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Pamela Creedon, Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670-6114

December 9, 2009

Dear Ms. Creedon,

Attached, please find a proposal to enhance and strengthen certain aspects of the Additional Groundwater Monitoring and Reporting Program (hereafter referred to as the MRP) included in Attachment A of General Order R5-2007-0035. This document is not a comprehensive list of our recommendations for the MRP, but rather, a proposal for strengthening a several aspects of the program as currently written. We may make additional requests in the future. We are also aware that dairy industry groups plan to submit a proposal for an alternative groundwater MRP in the spring and we look forward to participating actively in the stakeholder review of that proposal.

The MRP presents an opportunity to gather much-needed data on the impacts to groundwater quality from specific dairy operations. This data will help the Board, dairy program staff, policymakers and other stakeholders assess the effectiveness of the General Order's nutrient and waste management requirements. Central Valley communities also deserve to know what pollutants may be reaching their drinking water from dairies. To provide the most comprehensive data possible, the program should test for additional contaminants beyond nitrates and salts. This document lays out the grounds for this request and makes additional requests regarding MRP implementation and enforcement.

Ninety percent of Central Valley communities receive drinking water from groundwater sources. Monitoring over the last decade has shown that dairies are having a significant impact on the quality of that water. For example, according to data provided to the stakeholder group by dairy program staff, a vast majority of the dairies that reported well test results between 2000 and 2007 -- 49 out of 54 dairies -- reported nitrate-N levels above the drinking water standard of 10 mg/l. Nearly half of them reported nitrate-N levels that exceeded the standard by at least a factor of five, and seven reported levels over 100 mg/l, or ten times the standard, most of them for multiple years.

Unfortunately, none of these dairies received letters this fall requiring them to install a monitoring well. Instead, it appears that priority for the first round of letters was given to operations that have not submitted Nutrient Management Plans or filed annual reports. We look forward to working with you and the staff of the dairy program to ensure that high-risk dairies are brought under the MRP as quickly as possible, that data collected by the program are robust and serve the needs of all stakeholders, and that where data show that groundwater is being polluted, that dairies be required to promptly implement treatment

and control measures to prevent further pollution. As a first step, we are submitting the attached petition.

Under the state's Anti-Degradation Policy and the regional Basin Plans, the Central Valley Regional Water Quality Control Board is charged with protecting water quality from pollution and ensuring that all beneficial uses of ground and surface water – including domestic and municipal supply – are protected. Several lawsuits have been brought against the Board charging that it has failed to ensure adequate protection.

Protecting the beneficial uses of domestic and municipal supply requires preventing practices that pollute water to the extent that it is unsafe to drink. As currently written, the MRP leaves out a number of contaminants present in dairy waste that have the potential to reach groundwater and pollute it. These constituents should be included in the MRP in order to comply fully with the Basin Plans, which specify a numerical objective for bacteria in groundwater and mandate that groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses.

Under the Anti-Degradation Policy, it is the responsibility of the Board to show that water quality is not deteriorating (or, if it is, that the costs of degradation are outweighed by benefits to the people of the state). Doing so requires that the Board compare current water quality with the historic baseline. The MRP cannot gauge current water quality in part because it does not include several major contaminants associated with dairy production that threaten human health and the environment.

We are aware that some in the industry have expressed concerns about the cost and complexity of testing for additional contaminants. For that reason, the attached proposal includes information on other states in which this testing is taking place and the methodology and costs associated with some of their programs.

The enclosed petition also requests clarification in the General Order on MRP testing procedure, the fate of laboratory testing results, and enforcement.

A strong monitoring program will help policymakers, dairy operators, Central Valley communities and other stakeholders make informed decisions to protect groundwater now and in the future. Some of the signatories below would like to request a meeting with you and Dr. Longley to discuss this proposal in January; Elanor Starmer of Food & Water Watch will be in touch regarding the possibility of scheduling such a meeting.

In the meantime, please feel free to contact Elanor at 415-293-9917 or estarmer@fwwatch.org with any questions. We look forward to working with you.

Sincerely,

Elanor Starmer
Food & Water Watch

Britton Schwartz
Community Water Center

Erin Ganahl
Environmental Law Foundation

Bill Jennings
California Sportsfishing Protection Alliance

Martha Guzman Aceves
California Rural Legal Assistance Foundation

Jennifer Clary
Clean Water Action

Conner Everts
Southern California Watershed Alliance

Cc: Dr. Karl Longley, Chair, Central Valley Regional Water Quality Control Board
Cc: Clay Rodgers, Dairy Program

Summary

Antibiotics, antibiotic metabolites, and natural and synthetic hormones have all been found to be present in livestock waste, including that from dairy cows. A growing body of research shows the potential for these constituents to reach surface and groundwater.

While additional research is needed to fully determine the impacts of these emerging contaminants, alone and in combination, on human health and the environment, there is a growing consensus that they negatively impact water quality and are a serious public health concern. This consensus has driven a number of municipal governments to test drinking water supplies for the contaminants. In addition, several states have ongoing research to monitor emerging contaminants in ground and surface water, including near dairies; pharmaceutical manufacturers that discharge to U.S. waters are required to obtain NPDES permits under federal law; the Safe Drinking Water Act authorizes the U.S. EPA to consider hormone-disrupting chemicals in drinking water; and the U.S. EPA is funding and conducting its own research on livestock operations' contribution to water contamination with hormones and antibiotics.

Pathogenic organisms are also present in animal waste and can migrate to groundwater. Pathogens have long been known to degrade water quality and threaten human health.

