# REPORT TO THE GENERAL ASSEMBLY STATE OF COLORADO

## STATUS OF IMPLEMENTATION OF SENATE BILL 90-126, THE AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT

Submitted by
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December 31, 1995

# Report to the General Assembly of the State of Colorado

## Status of Implementation of Senate Bill 90-126, the Agricultural Chemicals and Groundwater Protection Act

In accordance with Title 25 Article 8 Section 205.5 (9), C.R.S. (1995 Supp.), the following report of the progress made in implementing the provisions of the Agricultural Chemicals and Groundwater Protection Act ("Act") is hereby provided. This report reflects progress made since the last report, dated December 31, 1994.

In the report to the Legislature dated December 31, 1994, several goals for 1995 were identified by the cooperating agencies. The progress made toward each of the goals is detailed in the following pages.

### Memoranda of Understanding

Memoranda of Understanding as provided in Section 25-8-205.5 (3)(f) and (g) of the Act have been signed for fiscal year 1995/96 between the Colorado Department of Agriculture and: 1) Colorado State University Cooperative Extension, 2) the Colorado Department of Public Health and Environment. The objectives for 1996 for this program are stated on pages 8 and 9.

### Education and Communication

Communication is a vital component of the program. Numerous methods are used to provide information to individuals and organizations affected by the program as well as the general public. Fact sheets are prepared to provide information on the program and are being distributed at meetings, conferences and trade shows (Appendix I). Also, a display board is being utilized at conferences and trade shows to provide information on the program. A short video entitled Protecting Colorado's Groundwater is available to inform the general public on groundwater quality, agricultural

chemicals and the Act. This video may be borrowed from the Department of Agriculture or copies may be purchased from the CSU bulletin room. Information on the program is continually being presented to the public through radio shows, mass media, press releases and at presentations at meetings throughout the state.

Recent development pressures, in once rural outlying areas, has heightened public awareness of the potential for impacts to water quality. The program has responded to these concerns by offering technical assistance to water conservancy districts, groundwater management districts, and other local entities interested in evaluating water quality in their area. Presentations of how the program works, past and present water quality projects, and plans for future projects with request for local input are made at every opportunity. We consider this type of outreach an important part of the customer service component of the program.

The initiation of the National Certified Crop Advisor program in Colorado has dovetailed into this program to provide a mechanism for training and education regarding the correct use of agricultural chemicals. 109 crop consultants and advisors have passed the national and state exam and proven sufficient experience to be certified as crop advisors in Colorado. These individuals and others to be certified in the future are required to obtain continuing education units to maintain their certification. This affords an ideal opportunity to provide information concerning pesticides and fertilizers and groundwater protection to those making recommendations to farmers.

## Best Management Practices

Best Management Practices (BMPs) are being developed at the user level through extensive local input. A general BMP notebook for Colorado Agriculture has been completed and consists of eight subject specific BMP chapters and one booklet providing an overview of the BMP process. All of the chapters are available through the CSU Bulletin Room. The completed notebook has been provided to pesticide and fertilizer dealers, CSU Cooperative Extension offices, and all USDA Natural Resources Conservation Service offices.

The statewide notebook is being utilized to guide the local work groups through the BMP development process for regionally specific BMPs. The San Luis Valley and the South Platte River Basin from Denver to the Nebraska state line have been identified as the first two priorities for this localized BMP development. Based on

groundwater monitoring results through 1994, it was determined that additional resources also needed to be focused on the South Platte Basin. A booklet entitled Best Management Practices for Nutrient and Irrigation Management in the San Luis Valley was completed in 1994 and published in cooperation with the USDA Water Quality Demonstration Project. This group is now developing pesticide management BMPs for specific crops in the San Luis Valley. Localized BMPs for the Front Range/South Platte have also been completed. A document entitled Best Management Practices for Irrigated Agriculture was published from this group's efforts. Both BMP publications are available upon request. Development of localized BMPs for the Uncompahgre Valley on the west slope was initiated in 1995. Publication and distribution of the resulting BMPs is expected in early 1996. (Appendix II).

BMPs for urban pesticide and fertilizer use have been drafted. The first draft is currently being reviewed by the Advisory Committee. The BMPs will be published and distributed in 1996.

## Demonstration Sites and Field Days

Seven (7) sites in the South Platte River Valley were selected and used to demonstrate improved nitrogen management techniques in irrigated corn. One field day was held to show producers and crop advisors the field application of the BMPs. Demonstration plots and field days will be continued in the South Platte River Basin and the San Luis Valley in 1996. In the future, locations for these plots will be expanded to other regions of the state and will focus on additional crops (Appendix II).

## Groundwater Monitoring

In the 1994 Report to the Legislature, the sampling of groundwater wells in the urban areas along the front range was identified as a priority. However with the input of the advisory committee it was determined to push this effort back one year so that a long term monitoring effort could be initiated for the South Platte alluvial aquifer in Weld County between Brighton and Greeley. The need for this effort came about as a result of numerous groundwater monitoring efforts identifying this area as having elevated nitrate levels. Information is needed over the long term to determine if changes in management practices relating to nitrogen application are effecting water quality. In addition follow-up sampling based on 1994 results was performed in the Arkansas River Basin.

The first area, the South Platte alluvial aquifer from Brighton to Greeley included 88 wells being sampled for nitrate and 33 pesticides. Three types of existing wells were used, 16 monitoring wells operated by the Central Colorado Water Conservancy District, 21 domestic wells first sampled in 1992, and 51 irrigation wells sampled in 1989, 1990, 1991, and 1994. Nitrate analysis showed that 69% of the monitoring wells, 48% of the domestic wells, and 82% of the irrigation wells exceeded the nitrate drinking water standard of 10 mg/L. Pesticide data revealed three pesticides, Atrazine, Metolachlor, and Prometon present in the monitoring well samples. These same three pesticides plus Lindane were detected in the domestic well samples. Atrazine, Metolachlor, Prometon, and Alachlor were detected in the irrigation wells. Only the insecticide Lindane exceeded a water quality standard. These wells will be sampled and analyzed every three to five years to try and determine any trend in nitrate concentrations.

In the Arkansas Valley, a confirmation sampling was performed on those wells that had a nitrate level above 10mg/L, or a pesticide detection in 1994. The confirmation sampling tested 32 wells and found little change from 1994, indicating a high level of confidence in the initial work. Nitrate levels were statistically unchanged and the only pesticide detected was Atrazine. One well did contain Atrazine at a level above the standard of 3.0 ug/L. All well owners receive the full results of the analyses performed on their well. In addition, if the well had nitrate in excess of the of the 10 mg/L drinking water standard or had a detection of a pesticide, information on that constituent is provided.

The program contracted for analysis of groundwater samples taken by the U.S. Geological Survey (USGS) in the San Luis Valley for the nitrogen isotope $N^{15}$. The samples were taken in early August and analysis of the results will be completed in early 1996. The purpose of this project is to confirm that the $N^{15}$ isotope analysis is reliable in determining the source of nitrate in the aquifer. This analysis was performed on groundwater samples taken by the USGS in Weld County and indicated organic sources of nitrate as the dominant contributor to the aquifer.

Groundwater sampling will be performed in urban areas along the front range in 1996.

A detailed report of the groundwater monitoring that took place in 1993 in the San Luis Valley unconfined aquifer was published in 1995. It is available from CDA. Data is being compiled from the

Arkansas River Valley alluvial aquifer monitoring that took place in 1994 and 1995 and a report will be published in 1996.

All of the groundwater sampling is closely coordinated with extension agents, water conservancy districts, other agencies, and local and county officials. Many of these agencies have groundwater monitoring projects analyzing for at least one agricultural chemical, usually nitrate.

One goal of the monitoring program as stated in the long range sampling plan (Appendix III) is to have a permanent state wide well monitoring network that can be used to gather long term data. The U.S. Geological Survey is currently drilling numerous monitoring wells throughout the state as part of the National Water Quality Assessment. These wells will form a substantial basis for the Agricultural Chemicals and Groundwater Protection program monitoring network. The USGS has indicated they would like this program to take over ownership of some of these wells that local agencies such as water conservancy districts have not claimed. The USGS will be forced to abandon the wells and plug them if they remain unclaimed. This is an excellent opportunity to establish a large part of the monitoring network. CDPHE is currently working out the details in taking over ownership of these wells.

## Groundwater Data Management System

The collection, evaluation and entering of existing groundwater quality data from all available sources is ongoing. The data that is currently available has been or is in the process of being entered into the groundwater quality database at the Department of Public Health and Environment. Other data has been generated, however it remains unavailable due to concerns about privacy and future use of the data (Appendix III).

## Advisory Committee

The advisory committee continues to be an integral part of the implementation of this program by providing input from the many facets of the agricultural community and the general public that they represent (Appendix V). The committee met two times during 1995. All major program activities are discussed with the committee prior to implementation. The committee has been essential in providing input on program strategy by helping to determine which issues to address first, where geographically to focus efforts, critiquing drafted documents, providing ideas about the most effective means of

distributing materials, and giving comments on how the information will be received, in addition to many other items.

## Coordination

Coordination with other projects and programs relating to agricultural chemicals and groundwater is an essential part of the implementation of the program. All three agencies work continually to keep abreast of other programs both governmental and private so information can be incorporated into the implementation of the Act as well this programs information passed on to other agencies and organizations. Input is sought in all phases of the implementation of this program to avoid duplication of efforts, costs, conflict or duplication of regulation and to insure decisions are made with the most complete knowledge available.

## Storage Regulations

The rules and regulations as required in section 25-8-205.5 (3) (b) became effective September 30, 1994. 1995 was spent educating and providing information about the requirements of the rules and the time line for implementation. As required by law, owners of pesticide facilities must have their operations in compliance by September 30, 1997 and fertilizer facilities by September 30, 1999. Numerous facilities throughout the State have already been completed.

To address one particular requirement of the regulations, generic design plans for small to medium sized facilities were developed and made available. (Appendix IV).

## State Management Plan for Pesticides

EPA has developed a program which would require states to produce management plans for pesticides thought to be a significant groundwater hazard. If a state wants to allow continued use of any of the pesticides identified, it must produce an EPA-approved management plan specific to that product. A generic plan is being drafted that can be adapted to different chemicals once EPA formally identifies these pesticides. Numerous meetings have been held between EPA and CDA, CSU and CDPHE to develop the generic SMP. Many problems have hindered the process from being completed in 1995, including extensive turnover in EPA staff as well as disagreements as to what needs to be performed to have an acceptable plan in EPA's eyes.

One of the more significant issues involves EPA's demand to have a sensitivity analysis/vulnerability assessment map of the state in a

Geographic Information System (GIS) format by which to determine where to focus education and monitoring activities. Funding is currently unavailable to perform this analysis for the entire state. In addition, significant amounts of data that is required is not in a electronic format to utilize with GIS. Work has begun on doing a sensitivity analysis pilot project for the northeastern part of the state. The project will be completed by April of 1996. If the results of the pilot project are acceptable to EPA, other areas of the state will be addressed if funding permits.

EPA has addressed some of the concerns the States have and it is hoped Colorado can complete and receive EPA concurrence on the generic plan in 1996.

## Major Issues

In last years report, the State Management Plan (SMP) for pesticides and current funding levels for portions of the program were identified as major issues. As discussed earlier many components of the SMP are being addressed but it is still a major concern. Current funding levels were identified as being insufficient to meet the increasing demands of the education and groundwater monitoring portions of the program. Decision items to increase the spending authority in both of these areas have been submitted, and if approved will address these needs.

