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INTRODUCTION

Nowadays, more than 6500 petrol stations operate in Poland and each is a potential object which can impact on many susceptible parts of the environment. Spillage from fuel tank or pipelines makes soil and groundwater most endangered site and this are subjects of every monitoring system. It also could be realized what is the real level of influence and what is real land requirement to keep safety. In this paper consideration about petrol station influence was support on studies of sample station located in central Poland and was analyzed regarding environment and petroleum pollutants properties.

THE STRATEGY OF THE SUSTAINABLE DEVELOPMENT

The first definition of the sustainable development was originally formulated by Hans Carl von Carlowitz (1713) and it deal with forestry industry. This eighteenth century right described the way of husbanding the forest, depend on cutting out only as many trees, as many can grow in the same place, so the forest would not be liquidate and always allow to rebuilt itself.

Global definition of sustainable development was translated from Carlowitz and defined by the United Nations World Commission on Environment and Development ("Brundtland Report"), as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (United Nations World Commission on Environment and Development., 1987). Following prof. Jonathan Smith from the University of Sheffield, this is interpreted as those actions which, having regard to social, environmental and economic factors, and to short and term-term issues, maximize the overall benefit (Smith, 2009).

The strategy of the sustainable development concern:

- stimulating the processes of the development, as so to affect on the environment at the lowest degree,
- successive eliminating of economic actions that are harmful for environment and people's health,
- promoting the ways of "environmental friendly" management,
- accelerating actions of restoring the environment to the proper state.

Generalize the strategy of the sustainable development has defects:

- companies growing costs connected with the "environmentally friendly" policy
- higher prices of the products compare with the prices offered by the states not warning the principles of the sustainable development.
- setting- back the several areas of the economy
- development of the unethical business consist on using the items based on the environmental protection policy.

The strategy of the sustainable development pressures on keeping permanency of all processes, underplay local authorities capacity and still very general, described as social-economic development in which integration process of political, economical and social actions occurs and natural balance and constancy of basic natural processes are maintained.

Unfortunately, last few years European economic was dented because of changing economic reality and also soundness of all generally accepted principles. Everybody has to face up the growing crisis and its effects. Finding the way to react President J.M. Barroso at his presentation of to the Informal European Council of 11 February 2010 remarked that "Economic realities are moving faster than political realities" that is the one of main problems which many companies have to clash with. In opposition he pointed to three priorities should be the heart of Europe 2020:

- Smart growth – developing an economy based on knowledge and innovation.
- Sustainable growth – promoting a more resource efficient, greener and more competitive economy.
- Inclusive growth – fostering a high-employment economy delivering economic, social and territorial cohesion.

Barroso also said „The exit from the crisis marks the passage to the different economy from the exit from the crisis to the durable reconstruction, and not the return to the situation from before the crisis".

That idea was spreading earlier by The Sustainable Remediation Forum – UK (SuRF-UK), which is a multi-stakeholder initiative to develop a framework for sustainable remediation, which involves incorporating sustainable development principles in remediation (Pazdro, Kozerski, 1990). Established in 2007, it has involvement and support from industry, service providers, government agencies and academies.

SuRF-UK has defined sustainable remediation as the practice of demonstrating in terms of environmental, economic and social indicators, that an acceptable balance exists between the effects of undertaking remediation activities and the benefits the same activities will deliver (Pazdro, Kozerski, 1990).

In a wider context the SuRF-UK framework is applicable to any assessment of sustainable remediation or ground water monitoring, and it was drafted to be consistent with the requirements of the most recent draft of the EU Soil Protection Framework Directive, which required an assessment of environmental, social and economic considerations in selecting a sustainable remedial solution.

The purpose of cited views and ideas is to create initiative like the SuRF-UK, to discus, find new solutions and to generate framework for actions, also in Poland, which involves incorporating sustainable development principles in monitoring decision-making in case of supposed side effects of soil and groundwater contamination.

In the time of crisis we are forced to re-define many aspect of our activity. Profits, collaboration, competitions, development, costs, directions for future actions should not be steady. In this new situation also authorities are forced to re-define their expectations. Local authorities must fulfil new regulations in which new situation will be taken into consideration. All of us must use new ideas coming from "knowledge based economy" (Wrzecioniarz et al., 2010). Academics should help, using their specific knowledge, to reduce cost connected with environmental outsourcing and also to reduce the investors costs to grow up whole economy and let it be competitive in comparison to another companies which not fulfil specific environmental restrictions. There is

strong need to find common point of collaboration and proceed to enlarge "sustainable collaboration area" as much as it is possible (Fig.1).

