Reclaimed Water Technical Advisory Panel Meeting
May 21, 2008
9:00 am – 3:30 pm

Welcome and Introductions

Kathy Cupps, Washington State Department of Ecology (Ecology), announced that she will be moving to Texas at the end of the month but will maintain her position with Ecology for the near future while working from Texas.

Angie Thomson welcomed everyone and reviewed the agenda. Angie said the panel would work in small groups to resolve some of the outstanding issues on the pathogen topic. Each small group will work to develop a proposal for pathogen standards in the 2010 rule and determine how Ecology should measure the standards. Angie said the proposal needs to include the rule language. In the afternoon the panel will begin to address irrigation and prepare for the June discussion on that topic.

Jim McCauley, Ecology, reviewed the timeline for Technical Advisory Panel (TAP) activities through October 2008. Jim said the TAP needs to develop conceptual rule language and present it to the Reclaimed Water Rule Making Committee (RAC). Jim summarized TAP work to date on developing conceptual rule language: in February the TAP suggested use-based standards and presented those to the RAC, in March the panel began talking about sources, pretreatment, and pathogen reduction, and in April the panel got into a more detailed discussion on pretreatment and developed six recommendations and proposed language for the rule. Jim said the panel also came to some preliminary recommendations for pathogen reduction: to re-do the Pomona Virus Study, and to develop parameters for pathogen removal requirements. The idea was not fully developed, but the concept was presented to RAC and while they had a few questions they were not alarmed by anything presented.

The TAP still needs to look at irrigation recommendations for urban and non-urban uses, groundwater recharge, aquifer storage and recovery, and wetland mitigation. Jim said the panel needs to determine if they might benefit from Walt Jakubowski's participation. Kathy suggested that Walt could validate some of the decisions the panel makes today regarding pathogens. Jim listed the other water quality parameters for reclaimed water that the panel has yet to look at: industrial, plant tolerance, pH, nutrients, temperature, and pharmaceuticals and personal care products (PPCP). Jim said the panel also needs to address storage and distribution, pipe separation, setbacks, application rates, runoff,

blending, type and size of systems, and reliability. Jim said the panel needs to finalize these recommendations for October and determine what will go in rule versus guidance.

Questions/Comments:

- Emily Callaway suggested reorganizing the topics to help the panel get to a result faster. Emily said during the last meeting there was consensus that panel members may not be able to make decisions on pathogens. Emily suggested addressing some of the future topics now and setting aside the pathogen discussion until input from experts like Walt is available. Bill Persich added that there are not enough studies on health effects to give the panel the understanding needed on this topic. Ron Brown agreed and felt he did not have the background to discuss pathogen treatment recommendations and set limits. Ron said as an engineer he would feel more comfortable discussing the pipe separation and other engineering aspects.
- Frank Loge suggested breaking the panel into groups to address different topics. He suggested letting panel members choose topics that they feel comfortable with and then have small groups work to develop a plan and bring it back to the larger group to get feedback. Frank thought this approach would allow for multiple topics to run in parallel and be accomplished faster. Ron supported this idea and thought the work could be accomplished through a workshop like setting and could produce deliverables faster.

Angie asked panel members to identify the topics they felt they could contribute to in a meaningful way.

Break-out groups by topic		**TAP members**								
		PS	RB	BP	EC	FL	JS	DOH	Ecology	
Topic	**Month**								JM	KC
Pathogens	May	X				X	X	X	X	X
Irrigation/Urban Uses	May	X	X	X	X	X				
Groundwater recharge			X	X		X	X		X	X
ASR, UIC, injection wells			X	X	X	X				X
Wetland mitigation		X		X						X
Other WQ concerns: odor, scaling, etc.		X	X	X	X	X	X			X
Storage & distribution		X	X	X				X	X	X
Pipe Separation		X	X	X				X	X	X
Setbacks, etc.		X	X	X	X			X	X	X
Type & size of		X	X	X				X		X

system										
Reliability		X	X	X			X	X	X	X

Angie suggested selecting two of topics to move forward on during today's meeting, she said one group could work on pathogens and another could work on irrigation and urban uses. Angie said the group addressing pathogens should follow the questions in the agenda and use that as the basis to guide the work. Angie clarified that the groups should not just look at what needs to be considered, but actually make progress on decision making. Paul Schuler, Frank, Jay Swift, Denise Lahmann, and Jim worked on the pathogen topic while Kathy, Ron, Bill, and Emily worked on irrigation.