## Objectives for 1996 Determined

The following objectives for 1996 have been established:

- Continue the implementation of localized BMPs for irrigated crops in the South Platte River Basin;
- Complete development of the localized Pesticide Use BMPs in the San Luis Valley for the major crop rotation patterns;
- Coordinate an interagency field day to deal with water quality issues in the South Platte River Basin;
- Continue demonstration plots in the South Platte River area for displaying improved nitrogen and water management to farmers;
- Continue demonstration work in the San Luis Valley;
- Complete the production and distribute a video featuring BMPs;
- Continue developing educational resource materials for groundwater education particularly for urban uses to encourage improved agricultural chemical and water management;
- Continue development of Urban BMPs and print and distribute completed BMPs;
- Continue to hold in-service training for chemical applicators, agency personnel, etc.;
- Participate in the Certified Crop Advisor program;
- Continue to provide information and training on the containment rules and regulations;
- Complete the report of the groundwater samples taken during 1994 and 1995 in the Arkansas River Basin;
- Collect and analyze groundwater samples in the urban front range for pesticides and nitrate;

- Continue field assessment of the aquifer vulnerability model in the San Luis Valley;
- Complete sensitivity analysis for groundwater for northeast Colorado;
- Obtain and input results of other groundwater monitoring for agricultural chemicals into the Agricultural Chemicals and Groundwater database;
- Continue the implementation of the long term sampling plan;
- Integrate results of other projects to achieve goals in the Act;
- Continue disseminating information on the Act and groundwater protection to special interest groups in Colorado;
- Continue publishing and distributing the newsletter and fact sheets;
- Continue using the display board to provide information on the program at trade shows and professional meetings;
- Complete development of the generic State Management Plan for pesticides.

# APPENDICES

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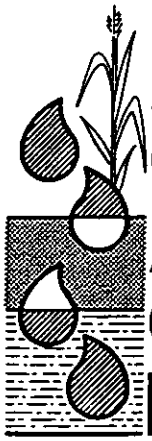
# APPENDIX I



# AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION

SLV Monitoring
Fact Sheet #9
February 1995

# Ground Water Monitoring in the San Luis Valley

The Water Quality Control Division of the Colorado Department of Public Health and Environment (CDPHE) has responsibility under the Agricultural Chemicals and Ground Water Protection Program (SB 90-126) to conduct monitoring for the presence of commercial fertilizers and pesticides in ground water. The Agricultural Chemicals Program has been established to provide current, scientifically valid, ground water quality data to the Commissioner of Agriculture. Prior to passage of SB 90-126, a lack of data had prevented an accurate assessment of impacts to groundwater quality from agricultural operations. This program will assist the Commissioner of Agriculture in determining to what extent agricultural operations are impacting ground water quality. The program also assists the Commissioner in identifying those aquifers that are vulnerable to contamination. The philosophy adopted is to protect ground water and the environment from impairment or degradation due to the improper use of agricultural chemicals, while allowing for their proper and correct use.

The ground water quality sampling program is intended to fulfill the following objectives:

- Determine if agricultural chemicals are present in the ground water.
- Provide data to assist the Commissioner of Agriculture in the identification of potential agricultural management areas.

The factors considered in selecting an area for monitoring are:

- Agricultural chemicals are used in the area.
- The ground water in the area is shallow in depth or vulnerable to contamination.
- The majority of the agricultural production in the area is irrigated.

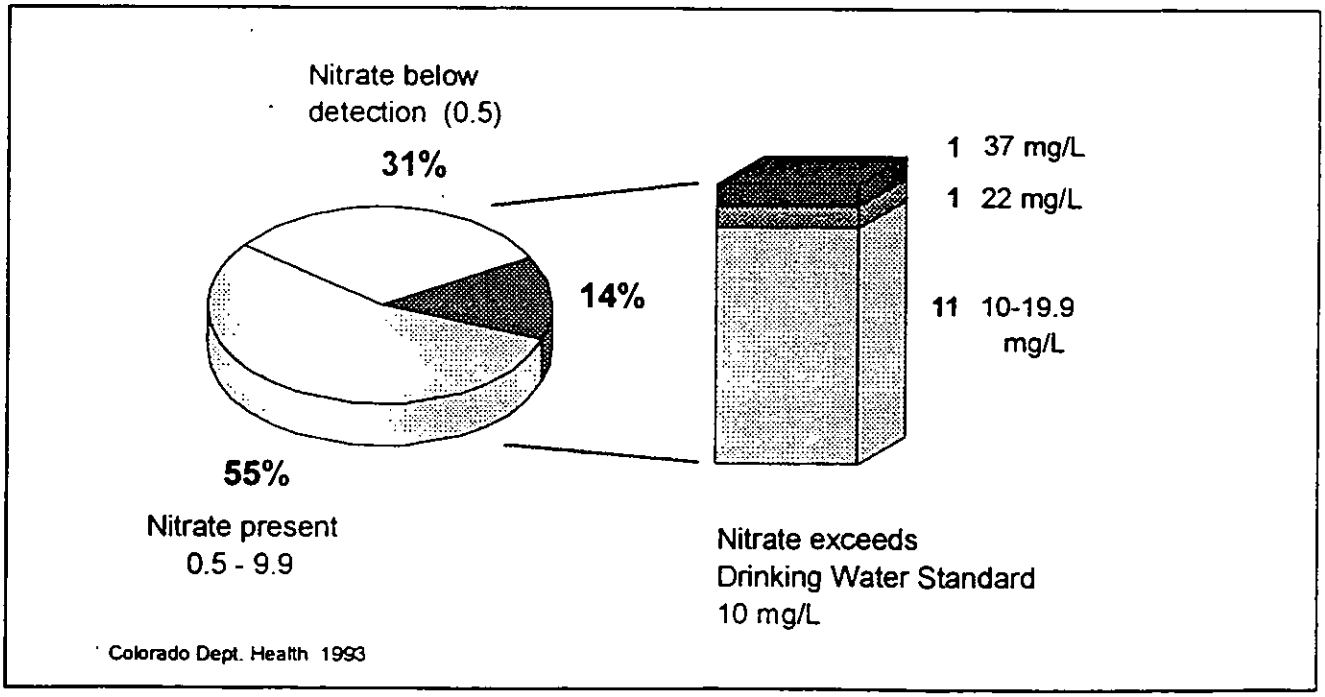
- The soil types are prone to leaching.
- The alluvial and /or shallow bedrock aquifers are utilized for domestic water supplies.

The 1993 monitoring program focused on groundwater quality monitoring in one of Colorado's major agricultural regions, the San Luis Valley. The monitoring program included sample collection, laboratory analysis, and data analysis and storage. Upon completion of the full analysis, which will include integration with previous and current studies by other agencies, this sampling program will provide the basis for determining a groundwater quality baseline for this region.

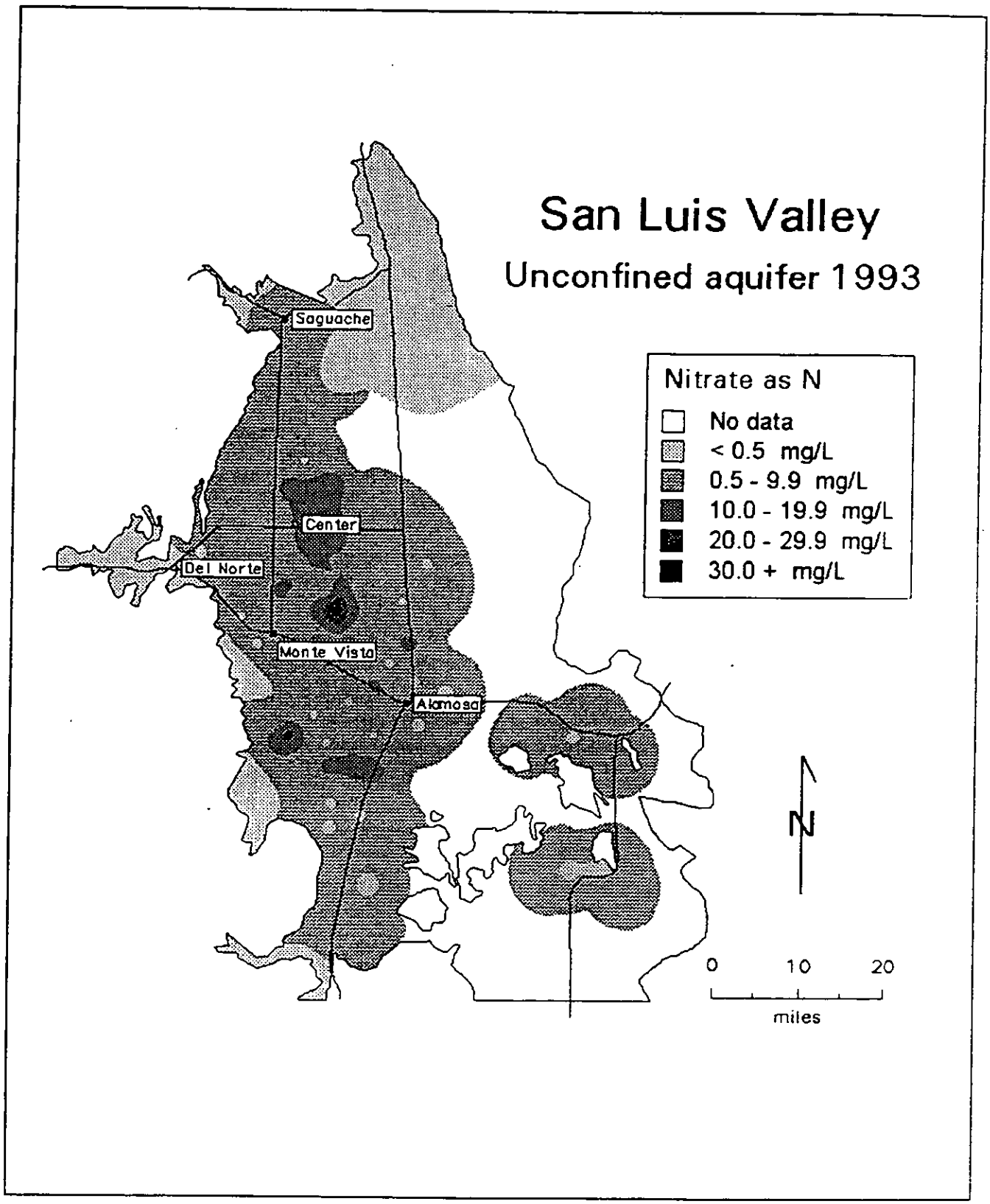
The Ag Chemicals Program of the Water Quality Control Division sampled ninety three (93) domestic wells throughout the San Luis Valley between May and August 1993. The San Luis Valley sampling program was the first effort to screen the entire shallow aquifer to establish the possible impacts and magnitude of agricultural chemical contamination. The San Luis Valley is characterized by intense irrigation agriculture encompassing both surface water diversions and large capacity irrigation wells for irrigation water supplies. The wells supply surface and center-pivot irrigation systems from the shallow unconfined aquifer. This shallow aquifer is also a major source for domestic water supplies throughout the valley.

All wells were sampled once between May and August, 1993. Wells were selected for sampling based on the following factors: permitted for domestic or household use, located within the unconfined valley fill aquifer, and cooperation of the well owner. All field sampling was performed by Brad Austin and John Colbert of CDPHE. Field sampling procedures followed the protocol developed by the Ground Water Quality Monitoring Working Group of the Colorado Nonpoint Task Force.

Well samples were analyzed for basic water quality components (calcium,sodium,sulfate,etc) dissolved metals, and selected pesticides. The basic and metals analysis was performed by the laboratory at CSU with all samples split with the CDPHE inorganic laboratory for nitrate and ammonia for quality control evaluation.




Nitrate levels in domestic wells in the San Luis Valley, May - June 1993. Values are given in milligrams per liter or parts per million.




Map of nitrate concentrations in the San Luis Valley unconfined aquifer from Colorado Department of Public Health and Environment data collected in 1993.

In addition to the inorganic parameters, all of the groundwater samples collected were analyzed for selected pesticides. The pesticide analysis was performed by the CDPHE and Colorado Department of Agriculture laboratories. A listing of pesticides was compiled for analysis based on those substances that have recently been, or are currently being utilized in the San Luis Valley according to agricultural officials there. Budget restrictions would not allow testing for all pesticides used in the study area. To reduce the analysis cost, each pesticide was weighted according to its chemical properties of persistence and mobility in the environment, amount of active ingredient used per acre, and the amount of acreage within the study area that pesticide was used on. Pesticides were then selected according to their final score and the ability of the laboratory to detect their presence.

