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Report #EES 09-07

**REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY 28 JANUARY 2009**

SUBJECT **CORE AREA AND WEST SHORE WASTEWATER TREATMENT CHARACTERIZATION OF WASTEWATER – 2009 PROGRAM**

PURPOSE

To obtain approval for a wastewater characterization program in 2009 that will provide information on the quality of the wastewater to enable the design of the required wastewater treatment works.

BACKGROUND

With the requirement to provide wastewater treatment for the core area and west shore municipalities, substantial and reliable additional information is needed on the quality of the wastewater during a variety of weather and seasonal conditions and during a variety of time periods and flow conditions, including maximum day flow, maximum week flow and maximum month flow. This information will enable engineers to appropriately design wastewater treatment components and systems and to ensure that the required quality of effluent, biosolids, air and receiving water is achieved during all operating conditions.

A report on wastewater characterization was presented to the committee on 07 January 2009. The proposed work had an estimated cost of \$350,000. The committee requested additional information on two points:

1. Why not do additional monitoring for endocrine disrupting compounds (EDCs) under this characterization?
2. Why not undertake the additional monitoring for the potential future wastewater treatment plant sites now in order to assist in the decision-making on the wastewater management strategy?

Staff requested Richard Corbett of Associated Engineering, who attended the 07 January 2009 committee meeting, to respond to these questions and provide a cost estimate of doing any additional characterization work. The consultant's report is attached.

Regarding the first question, the consultant noted that:

... the CRD has already accumulated a significant database on EDCs through two partnering programs. The first was a collaborative study with Environment Canada, initiated in 2004, to determine the potential toxicogenomic effects of wastewater on marine fish (CRD, 2008). The second was a study with the University of Victoria on the assessment of PPCPs in wastewater and the determination of potential correlation with prescription rates and demographic data. The data have been collected but not yet published (CRD, 2008). This work to date equals or, in most cases, far exceeds what other wastewater utilities have done on this issue. The results to date indicate that the potential for adverse biological effects is low (CRD, 2008).

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Re: Core Area and West Shore Wastewater Treatment Characterization – 2009 Program
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and:

Based on the above, we feel that the existing level of data and understanding of the EDC issue is sufficient to allow the CRD to make the required decisions on a wastewater management strategy. We do, however, believe that the CRD should continue to be involved in EDC and other micro-constituent monitoring. We suggest that the best way to do this, is not to include it in the Wastewater Characterization Program, but to continue to participate in industry partnerships to obtain the data under a planned scientific protocol. This approach will ultimately provide the CRD with much better value.

Regarding the second question, the consultant concluded:

We are confident that the existing wastewater information is sufficient to allow the CRD to proceed with the decision-making process in the spring of 2009. The wastewater characterization program is primarily required to establish the data base for future detailed design and establishment of contractual performance conditions. At the present time, up to eleven wastewater treatment plants are being considered. A decision on the final number of plants is expected in mid-2009. While the additional monitoring can start earlier than planned, there is the question of value of the dollars spent, if a monitoring site is not ultimately chosen as a wastewater treatment plant site. We believe, however, that there is merit in moving some of the future monitoring forward to the summer of 2009. This is not to assist in the decision making, but to allow for the contingency that the CRD may wish to advance the construction of certain wastewater treatment plants, given the funding opportunities that may emerge in the coming months. We suggest that the proposed program of \$350,000 be increased to \$525,000 to enable monitoring at a minimum of four additional locations. This will allow the Committee to have the opportunity to start the additional monitoring, if warranted, in the summer of 2009, once the wastewater management strategy has been decided.

ALTERNATIVES

1. That the committee approve proceeding with the originally proposed characterization program at an estimated 2009 cost of \$350,000 to sample and test core area and west shore wastewater at two locations to provide information to facilitate treatment plant design.
2. That the committee approve proceeding with the expanded program at an estimated 2009 cost of \$525,000 to sample and test core area and west shore wastewater at a minimum of four locations to provide sufficient information to facilitate treatment plant design.

FINANCIAL IMPLICATIONS

The cost of the wastewater characterization work will be charged to Bylaw No. 3461.

SUMMARY/CONCLUSIONS

Detailed information is required on the characteristics of the core area and west shore wastewater for various time periods and under a variety of weather and seasonal conditions, to provide sufficient information to enable engineers to appropriately design wastewater treatment components and systems.

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RECOMMENDATIONS

That the Core Area Liquid Waste Management Committee approve:

1. proceeding with an expanded characterization program, at an estimated 2009 cost of \$525,000, to sample and test core area and west shore wastewater at a minimum of four locations to provide sufficient information to facilitate treatment plant design; and
2. a temporary staff person be engaged to collect and process the required wastewater samples daily and deliver or courier them to a laboratory for analysis.

