1.0 INTRODUCTION AND BACKGROUND:

Sewer utilities in developed countries face the need to avoid the possible adverse effects of non-domestic discharges to municipal sanitary sewer systems. A number of approaches have been used to achieve this purpose. Most established sewer systems have some type of regulation (“sewer ordinance”) governing the type and amounts of materials which can be discharged to them. A key question in such cases is how to determine if a given discharge is or not acceptable in a sewer system. Experiences in Puerto Rico will be used to develop criteria which can be applied on purely technical bases and which is independent of prevailing regulations. Such criteria can be applied to any area, with their use being particularly suited for areas where no controls exist at the present time.

In Puerto Rico, the Puerto Rico Aqueduct and Sewer Authority (PRASA), which is the agency that provides water and sewer service throughout the island, has had regulations for the control of non-domestic discharges to the sanitary sewer system since May 15, 1958. The original regulations, similar to many sewer use ordinances in the United States, set maximum allowable values for discharges to the sewer, and also included a surcharge mechanism to allow for discharges which materially differed from the characteristics of domestic, or municipal, wastewaters. From 1958 to the mid-1980’s, the resources dedicated by PRASA to the enforcement of these regulations were limited, and application concentrated on the occasional imposition of sewer surcharges and to cases where gross problems were caused by a given discharge. For the sake of fairness, it should be stated that similar situations occurred in most major sewer utilities in the United States and elsewhere.

As a result of the requirements of Section 307(b) of the Clean Water Act, the United States Environmental Protection Agency (EPA) developed requirements for a pretreatment program. This program consists of a highly legalistic framework, requiring the issuance of permits, creating enforcement mechanisms and developing a number of specific treatment standards which apply throughout the United States. Since Puerto Rico is part of the United States regulatory system,
these laws and regulations became applicable to the island.

PRASA undertook in the early 1980's a detailed review of existing regulations, aimed at modifying the regulations to conform to EPA's requirements for pretreatment programs. Work performed included a detailed sampling program and a regulatory review. The results of this program were summarized in a document titled "Amendments to Certain Sections of the Regulations for Water and Sewer Service," which is commonly known as the "Pretreatment Regulation," and which became effective in 1985. This document served as the basis for the initial implementation of the pretreatment program throughout Puerto Rico, which began in 1987 and was completed by the end of 1992.

During the implementation of the pretreatment program, some problems with the original pretreatment regulation became apparent. The PRASA regulation is highly specific, with detailed limits for a number of parameters representative of the characteristics of discharges. Questions arose as to the bases for regulating certain parameters, the appropriateness of the methods used to determine payment for non-domestic discharges, the interaction between NPDES permits and pretreatment limitations and the possible effect of EPA's 40 CFR 503 sludge regulations on pretreatment limits. These questions made evident to both PRASA and the regulated community that a revision of the regulations was necessary.

To accomplish this revision, a major review process was undertaken. The review covered both legal and technical aspects, and included representatives from PRASA, other government agencies, users, law firms, trade associations and universities. A key portion of this review was a detailed review of the technical bases of the regulations. The result of the effort was a revised version of the regulation which addresses most of the concerns caused by the original one. The partnering effort undertaken by the workgroup on this matter is an example of the way in which public and private forces can collaborate in a mutually beneficial and efficient manner. From the technical review, a number of conclusions were obtained which can be applied to allow any sewer system to determine if a given discharge can be accepted, based strictly on technical aspects. These findings will be summarized in this presentation.

2.0 PRESENT ENVIRONMENTAL REGULATORY PROCESS IN PUERTO RICO:

In the United States, environmental management efforts tend to be legalistically oriented. Since the creation of the Clean Water Act, the Clean Air Act and other environmental legislation of the 1970's, the environmental management process has been politically driven, with decreasing attention on scientific and technical aspects on which regulations should be based. For example, many scientists have criticized recent U.S. legislation on the so-called "global warming" phenomenon for being based more on emotion and politics than in objective scientific evidence.

