month and to record that same value for the rest of the month.

Problems with State Oversight

According to Region 10's Drinking Water Program Section Chief, the State of Oregon had not performed a sanitary survey at this system since October 1989--over five years ago. According to current Federal requirements in 40 CFR 141.21, states generally must conduct a sanitary survey at least once every five years at each surface PWS. The Region 10 Chief told us that this PWS will soon be merging with other PWSs and will cease to be a separately regulated PWS.

**An Indian Land PWS in New Mexico
Reported Unreliable Turbidity Results**

A PWS operator at a medium-sized Indian land system in New Mexico³⁰ reported unreliable effluent turbidity values due to the use of improper laboratory techniques. Beginning in July 1993, we noted this system's reported effluent turbidity levels dropped from around 1.0 NTUs to around 0.5 NTUs or below and stayed at this new level in the ensuing months.³¹ Based on our site visit, we determined that: (1) secondary standards used by the operator were over a year old, and a primary standard was not used to check the accuracy of the secondary standard; (2) the secondary standards used by the operator were not within the range of turbidity values expected (that is, 0 - 1.0 NTU) to be achieved; and (3) the operator did not calibrate the bench model turbidimeter prior to sample measurements.

**A North Carolina PWS
Reported Invalid pH Test Results**

A PWS operator at a medium-sized system in North Carolina reported invalid data for pH for over three years due to improper testing procedures and poor equipment. The operator reported identical pH readings of 8.4 for filtered and finished water to its state nearly every day from January 1991 through May 1994. During our site visit, we determined that operators used: (1) improper procedures to read the pH levels and (2) a crude colormetric wheel to measure pH. For example, we found that operators read their results by holding the color wheel up to a window with evergreen trees in the background. Because the color wheel used varying shades of green to measure pH values, light filtered through the green background of the trees would have made it difficult to obtain accurate readings.

This PWS obtained a new and more scientific pH meter in March 1995. Recorded pH values in the PWS's daily logs began to fluctuate beginning that month. Although erroneous readings were reported in the past, there did not seem to be an ongoing reporting problem as of March 1995. The system's purchase of a new pH meter, along

³⁰Region 9 is responsible for direct oversight of this system. Although the system is in New Mexico, which normally falls within the coverage of Region 6, Region 9 officials have an agreement with Region 6 to monitor the system.

³¹In July 1993, the Surface Water Treatment Rule became effective. Under the Rule, a PWS using conventional or direct filtration was deemed in violation of the turbidity standard if more than 5 percent of its test readings for the month were over 0.5 NTU. Prior to the Rule, the violation standard was 1.0 NTU.

with training for the operators, should result in more accurate, and fluctuating, readings.

A Tennessee PWS Operator Reported Invalid Chlorine Residual Results

A PWS operator at a small-sized system in Tennessee reported invalid data for chlorine residual for over two years. The operator reported identical chlorine residual readings of 2.0 mg/l for "on top of filter", "plant effluent", and "distribution system" from September 1991 through November 1993. A state official told us that: (1) the city which operated the PWS had difficulty keeping a certified operator on-site because the city was unable to pay much in wages and (2) he had visited the treatment plant in the past and found operators either asleep or watching television. The city, however, has taken steps to correct deficiencies including the recent hiring of a State-certified operator. It was evident during our site visit that the newly hired operator was making a serious effort to provide a safe product to his customers and meet State and Federal requirements. The operator's daily logs showed that he was recording more accurate data than others reported in the past.

Six Site Visits Showed Accurate Testing

Six of the 15 PWSs we visited seemed to be operating satisfactorily. Our inspections of these PWSs' facilities, equipment, and records, and discussions with water plant officials, showed that the reported data we initially questioned were likely to be valid.

For example, one PWS consistently reported finished turbidity readings of 0.02 from September 1991 through March 1992. Turbidity measurements at that level are very low--that is, the water would have to be extremely clear and free of particulate matter. As a result of our on-site visit, however, we found that the PWS used a continuous monitoring device which had an automatic alarm system that shut the plant down when turbidity and chlorine residuals reached a pre-set limit. As a result, the systems were prevented from exceeding certain limits. Independent tests we took during our visit did not significantly differ from the reported turbidity results.

Another PWS consistently reported chlorine residuals in the distribution system at 0.8 for 20 consecutive months. The operator at the treatment plant stated that he began using a manual Hach color wheel to measure chlorine residuals because the in-line chlorine monitor was not working properly. The operator rounded chlorine residual measurements to the nearest tenth of a decimal. Independent tests we took during our visit did not significantly differ from the reported chlorine residual readings.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 27 1995

MEMORANDUM

OFFICE OF
WATER

SUBJECT: OIG Draft Report "EPA Procedures to Ensure Drinking Water Data Integrity" (E1HWE5-23-001)

FROM: Robert Perciasepe
Assistant Administrator *Robert Perciasepe*

TO: Michael Simmons
Deputy Assistant Inspector General
for Internal and Performance Audits

The purpose of this memorandum is to respond to the recommendations in the OIG's draft report entitled "EPA Procedures to Ensure Drinking Water Data Integrity". I appreciate the cooperative spirit your staff has shown in carrying out this study. Before responding to the recommendations, I would like to provide our thoughts on the principal findings of the draft report.

