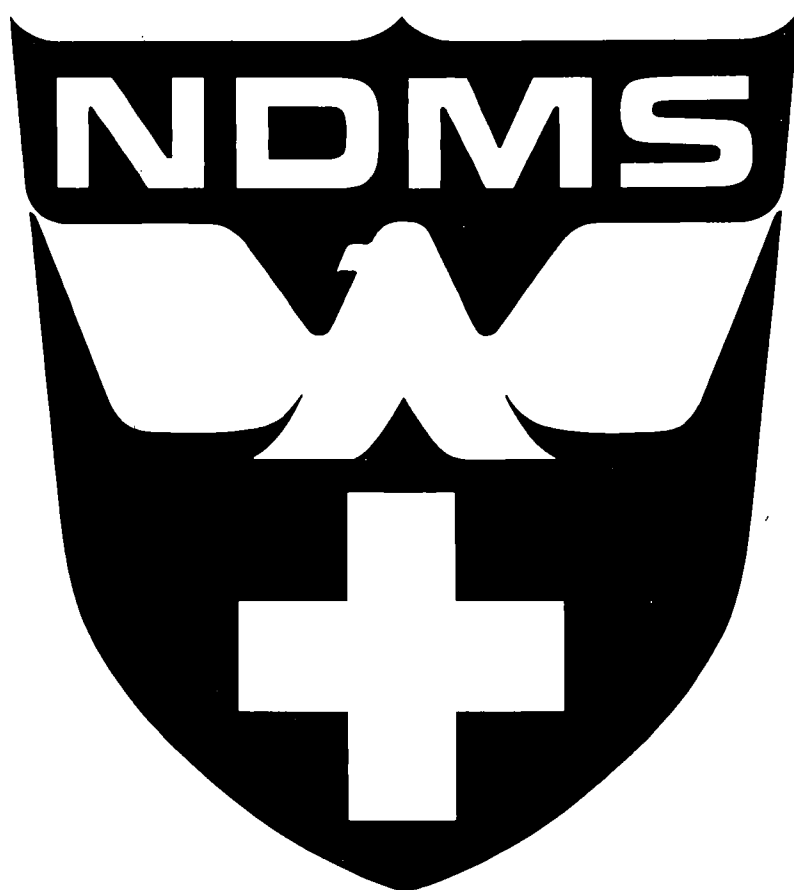


WAY  
**NATIONAL DISASTER MEDICAL SYSTEM**

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CLINTON LIBRARY PHOTOCOPY

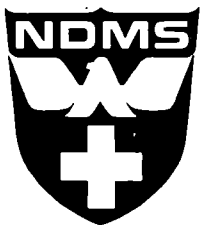
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DEPARTMENT OF DEFENSE  
DEPARTMENT OF HEALTH AND HUMAN SERVICES/Public Health Service  
FEDERAL EMERGENCY MANAGEMENT AGENCY  
DEPARTMENT OF VETERANS AFFAIRS

**CLINTON LIBRARY PHOTOCOPY**



**NATIONAL DISASTER MEDICAL SYSTEM**

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**Memorandum**

Date February 23, 1994

From Co-Chairs, Committee on Environment, Health, and Safety

Subject Long Range Flood Recovery - Environment, Health, and Safety Committee - Request for Funding Approval of Nine-State Potable Water Assessment and Sampling Project

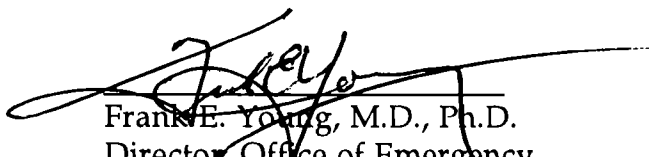
To Kathi Way, Special Assistant to the President for Domestic Policy/ EOP Chair, Long Range Flood Recovery Steering Committee

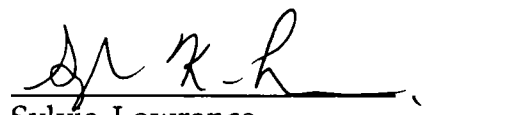
We are pleased to report to you that the nine states impacted by the 1993 midwest floods have completed their technical review of the Groundwater and Potable Water Assessment and Sampling Plan, have approved it, and all have agreed to participate. Additionally, the Federal Partners of the Environment, Health, and Safety Committee have reviewed the plan and fully endorse its implementation as soon as possible.

