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Drinking Water Engineering and Science Discussions

Interactive comment on "Efficient Online Source Identification Algorithm for Integration within Contamination Event Management System" *by* Jochen Deuerlein et al.

Anonymous Referee #1

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General Comments:

The manuscript "Efficient Online Source Identification Algorithm for Integration within Contamination Event Management System" describes an algorithm for the identification of the location of a contamination event in a water distribution system. I think the paper is interesting and should be published, because (as highlighted by the Authors) existing software and approaches are not implemented for a real-time (or near-real time) control. Therefore, this manuscript provides a clear contribution to the current knowledge. I think the paper is in general well written and I don't have any major issue. However, I think that the paper could be clarified in some aspects (see below). While I understand that the Authors may have been limited (in terms of paper length) by the

conference guidelines, I hope that the Journal will allow them to extend the manuscript, so that the content can be easily understood by a larger audience.

Specific Comments:

- Introduction, Line 27-28: I am not sure I understand this sentence. Do you mean that the algorithm is always running? Or it will be run (with a 1 minute time step) when there is an event?

- Introduction, Line 28-29: I don't understand why there could be problems with the order of calculations. Could you please explain it? (Are the calculations performed on multiple processors or something similar? Or is it in case some of the inputs from the network are delayed?) Or maybe you can move this line in page 4 (about line 29) and give some details here.

- Page 2, line 25: please, explain or give an example of external time step. I think this refers to the time step of the steady state hydraulic simulation (in contrast with the time step used in the method of characteristics), but please, confirm.

- Page 3, line 5: why are the computations performed even in case of no alarm? Maybe you can just refer the reader to section 4.2 (at least the reader will know that it will be explained somewhere).

- Page 3, line 15-17: "In combination with the event driven method, which means that instead of time driven simulations only changes in water quality at the boundaries are considered, the memory requirements are minimized." I don't understand what this sentence means. Could you please reword it? In particular, I don't understand the difference with time-driven simulation and event driven simulation.

- Page 3: line 25-26: "A specific weighting function has been developed that identifies the most probable locations for the contamination source based on the results of the backtracking method." Could you please give a bit more detail and explain why you need a weighting function? Is it to take into account possible sensor fail-

ures/malfunctioning or the fact that the concentration may be very small and not detected in some pipes/sensors?

- Page 4 lines 21-22: “Positive alarms are generated by the EMS as soon as a pending alarm is acknowledged by the operator. After pressing the Acknowledge Alarm button [. . .]”. I think the software developed has the capability to automatically generate an alarm and start the computations. Maybe, at this stage, this is not performed in order to avoid several false alarms (or other reasons). However, I think it could be good if you could highlight that the operator response could be avoided.

- Page 4, Line 24: could you please give more details about the choice of the worst case assumption? How is the single contamination source chosen? Is it the one that could affect the largest number of users (or the users with the largest demands or something else?). I think this is related to line 5 of page 5: does the backtracking algorithm always reach a water source? I think this depends on the location of the sensors and the contamination event: for example, if the contamination is after the source and you have a ‘negative’ sensor next to the source, the algorithm will select a pipe/node upstream of a ’positive’ sensor, but not the water source. I think you should clarify it in the manuscript. (I think you had this in page 8 lines 3-4, but I think it should be written (also) earlier in the paper).

- Fig 1: maybe you could add some information about the test network (e.g. total pipe length), in order to give an idea of how big the network was. Also, you may be able to show in the figure the location of the closed valve (which is described in line 18 of page 5).

- Page 8, line 10: Could you briefly discuss how these velocities are obtained? For example, are they computed from the hydraulic model based on some assumption on the demands? If so, this would introduce some uncertainty in the location of the contamination and the contamination zone. I understand that this is not the focus of this paper, but I think it should be mentioned. If the velocities are estimated/calculated

in a different way, please, provide some more details (e.g. do you have a real-time demand estimation algorithm?).

Technical Corrections:

- Please, check the references: in page 2, they are referred as [7] and [8] instead of using the Authors’ names. Also, I am not sure these references are reported at the end of the manuscript. - Please, add Shang et al 2012 to the references. - Eq 1a and 1b: please, define PDE, IC and the symbols in the equation (ct, cx, and c0) - Please, define IVP (Initial Value Problem) in line 13 of page 2. - Page 8, line 16: I think the sentence should read “While the run time [. . .] is considered to be sufficiently short also for large networks, [. . .]”

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