The discipline of "environmental law" has developed to handle the increasing mass (mess?) of laws and regulations. Unfortunately, this trend has extended to Puerto Rico, and most arguments about proposed measures for environmental management revolve around the way regulations are
interpreted. In many unfortunate cases, key decisions are delegated to attorneys with little or no scientific or technical training, and are based on interpretations of the letter of the law and permit conditions, ignoring fundamental principles. This often results in less-than-optimal solutions, and sometimes in results that are technically absurd. In fairness, it should be stated that both regulators and the regulated community are equally to blame on this matter.

3.0 APPROACH TO TECHNICAL REVISION OF THE REGULATIONS- BACK TO BASICS:

Because of the above phenomenon, when the revision of the PRASA regulation was to be undertaken, it was decided to go "back to basics" and try, whenever possible, to determine the technical bases for both existing and proposed regulations. The technical and scientific reasoning behind each condition in the present regulations was questioned. This led to some very interesting conclusions which have universal applicability, as will be demonstrated below:

Municipal sewer systems are meant to convey domestic effluents to a central facility for treatment. The concept of centralized treatment facilities served by a sewer system originated in the early twentieth century as a way of preventing the adverse effects of inadequate individual mechanisms of treating and disposing of wastewaters on human health and the environment.

Centralized treatment facilities for municipal effluents (with the exception of special cases, such as Puerto Rico's Barceloneta regional plant) are usually designed to handle a limited amount of industrial wastewaters. Setting regulatory considerations aside for the moment, if the industrial effluents are not compatible with the treatment facility or the sewer system, problems will occur. A non-domestic effluent management (usually referred to as "pretreatment") program is aimed at assuring that nondomestic effluents discharged to the sewer system do not cause adverse effects on the collection and treatment system, and on personnel attending these systems. Furthermore, treated effluents and residuals from the centralized treatment facility should not adversely affect human health or the environment.

Thus, on a conceptual basis, the objective of a pretreatment program can be stated as ensuring that non-domestic discharges to the sewer maintain a level of quality which will not adversely affect the collection, treatment and disposal system, nor the quality of receiving waters. Simplistically, this is often expressed as “making the quality of industrial effluents approximate that of domestic sewage.”

4.0 THE FIVE BASIC FACTORS FOR THE MANAGEMENT OF NON-DOMESTIC EFFLUENTS IN MUNICIPAL SEWERS:

With the previous objective in mind, it was found that five (5) basic factors must be considered in the management of any non-domestic discharge to municipal sewer systems. The factors are not
new. Actually, they are really another way of presenting the scientific concept behind the EPA general pretreatment regulations presented in Section 403 of the Code of Federal Regulations. These five factors are:

1) **Prevention of adverse effects on the collection system**

2) **Protection of personnel working in the collection and treatment systems;**

3) **Preventing adverse effects on treatment processes;**

4) **Preventing interference with the disposal or beneficial use of residuals;** and

5) **Preventing adverse effects on receiving bodies of water.**

These factors can be applied independently of any regulation or law, and will always lead to an environmentally sound and technically reasonable solution to a non-domestic effluent management problem. For this reason, they can be considered to be universally applicable, since they will automatically adjust to any local variables in regulations or discharge conditions.

**5.0 DISCUSSION OF THE FIVE BASIC FACTORS:**

The implications of the five basic factors, together with some real-life examples of their application, will be discussed in detail in this section. Each factor will be individually discussed.

**5.1 Prevention of adverse effects on the collection system:**

This should be self-evident. No discharges which can impair the integrity and proper operation of the collection system should be accepted. Examples include: flammable materials, corrosives, substances which can attack sewer pipe or joints, discharges with excessively high temperatures, etc. This also includes materials which can cause obstructions, such as excessive amounts of grease and solids. Another category includes effluents discharged at excessively high flowrates in a manner which can exceed the capacity of the sewer and cause overflows, etc.