The estimated cost of this landmark standardized and statistically valid survey for private well contamination in every county in the nine states is approximately \$2.0 million. Based on the amount of up front work that has already been conducted by federal and state partners the survey could be started almost immediately and completed by mid to late spring.

As previously agreed, we are forwarding this project to the Steering Committee for endorsement and submission to the Federal Emergency Management Agency (FEMA) for funding consideration. We respectfully urge that this request be considered by the Steering Committee and, if endorsed, forwarded to FEMA for its funding decision within the next two weeks. This urgency is based on two factors: first, if FEMA decides not to fund this project, the other Federal Partners need to know as soon as possible in order to seek the necessary funding from remaining contingency funds; second, the States have indicated that the March-early April timeframe is an opportune time to conduct such a study.

We look forward to your response to this request. Please do not hesitate to call either of us if you have any questions, comments or concerns.

  
Frank E. Young, M.D., Ph.D.  
Director, Office of Emergency  
Preparedness, DHHS

  
Sylvia Lowrance  
Deputy Associate Administrator,  
U.S. EPA

--PROTOCOL FOR--  
ESTIMATING THE RATE OF WELL CONTAMINATION  
NINE MIDWESTERN STATES AFFECTED BY 1993 FLOODING

GOALS OF THE SURVEY

This survey is designed to provide a valid estimate of the proportion of contaminated wells in each participating state at a specified time. The survey provides for testing for coliforms, nitrates, and atrazine. Contamination will be measured by approved methods capable of determining common levels of concern which are: 1) the presence of one or more organisms per 100 ml, 2) a nitrate level of 10 mg/l of nitrogen or greater, and 3) an atrazine level of 3 $\mu$ g/l or greater. States will be able to establish individual action levels based on sample results and other factors.

*The primary goal is to estimate the contamination fraction in each state with a minimum of 90% statistical power within a specified % difference (+/- 10%) from a presumed contamination rate of 50%. A 50% rate is used because we have only anecdotal data on contamination and a 50% rate assumes an equal likelihood that a well is contaminated.*

The second goal is to provide information on the within-state (district) and within-county distribution of contamination. Statements of statistical significance cannot be made at these levels.

The third goal is to obtain data on levels of background contamination by sampling areas not affected by the flooding.

The fourth goal is to obtain well construction and maintenance data for an objective assessment and development of cost-effective solutions to contamination.

Information from the statistical analyses will be used to focus further sampling work, if necessary.

Implementation of this protocol is contingent upon factors such as state acceptance, laboratory agreement, and availability of staff for sample collection. Sample collection time frames will be developed as a part of each state's specific survey plan. Current plans are for all states to use the same semi-quantitative bacteriologic test kit, the cadmium reduction methodology for testing for nitrates, and the same immunoassay kit for atrazine. *All samples must be refrigerated immediately and analyzed within 24 hours when possible and no later than 48 hours after collection.* To provide information on accuracy and precision of testing, 1) quality control (QC) samples will be analyzed with the well samples by each laboratory, and 2) one well from each county will be sampled and tested twice.

This survey is not designed to make a statement of statistical significance about contamination levels in each county within a state. It is not intentionally designed to stratify on conditions such as well depth, distance from river, soil type, or

chlorine use because preliminary information about these are not available. However, information on these factors will be collected and be available to examine their effects, where possible.

Sampling unit: individual well within each county  
Primary strata: state

#### STATISTICAL POWER

The following table gives the statistical power to test whether the wells within a state are contaminated within a specified percent difference from 50%, given that N samples are measured. (Type I error level is near 5%. Depending on the number of samples, the level is not exactly 5% due to the discrete nature of the data.)

