SAB Drinking Water Committee

Review of the draft Fourth Contaminant Candidate List (CCL4)

April 29-30, 2015 Meeting

Pre-Meeting Comments (as of 4/23/2015)

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**Mark Benjamin**

**CHARGE QUESTION #1.** My feeling is that the Draft CCL 4 support documents are adequately clear and transparent. The subject matter of these documents is unavoidably dense, and the EPA faced a challenging task to explain the screening process in a way that would be accessible to interested parties who have a very wide range of technical expertise. I believe that the ‘tiered’ communication approach that was used, with overview documents written at a very general level that contain links that get ever deeper into the details of the process, was appropriate and successful.

**CHARGE QUESTIONS #2-4.** I am not aware of additional information that should be included in the evaluation of candidate chemicals for CCL4, nor do I have recommendations for additional candidate chemicals to add or chemicals to remove from the Draft CCL4. In the interest of clarity and transparency myself, my expertise is in water chemistry and physical/chemical processes for removing contaminants from water. As such, I have interest in, and I try to keep up with, information regarding the occurrence and effects of chemical contaminants. However, those issues are not the primary focus of my work, so my inability to respond more substantively to these charge questions is not based on deep expertise on the subject.
Charge Question 1: Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

Response: The documents provided were to support the selection of the compounds (100 chemicals and 12 pathogens) on the draft CCL4 list. Overall, I found the documents difficult to navigate and lacked transparency in the selection process. While I may agree or disagree with the decisions made, it was very challenging to review the summary and make sense of how this particular compound was nominated or maintained from a previous list.

In the “Summary of Nominations for the Fourth Contaminant Candidate List” document, a brief review of the overall process is provided as well as the overall nomination process. The EPA then provided a summary of the nominated chemicals and pathogens along with the nominating party (if known). A brief summary of the justification for including/excluding certain nominated chemicals/pathogens to the final draft list along with supporting documentation (as a reference) were provided. The document listed all nominated compounds in appendices 1-5 with appendix 6 displaying the outcome of the nominated compounds.

This summary document is clear from the standpoint of providing a list of what was nominated and then included/excluded to the draft CCL4 list. However, it is not transparent to the reader why many of the compounds would receive priority over others. The summary document is missing the scoring values used to rank these compounds. Tables should include scoring values, a ranking of each compound, EPA recommendation, and a brief reason for inclusion/exclusion from the draft CCL4 list. Specific reference documents should be listed to point the reader to the rubric used to develop the scoring/ranking procedure. Overall, it would be very challenging for the reader to make sense of all the data used to arrive at the final nominated list of compounds to either agree or disagree with the EPA decision if only pdf documents are provided. Therefore, I think that a web-based list of each nominated compound that is hyperlinked to its specific profile, scoring rubric, ranking, and EPA discussion of inclusion/exclusion should be created.

In the “Data Sources for the Contaminated Candidate List 4” document, the EPA basically lists all reports or databases used to characterize each compound. EPA provided the assessment factors (relevance, completeness, redundancy, and retrievability) to evaluate the source’s suitability for analyzing the CCL4 compounds. The document is clear. However, it is not transparent as to whether other documents were evaluated and excluded based on the failure to meet the requirements of the assessment factors. Some of the sources did not meet the retrievability requirement but were still included as a source. Was there a rubric used to score these sources? Does inclusion mean that it had to meet at least 1 or 2 of the assessment factors? I could not find the criteria that would cause a source to be excluded in this document.

The “Screening Document for the Draft PCCL4 Nominated Contaminants” provides an explanation of how EPA determines the potency (toxicity) and occurrence (concentration, frequency). Exhibit 2 and 3 (in the form of toxicity categories based on a quantitative or qualitative data element) defines the level of potency while a hierarchal approach from different data sources (Finished water=ambient water>total environmental releases>pesticide application rates>production volume) defines the level of occurrence. The document also states that the EPA considered chemicals with descriptive data based on the likelihood of occurrence in

Pre-Meeting Comments from Dr. Ducoste
drinking water. This statement is quite vague. The exclusionary criteria listed for microbes are clear and transparent.

The assigning of a toxicity level for the chemical contaminants based on the data source is clear. I also do not have a significant problem with how occurrence is determined using this hierarchal approach. However, what is not clear is how data variability is accounted for in the determination of both potency and occurrence. Is the geometric mean, arithmetic mean, or median used in the calculation or some other statistical calculation?

In Exhibit 4, the combined effect of potency and occurrence is described. While I understand the occurrence assignment related to finished/ambient water concentrations, the annual release amount or production volume may be more challenging for the reader to understand since those values include the number of affected states. If we are talking about a contaminant in toxicity category 2 or 3, the public health in the few states that are affected could be significant yet the contaminant may not reach the threshold for inclusion in the CCL4.

Once screening has been performed (i.e., determination for inclusion to the PCCL), classification from the PCCL to the CCL is described in the “Contaminant Information Sheets (CIS) for the Draft Fourth Preliminary Contaminant Candidate List (PCCL4) Nominated Contaminants” document. Classification from PCCL to CCL is performed using classification models and a scoring system involving attribute score (Potency, Severity, Magnitude, and Prevalence as metrics), health reference level (HRL), HRL/concentration ratio, and a three model categorical prediction. Tables are produced for each contaminant listing these evaluation scores along with other health effects and occurrence related data. Overall, the document and tables are very difficult to follow. There is no clear and transparent way to determine why this contaminant is being included/excluded for the CCL4 list by reading these tables. It’s also not clear how each of the scoring metrics are combined in a formula that leads to a ranking for each contaminant. The reader may find it confusing on how potency, severity, magnitude, and prevalence are independent from each other. In addition, no ranking was actually provided.

A recent report published by the American Water Works Foundation (Roberson, A., Bench, R., Adam, C., Rosen, J., 2015, Recommendations for Contaminant Candidate List 4 (CCL4)) has provided a framework for presenting a clear and transparent approach to displaying the contaminants that should be considered for CCL4. While I am not advocating all the nominated candidates selected in this report, nor how they were scored, I am suggesting that the report is structured in a way that the reader can review how contaminants were evaluated, equations/rubric used, ranked, and ultimately included/excluded by the selection committee representing AWWA. The data analyses used in this report includes a graphical approach (Figure 1), alternative mathematical equations to develop an overall score that combines potency, magnitude, and prevalence (Figure 2), and the review of the data from an expert panel. Contaminant data sheets incorporate this graphical representation, potency and occurrence data, mean values for P, Pr, and M, along with values from the different mathematical equations (Figure 3). A table is then produced that lists all the candidate contaminants in rank order based on the frequency of being in the top 5-50 using the different mathematical equations. The table also lists what the expert panel finally selected for inclusion in the CCL4 in the final column of the table (Figure 4). The graphical approach is also good at communicating the relative differences among contaminants in major groups (i.e., industrial compounds) (Figure 5).