Seamus B. McDonnell, PEng
Senior Manager, Engineering Services

Dwayne Kalynchuk, PEng
General Manager, Environmental Services
Concurrence

SMcD:cl
Attachment: 1

MEMO

Date: January 14, 2009 File No.: 20062935.04.E.03.04

To: Seamus McDonnell

From: Rick Corbett

Project: Core Area Wastewater Management Program

Subject: Wastewater Characterization Program – Response to CALWMC Comments

1 BACKGROUND

In a memo dated September 11, 2008, the Consulting Team proposed a wastewater characterization program that would build on the current program. The two sampling points in the initial year of the Program would be at Macaulay Point and Clover Point. These points were chosen as a significant data base was already available for these locations and the new information would allow historic trends to be better defined. The memo noted that as work continues on the Core Area Wastewater Management Program and the locations of the distributed wastewater treatment facilities are further refined, a modified characterization program will be needed to be implemented to provide information on the sewerage areas specific to these facilities. This was envisioned to start in 2010. The CRD staff used the information in this memo to prepare CALWMC Report #EES 08-94 entitled *Characterization of Wastewater – 2009 Program*, presented to the Committee at the January 7, 2009 meeting.

The Committee requested additional information on two points:

- Why not do additional monitoring for Endocrine Disrupting Compounds (EDCs) under this characterization?
- Why not undertake the additional monitoring for the potential future wastewater treatment plant sites now in order to assist in the decision making on the wastewater management strategy?

This memo provides information and recommendations on these two points.

2 ENDOCRINE DISRUPTING COMPOUNDS – THE NEED FOR ADDITIONAL MONITORING

Endocrine Disrupting Compounds (EDCs) are substances that affect the endocrine system in humans or animals, including fish. They are part of a broader group of compounds often referred to as “micro-constituents” or “emerging substances of concern”. One source of these compounds is pharmaceuticals and personal care products (PPCPs). We have attached a “Fact Sheet”, produced by the Water Environment Research Foundation (WERF) as background to these compounds and the implications in wastewater management.

In the context of the CRD and in the upcoming decision making on a wastewater management strategy, this emerging issue needs to be considered. This question raised by the Committee is essentially – do we have

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Seamus McDonnell

January 14, 2009

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enough information on the presence of EDCs in our sewerage system or would we benefit by doing additional monitoring at this time?

There are three points to consider in addressing these questions.

First, the CRD has already accumulated a significant database on EDCs through two partnering programs. The first was a collaborative study with Environment Canada, initiated in 2004, to determine the potential toxicogenomic effects of wastewater on marine fish (CRD, 2008). The second was a study with the University of Victoria on the assessment of PPCPs in wastewater and the determination of potential correlation with prescription rates and demographic data. The data have been collected but not yet published (CRD, 2008). This work to date equals or, in most cases, far exceeds what other wastewater utilities have done on this issue. The results to date indicate that the potential for adverse biological effects is low (CRD, 2008).

Second, undertaking EDC monitoring is fairly expensive. The very low concentrations require special sampling and expensive analytical work, as compared to the "conventional" parameters. Depending upon the suite of compounds being considered, typical costs are in the range of \$500 to \$2000 per sample. It is thus very easy to quickly spend several hundred thousand dollars.

Third, given the current understanding of this issue in the industry, the implications on treatment technology decisions are more subjective than quantitative. At this time, from ongoing research, we know that some biological secondary processes with long solids retention times, exhibit higher removals of EDCs than other processes. This understanding will allow the CRD to select processes that will provide the best performance, even if the regulatory and scientific communities have not yet defined the specific numerical goals.

Based on the above, we feel that the existing level of data and understanding of the EDC issue is sufficient to allow the CRD to make the required decisions on a wastewater management strategy. We do, however, believe that the CRD should continue to be involved in EDC and other micro-constituent monitoring. We suggest that the best way to do this, is not to include it the Wastewater Characterization Program, but to continue to participate in industry partnerships to obtain the data under a planned scientific protocol. This approach will ultimately provide the CRD with much better value.

3 WASTEWATER CHARACTERIZATION AT FUTURE POTENTIAL WWTP SITES

As noted above, it has always been the intention to ultimately do wastewater characterization, to the extent possible, on the raw wastewater at the actual wastewater treatment plant sites. This data is required to determine the subtle differences in the daily, weekly and monthly organic loading at specific locations, relative to the overall loading in the sewerage system, as measured at the two existing discharge locations. This data will be used, not to determine the treatment process, but to allow fine tuning of the design of process tankage. This will be



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Seamus McDonnell

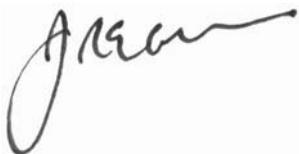
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particularly important if the CRD decides to transfer the contractual risk to an outside party through a competitive P3 process.

