

**REPORT TO THE TWENTY-THIRD LEGISLATURE  
STATE OF HAWAII  
2006**

**UPCOUNTRY MAUI WATER SYSTEMS**

**PURSUANT TO HOUSE CONCURRENT RESOLUTION 222, 2005  
REQUESTING THE DEPARTMENT OF HEALTH TO REVIEW AND  
STRENGTHEN ITS WATER QUALITY STANDARDS AND PRACTICES**

**PREPARED BY:**

**DEPARTMENT OF HEALTH  
STATE OF HAWAII  
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PURSUANT TO HOUSE CONCURRENT RESOLUTION 222**

Introduction

In response to public concerns about the quality of Upcountry Maui drinking water systems, the 2005 Hawaii State Legislature passed HCR 222, HD1, SD1 requesting the Department of Health to do four things.

- A. Review drinking water standards and practices, focusing on Upcountry Maui, including standards and procedures for timely public notification by Maui water systems administrators of any violations or health concerns posed by system contaminants or additives.
- B. Work closely with the Upcountry Maui community and the Maui County Department of Water Supply to address citizen concerns including plans for remediation of the system, the health impacts of any current or future additives and establishment of a system to receive and respond to citizen concerns.
- C. Petition the federal Environmental Protection Agency (EPA) to review adherence to EPA lead and copper rules.
- D. Report findings and recommendations to the Legislature, including any necessary proposed legislation, no later than twenty days prior to the convening of the Regular Session of 2006.

In June of 2001, the Maui Department of Water Supply initiated corrosion control treatment of their Upcountry Maui water systems. This attempt at compliance with the EPA Lead and Copper Rule was in an effort to reduce tap water first draw levels of lead and/or copper found to be in excess of the federal action level of 15 parts per billion for lead and 1.3 parts per million for copper. The initial corrosion control agent selected was zinc orthophosphate, a corrosion control chemical used in other water systems both in the state and nationally, and not known to cause adverse health effects. Sometime after June 2001, the Maui Department of Water Supply began receiving complaints from consumers served by the Upcountry Maui water systems, (Makawao, Upper Kula and Lower Kula) of skin irritations. Of the approximately 33,000 persons served by these systems, approximately 200 persons felt strongly enough to complain about their skin problems. According to complainants, not long after June 2001, people started noticing the occurrence of rashes and skin irritations. Later, there were other health complaints of various types.

## **Summary of Findings**

1. The Upcountry Maui water systems cannot comply with the standards of the Lead and Copper Rule without some form of corrosion control.
2. The Department has tracked the Upcountry Maui water systems' conformance to the lead and copper action levels, and has found that these systems are capable of meeting the Lead and Copper standards with corrosion control.
3. The Department has tracked the conformance of these systems with total coliform standards, and has found that the Maui Department of Water Supply is currently in conformance with the total coliform standard for drinking water.
4. The Department has reviewed the appropriateness of the heterotrophic plate count (HPC) as a method for protecting consumers from adverse health effects and finds the current use of HPC as an indicator of water system operation and maintenance both adequate and appropriate and by extension, pseudomonas which is known to be a constituent of HPC.
5. The Department has reviewed the existing public notification requirements and finds them adequate, but intends to enforce more strongly against violation of the public notification requirements.
6. The Department's sampling for pseudomonas and the Maui Department of Water Supply's HPC results demonstrate that the Department of Water Supply is capable of controlling bacterial levels throughout the Upcountry Maui water distribution systems when they initiate and maintain good water distribution system practices.
7. The Department found no direct relationship between the use of zinc orthophosphate or phosphoric acid to the skin irritation, however, these additives may have created an environment more suitable for the growth of bacteria within the water systems through the provision of nutrients.
8. The Department has compiled the results of the Maui Department of Water Supply's HPC testing since before the introduction of corrosion control agents in June of 2001 and has found that the number of HPC samples above 500 cfu/ml was higher prior to June 2001 than after.
9. The Department has found that the number of complaints has declined to a level that is normal for other systems on Maui.