Small Group Presentations

Pathogen discussion

Denise said the pathogen group began by discussing five categories of contact water: potable, unrestricted human contact, restricted human contact, no human contact but animal contact, and no contact. The group decided to consolidate the categories to potable, human contact non-potable, and limited/restricted human contact. Denise said the group also tried to name the water using colors (e.g. blue water, purple water, and green water). The group asked Jim to look at the old categories and make sure the new categories do not leave any uses out. Denise reviewed the standards the group decided on for each new category.

Potable

Direct potable: intent to consume again without environmental contact

1. Treat to human contact non-potable then reverse osmosis = "source water"
2. Meet Safe Drinking Water Act (SDWA)/state water quality potable standards
    a. Zero total coliform (TC)
    b. Zero fecal
    c. Four log virus (approaching five log)
    d. Three log giardia
    e. Two log crypto
3. (Nitrate < or = five mg/l average; 10 mg/l max)

Indirect potable: intent to consume again after contact with the environment

1. Treat to human contact non-potable (Class A under existing standards)
2. If injection to groundwater: use reverse osmosis or if residence time is less than six months [check California standards for six or 12 months] (this is based on the survivability of pathogens)
3. If surface percolation: no further treatment beyond human contact non-potable*
4. If subsurface (vadose zone): no further treatment beyond human contact non-potable*

5. If mixed with surface water (will have surface water treatment when withdrawn): no further treatment beyond human contact non-potable*
   * for pathogen removal

Human Contact Non-Potable (Class A under existing standards)

1. After secondary treatment
   a. ≤ 30 mg/l biological oxygen demand (BOD) and
   b. ≤ 30 mg/l total suspended solids (TSS) and
   c. ??? mg/l dissolved oxygen (DO)
2. Effluent turbidity ≤ two NTU (real time, online indicator)
3. Suggest log removal across entire treatment (12 log), not per step (don't specify filtration or any other specific technology)
   a. After secondary treatment, five log removal bacteria (TC, E-coli, HPC), protozoa (cryptosporidium, giardia), virus (adenovirus, enterovirus)
4. Particle size – one time initial demonstration of ≤ 10 microns in effluent
   a. Seeding test
   b. Surrogates—do they exist? Perhaps: Total aerobic spore forming bacteria?
   c. Allow: one particle > one micron per liter
5. Total coliform / heterotrophs: < 2.2 MPN/100 ml (ongoing testing)
   a. Total coliform is ubiquitous and is a conservative indicator of performance
   b. Issue: trigger (indicator) vs. violation [corrective action concept]

Limited/Restricted Human Contact (e.g., cooling water, agricultural uses; similar to current Class D)

- Consider another name (non-human primary contact?)
- Much of this is covered by National Pollution Discharge Elimination System (NPDES) permit conditions for stream flow augmentation, wetlands and agricultural uses

1. After secondary treatment
   a. ≤ 30 mg/l BOD and
   b. ≤ 30 mg/l TSS
   c. Total coliform ≤ 23 MPN/100 ml
   * These numbers are not consistent with NPDES because the group wanted more protection for pathogens
2. No turbidity standard needed

* If aerosols are viewed as a significant issue, treat to human contact non-potable. If not, treat to limited/restricted human contact.

Questions/Comments:

- Kathy asked if the group considered grazing animal impacts. Denise said the group determined that depending on the use it could be categorized as human contact and would require higher treatment.