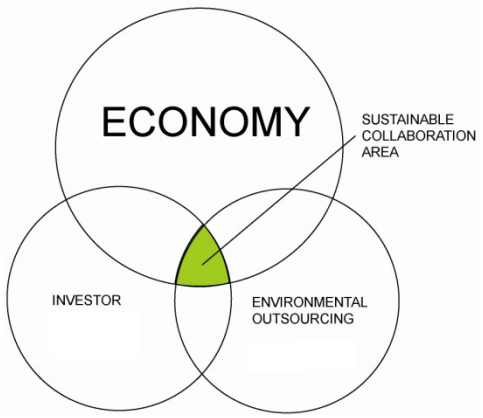

Figure 1. Sustainable development in recent years.

SUSTAINABLE DEVELOPMENT IN GROUND WATER ANALYSIS

The idea is to transfer the philosophy of SuRF-UK presented by prof. Smith and co-authors in this conference to more aspects of environmental protection actions. In reference to prof. Smith, re-definition is based on:

- Simple foundations are not always proper. Talking about influence on environment safety should contain all information about specific of this natural elements like soil and water character and properties.
- Minimization – optimization means in the strategy of the management to maximize benefits. Optimization doesn't mean minimization without subsistence high-level protection for environment, it's an action based on knowledge and technology in opposition to maximization means just for framework and ordinary actions.
- Considering the problem should be precede on all-embracing analysis (Pazdro, Kozerski, 1990).

It's hardly resisted on sustainable development UN definition and the idea was continued by SuRF-UK, formed that balance between actions and benefits is possible.

This redefined sustainable development ideas are applied for practical problems connected with monitoring of the influence of petrol stations to environment. It means to take kind of protection policies that could minimize of threats thereby minimize of the preventive repair costs. Reduction of sustainable development costs should take place on the basis knowledge and best available practice connected with specific hydrogeological know-how.

APPLICATION OF SUSTAINABLE DEVELOPMENT IN EUROPE

The upgrade idea of sustainable development was describe on the examples from Germany and Hungary. In several cases reduction of contamination of soil risk was conducted by natural attenuation and frequency of required groundwater monitoring visits were reduced.

German conception of reducing the risk of the pollutants is based on the process enabling the natural reduction of contaminating medium in the soil environment (NA – natural attenuation) (Solecki, 2005; Stupp, 2007, 2008). The biological schedule of BTEX (benzene, toluene, ethyl petrol, xylol) in the result of the redox reaction based on the microorganisms. Second level is modeling and prognosis the propagation of the pollution medium in soil environment, analysing the physical and chemical propriety of contamination and the influence of the soil parameters on the migration character.

Hungary applies similar solutions, where local authorities agree to cut a frequency of monitoring. In the 2009, 4 proposals of the monitoring reduction at the petrol stations were announced, one of them was approved, so it cause 25 percent reduction of monitoring cost.

Hereinafter in this paper more detailed solution will be presented for Poland.

Oil derivatives in ground

Considering ground and water pollution it's should be understood that no ground has the equal properties but every state can be recognize and described by characteristic ratios. Water and soil proprieties mainly determinate spreading of pollution, so the environment and its hydrogeological ratings determine protecting actions should be taken. Risk management should firstly establish that simple, basic questions to estimate time and place of predict contamination, different in various area.

Petrol and other petrochemicals concentrate in the soil environment as a liquid, create thin layer on the first groundwater table surface or in dispersed form in unsaturated and saturated zone. Its transport from the point of the injection begins when infiltrating in vadose water zone soil environment initially vertical, where it is partly contained by filling the pores of the soil and sorption. Areal spreading of pollution and speed and time which its reach the piezometer mostly depends on the groundwater level and the hydrodynamic (ratios) relations of the shallow groundwater stream. In fact, the migration of the contamination medium runs over water table surface, in line with a direction of the groundwater run-off. Linking the liquid character and filtration flow, the process of moving petrochemicals can be refer to the process of the groundwater flow. The physical proprieties of the soil and the physical proprieties of the liquid have the main leverage for these phenomena.