Note that I am not advocating for any of AWWA’s selection and do have lots of questions about the assignment of values for some of their contaminants. I do feel, however, that the way the report is structured is more transparent and clearer for the reader to review the determination of the CCL4 compounds.
Figure 1: Example of graphical display of potency, occurrence, prevalence, and magnitude data used in AWWA report (Roberson et al., 2015)
Figure 2: Example of mathematical equations that combine potency, prevalence, and magnitude data to develop an overall score used in AWWA report (Roberson et al., 2015)

<table>
<thead>
<tr>
<th>Title</th>
<th>Formula</th>
<th>Algorithm #</th>
<th>Score</th>
<th>Rank</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal weight P and Pr, M</td>
<td>((2P + Pr + M)/4)</td>
<td>1</td>
<td>0.7</td>
<td>43</td>
<td>0.51</td>
</tr>
<tr>
<td>3x weighted P and Pr, M</td>
<td>((6P + Pr + 3M)/8)</td>
<td>2</td>
<td>6.8</td>
<td>55</td>
<td>0.38</td>
</tr>
<tr>
<td>P and 3x weighted Pr and M</td>
<td>((2P + 3Pr + 3M)/6)</td>
<td>3</td>
<td>6.6</td>
<td>33</td>
<td>0.63</td>
</tr>
<tr>
<td>Equal P and Pr (no M)</td>
<td>((P + Pr)/2)</td>
<td>4</td>
<td>8.5</td>
<td>26</td>
<td>0.71</td>
</tr>
<tr>
<td>Equal P and Pr (no Pr)</td>
<td>((P + M)/2)</td>
<td>5</td>
<td>5.0</td>
<td>83</td>
<td>0.21</td>
</tr>
<tr>
<td>Equal weight P, Pr and M with geometric mean</td>
<td>((P^2 * Pr * M))</td>
<td>6</td>
<td>6.2</td>
<td>49</td>
<td>0.44</td>
</tr>
<tr>
<td>P weighted M</td>
<td>(M\times(P/10))</td>
<td>7</td>
<td>2.1</td>
<td>59</td>
<td>0.33</td>
</tr>
<tr>
<td>P weighted M plus Pr</td>
<td>((0.8 \times M\times(P/10)) + 2)</td>
<td>8</td>
<td>8.1</td>
<td>21</td>
<td>0.76</td>
</tr>
<tr>
<td>P weighted M plus 2</td>
<td></td>
<td>9</td>
<td>3.7</td>
<td>70</td>
<td>0.33</td>
</tr>
</tbody>
</table>

\[ P = \text{Potency} \\
\[ Pr = \text{Prevalence (occurrence data)} \\
\[ M = \text{Magnitude (occurrence data)} \]

Figure 3: Example of overall data sheet for a specific candidate contaminant used in AWWA report (Roberson et al., 2015)
<table>
<thead>
<tr>
<th>Compounds</th>
<th>Frequency in Algorithm Top Rankings</th>
<th>Category</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top 5</td>
<td>Top 10</td>
<td>Top 20</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>0</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Anatoxin A</td>
<td>0</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Cylindrospermopsis</td>
<td>0</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>MC-LA</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>MC-LR</td>
<td>8</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>MC-LW</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>MC-RR</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>MC-YR</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Azinphos-methyl</td>
<td>0</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Nonylphenol ethoxylate</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Manganese</td>
<td>1</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Nonylphenol</td>
<td>0</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Saxitoxin</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Chlorate</td>
<td>0</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>NDMA</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Oclophenol</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Perchlorate</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Venadine</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Acrolein</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nitrobenzene</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Progesterone</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 4: Example table of the ranking of candidate contaminants in the AWWA report (Roberson et al., 2015)
Figure 5: Graphical display of potency, occurrence, prevalence, and magnitude data used in AWWA report for a contaminant group (Roberson et al., 2015)

Reference:
Roberson, A., Bench, R., Adam, C., Rosen, J., 2015, Recommendations for Contaminant Candidate List 4 (CCL4), AWWA, Denver CO.
Charge Questions 2: Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.

Response: I do not have any additional sources beyond what was provided by the EPA in their data source document.

Charge Question 3: Based on your expertise and experience, are there any contaminants currently on the Draft CCL4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.

Response: Hard to make this evaluation without more time and more transparency into the evaluation performed (scoring and feedback by experts who reviewed the data)

Charge Question 4: Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.

Response: I am surprised that more disinfection by products and personal care products did not make the list. It’s possible that potency determination for DBPs was not possible for many of the compounds since they were largely based on geno-toxicology or cyto-toxicology data and not mammalia
Kristi Mena

1. Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

The support documents provided for the Draft Drinking Water Contaminant Candidate List 4 (Draft CCL 4) are not particularly transparent, mainly because they consist primarily of references to other documents (those associated with CCL 3 development) while indicating these documents will provide explanations for Draft CCL 4 content and approach. Unfortunately, one has to then search these supporting documents that describe the CCL 3 process for information that would relate to the Draft CCL 4. This is inevitable since the process used to draft the CCL 4 is an “abbreviated” approach of what was applied for CCL 3, and includes CCL 3 contaminants that have not undergone regulatory determinations. Some of these supporting documents describe the creation of the CCL 3 Universe contaminants, and the subsequent screening to the Preliminary Contaminant Candidate List (PCCL) 3 and CCL 3. In sum, understanding the process used to draft CCL 4 either requires a working knowledge of the process for CCL 3 development, or a lengthy review of these previous supporting documents. Because this information is presented in a piecemeal fashion, it makes it more difficult to clearly identify the specific issues addressed that led to the development of the CCL 3 and, subsequently, the CCL 4.

It would be helpful if pertinent information that specifically identifies and discusses the implication(s) of inclusion/exclusion criteria regarding a contaminant is delineated in some of the Draft CCL 4 supporting documents, even if it is repeated from CCL 3 supporting documents. For example, the Federal Register notice for the Draft CCL 4 refers to 12 criteria considered when screening CCL 3 Universe contaminants to the PCCL. Listing these criteria (and still referencing the source) would provide the information needed for an initial interpretation of the Draft CCL 4. In addition, the explanation accompanying the CCL process schematic in the Federal Register notice for the Draft CCL 4 indicates that although the basic process to identify chemical contaminants and microbial contaminants was the same, there are specific process components that were applied for each of these two types of hazards. Unfortunately, no further information is provided in this document, and no other specific document is referenced. It would be beneficial to have (at least) a summary of the ways chemicals and microbes were addressed differently as specific members were considered for the CCL 3. Understanding these differences would require a review of a few different documents that may or may not clearly provide an explanation.

Since the Draft CCL 4 relies on the process used for the development of the CCL 3, a single document that adequately summarizes the decision-making rationale used to create the CCL 3 would be helpful. Some questions that could more easily be answered are:

- How was/is the CCL development process different for chemicals and microbes?
- Which inclusion/exclusion criteria have the greatest impact on CCL content and subsequent public health impact?
- During which part of the process, were specific data sources used? Was the peer-reviewed literature used only for personal care products and pharmaceuticals? What about microbes and other chemicals?
- What is/are the primary source(s) of information on contaminant occurrence in water or health risk(s)?
• Are health risk estimations from published risk assessments, judgments stemming from experience, or inferences/data from waterborne disease outbreak investigations?
• How is lack of data addressed when considering inclusion on a PCCL or CCL?
• How are human health effects considered? Are only acute health effects considered for microbes, for example, rather than chronic consequences? Do the health effects need to be deemed severe? Are specific sub-populations that may be most impacted a consideration?
• How are disease frequency and disease severity addressed?

When considering the screening process applied to move from CCL Universe contaminants to the PCCL, a set of criteria were used that may or may not capture all contaminants appropriate for ultimate inclusion on a CCL. Likewise, the screening process may lead to the inclusion of some contaminants that should not be on the CCL. Other considerations include:

- When considering the 12 criteria used to screen contaminants, were all criteria weighted equally? Did every reviewer use the criteria for screening in the same manner?
- Were contaminants often excluded because of lack of data rather than data indicating a minimal waterborne health threat?
- Since meeting only one criterion resulted in a potential CCL hazard’s omission from the list, it is possible that appropriate contaminants that should be included would be subsequently excluded. What if at least two criteria had to be met? How would this change the CCL? Is there adequate information available to address each criterion for every contaminant in question? This is particularly true since it is challenging to directly link a particular contaminant as the etiological agent of a waterborne disease outbreak.