We are confident that the existing wastewater information is sufficient to allow the CRD to proceed with the decision making process in the spring of 2009. The wastewater characterization program is primarily required to establish the data base for future detailed design and establishment of contractual performance conditions. At the present time, up to eleven wastewater treatment plants are being considered. A decision on the final number of plants is expected in mid-2009. While the additional monitoring can start earlier than planned, there is the question of the value of the dollars spent, if a monitoring site is not ultimately chosen as a wastewater treatment plant site. We believe, however, that there is merit in moving some of the future monitoring forward to the summer of 2009. This is not to assist in the decision making, but to allow for the contingency that the CRD may wish to advance the construction of certain wastewater treatment plants, given the funding opportunities that may emerge in the coming months. We suggest that the proposed program of \$350,000 be increased to \$525,000 to enable monitoring at a minimum of four additional locations. This will allow the Committee to have the opportunity to start the additional monitoring, if warranted, in the summer of 2009, once the wastewater management strategy has been decided.

Prepared by:



J. Richard E. Corbett, M.A.Sc., P.Eng.
Project Manager

RC/kk

Attachment: WERF Fact Sheet – Endocrine Disrupting Compounds and Implications for Wastewater Treatment

REFERENCES

Capital Regional District, 2008. Macaulay and Clover Point Wastewater and Marine Environment Program – Annual Report 2007, Marine Programs Scientific Programs Division. October 2008.



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FACTsheet

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Definitions:

- **Effluent** - treated water leaving a wastewater treatment plant.
- **Endocrine system** - a network of glands that produce hormones which react with receptors to regulate biological processes.
- **Estrogen** - a hormone produced primarily in female sex organs responsible for expression of female characteristics.
- **Hormone** - a "chemical messenger" produced by a gland that travels through the blood to another organ, regulating the activity of that organ.
- **Risk assessment** - a process used to estimate the possible risks to human health or the environment by considering who might be exposed to a compound and what the effects of that exposure might be.



Endocrine Disrupting Compounds and Implications for Wastewater Treatment

What are Endocrine Disrupting Compounds (EDCs)?

Endocrine disrupting compounds (EDCs), sometimes also known as hormonally active agents or endocrine modulating compounds, are substances that can affect the endocrine system in humans or animals, including fish (see definition at left). This fact sheet uses the term endocrine disrupting compound because it is currently the most commonly used term, not necessarily the most scientifically accurate one.

EDCs can be natural or manmade chemicals. Most chemicals are not EDCs. For more information on the endocrine system and hormonally active agents, see

<http://www.epa.gov/scipoly/oscpendo/edspoview/primer.htm>

Where Do EDCs Come From?

Most common EDCs entering and leaving a wastewater treatment facility are naturally produced by plants and animals. Some are found in products we use. New laboratory methods have enabled us to detect these compounds nearly everywhere.

- Plants and plant products and byproducts are primary sources of these compounds. Products containing soy can contain hormonally active agents.
- Humans and other animals excrete compounds that are hormonally active and can be EDCs. These compounds can occur naturally because our bodies produce them or because they are in the milk, meat or vegetables we eat. They can also be in pharmaceuticals such as birth control pills.
- Plastics, and the manufacture of plastics, can release compounds called plasticizers, some of which are EDCs.
- Some pesticides can be hormonally active.
- Detergents contain compounds called surfactants that improve their cleaning power. Some surfactants can be hormonally active.
- Some other industrial products (or their byproducts) can contain EDCs.

Have EDCs Been Measured In Surface Water?

Researchers have found natural estrogens and other compounds that may be EDCs in the surface water near some wastewater treatment plants. In some instances, the measured concentrations occur at levels that have been found in the laboratory to cause effects on a hormone system in fish.

Are There Environmental Effects from Exposure to EDCs in Wastewater?

In Europe, populations of some fish species near some wastewater treatment plants have shown a range of effects attributed to compounds acting like the hormone estrogen. The specific compounds or conditions causing the effects are not clear. For the most part, researchers found the affected fish near treatment plants where the level of wastewater treatment is more limited than it is in the United States. While much of the research on these effects and their occurrence near wastewater treatment plants began in Europe, similar studies are now underway in the United States and there may be a claim of similar effects in the future. To date, no studies in the United States have effectively linked changes in fish populations to wastewater treatment plant discharges.

