

REQUIREMENTS AND STRATEGIES FOR MANURE AND NUTRIENT MANAGEMENT ON DAIRIES

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ABSTRACT

Nitrogen management on agricultural lands is critical to protect valuable groundwater resources in California. The Central Valley Regional Water Quality Control Board adopted detailed nitrogen management requirements in the Dairy General Order (2007) and all Regional Boards will be implementing some sort of nitrogen management in future orders for irrigated agricultural Discharge Requirements. Understanding and implementation of regulatory requirements is essential for agricultural land managers.

Keywords: nitrogen management, irrigated lands, dairy, manure

INTRODUCTION

Water quality and quantity are important for human and agricultural activities. The State Water Resources Control Board and the nine Regional Water Quality Control Boards are responsible for overseeing the quality of both surface and ground waters through adoption and enforcement of Waste Discharge Requirements. Both salts and nitrates have been identified as key concerns for groundwater impairment in California ([Harter and Lund, 2012²](#); [CV Salts³](#)). Dairy was the first industry to receive detailed emphasis on Nitrogen management. Yet, greater emphasis on Nitrogen management will occur for all sectors of irrigated lands in California sooner, rather than later ([Nitrogen Monitoring and Reporting Task Force⁴](#); [Agricultural Expert Panel⁵](#)).

California produces more than 20% of the Nation's milk with the majority of this produced in the San Joaquin Valley. The discharge of waste to land from dairy operations was predominantly regulated through a Conditional Waiver of Waste Discharge Requirements in the Central Valley allowed operators to apply waste to land consistent with Title 27 Article 15 and not need to submit an annual report to the Regional Water Quality Control Board. On May 3, 2007 the [General Order for Waste Discharge Requirements for Existing Milk Cow Dairies](#) (GO) was adopted by the Central Valley Regional Water Quality Control Board (Revised October 3, 2013)⁶. Existing dairies per submission of a Report of Waste Discharge submitted by October 17, 2005 were automatically enrolled in the GO. Any new or expanded dairies (since October 17, 2005) must apply for and obtain Individual Waste Discharge Requirements.

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² <http://groundwaternitrate.ucdavis.edu/>

³ <http://www.cvsalinity.org/>

⁴ <http://www.cdwa.ca.gov/environmentalstewardship/PDFs/NTRSTFFinalReport122013.pdf>

⁵ http://www.waterboards.ca.gov/water_issues/programs/agriculture/docs/ILRP_expert_panel_final_report.pdf

⁶ http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0122.pdf

The Dairy GO identifies specific Prohibitions and a detailed Monitoring and Reporting Program (MRP). Key to the implementation of the GO are both Nutrient (NMP) and Waste (WMP) Management Plans. Basically, all nitrogen applied to land must be accounted for (regardless of source of origin) and the application rate to removal ratio is 1.4 for each crop on each field receiving manure applications. Specific operational differences in animal and manure management, collection, treatment and storage impact nutrient composition of solid and liquid manures. As such, the GO MRP requires solid and liquid manures be sampled regularly, 2 and 4 times per year respectively.

STAGED IMPLEMENTATION

Development and implementation of the NMP and WMP were conducted over a five year timeframe. The GO acknowledged that each facility would need to complete a needs assessment to identify needed infrastructure and management changes necessary to achieve the 1.4 targeted N application to removal ratio. The needs assessment was required in the first years of the 5 year implementation period with developing infrastructure occurring in the later time frame.

The NMP is an umbrella Plan that includes: Land Application Information (detailed facility map), Sampling and Analysis Plan, Nutrient Budget, Setbacks, Buffers, and Other Alternatives to Protect Surface Water, Field Risk Assessment, Record-Keeping, and Nutrient Management Plan Review.

The Sampling and Analysis Plan specifies the sampling methods used to obtain samples, sampling frequency, and analyses to be conducted for soil, manure, process wastewater, irrigation water, and plant tissue analyses.

From the [November, 2014 University of California Cooperative Extension \(UCCE\) Dairy Newsletter](#)⁷: “The Dairy General Order has specific sampling protocols as well as laboratory analytical requirements. [Approved protocols](#) are maintained at the Central Valley Regional Board’s website.⁸

The Regional Board spells out the type of laboratory and the methods the laboratory should be using. Let’s take a careful look at these [requirements](#)⁹ so your results are acceptable to the Regional Board. Specifically, the Regional Board wants to be sure that samples arriving for analysis at a laboratory are analyzed with the correct methods and that the laboratory is enrolled in a proficiency testing program or environmental certification program appropriate for the analyses needed. **Method of analysis AND proficiency testing or certification requirements are listed.** We worked diligently to assemble the [California Analytical Methods](#)¹⁰, a laboratory methods manual for compliance with the General Order, which is available electronically for your lab to use.”