When considering scoring of contaminants, it appears an attempt was made to evaluate and characterize all contaminants in the same fashion in order to fairly address both contaminant occurrence and contaminants’ association with waterborne disease outbreaks. Unfortunately, contaminants have not been addressed the same way when considering those chosen for monitoring studies or waterborne disease outbreak investigations, warranting potentially unique considerations for each candidate. In addition, did bias have a role during scoring of potential CCL members by considering practical limitations with regulation, and/or expected current water treatment applications at a Public Water System? Further, has the reliability of the scoring method been evaluated?

One way to improve clarity of the screening and scoring processes that provide the basis of a CCL – and in this case the Draft CCL 4 – would be the use of a decision tree format. This format would not only inform the creation of a CCL, but could also serve other purposes. Because source water quality, water treatment, and distribution system infrastructure differ by Public Water System and geographic region, a decision tree could provide a user-friendly format to address these differences and how they relate to waterborne hazards for those working in the water industry (such as Public Water System personnel, regulators, and researchers). Specifically, a decision tree could:

- Categorize contaminants based on a range of different factors (such as the current 12 criteria), including factors that may otherwise exclude them from a CCL (like those associated with distribution system risks);
Direct future studies (such as monitoring studies) where (additional) data are needed (contribute to data gaps);
Identify the implications of limited data during CCL development;
Capture contaminants that pose a human health threat via water that may otherwise not make the CCL;
Improve the current screening process by visually showing where data are lacking for some of the 12 criteria (not just data limitations of contaminants);
Improve the current screening process by identifying or redefining new criteria; and,
Identify criteria that have the greatest impact on uncertainty or the greatest influence on contaminant CCL inclusion/exclusion. Such information could help redefine the scoring process.

Such a decision tree could be modified/expanded for subsequent CCLs with branches added, moved or eliminated.

2. Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.

The supporting documents describe the process used for identifying appropriate data sources to be used in the development of the CCL. Specific factors are provided and explained so that there is a consistent method to finding and using sources of information. While this process helps characterize the information used to inform the CCL, it may exclude important resources of information. Waterborne contaminants associated with human health consequences – but not necessarily outbreaks – may be missed through this data search format. Information related to endemic disease, particularly those associated with waterborne pathogens, may not be easily accessed through that data search process. Although this would be an inconsistent approach, city/county health departments and Public Water Systems could be contacted to retrieve local human health information and water-related issues not readily found through the described data search process. Although the supporting documents state that the peer-reviewed literature was used to inform CCL development, the range of search engines employed and search terms used are not clear. Moving from the PCCL to the CCL may utilize specific searches of waterborne contaminants in the peer-reviewed literature for scoring purposes, but this also isn’t clear. As specific contaminants are evaluated for CCL inclusion, such searches that address waterborne occurrence, environmental survival/resistance, and human health risk assessments would provide critical input for CCL consideration. This may, however, bias the process since data would be lacking for some waterborne hazards.

3. Based on your expertise and experience, are there any contaminants currently on the Draft CCL 4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.

The Draft CCL 4 for chemicals is rather lengthy. It isn’t clear from the supporting documents where prioritization played a role, and which specific factors drove the selection process. The result of the process used to develop the Draft CCL 4 for chemicals seems particularly inclusive, whereas the end result to draft the CCL 4 for microbes appears exclusive. Can regulatory determinations be made from such a large list of
chemicals? For the Draft CCL 4 microbial contaminant list, enteroviruses do merit inclusion on the list. However, it would be beneficial from a public health perspective to have specific members of this group – such as coxsackievirus – receive a separate focus (see question 4).

4. Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.

As mentioned in question 3, the Draft CCL 4 for chemical contaminants is already quite lengthy. It isn’t clear what prioritization strategy was used to develop this list. The Draft CCL 4 for microbes could include a few additions. First, enteroviruses are significant waterborne pathogens in terms of their occurrence in water and associated human health consequences. However, members of the enterovirus group are associated with a range of clinical consequences. While detecting enteroviruses in water sources is important, it’s even more beneficial to identify the specific type of enterovirus present. Coxsackieviruses are members of the enterovirus group and are associated with both acute (gastroenteritis, respiratory illness, hand-foot-mouth disease) and chronic (type 1 diabetes, myocarditis) health outcomes warranting it individualized attention (Mena, K.D., C.P. Gerba, C.N. Haas and J.B. Rose. 2003. Risk assessment of waterborne coxsackievirus). Disease outbreaks are not rare, however, linking water as the source of transmission is uncommon.

Acanthamoeba is an example of a microorganism that had appeared on a previous CCL and was later omitted. This pathogen was part of the CCL 1, but was kept off of the CCL 3 – perhaps when the CCL screening process changed. This is an example given in one of the supporting documents, but the explanation is not specific. Acanthamoeba has been detected in waters, particularly in certain regions, and human health consequences are well documented. It has been speculated that its association with eye disease may be related to its occurrence in surface waters (Nwachuku, N. and C.P. Gerba. 2003. Health Effects Support Document for Acanthamoeba. USEPA, Office of Water, Health and Ecological Criteria Division, EPA-822-R-03-012, Washington, DC).

Although Pseudomonas aeruginosa is most often considered a nosocomial pathogen, they can adapt and grow in a variety of environments, including water. This microbe is associated with biofilm formation, and may thrive within distribution systems. Pseudomonas aeruginosa is associated with a range of clinical outcomes such as pneumonia, urinary tract infections, and ear, skin and eye infections. Because it is an opportunistic pathogen, immunocompromised populations are at greatest risk of experiencing severe health consequences following exposure to Pseudomonas aeruginosa (Mena, K.D. and C.P. Gerba. 2009. Risk assessment of Pseudomonas aeruginosa in water. Reviews in Environmental Contamination and Toxicology 201:71-115).
Charge Question 1: Clarity of the CCL4 support documents?

The process generally was clear, but could be improved in several respects. First, it would be helpful to combine all of these materials into one document. It was somewhat frustrating to read some general comments repeated in multiple documents and have to search for the materials that provided the details. Eventually I found them. However, it appears that the CCL4 process is essentially similar to the CCL3 process. Broad introductory comments about the process were included in each document. For the CCL4 documents, a summary of the CCL3 process was included in each document covering a particular step (e.g., proceeding from the Universe to the PCCL). Additionally, many of the contaminants on the CCL3 Universe, PCCL3 and final CCL3 were carried over to the CCL4 process. However, the details regarding these “carry-over” compounds were contained in the CCL3 document. I can understand the need to have these separate documents in terms of indicating the date at which various decisions were made. However, it would be useful to have one “living document”, perhaps online, that would contain a summary of the review and decision process, and the files for all of the compounds that have been considered, all in one place.

Second, the decision criteria could be clarified. Two general approaches appear to have been taken. The first approach rates each chemical separately for potency, severity, prevalence and magnitude. The first two criteria are associated with toxicity and the latter two with occurrence. Each category is rated on a 10-point scale. A neural network-type model, calibrated with a training set, appears to have been applied to evaluate whether a chemical should be listed on the CCL4. The criteria used to apply these scores should be summarized in the CCL4 documents. What are the cut-offs to merit a rating of 10, for example, for prevalence?

The other approach developed a concentration in drinking water associated with a health-based risk level and divided this value by an anticipated or measured concentration in drinking waters. When the ratio was <10 (essentially a margin of safety < 10), the compound was included in the CCL. Again, the criteria to develop these numbers should be summarized and clarified better. Importantly, when the two approaches do not agree, which approach is followed? It appears from the documents that the second (ratio-based) approach is followed.

