APPENDIX A

- 97-005 CDPH Guidance Memo and draft DDW Guidance Memo
- Workplan for Well V-201, DPH Comments and VWC Response to Comments including:
  - Draft Workplan for Restoration of Well V201 dated 5 March 2012
  - CDPH Draft Workplan for Restoration of Well V-201 Approval Letter, 28 March 2012
  - VWC Response Letter dated 7 August 2012 to CDPH Approval Letter dated 28 March 2012

97-005 CDPH Guidance Memo

Memorandum

Date: November 5, 1997

To: Drinking Water Program
Regional and District Engineers

From: Division of Drinking Water and
Environmental Management

Subject: Policy Memo 97-005 Policy Guidance for Direct Domestic Use of Extremely Impaired Sources

A. General Philosophy

The primary goal of the Drinking Water Program (DWP) is to assure that all Californians are, to the extent possible, provided a reliable supply of safe drinking water. In furtherance of this goal, the DWP continues to subscribe to the basic principle that only the best quality sources of water reasonably available to a water utility should be used for drinking. When feasible choices are available, the sources presenting the least risk to public health should be utilized. Furthermore, these sources should be protected against contamination. Whenever possible, lower quality source waters should be used for nonconsumptive uses, such as irrigation, recreation, or industrial uses, which pose lower health risk.

The use of contaminated water as a drinking water source always poses a greater health risk and hazard to the public than the use of an uncontaminated source because of the chance that the necessary treatment may fail.

The use of an extremely impaired source should not be approved unless the additional health risk, relative to the use of other available drinking water sources, are known, minimized, and considered acceptable.

Water utilities (including wholesalers) should be encouraged to minimize the concentration of man-made toxic substances, naturally occurring contaminants, and pathogenic microorganisms in drinking water supplies, maximum contaminant levels (MCLs) notwithstanding.

Extremely impaired sources that contain or are likely to contain high concentrations of contaminants, multiple contaminants, or unknown contaminants (such as groundwater subject to contamination from a hazardous waste disposal site) should not be considered for direct human consumption where alternatives are available.

Where reasonable alternatives are available, high quality drinking water should not be allowed to be degraded by the planned addition of contaminants. In other words, the MCLs should not be used to condone contamination up to those levels where the addition of those contaminants can be reasonable avoided.

Drinking water quality and public health shall be given greater consideration than costs or cost savings when evaluating alternative drinking water sources or treatment processes.

The DWP recognizes that there are extremely impaired sources in California that need to be cleaned up and for which the resulting product water represents a significant resource that should not be wasted. In some situations, it may be reasonable to consider the use of these treated extremely impaired sources for domestic use. Some communities may not have any choice. In such cases, the public health principles as set forth in this policy should be used to guide the evaluation of such situations.

B. Purpose of Policy Guidance

The purpose of this guidance document is to set forth the position and the basic tenets by which DWP would evaluate proposals, establish appropriate permit conditions, and approve the use of an extremely impaired source for any direct potable use.

An extremely impaired source meets one or more of the following criteria:

- exceeds 10 times an MCL or action level (AL) based on chronic health effects,
- exceeds 3 times an MCL or AL based on acute health effects,
- is a surface water that requires more than 4 log *Giardia*/5 log virus reduction,
- is extremely threatened with contamination due to proximity to known contaminating activities
- contains a mixture of contaminants of health concern
- is designed to intercept known contaminants of health concern.

Examples include:

- Extremely contaminated ground water
- Effluent dominated surface water
- Oilfield produced water
- Water that is predominantly recycled water; urban storm drainage; treated or untreated wastewater; or agricultural return water
- Products of toxic site cleanup programs

It is recognized that the circumstances surrounding each situation may be different. Proposals for the use of extremely impaired sources, therefore, must be considered on a case-by-case basis.

C. Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source

1. Source Water Assessment:

The purpose of the source water assessment for the extremely impaired source is to determine the extent to which the aquifer or surface water is vulnerable to contaminating activities in the area. There may be other contaminants associated with activities that contribute to the known contamination, or other contamination sources that have yet to impact the drinking water source. There may not be drinking water MCLs, Als or monitoring requirements established for these additional contaminants, but health related information may be available through other programs. The appropriate level of monitoring and treatment to produce a safe drinking water cannot be determined unless the activities that are affecting or may impact raw water quality are understood. The assessment should include:

- Delineation of the source water capture zone
- Identification of contaminant sources
    - Identify the origin of known contaminants found in the source water and predict contaminant level trends
    - Identify chemicals or contaminants used at or generated by facilities responsible for the known contamination
    - Identify all potential contaminant sources and determine the vulnerability of the water source to these contaminant sources

2. Full characterization of the raw water quality:

The appropriate level of monitoring and treatment to produce a safe drinking water cannot be determined unless the raw water quality is fully understood. The following categories should be considered to fully characterize the source water quality:

- Title 22 drinking water regulated and unregulated chemicals
- All chemicals for which drinking water action levels are established
- All chemicals listed pursuant to Safe Drinking Water and Toxic Enforcement Act of 1986
- Microbiological quality
- Priority pollutants
- Gross contaminant measures [total organic carbon (TOC), etc.]
- Any compounds identified under source water assessment.
- Determine variability of contaminant concentrations with time (seasonal and long term)
- Determine variability of contaminant concentrations with pumping rate.
- The detection of any contaminant identified in the raw water quality characterization (step 2) should require assessment of the impact on the source water pursuant to the source water assessment (step 1).

3. Source Protection:

There must be a program in place to control the level of contamination. At a minimum, best management practices for waste handling and waste reduction should be required. In addition, monitoring at the source should be conducted to determine the level of contamination

and to reasonable assure that the contamination level will not increase. Unless the level of contamination is known a determination cannot be made that the proposed treatment is sufficiently adequate and reliable to render the water potable.

If the use of an extremely impaired source is to be approved, the source of the contamination must be controlled to:

- Prevent the level of contamination from rising.
- Minimize the dependence on treatment.

4. Effective Monitoring and Treatment:

The treatment process used to treat the extremely impaired source prior to direct usage in a domestic water distribution system must be commensurate with the degree of risk associated with the contaminants present. As a minimum, treatment of extremely impaired sources shall include use of the best available treatment technology defined for the contaminant(s) by the Environmental Protection Agency. Furthermore, the treatment processes must have reliability features consistent with the type and degree of contamination.

All treatment processes used must be optimized to reliably produce water that contains the lowest concentration of contaminants feasible at all times. The entire flow from the extremely impaired source must pass through the complete treatment process or processes. Any water from other sources that is available for blending prior to entry into the distribution system should be used to provide an additional safety factor.

Multi-barrier treatment is a set of independent treatment processes placed in series, and designed and operated to reduce the levels of a contaminant. Each barrier should effectively reduce the contaminant by a significant fraction of the total required reduction. The treatment processes should address all the contaminants of public health concern in an extremely impaired source. Multi-barrier treatment may be appropriate when:

- The primary treatment is not sufficiently reliable;
- The primary treatment is of uncertain effectiveness;
- There is no direct way to measure the contaminant (e.g., pathogenic microorganism);
- The health effect of the contaminant is acute; and/or
- Very large reductions in contaminant concentration are required.

The description of the proposed monitoring and treatment should include the following:

- Performance standards (field measurable indicator of treatment efficiency);
    - Identify level to assure compliance with the treatment objective
    - The treatment objective for all contaminants should be optimized to the lowest extent feasible and must assure compliance with the MCL/AL at all times.

- Facilities for treating water containing specific contaminants for which the MCL is higher than the maximum contaminant level goal (MCLG) should be designed and operated to meet the MCLG where this can be accomplished in a cost effective manner.

- Operations plan that identifies all operational procedures, failure response triggers, and loading rates, including:
  - Process monitoring plan
  - Process optimization procedures
  - Established water quality objectives or goals
  - Level of operator qualification

- Reliability features
  - Response Plan for failure to meet the treatment objective
  - Alternative disposal methods
  - Shutdown triggers and restart procedures

- Compliance monitoring and reporting program
- Notification plan
- Extremely impaired source water quality surveillance plan

  The water quality surveillance plan should include monitoring between the origin of the contamination and the extremely impaired source that is proposed for drinking water.

5. Human Health Risks Associated with Failure of Proposed Treatment:

   Treatment technologies are not failure proof, and insufficiently treated or untreated water may, on occasion, pass through the treatment process and into the distribution system. An assessment must be performed that includes:

   - An evaluation of the risks of failure of the proposed treatment system.

     The proposed treatment system must be evaluated in terms of its probability to fail, thereby exposing customers to insufficiently treated or untreated drinking water from the extremely impaired source.

     All treatment failure modes are to be evaluated. The evaluation must include an assessment of the proposed frequency of monitoring as it relates to protection of the public from insufficiently treated or untreated drinking water.

   - An assessment of potential health risks associated with failure of the proposed treatment system. The health assessment must take into account:

- the duration of exposure to contaminated drinking water that would result from such a failure

- the human health risks associated with such exposure to insufficiently treated or untreated water over the course of that failure, considering the risks of disease from microbiological organism, and the risks of acute and chronic effects (including cancer risks) from chemical contaminants

- potential cumulative risks, due to multiple failures

When risks of adverse health effects from treatment failure are not acceptable, then additional treatment safeguards must be used for the protection of public health, or the proposal must be rejected.

6. Identification of alternatives to the use of the extremely impaired source and compare the potential health risk associated with these to the project's potential health risk.

Use of alternative sources of drinking water reasonably available to a water utility should be evaluated as to health risk (assuming MCLs are, or can be, met), and compared to the use of the extremely impaired source.

In evaluating the relative risk comparison of the extremely impaired source and alternative drinking water sources, additive effects of multiple contaminants are an important consideration. Generally, consideration of allowing direct potable use of an extremely impaired source should be limited to a single toxic contaminant or a limited number of similar chemicals that can be reliably treated with the same process.

The comparison of alternatives should include a comparison of the risks of treatment failure for the alternatives, as well as for the extremely impaired source (step 5).

7. Completion of the California Environmental Quality Act (CEQA) review of the project:

CEQA review of the project must be completed.

8. Submittal of a permit application:

The public water system(s) collecting, treating and distributing water from the extremely impaired source must submit a permit application for the use of the extremely impaired source that includes the items identified above. A supplier of treated water to a public water system is a water wholesaler and must be permitted as a public water system, as required by the Safe Drinking Water Act.

9. Public hearing:

A public hearing must be held to identify concerns of consumers who will be served water from the extremely impaired source and to assure that all parties have a chance to provide relevant information.

10. DHS evaluation:

DHS staff shall conduct an evaluation of the application and make recommendations.

11. Requirements for DHS approval:

The following findings are required of DHS for approval to use an extremely impaired source:

- Drinking water MCLs and AIs will not be exceeded if the permit is complied with, and
- The potential for human health risk is minimized, and the risk associated with the project is less than or equal to the alternatives.

12. Issuance or denial of permit:

DHS either issues a permit or denies a permit for the use of the extremely impaired source. If a permit is issued, it shall include all necessary treatment, compliance monitoring, operational, and reporting requirements.

