Summary notes for Continuous Real-time Water Quality Closing Session

National Monitoring Conference

Denver, Colorado April 28, 2010

Results of an interactive discussion between participants and moderators for each of the sessions on the continuous real-time water-quality monitoring sessions. Session moderators were Rob Ellison (YSI), Janice Fulford (USGS), Reed Green (USGS), Ken Hyer (USGS), Chuck Spooner (EPA), Dan Sullivan (USGS/NWQMC), and Andy Ziegler (USGS) (notetaker). Notes also include input from opening session speakers; Andy Ziegler, Stewart Rounds (USGS), and Mario Tamburri (Alliance for Coastal Technologies). Goal of closing session was to identify and discuss needs, issues, and future directions for continuous water quality monitoring. This brainstorming session resulted in a list of a number of issues and needs. Session was attended by 30 participants.

Closing Session Discussion questions:

Where do we need to go (what isn't getting done that is needed for instruments, protocols, databases, etc)?

Why aren't we there? (What are the technological and other impediments?)

How do we fill these gaps to get where we need to go?

Notes:

Where do we need to go? (What isn't getting done that is needed for instruments, new gizmos, protocols, databases, etc.?)

Need a National Network with in-situ instruments that reliably measure what we are interested in with defined uncertainty and all of the attributes are stored with these data. Self maintaining/cleaning, Uniform protocols, wireless data transmission, handheld computing, data and uncertainty display and data access, etc.

Use continuous monitors where they are most effective;

Cheaper! Better! Faster;

Need new and better probes:

- longer periods between calibrations
- more resistant to fouling (fewer site visits → lower cost)
- more types – matched to water-quality & research objectives

Need models and methods to mine the information content of the data (surrogates, process-related information, etc.)

Methods for surrogate models need standardization

Need to make every data point available online, with quantitative uncertainty estimates for each point

Effective monitoring/observing requires high spatial and temporal resolution to address diverse societal needs

Reliable/robust, accurate/precise instrumentation is key

Go Beyond physical and chemical measurements with bio- and geno-sensors

Need sensors that work in a small water depth for sensors, especially SC

Turbidity – extended range, microfouling issues

Consistent use and protocols

Easy and accessible database with common data fields (data elements)

AC power source for cleaning-- maybe compressed air and wiping and /or UV—for disinfection of sensor

Fouling camera to visually examine fouling

Pumped systems to keep sensors and optics clean also copper antifouling—copper chore boy

Nitrogen gas systems to clean sensors.

CO2 jetting used by USGS in Texas—TCEQ 12V compressor to clean and available at home depot

Texaswaterdata.org for pictures of site installations

Envirotech put a monitor in a "garage" and then inject a dose of bleach for disinfection—Vince Kelly cost of about $5K

Also some versions add on for long-deployment cell that leaves the sensors dry between readings.

Limiting light on sensors helps minimize fouling.

Get lots of advantage from adding/treating as much of the system as possible with copper to extend- especially important for optical sensors.

Issues with sc sensors—adding slick coatings to extend deployments and minimize fouling

Real-time E.coli/biological sensors are NEEDED

Algal toxin and odor compound sensors are NEEDED

Atrazine sensors are needed

Possibilities of mutlispectral satellites for e. coli estimates?

Blue tooth communication!! Turn on/off query systems and eliminate cables. Can blue tooth work? Also could use acoustic communications

HOBO example-- optical communication eliminates direct cabling for battery charging—elimination of corrosion and connections on cabling would be a big improvement

Can use blue tooth communication between data collection platform and download—Colorado USGS example

Auto download like HOBO—need to be very close (touching).

Multiple brands and cables and no consistency amongst brands of monitors—standardization of cables and connectors are needed—Get industry to agree of common standards and approaches

Establish consistent protocols for communications—driver info into each vendor sensor and have PUCK? protocols

It is reasonable to get vendors to do communications in similar fashion—customers need to ask for it

Chuck D.- reasonable? To write a spec? to develop protocols and that is the hope with PUCK—Recommend that NWQMC sensor workgroup do this

Standardized data output spreadsheets and corrections, etc. are needed

Less expensive communication devices are needed—have a small unit out of WEFTEC recent meeting that can submerge and then pop up and float up to limit issues with vandalism

Time-dense data and also need spatially-dense data. Explore fiber optic temperature sensors and do similar approaches to get that spatial data – a continuous spatial sensor(s) in addition to time density

Obtaining total and dissolved concentrations—Need new sensors that do both. Examples nitrogen, phosphorus, and carbon

Total reactive and true total phosphorus –on site digestions are possible now.

Pumping samplers to move sample to the sensor—how to ensure representativeness

DATA and SOFTWARE—where should this be coming from? What are our needs?

Suggest data management group efforts work on this —getting data in—using the info and vast differences from site to site are complications that need to be addressed

Implement automated data entry and record working

Store uncertainty with each data value

Similar analogies to streamflow data and storing all unit value data. This is dictated by the needs for the info and need to change the data analysis tools to match with the density of this amount of data.