The frequency of groundwater monitoring should be mainly based on the contamination filtration speed in the specific soil conditions. It should verify all hydrogeological condition of local area, mainly to recognize filtration properties of soil which could be vulnerable for contaminant factors.

ANALYSIS FOR EXEMPLARY PETROL STATION IN POLAND

The exemplary area of the petrol station in located in Sieradz, central part of Poland. The soil profiles are typical for most subsoils in this part of Europe and it's determined by last quaternary glaciation. It's posed by bedding clay with sand and sand with clay. Local in the profile there are fluvioglacial sediments which formed one thin layer of fine sand, about 2 meters deep. This is unconfined aquifer with small flow rate. Contain to its genesis it's non-continious bed and has about 2 to 5 meters of thickness. Soil fine-grained type and thinckness of

the aquifer couses that hydromagnetics flow is very finite, so the possibility of migration of the contamination is finite as well.

Velocity of water in porous medium can be refer to liquid petrochemics contamination. Calculations one can bring back the soil to the speed of the migration of contaminant stepping out in the liquid form. This phenomenon describes Darcy's law.

$$v = k \cdot I$$

v - seepage velocity [m/s]
k - hydraulic conductivity [m/s]
I - hydraulic gradient [-]

Evaluating the velocity of the groundwater flow, firstly the hydraulic conductivity should be remarkable as resultant of soil graining and also physical properities of liquid.

$$k = K \frac{\gamma_r}{\eta_r}$$

k - hydraulic conductivity [m/s]
K - intrinsic permeability [m^2]
γ_r - specific weight of U95 petrol [N/m^3]
η_r - dynamic viscosity coefficient of U95 petrol [Ns/m^2]

In calculations here, the physical properities of specific weight and dynamic viscosity of benzine were assumpted as a contamination medium. Specific weight amount 72610 N/m^3, and the value of dynamic viscosity of petrol is 0,06 Ns/m^2.

The transmissivity coefficient of the mid-compacted fine sand which formed aquifer amount from 1 to 10 darcy. For calculations the enlarged value assumed 10 darcy, that is $0{,}987 \cdot 10^{-11}$ m^2.

So, the hydraulic conductivity is $1{,}19 \cdot 10^{-5}$ m/s, equal 1,03 m/d.

$$I = \frac{\Delta h}{l}$$

I - hydraulic gradient [-]
Δh - distinction of piezometric head
l - flow distance

The hydraulic gradient defines the change of the height of groundwater table which is established on known distance, in exemple for Sieradz, between piezometers P1 and P2. The way of groundwater flow is about 55 m. Average all results of seasonal piezometric table fluctuation of multiannual observation, disparity of piezometric table is 0,77 m. The hydraulic gradient amount to 0.014.

$$v = k \cdot I$$

v - seepage velocity [m/s]
k - hydraulic conductivity [m/s]
I - hydraulic gradient [-]

Substituting the values of the hydraulic conductivity and hydraulic gradien the velocity of the groundwater flow is about $1{,}67 \cdot 10^{-7}$ m/s, so that is 0,0144 m/d.

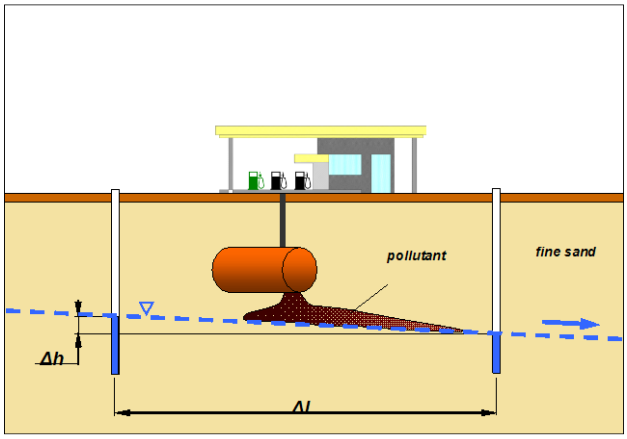

Figure 2. Migration of pollutant scheme.