## **Review of drinking water standards**

The Department of Health relies primarily upon the U.S. Environmental Protection Agency (EPA) for its drinking water standards. The EPA expends significant resources to develop the kind of information required to establish and maintain drinking water standards. This work

requires the assembling, review and evaluation of current health effects and toxicological research on the over 100 contaminants currently regulated by EPA as well as information on contaminants it is considering for regulation. These activities require the kind of resources that the Department currently does not have. By adopting EPA drinking water standards, the Department has substantially reduced the cost of regulating drinking water. The EPA lead and copper rule would be an especially expensive regulation to scientifically and technically review and has already been brought to EPA's attention. It should be also mentioned that the EPA is required to review its own drinking water standards for adequacy every six years.

In addition, the EPA is required to establish and maintain a Drinking Water Contaminant Candidate List (DWCCCL). The DWCCCL is a list of contaminants that the EPA will study for possible regulation as a drinking water contaminant. The EPA studies these contaminants for adverse health effects and their occurrence in drinking water systems. Once the EPA has selected a candidate contaminant for regulation, it must identify and propose a drinking water standard as well as analytical methods for the accurate detection of the contaminant. Contaminants added to the DWCCCL can be nominated, but must be accepted by EPA on the basis of sufficient information. The DWCCCL currently includes a number of microbes for possible regulation in drinking water, but does not include either heterotrophic plate count (HPC) or *Pseudomonas aeruginosa* which were proposed targets for regulation and treatment by the 2005 Hawaii State Legislature. EPA is aware of the concerns raised by some Maui residents about HPC and *pseudomonas*.

The Department reviewed the possibility of regulating HPC in response to H.B. 1035 and 1036, which called for a standard for HPC of 100 colony-forming units per milliliter of water. In its review, the Department found statements from both the World Health Organization (WHO) and Health Canada (Canada's national health organization) that directly related to this issue. These statements are as follows:

#### **World Health Organization**

"Heterotrophic Plate Count Measurement in Drinking Water Safety Management, Report of an Expert Meeting, Geneva 24-25 April 2002"

"There is no evidence that HPC values alone directly relate to health risk either from epidemiological studies or from correlation with occurrence of waterborne pathogens. They are therefore unsuitable for public health target setting..."

#### **Health Canada**

"Microbiological Quality of Drinking Water: Heterotrophic Plate Count - Document for Public Comment," August 2004"

"No maximum Acceptable concentration (MAC) is necessary for heterotrophic plate count (HPC) bacteria in water supplied by public, semi-public, or private drinking water systems. Instead, increases in HPC concentrations above baseline levels are considered undesirable and may prompt further actions as described in Section 3. It should be noted

that HPC results are not an indicator of water safety and, as such, should not be used as an indicator of potential adverse human health effects. HPC measurements should be used as one of several available methods for monitoring the overall quality of the water, both immediately post-treatment and in the distribution system.”

In addition, the EPA’s use of 500 colonies per milliliter as a measure of adequate disinfection of surface water supports both the positions of the WHO and Health Canada because EPA does not use HPC as an indicator of potential adverse health, but as an indicator of proper water treatment.

Finally, the Department followed-up on a claim that the state of Florida regulated HPC in drinking water, and found that Florida does not regulate HPC in drinking water. We are not aware of any state that has set a standard for HPC in drinking water.

The Department has also reviewed the public notification requirements and has determined that the terms of the Revised Public Notification Rule, which has been in effect since May 2002 are adequate to provide the public with necessary health precaution measures. This rule requires that public water systems that violate drinking water regulations notify the public on a schedule dependent on the health implications of the violation. Violations are divided into three “tiers”. For violations with acute potential health impacts, (Tier 1), public notification is required within 24 hours of the notification of results. For violations with non-acute impacts, (Tier 2) notification is required within 30 days. For violations without health impacts, (Tier 3) notification is required within 1 year.