I would agree with this approach. The toxicity exerted by a contaminant in water is really a function of the toxicity of the compound multiplied by the concentration of the contaminant in the water. The second approach takes this route, while the first treats the two separately. For example, the PCCL4 screening document indicates that probable human carcinogens (such as nitrosamines) would need to occur at concentrations > 1 ug/L to be considered. At such high concentrations, the excess lifetime cancer risk values for nitrosamines would be in the $10^{-3}$ range. Similarly, the magnitude metric favors chemicals that occur at high concentrations. Extremely toxic substances may represent a concern, even where they occur at much lower (magnitude) concentrations.

Additional concerns:

1. The first approach favors the listing of a compound like alpha-hexachlorocyclohexane, which rarely occurs (0.3% of PWS via NAWQA) but that feature very high potencies. Alternatively, widespread problems, such as manganese (detected in 70-80% of surveys at concentrations close to the 10 HRL/NAWQA ratio cutoff value), were more likely to yield a NL listing via the first method. With
three states requesting a regulatory determination for manganese, this would seem to be a priority for regulatory determination.

2. What happens if there is little in the way of occurrence data? It is clear from the CIS files that production volumes can be considered. However, if the HRL/NAWQA ratio (approach 2) is pursued, the criteria for such a scenario should be clarified in the documentation. Additionally, if the lack of occurrence data is a reason for not listing a chemical, the documents should clarify whether such a scenario sets in motion a process to obtain occurrence data. If not, won’t the same issue occur again during the CCL5 process if most contaminants are rolled over?

3. How are specific water subsets handled? The prevalence metric favors compounds that occur in waters throughout the US. However, what about source water sub-categories that are important in subsets of the US? For example, potable reuse of wastewater is becoming increasingly important, certainly in the western US. There may be contaminants particularly associated with these sub-categories. The procedure may be biased against acting upon these chemicals because potable reuse of wastewater provides a relatively small fraction of source waters when considered on a nationwide basis.

4. Regarding data sources, one of the criteria mentioned was that specific data values (e.g., concentration measurements) needed to be available. On the other hand, production volumes also appear to have been considered. How are articles handled that report concentrations in the form of bar charts, as opposed to a table listing specific concentrations? Similarly, what if median and range values are provided for concentration measurements rather than individual sample concentrations?

**Combined response to the following questions:**

**Charge Question 2: Additional data sources to consider?**

**Charge Question 3: Are there contaminants on the CCL4 that should not be listed?**

**Charge Question 4: Are there additional contaminants that should be considered for CCL4?**

Regarding N-nitrosamines, NDMA seems to be far more important in terms of occurrence relative to nitrosodiethylamine, nitrosodipropylamine and nitrosodiphenylamine. It would be useful to consider other nitrosamines that exhibit a greater prevalence. These include nitrosomorpholine, nitrosodiethanolamine and nitrosopyrrolidine, as detailed in the sources below. All three are listed as reasonable anticipated to be carcinogens in NTP and nitrosodiethanolamine is included in the EPA IRIS database with a 10 ng/L concentration in drinking water associated with a 10\(^{-6}\) lifetime excess cancer risk. These have been measured in ambient waters and recycled wastewaters.


Similarly, it might be useful to consider other disinfection byproducts. Formaldehyde and acetaldehyde make sense to list given their prevalence. However, many of the halogenated byproducts feature a far
greater prevalence than many of the compounds on the CCL4 (e.g., 1,2,3-trichloropropane at 0.25% prevalence). Many also feature high toxicity. Many lack human toxicity evaluations, so perhaps the scenario is similar to compounds that lack occurrence data. However, many feature high in vitro genotoxicity and cytotoxicity values. An example might be chloropicrin, one of several halonitromethanes, and dichloroacetonitrile. Halonitromethanes would tend to be favored in waters disinfected with ozone or medium pressure UV light.


1. Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

I found the support documents to be very clear and transparent in describing the approach used to list the CCL4 contaminants.

2. Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.

There are no additional information or data sources I wish to recommend at this time.

3. Based on your expertise and experience, are there any contaminants currently on the Draft CCL 4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.

No.

4. Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.

None that I wish to recommend at this time. There are several I plan to review prior to the meeting to see if it might be appropriate to bring them up for discussion.
EPA formulated its third Contaminant Candidate List (CCL3) in 2009, after an overhaul of the process that had been used to formulate the first and second (CCL and CCL2) lists. This revision came at the suggestion of the National Research Council. It provides greater “transparency” (especially after implementing the recommendations of the 2009 SAB to provide flow charts), and is much more objective than the processes involved in formulating CCL and CCL2, incorporating as it does a data-driven process, in which first a “universe” of potential CCL3 compounds (comprising some 6000 chemicals) was whittled to a potential CCL3 list (PCCL3) of some 532 chemicals, based on health and occurrence (or usage) data. Further classification, as well as expert opinion, were used to narrow this to CCL3.

The process used in 2015 to select the draft CCL4 list is substantially compressed relative to that used to formulate CCL3: “The agency conducted an abbreviated evaluation and selection process for CCL 4. This abbreviated CCL 4 process included a three-pronged approach: (1) carrying forward CCL 3 contaminants (except those with regulatory determinations), (2) seeking and evaluating nominations from the public for additional contaminants to consider, and (3) evaluating any new data for those contaminants with previous negative regulatory determinations from CCL 1 or CCL 2 for potential inclusion on the CCL 4.” In other words, the “universe” for CCL4 consists of eligible CCL3 contaminants, plus new contaminants nominated by the public. This list is therefore much shorter than either the “universe” of CCL3 contaminants, or the PCCL3 list.

One important step apparently missing from this process is review of the literature for contaminants of emerging environmental concern, apart from those with previous negative regulatory determinations from CCL1 or CCL2. If a chemical wasn’t on a previous CCL, or nominated by the public, it won’t be on CCL4 (if I interpret things correctly), even if recent publications reveal it to be a problem. In other words, EPA seems to be relying on the public to keep up to date on all of the pertinent literature. New constituents of potential concern are constantly being discovered, their occurrence quantified, and their toxicity assessed; this is especially true of many disinfection byproducts (DBPs), where gaps in occurrence or toxicity data that might have led to their exclusion from CCL3 have now been filled. What steps is EPA taking to ensure that the relevant literature is being reviewed to avoid gaps that might occur in the public nomination process? In brief, I share the opinion of the SAB that reviewed the draft CCL3: “EPA efforts to update data and research will be critical to the success of future CCLs.” My concern has been raised in the past – from the 2009 SAB Report on CCL3: “Furthermore, the databases used by the EPA in the CCL 3 analyses do not include much of the journal literature that could be a rich source of information. While these sources might be difficult to search for the Universe, these data could more easily be included in the PCCL to CCL process.”

Another concern I harbor is that “occurrence” is not a static phenomenon. Usage of chemicals of potential concern can change tremendously over time (for example: some constituents of fracking fluids are toxic, such as acrolein, present on CCL3 as well as the draft CCL4; with the explosion of fracking, the introduction of such chemicals into drinking water sources could also be increasing at a rapid rate). Could demand for such chemicals have increased to the point that some constituents that did not make the cut from the “CCL3 universe” to PCCL3, or from PCCL3 to CCL3, are now being used to an extent that would merit their consideration for regulation as drinking water contaminants? What mechanism is in place to periodically review usage data in order to make sure that changes in usage don’t lead to a chemical of concern falling through regulatory cracks? Of course, “usage” is of little utility when it comes to constituents such as DBPs or degradation products of environmental pollutants that are not themselves...
deliberately synthesized, but adequate review of the literature should ensure such constituents of potential concern are not being overlooked.

