Stakeholder Participation in Sulphate Monitoring in Lake Nuasjärvi, Finland

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Abstract

Stakeholder participation in environmental monitoring may enhance the data collection process. The paper presents a pilot study of a stakeholder participation in water quality monitoring and explores reliability and validity factors of measurement results. In a pilot project at the Lake Nuasjärvi the community members used a mobile phone data management platform application to report commercial quality colorimetric reagent strips readings on site. The objective of the pilot was to assess preliminary monitoring solutions performance in field settings and to gather stakeholder experience in order to identify needs for further studies and to understand different stakeholder profiles and their needs.

During the pilot, a pilot group of five users observed selected monitoring points at lake Nuasjärvi. The results were collected from the mesurement devise to an information management platform. To minimize data unreliability, the calibrated primary data was run through a set of comparable datasets to identify and eliminate deviations.

Keywords: citizen observations, stakeholder participation, environmental assessment

Introduction

In 2012 a local mining operations at Talvivaara in Sotkamo municipality, Finland, nickel and sulfate leaked into a nearby water bodies. Due to damaged dam structures a water discharge exceeded the permitted quantities both in water volumes and in the allowed contaminant loads. In aftermath of the incident, the responsible corporation initiated a new discharge pipeline plan leading to a bigger water body, the lake Nuasjärvi, to prevent future environmental violation.

The pilot project intended to increase the amount and the availability of water quality data and to support stakeholder communications prior to the pipeline construction. (Accident incident reporting center, Onnettomuustutkintakeskus 2014) The field piloting for citizen observation in sulfate monitoring was carried out during during eight weeks in summer 2016. The pilot campaign was designed by Measurepolis Development (part of KAMK University of Applied Sciences since 7/2016), PHD Nordic Oy and SYKE.

One of the objective of the pilot was to build social capital in water quality measurement procedures among the community residing in the lake area, hereafter referred to as 'affected population'. Five households in the affected area were selected to participate in the pilot. Three were house owners and two were summertime residents. The screening questions included asking about previous participation and willingness to participate in a field experiment.

The selected participants had no prior professional training in water quality monitoring. They participated in a practical training session regarding the use and the readings of reagent strips, how to use the smartphone application to transfer the data, the monitoring sequence and the data management model. They also visited the monitoring sites and were informed of possible factors influencing accurate data

readings. After the initial training, the selected household carried out the data readings and transfer independently.

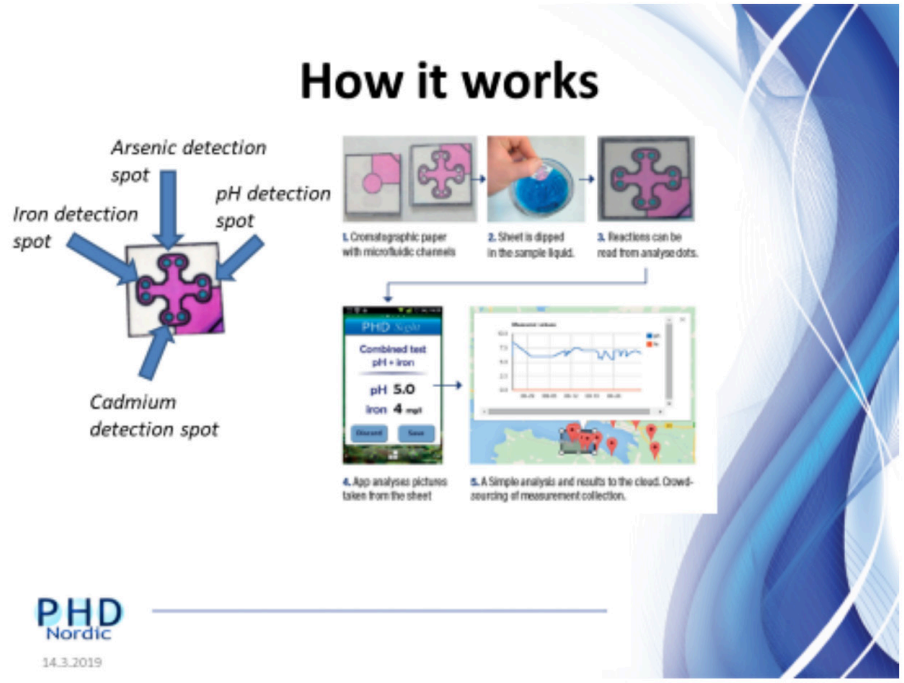
The stakeholder participation pilot took place prior to the installation of a water discharge pipeline. Presumably attitudes of the affected population could had been influenced by the widerspread media attention to the previous environmental accidents. All participants reported having followed up media discussion regarding the previous environmental accidents.