The 2007 General Order was developed to comply with regional Basin Plans, which protect all beneficial uses of surface and ground water in the state. The Basin Plans in turn are informed by the state's Anti-Degradation Policy, which prohibits discharges that cause pollution. The Additional Groundwater Monitoring and Reporting Program (MRP) included in Attachment A of the 2007 General Order should include pathogens, antibiotics and hormones in order to fully comply with the Basin Plans—which specify a numerical objective for bacteria in groundwater and mandate that groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses—and with the Anti-Degradation Policy.

Moreover, because these contaminants negatively affect beneficial uses of groundwater, testing for pathogens, antibiotics and hormones is necessary to gauge the effectiveness of the General Order's Nutrient Management Plans (NMP) and Waste Management Plans (WMP) in protecting groundwater quality. We therefore petition the Executive Officer to include the following constituents in MRP requirements for semi-annual testing:

- **Microbial indicator organisms:** Total coliforms, fecal coliforms, *E. coli* and *enterococci spp.*
- **Antibiotics and antibiotic metabolites** common to dairy production: aminoglycosides; tetracyclines and tetracycline degradates; cephalosporins; beta-lactams; florfenicol; macrolides; sulfonamides; neomycin; lincosamide; and the ionophore monensin.
- **Steroidal hormones and non-steroidals** in use on the dairies studied.

In order to ensure that the MRP is a useful, credible and transparent tool to evaluate the impacts of the General Order and that the data collected are as robust as possible, we offer these additional recommendations:

- **That all dairies covered under the General Order be required to report the names of all pharmaceuticals** (antibiotics, including ionophores, and hormones) in use on the dairy, and the quantity purchased and used, in their annual reports, and that this data be made available to the public (without identifying information if necessary to guarantee full disclosure);

- **That dairies participating in the MRP be given specific guidelines regarding the installation of monitoring wells**, including that each operation have a minimum of four wells—at least one upgradient of the dairy, and at least one each downgradient of the corrals, lagoon, and cropland to which manure is applied—in order to determine the direction and gradient of groundwater flow; that the initial wells be developed in the same aquifer; that the wells be established in the first encountered shallow aquifer, with wells added to deeper aquifers if necessary to determine migration of pollutants; that all groundwater monitoring wells be located as close as possible to the point of discharge (corrals, lagoons and cropland to which the manure is applied); that all groundwater monitoring wells be surveyed for location and marked for elevation, with a map accompanying each report or maintained in the case file; that the groundwater elevation be recorded to the nearest one one-hundredth of a foot when water is monitored; and that all monitoring wells be logged by a certified geologist or engineering geologist;

- **That quarterly monitoring be required** for at least the first two years of a dairy's participation in the MRP to provide an accurate assessment of the direction and gradient of groundwater flow; if degradation or pollution is not detected, the monitoring could be reduced to twice annually during critical periods, as defined in this document;

- **That dairies participating in the MRP be given clear instructions in the General Order to test groundwater at critical times** when contamination is most likely to occur, such as after the land application of manure or a rainfall event;

- **That the Executive Officer provide all participating dairies with a list of approved laboratories** certified by the California Department of Public Health's Environmental Laboratory Accreditation Program (ELAP) and require that dairy operators use one of these labs for groundwater testing;

- **That the Executive Officer require a copy of all test results to be sent directly from the laboratory to dairy program staff**, ensuring that all results are reported to staff and can be cross-checked with results included in dairies' annual reports;

- **That data gleaned from dairies' annual reports, including test results from the MRP, be made available to stakeholders** no more than two months after annual reports are submitted; and

- **That formal enforcement action be taken against dairies that have not submitted nutrient management plans or annual reports**, rather than prioritizing them for the installation of monitoring wells under the MRP.

A. Pathogens – Rationale and Request

Livestock manure contains a variety of pathogenic organisms, including many that are harmful to humans. Six of the 150 human pathogens found in animal manure are responsible for 90% of human food- and water-borne diseases: Campylobacter, Salmonella, Listeria, E. coli 0157:H7, Cryptosporidium, and Giardia.[1] Groundwater contamination with pathogens from livestock operations has been implicated in at least one major contamination event involving a municipal supply well, which led to seven deaths and several hundred illnesses.[2]

On fields where manure-treated water has been applied, most of the bacteria of concern to humans (E. coli 0157:H7, Salmonella, etc.) can be biologically active for as long as three months.[3] Studies in the U.S. and abroad have found that E. coli 0157:H7 and other pathogens from land-applied animal manure can reach groundwater,[4] [5] [6] [7] [8] particularly when manure is applied to sandy, gravel, or otherwise porous soils.[9]

In addition, near dairies and other animal operations, researchers find that shallow groundwater can have high pathogen loads because the large quantity of waste renders the filtration capacity of the soil ineffective.[10] One of the few studies conducted on Central Valley dairies determined that modest levels of pathogens were present in the groundwater.[11] Research suggests that pathogens can persist in groundwater for periods ranging from less than a day to several weeks or months depending on the organism.[12] The distance that pathogens can travel in water is not well understood.[13]

Pathogenic bacteria from dairy operations may be resistant to one or more antibiotics, increasing the risk they pose to communities that rely on groundwater as their drinking water source. Recent studies find antibiotic-resistant genes in groundwater underlying livestock operations and link them directly to waste pollution from the operations.[14]

Notably, both the Tulare Lake Basin Plan[15] and the Sacramento River and San Joaquin River Basin Plan[16] specify numerical objectives for bacteria in both surface and groundwater.

In sum:

- Pathogenic bacteria from animal waste can reach groundwater sources;
- Pathogenic bacteria are harmful to human health even at very low levels;
- The Basin Plans apply numerical objectives for bacteria to all groundwater;

Therefore, we petition that pathogens be included in the MRP requirements for testing, using EPA-approved laboratory testing methods. These tests are widely available, generally for between $15 and $30 per sample.