The results from this sampling program have been entered into the Groundwater Quality Data System recently developed at CDPHE. A detailed report describing the area sampled, the protocol for sampling and analysis, and the results of the analysis will be provided to the Commissioner of Agriculture in 1995. The WQCD intends to include, in the final analysis of the San Luis Valley aquifer, all available ground water quality data. Results from previous and on-going studies by other agencies in the area will be integrated into this analysis.

Analysis of the data collected by CDPHE in 1993, for the San Luis Valley, indicates that ground water in parts of the study area has been impacted by various agricultural chemicals. The major inorganic contaminant of concern is nitrate. Thirteen of the ninety three (14%) domestic wells sampled showed nitrate levels in excess of the EPA standard for drinking water (10 mg/L). Three different pesticides were detected, but only one well contained a pesticide at a level higher than the EPA drinking water standard. This pesticide, Lindane, was detected at a level of 0.29 ug/L; the maximum contaminate level (MCL) for lindane is 0.2 ug/L. No single pesticide was detected in more than one well.

**Results of Pesticide Analysis, San Luis Valley Aquifer, 1993.**

| Pesticide | Use | Amount | MCL | DW |
|---|---|---|---|---|
| 2,4-D | Herbicide | 0.18 | 70 | Y |
| Hexazinone | Herbicide | 0.2 | None | Y |
| Lindane | Insecticide | 0.29 | 0.2 | Y |

Amounts are given in micrograms per liter or parts per billion
MCL - the maximum amount allowed in drinking water
DW - was this well used as a drinking water source

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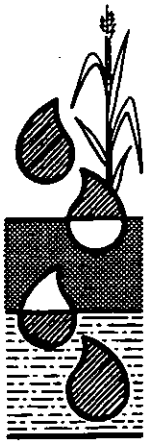


# AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION

South Platte Monitoring
Fact Sheet #10
March 1995

# Ground Water Monitoring in the South Platte Valley

The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) has responsibility under the Agricultural Chemicals and Ground Water Protection Program (SB 90-126) to conduct monitoring for the presence of commercial fertilizers and pesticides in ground water. The Agricultural Chemicals Program has been established to provide current, scientifically valid, ground water quality data to the Commissioner of Agriculture. Prior to passage of SB 90-126, a lack of data had prevented an accurate assessment of impacts to groundwater quality from agricultural operations. This program will assist the Commissioner of Agriculture in determining to what extent agricultural operations are impacting ground water quality. The program also assists the Commissioner in identifying those aquifers that are vulnerable to contamination. The philosophy adopted is to protect ground water and the environment from impairment or degradation due to the improper use of agricultural chemicals, while allowing for their proper and correct use.

The monitoring program involves the collection and laboratory analysis of ground water samples. The goal is to provide a preliminary determination of the existence of agricultural chemicals in the ground water in a safe, cost effective, and timely manner.

The ground water quality sampling program is intended to fulfill the following objectives:

- Determine if agricultural chemicals are present in the ground water.
- Provide data to assist the Commissioner of Agriculture in the identification of potential agricultural management areas.

The factors considered in the choice of the lower South Platte River Basin as a study area are:

- The South Platte River Basin is a major agricultural area of Colorado.
- The ground water in the alluvial aquifer within this area is shallow in depth.

- The area is heavily irrigated by both surface water diversions and ground water pumpage.
- The soil types are conducive to leaching.
- The alluvial and shallow bedrock aquifers are utilized for irrigation and domestic water supplies throughout the basin.
- The Colorado Department of Agriculture and Colorado State University Extension have chosen the South Platte as the site for initial development of Best Management Practices.

Based on the land use and hydrogeologic factors, the potential exists for migration of agricultural chemicals into the ground water in this area. In addition, this area is currently the subject of other scientific research into agricultural impacts to ground water quality.

## Ground Water Monitoring Program

The monitoring program in the South Platte River Valley included sample collection, laboratory analysis, and data analysis and storage. Upon completion of the full analysis of data from previous and current studies by other agencies, this sampling program will provide the basis for determining a groundwater quality baseline for this region.

The Ag Chemicals Program of the WQCD sampled ninety six (96) domestic wells along the South Platte River from Denver to Julesburg. This sampling program was the first effort to monitor the entire lower South Platte alluvial aquifer to establish the possible impacts and magnitude of agricultural chemical contamination. This region is characterized by intense irrigation agriculture encompassing both surface water diversions and wells for irrigation water supplies. The wells supply surface and center-pivot irrigation systems from the shallow alluvial aquifer along the river.

Wells were selected for sampling based on the following factors: permitted for domestic or household use, located within the valley fill aquifer of the South Platte River or one of its major tributaries, and cooperation of the well owner. The wells were sampled once between June and August, 1992 by Brad Austin and John Colbert of CDPHE. Field sampling procedures followed the protocol developed by the Ground Water Quality Monitoring Working Group of the Colorado Nonpoint Task Force.

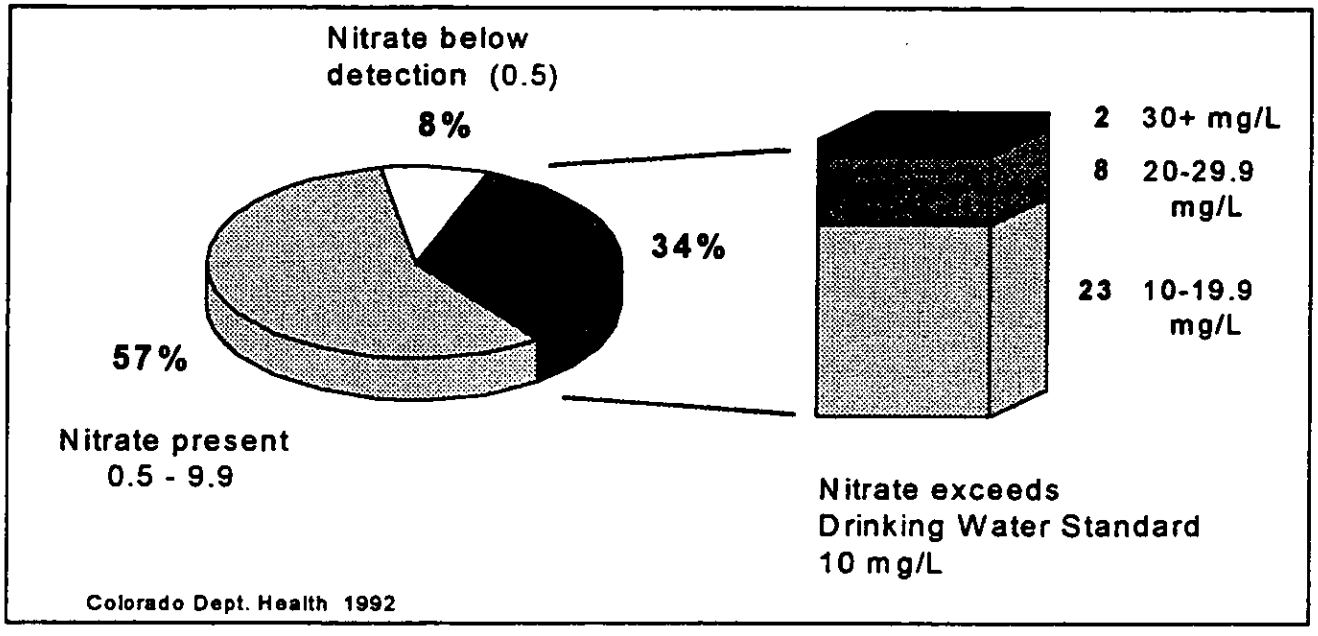
Well samples were analyzed for basic water quality constituents, dissolved metals, and selected pesticides. The basic inorganic analysis was performed by the Soils Laboratory at CSU with all samples split with the Colorado Department of Health Laboratory for nitrate and total dissolved solids for quality control evaluation. Comparison of these split parameters shows consistent results between the two laboratories.

In addition to the inorganic constituents, all of the groundwater samples collected were analyzed for selected pesticides. A listing of pesticides was compiled for analysis based on those substances that have recently been, or are currently being utilized in the South Platte Valley according to agricultural officials there. Budget restrictions would not allow testing for all pesticides used in the study area. To reduce the analysis cost, each pesticide was weighted according to its chemical properties of persistence and mobility in the environment, amount of active ingredient used per acre, and the amount of acreage within the study area that pesticide was used on. Pesticides were then selected according to their final score and the ability of the laboratory to detect their presence.

## Ground Water Monitoring Results

The results from this sampling program have been entered into the CDH Groundwater Quality Data System, a database specifically designed and maintained by the WQCD to store ground water quality data. Reports may be generated from the database on ground water quality in any area of the state from all data sources available.

Analysis of the laboratory results indicates that ground water in portions of the South Platte

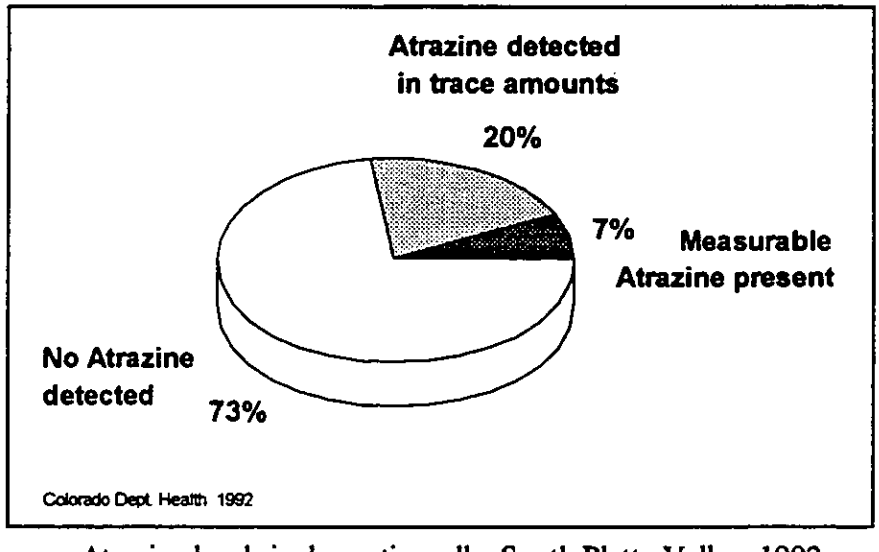



Nitrate levels in domestic wells, South Platte Valley, 1992.

