What Does "An Equivalent Level of Public Health Protection" Mean to You?

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Drinking Water Subcommittee
California Bay-Delta Public Advisory Committee

A Synthesis of ELPH Meanings

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To date, nine Drinking Water Subcommittee members have described what "An Equivalent Level of Public Health Protection," fondly referred to as "ELPH," means to them. Across all nine, there is a remarkable level of consensus on a number of issues.

- There is a need to develop a baseline of health risk represented by the "50/3" ROD targets for bromide and total organic carbon, covering both chronic and acute risks, which could then serve as a benchmark for achieving an equivalent level of public health protection in other ways.
- CALFED's strategy for water quality should contain tools that permit CALFED and local agencies to improve water quality in a flexible manner and using a regional approach.
- The strategy could recommend best management practices (BMPs) and best available technologies (BATs) for protecting, managing, treating, and distributing Delta source water used for drinking water.
- The tools used to improve water quality should utilize monitoring and assessment, afford equity to all stakeholders, and provide multiple benefits (to other CALFED program elements).
- Such actions must also be cost-effective.

In general, there were no major areas of disagreement in the DWS's approach to ELPH.

The Meaning of ELPHP

Greg Gartrell
Contra Costa Water District

The Equivalent Level of Public Health Protection (ELPHP) as it relates to the stated CALFED Drinking Water Quality Program goals for TOC and bromide should be viewed as a surrogate indicator for the public health protection of drinking water[1]. The specific levels of TOC and bromide were chosen in the CALFED ROD based on the best available science and information to meet acceptably low levels of bromate, a carcinogen, and other disinfection byproducts formed during the treatment of Delta water for M&I purposes, while meeting acceptable disinfection requirements necessary to protect public health from acute and chronic effects of pathogens.

CALFED's obligation is to meet the 50/3 target or to provide some equivalent means to meet the ELPHP. As a surrogate indicator, ELPHP can be used to prioritize the funding of projects to improve the quality of drinking water by meeting the target directly or through other means. A number of elements to address the ELPHP need to go into a strategic plan for the CALFED Drinking Water Quality Program, which would enable the program to prioritize funding and measure its performance.

BASELINE

To use ELPHP, the baseline ELPHP first needs to be established. The baseline ELPHP would be the public health risk assessments (for example, a 10^{-6} increased cancer risk, or a 4-log removal for pathogen risks) associated with meeting the CALFED drinking water quality program goals. It can be determined through a risk assessment analysis, evaluating what level of chronic plus acute risk is achieved through treating Delta waters meeting the TOC/bromide goals at some baseline level of treatment technology, and would include a suite of factors (DBPs and pathogens for example, or surrogates for them). Note that for a Delta water supply that meets the 50/3 criteria, there will still be tradeoffs in treatment (higher pathogen removal with higher DBPs for example, while still meeting regulations). The assessment analysis could then be used by individual drinking water providers to determine what their current level of health protection is, the level they could achieve under different CALFED scenarios for meeting the ELPHP if the 50/3 goal for bromide and TOC cannot be met directly, and the level of improvement required. The Drinking Water Quality Program could assist individual agencies in this effort by establishing a common database of risk analysis components, such as carcinogen lists and associated potency factors.

Physical Solutions

Once a baseline is established, tools can be fleshed out. The ELPHP diagram developed by the Drinking Water Quality Subcommittee defines a number of tools, but does not describe their attributes, such as effectiveness, flexibility, and economics. Each of the tools should be fleshed out at a programmatic level, with uniform evaluation criteria for the project level determinations of alternative tools in meeting specific public health goals. The same evaluation criteria could be used by other CALFED programs to determine if projects can or do included drinking water benefits. Some of the tools may need further study to set the evaluation criteria, and this could be a funding priority for the strategic plan. For example, an agency could look at the list of tools (source control, treatment technology, water exchanges) and develop a list of alternatives that could achieve its desired public health protection level. It could then use the evaluation criteria and the environmental review process to determine which projects to pursue (which could, of course, include support of regional programs).