In connection with the character of the soil, water movement is not homogeneous, which is caused by the pores in it, which have diiferent size, form and often are unconnected. The parameter of the effective porosity termed this feature and it is always smaller than the total porosity of the soil about 10-40%. For find sand described in the profile of this area the value of effective porosity is 0,2. Having the value of effective porosity and accounts the apparent velocity of the flow, the actual velocity of moving contaminetion medium could be compute.

$$V = \frac{v}{n_e}$$

V - average seepage velocity [m/s]
v - seepage velocity [m/s]
n_e - effective porosity

The velocity of the pollution liquid substance which is transport was calculated to 26,28 meters a year. Resting on groundwater levels from observation wells it can be infer that the water flow rate has SW direction. Basing on detailed site map minimum distance from the edge of the tank and other petrol devices, which can conaminate ground, is amount about 32 m from the P2 piezometer, which is located on the way of water flow.

Analyzing only the calculations of the aquifer flow velocity using the simplified Darcy's equation it should be noticed that petrochemicals also undergo natural biodegradation or sorption process. So that can be infer contamination medium from petrol tank couldn't reach to the piezometer in shorter time than one year. Moreover, all petrol station service carries on reservoir balance so the petrol wastage and pollution hazard could be noticed quicker then the monitoring does.

The monitoring of the first groundwater table, which is the mostly vulnerable for contamination causes by the working petrol station, is extremely necessary for environment safety and equilibrium. It supplies information about the quality of water, table fluctuation, and first of all it could recognize contamination endangering bound up with oil derivatives.

All the processes have to deal with are microscale, local problems, going on a small area, involving petrol station parcel, so it mainly whittle down the high-level risk of this human activity. At advantage land conditions to protection activities can be limited, but still based on strict, reliable and recurrent monitoring.

RISK ASSESSMENT

In analysis of approaches to prevent soil contamination an important common problem is how to assess the risk of a local activity of petrol station or already contaminated site. There is no such a thing as "universal risk assessment", because the way these problems should be answered can be very different. For local sources the risk should be assessed is associated with certain activities, technological abilities, failure range but mostly with soil condition of a land. The probability of a spill or leakage and, in the end, transport of a hazardous substance in soil and groundwater is the main problem in the assessment.

Unfortunately, there is still a strong need for uniform analysis and research procedures focus on environment protection actions with conform to universal directions of sustainable development. There is a wish for minimize risk in the name of sustainable development without identification of all conditions it could occur and which can influence on endangering scale.

Every taken action has to be oriented as much as possible to the objective of the monitoring. Sampling and analysing to get a better understanding of the possible effects of a contamination is important rather than getting an idea only about concentrations of a certain substance, without any notion of possible transport, risks and potential effect of hazardous substances. Practical boundaries, such as the time and space available to carry out remediation, could also limit the range of possible interventions.

The risk management should be re-oriented and, following EU Soil Framework Directive working groups: "(…) costs to be proportionate to environmental and social benefits" (Smith, 2009). Most pollution protect concepts have an environmental impact themselves, for example emissions of volatile fuel combustion products or energy consumption. Every steps, not only protection jobs, should be based on knowledge from simple qualitative methods to multi-criteria analysis of media involved in bio-process to amount the social, environmental and economic benefits to attain the aim. A scope of assessment methods based on a series of indicators are available to inform the decision-making units and start discussions to identify the optimum solution.

Sustainability assessment is possible, but it has to be done a framework to allow balanced decision making in the environment protection strategy.

CONCLUSION

The definition of sustainable development is still actual and many parts of human activity, not only environmental protection actions, is determined by rules which were described over 20 years ago. Following authorities and changing European economic situation we need to redefine of sustainable development in the day of the crisis, discuss and trying to use new conceptions, knowledge and keeping effectiveness and competitiveness. The main point is not to minimize safety measures at the cost of benefits, but to optimize preventive and repair actions to minimize the risk.

The risk assessment is main thing which should by analyses for local activity of petrol station or already contaminated site. In hydrogeological practice there is no such a thing as "universal conditions", so that there is no "universal risk assessment", because the way these problems should be answered can be very different.

On the basis of described ideas 30 sites located in Poland were selected to the preliminary program of costs reduction. Specific hydrogeological conditions of petrol stations areas are described and calculation were prepared. In 6 locations the amount of inspections are reduced. Local authorities were informed and the idea of cost reduction was also presented to the polish government (Chief Inspector for Environmental Protection). The program will be applied soon to the hydrogeological practice.

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