Statistical Power  
to Detect Specified Difference from Hypothesized Proportion  
of One-Half (50% contamination rate)  
at a Type I Error Rate of 5%

|           | Difference to be Detected |      |      |      |
|-----------|---------------------------|------|------|------|
|           | 5 %                       | 10 % | 15 % | 20 % |
| # samples | Statistical power %       |      |      |      |
| 60        | 12%                       | 35%  | 66%  | 90%  |
| 80        | 16                        | 46   | 80   | 96   |
| 100       | 18                        | 54   | 87   | 99   |
| 120       | 21                        | 61   | 92   | 99   |
| 140       | 22                        | 67   | 95   | 99   |
| 160       | 24                        | 72   | 97   | 99   |
| 180       | 25                        | 76   | 98   | 99   |
| 200       | 31                        | 83   | 99   |      |
| 250       | 35                        | 89   | 99   |      |
| 300       | 43                        | 94   | 99   |      |
| 400       | 52                        | 98   | 99   |      |
| 500       | 62                        | 99   |      |      |

Note: the hypothesized rate of 50% is used as a standard statistical beginning value when no prior data are available.

### *TOTAL NUMBER OF SAMPLES PER STATE*

The generally accepted criterion for minimum statistical power is 80%-90% or greater. The table shows that the number of samples required (within a state) to achieve this power level to detect a difference of +/- 5% is high. For example, it would be difficult to determine whether the true contamination rate is 50% versus 55% without taking > 500 samples in a state.

A 90% power to detect a difference of +/- 10% can be achieved by taking about 250 samples, and ~95% power by taking 300 samples. The plan outlined below insures that 1) a minimum of 400 samples will be collected and analyzed in each state and 2) several samples will be collected in each county so that a preliminary observation can be made about that county.

### *SAMPLE COLLECTION WITHIN EACH STATE*

An overall ten-mile intersecting grid will be overlaid on each state. Samples are to be collected at the intersecting points of this grid. Ten-mile intervals will require a range of approximately 600 samples (Iowa) to 1,400 samples (Minnesota). [Note: the grid interval (10 miles) may be changed to optimize sampling once maps have been produced.] The grid sampling method has the advantage that it is systematic and, therefore, will facilitate production of isopleth maps of each state. Additional samples may need to be collected in some counties to insure that each county has a minimum number of samples. This approach will facilitate comparison of "declared" versus "non-declared" counties. Additional sampling points (within county) will be designated when county maps are produced.

Additional samples may be collected by states during the sampling interval for their own purposes. These sample results will not be included in this project.

### *SAMPLE COLLECTION WITHIN EACH COUNTY*

Sufficient samples will be collected within each county to make a preliminary descriptive statement about levels of contamination but not a definitive statistical statement. The survey will specify that each county should have a minimum of eight samples. Additional sampling locations will to be specified based on county geographic configuration versus intersecting points. To provide quality control, one of the wells in each county will be sampled twice. This site will be chosen at random in advance and identified to the county. If no well is found within a 3 mile radius of sample location, duplicate sample will be collected at the previous or following sample site.

#### DEVIATIONS FROM SAMPLING LOCATIONS:

The sampling location is the intersection of the vertical and horizontal sampling lines. The sampling point is the exact location of the well sampled, relative to its map location. Because wells will not fall exactly at sample locations, a protocol is necessary to select them systematically. *This is done by drawing concentric circles outward from each sampling location (intersection point) and sampling that well falling closest to the sample point, regardless of its direction from the location. That well becomes the sample point.*

If no well is found within a three mile radius from the sampling location, the form should be marked (NO WELL at LOCATION.) Radius may be increased to as much as 5 miles for extremely low well density areas. If a sampling location falls within a city limit, an active private well can still be sampled within the limits. If a sampling location falls within a densely populated area with no known private wells, the form is marked NO WELL AT LOCATION.

#### SAMPLING METHOD

A standard sampling method for collecting water will be used by all states. Briefly, untreated tap water (i.e. unfiltered, non-softened) will be taken from a faucet in the house. Water will be run 3-5 minutes prior to taking sample and care will be taken not to touch the sample tube against any object when taking sample.

#### FEDERAL ASSISTANCE TEAMS

During the initial phase of the survey, a federal team may be assigned to each state. This team will be trained to assist the state in answering questions from the counties on the sample collection and provide assistance in resolving problems that arise from unusual situations. The team will consist of a public health advisor, a sanitarian, and a representative from EPA.