⁷ http://cestanislaus.ucanr.edu/news_102/Dairy_Newsletter/?newsitem=53385

⁸ http://www.waterboards.ca.gov/centralvalley/water_issues/dairies/general_order_guidance/sampling_analysis/index.shtml

⁹ http://www.waterboards.ca.gov/centralvalley/water_issues/dairies/general_order_guidance/sampling_analysis/sampling_and_analysis_21feb08.pdf

¹⁰ http://anlab.ucdavis.edu/dairy-general-order-compliance-2013-nutrient-management-plan/uc_analytical_methods.pdf

The Nutrient Budget specifies application frequency and quantity of both nutrients and non-rain irrigation events. It requires a signature from a Certified Crop Adviser or Technical Service Provider when initially developed and after modifications. Nutrient Budgets should be current for each field in the crop rotation. Records of all applications to each field where manure is applied must be maintained. Application quantities are paired with corresponding nutrient concentrations to quantify nutrient application rates. These values are presented in each annual report and summed by field and crop for total nutrients applied. Analyses of harvested material and quantity of material harvested from each crop in each field are used to compare quantity of nutrients applied to quantity of nutrients removed by crop and field.

The ratio of N applied to N removed should be targeted near 1.4. The base premise for application of manure N is to restrict or minimize application of organic manure (solids fraction) as its bioavailability is less predictable than plant available sources. The 1.4 was calculated based on unavoidable losses (leaching and atmospheric) given the flood irrigation systems common for forage production. The 1.4 ratio was adopted as it is meant to be protective of groundwater nitrate quality (not exceed the drinking water standard). The calculated 1.4 is a summation of quantity and nutrient concentration of all N materials applied to land (organics, manures, irrigation water, commercial fertilizer, etc.). This calculation is TOTAL NITROGEN APPLIED, not just the estimated plant available N.

CHALLENGES AND OPPORTUNITIES

During the first years of the GO the challenges included separating fact from fiction for dairy operators. Few individuals read the 127 page GO and associated attachments. Fewer individuals understood what they read if they read the GO. Unfortunately, numerous consultants saw the GO as an opportunity for billable hours, regardless of their qualifications of working in agricultural settings with dairy manures. Suffice to say, there was ample opportunity for confusion both with consultants and dairy operators. The California Dairy Quality Assurance Program worked diligently with its partners [to develop and disseminate technical assistance and compliance information](#)¹¹ for operators. Outreach courses were developed and delivered throughout the Central Valley to meet each compliance deadline and provide assistance to producers and allied industry. Regional Board and industry representatives reviewed materials and assisted in information delivery.

Regardless of how each individual NMP implementation plan was developed, producers had to think through a series of questions related to the ability to quantify and distribute nutrients as uniformly as possible over each field as well as quantify plant removal and nutrient composition of each harvested crop. Improvements were identified and a timeline for installation of improvements was made. Operators certified completion of implementation of the NMP.

The importance of maintaining detailed records cannot be overstated. Very detailed record keeping requirements exist in the MRP. Some of the records are included in the Annual Report in summary form. Other records are included as copies. Other records are maintained and not

¹¹ <http://cdrf.org/home/checkoff-investments/cdqap/about-the-environmental-stewardship-program/wdr-general-order-reference-binder-materials/>

included in the Annual Report. All records must be available for Regional Water Quality Control Board inspectors during inspections.

WHEN NATURE THROWS A CURVE BALL

Once Nutrient Budgets were completed each operator had a roadmap for estimated N excreted by the animals and estimates of crop area (given assumed yields) needed to utilize N. Facilities with insufficient manure N need to import additional N (commercial fertilizer). Facilities with insufficient land capacity need to export (manifest) manure N. At the time of the initial Nutrient Budget, facility operators had sufficient information available to identify if they were land rich or nutrient rich (land poor). This calculation was based on anticipated excretion values and crop yields.

Crop yields in the Nutrient Budget are based on available water supply and nutrients for application. Minor to major modifications to Nutrient Budgets may be necessary when less water available for farming as fewer acres may be planted or reduced yields may be anticipated on the planted acreage. More detailed management of manure resources will be necessary. Additional manifesting of manure off-site or implementation may need to occur.

SUMMARY

The Dairy GO was the first GO to require detailed management of nitrogen. The regulatory process for irrigated agriculture is f undergoing major changes in monitoring and reporting to reduce agricultural nitrogen from reaching groundwater.