- Bill asked if the log removal for direct potable would be an ultra filtration/reverse osmosis combination. Denise said yes, the reverse osmosis system would be used instead of just the micro or ultra membranes themselves.
- Kathy asked if reverse osmosis would be followed by disinfection for direct potable use. Jay said the group determined that a four log removal could not be accomplished by reverse osmosis so disinfection would be needed as well. Jay said disinfection would occur before and after reverse osmosis.
- Bill asked if reverse osmosis and a residence time would be required for indirect potable uses. Denise said it would be either reverse osmosis or a six month residence time. Kathy said direct injection is reverse osmosis plus twelve months currently. Denise clarified that the six month recommendation was based on California's standards but needs to be confirmed, it may actually be twelve months. Jay added that the group included the asterisk because of a concern regarding micro-constituents. Jay thought the standards should be protective of micro-constituents as well as pathogens.
- Kathy asked if there is a travel time to uptake or if the water could be immediately withdrawn in surface percolation for indirect potable. Denise said mixing and travel time was not considered by the group.
- Kathy asked when the water becomes direct versus indirect. Jay said that is a follow up question the group will need to consider and could require dilution or time. Jim said this could be an issue for any category of water: if you are percolating into a shallow aquifer you also may have an almost direct use. Kathy agreed and said that line needs to be defined.
- Kathy asked what the purpose was of including dissolved oxygen in the human contact non-potable category. Jay said it was intended to prevent septicity and dissolved oxygen depletion. The group discussed whether it should just be measureable dissolved oxygen or other options and it is still in debate. Kathy thought that King County would be against this because it would require them to post-aerate.
- Ron said particle counters are not reliable for instream testing. Denise said the particle count would be an initial demonstration and was not meant to be confirmed with a particle counter. Jay said the 10 micron requirement should be critiqued because the number was debated among group members. Jim agreed and said they came up with 10 because of interference with disinfection, not that it will capture the actual protozoa.
- Kathy asked at what point the water quality measurements for human contact non-potable would be taken. Jay said the point of the water quality standards was to ensure the water had been through secondary treatment before tertiary. Kathy wanted to know how a membrane bioreactor (MBR) would fit in. Jay suggested that an either/or clause be added into the recommendation to accommodate MBRs. Jay also thought that lower criteria could be created for an MBR. Kathy proposed 10 BOD and 5 TSS after tertiary. Jay said the group's intent was just to require secondary treatment ahead of tertiary and not to require a verification test. Denise suggested taking the numbers out and just stating secondary treatment is required. Jay clarified

that it was the group's intent to make the levels ahead of the filter and as a design level. Kathy suggested including a compliance level too.

- Bill asked how the five log removal requirement was determined for human contact non-potable uses. Jay said the five log requirement needs to be scrutinized. Jay said Frank also proposed some unusual indicators that need to be reviewed. Jay clarified that these are design system validation requirements and not something plants would have to do regularly. Jay said the group talked about full scale testing for manufacturers but did not address system testing at installation. Jay said the group decided they did not want to create a log removal per treatment process to allow the engineers to build the system. Jay said the group also did not decide who would oversee the validation tests.
- Bill said for ultra violet (UV) systems manufacturers go through a validation process and once a system is approved then anyone can use it. He said this process has created a tool box of technologies that any plant can grab off the shelf and use. Bill said he thinks this also exists for MBR technology and recommended this type of approach for reclaimed water technology.
- Kathy asked what people thought about accepting third party validations. Bill thought as long as it is done in a professional manner, third party validations are acceptable. However, someone should define what type of third party evidence would be allowed.
- Bill thought that the testing levels should be set to indicate whether the filters are working and the chemicals are being applied appropriately. He suggested that it might be worth looking at what sand filters are capable of achieving in terms of removal rates so the levels are not set too high. Denise agreed that additional work is needed to get correct rates.
- Kathy said the new categories eliminate Class C and everything below Class D. Kathy said there are some current uses that would not fit under these categories. She gave the example of Kimberly Clark where effluent runs through a closed system and to an outfall. Jay thought that if a system is using effluent once through closed loop an exception could be made.
- Bill said the current standard for cooling tower use requires Class A because of drift, but for areas where no mist exists it requires Class C. Jay explained that if there is a significant potential for aerosols the group determined Human Contact would be required. Denise clarified that what qualifies as significant drift will need to be defined.
- Kathy said the new categories also remove Class B which is used as a regulatory tool when people cannot meet Class A. Denise suggested that Ecology could permit for non-contact uses and would essentially be doing the same thing.
- Jay said there is some work for Walt and other experts in terms of validating the suggestions made by this group. Jay thought microbiologists should confirm these recommendations as well.