Possibilities to do data compression similar to video/pic/music files to make data handling easier for both temporal and spatial data.

Biggest problems of Information Technology are storage and transfer of data and processing of these data – what is needed to make these task easier?

What tools? Excel? And need to handle more data

Suggested existing approach using Data turbine from NSF and real-time data viewer also CUASHI—

Data discovery or data consolidation? – routes all types of data, but discovery requires different approaches than consolidation.

Can use a centralized data server, but must have the data attributes/Data Quality Objectives also stored with these data—need standardized formats

Data elements and pieces are moving forward through NWQMC have beginnings of pick lists and is an important first step and ensure that data are all needed—have long list done

Necessary to link the QA data with all data values

Xml is an implementation tool for discovery and consolidation

Need funding and champions for getting data outside of each organization's "own" data

Paul Courier presentation oceans data discovery system as an example

Trish Solberg USGS—Colorado example and include look at publically accessible data base—NEW storet WQ DX? Have a distributed data base and then interrogate and bring to your system to work with the data for your specific purpose is the best approach

Can't require the same method? Different methods and use performance-based approaches for data

SOPs likely difficult to do standard operation procedures for everything and need a standardized structure for an SOP to have a table of contents similar to EPA QAPs and so you know where to look for the information of interest and meta data

2 categories of meta data- description of dataset in detail--

Meta data and core data elements

Look at NASA metadata catalog Global change master data catalog

Turbidity comparability and temperature sensors large nstrument sensing variability and attributes need to be understood and stored with the data

Accuracy and precision standards and criteria are needed

Data of variable quality—how to put these different data sets together, but aren't quite as precise/accurate. What is the best way is to store with the data and DQO

The use of data is the users choice, but it must be an informed choice

Validity of data within specifications and that is different and separate from performance standards

Turbidity specifications and issues as an example—need an independent standard? In addition to formazin that is more similar to the characteristics of natural water samples. Readings/values depends on design and different definitions for turbidity. If a performance-based standard is used would be better.

More standardization of specifications by manufacturers is needed. Possibly use a certification similar to MCERTS? (United Kingdom Environment Agency) Really need testing labs/ specs, to make sure efforts and instruments are done well.

Discussed current meter example and specifications and testing variability and cost. (not all are created equally!)

Need agreement on common set of specs and how determined – temperature accuracy and drift and there is no ability to recalibrate.

Regulatory acceptance and environment has different meanings and definitions in each state/country—

Chuck Spooner-Non-point Source (NPS) and studies examples and effectiveness of controls are needed– RTWQ sensors provide much more insights that can be seen – Phil's example with—Regulations can be very blunt and are out-of step with the knowledge base we can now generate. Regulated communicate problems, funding, attention span sell to the community and multi-front approach—TMDL program is a good example of using technology and meeting water-quality standards. Keep going!

EPA has been very slow to accepting and approving use—Whatever we need to do to give confidence to regulatory community needs to be sped up and will help manufacturers if not EPA approved then difficult to get technologies advanced

Aquatic sensor workgroup (NWQMC) to assemble the technologies and instruments and get approved-- The process is much better and needs to move more quickly to get EPA Approval.

Natural waters are between waste and drinking water compliance issues. It is time to play the American leading technology in this area—we still are currently competing, but lots of competition from other countries

NJ coordinating council – must generate data of known quality and document—EPA Region II Flexible approval policy is working and accepts RTWQ data

Still need to have the EPA approval to be able to defend the findings and enforcement on each measurement

Turbidity is an example for enforcement and is messy because of the large differences among sensor readings

QA white paper on the NWQMC web site

Canada example and requirements transparency and product base is because of legislation have a seamless or apparent seamless relation with environment Canada-- have a robust agreement and it works!

Why aren't we there? (What are the technological and other impediments?)

Need to have regulatory community develop acceptance criteria that will allow for these continuous water-quality data to be used in enforcement activities--this feeds back into instrument design being done consistently and protocols—UK-EA MCERTS; ASTM, ISO 9001 and 14001

Expense

Need time to develop new technologies

Need upgrades for databases & data distribution procedures

Market driven technology development

Standardization and interoperability

Microfouling is a freshwater issue, coastal macrofouling has been addressed

Little understanding or will at policy/funding level for the benefits of coordinating efforts across national programs

How do we fill these gaps to get where we need to go?

Funding, More sites, Standardization? ? ASTM, EPA QAP, MCERTS, ?

Reduce barriers to use (decrease costs, streamline processes)

Demonstrate the utility of continuous monitors to researchers and management/regulatory agencies

Develop new applications and methods to mine information

Upgrade databases and online tools

Significant and sustained local, state and federal commitment to environmental monitoring, ie FUNDING is needed

Methods Board Aquatic Sensors Workgroup is public-private partnership formed to address some basic issues

Continue to pressure/communicate with national decision makers on benefits of long-term monitoring. Don't wait for upper level management to direct efforts: Coordinate amongst groups and leverage off times of change (e.g. DOI integrating computing environments)