#### DATA COLLECTED FOR EACH WELL

For each sampled well, information on a variety of useful criteria will be obtained. This will allow investigation of factors potentially important in evaluating common features of contaminated wells. If the owner refuses to allow a sample to be collected, the form should be marked REFUSED. Samples will be forwarded as usual if the owner allows the sample to be taken but refuses to answer questions. Each "refusal" will be contacted within two weeks by designated state or local personnel to ascertain the reason for refusal. A follow-up questionnaire about the reason for refusal will be completed.

### UNIQUE SAMPLE IDENTIFICATION CODE:

Assigned sample identification codes will identify each study sample uniquely including state and county. For example, WI-102-(1) indicates Wisconsin, county 102, sample 1. Each sample that falls on an intersection location will be cross-referenced back to that location. If a sample is an additional collected sample to reach the required minimum of eight, it will not have an intersection location. Each sample also will have a number assigned by the state for internal purposes. Each sample ID code will also be referenced to its matching grid point.

### ANALYTICAL METHODS & QUALITY CONTROL

All states will use identical analytical methods. Literature will be cited on these methods. It is vital to obtain QC information about the measurement of contamination in order to be able to understand if analytical measurements are valid and reproducible. Blind QC samples are submitted to the state laboratories according to the following protocol. *One well per county will be sampled twice and both samples will be tested.* The two test results will be compared to determine agreement (2x2 contingency table with chisquare test.) The agreement will be examined to determine if the laboratory is in control.

For bacteriological sampling, each state will run the "Qualicult" QC samples periodically with unknown samples. This will provide a qualitative check on the QC that is not based on replication. A minimum frequency of QC for bacteriological and other samples will be specified.

### DATA COLLECTION AND TRANSMISSION

Data flow: county => state office => CDC/Atlanta.  
The attached form will be completed at the time of sampling of each well. The exact sample collection time will be recorded on the form so that the interval between collection and measurement can be checked. One copy will be forwarded to the appropriate sample collection office within each state. Each sampling site will have a state laboratory ID and the study ID (state code, county code, and well number). Numbers will positively identify each data sheet against each specimen. *The state laboratory will only be furnished the state ID, not the study ID, so that it will be blind to matching samples.* The state sample collection offices will forward the completed information sheet to CDC. At CDC, data from duplicate samples will be analyzed for reproducibility. Laboratories also will provide other QC information.

### DATA ANALYSIS

Data entry will be doubled-keyed to ensure accuracy. Each state's data will be used to make an estimate of the

contamination rate and its confidence limits in that state. Sample data will be mapped into a Geographic Information System for display by county and latitude/longitude format. Surface water and aquifers also will be mapped. Multiple linear least squares logistic regression will be used to evaluate the effects of well depth, well head condition, distance from local river/stream, soil type, etc. Other statistical techniques such as comparisons of proportions will be used where appropriate. Summary and detailed data from each state will be furnished to that state.

#### *DATA CONFIDENTIALITY*

Individual identifier data will not be forwarded to CDC but will reside with the county or state to facilitate appropriate follow-up. When data are made available to the public, it will be on an aggregate basis only, so that results from individual wells cannot be determined.