Angie said it sounds like there is some fine tuning work needed on this topic but asked if in general this is an approach the panel agrees with. Panel members supported the

proposed approach. Kathy congratulated the group on a great job developing a path forward for pathogen standards. Angie suggested sending this information to the RAC and bringing back their comments to discuss with Walt at the next TAP meeting.

Irrigation discussion

Bill provided a summary of the irrigation group's discussion. He said the group started by talking about different forms of irrigation, food crops, root crops, crops to be washed or canned, etc. The group explored the concept of water quality on food crops and created a list of issues to consider. Emily found Food and Agriculture Organization (FAO) criteria for constituents by crop that could be used as a guide for farmers to follow. Bill said the group also found the Environmental Protection Agency's (EPA) guidelines that would be useful for this work as well. It defines irrigation water for agricultural use and non-agricultural use. The group identified agronomic uptake and worker safety as concerns in water quality with food crops.

Contact potential
Food crop
- Contact
    - Edible portion
- No extract
- Worker safety
    - Aerosols
    - Eat food crops

* Food crop – processing, canning, etc. (make no distinctions)

Water quality
Food crops
- Edible – contact with water
- Edible – non-contact
- General water quality standards
    - Salts
    - Organics (BOD & DBPs)
    - Solids
    - Metals
    - Emerging contaminants
    - pH/alk.
    - Temperature
    - Macro nutrients
    - Micro Nutrients

1. Overall EPA Guidelines
2. FAO – 29 guidelines to food crops by crop

Other concerns:
- Agronomic uptake
- Worker safety – aerosols -> pathogens

- Nutrients at right time

Bill said the group tried to break things down further into type of application and crops and developed specific water quality standards for irrigation. Bill explained the standards would apply to all types as a minimum. Bill said the group thought it was important to include reference documents in the guidance. The group also considered standards for pathogens, micro-nutrients, phosphorus, and nitrogen.

Irrigation types
- Spray
- Surface
- Sub-surface

Crops (Ag, Commercial)
- Food
    - Raw
    - Cooked
- Non-Food
    - Trees
    - Flowers
    - Animal

Urban
- Landscapes
- Golf course
- Parks, schools, playgrounds
- Impoundments

Minimum water quality standards
- BOD ≤ 30 monthly average
- TSS ≤ 30 monthly average
- pH 6-9 plant tolerance
- Free Chlorine residual ≤ 1.0 mg/L

Literature references to support guidance:
- EPA Table 2.7 – recommended guidance
- FAO Paper 29 Table 1
- FAO – UN
- Table 17.5 Asana (pg 956)

Other considerations:
- Pathogens – other growth
- Micro-nutrients
- Nitrogen < 10 mg/L Total nitrogen?
- Phosphorus – ok!

Bill said the group then discussed best management practices, how to measure agronomic uptake rates, and issues with monitoring. The group came up with a plan for best management practices to address issues on a site-by-site basis. For example, if a farmer were going to take water from a generator they would have to sign the best management practices plan that would be customized to the particular site. Bill said there is a lot of literature to refer to on this topic. The group talked about the timing of irrigation to address inadvertent exposure to the public and other environmental conditions like wind. The group was limited by the existing categories but may be able to develop this further based on the work in the pathogen group today.

Best Management (Plan Required) Practices (BMP)

1. Agronomic Rates
    - How to determine?
    - How to monitor?
        - Hydraulic loading
        - Limiting parameter?

Issues:

- No ponding
- No runoff – incidental only?
- Soil moisture measurements?
- Consult local irrigation specialist – Washington State University or Natural Resources Conservation Service
- Time of irrigation
    - Limit contact
    - ET – water conservation
    - Environmental – scheduling

Other considerations:

- Guidance?
- Agreement?
- Operations & Maintenance manual?