<Original signed by>

David P. Spath, Ph.D., P.E., Chief

Process Memo 97-005-R2020
Division of Drinking Water
State Water Resources Control Board

Addressing the Direct Domestic Use of Extremely Impaired Sources
Process Memo 97-005
Initially Established November 5, 1997

Process Memo 97-005-R2020; Revised Guidance for Direct Domestic Use of Extremely Impaired Sources
Revised August 20, 2020

Contents

A. General Philosophy

The primary goal of the Division of Drinking Water (DDW) of the State Water Resources Control Board is to assure that all Californians are, to the extent possible, provided a reliable supply of safe drinking water. In furtherance of this goal, DDW continues to subscribe to the basic principle that only the best quality sources of water reasonably available to a water utility should be used for drinking. When feasible choices are available, the sources presenting the least risk to public health should be utilized. Furthermore, these sources should be protected against contamination. Whenever possible, lower quality source waters should be used for nonconsumptive uses, such as irrigation, recreation, or industrial uses, which pose lower health risk.

The use of contaminated water as a drinking water source always poses a greater health risk and hazard to the public than the use of an uncontaminated source because of the chance that the necessary treatment may fail. Thus, the use of an extremely impaired source should be avoided where alternatives are available, unless the additional health risks, relative to the use of other available drinking water sources, are known, minimized, and considered acceptable.

Extremely impaired sources are those that contain, or are likely to contain, very high concentrations of contaminants (see Section B), multiple contaminants, or unknown contaminants (such as groundwater subject to contamination from a Superfund site).

Drinking water quality and public health protection must be given greater consideration than costs or cost savings when evaluating alternative drinking water sources or treatment processes.

DDW recognizes that there are extremely impaired sources in California that need to be remediated and for which the resulting product water represents a significant resource that should not be wasted. In some situations, it may be reasonable to consider the use of these treated extremely impaired sources for domestic use. Some communities may not have any choice, due to limitations in their water supply. In such cases, the public health principles as set forth in this process memorandum should be used to guide the evaluation. If the water is determined to be too contaminated to be reliably treated, or if the potential risk to public health is determined to be too far above acceptable levels, the extremely impaired source should not be permitted for domestic use.

This update of the 97-005 memorandum seeks to incorporate lessons learned from DDW's review of projects over the past decade, and to provide information to staff and to water system consultants on what is necessary for a thorough review. It identifies information that is needed for review of a proposal to use an extremely impaired source, thereby minimizing missteps and repetition by project proponents/applicants, and the workload that those activities generate.

B. Purpose of Process Memo 97-005

This memorandum was originally issued in 1997 to address proposals to use water generated from large remediation projects [e.g., Superfund cleanups, that is, sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)], in which federal and/or state environmental agencies—not drinking water regulators—and their consultants seek to make use of the project-generated water.

In these cases, federal and state agencies as well as the "responsible parties" involved in site cleanup are focused on removal of the "contaminant mass" from soil and groundwater to prevent the spread of contamination. These entities are guided by particular federal and state statutes, such as CERCLA and the Clean Water Act, which may not fully address the requirements of DDW and its implementation of the federal and state Safe Drinking Water Acts.

The proponents/applicants of a CERCLA environmental cleanup project may focus on capture of the contaminant plume and treatment of the contaminated water for a relatively short list of identified or targeted contaminants to remove their mass from the soil or groundwater. DDW, on the other hand, is entrusted to *"impose permit conditions … it deems necessary to assure a reliable and adequate supply of water at all times that is pure, wholesome, potable and does not endanger the health of consumers"* (California Health and Safety Code Section 116540) and to take the health risk posed by all the contaminants into consideration. The priorities of project proponents/applicants may have a slightly different emphasis than those of DDW, or of the community that is proposed to receive this water as part of its drinking water supply. For example, high nitrates in the groundwater associated with past agricultural practices may not be a targeted contaminant to be removed for the CERCLA project. However, DDW will require the nitrate to be treated prior to use as a domestic water source and the cost of the treatment will need to be agreed upon by parties involved.

Because of the inherent risk associated with the extremely impaired source, the evaluation for its use, including examination of the sources and the levels of contamination, the acceptability and reliability of the treatment processes and the adequacy of the monitoring and maintenance program is far more detailed and deeper in scope, in comparison, than a typical drinking water source. Therefore, it is important from the outset that project proponents/applicants (which must include a water system) realize if the proposed beneficial use of the water generated by the cleanup project is for domestic water supply, it is in the project proponents' interest to cooperate with DDW so that the evaluation will proceed in an efficient manner and a decision can be quickly reached.

The purpose of this process document is to set forth the process and principles by which DDW would evaluate the proposals, establish appropriate permit conditions, and approve the use of an extremely impaired source for direct potable use.

C. Extremely Impaired Sources

An extremely impaired source is a source that meets two or more of the following criteria:

- contains a contaminant that exceeds 10 times its MCL based on chronic health effects,
- contains a contaminant that exceeds 3 times its MCL based on acute health effects for example, nitrate or perchlorate,
- contains a contaminant that exceeds 10 times its NL, based on chronic health effects,
- contains a contaminant that exceeds 3 times its NL, based on acute health effects,
- contains one or more contaminants that meet any of the criteria of the four bullet points above and the source has not been adequately characterized by responsible parties,
- is a surface water that requires more than 4 log *Giardia*/5 log virus reduction,
- is a surface water source that on an annual average contains more than five percent treated wastewater, unless it is associated with an approved drinking water-related surface water augmentation project,
- is extremely threatened with contamination due to known contaminating activities within the long term, steady state capture zone of a drinking water well or within the watershed of a surface water intake,
- contains a mixture of contaminants of health concern beyond what is typically seen in terms of number and concentration of contaminants,
- is designed to intercept known contaminants of health concern.

Examples include:

- Extremely contaminated ground water
- Sewage effluent dominated surface water
- Oilfield produced water
- Water that is predominantly recycled water (unless associated with an approved drinking water-related project using groundwater replenishment or surface water augmentation); urban storm drainage; treated or untreated wastewater; or agricultural return water
- Products of toxic site cleanup programs

If the impaired source produces or would be expected to produce water that meets only one of the above criteria, it may not be considered extremely impaired. However, DDW may require the submittal of a technical document addressing the elements listed in Sections D, subsections 1, 2, 3 and 4, as presented below. This is to ensure that no uncommon contaminants are present at levels that may pose a potential health concern.

These determinations will be site specific, and DDW will set appropriate conditions within the domestic water supply permit. DDW recognizes that the circumstances surrounding each situation may be different. Project proponents/applicants who copy or use prior 97-005 evaluations when preparing their own evaluations must recognize that a prior approval of one project should not be interpreted as a precedent for another project.

D. Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source

IT IS IMPORTANT TO NOTE:

- ***The steps in the Evaluation Process are sequential in nature. That is, each step relies upon the findings and conclusions of the prior step.*** *These steps should not be done concurrently, e.g., presentation of the treatment equipment proposal and reliability sections should proceed only* ***after*** *the Drinking Water Source Assessment and Contaminant Assessment (SA/CA) and Raw Water Quality Characterization are made final.*

- ***Each step should include clear, specific detailed statements of findings, interpretations, and conclusions as they relate to the goal of each step*** *(not just a statement of the tasks that were performed)*.

1. Drinking Water Source Assessment and Contaminant Assessment

This section includes a discussion of Drinking Water Source Assessment (SA) and Contaminant Assessment (CA), plus addition information pertinent to both assessments.

a. Drinking Water Source Assessment (SA)

The purpose of the drinking water source assessment for the extremely impaired source is to determine the extent to which the aquifer or surface water is vulnerable to contaminating activities in the area. There may be additional contaminants associated with activities that contribute to the known contamination, or other contamination sources that have yet to impact the drinking water source. There may not be drinking water MCLs, advisory notification levels or monitoring requirements established for these additional contaminants, but health related information may be available through other programs. The assessment should include:

- Delineation of the source water capture zones (groundwater sources) or watershed areas (surface water sources)
  - For groundwater sources: Evaluate the hydrogeology and delineate capture zones. A description, including maps and hydrogeologic cross-sections, of the

capture zones of the proposed drinking water sources must be provided. This should include a discussion of how the capture zones were determined, assumptions and methods used, and time frames. Supplemental field work may be necessary to fill in the data gap in hydrogeological information.
    - For surface water sources: Delineate watershed areas
- Identification of contaminant sources
    - Identify the origin of known contaminants already detected in the source water and predict contaminant level trends
    - Present a list which identifies all chemicals or contaminants used at or generated by facilities responsible for the known contamination
    - Identify all potential contaminant sources (including the potential contamination sources currently or historically present within the capture zones or watershed areas)
    - Present a list that identifies all other potential chemicals or contaminants that may be associated with potential contaminant sources.
    - Present maps showing the locations of known or suspected contaminating activities, including the spill or disposal sites

b. Contaminant Assessment (CA)

The purpose of the contaminant assessment is to provide a characterization of the contamination of soils and groundwater at and around the contamination and former contamination sites located within the long-term capture zone or watershed areas of the drinking water source. This means there must be a description of the history of chemical activities at the site(s), including intentional releases, spills and waste management or if applicable, remediation practices. The characterization of the known contamination in soil and water includes identification of the chemicals involved, and their concentrations in soil and water at and near the contaminated site. This can be supplemented by or presented as plume maps.

If there is an existing system of monitoring wells at the site, data from these wells should be utilized for this step. If there is an existing Remedial Investigation/Feasibility Study (RI/FS) or other environmental documentation, it should also be utilized as an informational source. However, existing cleanup projects typically focus on only a few major contaminants and additional site specific sampling and analyses will often be required to fill in any data gaps that come into play when proposing a drinking water source. This could include analysis for chemical contaminants which may not been previously tested for, or should have been tested at lower detection levels.

For example, the project proponents/applicants often have to check for low levels of less traditional drinking water contaminants including contaminants of interest to DDW , such as nitrosamines, 1,4-dioxane or site-specific contaminants, e.g. RDX, TNT or other explosives, which may have been largely ignored during the cleanup of other major “target contaminants.”

Based on site history, chemical usages, fate and transport of the contaminants in the environment, a list of additional potential source water contaminants must be prepared, and sampled for, if not previously performed. All contaminants with potential health effects must be identified and considered. Attention should be paid to the following chemicals with regard to activities or conditions that may contribute to possible presence:

- Title 22 drinking water regulated chemicals and Title 22 unregulated chemicals requiring monitoring
- Chemicals for which drinking water notification levels are established
- Chemicals listed pursuant to Safe Drinking Water and Toxic Enforcement Act of 1986, to the extent feasible
- Microbiological quality
- Priority pollutants
- Hazardous wastes and constituents mentioned in 40CFR Part 261, including Appendices VII and VIII
- Chemicals of Emerging Concern as recommended by the State Water Resources Control Board's Science Advisory Panel in the most recent version of the "Monitoring Strategies for Chemicals of Emerging Concern (CEC) in Recycled Water" report.

Tentatively identified chemicals (TICs) and peaks signifying the presence of unidentified chemical species that show up on GC/MS scans should also be investigated to fully evaluate the water quality in the source area. If such contaminants are consistently detected, they should be included in the Raw Water Quality Characterization (RWQC). If the RWQC estimates them to be detectable at the production well(s), their treatability must be evaluated to see if they can be removed. If these contaminants cannot be destroyed or removed by the proposed treatment, the applicant will need to expend time and efforts needed to identify such compounds and then determine if they are innocuous or of health concern, or modify the proposed treatment.

Based on the information gathered in the steps above, the project proponents/applicants should present a map showing the intersection of the proposed water source capture zone with the contaminated areas and plumes. The project proponents/applicants must also identify the list of contaminants of concern and the potential contaminants of concern for the proposed drinking water sources.