The Public Notification Rule, in addition to the requirements under the Consumer Confidence Report Rule, provides water system customers with a substantial amount of information about their water supply when the water system complies with the requirements. The stringency of requirements is a separate issue from compliance.

Based on current information, the department does not find a need to change the standards it reviewed.

### **Work with the Upcountry Maui community and Maui Department of Water Supply to address citizen concerns.**

The Department of Health has been involved with the Upcountry Maui community and Maui Department of Water Supply for several years on this issue and will continue to be involved. This involvement has included: conference calls and meetings with members of the Coalition for Safe Water; attending community meetings; provision of facts and information; researching theories and allegations; discussing issues and concerns with coalition members; receiving and responding to inquiries and complaints from people in Upcountry Maui; conducting limited sampling to quantify the presence of *Pseudomonas aeruginosa* and HPC in both upcountry and other Maui water systems; reporting results of this sampling to the owners of homes where the samples were taken explaining their significance; taking special chlorine residual readings to determine the effectiveness of newly instituted DWS flushing and disinfection activities; monitoring the effectiveness of lead reduction after changes in corrosion control treatments;

testifying before the Hawaii State Legislature; tracking the history of bacteriological sampling since before the introduction of corrosion control treatment; attending and participating in the Project Advisory Committee (PAC) meetings; researching national and international positions on HPC; responding to Congressional inquiries; and supporting the PAC efforts through testing of Upcountry children's blood lead levels.

The Department has responded to many of the issues and actions surrounding the skin irritation complaints from Upcountry Maui.

In response to the speculation that zinc orthophosphate was the direct cause of the skin irritation, the Department researched zinc orthophosphate and found no record or history of similar reaction. It is our understanding that zinc orthophosphate is used in systems nationally for the same type of corrosion control. It is also used in other systems in Hawaii without such complaint. In addition, Department toxicologist reviewed the ingredients of zinc orthophosphate and concluded that its phosphate content at the level applied to the Upcountry water (one part per million) would not cause skin irritation either through ingestion or dermal contact. Many common foods contain significantly higher levels of phosphates, and ocean water contains approximately twice the concentration of phosphates as was added to the Upcountry Maui water systems.

The finding of *Pseudomonas aeruginosa* in residential hot water heaters and showerheads by Dr. Marc Edwards from Virginia Tech, who was studying the presence of lead in the water in the Upcountry water systems introduced the possibility that the skin irritations were caused by bacteria. After consulting with the Centers for Disease Control, Atlanta, Georgia, and the U.S. Environmental Protection Agency, Cincinnati, Ohio, the Department of Health performed special sampling in Upcountry Maui in January and March 2005. The objective of the sampling effort was to determine the typical levels of Heterotrophic Bacteria (HPC), *Pseudomonas aeruginosa*, chlorine levels found in the surface water treatment plant effluents (i.e., after filtration and disinfection or finished water), water distribution systems, and residences in Upcountry Maui.

The Department of Health utilized an approach that targeted existing Maui Department of Water Supply bacteriological sampling sites, spaced throughout the distribution system, and the nearest available residence (exterior hose bib) adjacent to each sampling site. In addition, finished water samples were collected from each Upcountry Maui surface water treatment plant (Kamole, Piihola, and Olinda). Finally, samples were collected outside of Upcountry Maui, in other Maui Department of Water Supply surface water systems (Wailuku and Lahaina). Please note that while hose bibs are not ideal sample sites (exposure to the elements, contaminating devices such as hoses or other attachments, etc.) they did not require that the residents be home or awake at the time to provide access. All of the public water systems sampled, were utilizing free chlorine for disinfection. However, it should be pointed out that Public Water System No. 215, DWS Upper Kula, has since switched back to chloramines (March 2005) since exceeding the maximum contaminant levels for the disinfection by-product, Haloacetic Acids.

All of the samples were collected by DOH personnel and analyzed by the Department of Health, Environmental Microbiology Laboratory, in Pearl City (island of Oahu). In reviewing the

combined data from the first and second sampling trips, NO *Pseudomonas aeruginosa* was found in any of the thirty-eight (38) samples collected in the Maui Department of Water Supply surface water systems during January and March 2005. Of the 38 samples collected, thirty-two (32) were taken from Upcountry Maui and six (6) were taken outside the area.