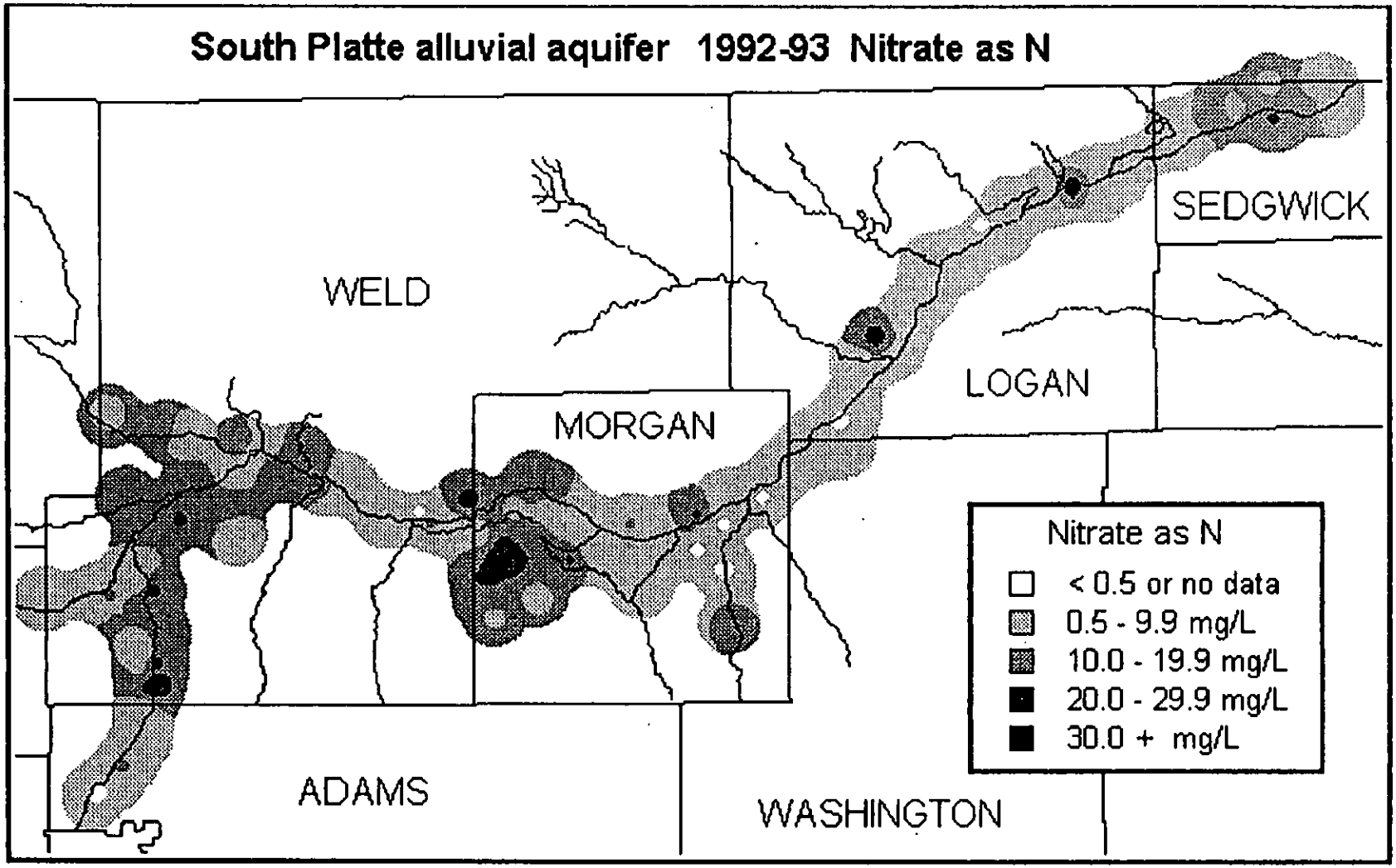
alluvial aquifer has been impacted by nitrates and certain pesticides. The major inorganic contaminant of concern is nitrate. Thirty three (33) of the ninety six (96) domestic wells sampled (35%) showed nitrate levels in excess of the EPA standard for drinking water (10 mg/L). Fifty five (55) wells (57%) tested positive for nitrate but were below the EPA standard. Only eight (8) wells tested below the detection level of 0.5 mg/L.

Looking at the nitrate map as you move downstream along the South Platte River from Denver to Julesburg we see that immediately below Denver, in Adams County, levels are well below the drinking water standard. Just below Brighton the levels begin to increase and an area from Brighton through Greeley shows several wells above 20 mg/L with the average level consistently above the standard of 10 mg/L. Around Wiggins in western Morgan County, a second area of elevated nitrate appears. Nitrate levels then decrease through eastern Morgan and Logan County with the exception of two isolated wells at Sterling and Crook. In Sedgwick County the nitrate levels once again begin to increase with the overall average rising above the drinking water standard. The elevated nitrate levels (above the EPA drinking water standard) appear in three distinct areas: the Brighton to Greeley reach of the aquifer, an area in western Morgan County around Wiggins, and Sedgwick County.

Examination of the pesticide data reveals that seven different pesticides were detected in the South Platte alluvial aquifer. Of the ninety six (96) wells sampled, only one well contained a pesticide




Atrazine levels in domestic wells, South Platte Valley, 1992.




Map of interpolated nitrate concentrations, South Platte alluvial aquifer, 1993.

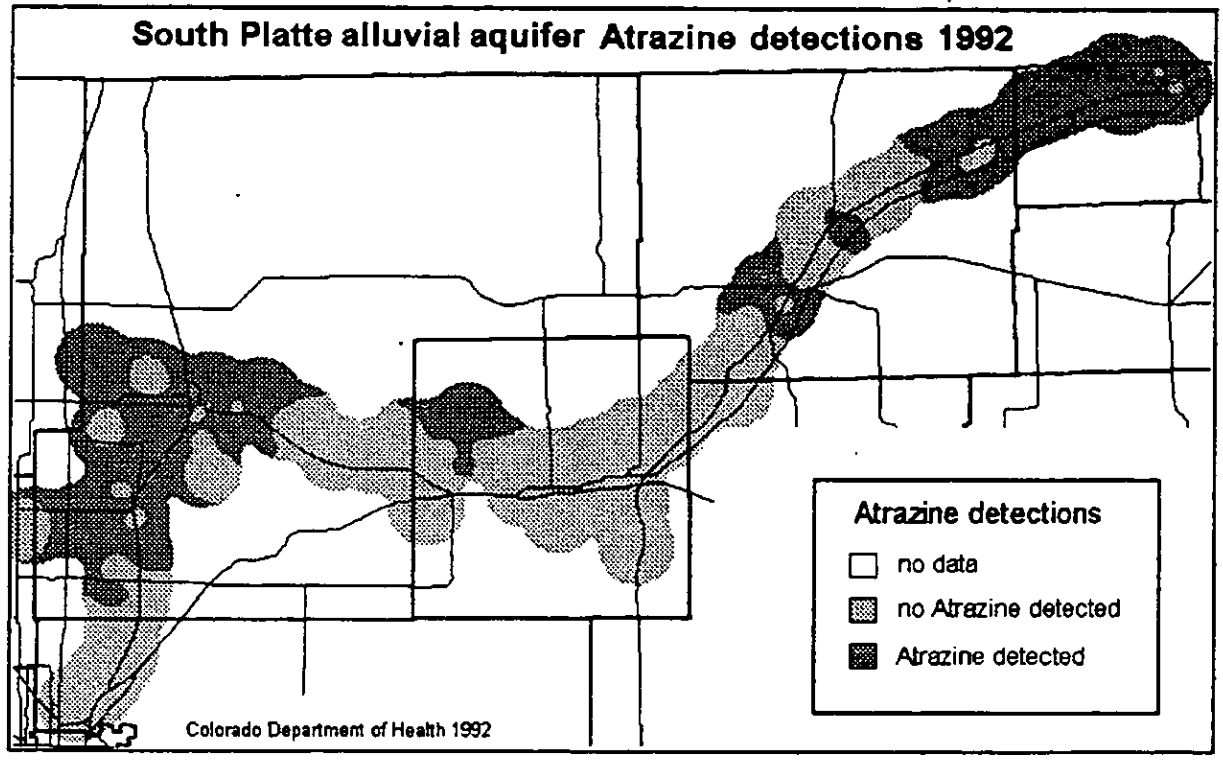
Note: The shading on the maps in this fact sheet represent interpolated values from data collected at individual well locations. Map concentrations may not reflect actual ground water conditions at some other location.

at a level higher than the EPA drinking water standard. This pesticide, alachlor, was detected at a level of 3.09 ug/L; the MCL for alachlor is 2.0 ug/L. Several wells had detectable levels of the pesticide atrazine. Nineteen (19) wells showed a trace of atrazine (detectable by the lab, but in very small quantites), and seven (7) wells had measurable levels of atrazine. None of these atrazine levels exceeded the EPA standard for drinking water of 3.0 ug/L.

Due to the widespread nature of the detections of atrazine in the South Platte alluvial aquifer, the occurrence of this pesticide appears to result from non-point sources. The areas where the atrazine occurs also corresponds well with the elevated levels of nitrate. This is most likely due to similar soil types and irrigation practice in these areas. Atrazine is a common herbicide used extensively on corn, with over one million pounds of active ingredient used per year in Colorado. Water quality studies in other states and nationally have also detected atrazine as a common pesticide in surface and ground water. The WQCD intends to include, in the final analysis of the South Platte alluvial aquifer, all available ground water quality data. Results from previous and on-going studies by other agencies in the area will be integrated into this analysis.

## Follow-up Sampling

A follow-up sampling program was conducted in May, 1993, to resample a portion of the original South Platte study area. The sampling program consisted of resampling a majority of the original wells in Morgan and Sedgwick Counties, plus adding additional wells to improve the sampling density. In all, forty seven (47) wells were sampled for nitrate. The resampling program was designed to determine if the contamination originally detected was a widespread non-point source occurrence or only a coincidence of randomly selecting a few wells with high nitrate levels. The 1993 results confirmed that nitrate levels




Map showing areas of atrazine detections, South Platte alluvial aquifer, 1992.

exceeded the drinking water standard in both counties. In Morgan County, thirteen of thirty four (38%) of the wells had nitrate levels in excess of the EPA drinking water standard of 10 mg/L, with only two wells (5%) showing no nitrate. In Sedgwick County, five of thirteen (38%) of the wells had nitrate levels in excess of the EPA drinking water standard of 10 mg/L. All Sedgwick County wells had some level of nitrate present. The resampling also indicated little or no change in nitrate levels from one year to the next in those wells that had been sampled both years.

In Morgan County the elevated nitrate area first observed around Wiggins has now expanded and sampling confirms that an area of elevated nitrate levels exists in western Morgan County.

In Sedgwick County the additional sample points slightly expanded and confirmed an area of elevated nitrate levels centered about Ovid.

## Results of Pesticide Analysis, South Platte Aquifer, 1992.

| Pesticide | Trace | DW | Present | DW | MDL | PQL |
|---|---|---|---|---|---|---|
| | Number of wells | | | | (ug/L) | |
| Alachlor | 1 | 0 | 1 | 0 | 0.3 | 2.5 |
| Atrazine | 19 | 9 | 7 | 4 | 0.05 | 0.5 |
| Benefin | 1 | 0 | 0 | 0 | 0.03 | 0.3 |
| DCPA | 1 | 1 | 0 | 0 | 0.03 | 0.3 |
| Diazinon | 1 | 0 | 0 | 0 | 0.2 | 2.0 |
| EPTC | 1 | 0 | 0 | 0 | 0.05 | 0.5 |
| Hexazinone | 1 | 1 | 0 | 0 | 0.15 | 1.5 |

Trace - Well sample contained a pesticide at a concentration above MDL but below PQL.
Present - Well sample contained a pesticide at or above the PQL.
DW - Number of wells with that pesticide that are a drinking water source.
MDL - Method Detection Level. Lab instrument can detect the presence of a compound at this level but not measure it.
PQL - Practical Quantification Level. The concentration, at or above which, lab can quantify results and return a measurable value.
ug/L - Micrograms per liter. Units of measurement for pesticide concentrations. In water, equivalent to parts per billion.

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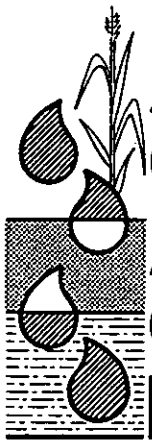

# AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION

October 1995
Fact Sheet #11
Soil, Plant & Water Testing

# Soil, Plant, and Water Testing

Soil and manure testing are the foundation of an economically and environmentally sound crop management program. Plant tissue analysis can be a very useful method for assessing crop nutrient status. In addition, rural homeowners should periodically test their well water to ensure it is safe for drinking.

There are a number of qualified laboratories in Colorado that can provide these services. There are also commercially available quick test kits which can be used at home for testing both soils and water. Without an analysis, you may be buying unnecessary fertilizer or applying too much manure to your fields. Neither practice is sound. In some cases, a $35 soil analysis can save a crop producer thousands of dollars in unnecessary fertilizer costs.

**Proper Sampling Techniques**

Obtaining a representative sample is the key to getting accurate results. Steps for proper sampling are available from your local Cooperative Extension office or from the laboratory that will analyze your samples. The main things to remember are to use clean collection implements and to obtain a sample that is representative of the soil or material you wish to have analyzed. In general, the more material you composite to form your sample, the more reliable the results will be.