New compounds are continually being synthesized, some of which have toxic properties, and many of which are designed for release to the environment, enhancing their probability of occurring in drinking water sources. Some of these (such as disinfection byproducts or DBPs) are often only tested for toxicity once their occurrence has been assured. The “universe” of contaminants being automatically considered for future CCLs should not be limited to those on CCL3, or nominated by the public.

Advances in analytical chemistry will make it possible to quantify chemicals in drinking water that have been overlooked in previous occurrence surveys. Discoveries in drinking water sources may, in turn, trigger toxicity assays. Advances in analytical chemistry have proven instrumental in recent years in identifying a number of constituents of human health concern in drinking water, some of which are now included on the draft CCL4. It is hard to anticipate the sort of new constituents that we might discover with additional advances – will improvements in (for example) capillary electrophoresis/mass spectrometry (not presently routinely used in environmental laboratories) aid in our identifying and quantifying some of the low-molecular-weight ionic constituents that have challenged analytical chemists in the past? The system implemented by EPA for selecting the draft CCL4 list seems designed to guarantee that such “emerging” contaminants will never be regulated, unless they happen to be nominated by the public, simply because the techniques needed to document their occurrence did not exist when CCL3 (or pCCL3) was formulated.

To be sure, the document entitled “Data Sources for CCL4” notes that “Additional occurrence data for the nominated contaminants were collected from data sources that are new since the CCL 3 including:

- USGS studies that focused on contaminant occurrence in source waters for public water systems (Hopple et al., 2009, and Kingsbury et al., 2008) and water quality in public supply wells (Toccalino et al., 2010);

- Individual State public water supply data provided to EPA during the second Six-Year Review of regulated contaminants (for the time period covering 1998-2005) from States including: CA, FL, IL, NC, OH, Region 9 Tribes, SD, TX and WI;

- Data from the California State Water Resources Control Board’s Groundwater Ambient Monitoring Assessment (GAMA) program; and Page 4 of 7 EPA-OGWDW Data Sources for the Contaminant Candidate List 4 EPA 815-R-15-004;

- New data from a literature review of published studies on pharmaceuticals, personal care products and other contaminants.”

(Emphasis added by me). Was this literature review restricted to nominated constituents? (It appears to be the case).

With respect to the charge questions:

1) Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

The documents provided by EPA (especially the “Screening Document for the Draft PCCL4 Nominated Chemicals”) is sufficiently clear, in my opinion, in indicating why a particular compound might not have
progressed from the CCL4 universe to the draft CCL4 list (for example “Incomplete data for screening/remains in CCL 4 Universe”), at least insofar as the data sources cited. (Whether these are incomplete is another question).

One question I have relates to future CCLs: will these be drawn from CCL4 only (with the addition of nominated chemicals, as done with CCL4), or from the CCL4 universe (representing essentially CCL3 plus nominated chemicals)? Or a list that’s broader still?

2) **Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.**

Time limitations make it impossible for me to review the scientific literature between 2009 (when the CCL3 universe was identified) and the present date in order to specify additional peer-reviewed information or other data that would yield chemicals that merit consideration for CCL4.

3) **Based on your expertise and experience, are there any contaminants currently on the Draft CCL 4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.**

I’m not certain whether ethylene oxide merits inclusion – is there any information available concerning its persistence? How rapidly does it undergo hydrolysis at environmentally relevant pH values? Time limitations have made it impossible for me to research the answer to this question at present.

In terms of pharmaceuticals and personal care products (PPCPs), I see several estrogens that have been used in the past for hormone replacement therapy – hasn’t the use of such compounds plummeted? (Natural sources could exist, of course).

4) **Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.**

A complete answer to this question would require review of all of the scientific literature pertaining to chemical occurrence in drinking water/drinking water sources between 2009 and 2015; time constraints make such a review impossible.

I did note that one constituent nominated for CCL4, 3-chloro-4-dichloromethyl-5-hydroxy-2(5H)-furanone, appears to have been eliminated from the draft CCL4 list (but retained in the CCL4 universe). Apparently EPA was not able to identify any occurrence data for screening. I thought this was a chemical selected for occurrence studies by a current member of the SAB, so I will be interested to see their response to this question.

Three cyanotoxins are being considered for CCL4: Anatoxin-a, Cylindrospermopsin and Microcystin-LR. Ohio and Oregon (in addition to these three cyanotoxins) also set guidance/action levels for Saxitoxin. Is there some reason why EPA has not included Saxitoxin for consideration on the draft CCL4 list?

In terms of PPCPs - what about Carbamazepine (seemingly ubiquitous)?
Janice Skadsen

1. Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

The abbreviated high level overview approach used for development of the Draft CCL 4 is described in adequate detail. The basic approach for moving contaminants from the “universe” to the draft CCL consists of three main steps.

1. Carrying forward CCL 3 contaminants (except those with regulatory determinations).

2. Seeking and evaluating nominations from the public for additional contaminants to be considered.

3. Evaluating any new available data for those contaminants with previous negative regulatory determinations from CCL 1 or CCL 2 for potential inclusion on the CCL 4.

The transparency of the process is improved since the CCL 3, but could still benefit from further clarification. It is very difficult to track a contaminant through the process as the relevant information resides in multiple documents or is not apparent. Some information is only provided in prior CCL3 documentation, which is presumably not updated. The document “Summary of Nominations for the Fourth Contaminant Candidate List” provides a comprehensive overview of the nominated contaminants but not the ones retained from CCL3. Appendix 1. Screening data for the Nominated Chemicals in the CCL4 Universe (from Screening Document for the Draft PCCL 4 Nominated Contaminants) likewise provides information on new contaminants but not the ones retained from CCL 3 (unless they were re-nominated). It would be useful to provide the information and results of the screening criteria for all potential contaminants not just the new nominations. All information should be updated from the CCL 3 to reflect the current state of knowledge. Such a comprehensive review would be useful for comparison of the entire set of contaminants included in the draft CCL 4. This would also aid in tracking a contaminant through the process. For example, the list of contaminants rated as “makes CCL4” in Appendix 1 of the Screening Document for the Draft PCCL 4 Nominated Contaminants (EPA, January 2015) is difficult to reconcile with the list provided in Fact Sheet: Drinking Water Contaminant Candidate List 4 - Draft (EPA, January 2015). It is not also clear if expert panels were used as part of the CCL4 process (as done in CCL3).

In order to achieve clarity and transparency, a complete set of information should be provided that covers all the proposed contaminants in a single document. These information and results are valuable for both understanding the process but also for identifying data gaps. Identification of research needs based on these gaps can then provide useful and necessary information for future CCLs. It is recommended that a process to capture key research needs based on data gaps be developed.

Beyond the question of process clarity is the question of the appropriateness of the CCL process. The process itself produces an excessive and impractical list of contaminants with 12 microbial and 100 chemical proposed for inclusion in CCL 4. Modifications to the process should be considered to reduce the proposed list to a manageable quantity. For example, assuming that all prior CCL list contaminants are carried forward unless they are regulated, will continue to create an ever-expanding list for future CCLs. Updated health effects and occurrence data should be incorporated in every CCL process to address these
issues. Applying criteria that include the absence of a validated robust analytical method would also be useful in reducing the universe, but valuable in identifying research need for future CCLs.

2. **Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.**

The EPA should use the UCMR data from UCMR 1, 2 and 3 to inform the decision making process for CCL 4. The UCMRs provide data on a variety of the draft CCL 4 contaminants. In particular, those contaminants where occurrence has been demonstrated to be infrequent and/or at very low concentrations below the level of concern, should be removed from the CCL 4 list. It appears that EPA relied on data submitted by the only some of the States and that this submission was limited ("Individual State public water supply data provided to EPA during the second Six-Year Review of regulated contaminants (for the time period covering 1998-2005) from States including: CA, FL, IL, NC, OH, Region 9 Tribes, SD, TX and WI" from *Data Sources for the Candidate Contaminant List 4*, EPA, January 2015). Expanding this data set is critical to obtaining a picture of occurrence based on the studies done to date.