Links to other CALFED Programs

When a strategic plan around the ELPHP is developed, other CALFED programs can use the plan to determine if their projects have multiple benefits (another CALFED goal), or whether their projects can be

[1] As a comparison, consider that the position of X2 is a surrogate indicator of fishery habitat health in the Delta.

capitalized to provide benefits to the Drinking Water Quality Program (for example, by adding another sample collection to an established monitoring program). The strategic plan might also define an overall regulatory drinking water policy[2], significance criteria, and linking mechanisms to insure that the balance of CALFED is maintained and drinking water quality achieves its goal of continuous improvement over the next 30 years.

[2] Through support of the Regional Water Quality Control Boards efforts.

An Equivalent Level of Public Health Protection (ELPH)

Marguerite Young
Clean Water Action

The public health concerns associated with Delta Water are due to the interaction of organic carbon (TOC) and bromide with either ozone or chlorine in the disinfection process. Disinfection by products are associated chronic health concerns (bladder cancer) and may also be implicated for reproductive/developmental health risks (miscarriage, birth defects) though our scientific understanding of these processes is still limited. Conversely, disinfection is required due to source water contamination from upstream discharges and agricultural runoff. The CalFed plan set benchmark targets of 50 ppb bromide and 3 ppm TOC as capable of meeting projected drinking water standards with then available treatment technology. The concept of ELPH then recognizes that these targets could act as surrogates for a combination of actions involving source water improvements/controls, water management (broadly defined) and treatment.

ELPH elements:

1. A baseline for public health outcomes (cancer, repro/devo, and microbial outbreaks) associated with meeting 50/3 for Delta source water given today's predominant treatment technologies. This could be set at the most protective level or be defined as a range of risk to account for scientific uncertainties. Periodic expert review of the available science (this could be timed with existing EPA or NRC reviews).
2. CalFed to establish the range of actions, evaluation criteria, and the measurable outcomes to be taken to improve conditions in the Delta. This should include but not be limited to actions identified in the ROD.
3. A clearly defined drinking water policy for the CVRB to guide the actions of upstream dischargers.
4. Regional alternatives for achieving ELPH need to be based on a common architecture in order to be able to compare performance across systems. ELPH needs to have a mechanism for accounting for the differences in overall water quality between systems. For instance, should achieving ELPH assume BAT will be used in each area, or identify a set of BMPs to be incorporated in water management, source control, water use efficiency etc…
5. Have a mechanism for assessing disproportionate impacts.
6. Cost effectiveness should be measured broadly with regard to long term, multiple benefits such as but not limited to avoided environmental costs and public health benefits.
7. An adaptive management strategy incorporating review of progress on Delta water quality, innovations in treatment technology
8. Encourage innovative solutions that provide multiple benefits to other CalFed program areas or help achieve other public objectives.

Equivalent Level of Public Health Protection

Robert Neufeld
Cucamonga County Water District

The Cucamonga County Water District is in agreement with most of the points identified in the "Meaning of Equivalent Level of Public Health Protection" outlined by the Metropolitan Water District with regard to the CALFED drinking water quality goals. CCWD receives nearly 60% of its drinking water supply from imported water from the Bay-Delta, therefore how we define ELPH will be very similar to what has been stated by MWD. In particular, CCWD is in agreement with the elements of flexibility and cost effectiveness.

CCWD is also in agreement with the MWD's position on the CALFED salinity goals. CCWD has pumping rights in the Chino Basin, which is one of the largest groundwater basins in California. Maintaining salinity objectives of 150 ug/L for State Project Water is critically important to the Chino Basin Watermaster for basin management purposes. In the near future, the Chino Basin will embark on conjunctive use programs that place Bay-Delta water into the Basin, as well as the recharging of recycled water into the Basin. Much of the groundwater in Chino Basin already has a high concentration of salts, therefore any effort to maintain a level of salinity would assist with the Basin's water quality objectives.

Other local water quality concerns for CCWD include the level of Total Trihalomethanes in the water treated from the State Project. CCWD is constantly attempting to decrease the level of TTHM's in order to comply with the Disinfection By-Product Rule.

ELPH in the CALFED Water Quality Program

Pankaj Parekh
LA Department of Water and Power

The ELPH was a necessary inclusion within the CALFED process to allow flexibility in the solutions pursued for water quality improvement without necessarily compromising the net public health benefit offered by the recommended WQ targets for bromides and total organic carbon. It remains a commendable concept.