The contaminant concentration ranges ascertained in the CA are used in the subsequent step of estimating the concentration of contaminants at the inlet of the proposed treatment equipment.

c. Both Assessments

The text of reports submitted by the proponent/applicant should be as quantitatively descriptive and specific as possible. Although presentation of information in graphical

or tabular forms is welcome, general or vague statements, with detailed information buried in voluminous tables or appendices is not acceptable.

2. Full Characterization of the Raw Water Quality

The end product of this step is to characterize the quality of the water that will be fed into the treatment system, so that the treatment system is properly designed. This should include an evaluation of all the contaminants found present in the CA as to whether they are or will eventually appear at the production/extraction wells and plant influent.

The proponent/applicant should include a clear explanation of how the characterization was performed. This can include an examination of current quality of the water at the extraction wells, if they are available for sampling, but must include an estimate or projection of concentration trends and variability that the production wells will be showing in the future. If a mathematical averaging or modeling technique is used, all assumptions must be identified and justified.

The appropriate level of monitoring and treatment to produce a safe drinking water cannot be determined unless the raw water quality is fully understood. The following categories should be evaluated to fully characterize the source water quality:

- Title 22 drinking water regulated chemicals, including lead and copper, and Title 22 unregulated chemicals for which monitoring is required
- Chemicals for which drinking water notification levels are established
- Chemicals listed pursuant to Safe Drinking Water and Toxic Enforcement Act of 1986, to the extent feasible
- Microbiological quality
- Priority pollutants
- Gross contaminant measures [total organic carbon (TOC), etc.]
- Hazardous wastes and constituents mentioned in 40CFR Part 261, including Appendices VII and VIII
- Chemicals of Emerging Concern as recommended by the State Water Resources Control Board's Science Advisory Panel in the most recent version of the "Monitoring Strategies for Chemicals of Emerging Concern (CEC) in Recycled Water" report.
- Any additional compounds identified as contaminants of concern or the potential contaminants of concern during the CA process.

The detection of any additional contaminant identified during the raw water quality characterization tests (step 2) should require a re-assessment of the SA/CA in terms of that contaminant (step 1).

The project proponents/applicants should determine variability of contaminant concentrations with time (seasonal and long term), with pumping rate and with any other variable that may change the concentrations of contaminants reaching the treatment plant influent and explain how the design concentrations were arrived at. The project

proponents/applicants should include in this section a table of the contaminants expected in the raw water at the plant inlet and their expected range of concentrations. The table should be accompanied by a discussion of the degree of uncertainty and the safety factor commensurate with the degree of uncertainty of the concentrations.

A second table should be prepared which lists additional potential contaminants associated with the contaminating activities. These compounds could include for example, those which are associated with releases or have been consistently detected in soil or groundwater beneath or around the contamination sites, and which were not included in the first list. Generally, these would not factor into the treatment plant design, but should be checked for on an appropriate schedule in production and upstream monitoring wells.

3. Drinking Water Source Protection

If the use of an extremely impaired source is to be approved as a drinking water supply, the origin of contamination must be controlled to:

- Prevent the level of contamination from rising.
- Minimize the dependence on treatment for contaminant removal by the public drinking water system.

There must be a program in place to control the level of contamination. At a minimum, best management practices for waste handling and waste reduction should be required at the origin of the contamination. In addition, an evaluation of cleanups, mitigations and remediations within the capture zones of the proposed production well or surface water source should be performed to demonstrate that releases are not continuing.

Water systems proposing to use an extremely impaired source can take specific steps to develop a program to protect all of its drinking water sources. Such a program could include keeping informed of all environmental cleanups within the system's jurisdiction, being aware of any new facilities handling hazardous material or hazardous wastes and ensuring, to the extent feasible, that such facilities are in compliance with current hazardous waste regulations and handling of toxic compounds so that the risk of future releases are minimized.

- The drinking water source protection program should identify specific personnel that will act as liaisons with agencies that may be involved with permits involving hazardous materials and wastes as well as remediations or cleanups undertaken by USEPA, the California Department of Toxic Substances Control (DTSC), the local Regional Water Quality Control Board, and the local health department or fire department.

- These liaisons should be aware of all such activities, and attend public meetings and hearings held by these agencies as well as to be sure to be on all project mailing

lists for notices and fact sheets published by state and federal environmental agencies.

Included in the design of the treatment facilities, a source treatment facility, usually at the origin of the contamination, low flow, hot spot type treatment is needed. The source treatment facility effluent will not be used as a domestic source. In addition, monitoring between the origin of the contamination and the drinking water source (from a monitoring well or monitoring wells) should be conducted to determine the level of contamination, to demonstrate contaminant control, and to reasonably assure that the contamination level will not increase at production/extraction wells.

4. Effective Treatment and Monitoring

a. Treatment

The 97-005 submittal must include a treatability assessment for all contaminants projected to be detectable at the production/extraction wells. DDW has encountered situations associated with Superfund cleanups that focus on MCLs only and only for a few major “target contaminants”. This is not satisfactory for an extremely impaired source. The applicant and consultant must address all contaminants of health concern and to treat down to the lowest concentration feasible. In many cases, this may turn out to be the level of non-detection (ND) or to the detection limit for purposes of reporting (DLR). Similarly, treatment for drinking water will likely require more effective and reliable contaminant removal to a lower level than is associated with site cleanup. Hence, project proponents will need to adopt a different approach for such projects, keeping in mind the intended use of water produced by the project.

With more extensive “drinking water-oriented” concerns kept in mind, the treatment process used to treat the extremely impaired source prior to direct usage in a domestic water distribution system must be commensurate with the degree of risk associated with the contaminants present. As a minimum, treatment of extremely impaired sources should include use of the best available treatment technology defined for the contaminant(s) by the US Environmental Protection Agency or DDW. Preference should be given to proven, reliable treatment technologies. Furthermore, the treatment processes must have reliability features consistent with the type and degree of contamination.

All treatment processes used must be optimized to reliably produce water that contains the lowest concentration of contaminants feasible at all times. The entire flow from the extremely impaired source needs to pass through the complete treatment process or processes unless a reasonable alternative is available. Any water from other sources that is available for blending prior to entry into the distribution system should be used to provide an additional safety factor.

Multi-barrier treatment is a set of independent treatment processes placed in series and designed and operated to reduce the levels of a contaminant. Each barrier should effectively reduce the contaminant by a significant fraction of the total required reduction. Multi-barrier treatment may be appropriate when:

- The primary treatment is not sufficiently reliable;
- The primary treatment is of uncertain effectiveness;
- There is no direct way to measure the contaminant (e.g., pathogenic microorganism);
- The health effect of the contaminant is acute; and/or
- Very large reductions in contaminant concentration are required.

In situations where there is additionally a regional or basin-wide contaminant (e.g., nitrates or TDS) that is not coming from identified contamination areas, blending with another water source not involved with the cleanup may be considered.

b. Monitoring

Monitoring associated with a proposal to use an extremely impaired source as a drinking water supply will likely require more extensive monitoring, in terms of frequency of testing as well as numbers of contaminants, than is associated with typical drinking water sources. Detection and reporting limits for all analytical chemistry work should be as low as practicable. In all cases, the effluent from the proposed treatment processes must be tested for regulated drinking water contaminants using drinking water analytical methods rather than analytical methods for hazardous waste or solid wastes. Other contaminants tested for should be reported using similar reporting limits.

Supplemental monitoring wells are typically required to provide periodic glimpses of the original contamination and to provide an early warning in case unexpectedly high concentrations or new contaminants are moving toward production/extraction well(s). The monitoring program for the production/extraction wells and up-gradient monitoring wells must be crafted to check for additional contaminants identified in the SA/CA and RWQC that potentially may migrate to the wells. In addition, the extremely impaired water source may contain a mixture of contaminants, some of which may be unidentified. TICs and unidentified contaminants must be addressed. If the source is approved by the DDW, the associated permit amendment should include a provision to update analytical methods and monitoring associated with the site to provide an appropriate level of vigilance.

The water quality surveillance plan should include specific proposed monitoring wells or monitoring locations and a proposed sampling and analysis plan. The purpose of these requirements is to provide early warning of any unexpected increases in contaminant concentrations or detections of additional contaminants, so that appropriate actions can be taken.

The submittal must also include a sampling and analysis plan for the drinking water source(s) and at appropriate locations in the treatment plant. Plant compliance should rely on drinking water analytical methods if available for the plant effluent, usually on a weekly basis. Operational monitoring of locations within the treatment train must be crafted on a case-by-case basis. All proposed monitoring plans must include the proposed analytical method and reporting limits.

If the project is permitted, the permit may contain a provision that allows for adjustment of the monitoring program based on additional information.

c. Treatment and Monitoring Program Proposal

The description of the proposed treatment and monitoring should include the following:

- Performance standards (if available, also use a field measurable indicator of treatment efficiency);
  - Identify level to assure compliance with the treatment objective
  - The treatment objective for all contaminants should be optimized to the lowest extent feasible and must assure compliance with the MCL at all times.
  - In addition to the treatment objective optimization for regulated contaminants, treatment should also be optimized to reduce the concentrations of unregulated contaminants below NLs, where NLs have been established.

  Treatment at facilities treating water from an extremely impaired source containing specific contaminants for which the MCL is higher than the public health goal (PHG), should be designed and operated to meet or be as near as possible to the PHG where this can be accomplished in a cost effective manner.

- Operations plan that identifies all operational procedures, failure response triggers, and loading rates, including:
  - Process monitoring plan
  - Process optimization procedures
  - Established water quality objectives or goals
  - Level of operator qualification
  - Frequent, thorough inspections to ensure that mechanical or rotating equipment is operating as designed. Finding evidence of a mechanical problem may provide a quicker indication of a problem than waiting for analytical results.

- Reliability features
  - Response Plan for failure to meet the treatment objective
  - Alternative disposal methods
  - Shutdown triggers and restart procedures

- Compliance monitoring and reporting program

- Notification plan: The water system's emergency notification plan should be used as a starting point when addressing the notification requirement. A decision tree can also be utilized to explain how various situations will be handled.

- Extremely impaired source water quality surveillance plan, which includes monitoring between the origin of the contamination and the extremely impaired source that is proposed for drinking water.

d. DDW Staff Evaluation of Treated Water Objectives or Goals

DDW seeks to minimize the potential for cumulative risks from the actual and potential contaminants in the extremely impaired source. The project proponents/applicants must set the treated water objectives or goals for the contaminants to the lowest concentrations feasible. By providing enhanced treatment, DDW believes there is a public health benefit that may accrue, in that the enhanced treatment may reduce or remove other contaminants that may be present but are unregulated and/or unknown.

This subsection describes a practical method DDW Staff may use in evaluating the treated water objectives or goals of the combined effluent of the proposed facility, to ensure the cumulative risk of multiple contaminants under normal operation has been reasonably addressed by the project proponents/applicants.

Use of MCL-Equivalents to Evaluate Treated Water Goals

To judge the appropriateness of treatment for an extremely impaired source with multiple contaminants, the following assessment could be used. The goal here is to keep the concentrations of contaminants as low as possible, evaluating them in terms of MCL-equivalents, or when MCLs are not available, surrogate values for MCL-equivalents. Each group of contaminants (acute vs chronic endpoint) should be kept separate, with a goal for each group to be below a single MCL-equivalent, as described below.

For purposes of this step an MCL-equivalent is such that, for example, two contaminants each at half its MCL is one MCL-equivalent, while four contaminants each at one-quarter of its MCL is one MCL-equivalent.

