

# Observations on Effluent Limits for Stormwater Runoff from Construction

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**ABSTRACT.** EPA recently proposed Effluent Limit Guidelines (ELGs) for stormwater runoff from active construction sites. In addition, South Carolina DHEC has been developing a new Construction General Permit (CGP) for stormwater discharges from construction activities to be issued in late 2012 that does not include a turbidity limit as advanced by EPA. This presentation describes the process by which EPA developed its numeric limit for turbidity, and observations about issues that remain in applying such a numeric limit to South Carolina construction projects as will likely be required in the next CGP anticipated to be issued in 2017.

On December 1, 2009, the United States Environmental Protection Agency (EPA) promulgated a rule establishing requirements to reduce pollutants from construction and development sites, including a numeric limit of 280 nephelometric turbidity units (NTU) based on the application of polymer-aided settling, or passive treatment. The 280 NTU limit was based on EPA data from only 8 separate construction sites in the states of Washington, New York and North Carolina. Each site used polymer-aided settling in impoundments or channel applications.

On January 3, 2012, EPA published a notice in the Federal Register seeking data on the effectiveness and technologies for controlling turbidity in discharges from construction sites, as well as information on related issues.

Most of our careers have been spent working in the area of stormwater and sediment control from construction sites. The presentation includes our perspectives on: 1) establishing reasonable construction sediment control rules, and 2) assuring that systems are designed with validated procedures and a high probability of actually working to meet the required standards.

Based upon review of each section of the January 3, 2012 notice, along with identified reference materials as appropriate, observations on numeric effluent limitations for turbidity are provided in this presentation. Comments specifically reflect conditions in South Carolina for its major land resource area and a variety of project types.

Review of the 2009 Development Document and the DCNs mentioned in the January 3, 2012 Federal Register Notice make it plain that there is little turbidity data from construction sites and that very little of the data available to EPA should be used to set a local standard, and certainly not a national effluent standard. Additional issues pertain to the sampling and analysis procedures which are not specified and do not even meet EPA Method 180.1. Additional issues and alternatives will be discussed in subsequent sections.

There are practical steps to the regulatory process that, if followed, can result in significant improvements to the water quality for stormwater discharges from construction activities. At the same time, these steps can minimize the friction between regulators and those being regulated. When these steps are not followed, controversy normally arises resulting in political and legal battles that delay enforcement and create considerable chaos.

## INTRODUCTION

Most of our careers have been spent working in the area of stormwater and sediment control from construction sites and surface mining operations. We and our graduate students have developed technology for sediment control from highly disturbed sites using laboratory studies, rainfall simulator analysis, small field scale studies, small watershed, and actual field demonstrations using actual construction sites. Further, we have developed a number of process based state-of-the-art computer models to analyze and design stormwater and sediment loading and best management practices (BMPs). These models have been validated with laboratory and field studies and have been widely used in the construction and mining industry for over 30 years. The research has been published in a variety of venues including engineering and hydrology journals, transactions, conference proceedings, and book chapters (over 250). In addition, starting in 1977, we taught stormwater and sediment control multiday workshops to engineer and hydrology professionals throughout the US

and in a number of foreign countries, as well as teaching over 6000 people how to inspect erosion prevention and sediment control practices. Also, we authored or coauthored three widely used textbooks on the subject. In the late 1970's, when the Office of Surface Mining (OSM) and EPA decided to modify sediment effluent standards from a TSS standard to a settleable solids standard that could be met with the technology available at that time, Bill and his students provided computer models that were used to evaluate the system. We have served as a consultant to state and federal organizations including EPA, OSM, USDA, DHEC, and SCDOT as well as a number of and local agencies private companies, mining and consulting firms throughout the country. We developed the sediment control design aids for South Carolina, Georgia, and Louisville, KY that are used to design sediment control systems. The following are our perspectives on: 1) establishing reasonable construction sediment control rules, and 2) assuring that systems are designed with validated procedures and a high probability or actually working to meet the required standards.

Having each worked in the area of stormwater and sediment control for construction and surface mining sites over the past 35 years, we have concluded that there are some practical steps to the regulatory process that, if followed, can result in significant improvements to water quality from construction site runoff. At the same time, these steps can minimize the friction between regulators and those being regulated. When these steps are not followed, a controversy normally arises resulting in political and legal battles that delay enforcement and create considerable chaos. Before listing these steps, we first must state that these steps are the product of our common thinking and should not be blamed on any other person or organization.

We would also like to state that we make the following statements with considerable reservation. In spite of 35 years of research, teaching, consulting, and advising experience in this field, we are still learning new things every day about sediment control. Certainly, we do not pretend to know all the answers. If the following comments are helpful, we will be pleased.

#### PROPOSED STEPS TO EFFECTIVE AND REASONABLE REGULATIONS

Our proposed steps to effective and reasonable regulations that can be reasonably implemented for construction sediment control are as follows:

1. Try hard to chew the elephant one bite at a time. When trying to swallow dramatic changes in an industry regulatory program all at one time, the numerous unanticipated issues that invariably arise tend to create major problems and ill will for

everyone. It is best to not try to swallow the elephant in one bite.