However, in light of the vast gains in knowledge about;- 1. the health effects of so many more potential contaminants in source waters, 2. the greater harm posed from existing, regulated compounds, 3. the further complexities and by-products afforded from common disinfection practices, and 4. the heightened awareness of the consuming public about the limitations of existing standards to fully protect them..... there needs to be a recognition that the CALFED targets are not going to fully resolve the challenges that drinking water suppliers face in the provision of safe water to their customers.

The recent introduction of an ELPH decision tree diagram offers additional strategies to achieve an ELPH solution. It is an excellent portrayal of the need to re-define the boundaries of influence and the necessary support of new programs needed within the CALFED process to help achieve the original WQ targets. I especially like this ELPH chart, because it still allows for a tangible end-point (the same WQ targets)to remain in focus, only moved further down the process chain in recognition of the limitations of the existing boxes at the top to achieve the bromide and TOC targets.

Finally, it would be tedious and impractical to try to seek any further public health benefit interpretations within the ELPH, because the universe of such protection is far wider than what the control of bromides and TOC can influence. There are so many other health influences and variables that would needed to be studied and defined, that it would be an onerous exercise at best.

Meaning of Equivalent Level of Public Health Protection

Timothy Quinn
Metropolitan Water District of Southern California

Equivalent Level of Public Health Protection Definition

The CALFED drinking water quality goal incorporates the concepts of "equivalent level of public health protection" (ELPH) and cost-effectiveness. To evaluate the performance of the CALFED Program in achieving the water quality goal it is necessary to develop a clear and broadly supported definition of ELPH. The definition of ELPH should include the following elements:

- Based on Public Health Risk. ELPH should be defined and measured in terms of public health outcomes. A baseline theoretical level of public health risk should be determined assuming Delta source water quality with 3 mg/L TOC and 50 µg/L bromide, and well-defined treatment assumptions. The baseline public health risk level should be characterized in terms of both chronic risk, such as increased cancer risk associated with the occurrence of some disinfection by-products, and acute health risk, and should be defined as a risk range due to the uncertainties in the science. CALFED should utilize experts in the fields of drinking water quality and public health/ epidemiology to define this range of risk.
- Criteria for Evaluation of Alternative ELPH Strategies. As alternative ELPH strategies for different regions in the CALFED solution area are developed, the public health risk levels associated with those strategies should be evaluated in comparison to the baseline risk level to assess their performance in achieving the CALFED goal. CALFED should develop common criteria for the comparison of risks associated with ELPH strategies to the baseline risk level.
- Flexibility. The ELPH concept should include sufficient flexibility to allow incremental steps toward achieving the goal, and to consider risk-risk tradeoffs for those strategies where new sources of supply with new contaminants and public health risks may be introduced into the mix.
- Cost-effectiveness. The cost-effectiveness of alternative ELPH strategies should be evaluated to identify the most cost efficient way to achieve ELPH.

Definition of CALFED Salinity Goal

While there are no public health concerns associated directly with salinity, it is important to recognize the water management implications of elevated salinity levels and the linkage to CALFED water management objectives. Elevated salinity levels cause economic impacts on water consumers due to increased corrosion, impact the ability to do water management programs such as recycling and groundwater storage, result in increased demand for Delta water to blend with other more saline water sources (such as the Colorado River), and affect the aesthetic quality of water and undermine public confidence in drinking water.

Recognizing the importance of managing salinity for its member agencies, CUWA adopted a long-term salinity target of 150 mg/L total dissolved solids (TDS) for Delta water, or an equivalent level of salinity reduction through a cost-effective combination of salinity reduction strategies. We believe CALFED should support this long-term salinity target. The salinity target is needed to provide a performance measure for evaluation of alternative water quality strategies and to ensure salinity improvement objectives are accomplished. The equivalent level of salinity reduction should be defined and measured in physical terms as the level of TDS (mg/L) in treated drinking water.

The Meaning of "ELPHP"?