Where an MCL is not available for a contaminant, a surrogate value is used. For non-regulated contaminants with DDW Notification Levels (NLs), this surrogate value is equal to one-tenth of the contaminant's Response Level, or 0.1 RL (Occasionally, the NL for a contaminant is higher than the health risk-based level, due to analytical limitations. Because analytical capability is one of the factors to be considered when an MCL is developed, the NL may be used as the surrogate value in the MCL-equivalent calculation when 0.1 RL is lower than the NL. Please note that DDW reviews laboratory analytical capabilities periodically, and the NLs may be lowered to values closer to the health-based advisory values based on the outcome of the review).

The RL is the level at which DDW recommends removal from service of the source that contains the contaminant. The RL is equal to a 10^{-4} risk level for contaminants considered to pose a carcinogenic risk, and 10 times the NL for non-carcinogens. For non-carcinogens, the NL is the concentration considered to pose no significant health risk, taking into account the no observable adverse effect level from laboratory animal studies, appropriate uncertainty factors to scale from laboratory animal to human exposures, and other considerations used in standard human health risk assessments. Thus, the surrogate MCL values to use for chemicals with RLs correspond to 10^{-5} risk for carcinogens, and to the NL for non-carcinogens. For this evaluation, the NL can be considered analogous to the PHG, and the RL, analogous to 10 times the MCL, at which point sources are removed from service. In between are the MCL and its analog for this evaluation, 0.1 RL.

Applying the same principal, for non-regulated contaminants without DDW NLs, but with USEPA Health Advisory Levels, this surrogate value is equal to 10^{-5} cancer risk level (that is, one-tenth of the contaminant's Health Advisory Level for a carcinogen, which is the concentration of a contaminant in water corresponding to an estimated lifetime cancer risk of 1 in 10,000, or 10^{-4} cancer risk level). For non-carcinogens, the Lifetime Health Advisory Level may be used as the surrogate. The Lifetime HA is the concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for a lifetime of exposure, calculated using the oral Reference Dose and incorporating a drinking water Relative Source Contribution factor of contaminant-specific data or a default of 20 percent of total exposure from all sources.

Where NLs/RLs or USEPA Health Advisory Levels do not exist, risk assessments following standard procedures can enable the determination of the surrogate MCL-equivalent values to use for this evaluation.

If known contaminants can be reduced to an MCL-equivalent of 1 or lower or even to 0 for the mixture of contaminants, it is DDW's belief that a prudent and practical approach has been implemented in providing extra caution for the protection of public health. This approach also helps in identifying the contaminant that contributes most to the MCL-equivalent, which may be useful in focusing additional treatment.

The assessment should include (in a table or tables):

- A list of chemicals that will be or are likely to be present in water delivered to consumers under normal operations and the maximum anticipated concentration. (NOTE: exposures from treatment failures are discussed in section 5).
- The MCL (or action level for lead and copper), 0.1 RL or similar concentration determined from an USEPA Health Advisory Level or other appropriate risk assessment for the contaminant, and its DLR.
- The maximum anticipated concentration of each contaminant

- The ratio of the concentration of each contaminant to its MCL, 0.1 RL, or similar concentration determined from an USEPA Health Advisory Level or other appropriate risk assessment. Chemicals should be separated by the primary health concern, e.g., nitrate and perchlorate, which are considered to pose acute health risk; arsenic, hexavalent chromium, some organic chemicals and others, which are considered to pose chronic health risks such as the risk of cancer; and boron, fluoride, selenium, vanadium and others, which are considered to pose chronic, non-cancer health risks.
- Each ratio for an individual chemical should be determined. The goal is to have the sum of the ratios equal to 0. The sum of the MCL-equivalent ratios needs to be less than or equal to 1.

For example, consider an extremely impaired source that contains perchlorate, nitrate, TCE, arsenic, hexavalent chromium, NDMA, 1,4-dioxane, PFOA and PFOS at the levels presented in Table 1. The sum of the concentration ratios of 0.7 MCL-equivalents for the acute risk contaminants, indicates that this level of treatment would be acceptable (Table 1). The sum of 1.6 MCL-equivalents for the chronic, cancer health risk contaminants exceeds the 1 MCL-equivalent treatment requirement. In this example, the source does not contain contaminants posing chronic, non-cancer risks. If it has, the MCL-equivalent should be calculated separately for the chronic, non-cancer causing contaminants as well.

Additional treatment to reduce the chemicals to non-detect levels would reduce the MCL-equivalent total for the contaminants contributing to chronic health risk (see below, and Table 2). Also, if arsenic or hexavalent chromium can be demonstrated to occur as a result of the natural background, there may be some allowance given (see below, and Table 3).

Table 1: Compare contaminants in treated water with their MCLs (or surrogate MCLs)

Contaminant	Maximum Effluent Concentration	MCL (or surrogate MCL*)	Concentration/MCL	Ratio
Acute, Non-Cancer Endpoint				
Nitrate (as NO_3)	30,000	45,000	30,000/45,000	0.7
Perchlorate	ND	6	0/6	0
TOTAL – MCL-equivalent (acute effects)				**0.7 ≤ 1**
Chronic, Cancer Endpoint				
Regulated Contaminants				
TCE	ND	5	0/5	0
Arsenic	7	10	7/10	0.7
Hexavalent Chromium	6	10**	6/10	0.6
Non-Regulated Contaminants				
NDMA	0.01	0.03*	0.01/0.03	0.3
1,4-Dioxane	0.8***(=ND)	3.5*	0/3.5	0
PFOA	ND	0.0051*	0/0.0051	0
PFOS	ND	0.0065*	0/0.0065	0
TOTAL – MCL-equivalent (chronic effects)				**1.6 > 1**

Concentrations are in units of µg/L.
* One-tenth of the RL is used as the surrogate MCL. When the value of one-tenth of the Response Level is lower than the NL, the NL is used as the MCL surrogate.
** The MCL for hexavalent chromium of 10 µg/L was repealed in September 2017 due to a court order. DDW is in the process of adopting a new MCL.
*** Is below a level considered reliably detectable by DDW; therefore, the maximum concentration is considered ND and the ratio is set to zero.
Note: Values should include one significant figure.

DLRs Limit the Required Levels of Treatment

From Section 4, Part C, we know the project proponent should remove the contaminant to the level as near the PHG as possible. For nitrate in this example, the concentration is already below its PHG, so the goal of meeting the PHG is met. However, nitrate still needs to be added to the calculation as it contributes to the cumulative MCL-equivalent for acute, non-cancer risk. The DLR often limits the ability to monitor the chemical. Therefore, treatment does not need to be to the level below the DLR, unless a lower concentration can easily be attained for the contaminant.

In the above example, additional treatment to reduce the concentration of nitrate to below the DLR would reduce their contribution to 0 MCL-equivalents (see Table 2). Reducing the concentrations of arsenic, hexavalent chromium, NDMA and 1,4-dioxane to below their DLRs would be the best approach to minimize their contributions to the cumulative exposure. Note 1,4-dioxane in Table 1 is below its DLR and was removed from consideration (ratio = 0). NDMA is at its Notification Level. It contributes to the elevated MCL-equivalent. Substituting the treatment-derived ratios in Table 2 for the ratios in Table 1 shows, for example, that treatment of either arsenic or hexavalent chromium to ND, plus NDMA to ND would result in an MCL-equivalent equal to or lower than 1 (0.6, if treating arsenic and NDMA or 0.7, if treating hexavalent chromium and NDMA). Treatment of all three to ND would result in an MCL-equivalent of 0.

Table 2: Consider reducing the contaminants in delivered water to below the DLRs

Contaminant	Maximum Effluent Concentration	MCL (or surrogate MCL*)	Concentration/MCL	Ratio
Acute, Non-Cancer Endpoint				
Nitrate (as NO_3)	ND (<2,000)	45,000	0/45,000	0
Perchlorate	ND (<4)	6	0/6	0
			Total – MCL-equivalent	0
Chronic, Cancer Endpoint				
Regulated Contaminants				
TCE	ND (<0.5)	5	0/5	0
Arsenic	ND (<2)	10	0/10	0
Hexavalent Chromium	ND (<1)	10**	0/10	0
Non-regulated Contaminants				
NDMA	ND (<0.005)	0.03*	0/0.03	0
1,4-Dioxane	ND (<1)	3.5*	0/3.5	0
PFOA	ND (<0.004)	0.0051*	0/0.0051	0
PFOS	ND (<0.004)	0.0065*	0/0.0065	0
			Total – MCL-equivalent	0

Concentrations are in units of micrograms per liter (µg/L).

* One-tenth of the RL is used as surrogate for MCL. When the value of one-tenth of the RL is lower than the NL, the NL may be used as the MCL surrogate.

** The MCL for hexavalent chromium of 10 µg/L was repealed in September 2017 due to a court order. DDW is in the process of adopting a new MCL.

Consideration of Background Credit for Naturally-Occurring Contaminants

In some situations, background levels of contaminants present due to their natural occurrence may be taken into account, and enhanced treatment may not need to be ND. For this to occur,

- Treatment for each contaminant must be to a level below the MCL;
- While treatment below the DLR is desirable, some credit for natural arsenic or hexavalent chromium may be used, provided that the source assessment results clearly demonstrate that the arsenic and/or hexavalent chromium is present naturally and at natural concentrations, as they would be in the absence of the reason the source is extremely impaired;
- If the natural background level of the arsenic or hexavalent chromium is lower than half the MCL, that value may be used as the background credit. If the natural level is greater than half the MCL, background credit is calculated by subtracting half the MCL from the maximum concentration delivered, as shown in Table 3. (Because this is an extremely impaired source, it is prudent not to allow full credit for background levels, consistent with the goal of enhanced treatment.)
- The ratio of the concentration of each contaminant to its MCL is then calculated by subtracting the background credit from the maximum concentration of the contaminant in the delivered water, and then dividing it by the MCL.

In the example shown in Table 3, the MCL-equivalent ratios for arsenic and hexavalent chromium add up to 0.4, which is lower than the combined 1.3 in Table 1, but not as low as the desired 0 in Table 2. However, if treatment to ND is too difficult to attain, and if the background levels of the naturally occurring contaminants are well characterized as required, this may be a reasonable approach to consider. If the values from Table 3 are used in Table 1, the sum of MCL-equivalents for contaminants posing chronic, cancer health risks becomes 0.7.

Table 3: Consider background levels of natural contaminants in delivered water and allow background level credit in determining MCL-Equivalents

Contaminant	Maximum Effluent Concentration	MCL (or surrogate MCL*)	Background	Max. Concentration minus Bkgd Credit	Concentration/ MCL	Ratio
Chronic, Cancer Endpoint						
Regulated Contaminants						
Arsenic	7	10	7**	7-5=2	2/10	0.2
Hexavalent Chromium	6	10***	4	6-4=2	2/10	0.2

Hexavalent Chromium Concentrations are in units of µg/L.
* One-tenth of the RL is used as surrogate for MCL. When the value of one-tenth of the RL is lower than the NL, the NL may be used as the MCL surrogate.
** 7 µg/L is greater than half the MCL, so use 5 µg/L as background credit
*** The MCL for hexavalent chromium of 10 µg/L was repealed in September 2017 due to a court order. DDW is in the process of adopting a new MCL.
Note: values should include one significant figure.

Table 4 below is an example of what may be included in a final report, with the background credit applied for naturally occurring contaminants.