Data gathering and the analysis process

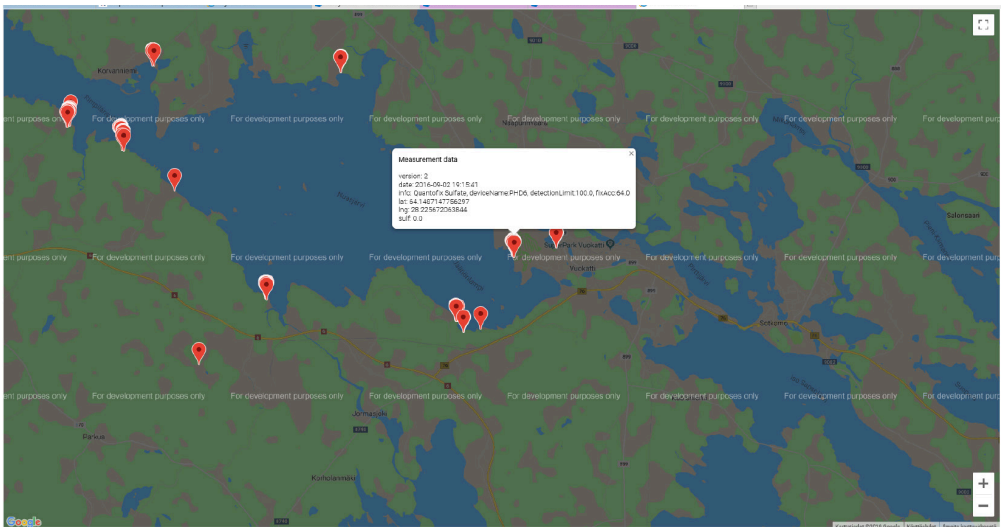
In the pilot project affected community members used a mobile phone data management platform (PHDSight) application to report commercial quality colorimetric reagent strips results on site. The PHDSight is developed by PHDNordic (SME) and Finnish Environmental Insitute (SYKE). The strips used in piloting were commercially available suplhate monitoring strips with sensitivity level of 220 pm, which was adequate to detect the possible exceeding of the permit limit control for total sulfate, but not the normal variation inside the environmental permit limit. Pilot users took two weekly readings for eight weeks.

In addition to building building social capital in water quality monitoring among the affected population, in general, the objective was also to gather field experience of monitoring devices, the strips, and to assess their usability and technical field performance. (PHD2018)

The selected monitoring method, whereas the basic principle is presented in Picture 1, consists of commercial colorimetric reagent strips. Smart phone camera is used to capture the readings with a calibrated color panel stabilizing the possible background lightning variations. The readings include location and time in order to show the results for a specific timely periods on a map. The colourmetric readings are transformed into numeric values and then transmitted using smartphones into information management solution PHD Sight and the Finnish Enviromental Insitute's database. Picture 2 shows the selected monitoring spots on the map and Picture 3 shows an example of a single measurement result. To avoid data gathering reliability



Picture 1 *Monitoring concept setup (courtesy PHDNordic).*



Picture 2: *Selected monitoring locations (courtesy PHDNordic).*

Picture 3 *Monitoring results with location and time info (courtesy PHDNordic).*

issues, the colorimetric readings are calibrated and the measurement readings, i.e. the primary data, is run through a comparable data set to identify and eliminate deviations.

The local information interface transfers the colorimetric information in the numerical values. In the pilot the numerical values were not shown locally before computing them. This was to prevent misleading conclusions in case of unaccurate or faulty measurement results.

In addition to industrial discharge, other factors, such as the seasonal rainfalls or swamp drainings, might influence the ph and sulphate levels in water bodies. Other uncertainty factors related to the selected method include reagent materials incorrect measurement procedures, external circumstances (eg. temperature or pH) or even misinformation provided in purpose.

No incidents which could have compromised field readings took place during the pilot. All participants were able to carry out the readings, to transfer the reading results and to receive the measurement reports in timely manner. All captured values

were in the range of environmental permit values, meaning no early warning indications occurred. Thus, no early warnings were initiated. A reading value out of the range of accetable sulphapte levels would have promted an early warning protocol including a repeated measurement.

Individual measurement readings were not shared with the affected population participating in the field measurement readings. Instead, we shared the summary data and a report with the stakeholders, who had participated in the field data gathering.

In addition to the five affected households, we conducted unstructed experts interviews prior to, during, and post the field pilot. The interviewees included two industry (mining) representatives, the environmental permit authority representativerepresentative, a local municipality administrator represenatative.