Questions/Comments:

- Jim asked if nitrogen criteria is included in the current land treatment standards. Bill said the agronomic uptake rate was limited for ammonia in the effluent in some projects. Kathy said that has been case-by-case and thought it might be good to set a level and then force a study if they want the level higher.
- Denise asked who is being regulated, the farmer or the generator. Bill said the generator is being regulated and would develop a best management plan for all users. Denise asked if Ecology would be responsible for making sure the generator was doing this. Bill said it would be just like it is now where a farmer can have an agreement to buy water. Denise was concerned that the agricultural interests would not want the liability of signing a best management plan.
- Kathy said she is working with the Water Rights Sub-task Force to determine the water rights issues involved in this. An Ecology employee will need to look at in

stream flows and identify where the effluent discharges are and the dry whether design flows of the discharges to determine the impact. Emily added that these rules should take Washington into the future as water availability changes.

- Bill said the group tested the framework and got the same result as the current state standards but the new framework provided more depth with water quality. Kathy suggested using the Australian standards as a reference because they have had to deal with issues before Washington has.
- Jim asked what would be included in the rule. Kathy said the group was thinking of including the requirement for the plan in the rule and then have tables as appendicies to the rule.

Angie asked if the panel generally supported the approach to the irrigation topic. The panel voiced their support for the group's work. Kathy suggested that this work be written up and tied to the pathogen discussion before it is brought to the RAC for feedback. Kathy said the panel could work on developing conceptual language for the rule at the next meeting but Ecology will not have a rule writer until after July so it will not be final until later in the summer.

Topics for Next TAP Meeting

Frank said the goals and questions in the agenda were really useful and suggested preparing these again for the next meeting. Emily thought the one page piece that Jim put together was very helpful as well.

The panel discussed potential topics for the next TAP meeting. Kathy suggested following up on the irrigation discussion with urban non-irrigation (other) and groundwater issues. Denise suggested groundwater recharge as a topic for the next meeting. Angie proposed that the next TAP meeting begin by getting feedback from the RAC on the pathogen and irrigation discussions and then split into two groups to address groundwater and urban non-irrigation uses. Angie asked the group to develop a list of things to consider for the topics selected for the next meeting.

Groundwater recharge

What technical standards should Ecology adopt for the 2010 rule and how will we measure them?

Consider:

- Types of groundwater recharge (surface, recharge, direct, aquifer storage recovery (ASR))
- Ecology groundwater quality standards and DOH drinking water standards (including ASR)
- Point of compliance and monitoring
- Hydro geological analysis
- Fate of contaminants

Questions/Comments:

- Kathy said the water resources people said they could modify the ASR if there was something the reclaimed water group could not work around. She thought it might be good to have support from hydrogeology staff at the meeting.
- Kathy said another thing to consider is that Washington has a standard for recharge in a non-potable aquifer, but the state groundwater standards state that all aquifers are potable water sources. Ecology has not figured out where this would apply. They might be able to use an overriding consideration of the public interest. This could be nested into some of the topics for the next meeting.

Urban non-irrigation discussion

What technical standards should Ecology adopt for the 2010 rule and how will we measure them?

Consider:

- How much risk of human contact?
- Are there conflicts with local or state code?
- How do we define or address additional treatment needs? (suitability for the use)

Questions/Comments:

- Frank asked how this topic was different than the non-human contact category. He asked if the goal was to identify the uses and which ones would fall into the pathogen categories. Emily said the output of this discussion is to identify uses and the water type it falls under in a matrix. Kathy said the group needs to consider suitability for the use as well as human health and environmental considerations.
- Denise said Washington does not have a regulatory standard for some of the uses and thought suitability for the use is not a regulatory standard. Frank asked where you would draw the line with identifying and defining uses. Frank thought you have to let industry dictate some of it. Kathy said if the water is not suitable for a use, Ecology at least needs to say it could be a source water so people are aware it is not appropriate. Kathy said Ecology's surface water quality standards are written the same way.
- Frank asked how the panel would set standards for things like water parks, snow machines, and hatcheries. Kathy said the panel has to look at all beneficial uses of the water. Denise asked why the panel is looking at pathogens and not particulates. Kathy said she thought the panel would have to look at both.
- Denise said she did not think potable water was treated to be put in a boiler and asked why reclaimed water needs to be suitable for that use. Kathy said Ecology's standards say Class A is suitable for a boiler. Denise said it seems like Ecology would let the market determine that. Jim said this gets back to source issue of industrial reuse water that would be evaluated by a case by case treatment basis because you do not know what specific industries need. Kathy said the rule might not include every use, but

before Ecology signs off on a use they have to make sure the quality of the water is going to be good.