Analyte	**Max. Influ-ent Conc.**	**DLR**	**Max. Efflu-ent Conc.**	**MCL**	**NL**	**RL**	**Surrog ate MCL*** **	**Known Bkgd. **** **	**Allow-able Bkgd.**	**Max. Effluent Conc. Minus Bkgd. Credit**	**Chronic, Cancer MCL Ratio**	**Acute MCL Ratio**
Nitrate	30,000	2,000	30,000	45,000								0.7
Perchlor-ate	5	4	ND	6								0
TCE	15	0.5	ND	5							0	
Arsenic	7	2	7	10				7	5	7-5 = 2	2÷10 = 0.2	
Cr (VI)	6	1	6	10**				4	4	6-4 = 2	2÷10 = 0.2	
NDMA	10	0.005*	0.01		0.01	0.3	0.03				0.01÷0.03 = 0.3	
1,4-dioxane	3	1*	ND		1	35	3.5				0	
PFOA	0.01	0.004*	ND		0.0051	0.01	0.0051				0	
PFOS	0.01	0.004*	ND		0.0065	0.04	0.0065				0	
Sum of MCL Ratios											**0.7 < 1**	**0.7 < 1**

Concentrations are in units of µg/L.
* Because DDW does not have DLRs for unregulated chemicals, DDW established these values as the level considered reliably detectable in drinking water.

** The MCL for hexavalent chromium of 10 µg/L was repealed in September 2017 due to a court order. DDW is in the process of adopting a new MCL.
*** One-tenth of the RL is used as the surrogate MCL. When the value of one-tenth of the Response Level is lower than the NL, the NL is used as the MCL surrogate.
**** Background concentrations vary with location and must be discussed and agreed upon with the DDW.

5. Human Health Risks Associated with Failure of Proposed Treatment

Treatment technologies are not failure-proof, and insufficiently treated or untreated water may, on occasion, pass through the treatment process and into the distribution system. An assessment must be performed that includes:

- An evaluation of the risks of failure of the proposed treatment system.

  The proposed treatment system must be evaluated in terms of its probability to fail, thereby exposing customers to insufficiently treated or untreated drinking water from the extremely impaired source. Likely treatment failure modes are to be evaluated.

  Assumptions of the rate of failure should reflect experience and data for treatment technologies and similarly engineered projects. For proposals with multiple treatment technologies, there may be multiple failure evaluations: each may be assumed to fail individually, various combinations of technologies may be assumed to fail together, and all may be assumed to fail at the same time. For example, in prior 97-005 evaluations,

  - One applicant simply assumed complete failure (as a worst case) on a conservative frequency and for a duration based on the planned operational monitoring plan and performed health risk calculations based on this;
  - Another applicant performed a more involved analysis of various failure modes, including evaluating feasible failure modes followed by Event Tree Analyses. Failure modes that could affect water treatment effectiveness were carried through to the health risk calculations.

- An assessment of potential health risks associated with failure of the proposed treatment system. The health assessment must take into account:

  - The duration of exposure to contaminated drinking water that would result from such a failure. The evaluation should assess the proposed frequency of monitoring and the time it takes for treatment plant operator to receive the monitoring results as it relates to protection of the public from insufficiently treated or untreated drinking water.

- The human health risks associated with such exposure to insufficiently treated or untreated water over the course of that failure, considering the risks of disease from microbiological organism, and the risks of acute, chronic, non-cancer effects, and cancer risks from chemical contaminants.
- Potential cumulative risks, due to multiple failures.

For chemical contaminants, the treatment failure assessment's focus should be based on health risks associated with short-term exposures that may arise from treatment failures. Naturally occurring contaminants such as arsenic and hexavalent chromium need not be included in the treatment failure-related evaluation, provided that:

- They have been addressed in Section 4.d (DDW Staff Evaluation of Treated Water Objectives or Goals) and have been shown to be present primarily at background levels, and
- They are not included in the extremely impaired source's chemicals requiring treatment to meet MCLs.

The assessment of potential health risks associated with failure of the proposed treatment system should include (in a table or tables):

- A list of chemicals that will be or are likely to be present in water should a treatment failure occur, and the maximum anticipated concentration (based on monitoring data, knowledge of contaminant plumes, and an appropriate safety factor).
- The MCL (or action level for lead and copper), notification level or USEPA Health Advisory Level for the contaminant.
- The appropriate value for cancer or non-cancer endpoints, based on the California Public Health Goal (PHG), or PHG-like value for the contaminant

  The assessment of health risk should utilize PHGs, which are expressed in terms of drinking water concentration, whenever they are available for a given contaminant. PHGs for carcinogens are set at the 10^{-6} lifetime cancer risk level (At that level, not more than one cancer case would be expected in a population of one million people as a result of drinking water containing that level of the contaminant daily for 70 years). PHGs for non-carcinogens are set at the no observable adverse effect level, divided by appropriate uncertainty factors, and multiplied by the relative source contribution. Each PHG document generally contains cancer (if carcinogenic) and non-cancer endpoints, and the lowest concentration is the PHG. This document should be used for each endpoint.

  If PHGs are not available, PHG-like values (e.g., 10^{-6} cancer risk level) should be determined from other sources in the following order (if available):
  - DDW drinking water notification levels
  - Proposition 65 cancer risk values (the Proposition 65 values are 10^{-5} risks for a daily exposure. Dividing by 20 yields 10^{-6} risk for 2 liter per day ingestion)

- USEPA Integrated Risk Information System (IRIS) (RfDs should be used to calculated PHG-like numbers, or for carcinogens, use IRIS 10^{-6} cancer risk numbers for drinking water)
- USEPA Region 9 – Preliminary Remediation Goals (PRGs)

- The risk from the exposure attributable to each contaminant.
  - For carcinogen, the lifetime cancer risk from the exposure attributable to each contaminant, in units of cancer case x 10^{-6}.

    The cancer risk attributable to the contaminant in cancer case x 10^{-6}= concentration during failure/de minimis risk concentration (e.g., PHG) x (period of exposure in days)/365 x 70 years).

    For example, an exposure to 50 ppb of a carcinogen with a 5 ppb PHG that occurs 1 day per year for 70 years would have 0.027 x 10^{-6} cancer risk [(50 ppb/5 ppb)x(1 day/year x 70 years)/(365 days/year x 70 years)] = 50/5 x 70 days /25550 days = 0.027).

  - For non-cancer hazard attributable to each contaminant, expressed as a ratio (the hazard index, HI)

    HI= the exposure in µg/L/ PHG or PHG like value in µg/L

    For example, an exposure to 60 ppb of perchlorate would produce a HI of 60 [60 ppb perchlorate/1 ppb (PHG) = 60].

- The sum of cancer risks and the sum of non-cancer hazards (also referred to as hazard indices HIs).
- References that indicate the origin of the PHGs, PHG-like values, and other pertinent information.

For microbiological contaminants, the risk assessment needs to consider the impact of single and multiple failures of the proposed multi-barrier treatment system, and the likelihood of exposure to virus, bacteria, or parasitic organisms, as well as the risk of infection.

An assessment should be repeated for each scenario of treatment failure unless each scenario results in the same exposures.

Risks that exceed the usual acceptable lifetime cancer risk range of 10^{-6} to 10^{-4}, or that exceed a cumulative hazard index of 1 for a given organ system do not necessarily mean the project must be rejected. However, when the risks of adverse health effects, including infection risks from treatment failure are excessive, then additional treatment safeguards, additional monitoring, additional

alarms or additional maintenance inspections must be used for the protection of public health, or the proposal must be rejected.

6. Completion of the California Environmental Quality Act (CEQA) Review of the Project

CEQA review of the project must be completed before the final permit or amendment will be issued.

7. Submittal of a Permit Application

The public water system(s) that will be collecting, treating and distributing water from the extremely impaired source must submit a permit application for the use of the extremely impaired source that includes the items identified above.

A supplier of treated water to a public water system is a water wholesaler and must be permitted as a public water system, as required by the Safe Drinking Water Act. Thus, an entity focused on cleanup activities with environmental regulatory agencies must keep in mind that drinking water systems are subject to different regulatory requirements. In many cases, the requirements upon drinking water systems are more stringent that those upon cleanup projects.

8. Public Hearing

A public hearing may be held as part of the permitting process by the water system or the DDW to identify concerns of consumers who will be served water from the extremely impaired source and to assure that all parties have a chance to provide relevant information.

DDW strongly recommends that a public meeting or other form of outreach to the public occur early in the process to identify any concerns or issues the public may have with the proposed project. This may be combined with outreach activities performed by other agencies involved with a cleanup, if available.

9. DDW Evaluation

DDW staff will conduct an evaluation of the application and make recommendations.

For sources near or associated with hazardous waste sites, staff may consult with colleagues (particularly hydrogeologists and geologists) in the Regional Water Quality Control Board and or Department of Toxic Substances Control for input, since these agencies may be involved in cleanup activities, or otherwise be familiar with the project.

Requirements for DDW Approval

The following findings are required of DDW for approval to use an extremely impaired source:

- Drinking water MCLs, action levels for lead and copper, and NLs will not be exceeded if the permit is complied with, and

- The potential for human health risk is minimized by treatment, and the risk from treatment failure is minimized through good engineering practices that may involve redundancies in treatment, and efficiencies in maintenance, inspections, monitoring, and alarms.

10. Issuance or Denial of Permit

DDW either issues a permit or denies a permit for the use of the extremely impaired source. If a permit is issued, it must include all necessary treatment, compliance monitoring, operational, and reporting requirements.

Workplan for Well V-201, D**DW** Comments
and VW**D** Response to Comments

DRAFT
WORKPLAN FOR RESTORATION OF WELL V-201

5 March 2012

Background

Well V-201 is a Saugus Formation water supply well that is owned and operated by the Valencia Water Company (VWC). Well V-201 has a production capacity of 2,400 gallons per minute (gpm) and is identified as a threatened well in the Castaic Lake Water Agency Litigation Settlement Agreement ("Agreement") because of the presence of perchlorate in the Saugus Formation, in areas west of the Whittaker Bermite property. The well provides a relatively small annual supply (approximately 300 acre-feet per year) but is expected to provide a significant supply during dry year conditions (up to 3,777 acre-feet per year). Accordingly, Well V-201 provides both annual and dry year water supplies.

In August 2010, perchlorate was detected in Well V-201 at concentrations approaching the Department of Public Health (DPH) current maximum contaminant level (MCL) of 6 micrograms per liter (µg/L) and the well was shut down. Perchlorate was subsequently detected in Well V-201 at concentrations exceeding the MCL. VWC has informed DPH that it seeks to restore the impacted groundwater supply capacity of Well V-201 and to design a containment system that will minimize the potential for other water supply wells to be impacted by perchlorate contamination that is present in the Saugus Formation. Subsequently, DPH has requested that VWC prepare documents to address the first four elements of DPH's Policy Memorandum 97-005 (97-005). These elements are:

- Element 1 - Source Water Assessment
- Element 2 - Raw Water Characterization
- Element 3 - Source Water Protection
- Element 4 - Effective Monitoring and Treatment.

In addition, DPH staff requested that VWC address several other issues, including the effectiveness of the Saugus 1/Saugus 2 containment system, the potential beneficial influence or impact of Well V-201 pumping and treatment on the existing Saugus 1/ Saugus 2 containment system, and the potential impact of a prolonged shutdown of the Saugus 1/Saugus 2 containment system.