The universe of Water Research Foundation reports should be reviewed and any relevant documents included in the data sources. For example, *Assessment of Blue-Green Algal Toxins in Raw and Finished Drinking Water* - 236 (2001) provides occurrence data. *Factors Affecting the Formation of NDMA in Water and Occurrence* - 2678 (2006) is another example that provides real world water utility occurrence data.

3. **Based on your expertise and experience, are there any contaminants currently on the Draft CCL 4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.**

The proposed CCL 4 list of contaminants is too extensive to be adequately reviewed by the SAB in the time allotted. The length of this list is impractical and the development process needs to be reviewed in order to produce a more efficient and effective approach. Therefore, any comments on this question are limited.

As discussed in Question #2, the list should be reduced based on existing occurrence data. Review of existing data sources will demonstrate that some of the proposed contaminants have a low frequency of occurrence. For example, from UMCR 3, the compound 1,4 butadiene was detected once from 3,584 samples (http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/upload/epa815s15001.pdf). Given its limited occurrence data from water utility sampling, its inclusion in CCL 4 is not warranted. It is expected that a thorough review of the data will identify additional contaminants with similar low occurrence rates or concentrations.

The CCL 4 pathogen list appears to be the same one used for CCL 3. This list should be updated and prioritized based on current health and occurrence information. Shifting focus to higher priory pathogens based on health outcomes and occurrence would be appropriate. This would shift emphasis to organisms which are both harder to control and implicated in drinking water outbreaks, such as *Legionella pneumophila* (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6235a3.htm). Given the recent *Naegleria fowleri* occurrence in Louisiana, this pathogen may warrant a higher priority (2015 (download), CDC, *Number of case - reports of Primary Amebic Meningoencephalitis, by month of illness onset and probable water exposure — United States, 1962 – 2013* (http://www.cdc.gov/parasites/naegleria/pdf/naegleria-case-reports-by-onset-and-exposure-2013.pdf))
Water treatment process removal or inactivation of pathogen, would be appropriate to consider in the overall evaluation. Focusing on the organisms which are more difficult to remove or disinfect would be appropriate and would help to focus finite resources.

4. **Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.**

The proposed CCL 4 list of contaminants is too extensive to be adequately reviewed in the time allowed. The length of this list is impractical and the development process needs to be reviewed in order to produce a more efficient and effective approach. Therefore, any comments on this question are limited.

Iodinated DBPs are set of disinfection byproducts that the EPA may want to evaluate as part of the CCL process. While these byproducts are most common in coastal areas, their relatively high toxicity combined with locational occurrence data suggests that further reinvestigation of these may be warranted as part of the CCL process. (H. S. Weinberg, K. Kritsch, S. W. Krasner, 2011, *Iodoacids in Drinking Water Supplies: Methods and Occurrence*, Water Research Foundation Report #3175)

Cyanotoxins are listed as a group in the CCL 4. It is recommended that the EPA be specific as to which cyanotoxins are included in this grouping in order to achieve consistency of proposed contaminant assessment. The individual cyanotoxins, including the suite of microcystins, cylindrospermopsin and anatoxin A, should be incorporated. This set of contaminants is likely to be of increasing importance due to potential increasing occurrence with climate change. Some states are already addressing HAB (Harmful Algal Bloom) issues

Question #1: Are the support documents clear and transparent?

Simplified, clearer description: The descriptions of some of the processes used to develop the Contaminant Candidate List 4 (CCL4) are not completely clear. It is clear that there are three pathways by which an agent would be placed on the CCL4: direct advancement from the CCL3, re-evaluation of agents previously receiving negative determinations, or nomination by the public. It appears that some of the agents that end up on the CCL4 are screened for health effects and occurrence data, some undergo a more complex scoring system, and some are simply advanced from the CCL3 without any additional updating (i.e. rescreening or scoring). The documents that describe this process are difficult to follow in some places. Specifically, it took several readings and frequent referencing to multiple other documents and websites to determine which agents undergo which process and what each process involves. A diagram showing the advancement of these agents from the nomination process or the CCL3, through the CCL4 Universe and PCCL4, and eventually to the CCL4 might make this section easier to follow. This diagram could contain the number of agents involved in each step, labels showing where the screening and scoring were done, and links to relevant websites or documents. A preliminary example is shown below. The 2009 Scientific Advisory Board (SAB) Drinking Water Committee made a similar recommendation regarding the CCL3 process but it’s not clear this was ever done. There is a diagram (Exhibit 1) in the 2015 Federal Register Vol. 8. No. 23 but its very limited and doesn’t appear to be specific to the CCL4. Overall, a clearer and more simplified description of the process could be provided. This could include a description that doesn’t involve excessive referencing to other documents, that shows where the screening and scoring were done, and indicates how many agents were advanced or eliminated at each step.

Screening versus scoring: These seem to be two separate processes, and their differences should be made a bit clearer.

Updating CCL3 agents: It appears that agents carried forward from the CCL3 are not rescreened or rescored unless nominated by the public (or received a prior regulatory determination). If this is the case, it seems that health and occurrence information on many of the agents that end up on the CCL4 will not be updated. If this is all true, it should be specifically and clearly stated and some justification provided. In addition, the potential impacts of this; that is, of not updating much of the list, should also be discussed. Since the CCL3 and the CCL3 Universe were created in 2009, it would seem that the screening and scoring data on these agents would need to be updated at some point. Its understandable that updating the entire CCL3 could involve a tremendous amount of effort, and perhaps this effort is not needed or perhaps some abbreviated process or a shortening of the list could be considered.

Possible missed agents: As mentioned, agents in the CCL4 are derived from three sources: the CCL3, chemicals with negative determinations, and public input. Is it possible a new emerging chemical could be missed by these three sources? In other words, what if a chemical was not on the original CCL3 and isn’t nominated by the public? This seems a little over-reliant on either outdated data (data used to put the agent on the CCL3) or on the public nomination process. Has US EPA considered some additional mechanism for identifying potentially important new agents that aren’t on the CCL3 and aren’t nominated by the public.

Data Sources and Screening Documents: The methods used to develop the Universe are described only in vague terms in the Data Sources document. It’s not clear what is meant by “relevance”, “completeness”, “minimum documentation”, or “quality requirements” except as vague concepts. Were any systematic or quantitative processes used to develop the Universe? If so, maybe a brief mention of these could be added to the summary on page 3 of the “Data Sources” document so that one does not have to read all the CCL3
documents. [Note, this is a minor point that may simply make the process easier to follow without referring to and searching through multiple other documents]. Also, there is a lot of repetition between the Screening Document for the Draft PCCL4 (“Screening Document”) and the Data Sources Document. Combining these two documents might reduce this repetition, save time reviewing the documents, and make the process easier to follow. The same issue should be considered for the CCL4 website. In reviewing the documents, reference is made numerous times to the CCL3 process, which involves visiting several different websites. Perhaps one website could be developed that contains all relevant documents.

**Outdated information:** It seems that some of the potency measures don’t account for the possibility that some agents may not have established NOAELs, RfDs., or if they do, they are out of date. It’s not clear that simply because there is not an RfD or one of these other metrics that adequate health effects data on an agent are not available. It may be essentially impossible to update information on all CCL3 agents in the time frame given, but the potential impact of this should be noted.