<u>Upcountry Maui:</u>	<u>Total No. of Samples</u>
Public Water System No. 213, DWS Makawao:	16
Public Water System No. 215, DWS Upper Kula:	9
Public Water System No. 247, DWS Lower Kula:	7
<u>Surface Water Systems Located Outside of Upcountry Maui:</u>	
Public Water System No. 212, DWS Wailuku:	3
Public Water System No. 214, DWS Lahaina:	3
	38
 Total Number of <i>Pseudomonas aeruginosa</i> Samples:	

This information was shared with the Maui Coalition for Safe Water, Maui County, appropriate Department of Health agencies, the U.S. EPA (Cincinnati) and the Centers for Disease Control (Atlanta).

Also in response to the complaint that the rash was bacteriologically caused, the Department has compiled the testing records of the Upcountry Maui water systems for total coliform and HPC since January 2000. A review of the HPC data reveals that the occurrence of HPC samples which exceeded the 500 colonies per milliliter level (level in surface water systems which qualifies as properly disinfected water) was actually higher before the addition of zinc orthophosphate in June of 2001 than in any period subsequent. A copy of the summary of this data is attached.

In response to the complaint that the rash was caused by *Pseudomonas*, the Department enlisted the assistance of experts in water quality issues from the Centers for Disease Control and the Agency for Toxic Substances Disease Registry. It was concluded by our consultation with these experts that the health effects were much broader than what could be attributed to *Pseudomonas* alone, and that they could be due to a variety of exposures or underlying illnesses other than *Pseudomonas*. In addition, there was not sufficient evidence to substantiate that the observed conditions were either caused by *Pseudomonas* or related to potable water.

The Maui Department of Water Supply changed the corrosion control agent from C-9 to phosphoric acid in April 2003 in all three Upcountry Maui water systems, in an attempt to eliminate or reduce possible, adverse health effects experienced by consumers. The Department of Health tracked the first flush lead and copper levels under the new corrosion control treatment to assure that the levels again complied to lead and copper action levels.

In an attempt to reduce the potential presence of microbes in the Upcountry Maui water systems,

the Maui Department of Water Supply initiated an extensive flushing program to reduce water stagnation and help maintain disinfectant levels throughout the distribution systems.

A second change in the corrosion control agent was instituted by the Maui Department of Water Supply from phosphoric acid to soda ash for the Makawao and Lower Kula system and the initiation of lime treatment in the Upper Kula system in June 2004, also in an attempt to eliminate or reduce possible, adverse health effects experienced by consumers. In response to this change, the Department tracked the system's compliance with lead and copper action levels and determined that the systems, initially struggled with compliance to the action levels, had returned to compliance after a short period of non-compliance.

The Maui DWS conducted a "chlorine burn" (period of heavy application of chlorine to the water in an attempt to address biofilm buildup in the distribution system) in September of 2004. The Department of Health tracked the system's compliance with disinfection by-product MCLs and determined that the Upper Kula water system had exceeded the standard for haloacetic acids. Due to the fact that this MCL is based on the running annual average of quarterly results, the system was in violation for the quarters, July - September 2004, October - December 2004, January - March 2005, and April - June 2005. Public notifications have been issued for the first, second and fourth quarter violations. The Department of Water Supply inadvertently did not include the third quarter notice, assuming that the fourth quarter notice was sufficient.

Chlorine residual measurements were taken by the Department throughout the Upcountry Maui water systems on May 18, 2005 to determine the effect of both the chlorine burn and the flushing program instituted by the Maui Department of Water Supply. The Department's conclusion was that these actions had a positive impact on the maintenance of chlorine residual in the distribution system.