Well V-201 is located downgradient of the Whittaker Bermite source areas and the Saugus 1/Saugus 2 containment system. A settlement agreement regarding perchlorate migrating from the Whittaker Bermite site has been executed between Whittaker and the Water Purveyors (Purveyors). The Department of Toxic Substances Control (DTSC) serves as the oversight agency for remediation of soil and groundwater impacted by chemical releases at the Whittaker Bermite site. Consistent with the cooperative approach incorporated into the settlement agreement, the Purveyors met with Whittaker

and Chartis representatives to discuss an approach and funding to address perchlorate in Well V-201. A workplan describing the anticipated activities, including cost and schedule, was requested to serve as the basis for funding. Prepared in response to that request, this workplan identifies ten project tasks; describes the activities required under each task; and discusses how each task fulfills the DPH requirements for the first four elements of 97-005, the additional information requested by DPH staff, and the DTSC requirements for modifying the existing Interim Remedial Action Plan (IRAP) for containment and mass removal of perchlorate offsite of the Whittaker Bermite site.

This workplan is structured to address DPH and DTSC requirements. Accordingly, the proposed remedy is developed through modification of the existing IRAP as required by DTSC and evaluated through the requested Elements 1 through 4 of the DPH 97-005 process. The additional information requested by DPH staff will be incorporated into these documents. The workplan is designed to develop said remedy on an expedited basis consistent with all regulatory requirements.

Project Team

Based upon past activities performed on behalf of the Purveyors, both in modeling groundwater within the Santa Clarita Valley and in preparing documents to comply with regulatory agency requirements pertaining to the presence of contaminants in groundwater, three consulting firms will participate in the implementation of this workplan. Each firm will perform activities and tasks consistent with their prior activities and contributions during preparation of the IRAP and 97-005 documents associated with the Saugus 1/Saugus 2 containment system. Although several firms are involved in the tasks described in this workplan, each firm will build upon their prior knowledge, information, and internal data sources so as to avoid duplication of effort. The roles of the three consulting firms are summarized below:

- Luhdorff and Scalmanini Consulting Engineers (LSCE) has maintained the Purveyors' groundwater database for many years and will update the database with information necessary for subsequent groundwater modeling activities being conducted as part of this workplan. LSCE will also assist with formulation and evaluation of containment options, and with reviewing and updating the existing sentinel (surveillance) monitoring program to incorporate the restoration activities at Well V-201.

- GSI Water Solutions (GSI) will be responsible for updating and revising the Purveyors' groundwater model that was previously used to estimate the capture zones for the (then) proposed Saugus 1/Saugus 2 containment system. Consistent with the prior process, GSI will then evaluate multiple containment options using the model; use the results of the groundwater model to provide estimated capture zones for use in the DPH 97-005 process; and identify groundwater pumping rates that will be incorporated directly into the modified IRAP.

- Kennedy/Jenks Consultants (KJC) will be responsible for preparation of documents to address Elements 1 through 4 of the DPH 97-005 process (as required by DPH), and for modification of the IRAP (as required by DTSC).

Project Approach, Structure and Task Sequence

The project approach consists of two fundamental core activities:

- Hydrogeologic analyses and groundwater modeling to evaluate groundwater pumping strategies that will restore impacted water quality at Well V-201 while also protecting threatened supply wells (i.e., wells that have not been impacted by perchlorate). As described below, this work will be conducted under four tasks (Tasks 1 through 4).

- Development of a modified IRAP and a 97-005 summary document that together analyze treatment and water use options and select a preferred option for the Well V-201 containment/treatment system. As described below, this work will be conducted under six tasks (Tasks 5 through 10).

Implementation is based on six major categories that have been further subdivided into ten specific project tasks as follows:

- **Tasks 1 through 3: Hydrogeologic Analysis (LSCE and GSI).** Historical data analysis (Task 1), update of the Purveyors' regional groundwater model (Task 2), and modeling analyses of restoration and containment options (Task 3). These work activities consist of hydrogeologic and groundwater modeling analyses that provide the subsurface technical information upon which the Purveyors will (1) formulate the responses to Elements 1 through 3 of the DPH Policy Memorandum 97-005, (2) respond to the additional related questions posed by DPH, and (3) identify the pumping rates to be specified in the DTSC-required IRAP.

- **Task 4: Sentinel Monitoring Evaluation (LSCE and GSI).** Review and, if necessary, update the design of, the existing sentinel monitoring program that was originally developed as part of the Saugus 1/Saugus 2 containment system. The sentinel monitoring program (also called a "water quality surveillance plan") is required under Element 4 of DPH Policy Memorandum 97-005 and will also respond to DPH concerns regarding the regional containment of the perchlorate plume.

- **Task 5: IRAP Modification (KJC).** Modification of the existing IRAP. The IRAP was first developed by the Purveyors in 2004 to meet DTSC requirements for constructing and operating the Saugus 1/Saugus 2 containment system. Using the planned pumping rate for Well V-201 that is identified during Task 3 of this workplan, the IRAP will identify, screen, and evaluate alternatives for treatment and conveyance of the pumped groundwater. The IRAP will evaluate each treatment/ conveyance alternative against specified criteria.

- **Tasks 6 through 9: 97-005 Document (KJC).** These four tasks together consist of preparing formal documents to address Elements 1 through 4 of DPH Policy Memorandum 97-005. Information prepared by LSCE and GSI in prior tasks and specific analyses conducted by KJC under Tasks 6 through 9 will be used to prepare the documents.

- **Task 10: Project Coordination.** This work occurs through the course of the project and consists of program oversight and coordination by the lead engineering firm (KJC), with support as needed from the hydrogeologic and groundwater modeling consultants (LSCE and GSI). This includes conference calls, meetings, and other communications with Whittaker, DPH, and DTSC; public hearings or other presentations and meeting forums involving the public (where the Purveyors require technical support); and communications if needed with other interested parties (for example, U.S. Army Corps of Engineers).

Specific details regarding the sequencing of the tasks are as followed:

- Tasks 1 through 3 comprise the majority of the work to be conducted by the hydrogeologic consultants (LSCE and GSI) and will provide critical input to Tasks 5 through 9, which will be conducted by KJC. As such, the work under Tasks 5 through 9 will begin as preliminary findings from Task 3 become available to the Project Team.

- Task 4 will occur concurrently with Tasks 5 through 9, in order to best coordinate the Task 4 evaluation with the Elements 3 and 4 analyses being conducted by KJC under Tasks 8 and 9.

- Tasks 5 through 9 will begin as information becomes available from Tasks 1 through 3.

- Task 10 is an ongoing project task to facilitate communications and manage the project scope and schedule.

Task Descriptions

The scope of work for each task is described below, along with a discussion of how each work activity supports (1) the analyses and documentation required under Elements 1 through 4 of the DPH Policy Memorandum 97-005, (2) the response to DPH information requests, and (3) the modification to the IRAP.

Task 1: Historical Data Analysis (LSCE/GSI)

Task 1 will include obtaining historical water quality, aquifer test, and groundwater level data that have been collected as part of remedial investigations, monitoring programs, and the Saugus 1/Saugus 2 containment program. This review will include evaluations of data collected both onsite and off-site of the Whittaker-Bermite site. These data will be entered into the existing Purveyors' database that is maintained by LSCE.

This work is essential to understanding of groundwater conditions in the vicinity of the Whittaker-Bermite site and the off-site areas west of the site. This task will evaluate and analyze existing data to gain a greater understanding of historical and current groundwater levels, quality, and flow directions in the Saugus Formation. This task will directly support the source water assessment element (Element 1) of the DPH Policy Memorandum 97-005 (Task 6 of this workplan), and will also provide technical information that will serve as necessary input to subsequent projects tasks, including: (1) the groundwater modeling work in Tasks 2 and 3, (2) the evaluation of the sentinel

monitoring program in Task 4, and (3) the raw water characterization evaluation that comprises Element 2 of 97-005 (Task 7). The focus of the Task 1 analysis will be on the area west of the Whittaker-Bermite site and will include the following components:

- Evaluate historical data and process these data for import into the model (under Task 2 of this workplan). This work will consist of the following specific activities:
    - Identify variations in groundwater elevation contours and flow directions from the vicinity of the Whittaker-Bermite site to Wells V-201, V-205, and V-160.
    - Review groundwater quality data to describe historical occurrence of perchlorate.
    - Update well characteristics and aquifer properties (transmissivity, hydraulic conductivity, specific capacity, and storativity).
    - Use the estimates of aquifer properties and groundwater elevations and flow directions to conduct an initial assessment of historical off-site migration of perchlorate from 1997 until May 2010 when operation of the Saugus 1/Saugus 2 containment system began. This work will be complemented by modeling analyses described in Task 2 below to address DPH questions.
- Describe/illustrate current groundwater elevations, contours, and perchlorate occurrence, for input into the groundwater modeling analyses described in Tasks 2 and 3 of this workplan.
- Evaluate current data to estimate cones of depression, capture zones, etc. from the Saugus 1/Saugus 2 containment system – information which will facilitate model calibration-check evaluations in Task 2 of this workplan.
- Review the delineation of Saugus Formation geologic sub-units developed as part of the USACE and Whittaker-Bermite investigations. Among the outcomes of this activity will be decisions regarding further subdivision of the regional model's layering, and the development of recommendations for the sentinel monitoring program in Task 4.

Deliverables: Prepare a brief technical memorandum documenting the work conducted under this task. The technical memorandum would be intended to serve as an appendix to the 97-005 document being developed by KJC under Tasks 6 through 9 of this workplan. The LSCE/GSI technical memorandum developed under Task 1 will serve as one of the technical information and reference sources for the KJC documents for the 97-005 Elements 1 through 3.

Deliverables to KJC: The LSCE/GSI technical memorandum developed in this task will provide KJC with some of the information necessary for the "Environmental Setting" discussion (Preliminary Table of Contents First Four Elements of 97-005 Documentation (TOC) Section 2.2 [attached]) that is a sub-section of the source water assessment. Some of the Task 1 information will also support the raw water characterization, in particular TOC Sections 3.3 to 3.9.

Task 2: Update of Purveyor Groundwater Model (LSCE/GSI)

The Purveyors' existing groundwater flow model has been calibrated in the past to a time period that extends from 1980 through 2007. Task 2 will include the extension of the calibration period through 2011 in order to capture the initiation of the Saugus 1/ Saugus 2 containment program and the detection of perchlorate at Well V-201 in 2010. These activities then will provide a foundation to build upon for evaluating (under Task 3 of this workplan) how Well V-201 and other nearby Saugus Formation wells should be operated so as to meet perchlorate containment objectives that are consistent with the intent of Element 3 of the DPH Policy Memorandum 97-005, which is to prevent contaminant concentrations from increasing (in this case, in Saugus Formation groundwater). Because the Task 2 work sets up the analysis for Task 3, the Task 2 modeling effort will provide technical information to support both the source water assessment element (Element 1) and the source water protection element (Element 3) of the DPH Policy Memorandum 97-005. Task 2 work activities will include the following components:

- Extending the model simulation time period through 2011 and evaluating model calibration from 2008 through 2011 – specifically:

    - Incorporate monthly data collected in Task 1 for the years 2008 through 2011 into the model, including basin-wide groundwater pumping and groundwater level measurements and all other hydrologic processes (e.g., rainfall, streamflow, WRP discharges to streams, releases from Castaic Lake, etc.) into model input files. Conduct a model run and compare model results on a monthly basis to observed groundwater levels and estimated groundwater discharge rates to streams.

    - Conduct particle-tracking to evaluate the model's ability to simulate historical movement of perchlorate to Well V-201, with an emphasis on the time period between 1997 and 2011 in response to DPH questions.

- Conduct additional simulations on a daily or weekly basis beginning in mid-2010 to simulate the start-up of the Saugus 1/Saugus 2 containment system, and – to the extent data are available – compare the simulated groundwater level fluctuations with those measured at these two wells and at other nearby monitoring locations.