2. Be sure that the standards and procedures being proposed can be met with technology that has been well established in both laboratory and field studies that span the duration of typical construction projects and other disturbance operations. When a well validated procedure is available, it is much easier to obtain industry acceptance.
3. A system will not be built on a construction that is any better than the design included in the regulatory permit package. This leads to the following bullets:
  - a. The first line of defense against inadequate sediment controls is to assure that the design has a high probability of successfully meeting the regulatory standard.
  - b. It is usually obvious which characteristics of the watershed and the sediment control system have the most impact on the probability of a design being adequate to meet the standard. If the design procedure does not consider those characteristics, it likely will not give dependable designs. For example, design based only on a detention time and runoff volume for a detention basin being used for sediment control will not consider the most important parameter impacting trapping, i.e. the size distribution of the sediment. Also, if the design does not consider whether the sediment is only primary particles or has primary particles plus aggregates, it is likely not properly designed.
  - c. Resist using simple rules of thumb for design. For a rule of thumb to be sufficient, it should be conservative enough to cover almost all possible scenarios. For example, when the newly established Office of Surface Mining first proposed a standard for sediment, it selected design criteria of a 24-hour detention time in a 10-year, 24-hour storm. Obviously, flows with a high concentration of sand and silt will have a much lower TSS in the effluent than a flow with a high concentration of clay sized particles.
  - d. The only way to perform adequate design is to require the use a well validated, science- based procedure to design sediment control systems to meet the standards being promulgated.
  - e. It is better to prevent erosion from occurring in the first place than to try and remove sediment from runoff. Proper construction site management, staging, minimizing disturbed areas, and rapid stabilization and vegetation establishment should be the key features in all Erosion & Sediment control plans.

4. Require that the land disturbance permit include simulations with those procedures to show that the proposed design has a high probability of meeting the standard. If alternative procedures are used to perform the design, require proof that the alternative procedure is well documented and validated with field studies.
5. If sampling is required to assure that standards are being met, don't punish those who are trying to do the right thing and meet the standard and reward those who are trying to cook the books. This comment leads to the following bullets:
  - a. The EPA development document<sup>1</sup> states "Turbidity measurement is a simple measurement that requires only the turbidimeter and can be conducted in the field . . . Turbidity measurement does not require any sample preparation, other than shaking the sample bottle well before analysis." My experience and that of my colleagues is in serious contrast to this statement.
  - b. Our experience is that the location of the sample collection is very important and that the timing of the reading on the turbidity meter after the sample vial is inserted into the meter can make huge differences in the reading.
  - c. Further, maintaining instrument calibration to a primary or secondary standard is very problematic. Depending on the material used for developing standard samples, readings can change dramatically.
  - d. Variations in readings between different manufactured brands of calibrated turbidimeters can be very significant and are particularly critical if the value is delineating compliance with a numeric limit.
  - e. In addition to the issue of accurately measuring the turbidity in a sample, there is the issue of the sample collection itself. Our experience is that the best place to collect a sample is at the outflow of a principal spillway pipe or at the overflow of a weir where the flow tends to be highly turbulent and well mixed. The sample bottle should be moved across the outflow in order to gain a representative sample. To do this, a sample bottle considerably larger than the small vial used in manufactured portable meters is required. This will require that a large sample be collected (1 to 2 liters or more, stirred well, and while stirring, pass the small turbidimeter vial through the larger sample to collect the sample.
  - f. Shake the vial vigorously, place in the meter, and take a reading as soon as possible (in a few seconds, not minutes).
  - g. Given these issues and based on years of collecting water samples in the field, we would claim that "accurate" measurement of turbidity is not a simple task. If dilution of a sample is required, as described in Method 180.1, the issue of accurate turbidity measurement becomes even more problematic.
  - h. Because of these difficulties and the lack of significant oversight that states can afford, both economically and politically, to the construction industry, the system is fraught with opportunities to accidentally or intentionally bias the results.
6. Give strong consideration to phasing in the rules, starting with a standard that can be met with current, widely available technology. The following observations may be helpful on this.
  - a. Currently, modeling software is readily available to predict settleable solids concentration in the effluent from sediment ponds and other BMPs.
  - b. A settleable solids concentration of 0.5 mL/L has been used by EPA for surface mining and by some states and local governments. Examples include South Carolina and Louisville, KY.
  - c. After a reasonable amount of time (perhaps 3 years) and after research and demonstration has shown that a reasonable TSS standard can be met, then transition to a TSS standard. Models are available to predict TSS in effluent from sediment ponds. TSS is generally considered to be a direct indicator of the quality of water that actually affects life in the water as compared to turbidity that indicates how the water looks.
  - d. When the technology is sufficiently developed to predict turbidity as a function of TSS, soil characteristics, and flocculent used, make a transition to a turbidity standard, if desirable.

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<sup>1</sup> EPA Development Document for Final Effluent Guidelines and Standards for the Construction and Development Category, Nov 2009.