Most water quality experts test for microbial indicators of fecal contamination, including **total coliform bacteria**, **fecal coliform bacteria**, and ***E. coli***. However, according to the Task 2 report by Brown, Vence and Associates, these bacterial indicators may be more easily inactivated in the environment than the pathogens of concern. ***Enterococci spp.*** is therefore included in some testing regimens.[17] We request that all four organisms be included in MRP requirements for semi-annual testing.

B. Hormones – Rationale and Request

Hormones are naturally occurring in beef and dairy cows but are also used as supplements to increase productivity. Scientific literature indicates that animals excrete physiologically active steroidal hormones in their waste; the USDA's Agricultural Research Service has determined that "clearly, CAFOs [Concentrated Animal Feeding Operations] provide elevated releases" of hormones to the environment.[18] Animal manure has been shown to contain estrogens, estradiol, progesterone, testosterone, and synthetic hormones.[19]

Human exposure to hormones in the environment has been linked to health problems, including reproductive and metabolic abnormalities.[20] For example, the International Agency for Research on Cancer classifies estrogen as a Group 1 human carcinogen.[21] A major consensus meeting in 2008 outlined the growing body of scientific literature that human exposure to hormones and other endocrine-disrupting chemicals can disrupt normal hormone function and alter fetal programming and child development, increasing the risk of hormone-related cancer and other chronic diseases later in life.[22] Hormones in surface water have been linked to the feminization of male fish at levels as low as 1 nanogram per liter (ng/l).

In dairy waste lagoons, concentrations of hormones have been detected at levels as high as 650 ng/l.[23] Ongoing research is investigating transport routes for hormones from livestock waste to surface and groundwater.[24] To date, several studies have found the presence of hormones in groundwater near dairy operations. While some have detected them at levels under 1 ng/l,[25] other studies have found hormones present in groundwater at higher levels,[26] including studies by the Idaho Department of Agriculture that found estradiol in groundwater downgradient of dairies at levels as high as 2.8 micrograms per liter.[27] Studies have found that hormones from other sources, including human wastewater, are capable of reaching and contaminating groundwater.[28] [29]

A 1996 amendment to the Safe Drinking Water Act recognized some of the risks associated with EDCs and authorized the EPA to consider EDCs in drinking water.[30] The EPA is in the process of developing an Endocrine Disruptor Screening Program (EDSP). In June 2009, the Endocrine Society released a scientific statement determining that hormones and other endocrine-disrupting chemicals (EDCs) in the environment are "a significant concern to public health."[31] In November 2009, the American Medical Association adopted a resolution calling for new policies to decrease the public's exposure to EDCs because of their human health effects.[32] That same month, the American Public Health Association adopted a resolution calling for the Food and Drug Administration to ban the use of hormone growth promoters in beef and dairy cattle production, based on evidence that environmental hormone exposure interferes with human hormone function.[33]

Along with the growing concern over the presence and toxicological effects of hormones in drinking water and the environment, there is a clear understanding that livestock operations contribute to this presence.[34] Monitoring is an important first step in understanding the role of dairies in contributing to the pollution of water with hormones. While the Basin Plans do not specify water quality objectives for hormones, they do require that "ground waters… not contain chemical constituents in concentrations that adversely affect beneficial uses" and note that the list of contaminants in the Plan should be

considered a minimum. The science has evolved to the point where hormones must now be considered to affect beneficial uses when present in groundwater in significant concentrations.

In sum:

- Animal manure has been shown to contain estrogens, estradiol, progesterone, testosterone, and synthetic hormones;
- Studies have found the presence of hormones in groundwater near dairy operations;
- Human exposure to hormones in the environment has been linked to health problems, including reproductive and metabolic abnormalities;
- The Basin Plans mandate that groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses, including municipal and domestic supply;

Therefore, we petition to add steroidal hormones and all non-steroidals in use on dairy operations to the list of contaminants tested for under the MRP.

We also petition that all dairies covered under the General Order be required to list the hormones in use on their operation, including the volume used, in their annual reports to the Board, as outlined in section D. All hormones in use should be tested for.

A number of municipal governments around the country, including Chicago, Phoenix, and Milwaukee, already test their water for the presence of natural and synthetic hormones, showing that these contaminants are a significant public health concern. A growing number of labs have the capacity to test for them. Some labs in the state of California and elsewhere test for hormones in groundwater using solid phase extraction and high performance liquid chromatography-tandem mass spectrometry (HPLC-MS/MS). The Idaho Department of Agriculture contracted with the University of Idaho Analytical Sciences Laboratory to test water around dairies in that state for steroidal hormones using an LC/MS-ESI(+) method. The latter tests cost between $100 and $200 per sample. We encourage dairy program staff to work with researchers at the University of California and elsewhere to find ways to reduce laboratory costs for these important tests.

C. Antibiotics – Rationale and Request

A 2007 USDA survey of dairy producers in California and other major dairy states found that antibiotics are widely administered throughout the life of the dairy cow. These drugs are used for nontherapeutic purposes (growth promotion and disease prevention) as well as to treat sick cows.

Among the survey's findings:

- Nearly 60 percent of all operations feed medicated milk replacer to preweaned heifers for the purposes of disease prevention and growth promotion;
- Nearly 70 percent treat them with antibiotics for respiratory or other diseases;
- 50 percent of operations treat weaned heifers with one or more antibiotics;

- Over 90 percent of operations use intramammary antibiotics on dairy cows during the dry-off period for nontherapeutic purposes;
- 86 percent treat cows with antibiotics for mastitis, and 56 percent use them to treat respiratory diseases.