**Soil Testing**

Yearly sampling of each crop field is recommended to make accurate nutrient management recommendations. Routine soil sampling also provides valuable information about soil salinity, pH, and organic matter content. Collect soil cores from a variety of locations in the field to get a representative sample. Combine 20 to 30 individual samples and mix thoroughly before filling the sample bag. Avoid (or sample separately) any unusual areas that will bias your results. Large fields should be broken into smaller sampling units based upon crop, yield, and fertilizer histories. Typically, soil is collected from the top 8 to 12 inches for routine analysis for fertilizer recommendations. Separate subsoil samples for nitrate analysis are suggested for N recommendations for irrigated crops.

Lawn and garden management can also be improved by soil sampling for nutrient analysis. Usually about a dozen soil cores to a depth of 4 - 6 inches are adequate for a typical urban lawn or garden sample.

Soils can also be analyzed for less common elements such as selenium or lead, as well as organic compounds such as pesticides or hydrocarbons. Pesticide tests are expensive and not routinely recommended unless serious contamination problems are suspected. Check with the laboratory concerning the submission of samples for pesticide testing. Sampling for organic compounds requires special handling.

Air dry soil samples prior to mailing to the laboratory and be sure to keep all samples cool. For best results, deliver samples to the laboratory as soon as possible.

**Water Testing**

People who get their water from a public supply have the benefit of strict federal and state regulations governing water quality and testing. If you have a private water system, it is your responsibility to make sure your family's water is safe. Contaminated water may not taste, look or smell different from safe

| Laboratory Name | Soil Test | Water Analysis | Manure Analysis | Nitrate Analysis Only | Pesticide Analysis in Soil or Water | Bacteriological Analysis |
|---|---|---|---|---|---|---|
| **Price Range** | $9.50-$60.00 | $10.00-$74.50 | $10.00-$55.00 | $3.00-$20.00 | * | $13.00-$50.00 |
| **Most Quoted Price** | $30.00 | $30.00 | $30.00 | $15.00 | | $20.00 |
| A & L Laboratories, Inc. | X | X | X | X | | X |
| Accu-Labs Research | X | X | | X | X | X |
| ACZ Labs | X | X | | X | X | X |
| Agricultural Testing and Consultants | X | X | X | X | X | X |
| Analytica, Inc. | X | X | | X | X | X |
| Analytical Technologies, Inc. | | X | X | | X | |
| Aspen Analytical | X | X | | X | X | X |
| Colorado Analytical Laboratory | X | X | X | X | | X |
| CO Dept. Public Health and Env. | | X | | X | X | X |
| CSU - Soil, Water, and Plant Testing Lab | X | X | X | X | | |
| Core Laboratories | | X | X | | X | X |
| El Paso County Dept. Health/Env. | | X | | X | | X |
| Environmental Science & Engineering | X | X | X | X | X | X |
| Evergreen Analytical, Inc. | | X | | X | X | X |
| Grand Junction Laboratories | X | X | | X | | X |
| Harris Laboratories | X | X | | X | X | |
| Hydrologic Laboratories, Inc. | | X | | X | X | |
| Industrial Laboratories | X | X | X | X | X | X |
| Inter-American Laboratories | X | | X | X | | |
| Midwest Laboratories | X | X | X | X | X | X |
| Northeast CO Dept./Public Health/Env. | | X | | X | | X |
| Olsen's Agricultural Laboratory, Inc. | X | X | X | X | | |
| Quanterra Environmental Services | X | X | | X | X | |
| SLV Analytical Services, Inc. | X | X | | X | | |
| Servi-Tech Laboratories | X | X | X | X | | X |
| Stewart Environmental Consultants, Inc. | X | X | | X | | X |
| Stukenholtz Laboratory | X | X | X | X | X | X |
| Trace Minerals International | | X | | X | X | X |
| Triple S Lab, Inc. | X | X | X | X | | |
| Ward Laboratories, Inc. | X | X | X | X | X | |
| Warren Analytical | X | X | X | X | X | X |
| Weld County Dept./Public Health/Env. | | X | | X | | X |
| Weld Laboratories, Inc. | X | X | X | X | | X |
| Western Laboratories | X | X | X | X | | |

**X - indicates service provided**

*Costs of analyzing soil or water for pesticides will vary depending on how many and which pesticides are being analyzed for.

Laboratory services, prices, and addresses may change. Contact the lab you intend to use prior to sample collection to get the most up to date information and specific sample collection instructions. Quality of laboratory services may vary. Ask the laboratory manager about areas of expertise or seek references. Listing of labs does not constitute endorsement nor does omission imply criticism. The information herein was compiled in the summer of 1995.

**A & L Laboratories, Inc.**
P. O. Box 1590
302 34th St.
Lubbock, TX 79408-1590
(806) 763-4278

**Accu-Labs Research, Inc.**
4663 Table Mountain Dr.
Golden, CO 80403-1650
(303) 277-9514

**ACZ Laboratories, Inc.**
30400 Downhill Drive
Steamboat Springs, CO 80487
(970) 879-6590
1-800-334-5493

**Agricultural Testing and Consultants, Inc.**
2043 Kimberly Road
P.O. Box 4
Twin Falls, ID 83303-0004
(208) 734-2303

**Analytica, Inc.**
325 Interlocken Pkwy,
Suite 2000
Broomfield, CO 80021
(303) 469-8868

**Analytical Technologies, Inc.**
225 Commerce Dr.
Ft. Collins, CO 80525
(970) 490-1511

**Aspen Analytical**
1110 Elkton Dr., Suite A
Colorado Springs, CO 80907
(719) 593-9595

**Colorado Analytical Laboratory**
240 S. Main St.
P.O. Drawer 507
Brighton, CO 80601
(303) 659-2313

**Colorado Dept. Public Health Environment**
Division of Laboratories
4210 East 11th Ave.
Denver, CO 80220
(303) 691-4726

**CSU-Soil, Water and Plant Testing Laboratory**
Room A319, NESB
Fort Collins, CO 80523-1120
(970) 491-5061

**Core Laboratories**
10703 E. Bethany Dr.
Aurora, CO 80014
(303) 751-1780

**El Paso County Dept./Public Health/Env. Laboratory**
301 South Union Blvd.
Colorado Springs, CO 80910
(719) 578-3120

**Environmental Science & Engineering Inc.**
7330 S. Alton Way, Suite N
Englewood, CO 80112-2319
(303) 741-0639

**Evergreen Analytical Inc.**
4036 Youngfield St.
Wheat Ridge, CO 80033-3862
(303) 425-6021

**Grand Junction Laboratories**
435 North Ave.
Grand Junction, CO 81501
(970) 242-7618

**Harris Laboratories**
624 Peach Street
P.O. Box 80837
Lincoln, NE 68501
(402) 476-2811

**Hydrologic Laboratories**
695 North 7th Avenue
Brighton, CO 80601-1559
(303) 659-0497

**Industrial Laboratories**
1450 E. 62nd Ave.
P.O. Box 16207
Denver, CO 80216
(303) 287-9691
1-800-456-5288

**Inter-American Laboratories**
P.O. Box 94
Cozad, NE 69103
(308) 784-4011

**Midwest Laboratories, Inc.**
13611 B Street
Omaha, NE 68144-3693
(402) 334-7770

**Northeast CO Dept/Public Health/Env. Laboratory**
700 Columbine
P.O. Box 3300
Sterling, CO 80751-0316
(970) 522-3741

**Olsen's Agricultural Laboratory, Inc.**
P.O. Box 370
210 East First
McCook, NE 69001
(308) 345-3670

**Quanterra Environmental Services**
4955 Yarrow
Arvada, CO 80002
(303) 421-6611

**SLV Analytical Services Inc.**
411 Ross Ave.
Alamosa, CO 81101
(719) 589-4417

**Servi-Tech Laboratories**
P.O. Box 1397
1816 E. Wyatt Earp
Dodge City, KS 67801
(316) 227-7509
1-800-557-7509

**Servi-Tech Laboratories**
P.O. Box 169
1602 Park West Drive
Hastings, NE 68901
(402) 463-3522
1-800-468-5411

**Stewart Environmental Consultants Inc.**
214 N. Howes
Fort Collins, CO 80523
1-800-373-1348

**Stukenholtz Laboratory**
Addison Avenue East
Box 353
Twin Falls, ID 83303
(208) 734-3050
1-800-759-3050

**Trace Minerals International**
6545 Gunpark Dr., Suite #240
Boulder, CO 80301
(303) 530-5135

**Triple S Lab Inc.**
P.O. Box 678
2752 S E Frontage Rd.
Loveland, CO 80539
(970) 667-5671

**Ward Laboratories, Inc.**
P.O. Box 788
4007 Cherry Ave.
Kearney, NE 68848
(308) 234-2418
1-800-887-7645

**Warren Analytical**
650 East O St.
Greeley, CO 80631
1-800-945-6669

**Weld County Dept. Public Health & Environment Laboratory**
1517 16 Ave. Ct.
Greeley, CO 80631
(970) 353-0635 x2241

**Weld Laboratories Inc.**
1527 1st Ave.
Greeley, CO 80631
(970) 353-8118

**Western Laboratories**
P.O. Box 1020
Parma, ID 83660
(208) 722-6564

drinking water. Laboratory analysis is the only sure method to determine the quality of your water.

If you are buying a new property or if you cannot remember when your well was last tested, you should have your water analyzed by a reputable laboratory for bacteria, nitrate, sulfate, chloride, pH, total dissolved solids (TDS), hardness, and conductivity to get baseline information on your well. Bacterial analysis is strongly recommended for all private water supplies, especially for a well in close proximity to septic systems or animal confinement facilities. Tests for pesticides, other organic contaminants, and radon are expensive and not usually recommended unless you have reason to suspect contamination.

Annual water testing is suggested to help monitor the quality of your private water supply. If you see a decline in quality, more thorough investigation is warranted. These records will provide valuable information on the history of your well if your water is ever contaminated.

When you take a water quality sample, be sure to follow your laboratory's sampling protocol. Many laboratories provide clean containers with detailed instructions on how to take the sample. If a container is not provided, use a clean plastic container which is rinsed 3 times with the well water before you collect the actual sample. Be sure to wash your hands prior to sampling and do not touch the inside of the container or lid. It is best to let the water flow for about 5 minutes before sampling, and do not draw from an aerated faucet or a swing arm faucet. For best results, water samples should be analyzed within 30 hours of the initial collection.

**Manure Testing**

Manure testing is the best way to know the fertilizer value of manure spread on fields or gardens. Manure should be analyzed for N, P, K, micronutrients, and salt content (E.C.). There are a number of qualified laboratories in Colorado that can provide these services.

Obtaining a representative manure sample can be challenging. For proper manure sampling, you need a clean bucket and sample jar. If you are spreading manure daily, take many small samples over a representative period. For periodic spreading from a manure pack or pile, collect samples from a variety of locations in the pack or pile using a clean shovel or fork. Be sure that you collect both manure and bedding if they will be applied together. Agitate liquid manure handling systems before sampling and collect several separate samples. Combine the individual spot samples from a particular lot or lagoon in the bucket and mix thoroughly before filling the sample jar. Keep the sample refrigerated and deliver it to the laboratory within 24 hours if possible.

Collect the samples well in advance of your spreading date so that you will have time to obtain test results and calculate the correct application rate for the crop to be grown. An accurate manure test is an excellent investment of time and money, as it may help you realize significant savings on fertilizer bills while simultaneously avoiding water contamination problems.

**Plant Analysis**

Plant analysis during the growing season is another practice to help assess nutrient sufficiency in the growing plant. While nutrient deficiencies are many times visibly apparent, excess nutrient levels can only be determined by plant tissue analysis. This technology offers producers the ability to apply lower rates of fertilizer preplant, and to monitor and adjust plant nutrient status throughout the growing season. Plant analysis, when properly used, offers producers insurance that careful nutrient management will not negatively affect the bottom line.