Jim Sequeira
City of Sacramento

Preamble

The long term quality goal for Delta water used as a drinking water source is less than 50 micrograms per liter of bromide, 3 milligrams per liter of total organic carbon, and x milligrams per liter of total dissolved solids[(1)]. These target Delta parameters should provide adequate water quality for public health protection to those water purveyors using it as a source of drinking water for the foreseeable future. If these goals are unattainable then a cost-effective "Equivalent Level of Public Health Protection" (ELPHP) must be achieved.

Water quality goals for Delta source water (50-3-x) may be achieved by utilizing a number of strategies. These strategies might include incorporating upstream source water and conveyance enhancements with new storage facilities and operational changes.

If the "50-3-x" goal cannot be met in the Delta then advanced water treatment techniques (UV, membranes, etc..) will have to be used to ensure that drinking water from this source meets all state and federal standards (ie an equivalent level of public health protection or ELPHP).

A Possible Strategy

To maximize potential benefits from the most significant parameters associated with Delta water quality (source control, conveyance/Delta operations, and storage) a strategy must be developed for each. These strategies should contain goals and action plans that come from realistic evaluations of opportunities and their associated costs for quality improvements utilizing a collaborative process with affected parties.

Following the formulation of these strategies, modeling should be used to indicate if the Delta water quality goals might be met and under what circumstances. Then compare these findings with the costs associated with meeting an ELPHP at the plant using advanced treatment technologies.

With these comparative numbers decisions could then be made as what combination of enhancements, upstream, in-Delta, and at treatment plants, might be the most effectual.

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1. Although not specifically in the ROD, it is an important water quality constituent of importance to Delta users.

Equivalent Level of Public Health Protection

Kevin Wattier
Long Beach Water Department

The CALFED Record of Decision states “CALFED Agencies’ target for providing safe, reliable and affordable drinking water in a cost-effective way, is to achieve either: (a) average concentrations at Clifton Court Forebay and other southern and central Delta drinking water intakes of 50 µg/L bromide and 3.0 mg/L total organic carbon, or (b) and equivalent level of public health protection using a cost-effective combination of alternative source waters, source control and treatment technologies.”

The specific numeric targets for bromide and total organic carbon (TOC) were established based on the levels of certain disinfection byproducts (DBPs) which would be created when water of this quality was treated with a particular treatment technology. The DBPs of concern were primarily trihalomethanes (THMs) and bromate. THMs are formed when chlorine reacts with certain types of organic matter, for which TOC is a good surrogate. Bromate is formed when ozone reacts with bromide. These DBPs have both long-term (chronic) health impacts and in some cases short-term (acute) health impacts. The levels of these particular DBPs which would be created by treating Delta water with the specific quality goals of the CALFED ROD can be readily translated into both chronic and acute health risks, in terms of both lifetime cancer risk and the risk of acute impacts, such a premature abortion as is associated with one of the trihalomethane species.

So, what does the phrase “equivalent level of public health protection” mean? It is my understanding that the objective of CALFED is to achieve the same chronic and acute health risks to those drinking Delta water as they would have been exposed to if they had received water with the specific TOC and bromide numerical goals. In other words, the same risk levels must be achieved by any combination of alternative source waters, source control and water treatment as would have been achieved if Delta water was reduced to 50 µg/L bromide and 3.0 mg/L TOC.

Comments on the Meaning of "Equivalent Level of Public Health Protection" and the Draft ELPHP Decision Tree

Walt Wadlow
Santa Clara Valley Water District

The term "equivalent level of public health protection" ("ELPHP"), as it appears in the Record of Decision, means using a cost-effective combination of actions at multiple points in the water delivery system to achieve a solution that is at least as protective of public health as achieving source water quality of 3.0 mg/L total organic carbon ("TOC") and 50 µg/L bromide at Delta drinking water intakes.

To determine whether a solution provides an equivalent level of protection, one must first determine the level of health protection that would be provided by achieving the targeted TOC and bromide levels at Delta drinking water intakes. The level of protection could be characterized in terms of chronic health risks associated with Delta water containing 3.0 mg/L TOC and 50 µg/L bromide under a defined treatment scenario (e.g., enhanced coagulation and/or ozone treatment). Because there are many classes of disinfection byproducts (DBPs), each with different health risks, it is likely that the level of protection would be expressed as a risk envelope or range, rather than as a single number. Alternative strategies for improving water quality would need to be evaluated against this baseline risk level to determine if they would provide an equivalent level of protection.