Overall, the study found that the most common antibiotic classes used on dairies were tetracyclines, beta-lactams (such as penicillin and cephalosporins), sulfonamides, aminoglycosides, and lincosamide, with several other antibiotic classes also in use. Ionophores such as monensin were the most widely used antimicrobial in weaned heifers.[35] Other studies of antibiotic use on California dairy farms found that coccidiostats[36] and florfenicol[37] were also commonly used.

Antibiotics are excreted in animal waste in both metabolized and unmetabolized forms. Numerous studies have identified antibiotics and their metabolites in livestock waste and wastewater,[38] [39] [40] including that from dairies in the Central Valley.[41] [42]

Antibiotics can persist in the environment for extended periods of time; for example, erythromycin has been found to persist for longer than one year.[43] Research also demonstrates the capacity of these antibiotics to travel to groundwater. Two studies on Central Valley dairies identified antibiotics, including sulfonamides, lincomycin, and the ionophore monensin, in groundwater samples.[44] [45] Research by the Idaho Department of Agriculture found sulfonamides in groundwater monitoring wells downgradient from dairies in that state at levels up to 2.3 micrograms per liter.[46]

Studies of groundwater underlying other livestock operations where antibiotics are used have also determined that antibiotics are able to migrate through soil and are present in groundwater.[47] [48] Certain antibiotics travel more easily through the soil than do others, and soil type influences the speed with which they reach groundwater.[49]

Metabolized antibiotics have been found in groundwater as well,[50] but research on the presence and environmental impacts of antibiotic metabolites is very limited. What research is available suggests that some metabolites may be as potent as their parent compounds and may behave in unexpected ways in the environment. For example, metabolites of tetracycline and tylosin may be more readily transported to surface and groundwater than their parent compounds because they have a lower sorption coefficient.[51]

The presence of antibiotics and their metabolites in groundwater is a serious concern for water quality and human health. A study in the Proceedings of the National Academy of Sciences found that antibiotics introduced into the environment from livestock operations contribute to the development of antibiotic-resistant bacteria, which can then sicken humans.[52] Both the World Health Organization and the Institute of Medicine have determined that the use of antibiotics in livestock production contributes to antibiotic-resistant human pathogens.[53] The Centers for Disease Control and Prevention (CDC) has identified antibiotic resistance as one of the top public health threats in the United States.[54]

Contaminated groundwater near livestock operations is one vehicle for human exposure to antibiotic-resistant pathogens. For example, research at the University of Illinois has found tetracycline residues and tetracycline-resistant genes in groundwater beneath swine operations where the antibiotic was used.[55] Livestock antibiotics also compromise the beneficial use of groundwater by exposing the communities that drink it to low levels of the drugs over long periods of time. Impacts of this exposure are still unknown.

While the Basin Plans do not specify water quality objectives for antibiotics or metabolites in groundwater, they do require that "ground waters… not contain chemical constituents in concentrations that adversely affect beneficial uses" and note that the list of contaminants in the Plan should be considered a minimum. The science has evolved to the point where antibiotics must be considered to affect beneficial uses when present in groundwater in significant concentrations. The Clean Water Act already recognizes some of the risks associated with antibiotics and other pharmaceuticals in surface water, requiring pharmaceutical manufacturers to monitor and report regulated pollutants as part of their NPDES permit. Pollutants include components of pharmaceuticals and the final product.[56]

In sum:

- Antibiotics used in dairy production and their metabolites are capable of reaching groundwater;
- These contaminants contribute to antibiotic resistance, which can harm human health;
- The Basin Plans mandate that groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses, including municipal and domestic supply;

Therefore, we petition to add antibiotics commonly used on dairies to the list of contaminants tested for under the MRP. Specifically, we request testing for the following antibiotics: aminoglycosides; tetracyclines and tetracycline degradates; cephalosporins; beta-lactams; florfenicol; macrolides; sulfonamides; neomycin; lincosamide; and monensin.

Further, we petition that all dairies covered under the General Order be required to list the antibiotics they use, including quantities used, in their annual reports to the Board as outlined in section D. Antibiotics in use that are not included in the above list should also be tested for.

A number of municipal governments around the country, including Chicago, Phoenix, and Milwaukee, already test their water for antibiotics, showing that their presence in drinking water is a public health concern. A growing number of labs have the capacity to test for antibiotics. EPA researchers often use solid phase extraction and liquid chromatography/mass spectrometry with positive-ion electrospray (LC/MS-ESI(+)) to test for pharmaceuticals in water samples.[57] This method was also used during a multi-year study by the Idaho Department of Agriculture on groundwater quality near dairies in that state;[58] their testing cost between $100 and $200 per sample. Other researchers testing for antibiotics in surface and groundwater have used high performance liquid chromatography/tandem mass spectrometry (HPLC/MS-MS), which is more expensive but may be more effective at detecting antibiotics in groundwater. We encourage dairy

program staff to work with researchers at the University of California and elsewhere to find ways to reduce laboratory costs for these important tests.

D. Monitoring well placement, testing guidance, and information disclosure in the General Order

In order to ensure that the data collected under the General Order are as complete, credible and transparent as possible, we petition that the Executive Officer elect to make the following changes:

1. **All dairies covered under the General Order should be required to report the names of all antibiotics (including ionophores) and hormones in use on the dairy, and the quantity purchased and used, in their annual reports.** This data should be made available to the public (without identifying information if necessary to guarantee full disclosure). The Board, dairies and stakeholders must know what dairies are using on their operations in order to test for their presence in groundwater. The collection of this data is consistent with the growing consensus that emerging contaminants adversely affect beneficial uses.