- Use the results of the modeling steps above to assess the adequacy of the existing model's calibration to simulate historically observed groundwater conditions. If deemed necessary by the results of the modeling steps described above, refine the model's calibration (primarily in the areas impacted and threatened by perchlorate occurrence and migration) by adjusting the horizontal and vertical hydraulic conductivity values in the Saugus Formation, using (as a guide) data collected and analyzed in Task 1 and regional hydrologic data presented in previous reports prepared by the Purveyors and USACE.

- If desired by the Purveyors, subdivide one or more of the existing seven model layers to increase the model's vertical resolution of groundwater conditions in the Saugus Formation. The modeling software allows for simulation of up to 20

model layers. GSI and LSCE recommend that layer subdivision be carefully planned so as to provide benefit while minimizing modifications to existing pre- and post-processors. This work could be conducted either before or after completion of other Task 2 activities, as deemed appropriate by the Purveyors and the project team.

Deliverables: Prepare a brief technical memorandum documenting the work conducted under this task. The technical memorandum is intended to serve as an appendix to the 97-005 document being developed by KJC under Tasks 6 through 9 of this workplan. The LSCE/GSI technical memorandum developed under Task 2 will serve as one of the technical information and reference sources for the discussions in the KJC document about 97-005 Elements 1 and 3. The Task 2 technical memorandum also provides input to Task 3 of this workplan and, by reference, may also support other portions of the 97-005 report to be prepared by KJC.

Deliverables to KJC: The LSCE/GSI technical memorandum developed in this task will be used by KJC in the preparation of the DPH 97-005 documentation.

Task 3 - Groundwater Model Analysis of Restoration and Containment Options (LSCE/GSI)

The updated Purveyor groundwater flow model will be used to analyze the ability of various options to (1) restore the water supply capacity temporarily lost as a result of the perchlorate detections at well V-201 and (2) hydraulically contain perchlorate so as to minimize the chances of perchlorate migration to non-impacted Saugus wells. The groundwater flow model will be used to evaluate the likely effectiveness of various hydraulic control and restoration options (including at various locations, and for various pumping configurations), and to thereby provide the information necessary to address Element 3 of the DPH Policy Memorandum 97-005 with regard to any pumping for water supply (whether from V-201 or from other wells) as well as with regard to protecting any potentially threatened Saugus wells. This work will also provide rates of pumping from V-201 for use in developing the modified IRAP. This task will include the following components:

- As required by DPH, evaluate the potential for perchlorate migration, e.g. to Wells V-205 and V-160, under existing conditions (with Well V-201 not operating, Wells Saugus 1 and Saugus 2 each operating at 1,100 gallons per minute, and all other water supply wells operating at the rates specified in the 2008 operating plan for the basin).

- Repeat the prior analysis with no pumping from Well V-205. This run will be conducted twice as follows: (1) with the 2008 operating plan pumping of Well V-205 assigned to one or more other Saugus wells, and (2) without reassigning that pumping to any other wells.

- Develop an initial set of potential restoration and containment options to restore the impacted capacity of Well V-201, in accordance with DPH and DTSC requirements. Review the options with the Purveyors prior to conducting modeling work, then conduct transient model simulations that evaluate the effect of each restoration-and-containment option on perchlorate migration and

containment (up to 10 simulations are anticipated). Each transient model run will simulate variations in water supply needs and subsequent water supply well pumping arising from annual or multi-year cycles in external factors that drive this pumping (i.e., State Water Project availability and local hydrologic conditions). Each transient model simulation will consist of running the model on a monthly basis (to compute time-varying heads and water budget terms) followed by three-dimensional pathline analyses at various locations and for various time periods (for example, during extended droughts, over multi-decadal cycles, and over the entire simulation period). For a given model simulation, the purpose of the pathline analyses will be to evaluate the degree of hydraulic containment achieved under the simulated locations and rates for pumping.

- Work with the Purveyors and Whittaker representatives to review the modeling results and decide whether additional adjustments to the restoration-and-containment options are warranted, and whether any additional options should be evaluated. If deemed necessary by the Purveyors and Whittaker representatives, conduct up to 20 additional modeling simulations to evaluate the effect of each of the restoration and containment options on perchlorate migration and containment.

- From the results of the restoration and containment options, work with the Purveyors and Whittaker representatives to identify a preferred restoration and containment option, then delineate time-related capture zones for Well V-201 under that option. Delineations will be conducted using reverse particle-tracking methods in the groundwater model; the capture zones will be delineated for groundwater travel times to Well V-201 of 2, 5, 10, 25, and 50 years.

Our scope of work assumes that the basic design and setup of the Purveyors' model will not change during this project. Specifically, we assume that no changes will be necessary to the model grid (other than subdividing existing model layers if so desired by the Purveyors, as described in Task 2) or to the temporal sequences of normal and dry years (for local hydrology and SWP availability). Additionally, we assume that no modifications to the programming of pre-processing and post-processing utilities will be necessary in order to conduct this scope of work. If LSCE, GSI, KJC, and the Purveyors conclude that substantive changes to the model and/or supporting utilities are necessary, then an amended proposal for those additional work activities will be prepared as appropriate for review/approval by Whittaker and Chartis.

Deliverables: A technical memorandum documenting this analysis and presenting one or more recommended restoration and containment options.

Deliverables to KJC: A set of time-related capture zones (for durations of 2, 5, 10, 25, and 50 years) delineated for the final selected operational program at Well V-201 (for TOC Section 2.4); and a description of the wells for the Surveillance Plan (TOC Section 4.9). The LSCE/GSI team will provide this information to KJC primarily in text and figures.

Task 4 – Review and Update Design of Off-Site Monitoring Program (LSCE/GSI)

Task 4 will review the status of off-site monitoring activities, including the current sentinel well monitoring program developed primarily for the Saugus 1/Saugus 2 containment system, to evaluate the ability of the current monitoring programs to (1) address DPH's monitoring requirements under its Policy Memorandum 97-005; (2) provide data necessary to evaluate groundwater flow and perchlorate movement in response to regional and restored Saugus pumping; and (3) verify the effectiveness of current and planned restoration and containment activities to prevent migration of perchlorate to threatened Saugus wells. Note that the existing sentinel wells are located east of Saugus 1 and Saugus 2, and there are no sentinel wells located west of the South Fork of the Santa Clara River. This task will address DPH concerns on the effectiveness of containment operations, and also will build on the findings of Task 3 and subsequent selection (in Task 3) of a preferred restoration and containment alternative. Task 4 will include the following work components:

- Summarize the design and status of current off-site monitoring programs.
- Expand the design of the sentinel monitoring program based on the findings of Task 3 and DPH requirements for sentinel monitoring to incorporate recommended restoration of Well V-201.
- Develop recommendations for off-site monitoring to not only include sentinel monitoring of water quality that is upgradient of Saugus wells, but also to monitor the effectiveness of containment programs that are implemented to minimize perchlorate migration to non-impacted wells.

Deliverables: A technical memorandum summarizing the current off-site monitoring programs and providing recommendations for expansion of sentinel and additional off-site monitoring.

Deliverables to KJC: A description of the wells for the Surveillance Plan (TOC Section 5.5). The LSCE/GSI team will provide this information to KJC primarily in text and figures.

Task 5. Modification of the Interim Remedial Action Plan (KJC)

The IRAP for the Saugus 1/ Saugus 2 containment system was prepared by the Purveyors and approved by DTSC. Based on discussions with DTSC staff, the previously approved IRAP will be utilized as the basis for a modified IRAP which will describe the proposed restoration and containment action at Well V-201.

The modified IRAP will include a description of the groundwater contamination at Well V-201 using information developed in Task 1 and restoration and containment options developed in Task 3. The effectiveness of the Saugus 1/ Saugus 2 containment system will be described along with an off-site perchlorate occurrence as required by DPH. Historical and current on-site and off-site monitoring data collected as part of Task 1 and the groundwater model results from previous tasks will be utilized to perform this evaluation. The regional groundwater model prepared by GSI will be the primary tool

for evaluating restoration and containment options for Well V-201, as described under Tasks 1 through 3 of this workplan.

- The modified IRAP will include a summary of hydrogeologic and water quality conditions of the off-site area (from Task 1); also, from Tasks 2 and 3, the output and conclusions from the groundwater modeling activities (especially relating anticipated capture zones to pumping rates) will be used as fundamental inputs for the modified IRAP. Using the estimated pumping rate from Well V-201, as developed from the groundwater modeling performed during Task 3, KJC will identify options for remediation of groundwater impacted by perchlorate. As appropriate, information from the original IRAP will be incorporated.

- The modified IRAP then will use these evaluations to identify potential remedial alternatives to address the off-site groundwater contamination. The remedial objectives and potential remedial alternatives will be identified. Similar to the IRAP for the Saugus 1/Saugus 2 containment system, the treatment processes to be evaluated will include ion exchange and biological systems. The modified IRAP will include the following:

    - Remedial action objectives will be identified through discussions with the Purveyors, Whittaker representatives, DTSC, and DPH.

    - Potential remedial alternatives will be identified.

    - Capital and operating costs will be estimated.

    - The alternatives will be evaluated according to seven of the nine DTSC criteria and will be described in the modified IRAP. The other criteria, State acceptance and community acceptance, will also be described in the modified IRAP after regulatory review and the public hearing process.

KJC will prepare a draft modified IRAP for review by the Purveyors and Whittaker representatives. Following receipt and incorporation of comments, the final draft modified IRAP will be submitted to DTSC and DPH, and made available for public review.

Deliverables: A draft modified IRAP for review by the Purveyors and Whittaker representatives and the final draft modified IRAP for submittal to DTSC and DPH. As requested by Whittaker, participation by the Project Team (i.e., LSCE, GSI, KJC) and the Purveyors in a public participation process, including a public hearing and subsequent preparation of the final modified IRAP, will be included in a future scope of work.

Task 6. Source Water Assessment (Element 1 of DPH 97-005 Guidance Memo) (KJC)

The objective of this task is to determine the aquifer's vulnerability to contaminating activities, including impacts from other identified contaminant sources within the hydrologic unit (i.e., not just those currently impacting Well V-201 and the production aquifers). Based on the information compiled from Tasks 1 through 3 of this workplan, KJC will prepare a Source Water Assessment document that will:

- Describe the environmental setting (TOC Section 2.2).

- Describe the existing well (TOC Section 2.3).

- Identify the 2, 5, 10, 25, and 50 year capture zones from the focused groundwater model that will be utilized for the recommended plan – including how these capture zones are affected by variations in water supply needs and subsequent water supply well pumping (due to annual or multi-year cycles in external factors that drive this pumping [i.e., State Water Project availability and local hydrologic conditions]) (TOC Section 2.4).

- Identify potential sources of surface contamination (TOC Section 2.5).

- Summarize the Well V-201 Drinking Water Source Assessment (DWSA) vulnerability evaluation (TOC Section 2.6). It is assumed that this assessment has already been completed and will be provided by VWC.

- Summarize the findings from the contaminant source identification analysis and the DWSA (TOC Section 2.7).

As required by the DPH 97-005 guidance, Task 6 includes conducting a modified Phase I Environmental Site Assessment (ESA) for the 2- and 5-year capture zones. This assessment will be performed by KJC. The Phase 1 ESA will be conducted for these two estimated capture zones because the 2-year and 5-year time frames provide sufficient time for VWC to respond to any future changes in water quality (concentration changes of known chemicals of concern (COCs), and/or presence of new COCs) that might be identified through the sentinel well monitoring described in the surveillance plan.

