



All You Need to Know About

WASTEWATER TREATABILITY STUDIES

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Chapter One

WHAT IS A WASTEWATER TREATABILITY STUDY AND HOW DOES IT WORK?



WASTEWATER TREATABILITY STUDIES

What they are and how they work

When our customers come to us for separation/purification solutions, many times we need to begin the process with a treatability study. Treatability studies can be performed on all kinds of streams, but for this e-book, we'll focus on wastewater in particular.

With this in mind, you might be wondering, **“What is a wastewater treatability study and how does it work?”** A broken down and simplified answer is below:

What is a treatability study?

A wastewater treatability study is a study or test that tells us **how the wastewater might be treated**. If the study is done correctly, it will clearly identify the problem you're seeing in your wastewater stream, helping ensure the proper treatment solutions are considered.

For wastewater, the treatability study should also factor in local discharge regulations and whether you release your waste to a local municipality or to the environment. For example, a plant that discharges to the local municipal sewer would need to meet guidelines outlined by that municipal facility to avoid violating permits for discharging into the sewer. Other facilities will have



federal and state permits for discharging to a nearby waterway (called a watershed), and that would be to a local river, stream, lake, etc.

Therefore, when you're looking for someone to complete your treatability study, make sure they understand what discharge regulations your plant is required to meet as they will be able to better understand the chemistry of the wastewater stream you should be aiming for.

How does a treatability study work?

Identifying the problem

Once your plant communicates what you think the problem is to the company you hire to perform the test, they will conduct a study to determine how to pretreat whatever your concerns are while also testing for other problematic contaminants.

Let's just say, for example, that a plant processes metals—maybe a metal plating facility like a chrome or zinc plater—and suddenly residual metals are present in the wastewater, which are prohibited to be discharged in just about any receiving watershed or municipality. The company performing the study would start by taking a sample of the wastewater, aiming to identify what they think the problem is through analytical means (called a characterization study). They would then continue the study by taking it through a stepwise process to narrow down the most effective solution(s).



How long does it take to get results?

Depending on the scope and nature of the treatability study, it could take anywhere from a few weeks to approximately 90 days to come up with accurate results. For example, if a plant experiences a remedial event, such as a spill or contamination in their wastewater, and they need someone on-site immediately, the company performing the test will usually mobilize and set up in a laboratory on the premise. Other, more normal cases will have the samples sent out to a lab for analysis, which can add a bit more time.

Even if you are sending out the samples to an off-site lab, a treatability study for something straightforward could take about two weeks. The timeline would likely be a few days in the laboratory, a few days interpreting the data, and a week or two for the analytical reports to come in.

In a more complicated situation, such as having to treat organics and other complex materials, you should allow for up to 90 days. This would be a more extreme situation, but it does happen.

Local and EPA regulations

The company performing your study will usually deal with the engineer at your plant that is operating the problematic process. They will also interface with the environmental expert at your facility because they are closely involved with the regulatory aspects. Is it an air pollution violation? A wastewater violation? The company will need to gear their work toward meeting or superseding the environmental regulations set for your plant.



The company that performs your treatability study might also be well acquainted with the recommended Environmental Protection Agency's (EPA) testing recommendations and guidelines as they offer a thorough, stepwise approach for identifying contaminants and determining the success of the treatment. The EPA also has its own set of laws and regulations, so make sure you're also aware of the compliance guidelines outlined for your industry.

Alternative treatment methods

Once the treatability study is complete and the problem is identified, sometimes a plant will opt to test different solutions by initially using some conventional technologies to remove the contaminants from the solution.

Once they establish that they can removed the contaminants successfully, they will then scale-up the scope of the technology to sufficiently handle the full process. Sometimes this is done by renting or purchasing a piece of equipment, and other times this involves modifying and working within the plant's existing system.

Be sure that the company you go to for equipment doesn't just sell that one piece of equipment and keep in mind that there is usually more than one treatment available for your problem. A reputable company will perform the treatability study and recommend different solutions based on the most efficient technology recommendations for your plant and not base their advice on the one or two solutions they have on the shelf.



Chapter Two

DOES YOUR FACILITY NEED A WASTEWATER TREATABILITY STUDY?



DO YOU NEED A WASTEWATER TREATABILITY STUDY?