*Estimated Sampling size for ten-mile grid*

| <i>State</i>     | <i>North-South<br/>Miles</i> | <i>East-West<br/>Miles</i> | <i>Total<br/>Square<br/>Miles</i> | <i>Number of<br/>Samples</i> |
|------------------|------------------------------|----------------------------|-----------------------------------|------------------------------|
| <i>Missouri</i>  | <i>280</i>                   | <i>300</i>                 | <i>84,000</i>                     | <i>783</i>                   |
| <i>Minnesota</i> | <i>400</i>                   | <i>350</i>                 | <i>140,000</i>                    | <i>1,326</i>                 |
| <i>Nebraska</i>  | <i>210</i>                   | <i>415</i>                 | <i>87,150</i>                     | <i>810</i>                   |
| <i>N. Dakota</i> | <i>205</i>                   | <i>340</i>                 | <i>69,700</i>                     | <i>660</i>                   |
| <i>S. Dakota</i> | <i>240</i>                   | <i>360</i>                 | <i>86,400</i>                     | <i>805</i>                   |
| <i>Illinois</i>  | <i>380</i>                   | <i>205</i>                 | <i>77,900</i>                     | <i>722</i>                   |
| <i>Iowa</i>      | <i>205</i>                   | <i>310</i>                 | <i>63,550</i>                     | <i>585</i>                   |
| <i>Kansas</i>    | <i>205</i>                   | <i>410</i>                 | <i>84,040</i>                     | <i>780</i>                   |
| <i>Wisconsin</i> | <i>300</i>                   | <i>290</i>                 | <i>87,000</i>                     | <i>812</i>                   |

*Total number of samples = 7,344      Total square miles = 787,950*

*NOTE: The first 10-mile grid laid over the 9 states yielded a sample size of 8200 points.*

*Data Collection Form - Survey of Well Contamination  
Midwestern States Affected by 1993 Flooding*

Study Sample Code \_\_\_\_\_  
(State - County - Well Number)

State Sample # \_\_\_\_\_

State \_\_\_\_\_ County \_\_\_\_\_ County Code (3-digit) \_\_\_\_\_

Refused: \_\_\_\_\_ (check if "yes") Reason: \_\_\_\_\_ No well at sampling location \_\_\_\_\_

Latitude/longitude \_\_\_\_\_ / \_\_\_\_\_

Person collecting sample: \_\_\_\_\_

Date & time of sample collection: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ a.m. \_\_\_\_\_ p.m. \_\_\_\_\_  
MMDDYY hour min

Contact person: \_\_\_\_\_ Phone # \_\_\_\_\_

Location of well (address/distance from permanent markers):  
\_\_\_\_\_  
\_\_\_\_\_

Well depth (feet) \_\_\_\_\_

Well currently used for drinking water \_\_\_\_\_ Yes \_\_\_\_\_ No

Standing surface-water within 100'  
during/after flood \_\_\_\_\_ Yes \_\_\_\_\_ No

Age of well in years \_\_\_\_\_

Date of last chlorination  
(if within 7 days, do not survey) \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
MMDDYY

No. of chlorinations in last 6 months \_\_\_\_\_

Reason for chlorination \_\_\_\_\_

Well-water tested previously for contamination { \_\_\_\_\_ Yes \_\_\_\_\_ No \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ (date collected)  
MMDDYY  
\_\_\_\_\_ Pos \_\_\_\_\_ Neg (previous test result) }

Well-head location: (check one)

\_\_\_\_\_ Pumphouse \_\_\_\_\_ Pit \_\_\_\_\_ Basement \_\_\_\_\_ Barn \_\_\_\_\_ Outdoors \_\_\_\_\_ Other

Well diameter in inches: \_\_\_\_\_

Type of casing: (check one)

\_\_\_\_\_ Steel \_\_\_\_\_ Concrete or clay tile \_\_\_\_\_ Brick or rock \_\_\_\_\_ Plastic \_\_\_\_\_ Wood \_\_\_\_\_ Other

Type of well: (check one)

\_\_\_\_\_ Sandpoint \_\_\_\_\_ Buried slab \_\_\_\_\_ Drilled \_\_\_\_\_ Dug \_\_\_\_\_ Other: \_\_\_\_\_

**Important!**

Water samples must  
be refrigerated  
immediately after  
collection.

*Data Collection Form - Survey of Well Contamination  
Midwestern States Affected by 1993 Flooding*

page 2

Study Sample Code \_\_\_\_\_  
(State - County - Well Number)

State Sample # \_\_\_\_\_

Type of well-cap: (ND = Not Determined)

Lid setting on top of casing: (check one)

\_\_\_ Wood - solid sheet \_\_\_ Wood - boards \_\_\_ Concrete \_\_\_ Metal \_\_\_ Other \_\_\_\_\_

Cap secured to top of casing on the outside (standard cap)? \_\_\_ Yes \_\_\_ No \_\_\_ ND