Deliverables: Draft of this section for the 97-005 summary documentation report to the Purveyors and Whittaker representatives for review. Following receipt and incorporation of comments, the draft Element 1 document will be submitted to DPH once the documents for the three other 97-005 elements also have gone through this process.

Task 7. Raw Water Characterization (Element 2 of DPH 97-005 Guidance Memo) (KJC)

The objective of this task is to fully characterize the source water quality. To accomplish this objective the following activities will be required.

1. Using the text and tables developed in Task 1, summarize the historical water quality with descriptive statistics such as minimum, maximum and average values, and also include seasonal variability. This analysis will be conducted for wells located within the capture zones developed in Task 3 and described in Task 6. These historical data will be compared to the regulatory limits such as primary and secondary MCLs, Notification Levels, and Public Health Goals as well as to parameters that may impact planned and potential unit treatment processes. These summaries will also include the Title 22 DPH required monitoring parameters such as general minerals, and general physical parameters.

2. Using only existing historical data developed in Task 1, summarize the behavior of the COCs with respect to historical occurrence, pumping, and depth.

3. Identify additional sampling and laboratory analyses to fill in data gaps as appropriate. If this activity is needed, the additional sampling will be addressed in a separate workplan that will be prepared for review and approval by the Purveyors and Whittaker representatives.

Deliverables: A draft of this section of the 97-005 summary documentation report will be submitted to the Purveyors and Whittaker representatives for review. Following receipt and incorporation of comments, the draft Element 2 document will be submitted to DPH once the documents for the three other 97-005 elements also have gone through this process.

Task 8. Source Water Protection (Element 3 of DPH 97-005 Guidance Memo) (KJC)

The objective of this task is to describe a program intended to manage the level of contamination (i.e., to prevent increasing contaminant concentrations) and to minimize the dependence on treatment.

This task will develop a source water protection program that actively protects the drinking water source to eliminate or minimize the dependence on wellhead treatment. The source protection program will incorporate existing regulatory requirements listed below.

- Federal regulations and programs
- State regulations and programs
- Local regulations and programs

This document will also incorporate the hydrogeologic information and groundwater containment/restoration plan developed during Task 3 to control the source of the contamination at Well V-201.

Deliverables: A draft of this section of the 97-005 summary documentation report will be submitted to the Purveyors and Whittaker representatives for review. Following receipt and incorporation of comments, the draft Element 3 document will be submitted to DPH once the documents for the three other 97-005 elements also have gone through this process.

Task 9. Effective Monitoring and Treatment (Element 4 of DPH 97-005 Guidance Memo) (KJC)

Based on the IRAP, the recommended treatment train will be used as the basis to develop the following:

1. An operational plan for the recommended treatment train compliant with Title 22, Chapter 17 Section. The operational plan will include a process monitoring plan that will address, but not be limited to, the following:

- Process optimization procedures for the recommended treatment train.
- Established water quality objectives or goals for the recommended treatment train.
- Level of operator qualifications.

2. A source water surveillance plan which includes the information developed in Task 4.
3. An emergency notification plan as provided by VWC.
4. A compliance monitoring and reporting program for the treatment system and source water surveillance plan.

Deliverables: A draft of this section of the 97-005 summary documentation report will be provided to the Purveyors and Whittaker representatives for review. Following receipt and incorporation of comments, the draft Element 4 document will be submitted to DPH once the documents for the three other 97-005 elements also have gone through this process.

Task 10. Program Coordination (KJC/LSCE/GSI)

Subtask 10.1. Program Coordination - KJC

In this task, program oversight and coordination will be provided and monthly status meetings will be attended.

Subtask 10.2. Program Coordination - LSCE/GSI

This subtask will entail preparation for and participation in the following activities if requested by the Purveyors:

- Monthly technical progress meetings in accordance with the Castaic Lake Water Agency Litigation Settlement Agreement.
- Meetings with the Purveyors to discuss the results and status of our work.
- Meetings with DPH in advance of preparing the 97-005 document.
- Review and related consultation during preparation of the modified IRAP and the 97-005 document.
- Informational meetings held by the Purveyors for the public, as part of outreach efforts, if necessary.

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

March 28, 2012

Mr. Keith Abercrombie
General Manager
Valencia Water Company
24631 Avenue Rockefeller
P.O. Box 5904
Valencia, CA 91385

Dear Mr. Abercrombie:

SYSTEM NO. 1910240 – COMMENTS FOR WELL V-201 RESTORATION WORKPLAN

The California Department of Public Health (Department) has completed the review of the Draft Workplan for Restoration of Well V-201 dated March 5, 2012 (workplan) which was submitted by the Valencia Water Company (Company) on March 12, 2012. The Department hereby provides the following comments broken into two categories: general comments for the workplan and specific comments for individual tasks detailed in the workplan.

General Comments

The workplan seems to address only perchlorate and its effect on Valencia Well 201. Due to detections of VOCs at Saugus 1 and nearby monitoring wells, the Department would require the workplan to also address VOCs in addition to perchlorate contamination. Because it is evident that perchlorate has migrated to Well 201 from Saugus 1 and 2, considerable actions should be taken to prevent further migration to other wells downgradient from Well 201, such as Well 205. The Department would require that Well 201 be taken out of operation when Saugus 1 and 2 are not in production. Furthermore, the Company should consider a contingency plan which allows groundwater from Well 205 to be treated at Well 201 treatment plant if perchlorate is ever detected at Well 205.

Specific Comments

Task 3 – The modeling should simulate to show the effectiveness of Saugus 1 and 2 containment system, the impact of Well 201 pumping and treatment on the existing

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Saugus 1 and 2 containment system, and the impact on Well 201 as well as Well 205 from a prolonged shutdown of Saugus 1 and/or 2.

Task 4 – The Department definitely supports the additions of sentinel monitoring locations between Saugus 1 and 2 and Well 201 and between Wells 201 and 205. These additional monitoring locations will not only address the Department's concerns on the effectiveness of the containment operations, but also provide an early warning if and when high levels of contaminants or additional contaminants of concern may be approaching the production wells.

Tasks 6 through 9 – The Department would accept partial submittal by each task, rather than one report consisting of all completed tasks at the end. Same applies to the 97-005 report where individual report for each element may be submitted to the Department once the work associated with each element is complete, without further delay.

Task 7 - At a minimum, the Department requires a full suite of chemical analyses at Well 201, which include Title 22 monitoring, non-target volatile organic chemicals and non-target semi-volatile organic chemicals (Tentatively Identified Compounds (TICs) analysis), nitrosamines, hexavalent chromium, 1,4-dioxane, chlorate, and explosives (TNT, HMX, and RDX).

If you have any questions, please call Karen Wong at (818) 551-2037.

Sincerely,

Jeff O'Keefe, P.E.
District Engineer
Metropolitan District

cc: Mr. James R. Leserman, P.E.
Senior Engineer
Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350

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August 7, 2012

Mr. Jeff O'Keefe
California Dept. of Public Health
Southern California Branch - Drinking Water Field Operations
500 No. Central Ave., Ste. 500
Glendale, CA 91203

Re: V201 Workplan Feedback and Comments Raised in the Department's Comment Letter of March 28, 2012

Dear Mr. O'Keefe:

Valencia Water Company (Valencia) sent a draft of the V201 Workplan to the California Department of Public Health (Department) in March for review. The Department reviewed and commented on the Workplan (comment letter dated March 28, 2012 attached).

This letter is to provide feedback to the Department and to address the comments raised in the Department's comment letter;

General Comments

The Workplan seems to address only perchlorate and its effects on Valencia Well 201. Due to detections of VOCs at Saugus1 and nearby monitoring wells, the Department would require the Workplan to address VOCs in addition to perchlorate contamination.

Response. As requested by a specific comment presented later in the Department's letter, sampling will be conducted for a full suite of chemicals that includes target and non-target volatile organic compounds (VOCs). That work will be conducted under Task 7 of the Workplan, which addresses Element 2 (Raw Water Characterization) of the 97-005 guidance. As discussed during the April 10th technical meeting, groundwater modeling for VOCs is unnecessary because VOCs are generally less mobile than perchlorate; consequently, the use of groundwater modeling to evaluate perchlorate containment will serve as a surrogate for how the most mobile VOCs could potentially migrate.

Because it is evident that perchlorate has migrated to Well 201 from Saugus 1 and 2, considerable actions should be taken to prevent further migration to other wells down gradient from Well 201, such as Well 205.

Response. In Task 3, Valencia and its consultants will be evaluating restoration and containment actions which will not only address the existing perchlorate occurrence at Well 201 but also strategies to prevent perchlorate migration down gradient to Well 205. The Purveyors' model has been selected for the analyses described in the Workplan because of its ability to account for (1) local-scale movement of perchlorate between the Whittaker property and Well 201 and (2) local and regional pumping of the Saugus Formation. These two capabilities, which are inherent in the model's design, will allow Valencia to evaluate how best to prevent further westward migration of perchlorate while also meeting groundwater supply needs. Each model run that evaluates offsite perchlorate restoration and containment strategies will also be simultaneously simulating the Purveyors' regional pumping plan, which is described in the CLWA Urban Water Management Plan and which includes operation of other wells down gradient of Well 201.

Furthermore, the Company should consider a contingency plan which allows groundwater from Well 205 to be treated at Well 201 treatment plan if perchlorate is ever detected at Well 205.

Response. Valencia and its consultants will consider this recommendation as part of the selection of potential treatment and containment strategies developed in Task 3.

Specific Comments

Task 3 – The modeling should simulate to show the effectiveness of Saugus 1 and 2 containment system, the impact of Well 201 pumping and treatment on the existing Saugus 1 and 2 containment system, and the impact on Well 201 as well as Well 205 from a prolonged shutdown of Saugus 1 and/or 2.

Response. These specific items are identified in the Workplan in various bullet lists that are contained in the work descriptions for Tasks 1 and 3. Under the Task 1 work effort, groundwater level data and water quality data will be reviewed to provide an initial assessment of the effectiveness of the Saugus 1 and 2 containment system. Under Task 3, transient simulations and three-dimensional flowpath / flowline analyses will be conducted as part of the modeling effort to evaluate each of the items listed in this comment.

Task 4 – The Department definitely supports the additions of sentinel monitoring locations between Saugus 1 and 2 and Well 201 and between Wells 201 and 205. These additional monitoring locations will not only address the Department's concerns on the effectiveness of the containment operations, but also provide an early warning if and when high levels of contaminants or additional contaminants of concern may be approaching the production wells.

Response. Comment noted. Valencia will be working closely with the Department as to the siting of sentinel monitoring wells.

Tasks 6 through 9 – The Department would accept partial submittal by each task, rather than one report consisting of all completed tasks at the end. Same applies to the 97-005 report where individual report for each element may be submitted to the Department once the work associated with each element is complete, without further delay.

Response. Valencia appreciates the Department's willingness to accept partial submittals of the tasks as completed rather than waiting for a report at the time all tasks are completed in order to help expedite the review process.

Task 7 – At a minimum, the Department requires a full suite of chemical analyses at Well 201, which include Title 22 monitoring, non-target volatile organic chemicals and non-target semi-volatile organic chemicals (Tentatively Identified Compounds (TICs) analysis), nitrosamines, hexavalent chromium, 1,4-dioxane, chlorate, and explosives (TNT, HMX, and RDX).

Response. As discussed in the response to the general comment, Valencia will be conducting these requested analyses.

Valencia appreciates the Department's input and looks forward to working closely with you on this project.

Sincerely,

Keith Abercrombie
General Manager

Attachments