2. **Dairies participating in the MRP should be required to comply with specific guidelines governing the installation of monitoring wells in order to ensure that the data collected are robust and useful.** Each operation participating in the MRP should be required to install a minimum of four wells: at least one upgradient of the dairy, and at least one each downgradient of the corrals, lagoon, and cropland to which manure is applied. This will determine the direction and gradient of groundwater flow. Further, the initial monitoring wells should be developed in the same aquifer and in the first encountered shallow aquifer, with wells added to deeper aquifers if necessary to determine migration of pollutants. All groundwater monitoring wells should be located as close as possible to the point of discharge (corral, lagoon and cropland to which manure is applied). All groundwater monitoring wells should be surveyed for location and marked for elevation, with a map accompanying each report or maintained in the case file, and the groundwater elevation should be recorded to the nearest one one-hundredth of a foot when water is monitored. Finally, all monitoring wells should be logged by a certified geologist or engineering geologist.

3. **Quarterly monitoring should be required for at least the first two years of a dairy's participation in the MRP to provide an accurate assessment of the direction and gradient of groundwater flow.** If degradation or pollution is not detected, the monitoring could be reduced to twice annually during critical periods, as defined below.

4. **Dairies should be given clear instructions in the MRP to test groundwater at times when contamination is most likely to occur.** For example, dairies could be instructed to conduct tests a certain number of days following the land application of manure and/or a rain event. We encourage the Executive Officer and dairy staff to consult with experts at the University of California and elsewhere to develop this testing schedule.

5. **The Executive Officer should provide all participating dairies with a list of laboratories approved through the California Department of Public Health's Environmental Laboratory Accreditation Program (ELAP)** and should require that the dairies use one of these high-quality labs for groundwater testing.[59] The General Order requires the use of a government-approved laboratory for discharge and surface water sample analyses; similar requirements should govern groundwater testing to ensure the consistency and quality of the data.

6. **The Executive Officer should require that a copy of all test results be sent directly from the laboratory to dairy program staff** as well as to the dairies that contract with the lab. This requirement will ensure that all results are reported to staff. It will promote transparency by allowing staff to compare the test results that they receive with those submitted with dairies' annual reports.

7. **Data from the annual reports, including that collected under the MRP, should be made available to stakeholders no more than two months after annual reports are submitted.** Stakeholders are still waiting to receive the 2008 data that dairies were required to submit by July 1, 2009. This data covers the first year in which the General Order was in place. The delay makes it impossible for stakeholders, including dairy program staff, the Board, affected communities, and the dairies themselves, to gauge the impact of the new requirements and take any necessary action. Requiring that data be made available to stakeholders within two months will provide dairy program staff with ample time to compile the results while ensuring that external parties receive information about the performance of General Order requirements in a timely manner.

E. Enforcement

According to data provided to the stakeholder group by dairy program staff, a vast majority of the dairies that reported well test results between 2000 and 2007 -- 49 out of 54 dairies -- reported nitrate-N levels above the drinking water standard of 10 mg/l. Nearly half of them reported nitrate-N levels that exceeded the standard by at least a factor of five, and seven reported levels over 100 mg/l, or ten times the standard, most of them for multiple years.

Unfortunately, none of these dairies received letters this fall requiring them to install a monitoring well. Instead, it appears that priority for the first round of letters was given to operations that have not submitted Nutrient Management Plans or filed annual reports. The General Order currently prioritizes noncompliant operations in the MRP rankings by allotting them 100 points if they failed to complete their Nutrient Management Plan by the July 1, 2009 deadline. In contrast, an operation showing nitrate-N concentrations over 20 mg/l in a domestic or supply well receives 20 points.[60]

It is important to take action to address both noncompliant operations and those that show continued pollution of groundwater despite compliance, but the actions taken should be different. Existing law clearly stipulates that noncompliant operations are to be held civilly liable for their violations. Under the Porter-Cologne Act §13268, operations that have failed to furnish technical or monitoring program reports required by the Regional Board as part

of a waste discharge requirement are guilty of a misdemeanor and may be held civilly liable by the Regional Board for a fine of up to $1,000 per day of violation.[61] California Water Code § 13350 stipulates that any person who discharges waste in violation of WDR requirements is civilly liable and may be subject to a fine imposed by the Regional Board of up to $5,000 per day of violation.[62] According to the enforcement policy of the General Order, facilities that have not submitted the required reports on time should be considered high priority violations and be subject to formal enforcement actions.[63]

But rather than being subject to formal action, operations that have failed to furnish the reports required under the General Order are simply being required to install a monitoring well.

The purpose of the MRP is to gauge the effectiveness of the General Order's Nutrient and Waste Management Plan requirements. It is inappropriate to use the MRP as a punishment for dairies that have failed to comply with those requirements when the General Order calls for formal enforcement actions to address such violations. Noncompliant operations should be held civilly liable.

Therefore, we petition to remove noncompliant operations (those that did not turn in their Nutrient Management Plans by the July 1, 2009 deadline, and/or those that fail to submit annual reports by July 1 of each year) from the list of operations to be ranked under the MRP. These operations should be dealt with separately as high-priority violations and immediate enforcement actions should be taken.

We also petition to remove "Nutrient Management Plan completed by 1 July 2009" from the list of factors to be considered for ranking priority on page MRP-17 of the General Order.

The remaining ranking criteria should be applied to those dairies that are participating in the General Order as required.

Conclusion

Under the state's Anti-Degradation Policy and the Basin Plans, the Board is charged with ensuring that all beneficial uses of surface and groundwater are protected and that the waters of the state are not polluted. Among other requirements, the Basin Plans specify numerical water quality objectives for bacteria in groundwater. They also mandate that groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses, including municipal and domestic supply. Protecting the beneficial uses of domestic and municipal supply requires preventing practices that pollute water to the extent that it is unsafe to drink.