In theory, there could be many combinations of actions which would result in a level of public health protection equal to that provided by improved Delta source water quality. However, not every combination of actions will achieve the two goals of cost-effectiveness or robustness. When choosing which options to invest in, agencies will want to meet certain performance criteria. The performance criteria could include such factors as avoiding stranded investments, achievement of multiple benefits, flexibility to adjust to changes in regulations, ability to protect against multiple contaminants, providing a margin of safety, providing equity of benefit, timeliness, feasibility, cost-effectiveness and avoidance of redirected impacts.

It may be useful to view the ELPHP decision tree as a guide to investment decisions. Agencies can make investments at different points in the decision tree to achieve a solution that is at least as protective of public health as Delta water containing 3.0 mg/L TOC and 50 µg/L bromide. What's missing from the decision tree is an assessment of how well each of the components performs against the types of performance criteria outlined above. Such an assessment is necessary to identify the most robust combination of actions for protecting public health. Although the relative weight given by agencies to the individual criteria may to some extent be value driven, the performance assessment itself should be based largely on science and economics.

**Source Water Protection Through Watershed Management –
Part of the Solution to Better Drinking Water Quality**

Leah Wills
Forest Community Research

Watersheds are the “green infrastructure” parts of our water supply, water treatment and wastewater treatment facilities. A watershed’s natural ability to buffer variability can improve drinking water reliability. Although watersheds vary tremendously in their buffering capacities, healthy watersheds attenuate floods and moderate droughts through natural processes that capture, store and filter precipitation. Conversely, degraded watersheds have flashy runoff hydrographs that accelerate the transport and concentration of pollutants, amplifying variability for water managers. Reducing water pollution “spikes” has been identified as a key component of improving Delta drinking water quality. The watershed management approach seeks to restore the natural filtration and infiltration properties of healthy watersheds. From the most rural Sierran headwaters, to the farmlands of the Central Valley and the Delta, to the state’s most urbanized areas, watershed management **techniques** change to fit their settings. But the watershed management **approach**, which uses the hydrological properties of topography, vegetation, soils and aquifers to buffer water (supply and quality) variability; can be broadly applied to many different land uses and land types. Techniques for retaining precipitation on site and for filtering runoff often include: (1) re-creating or enhancing the detention and recharge functions of streams, floodplains, forests and wetlands and (2) installing vegetative buffers along waterways and around water bodies and over groundwater recharge areas to enhance filtration.

Improving drinking water quality in the source water areas involves a greater focus on groundwater. Most rural people rely on groundwater from individual or community wells for domestic and other uses. Water quality testing of groundwater is sporadic and records are often proprietary. Most groundwater becomes surface water as it moves downstream. What can be rather easy to fix upstream, often becomes harder to fix downstream. Pollutants are added, remixed, dispersed or concentrated depending on a broader and broader array of downstream factors. Given the increasing complexity of treating water as water moves downstream, it is commonly believed that water quality protection is easier and cheaper “at the source”. Legacy pollution problems tend to be a higher percentage of the pollutant load in rural source water areas. The mining (arsenic, cadmium and mercury) era, the utility (pcb,) era and the logging/treatment mill (pcp, dioxin, petroleum) era left pollution legacies that are the dark sides of the state’s colorful frontier and early settlement history. These historic pollution sites are often “abandoned”, meaning that there are no legal means to seek clean-up and abatement remedies from the original owners. Legacy pollution tends to remain untreated, except for bio-remediation processes that are often enhanced by cooperative watershed rehabilitation efforts. In conclusion, reducing water pollution through watershed management is not just “TMDL Lite”. Watershed approaches can and should be site-specific ways to “meet or exceed” clean water laws and standards. Watershed management can usually be enhanced by: (1) state–of-the-art, public science, (2) an up–to-date toolkit of feasible BMPs (with implementation funding), (3) cooperative and transparent monitoring, (4) inclusive and culturally sensitive outreach and involvement, and (5) a high awareness of impending regulations.