**Susceptible groups:** According to the 2015 Federal Register, the Safe Drinking Water Act directs the agency to take potentially susceptible subgroups into consideration, but it’s not clear how the CCL process does this.

**Identifying agents for future research:** It seems that the CCL has two goals: to identify those agents which should be considered for regulation (NPDWRs) and to identify those agents where occurrence or health effects data may be needed and guide future research. The CCL4 list published in the Federal Register doesn’t provide any information or prioritization on which agents on the CCL meet which of these two goals.

**Exhibit 2:** In the 2015 Federal Register, Exhibit 2 – perhaps a column could be added noting the final status of the nominated agents (e.g. “Existing NPDWR”, “carried forward from CCL3”, “from CCL3 Universe”, “Low occurrence”…)

**Models:** Several different elements are used in the Scoring (PCCL to CCL) process: its not totally cleared how all of these are integrated to eventually come up with a single yes or no decision (to included or not included on the CCL4) or into one of the classes: L, L?, NL?, NL, or in between. The models should be more clearly described. I believe that even the description provided in the Final CCL 3 Chemicals: Classification of the PCCL to CCL document would be difficult for most people to follow.

**Question #2: Any additional data sources US EPA should consider?**

With regards to health effects data for the nominated chemicals, it doesn’t appear that a standard literature search involving PubMed was involved in any part of the process (unless one of the sources mentioned links to PubMed) (page 5 Data Sources for CCL4 document).

It was suggested in the 2009 SAB report that US EPA should consider cumulative or interactive effects, that is, agents that work by a common mechanism. Some agents evaluated in isolation may not be advanced from the PCCL to the CCL when considered in isolation, but may advance if cumulative or interactive effects are considered.

**Question #3. Are there any chemicals that do not merit inclusion?**

The list of agents is too long to do a full review of each chemical in the time allotted. This was also a critique of the 2009 SAB.

**Question #4. Are there any chemicals that should be added to the list?**

None noted at this time.
On January 29, 2009, the Drinking Water Committee’s comments on the Draft CCL3 were submitted to Administrator Jackson. Many of the comments that they made are valid today, especially as the EPA did not change the process used to develop the Draft CCL4. Additionally, the majority of the contaminants that were on CCL3 were carried over to the Draft CCL4. No rationale for not accepting the comments and suggestions of the Drinking Water Committee (DWC) was provided by the EPA. This is of concern, at least to this member of the current DWC, as it does not engender a sense of confidence that the comments and suggestions of this committee will be acted upon, or even responded to.

1. Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

Some descriptions of the approach used to list contaminants on the CCL4 are clear; many others are not.

- The Federal Register notice announcing the draft CCL4 provides a flow chart that describes the process used to select the contaminants for the list. However, the documents that describe the steps in the process do not have the same names as those used in the flow chart, so it is somewhat difficult to determine which document is associated with which step in the process. It would also be helpful if each of the support documents showed the flow chart, and clearly indicated which step in the process was described in the current document.

- The EPA document, “Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process” describes the process used to move microorganisms to the CCL. While some aspects of the process are clear, others are not. Here are some examples of the lack of clarity in the process.

  - One part of the process is to assign a score to each pathogen based on its association with waterborne disease, using the Waterborne Disease Outbreak Scoring Protocol. Using this protocol, it is clear how each pathogen is assigned a score. What is not clear is how the scoring protocol was developed. For example, what is the rationale for giving a score of 4 to an organism that has “caused at least one documented WBDOs in the U.S. between 1990 and 2004” and a score of 3 to an organism that has “caused documented WBDOs at any time in the U.S.”? How was it determined that these two situations warranted a difference of one unit in a scoring system of five units? Was a sensitivity analysis conducted to quantify the effects of the assignment of the numerical values to each of these conditions?

  - What is the rationale for assigning a score of 5 to a microorganism that has caused 2 documented WBDOs in the U.S. surveillance between 1990 and 2004 and score of 5 to a microorganism that has caused dozens of documented WBDOs in the U.S. surveillance between 1990 and 2004?

  - Why is no consideration given to the number of people who were affected by the WBDOs? Two outbreaks involving four people would be assigned the same score as two outbreaks involving one million people.
A second component of the process is to assign the pathogens a score based on occurrence in water; the scores range between 1 and three. Again, what is the rationale for the specific numbers chosen for each condition? Has a sensitivity analysis been conducted to assess the effects of the scoring protocol?

The third component of the scoring process is the assignment of a health effects score for each pathogen; scores range between one and 7. The rationale for the specific outcome categories and associated scores is not provided. For example, why is the outcome, “Does the illness require short term hospitalization (< week)?” given a score of 4 and the outcome, “Does the illness result in long-term or permanent dysfunction or disability (i.e., sequelae)?” given a score of 5? Has a sensitivity analysis been conducted to assess the effects of the scoring protocol?

When determining the health effects score, separate scores are calculated for the “general” population and “sensitive” populations. What is the rationale for giving each of these groups an equivalent contribution to the health effects score? This is especially significant in view of EPA’s statement that, “More importantly, nearly all pathogens have very high health effect scores for the markedly immunosuppressed individuals; therefore there is little differentiation between pathogens based on health effects for the immunosuppressed subpopulation.”

The document clearly describes how the final score for the pathogens is calculated. However, no support for the following statement is provided, “Finally, EPA normalizes the Health Effects and WBDO/Occurrence score because the Agency believes they are of equal importance.” What is the basis for this belief? Has an analysis been performed to assess the impacts of normalizing these two scores?

While the process for assigning scores is clearly described (although the rationale for the scoring schemes is not adequately described, as discussed above), the process for determining which pathogens on the PCCL were placed on the draft CCL is not clearly described. The document states, “The 29 PCCL pathogens are ranked according to an equal weighting of their summed scores for normalized health effects and the higher of the individual scores for WBDO and occurrence in drinking water. EPA believes this ranking indicates the most important pathogens to consider for the CCL 3. To determine which of the 29 PCCL pathogens should be the highest priority for EPA’s drinking water program and included on the CCL 3, the Agency considered both scientific and policy factors. The factors included the PCCL scores for WBDO, occurrence, and health effects; comments and recommendations from the various expert panels; the specific intent of SDWA; and the need to focus Agency resources on pathogens to provide the most effective opportunities to advance public health protection. After consideration of these factors, EPA has determined that the CCL 3 will include the 12 highest ranked pathogens.” Based on this statement, it is not clear how strongly the scientific data, compared to the other factors, impacted the final decision.

The EPA also made the following statement, “Additionally, there are a few “natural” break points in the ranked scores for the 29 pathogens, with the top 12 forming the highest ranked group of pathogens. EPA believes that the overall rankings strongly reflect the best available scientific data and high quality expert input employed in the CCL selection process, and therefore should be important factors in helping to identify the top priority pathogens for the draft CCL 3.” It is not clear how this assessment was made, as the “break point” between the
top 12 pathogens (0.5 units) and the next highest pathogen is equivalent to the “break point” between the top 6 pathogens and the seventh highest pathogen. Even larger gaps (>1 unit) are seen between pathogens farther down on the list.

2. Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.

According to the EPA’s document, Data Sources for the Contaminant Candidate List 4, “For Waterborne Disease Outbreaks (WBDOs), the primary source for scoring data was the Center for Disease Control (CDC) Morbidity and Mortality Weekly Reports (MMWR). CDC, EPA and the Council of State and Territorial Epidemiologists (CSTE) maintain a collaborative surveillance system for collecting and periodically reporting data related to occurrences and causes of WBDOs. These reports from the CDC are published periodically in the MMWR. For the CCL 3, EPA used CDC’s MMWR summaries from 1998-2004 as the source for the WBDO scoring protocol. The same process was used for CCL 4, however the data were updated through 2008 (CDC, 2008; CDC, 2011).”