Cap secured to top of casing on the inside (sanitary seal)? \_\_\_ Yes \_\_\_ No \_\_\_ ND

Is the well vented? \_\_\_ Yes \_\_\_ No \_\_\_ ND If so, does the vent have a screen? \_\_\_ Yes \_\_\_ No

Are there any openings between the lid and the casing? \_\_\_ Yes \_\_\_ No \_\_\_ ND

Are there any holes or cracks in the casing? \_\_\_ Yes \_\_\_ No \_\_\_ ND

Is there a tight seal with a grommet, caulking, or conduit (to the electric source) where electric line inlet goes through the cap? \_\_\_ Yes \_\_\_ No \_\_\_ ND

Is there a standard pitless adaptor? \_\_\_ Yes \_\_\_ No \_\_\_ ND

Type of pump: (check one)

\_\_\_ Deep jet pump \_\_\_ Shallow jet pump \_\_\_ Pump jack/hand pump  
\_\_\_ Submersible pump \_\_\_ Centrifugal pump \_\_\_ Turbine pump \_\_\_ Other \_\_\_\_\_

Location of pump: (check one) \_\_\_ In the well \_\_\_ In pumphouse \_\_\_ In well pit \_\_\_ Other \_\_\_\_\_

Is the well located down gradient from any possible contamination sources within 100 feet? \_\_\_ Yes \_\_\_ No

Are any back-flow prevention assemblies present? \_\_\_ Yes \_\_\_ No

How far does the well casing extend above ground level: \_\_\_ feet \_\_\_ inches

Is the well located in a flood plain? \_\_\_ Yes \_\_\_ No

*Are any of the following found within 100 feet of well:*

(Check one)

Usage (check one)

Sinkholes? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Ag-drainage wells? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Abandoned wells? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Septic tank? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Lateral field? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Outhouse? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Sewage lagoon? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Manure storage? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Below-ground brick or tile cistern? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

Trench/ground silage facilities? \_\_\_ Yes \_\_\_ No \_\_\_ Don't Know

\_\_\_ Abandoned \_\_\_ continuous \_\_\_ intermittent

*Data Collection Form - Survey of Well Contamination  
Midwestern States Affected by 1993 Flooding*

page 3

Study Sample Code \_\_\_\_\_  
(State - County - Well Number)

State Sample # \_\_\_\_\_

Number of adults and children currently  
living in household

\_\_\_ adults (>17) \_\_\_ Children (6-17) \_\_\_ Children (<6)

Of those living in household, how many  
adults and children are currently drinking  
water from the well (do not count if all  
drinking water is boiled or filtered).

\_\_\_ adults (>17) \_\_\_ Children (6-17) \_\_\_ Children (<6)

Of those drinking water from the well,  
how many have had diarrhea (3 or more  
loose or watery stools in one 24-hour  
period) in the last 2 weeks?

\_\_\_ adults (>17) \_\_\_ Children (6-17) \_\_\_ Children (<6)

Commercial fertilizers ever used \_\_\_ (Check if "yes")

Distance used/mixed from well \_\_\_ feet

Date last used \_\_\_ Month 19\_\_ Year

Manure ever used \_\_\_ (Check if "yes")

Distance used/stored from well \_\_\_ feet

Date last used \_\_\_ Month 19\_\_ Year

Pesticides ever used \_\_\_ (Check if "yes")

Distance used/mixed from well \_\_\_ feet

Date last used \_\_\_ Month 19\_\_ Year

| For Laboratory Use Only: |                    | date         | / | /           | (MMDDYY) | hour          | min | a.m. | p.m. |
|--------------------------|--------------------|--------------|---|-------------|----------|---------------|-----|------|------|
| Bacti Test:              | (Check if present) | No. Positive |   | Tubes (0-5) |          | No. Organisms |     |      |      |
| Total Coliforms          | _____              | _____        |   | _____       |          | _____         |     |      |      |
| E. Coli                  | _____              | _____        |   | _____       |          | _____         |     |      |      |
| Nitrates:                | Results            | _____        |   |             |          |               |     |      |      |
| Atrazine:                | Results            | _____        |   |             |          |               |     |      |      |