The mining industry representatives were responsible for environmental sustainability. It was agreed to keep the stakeholder participation field experiment separated from the mining corporation's activities. Nevertheless, industry representatives expressed their concern of 'sabotage' of monitoring by stakeholders participating in the field readings or by outsiders. However, they also expressed interest to incorporate stakeholder participation in their own practices as a way to strengthen the collaboration with community and as a way to build social capital and trust. The piloted measurement device and measuring protocol could be used in the internal corporate water quality monitoring. Colourmetric reagents for monitoring of various contaminans are widely available and the data processing could be tailored to the industrial needs. To sum up, the industry representatives found bout, the actual measurement process and the stakeholder participation, something they were willing to explore further in the future.

The public sector representative expressed concerned of the possibily distorted information. In the interview the public sector representative expressed views that the pilot might lead to an opinionated general discussion among the public and in the media. "No matter what you measure, the discussion could twist the results and conclude that toxicity is present because there is a need to measure it. Moreover, the measurements cannot be trusted because they are conducted by the affected community members. As a rule, environmental monitoring should be left with the publich sector authorities, and that reporting of the results requires the authority asserted by the public sector." Please note that this views are expressed by an individual public sector official and do not reflect the general official public sector statement.

The Centre for Economic Development, Transport and the Environment has the oversight function of the environmental permist. The representative stated that accuracy and validity needed to be explicity outlined in the field data collection. Nevertheless, similarity to the industry's willingness to experiment with the new monitoring concept, the public sector expressed interest in utilizing stakeholder participation, and view it as an opportunity to provide background information for the environmental permit control procedures.

Results – Pilot case experiences on usability and field performance of sulphate monitoring as stakeholder participation

Technical field performance of the selected monitoring setup was adequate and no incidents which could have compromised field readings took place during the pilot. All participants were able to carry out the readings, to transfer the reading results and to receive the measurement reports in timely manner. All readings were recorded in the database.

All captured values were below the detection limit, meaning no early warning indications occurred. Thus, no early warnings were initiated. A reading value out of the range of accetable sulphapte levels would have promted an early warning protocol including a repeated measurement and further involvement of accredited measurement protocol. The sensitivity of the available reagent strips follows the environmental permit value limit for exhaust water and some exceedings have been reported during the 2012 incident.

Pilot user interviews showed positive experiences on the usability; none of the pilot users found difficulties in the use of the selected monitoring solution. The pilot users found the participation as an interesting and motivating act, and volunteered to participate also in future if similar activities take place.

Other stakeholder interviews raised up underlying questions related to possible wider adaption of the method; industrial representatives saw the method as a possible additional part in their internal operations and community trust building rather than as a part of environmental permit control. Authority representative saw the method as a supportive part for their background operations, when the possible uncertainties related to a single measurement are not in a critical part. All the other interviewed stakeholders, others than the pilot users, stressed the need for careful information management protocol in order to mitigate the risk for distribution of intentionally distorted information.

Conclusions - Stakeholder Participation in Monitoring as a Component of a Wider CSR and Sustainbility Protocols

Affected community members described the participation in environmental field monitoring as a positive experience. Similar positive experiences in ICT assisted citizen observations have been reported in previous studies. (Gharesifard & Wehn 2014) Affected community members reported that the active participation strengthened their sense of being active members in their community. They commented the polarized and opinioned media coverage and reflected it on their experience carring out environmental field monitoring. Participants suggested that stakeholder participation in carrying out environmental monitoring could enhance the information available to general public.

In conclusion, while regonizing possible validity and reliablity issues we postulate that stakeholder participation in environmental monitoring may provide valuable additional data to enchande the more traditional montoring conducted by environmental authorities and industry representatives. Involving affected communities in field data readings allows more comprehensive data gathering and monitoring of larger and and also environmentally sensitive areas. Stakeholde participation offers a relative cost-effective methos of field data gathering compread to the monitoring conducted by expert firms. While monitoring by contracted experts is usually conducted on one-off basis, affected communities and other stakeholder could conduct monitoring in regural basis. A comprehensive data analysis aids to eliminate data deviations and improves the reliability of the field data.

In this field study we piloted stakeholder participation in the environmental monitoring by enagaging community members to conduct water quality readings. The concept has wider potential and more studies are warranted to explore new ways, how affected population could actively participate in sustainability monitoring instead of just serving as a passive audience receiving information from environmental agencies, industry representatives, local authories and media. The stakeholder participation in monitoring activies not only has the potential to provide more frequent and more nuance primary data, but also to cover wider areas than typically are covered by monitoring protocols. Furthermore, stakeholder participation could be included as a standard component of a wider CSR approach, and even as an activity of community engagement in SLO and FPIC processes.

In conclusion, active participation in the monitoring processes creats trust in the monitoring process. Stakeholder participation in environmental monitoring processes builds social capital and could be incorporate in the industry CSR practices. In fact, stakeholder participation involves affected population in obtaining the very social licence to operate.

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