**5.2 Protection of personnel working in the collection and treatment systems:**

Any materials which can unnecessarily endanger the safety and health of utility personnel should not be allowed. In applying this factor, it should be remembered that sewage itself is pathogenic and presents real dangers to workers exposed to it, so a degree of risk will always exist. However, materials which would cause risk to be greater than what is normally experienced by utility workers should not be allowed. Essentially, this condition applies to substances such as corrosives, flammables and to substances which may react violently. It would also apply to discharges whose constituents may adversely affect the health of workers, such as those emitting toxic or noxious fumes, substances which are toxic or cause irritation on skin contact, and other
similar cases.

5.3 Preventing adverse effects on treatment processes:

When treatment processes are used to manage effluents, any materials which may adversely affect the proper operation of these processes should be avoided. Examples include substances which inhibit or kill the organisms used for biological treatment; substances which clog the screens used in a physical treatment plant; substances which can impede the effect of sedimentation on a primary plant, etc. It can also apply to substances which the treatment system can normally handle, when these are discharged in amounts which overwhelm the capacity of the system. A number of methods which can be used to determine if a given discharge can be handled in a treatment system can be found in the literature. These methods should be used whenever questions exist as to the possible effects of a given discharge on a plant.

5.4 Preventing interference with the disposal or beneficial use of residuals:

Even if a discharge can be safely managed in a treatment system, it should not be accepted if it adversely affects the quality of residuals generated from treatment. For example, in a system which uses residuals (“sludge”) as soil conditioners for agriculture, discharge to the sewer of a substance which would end up in sludge and adversely affect the crops grown on soil where the soil conditioner is applied should not be allowed.

5.5 Preventing adverse effects on receiving bodies of water.

A discharge which, after passing through the collection and treatment system, causes adverse effects on receiving waters should not be accepted. For example, a highly colored effluent may be safely managed in a municipal plant, but the amount of color left in the effluent may be so high that it would interfere with subsequent use of water from a river receiving the discharge. Another example would the discharge of a substance with toxic effects on marine organisms to a system which disposes of wastewaters by direct discharge to the ocean via a long outfall and diffuser system. The presence of adverse effects on receiving bodies of water essentially negates the intention of effluent collection and management systems.

It should be evident that any case involving a proposed non-domestic discharge to a municipal sewer system can be analyzed by applying these five factors systematically. If properly applied, the factors will always yield an environmentally sound solution.

6.0 A REAL-LIFE CASE: THE PRASA PRETREATMENT REGULATION:

As stated previously, the five criteria were systematically applied during the review of the PRASA pretreatment regulation. Application resulted in a number of major recommendations, aimed at making the PRASA pretreatment program more effective. The recommended major changes were the following:
• Reducing the maximum allowable temperature for sewer discharges from 80°C to 65°C, due to the potential effect of high temperatures on the structural integrity of sewers made of plastic, which are becoming the norm in Puerto Rico.

• Modifying the allowable pH of sewer discharges to allow discharges in the 6.0 to 9.0 range, with pH values of 5.0 to 10.0 allowable for a total of not over 5% of the time.

• Modifying the current limitations for oil and grease to use different limitations for edible greases and greases of mineral origin.

• Eliminating the generally applicable limitations for aluminum, iron, and tin, due to no evidence of harmful effects on receiving waters, treatment processes or sludge disposal from these parameters. Increasing the generally applicable limitation for manganese to 4.0 mg/L for the same reasons.

• Removing the generally applicable limitation for total phenolics, due to evidence of the great biodegradability of most phenolic compounds, and replacing it with limitations for nonbiodegradable, toxic phenolics (identified in the EPA Priority Pollutants test), developed as may be required on a case-by-case basis.

• Eliminating the limitation on settleable solids discharged to primary plants and using total suspended solids as the basis for controlling solids discharged to the sewer system.

• Finding that generally applicable limitations for some parameters may have to be changed to account for possible effects on sludge treatment and disposal.

7.0 CONCLUSIONS AND RECOMMENDATIONS:

By applying the five factors in a systematic manner, the highly complex PRASA regulation was both simplified and made more effective. It is recommended that a similar systematic approach, based on the five fundamental factors, be used whenever a decision on non-domestic discharges to a municipal sewer system is faced by a utility, municipality or regulatory agency.

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