Federal funding, in the form of an EPA grant was secured by Senator Daniel Inouye of almost \$500,000 to "determine causes and possible solutions to lead contamination and other secondary effects possibly caused by corrosion control methods." While the Maui Department of Water Supply is the recipient of these funds, a Project Advisory Committee (PAC) has been formed to carry out the purposes of the grant. The largest part of the grant (\$325,000) will go toward a research effort to study the control of lead and copper in the Upcountry Maui water systems. The study will also involve the identification of additional treatment to promote the mixing of water from the three systems. The PAC is comprised of members of the Upcountry Maui community as well as representatives from the Office of the Mayor, Maui Department of Water Supply and the Department of Health. The PAC has two basic responsibilities. First to obtain and distribute information about lead to the people of Upcountry Maui, and second to find as many Upcountry Maui children as possible to screen for blood lead levels.

Representatives of the Department have met with Boyle Engineering to provide some input to their plans to conduct the federally funded study for maximizing the control of lead and copper in the Upcountry Maui water systems. The Boyle study is important because a water supplier such as the Maui Department of Water Supply must balance many factors. For bacteria, it must optimize its treatment to reduce or eliminate as many of the factors that may promote bacterial

growth as possible and to institute good operation and maintenance practices within its distribution system to minimize opportunities for growth of microorganisms. There are also conditions that are beyond the water supplier's control which exist in every water system that promote bacterial growth. Among these are: areas of low water usage or circulation where water may stagnate such as dead-end lines; vacant homes and lots; unused taps and more. In addition, water fixtures that add heat or expose the water to air provide conditions that contribute to the growth of bacteria. However, it is incumbent on the water supplier to do the best it can. The water supplier must also deal with other contaminants, specifically disinfection byproducts, and comply with the lead and copper rule. Balancing disinfection, disinfection byproducts, and corrosion control for lead and copper can benefit from sound technical advice.

The Department attended an evening meeting of the Kula Community Association in August 2005 at which a representative of the Department informed association members that the number of complaints of rash had fallen to about two percent, a level consistent with other areas of Maui since the change of corrosion control treatment to a non-phosphate additive.

### **Petition EPA to review adherence to the Lead and Copper Rule.**

The Department has not officially requested EPA to review adherence to the Lead and Copper Rule. Based on informal discussions and other indications, the Department believes that EPA is well aware of concerns with the Lead and Copper Rule, in particular because of the Maui and Washington D.C. cases. The department also believes that there is little chance that the EPA would allow relaxing of the administration of the Lead and Copper Rule because of their concerns over the adverse health effects of lead. In fact, if any changes were to be made, EPA would probably impose more stringent requirements on the presence of lead in drinking water because of recent findings of unacceptable levels of lead in the Washington D.C. water system. However, EPA has been kept informed of the issues involved in Upcountry Maui. EPA representatives have attended public meetings in Upcountry Maui as well as met with the Coalition for Safe Drinking Water, and our EPA Project Officer continues to receive updates on this issue. In addition, an EPA staff member administers the federal grant that was appropriated through the efforts of Senator Daniel Inouye to investigate the water quality in Upcountry Maui. While we have not heard EPA express a need to revise their regulation, the American Water Works Association expects revisions to the Lead and Copper Rule in 2006.

### **Recommendations of the Department of Health:**

Based on the findings and discussions above, and experience of DOH, the Department of Health recommends that:

1. Additional legislation not be passed to regulate the water systems in Upcountry Maui or state-wide.
  - a. The heterotrophic plate count (HPC) should continue to be used as an indicator of distribution system operation and maintenance.

- b. The current standard for total coliform bacteria is sufficient and should continue to be used.
  - c. The public notification requirements currently in safe drinking water regulations should be continued.
2. The Maui Department of Water Supply has improved and should continue to improve its operation and maintenance of the Upcountry water systems. It should act upon the applicable recommendations of the Boyle Engineering Study, when completed
  3. The Department of Health should and will continue to work with the Upcountry Maui community and the Maui Department of Water Supply to assure that the operation and maintenance of all of their systems provides water that is fit for human consumption and meets all drinking water standards.