The Board cannot meet this goal unless it has a clear sense of the contamination that may be taking place around dairies in the Central Valley. For this reason, the groundwater monitoring and reporting program (MRP) under the 2007 General Order should include pathogens, antibiotics and hormones. These constituents are known to be present in

animal manure, can migrate to groundwater, and have serious impacts on human health and the environment.

In addition, dairies should be given clear guidance to ensure that well installation and testing procedures are as robust as possible. Information about the pharmaceutical products in use on dairies should be collected, analyzed, and made publicly available, and the data from dairies' annual reports should be provided to stakeholders in a timely manner. Finally, immediate enforcement actions should be taken against operations that have not complied with the requirements of the General Order.

We look forward to discussing these requests with the Executive Officer and dairy program staff and hope to work closely with you to facilitate implementation in the coming months.

References:

[1] Brown, Vence and Associates, "Review of Animal Waste Management Regulations: Task 2 Report: Evaluate Title 27 Effectiveness to Protect Groundwater Quality," San Jose State University Foundation, October 2003, at 22.
[2] Bruce-Grey-Owen Sound Health Unit, "Investigative Report of the Walkerton Outbreak of Waterborne Gastroenteritis, May-June 2000," October 2000. As cited in M. T. Rashid and J. West, "Dairy Wastewater Treatment with Effective Microorganisms and Duckweed for Pollutants and Pathogen Control," in M.K. Zaidi (ed.), Wastewater Reuse –Risk Assessment, Decision-Making and Environmental Security, 93–102 (Springer 2009).
[3] Thomas Harter, "Author response: How long will animal-derived (zoonotic) pathogens persist in groundwater and surface water?" University of California Extension, http://www.extension.org/faq/26430 (Accessed July 25, 2009).
[4] LD Ogden, DR Fenlon, AJ Vinten, and D Lewis, "The fate of Escherichia coli 0157 in soil and its potential to contaminate drinking water," Int J Food Microbiol, 66(1-2): 111-7, May 2001.
[5] Rebekka Artz, John Townend, Katie Brown, Willie Towers and Ken Killham, "Soil macropores and compation control the leaching potential of Escherichia coli 0157:H7," Environmental Microbiology 7(2): 241-248, November 2004.
[6] Alexander Semenov, Leo van Overbeek, and Ariena van Bruggen, "Percolation and Survival of Escherichia coli 0157:H7 and Salmonella enterica Serovar Typhimurium in soil amended with contaminated dairy manure or slurry," Applied and Environmental Microbiology, 75(10): 3206-3215, May 2009.
[7] J.C. Cho, Cho Hong Baek, and S.J. Kim, "Heavy contamination of a subsurface aquifer and a stream by livestock wastewater in a stock farming area, Wonju, Korea," Environmental Pollution, 109 (1): 137-146, 2000.
[8] Enzo Campagnolo and Carol Rubin, "Report to the State of Iowa Department of Public Health on the Investigation of the Chemical and Microbial Constituents of Ground and Surface Water Proximal to Large-Scale Swine Operations," Centers for Disease Control and Prevention, October-December 1998.
[9] Rebekka Artz, John Townend, Katie Brown, Willie Towers and Ken Killham, "Soil macropores and compation control the leaching potential of Escherichia coli 0157:H7," Environmental Microbiology 7(2): 241-248, November 2004. See also Thomas Harter, "Author response: How long will animal-derived (zoonotic) pathogens persist in groundwater and surface water?" University of California Extension, http://www.extension.org/faq/26430 (Accessed July 25, 2009).
[10] Thomas Harter, "Author response: How long will animal-derived (zoonotic) pathogens persist in groundwater and surface water?" University of California Extension, http://www.extension.org/faq/26430 (Accessed July 25, 2009).
[11] Brian Bergamaschi, Edward Atwill, Naoko Watanabe, Kunde Li, and Thomas Harter, "Occurrence, fate and transport of pathogens and antibiotics in dairies," UC Davis, http://groundwater.ucdavis.edu/Publications/Harter_215_Project_Factsheet.pdf (accessed July 29, 2009).
[12] Brian Bergamaschi, Edward Atwill, Naoko Watanabe, Kunde Li, and Thomas Harter, "Occurrence, fate and transport of pathogens and antibiotics in dairies," UC Davis, http://groundwater.ucdavis.edu/Publications/Harter_215_Project_Factsheet.pdf (accessed July 29, 2009).
[13] Brown, Vence and Associates, "Review of Animal Waste Management Regulations: Task 2 Report: Evaluate Title 27 Effectiveness to Protect Groundwater Quality," San Jose State University Foundation, October 2003, at 22.
[14] S. Koike, I. G. Krapac, H. D. Oliver, A. C. Yannarell, J. C. Chee-Sanford, R. I. Aminov, and R. I. Mackie, "Monitoring and Source Tracking of Tetracycline Resistance Genes in Lagoons and Groundwater Adjacent to Swine Production Facilities over a 3-Year Period," Applied and Environmental Microbiology 73 (15): 4813-4823, August 2007.
[15] California Regional Water Quality Control Board Central Valley Region, "Water Quality Control Plan for the Tulare Lake Basin: Second Edition," 2004, at III-7.
[16] California Regional Water Quality Control Board Central Valley Region, "Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins," 1998, at III-10.
[17] Brown, Vence and Associates, "Review of Animal Waste Management Regulations: Task 2 Report: Evaluate Title 27 Effectiveness to Protect Groundwater Quality," San Jose State University Foundation, October 2003, at 22.