The principal findings are:

- about 12 percent of the public water systems that use surface water reported erroneous data one or more times from 1991 through 1994,
- these systems serve only 0.1 percent of the population, and
- over half of the erroneous data cases were due to lack of training or improperly functioning equipment. Less than half of cases were classified as "potentially falsified".

In light of these findings, the draft report states that "We did not detect any significant internal control weaknesses during our audit."

After reviewing your findings, we are in total agreement that data integrity, and especially data falsification, is not currently a significant problem in the public water supply supervision program and is certainly not a significant weakness.

Since the draft report was issued, however, we were very surprised to learn that the Inspector General has nominated drinking water data integrity as an Agency level weakness. We do not believe that data integrity is an appropriate candidate for such a nomination. Further, we believe that the draft report does not support this nomination either. We have already nominated and



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are considering other issues that are better candidates.

The report provided recommendations for reducing the potential for data to be reported improperly. We have carefully considered these recommendations and are generally in agreement with them, although significant resource constraints that we are facing will limit the scope of some of our responses. Our specific responses to the recommendations are:

Recommendation #1: Request that the regions coordinate with the States to follow up on the 48 public water systems, or operators, which we found reported invalid or potentially falsified test data and consider providing training to, or taking enforcement action against them.

Response: We agree that follow up is needed on the 48 systems which the IG has identified as reporting invalid or potentially falsified data and we will ask the regions to encourage States to follow up on these cases and take appropriate action. Some States have already begun investigating these systems.

We would like to point out that training and enforcement may not be the only types of appropriate response. In some instances, the operators that were involved are gone, so the appropriate response may be no action. Further, it is difficult to take an enforcement action against systems which may have falsified data. Our regions are concerned that, even where they have evidence of potential criminal conduct, the criminal investigators often decline to investigate or prosecute because the case is not a high priority. This is a clear disincentive for addressing cases of potentially falsified data.

Recommendation #2: Consider incorporating the computer model developed by Region 8, or a comparable model, in the design, development and implementation of SDWIS to assist regions and States in identifying systems that report erroneous data.

Response: We would like to explore the feasibility of this recommendation, however, we cannot commit to this activity at this time given our budget constraints.

Recommendation #3: Revise EPA's Appendix G guidance to include additional steps to identify erroneous data and provide updated examples to illustrate the types of data patterns indicative of erroneous data, and redistribute this revised guidance to the regions.

Response: Assuming we receive sufficient resources in next year's budget, we will review the Inspector General's specific suggestions for revising the Appendix G guidance and make any necessary revisions. If we revise the guidance, we will distribute it to our Regional Offices.

Recommendation #4: Request that the regions distribute the revised Appendix G guidance to the States.

Response: If we revise the guidance, we will ask the Regions to distribute it to their States.

Recommendation #5: Update EPA's sanitary survey training materials to include reviews of data quality (for example, comparison of MORs with on-site logs and bench sheets).

Response: We have already added a one-hour data falsification module to our 4 day sanitary survey training course which addresses the need to compare monthly operational reports (MORs) with on-site logs and bench sheets. We have also drafted "EPA/State Joint Guidance on Sanitary Surveys" that identifies eight recommended elements of a sanitary survey. One of these elements, "Monitoring, Reporting, and Data Verification" includes reviewing the validity of data reported to the State, reviewing bench sheets, on-site logs, and monthly operational reports, and the calibration of process control and compliance equipment. This guidance will be finalized in November.

Recommendation #6: Establish schedules, with the regions, for providing sanitary survey training to state officials.

Response: Because of significant travel and resource constraints, we cannot commit at this time to establishing schedules for providing sanitary survey training to States.

Recommendation #7: Discuss with EPA Regions and State officials the feasibility of including a certification block on MOR forms for PWS operators to sign and certify to the accuracy of the reported data.

Response: We have discussed this recommendation with our regional counterparts at a national meeting that was held on September 19-21, 1995. Based on this discussion, we will send a memorandum to the Regions requesting them to inform their States of your findings and suggest that States consider including a certification block on the forms. Unfortunately, resource limits preclude us from following up with the States to track their progress in implementing this suggestion.

Recommendation #8: Continue to work with Regional and State stakeholders to minimize operational data reporting in streamlining the regulatory paperwork requirements.

Response: We plan to continue this effort and appreciate the IG's support.

Thank you for the opportunity to review this draft report. If you would like to discuss this further, please contact me or Cynthia C. Dougherty on (202) 260-5543.

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ABBREVIATIONS

AA	Assistant Administrator
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
FRDS	Federal Reporting Data System
GAO	General Accounting Office
MOR	Monthly Operational Report
NTU	Nephelometric Turbidity Units
OECA	Office of Enforcement and Compliance Assurance
OGWDW	Office of Ground Water and Drinking Water
OIG	Office of Inspector General
PWS	Public Water System
SDWIS	Safe Drinking Water Information System
USC	United States Code

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