In 2013, the CDC released a report on WBDOs in 2009-2010 (Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water and Other Nonrecreational Water — United States, 2009–2010 MMWR / September 6, 2013 / Vol. 62 / No. 35, 714-720). This should be included in the data sources. In addition, as suggested by the Drinking Water Committee in the SAB’s letter to Administrator Jackson on January 29, 2009 (EPA-SAB-09-011), “The Committee recommends that endemic disease data sets, numbers of outbreaks, geographical distribution of outbreaks and outbreak venues, as well as the peer-reviewed literature (which would better inform occurrence in U.S. waters), be used for the pathogens.”

3. Based on your expertise and experience, are there any contaminants currently on the Draft CCL 4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.

As stated by the DWC in their January 29, 2009 letter to Administrator Jackson, “With regard to providing any data that may suggest that contaminants which are currently on (or not on) the draft CCL 3 list, and should not be listed (or should be listed), the list is too large for the committee to complete a full review of these issues in the time allotted.”

4. Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.

As stated by the DWC in their January 29, 2009 letter to Administrator Jackson, “With regard to providing any data that may suggest that contaminants which are currently on (or not on) the draft CCL 3 list, and should not be listed (or should be listed), the list is too large for the committee to complete a full review of these issues in the time allotted.”
1. Please provide comment on whether or not the Draft CCL 4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL 4. If not, do you have any suggestions on how we could improve the clarity and transparency of the support documents?

I found the support documents to be very clear and transparent. The methodology used and the resources consulted were clearly described.

2. Please identify any additional peer-reviewed information or data collected in accordance with accepted methods which the agency should consider for CCL 4. Please see the Data Sources support document and CCL 3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCL 4.

The information and data sources drawn upon to consider the CCL 4 universe and to screen appear to be thorough and adequate.

3. Based on your expertise and experience, are there any contaminants currently on the Draft CCL 4 that you think do not merit inclusion on the list? Please provide the basis for your conclusions and any data or references.

no

4. Based on your expertise and experience, are there any contaminants which are currently not on the Draft CCL 4 that should be listed? Please provide the basis for your conclusions and any data or references.

With the exception of contaminants that did not make the draft PCCL 4 based on the procedural context of the screening of contaminants in the CCL 4 universe (e.g., Aldicarb ineligibility or some of the antibiotics for which there were incomplete data), the Draft CCL 4 appears to be an adequate representation of the priorities for contaminants to be considered.
Lloyd Wilson

I appreciate the work that the Environmental Protection Agency has completed to compose the Contaminant Candidate List 4 (CCL4). It certainly is a difficult task, and based on my preliminary review I believe the list includes those contaminants that are likely to be of the most potential health concern from drinking water in the near future. I look forward to discussing the draft CCl4 with the other members of the Science Advisory Board Drinking Water Committee (DWC) to finalize my thoughts.

Charge 1. Please provide comment on whether or not the Draft CCL4 support documents (listed above) are clear and transparent in presenting the approach used to list contaminants on the CCL4. If not, do you have suggestions on how we could improve the clarity and transparency of the support documents.

1) The DWC in review of the CCL3 suggested that a flow chart be provided for each contaminant to help clearly identify the justification for that contaminant to be included in the CCL3. I have read through many materials but I did not find such a flow chart for the CCL4, and I think it is difficult to identify the significant information that may be driving the selection for a specific candidate. I had to go to the Contaminant Information Sheets (CISs) to see the scores for the four attributes (potency, severity, prevalence and magnitude) to get a sense of what is driving the selection. For these reasons, I believe that the transparency can still be further improved. I agree with the previous suggestion of a flow chart, but also suggest considering if the transparency could be improved by providing a qualitative description as to why each candidate was included. The Draft CCL 4 fact sheet could be a place for such a qualitative description. The table at the end of the fact sheet that lists each candidate, its use, and CASRN number could easily be expanded to include a qualitative description of why it is being included.

   a. As a model, my suggestion for qualitative descriptions summarizing the finding for each candidate in the CCL4 is to complete something like the way the World Health Organization presents the findings for whether a health guideline is derived or not for a specific contaminant. They summarize the findings with short descriptions like: “unlikely to occur in drinking water, not persistent and only found rarely in drinking water”. In short these would help explain the outcomes of the literature reviews and model runs presented in the CIS.

2) The Contaminant Information Sheets are very good and useful. What I don’t understand is why the CCL4 is published with just the CISs for the nominated contaminants. Did I miss them? It would seem that it would be best to put the CISs for the entire draft CCl4 in one place.

3) Although very minor, the order by which Candidates are listed in the CCI3 and the CCL4 do not exactly mirror each other adding to some confusion in comparing the two lists. Obviously this is in part because the exact composition of each list is different but it also appears that there is a change in order (see the first 5 candidates listed in each list). This happens at least one more time in the course of the two lists. On an even more minor note, 1,1-dichloroethene is spelled incorrectly in the draft CCL4 factsheet table.
4) In the document, Summary of Nominations for the Fourth Contaminant Candidate List, Appendix 6 is very useful in trying to follow the well written but inherently confusing information provided in Section 3.1.1, Analysis of Nominated Chemical Contaminants. At a minimum I would at least reference Appendix 6 and do so early on.

Charge 2: Please identify any additional peer review information or data collected in accordance with accepted methods which the agency should consider for CCL4. Please See Data Sources support document and CCL3 Universe support document for a list of data sources that EPA used to evaluate contaminants for the Draft CCl4.

1) The CCL3 process referenced using UCMR and NHANES to develop the CCL 3 Universe. Since the CCL3, UCMR 3 has begun and CDC published the Fourth National Report on Human Exposure to Environmental Chemicals (2009). It is not clear to me if the data from these two efforts have been included in producing the draft CCL4. It would seem that these two data sources offer significant evidence on whether a contaminant is a concern or not and to be listed on the CCL4. The biomonitoring data doesn’t necessarily describe the route of exposure, so further evaluation of the relative contribution from different routes of exposure would need to occur to determine if that data would be of use.

Charges 3 and 4. (Pathogens and Toxins)

Charges 3 and 4  (chemical Contaminants)  3. Based on your expertise and experience, are there any contaminants currently on the draft CCL4 that you think do not merit inclusion on the list? Please provide a basis for your conclusions and any data and references.  4 Based on your expertise and experience, are there any contaminants which are currently not on the draft CCL4 that should be listed? Please provide the basis for your conclusions and any data and or references.

1) Related to my comment about data sources, it seems that the UCMR data is showing that several of the estrogenic compounds (e.g. estriol, equilin, estrone) are not being found in drinking water. The data shows that estriol was found just once in more than 7000 samples, and that the other two were not found at all above the reporting level. I think the evidence so far is suggesting that these may be more of an environmental/ecologic concern than a drinking water concern. Based on the UCMR data, discussion on whether they should move forward is warranted.

In summary, I am still reviewing the materials and supporting documents and may have other suggestions on the process, potential CCL4 candidates and other candidates already on the draft CCL4. The DWC in review of the CCL3 commented that 100+ candidates is too large because it has not whittled the Universe sufficiently to be efficient and effective. They stressed that a large CCL is against helping EPA to easily select 5 contaminants per 5 year cycle for regulatory determinations. I totally agree that this is a limitation but a large list does help cast a broad net that helps researchers and others have an idea where concerns are most likely to occur. The next step of prioritizing such a large number is the key for the list to eventually be useful, and I personally think the UCMR data and bio monitoring data (from CDC or the peer reviewed literature) should play a very clear and significant role.