[18] Cliff Rice, "CAFOs and hormones: Overview of ARS research," presentation at "Fate and Effects of Hormones in Waste from Concentrated Animal Feeding Operations," U.S. EPA workshop, Chicago, IL, August 20-22, 2007.
[19] Brown, Vence and Associates, "Review of Animal Waste Management Regulations: Task 2 Report: Evaluate Title 27 Effectiveness to Protect Groundwater Quality," San Jose State University Foundation, October 2003, at 23.
[20] Diaa Osman and David Wallinga, "Hormones in the food system," Institute for Agriculture and Trade Policy, August 2009.
[21] International Agency for Research on Cancer, Combined Estrogen-Progestogen Contraceptive and Combined Estrogen-Progestogen Menopausal Therapy. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. 91, 2007.
[22] Grandjean P, Bellinger D, Berman A, Cordler S, Davey-Smith G, Eskenazi B, Gee B, Gray K, Hanson M, van den Hazel P, Heindel JJ, Heinzow B, Hertz-Picciotto I, Hu H, Huang T T-K, Jensen TK, Landrigan PJ, McMillen IC, Murata K, Ritz B, Schoeters G, Skakkebæk NE, Skerfving S, Weihe P. The Faroes Statement: Human Health Effects of Developmental Exposure to Chemicals in Our Environment. *Basic & Clinical Pharmacology & Toxicology* 102:73–75, 2008
[23] Edward Kolodziej, Thomas Harter and David Sedlak, "Dairy wastewater, aquaculture and spawning fish as sources of steroid hormones in the aquatic environment," Environ. Sci. Technol. 38, 6377-6384, 2004
[24] See, for example, "Assessment of the occurrence and potential risks of endocrine disrupting chemicals in discharges from Concentrated Animal Feeding Operations," a project of the U.S. EPA and affiliated researchers. http://www.epa.gov/ppcp/projects/edc-cafo.html
[25] See, for example, Naoko Watanabe and Thomas Harter, "Emerging contaminants in dairy farming: Source characterization and shallow groundwater impacts," presentation at the 2008 USDA-CSREES National Water Conference, "Research, extension and education for water quality and quantity," Sparks, NV, February 3-6 2008.
[26] Shai Arnon, Ofer Dahan, Sara Elhanany, Keren Cohen, Irena Pankratov, Amit Gross, Zeev Ronen, Shahar Baram, and Lawrence S. Shore, "Transport of testosterone and estrogen from dairy-farm waste lagoons to groundwater," Environ. Sci. Technol. 42: 5521-5526, 2008.
[27] Craig Tesch and Dennis Owsley, "Assessment of Water Quality in the Sunnyside Area Washington County, Idaho: 2006 Update," Technical Results Summary #26, Idaho Department of Agriculture and Idaho Department of Environmental Quality, June 2006.
[28] C. Wicks, C. Kelley, and E. Peterson. Estrogen in a karstic aquifer. Ground Water 42: 384–389, 2004
[29] CH Swartz, S. Reddy, MJ Benotti, HF Yin, LB Barber, BJ Brownawell, and RA Rudel. Steroid estrogens, nonylphenol ethoxylate metabolites, and other wastewater contaminants in groundwater affected by a residential septic system on Cape Cod, MA. Environ. Sci. Technol. 40: 4894–4902, 2006.
[30] 42 USC § 300j–17
[31] Diamanti-Kandarakis E, Bourguignon JP, Giudice LC, Hauser R, Prins GS, Soto AM, Zoeller RT, Gore AC, "Endocrine-disrupting chemicals: An Endocrine Society scientific statement," *Endocrine Reviews* 30(4):293-342, 2009.
[32] The Endocrine Society, "AMA Adopts Endocrine Society Resolution Calling for New Policies to Decrease Public Exposure to Endocrine-Disrupting Chemicals," November 10, 2009. Available at http://www.endo-society.org/media/press/2008/AMAAdoptsSocietyResolution.cfm
[33] American Public Health Association, "Calling for Precautionary Avoidance of Hormone Growth Promoters in Beef and Dairy Cattle Production," adopted November 10, 2009.
[34] See, for example, Dana Kolpin, Edward Furlong, Michael Meyer, E. Michael Thurman, Steven Zaugg, Larry Barber, and Herbert Buxton, Pharmaceuticals, Hormones and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance," Environ. Sci. Technol, 36(6): 1202-1211, 2002.
[35] USDA Animal and Plant Health Inspection Service, "Antibiotic use on U.S. Dairy Operations," October 2008.
[36] Naoko Watanabe, Thomas Harter and Brian Bergamaschi, "Occurrence of Antibiotics and Emerging Contaminants in Dairy Farming," American Geophysical Union Fall Meeting, abstract #H41C-0653, 2007.
[37] John Kirk, "Commonly used antibiotics on dairies," University of California Davis School of Veterinary Medicine.
[38] Michael T. Meyer, J.E. Bumgarner, J.V. Daughtridge, Dana Kolpin, E.M. Thurman, and K.A Hostetler, "Occurrence of Antibiotics in Liquid Waste at Confined Animal Feeding Operations and in Surface and Ground Water," presentation at *Effects of Animal Feeding Operations on Water Resources and the Environment*, Fort Collins, Colorado, August 30 – September 1, 1999
[39] Kathryn D. Brown, Jerzy Kulis, Bruce Thomson, Timothy H. Chapman and Douglas B. Mawhinney,"Occurrence of antibiotics in hospital, residential, and dairy effluent, municipal wastewater, and the Rio Grande in New Mexico," Science of the Total Environment 366 (2-3): 772-783, 2006
[40] Campagnolo ER, Johnson KR, Karpati A, et al. 2002. Antimicrobial residues in animal waste and water resources proximal to large-scale swine and poultry feeding operations. The Science of the Total Env 299:89-95.
[41] See, for example: Naoko Watanabe, Thomas Harter and Brian Bergamaschi, "Environmental Occurrence of Antibiotics in Dairy Farming," presentation at the 2008 Joint Annual Meeting, Western Geological Society, Houston, TX, October 5-9 2008.
[42] Naoko Watanabe, Thomas H. Harter and Brian A. Bergamaschi, "Environmental Occurrence and Shallow Ground Water Detection of the Antibiotic Monensin from Dairy Farms," J Environ Qual 37:S-78-S-85, 2008
[43] E. Zuccato, D. Calamari, M. Natangelo, and R. Fanelli, "Presence of therapeutic drugs in the environment," *Lancet* 355 (9217) 1789 – 1790, 2000.
[44] Naoko Watanabe, Thomas Harter and Brian Bergamaschi, "Environmental Occurrence of Antibiotics in Dairy Farming," presentation at the 2008 Joint Annual Meeting, Western Geological Society, Houston, TX, October 5-9 2008