**Laboratory Services**

Individual laboratories will vary in services offered, prices, and the time they require for analysis. The laboratories listed in this fact sheet are not all inclusive and the list of services may change over time. To select a lab, consider convenience, but also think about services offered and quality. Call the laboratory manager prior to sample collection to determine lab suitability and to get more detailed information.

Be sure to keep a record of your lab results as a reference for future testing. If you need help interpreting the results of your sample, the lab manager where the sample was analyzed or your County Extension agent can assist you. Different labs may vary in analytical tests used and reported concentration values, but should not vary too much in actual recommendations. Ask your lab manager about their nutrient management philosophy to be sure it is consistent with your objectives.

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# AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION

## agricultural chemical bulk storage and mix/load facility plans for small to medium-sized facilities

*Approved by the Commissioner of Agriculture to fulfill the requirements of the Agricultural Chemical and Groundwater Protection Act (SB 90-126).*

# Best Management Practices For Crop Pests

Colorado State University Cooperative Extension

January 1995

Bulletin #XCM-176

# Best Management Practices For Agricultural Pesticide Use

Colorado State University Cooperative Extension

January 1995

Bulletin #XCM-177

# Best Management Practices For Private Well Protection

Colorado State University Cooperative Extension

January 1995

Bulletin #XCM-179

# APPENDIX II

# 1995 Annual Report
# Colorado State University Cooperative Extension

**Accomplishments:**

1. Conducted educational programs throughout Colorado on SB 90-126 and issues related to agricultural chemicals and groundwater quality. Groups addressed include commercial applicators, chemical dealers, weed districts, crop consultants, crop and livestock producers, agency personnel, and urban chemical users.

2. Conducted training related to the State Best Management Practice Manual. Distributed 10,000 booklets to Colorado citizens covering nutrient, pesticide, irrigation, manure, and water well management.

3. Worked with three local groups in Colorado to develop and disseminate localized BMP guidelines for groundwater protection. The local group in the San Luis Valley published their findings in a booklet entitled "Best Management Practices for Nutrient and Irrigation Management in the San Luis Valley". The local group in the front range area published their work in a booklet entitled "Best Management Practices for Colorado Agriculture". A new group headed by the Shavano Soil Conservation District is working with local Cooperative Extension Agents and producers in the Montrose/Delta area to define practices appropriate for the West Slope.

4. Compiled BMPs for urban pesticide and fertilizer use by homeowners in Colorado. These BMPs will be printed and distributed in 1996.

5. Conducted nutrient management demonstrations on 7 farmer fields and hosted a BMP field day in the South Platte area to introduce the public to proper nitrogen, manure, pesticide and water management practices.

6. Produced newsletter articles, press releases, fact sheets, technical papers, radio and other mass media articles on groundwater protection in Colorado.

7. Worked to coordinate efforts of the Agricultural Chemicals and Groundwater Protection program with other state and federal programs in Colorado.

8. Assisted the Colorado Department of Agriculture in the implementation of the Bulk Storage Regulations and the development of the generic State Management Plan.

## BMP Development

Colorado State University Cooperative Extension is working with the Colorado Department of Agriculture to develop Best Management Practices for Colorado farmers, land owners, and commercial agricultural chemical applicators. The BMPs adopted for use at the local level must ultimately be determined by the chemical user because of the site specific nature of groundwater protection. The local perspective is also needed to evaluate the feasibility and economic impact of these practices. The SB 90-126 Advisory Committee has recommended that a significant level of input be received at the local level prior to adoption of recommended BMPs.

Colorado State University Cooperative Extension has compiled a broad set of BMPs encompassing nutrient, pest, and water management which will be used as a template for local committees. These documents were published in a notebook form in 1995 that will be updated as needed and expanded to include additional guidelines.

Cooperative Extension has piloted the local BMP development process in the San Luis Valley and in the front range area of the South Platte Basin. The local working committees consist of a small group of producers, consultants, and chemical applicators. The San Luis Valley group has produced a set of BMPs appropriate for their area which are being publicized and will be implemented by cooperating farmers in field scale demonstrations. The South Platte group is working towards consensus in a very complex farming region. Both of these groups have produced BMPs for nutrient and irrigation management - the most serious problem in their respective areas. They are now working on pest and pesticide management BMPs for specific crops. A new local BMP group was formed in 1995 in the Montrose/Delta area. The Shavano SCD is working with local Extension agents and producers to develop a set of practices appropriate for the West Slope.

## Field Demonstrations

Colorado State University Cooperative Extension worked with the USDA Agricultural Research Service and farmers on field research and educational plots during 1995 to demonstrate improved nitrogen, manure, and irrigation management techniques. New production tools are being evaluated and demonstrated to farmers which may improve producer profitability and help protect groundwater.

Field trials were held on 7 farms in the South Platte River Basin during 1995. An educational field day was held to acquaint other producers and interested parties with the need for groundwater protection.

A new technology known as in-season nitrate testing was demonstrated to farmers on strip trials on their farms. This tool may help farmers improve N recommendation accuracy and minimize the use of "insurance" N fertilizer. By complementing preplant soil testing with in-season testing, it may be possible to improve N fertilizer requirement prediction accuracy, resulting in reduced leaching of nitrate to groundwater. Quick soil test kits for nitrate

have been developed that allow "field testing," thereby alleviating the problem of slow turn-around time in commercial soil testing laboratories. The development of these quick test kits has made the in-season nitrate test a viable soil testing procedure for assessing the N fertility status of crops at any growth stage. It is expected that this will result in the joint use of preplant deep soil nitrate testing and in-season testing which will increase the accuracy of N fertilizer recommendations. The total application of N fertilizer can be decreased without negatively affecting crop yields as farmers adopt this improved technology.

Other production tools being evaluated and demonstrated to farmers include the portable chlorophyll meter to access N status of growing plants and surge irrigation valves to help decrease irrigation water runoff and leaching. Additionally, research is being conducted on the usefulness of the NLEAP computer model in selecting and evaluating BMPs for nitrogen leaching.

Project sponsors include Colorado State University Cooperative Extension and Department of Soil & Crop Sciences, USDA Agricultural Research Service, Northern Colorado Water Conservancy District, and the Natural Resources Conservation Service.

# APPENDIX III

# COLORADO DEPARTMENT OF HEALTH
## Water Quality Control Division
## Ag Chemicals Program

## Executive Summary

The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) has responsibility under the Agricultural Chemicals and Ground Water Protection Program (SB 90-126) to conduct monitoring for the presence of commercial fertilizers and pesticides in ground water. This data assists the Commissioner of Agriculture in determining whether agricultural operations are impacting ground water quality. This past year the program monitored groundwater quality in two of Colorado's major agricultural regions, the South Platte River Valley, and the Arkansas River Valley.

This was the first year of a long term monitoring effort initiated in the South Platte alluvial aquifer from Brighton to Greeley. In Weld County, 88 wells were sampled for nitrate and 33 pesticides. Three types of existing wells were used, 16 monitoring wells operated by the Central Conservancy District, 21 domestic wells first sampled in 1992, and 51 irrigation wells sampled in 1989, 1990, 1991, and 1994. Nitrate analysis showed that 69% of the monitoring wells, 48% of the domestic wells, and 82% of the irrigation wells exceeded the nitrate drinking water standard of 10 mg/L. Pesticide data revealed three pesticides, Atrazine, Metolachlor, and Prometon present in the monitoring well samples. These same three pesticides plus Lindane were detected in the domestic well samples. Atrazine, Metolachlor, Prometon, and Alachlor were detected in the irrigation wells. In one domestic well, the insecticide Lindane exceeded a water quality standard.

In the Arkansas Valley, a confirmation sampling was performed on those wells that had a nitrate level above 10 mg/L, or a pesticide detection in 1994. The confirmation sampling tested 32 wells and found little change from 1994, indicating a high level of confidence in the initial work. Nitrate levels were statistically unchanged and the only pesticide detected was Atrazine. In one domestic well, the herbicide Atrazine exceeded a water quality standard.

In addition to monitoring ground water for the presence of agricultural chemicals, the Ag Chemicals Program is required to determine the likelihood that an agricultural chemical will enter the ground water. This type of determination has been described as a vulnerability analysis. The Program will work jointly with a researcher at Colorado State University to develop the details for the vulnerability analysis selected for use in Colorado. The sources, format, and availability of the data needed for the evaluation is currently being compiled. The project will then conduct a limited test of the method in the northeastern section of the state. Results will be evaluated and incorporated into a standard method to determine vulnerability statewide. This effort will become a key element of the State Management Plan for pesticides implemented under the Federal Insecticide, Fungicide, and Rodenticide Act.

## Introduction

The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) has responsibility under the Agricultural Chemicals and Ground Water Protection Program (SB 90-126) to conduct monitoring for the presence of commercial fertilizers and pesticides in ground water. The Agricultural Chemicals Program has been established to provide current, scientifically valid, ground water quality data to the Commissioner of Agriculture. Prior to passage of SB 90-126, a lack of data had prevented an accurate assessment of impacts to groundwater quality from agricultural operations. This program will assist the Commissioner of Agriculture in determining to what extent agricultural operations are impacting ground water quality. The program also assists the Commissioner in identifying those aquifers that are vulnerable to contamination. The philosophy adopted is to protect ground water and the environment from impairment or degradation due to the improper use of agricultural chemicals, while allowing for their proper and correct use.

This report has been prepared for the Colorado General Assembly to provide a summary of the work completed in 1995. The monitoring program involves the collection and laboratory analysis of ground water samples. This monitoring program was planned to meet the objectives necessary for a preliminary determination of the existence of agricultural chemicals in the ground water in a safe, cost effective, and timely manner.

The ground water quality sampling program is intended to fulfill the following objectives:

1. Determine if agricultural chemicals are present in the ground water.
2. Provide data to assist the Commissioner of Agriculture in the identification of potential agricultural management areas.

The factors considered in selecting an area for monitoring are:

1. Agricultural chemicals are used in the area.
2. The ground water in the area is shallow in depth or vulnerable.
3. The majority of the agricultural production in the area is irrigated.
4. The soil types are conducive to leaching.
5. The alluvial and /or shallow bedrock aquifers are utilized for domestic water supplies.

Before an area is selected for monitoring, CDPHE will contact interested parties to inform them of the sampling program and SB 90-126, and how we envision its implementation. CDPHE will coordinate closely with federal agencies, county extension agents, conservancy districts, and local health officials in the project area.

## Ground Water Monitoring Program

The 1995 monitoring program monitored groundwater quality in two of Colorado's major agricultural regions, the South Platte River Valley, and the Arkansas River Valley. Maps of the study areas are provided in Figures 1 and 2. Preliminary analysis of the nitrate and pesticide data indicates that ground water in parts of both study areas has been impacted by various agricultural chemicals. The major inorganic contaminant of concern is nitrate. The monitoring program included sample collection, laboratory analysis, and data analysis and storage. Upon completion of the full analysis, which will include integration with previous and current studies by other agencies, this sampling program will provide the basis for determining a groundwater quality baseline for this region.

This year was different from years past in that all sampling was in two areas that had been sampled before. The first area was the South Platte alluvial aquifer from Brighton to Greeley. This was the first year of a long term monitoring effort initiated in this area. The second area was a confirmation sampling of work performed last year in the Arkansas Valley. In Weld County, 88 wells were sampled for nitrate and 33 pesticides. Three types of existing wells were used, 16 monitoring wells operated by the Central Conservancy District, 21 domestic wells first sampled in 1992, and 51 irrigation wells sampled in 1989, 1990, 1991, and 1994. Nitrate analysis showed that 69% of the monitoring wells, 48% of the domestic wells, and 82% of the irrigation wells exceeded the nitrate drinking water standard of 10 mg/L. The drinking water standard is used as a benchmark for nitrate levels in all wells regardless of use because the alluvial aquifer is a significant source of drinking water in the valley. Pesticide data revealed three pesticides, Atrazine, Metolachlor, and Prometon present in the monitoring well samples. These same three pesticides plus Lindane were detected in the domestic well samples. Atrazine, Metolachlor, Prometon, and Alachlor were detected in the irrigation wells. In one of the domestic wells the insecticide Lindane exceeded a water quality standard. The measured level was 0.9 ug/L and the ground water standard is 0.2 ug/L.