- Denise thought this should be an additional topic for treatment needs that the panel should consider. How should the panel define additional treatment needs?
- Denise asked what language in 90.46 requires Ecology to develop water quality for suitability of the use. Kathy said the surface water standards use the same suitability standards and Ecology needs to let people know that removing pathogens and solids does not make it useable for their use. Frank said it seems like suitability for the use is an artifact from the NPDES permitting standards.
- Frank said the surface water treatment rules are created to protect humans or the environment. For a receiving water you have to identify uses and develop standards based on those categories. Frank said that process has been translated to reclaimed water and he questioned whether that is appropriate. Kathy said 90.46.015 says Ecology must address all aspects of reclaimed water uses. Denise thought that as long as the standards address public health and environmental protection then any specific use needs to independently analyze if it is appropriately treated for their use.
- Ron argued that if he was a generator and did not want to incur the cost of the additional treatment for a specific use he would have to send the user to the city to get drinking water. Bill added that if you are a generator and have nine customers, and another one comes along and wants higher treatment, the generator should not have to treat all the water to a higher standard to meet that users needs. The generator should be able to give the user plain water and they can polish it and essentially become another generator.
- Jay asked if Ecology could apply uses to the three categories the pathogens group developed today. Kathy said the rule does not have to establish limits but needs to address all uses so people are aware. Frank clarified that Ecology could either develop different classes of water and put all the uses under it, or a list of uses and standards for each of those. Frank said the confusion could be coming from the fact that the panel has not developed classes, so the panel needs to develop either classes or use structures. Bill thought it would be challenging to develop a list of all uses. Kathy clarified that Ecology needs to list classes with uses identified. Frank and Jay thought that the panel would not be able to provide standards for every use.
- Kathy emphasized that Ecology cannot report back to the legislature with a rule that does not address the suitability for the uses. Ron felt that the legislature does not know enough about reclaimed water to get that specific. Bill and Ron both felt that drinking water is not suitable for all uses and therefore reclaimed water should not have to be suitable for every use. Denise suggested including a statement in the rule that says the water is not directly suitable for all applications.
- Frank thought that the categories the pathogen group came up with today could be used as classes (blue, purple and green) to represent three waters that serve as source waters for other uses. The rule could list the uses that are safe for each class, and it could say the water is acceptable as source water for other uses but additional treatment may be required. Kathy said she would like to see how this would look

written up but her initial reaction was that this was less than what is in the current standards. Kathy said she wanted the rule to say if you intend to use the water for certain applications you need to consider x, y and z. She said this information could go in guidance but it needs to be included somewhere. Frank proposed using the three categories and listing the uses the panel feels that the water is safe for; everything else may require more treatment.

- Jay asked how Asana's book differs from this approach. Kathy did not think it was very different. Jay suggested replicating this as a guide. Frank said the two ideas could be merged: the rule has classes in it, under each could be a list of acceptable uses, and beyond those acceptable uses people could look to guidance to refer to a more complete list of uses. Denise reiterated that she would prefer a "buyer beware" type of system where the rule does not guarantee that the water is appropriate for every application. Kathy said she agreed. Frank added that if every use was guaranteed Ecology could put themselves at risk of a law suit if an engineer attempted to use the water for a specific application and it did not work for some reason.

Wrap-Up and Action Items

- Bring pathogen and irrigation topics to RAC in June.
- Address groundwater recharge and urban non-irrigation topics at next TAP meeting.
- Invite Walt Jakubowski to the next TAP meeting.

Meeting Attendees

Department of Ecology
Katharine Cupps, Agency Lead

Angie Thomson, Facilitator
Emily Neff, Note Taker

Committee Members and Alternates	**Guests**
Denise Lahmann, Department of Health	
Frank Loge, UC Davis	
Emily Callaway, CH2M Hill	
Bill Persich	
Ron Brown, HDR	
Jay Swift, Grey and Osborne	
Paul Schuler, (phone)	
Ecology Staff	
Jim McCauley, Department of Ecology	
Jennifer Busselle, Department of Ecology	