[45] Naoko Watanabe, Thomas H. Harter and Brian A. Bergamaschi, "Environmental Occurrence and Shallow Ground Water Detection of the Antibiotic Monensin from Dairy Farms," J Environ Qual 37:S-78-S-85, 2008
[46] Craig Tesch and Dennis Owsley, "Assessment of Water Quality in the Sunnyside Area Washington County, Idaho: 2006 Update," Technical Results Summary #26, Idaho Department of Agriculture and Idaho Department of Environmental Quality, June 2006.
[47] Michael T. Meyer, J.E. Bumgarner, J.V. Daughtridge, Dana Kolpin, E.M. Thurman, and K.A Hostetler, "Occurrence of Antibiotics in Liquid Waste at Confined Animal Feeding Operations and in Surface and Ground Water," presentation at Effects of Animal Feeding Operations on Water Resources and the Environment, Fort Collins, Colorado, August 30 – September 1, 1999
[48] R.I. Mackie, S. Koike, I. Krapac, J. Chee-Sanford, S. Maxwell, and R.I. Aminov, "Tetracycline residues and tetracycline resistance genes in groundwater impacted by swine production facilities," Anim. Biotechnol. 17(2):157- 76, 2006
[49] K.G. Karthikeyan and Joel A. Pedersen, "Final Project Report on the Fate of Representative Fluoroquinolone, Macrolide, Sulfonamide and Tetracycline Antibiotics In Subsurface Environments," University of Wisconsin Water Resources Institute, 2006.
[50] R.I. Mackie, S. Koike, I. Krapac, J. Chee-Sanford, S. Maxwell, and R.I. Aminov, "Tetracycline residues and tetracycline resistance genes in groundwater impacted by swine production facilities," Anim. Biotechnol. 17(2):157- 76, 2006
[51] Alistair Boxall, Dana Kolpin, Ben Halling-Sorensen and Johannes Tolls, "Are Veterinary Medicines Causing Environmental Risks?" Environmental Science and Technology, August, 287A-294A, 2003.
[52] David Smith, Anthony Harris, Judith Johnson, Ellen Silbergeld, and J. Glenn Morris, Jr., "Animal antibiotic use has an early but important impact on the emergence of antibiotic resistance in human commensal bacteria," Proceedings of the National Academy of Sciences of the United States of America, 99 (9): 6434-6439, 2002.
[53] World Health Organization, "Joint WHO/FAO/OIE Expert Workshop on Non-human Antimicrobial Usage and Antimicrobial Resistance Geneva", December 2003, available at http://www.who.int/foodsafety/publications/micro/en/exec_sum.pdf; M. Smolinski, M. Hamburg and J. Lederberg, *Editors*, " Microbial Threats to Health: Emergence, Detection, and Response," Institute of Medicine, 2003, at 207.
[54] See, for example, Centers for Disease Control and Prevention, "Campaign to Prevent Antimicrobial Resistance in Healthcare Settings," available at http://www.cdc.gov/drugresistance/healthcare/problem.htm.
[55] R.I. Mackie, S. Koike, I. Krapac, J. Chee-Sanford, S. Maxwell, and R.I. Aminov, "Tetracycline residues and tetracycline resistance genes in groundwater impacted by swine production facilities," Anim. Biotechnol. 17(2):157- 76, 2006
[56] 40 C.F.R. § 439.2. The list of regulated toxic and conventional pollutants can be found at 40 C.F.R. §§ 401.15 and 401.16.
[57] See, for example, Dana Kolpin, Edward Furlong, Michael Meyer, E. Michael Thurman, Steven Zaugg, Larry Barber, and Herbert Buxton, Pharmaceuticals, Hormones and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance," Environ. Sci. Technol, 36(6): 1202-1211, 2002.
[58] Craig Tesch and Rick Carlson, "Assessment of Water Quality in the Sunnyside Area, Washington County, Idaho: 2003 Update." Idaho Department of Agriculture Technical Results Summary #19, 2003.
[59] See http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx.
[60] California Regional Water Quality Control Board, Central Valley Region, "Order No. R5-2007-0035: Waste Discharge Requirements General Order for Existing Milk Cow Dairies," p. MRP-17, 2007.
[61] California Water Code Division 7 §13268, (a) and (b). Porter-Cologne Water Quality Control Act, effective January 1, 2009.
[62] Order No. R5-2007-0035, op. cit., at SPRR-8.
[63] Ibid at IS-26.