In the Arkansas Valley, a confirmation sampling was performed on those wells that had a nitrate level above 10 mg/L, or a pesticide detection in 1994. The confirmation sampling tested 32 wells and found little change from 1994, indicating a high level of confidence in the initial work. Nitrate levels were statistically unchanged and the only pesticide detected was Atrazine. In one of the domestic wells the herbicide Atrazine exceeded a water quality standard. The measured level was 4.2 ug/L and the ground water standard is 3.0 ug/L.

The monitoring wells in Weld County were sampled in cooperation with the Central Colorado Water Conservancy District in June 1995. All other sampling was performed by Brad Austin and John Colbert of CDPHE in July and August, 1995. Field sampling procedures followed the protocol developed by the Ground Water Quality Monitoring Working Group of the Colorado Nonpoint Task Force.

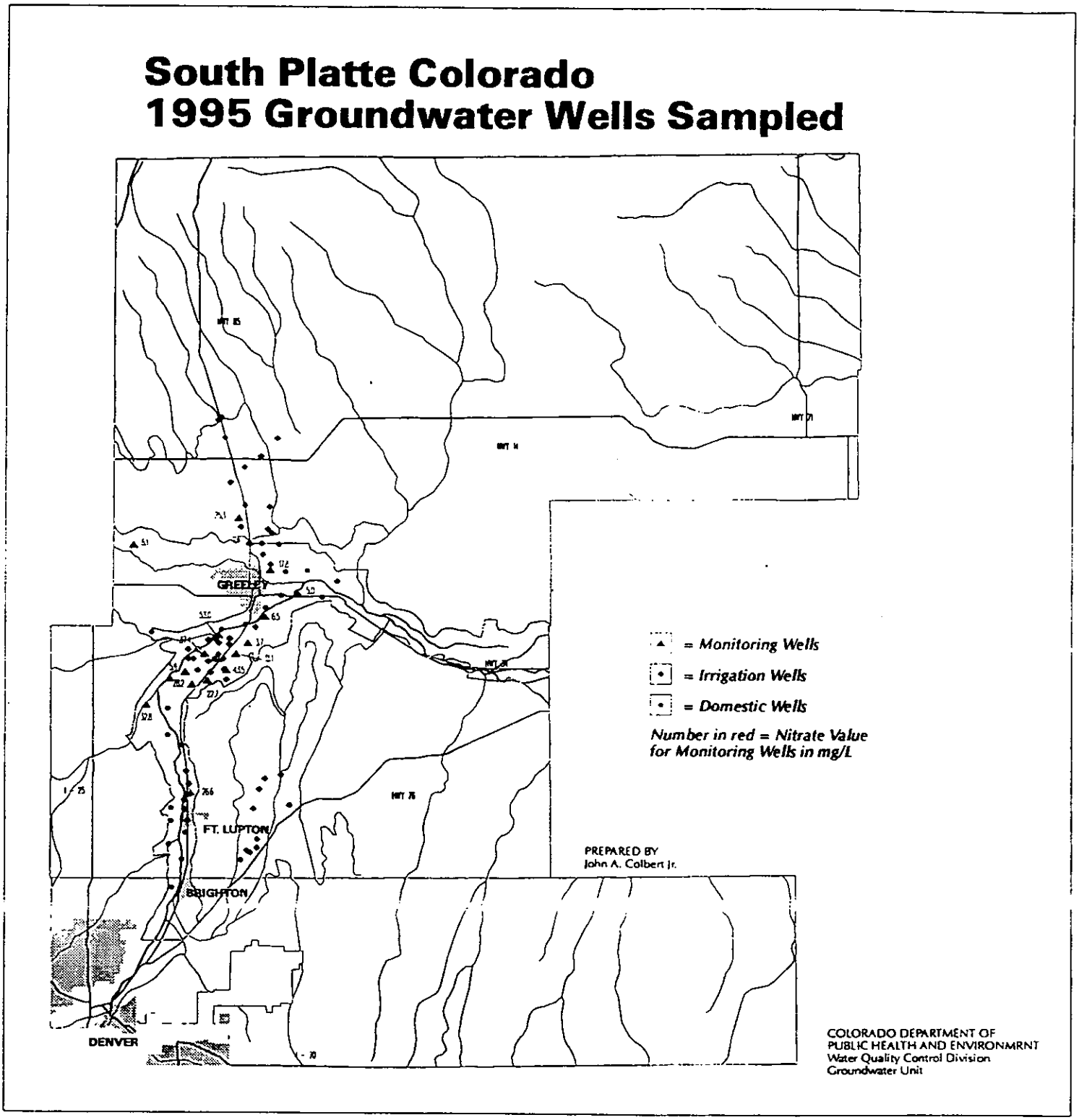
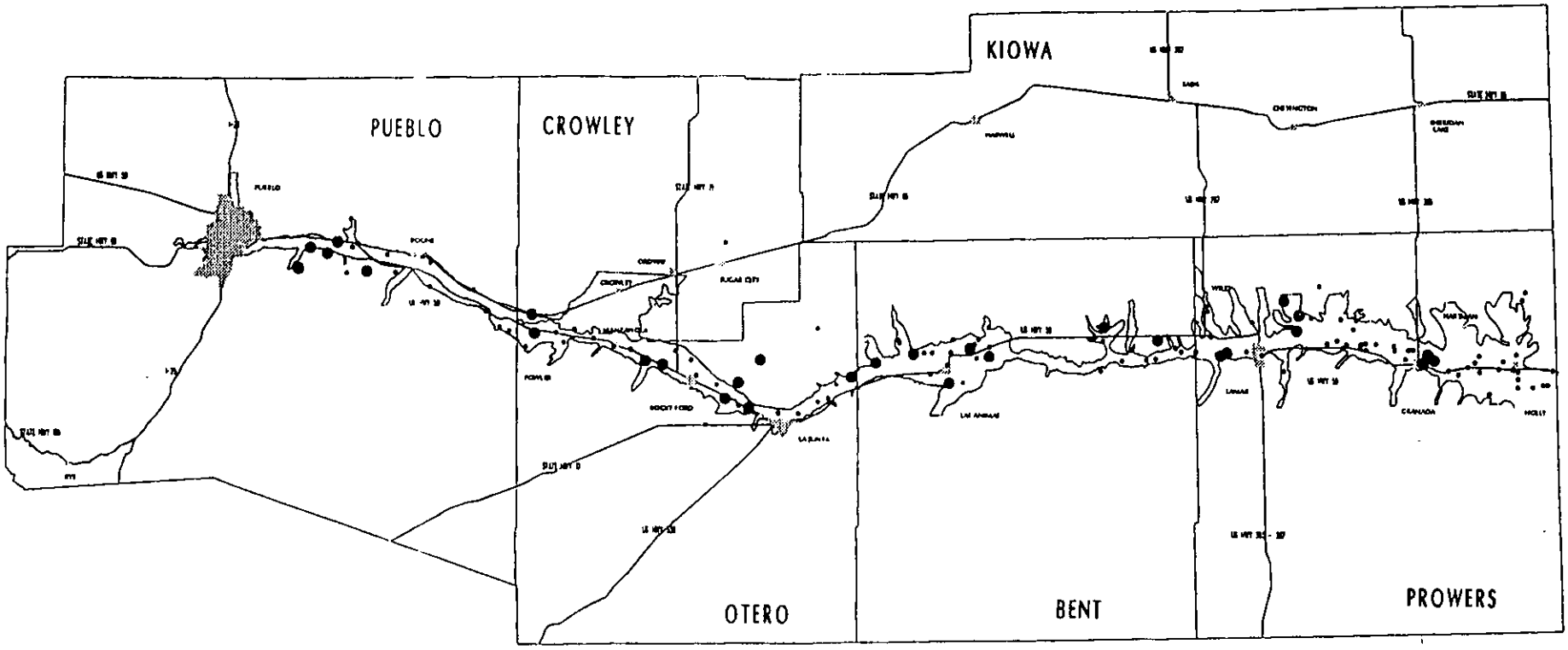
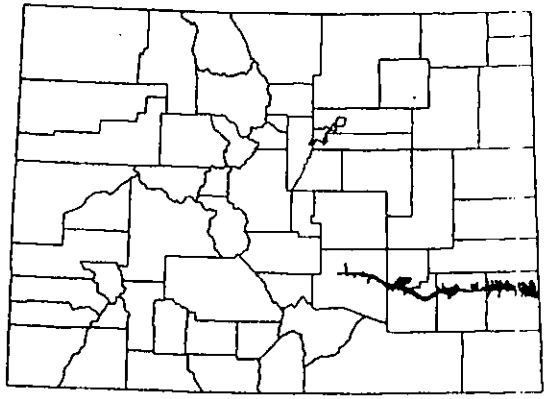



**FIGURE 1** - Map of well locations, South Platte alluvial aquifer, Weld County, 1995.




COLORADO DEPARTMENT OF
PUBLIC HEALTH AND ENVIRONMENT
WQCD
GROUND WATER UNIT

# Arkansas River Aquifer Colorado 1994 Pesticide & Nitrate Results



STUDY AREA LOCATION

= Well Locations
= Aquifer Boundry
= Roads
= Cities
= Trace Atrazine
= Nitrate as N > MCL
= Trace Atrazine
Trace Metolachlor
Nitrate as N > MCL

Detection limit for Atrazine & Metolachlor = 0.5ug/L
Trace = Present but at levels too low for lab to measure accurately
MCL for Nitrate as N = 10 mg/L
MCL = Maximum recommended level for drinking water

FIGURE 2 - Map of well locations, Lower Arkansas River alluvial aquifer, 1994.
Highlighted wells were resampled in 1995.

The Colorado Department of Agriculture, Standards Laboratory performed all laboratory analysis. Well samples were analyzed for nitrate as nitrogen, and selected pesticides. A list of the pesticides analyzed for is presented in Table 1. Temperature, conductivity, total dissolved solids, pH, and dissolved oxygen were measured in the field.

The results from this sampling program have been entered into the CDPHE Groundwater Quality Data System maintained at CDPHE. A detailed report describing the area sampled, the protocol for sampling and analysis, and the results of the analysis will be provided to the Commissioner of Agriculture in 1996.