Researchers are gathering more data on which chemicals are EDCs, the effects they may have at different concentrations, and their fate in wastewater treatment plants and the environment. While those efforts are underway, it is important to understand that many of the EDCs in treatment plant releases occur naturally. The ecological effects attributed to EDCs in the effluents from wastewater treatment plants may, in fact, be caused by EDCs, but they may also

be caused by other conditions, such as temperature.

Should the Public Be Concerned About EDCs In Our Waterways?

When people read or hear reports of possible EDC effects in fish or other aquatic life downstream of a wastewater treatment plant, they may wonder whether they should be concerned about similar effects occurring in humans. Two things are important to remember.



First, no studies to date have effectively linked low concentrations of EDCs in wastewater to adverse health effects in humans. So while concern is an understandable response, no data currently show endocrine disruption in humans as the result of using rivers, lakes, and streams. Large studies have not indicated any association with effects that have sometimes been attributed to environmental exposure to EDCs: Low sperm counts, premature puberty in girls, testicular cancer in young men, and breast cancer in some women.

Second, the effects observed in fish and other aquatic organisms downstream of wastewater treatment plants and attributed to EDCs can also have other causes. Temperature can cause some of these changes. They may also simply represent natural variations in a population. That is not to say that the effects cannot be associated with EDCs in the discharge from a wastewater treatment plant. They might be, but clearly demonstrating a link is difficult.

Are EDCs Treated In the Wastewater Treatment Process?

According to published research, the most commonly used treatment approach can remove over 90% of many of the most common EDCs entering a treatment plant. Engineers design municipal wastewater treatment plants to remove conventional pollutants (solids and biodegradable organic material) from sanitary wastewater. Through their normal operation, those plants will also remove many types of EDCs.

What Are the Implications for Biosolids?

According to Merriam Webster's Collegiate Dictionary, 10th edition, the term "biosolids" refers to "solid organic matter recovered from the sewage treatment process" that is often composted and added to soils as a fertilizer. Biosolids may contain trace amounts of hormonally active compounds that were removed from wastewater during treatment. Detailed studies of the potential effects of other EDCs following land application of biosolids are generally not available yet, and understanding what happens to EDCs in solids is a topic of ongoing research.

What Are the Implications for Recycled Water?

"Recycled water" refers to the practice of using treated wastewater to irrigate areas such as parks, golf courses, or agricultural land. As described above, common forms of treatment will remove most of the mass of the EDCs before the water is recycled. However, more research is needed to understand the environmental consequences, if any, of low levels of EDCs in recycled water.

What Are the Implications for Drinking Water?

Some cities and towns draw their water supplies from surface waters that may contain EDCs from upstream discharges. Researchers have not evaluated the potential risks associated with all of the EDCs that may be in such drinking water supplies. Research on this subject continues. One researcher¹ found that environmental residues of 17-alpha-ethinylestradiol, one of the key and most studied ingredients of birth control pills, present a negligible risk to humans.

Why Do Opinions On EDCs Seem to Contradict One Another?

Laboratory and field studies produce data that can sometimes be difficult to interpret and don't easily translate from lab to field. In addition, it is often difficult to specify exactly which compound is causing an observed effect when there are so many variables, such as water temperature or natural variations in fish populations, that might also cause or contribute to an observed effect. Risk assessment, another common study method that scientists use, may predict results that can't be easily proved or disproved.

Also, it is impossible to prove a negative. When researchers find no effect after an exposure to a suspected EDC, that would suggest the absence of an effect. As more



¹ Christensen, F.M. (1998). Pharmaceuticals in the environment - A human risk? *Regulatory Toxicology & Pharmacology*, 28, 212-221.

and more researchers fail to find an association between an exposure and an effect, the scientific community becomes more and more confident that the exposure does not cause the effect. But all those negative results would still not prove the absence of an effect. It is always possible that the next experiment will find an association.

What Are the Regulatory Implications?

The U.S. EPA is at the very beginning of the process of determining if additional requirements to control sources of EDCs to the environment are needed. The U.S. EPA's Regulatory Activities Workgroup is reviewing the authorities that U.S. EPA may invoke to require testing, and are exploring considerations for establishing the process that U.S. EPA will use to require the testing. You can find out more about these programs at <http://www.epa.gov/scipoly/oscpendo/edspoview/primer.htm>.

References

AMEC Earth and Environmental produced this Fact Sheet for the Water Environment Research Foundation (WERF).

This Fact Sheet serves as a companion piece to *Technical Brief: Endocrine Disrupting Compounds and Implications for Wastewater Treatment* (stock no. 04WEM6).

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