TABLE - 1

## Colorado Department Agriculture
## Standards Laboratory
## Pesticide Methods and Detection Levels

| Pesticide Trade Name | Pesticide Common Name | Pesticide Use | Chemical Type | EPA Method | MDL (ug/L) |
|---|---|---|---|---|---|
| Lasso | Alachlor | Herb | OrganoCL | 525 | 0.1 |
| Aatrex | Atrazine | Herb | Triazine | 525 | 0.1 |
| Harness | Acetachlor | Herb | acetoalinide | 525 | 0.1 |
| Balan | Benfluralin | Herb | OrganoFL | 525 | 0.2 |
| Bravo | Chlorothalonil | Fungi | Nitrile | 525 | 0.1 |
| Lorsban | Chlorpyrifos | Insect | OrganoPH | 525 | 0.1 |
| Bladex | Cyanazine | Herb | Triazine | 525 | 0.2 |
| | 4,4-DDT | Insect | OrganoCL | 525 | 0.4 |
| | Endrin | Insect | OrganoCL | 525 | 0.3 |
| | Heptachlor | Insect | OrganoCL | 525 | 0.6 |
| | Heptachlor epoxide | Insect | OrganoCL | 525 | 0.8 |
| Gamma-mean | Lindane | Insect | OrganoCL | 525 | 0.1 |
| Marlate | Methoxychlor | Insect | OrganoCL | 525 | 0.9 |
| Dual | Metolachlor | Herb | acetamide | 525 | 0.1 |
| Sencor | Metribuzin | Herb | Triazine | 525 | 0.5 |
| Prometon | Prometone | Herb | Triazine | 525 | 0.1 |
| Simadex | Simazine | Herb | Triazine | 525 | 0.2 |
| Treflan | Trifluralin | Herb | OrganoFL | 525 | 0.3 |
| Velpar | Hexazinone | Herb | Triazine | 525 | 0.1 |
| Weed B Gone | 2,4-D | Herb | PhenoxyAcid | 515.2 | 0.2 |
| Banvel | Dicamba | Herb | Benzoic Acid | 515.2 | 0.1 |
| Kilprop | MCPP | Herb | PhenoxyAcid | 515.2 | 2.0 |
| Agritox | MCPA | Herb | PhenoxyAcid | 515.2 | 2.0 |
| Temik | Aldicarb | Insect | Carbamate | 531.1 | 1.0 |
| | Aldicarb sulfone | | Carbamate | 531.1 | 1.0 |
| | Aldicarb sulfoxide | | Carbamate | 531.1 | 1.0 |
| Baygon | Propoxur | Insect | Carbamate | 531.1 | 1.0 |
| Sevin | Carbaryl | Insect | Carbamate | 531.1 | 1.0 |
| Furadan | Carbofuran | Insect | Carbamate | 531.1 | 1.0 |
| | 3-Hydroxycarbofuran | | Carbamate | 531.1 | 1.0 |
| | Methiocarb | Insect | Carbamate | 531.1 | 1.0 |
| Lannate | Methomyl | Insect | Carbamate | 531.1 | 1.0 |
| | Oxamyl | Insect | Carbamate | 531.1 | 1.0 |

## Aquifer Vulnerability Study Summary

In addition to monitoring ground water for the presence of agricultural chemicals, the Ag Chemicals Program is required to determine the likelihood that an agricultural chemical will enter the ground water. This determination is based upon the chemical properties of the chemical in question, the behavior of a particular chemical in the soil types of the region under study, the depth to ground water, the farming practices in use, and other factors. This type of determination has been described as a vulnerability analysis.

In the process of writing the generic State Management Plan for Pesticides (SMP), the staff at CDPHE, CDA, and CSU has studied various types of vulnerability analysis. The goal has been to satisfy the requirements of the SMP and SB 90-126, while remaining within the confines of existing staffing, organization and budget. The program will work jointly with a researcher at Colorado State University, to develop the details of a vulnerability analysis selected for use in Colorado. The sources, format, and availability of the data needed for the evaluation is currently being compiled. The project will then conduct a limited test of the method in the northeastern section of the state. Results will be evaluated and incorporated into a standard method to map those areas of the state were ground water is vulnerable to contamination from agricultural chemicals. The monitoring program can then target resources to those areas where attention is most needed. This effort will become a key element of the State Management Plan for pesticides implemented under the Federal Insecticide, Fungicide, and Rodenticide Act.

## Update on collecting existing Ground Water Quality Data

In the FY-96 Memorandum of Understanding, the Ag Chemicals Program agreed to pursue collecting, evaluating, and entering into a database all existing ground water quality data available. Ground water quality data from various regions of the state has been entered as it becomes available. Recently this includes, CDPHE data collected as part of Super Fund preliminary assessment studies by the Haz. Mat. Division, and recently published U. S. Geological Survey data. As the data from these studies is received, it is entered into a database specifically designed for this purpose. In addition, collection and entry of historical data from the U. S. Geological Survey and U. S. EPA is an ongoing process.

The U. S. Geological Survey (USGS) is now wrapping up monitoring in the South Platte and the San Luis Valley areas under the National Water Quality Assessment (NAWQA) program. The Upper Colorado Basin NAWQA is now underway with sampling planned for Federal FY96. As this data becomes available it will be incorporated into the final analysis for water quality in these areas. Several water conservancy districts are also actively engaged in collecting ground water quality data. Unfortunately, this data is not always readily available due to concerns about privacy and future use of the data. The program hopes that as the monitoring effort continues and the agricultural community grows comfortable with our goals and intent, this valuable source of data will become available and enhance our understanding of the overall ground water quality of the state.

## Other Activity

A long range sampling plan has been developed for the monitoring program. The plan covers three major types of ground water monitoring. The first type of monitoring is the initial screening surveys to be conducted on all major aquifers subject to contamination from agricultural chemicals. The screening surveys for the South Platte River alluvial aquifer, San Luis Valley unconfined aquifer, and the Arkansas River alluvial aquifer are complete. The second type of monitoring is a follow-up sampling program to resample, for confirmation, all wells in which any contaminant was detected at a level of concern. Surrounding wells may also be sampled, if available, to determine if the contamination is widespread or only a localized problem. Follow-up sampling was conducted in the South Platte in 1993 and in the Lower Arkansas in 1995. The third type of monitoring is the specialized sampling needed for evaluation of Best Management Practices or Agricultural Management Areas when established. This long term monitoring, utilizing special wells such as dedicated monitoring wells, was started this year in the Brighton to Greeley reach of the South Platte.

The program intends to include in its analysis of the study areas all available ground water quality data. Results from previous and ongoing studies in the South Platte River valley, San Luis Valley, and Arkansas River valley will be integrated into the final analysis for these areas.

Before an area is selected for monitoring, CDPHE will contact interested parties to inform them of the sampling program and SB 90-126, and how we envision its implementation. CDPHE will coordinate closely with federal agencies, county extension agents, conservancy districts, and local health officials in the project area.

Recent development pressures, in once rural outlying areas, has heightened public awareness of the potential for impacts to water quality. The Program has responded to these concerns by offering technical assistance to water conservancy districts, ground water management districts, and other local entities interested in evaluating water quality in their area. Presentations of how the program works, past and present water quality projects, and plans for future projects with request for local input are made at every opportunity. We consider this type of outreach an important part of the customer service component of the program.

# Long Range Sampling Plan
# Agricultural Chemicals Program

## Short Term: (1-5 years)

Regional Baseline surveys

1) Major aquifers underlying an area of irrigated agriculture

South Platte Alluvial Aquifer system
Arkansas Alluvial Aquifer system
San Luis Valley unconfined aquifer
High Plains - Ogallala aquifer
Uncompahgre - Lower Colorado Alluvial Aquifer system

2) Major aquifers underlying urban areas

Denver Basin aquifer system
Fountain Creek
Cache la Poudre
Saint Charles Mesa

## Mid Term: (3-7 years)

Begin follow-up surveys in those areas where baseline surveys suggest agricultural chemicals have impacted groundwater

1) Increase sampling density to better define area of impact
2) Establish trend if any
3) Incorporate other water quality data into analysis
4) Specific monitoring on BMP sites

Begin planning for permanent monitoring network

## Long Term: (5 years +)

Installing a permanent monitoring network

1) Low density control wells around the state
2) Medium density monitoring wells in areas of concern
3) High density monitoring wells within any designated AMA

# APPENDIX IV

# 1995 Annual Report
# Colorado Department of Agriculture

## Rules and Regulations for Agricultural Chemical Bulk Storage Facilities and Mixing and Loading Areas

Section 25-8-205.5 (3)(b) of the Agricultural Chemicals and Groundwater Protection Act requires the Commissioner of Agriculture to develop regulations where pesticides and fertilizers are stored or handled in quantities that exceed the established thresholds. These regulations were adopted in July 1994 and became effective September 30, 1994. Efforts to provide information on the requirements of the regulations and the time line for compliance were initiated at that time. In 1995, numerous presentations were made to groups throughout the state. The presentations were given to organizations and associations which have a substantial number of their members subject to the regulations. In addition, numerous facilities were visited to provide information and answer specific questions. This educational process will aid individuals in determining first whether or not compliance with the regulations is required and second what specifically must be accomplished to meet the requirements. The law mandated at least a three year phase-in period for the regulations. As a result of comments prior to and at the public hearings, a graduated phase-in schedule was adopted. Compliance is required by:

- **September 30, 1997** for liquid pesticide secondary containment and mixing and loading pads.
- **September 30, 1997** for liquid fertilizer tanks greater than 100,000 gallons, one of the three prescribed methods of leak detection must be utilized unless secondary containment is in place.
- **September 30, 1999** for liquid fertilizer secondary containment and mixing and loading pads.
- **September 30, 2004** for secondary containment for fertilizer storage tanks with a capacity greater than 100,000 gallons.

One requirement of the regulations is that facility designs be signed and sealed by an engineer registered in the state of Colorado; or the design be from a source approved by the commissioner and available for public use. The second part of the requirement was added as a result of comments at the public hearings. It was asserted that some of the facilities may be very similar and that it would be a burden for small facilities to have an engineer sign and seal the plans. By adding this part, it allowed approved generic plans to be utilized without each facility needing to solicit an engineer.

Subsequently, the Colorado Department of Agriculture (CDA) in conjunction with Dr. Lloyd Walker, extension agricultural engineer with Colorado State University Cooperative Extension, produced a set of plans that meet the second criteria. The document is entitled, Agricultural Chemical Bulk Storage and Mix/Load Facility Plans for Small to Medium-Sized Facilities. The plans are available from Colorado State University or CDA free of charge. A press release was issued to announce the availability of the plans as well a letter about the plans was sent to commercial applicators identified as potentially needing to comply with the regulations.

Copies of the complete regulations and a summary sheet that contains a check list to allow individuals to determine if the regulations apply to their operation are available.

## State Management Plans for Pesticides

In October of 1991, the EPA released their Pesticides and Ground-Water Strategy. The document describes the policies, management programs, and regulatory approaches that the EPA will use to protect the nation's groundwater resources from risk of contamination by pesticides. It emphasizes prevention over remedial treatment. The centerpiece of the Strategy is the development and implementation of State Management Plans (SMPs) for pesticides that pose a significant risk to groundwater resources.

The EPA will require an SMP for a specific pesticide if: (1) the Agency concludes from the evidence of a chemical's contamination potential that the pesticide "may cause unreasonable adverse effects to human health or the environment in the absence of effective local management measures; and (2) the Agency determines that, although labelling and restricted use classification measures are insufficient to ensure adequate protection of groundwater resources, national cancellation would not be necessary if the State assumes the management of the pesticide in sensitive areas to address effectively the contamination risk. If the EPA invokes the SMP approach for a pesticide, its legal sale and use would be restricted to States with an EPA-approved Pesticide SMP.

Therefore, the continued use of the pesticide in a state is dependent on the State producing a management plan. This plan must contain 12 components that the EPA has developed as part of the guidance document for the program. These include the State's legal authority to regulate the pesticide, responses to detections of the pesticide, prevention actions, and public participation among others.

EPA released to the States a draft of the proposed rule that would require the SMPs for specific pesticides. CDA submitted comments on the draft. Currently, it is believed the EPA may publish the proposed regulations for Pesticide-Specific State Management Plans (PSMP) during 1996.

As a precursor to this action, Colorado has begun development of a generic state management plan that can be adapted as necessary to address specific pesticides that the EPA determines require a PSMP. Work continues on completing this document for formal EPA review. Numerous meetings have been held between CDA, CSU, CDPHE and EPA to develop the generic SMP. Many problems have hindered the process including extensive turnover in EPA staff as well as disagreements as to what needs to be performed to have an acceptable plan in EPA's eyes.

There are two overriding concerns with the SMP program and EPA's strategy for its implementation. First, the program is extremely resource intensive. Second, the flexibility originally designed into the program to allow States to use their discretion in handling detections of pesticides in groundwater or in addressing areas that are vulnerable to impact from pesticides has not developed. EPA appears to want to dictate many of the responses.

One of the more significant sticking points involves EPA's demand to have a sensitivity analysis/vulnerability assessment map of the state in a Geographic Information System (GIS) format by which to determine where to focus education and monitoring activities. Funding is currently unavailable to perform this analysis for the entire state. In addition, significant amounts of data that is required is not in a electronic format to utilize with GIS. Work has begun on doing a sensitivity analysis pilot project for the northeastern part of the state. A contract was given to a researcher to perform the work and the project will be completed in April of 1996. If the results of the pilot project are acceptable to EPA, other areas of the state will be addressed if funding permits.

# APPENDIX V

**AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT**
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