How to know if it's necessary

Many of our customers often require some type of treatability study when they look to us for wastewater treatment solutions. As mentioned in prior text, this type of study or testing **determines how wastewater might be treated**, helping ensure proper treatments are considered. These tests can be useful—especially when there are several variables in wastewater streams and resolutions and technologies—at pinpointing exactly what problem the plant is experiencing and taking out the guesswork when it comes to finding the ideal solution.

If a facility is looking to treat its wastewater, whether for reusing in a process or discharging to the local environment or municipality, you might be wondering, **“How can I tell if a wastewater treatability study is necessary?”**

Below, we point out the scenarios where a wastewater treatability study is likely needed:



An unidentified contaminant is causing an upset in the wastewater treatment process

Wastewater treatment plant operators often conduct treatability studies (at least to some extent) in their daily routines to ensure their process is running optimally, but sometimes problems exceed the normal day-to-day parameters experienced. Usually this occurs when a facility is unable to pinpoint what contaminant or issue is causing wastewater treatment upset, which would warrant a wastewater treatability study. In these situations, there is always some kind of unknown, and **you would have to be 100% sure which contaminants are present and how they vary over time (and to what degree) in order to waive the study.**

For example, your facility might not need a treatability study if the company conducting the study has dealt with an *identical* situation or if your facility has a problem that keeps occurring and the designated solutions had previously worked. In these types of situations, the previously helpful solutions might be adapted to fix the issue moving forward.

A more specific example is in the metal plating industry, which has complex steps for removing metals from wastewater prior to discharge. If people operating the plating baths change their process upstream from time to time, and the discharge from the plating bath goes to the wastewater treatment area, it could disrupt the treatment process and cause it to fail. This happens sometimes when the process team doesn't regularly communicate with the wastewater treatment specialists.



But typically, the complaint from a wastewater treatment operator is that **the process is upset and he or she doesn't know why**, and this is where a treatability study is necessary to point out problem-causing contaminants and narrow down the technologies that can help.

Current wastewater treatment solutions aren't working

Many plants have complicated wastewater treatment handling systems and often work with local cities, municipalities, or authorities for final treatment and disposal. Sometimes the varying processes within the facilities generate different types wastewaters, and **it can be tempting to treat the wastewater contamination issues as they surface**. This can lead to more serious issues that cause wastewater treatment sequences to collapse, as one system often affects another.

At this point, treatability studies are often necessary to get a complete and clear picture of what is causing the process and system upsets and to take out the guesswork in finding the right solution.

Two important questions to consider in these cases are, **“What has previously been done about this problem?”** and **“Why did your earlier solution lose its effectiveness?”**

Answering these two questions can be useful because your water treatment specialist can then steer the study in a direction that's not duplicating previous efforts and will be able to help you explore better or newer technology you might not be familiar with.



Your wastewater treatment specialist says it's necessary

Wastewater treatment and system upsets are often unique, and in these cases, **it's important to trust your wastewater treatment specialist about performing treatability studies.** They can help narrow down your needs more efficiently. If your wastewater treatment specialist recommends it, think of it as a way to fast-track your facility's progress and ensure you're taking the right steps now rather than trying to clean up a potentially bigger problem later. In the long run, this can save your facility the cost and time it would take to try and figure out what was going wrong and what the proper solutions would be.

The facility isn't meeting discharge regulations

As mentioned in the previous chapter (and it is worth repeating), **treatability studies should always factor in local discharge regulations,** whether you release waste to a local municipality or to the environment. For example, a plant that discharges to the local municipal sewer would need to meet guidelines outlined by the local municipal utility to prevent permit violations for discharging into the sewer. Other facilities will have federal, state, and local permits for discharging to a nearby waterway or watershed, including local rivers, streams, and lakes, etc.



Chapter Three

POTENTIAL PROBLEMS WITH WASTEWATER TREATABILITY STUDIES AND HOW TO AVOID THEM



COMMON WASTEWATER TREATABILITY STUDY PROBLEMS

What are they? How do you avoid them?

If your facility needs a wastewater treatability study and it's an unfamiliar process, you might be wondering, **“What are some potential problems with wastewater treatability studies and how do you avoid them?”**

Here are some of the potential issues you should be aware of when addressing your treatability study needs:

Project timeline, available manpower/equipment

Oftentimes some of the issues that arise during treatability studies are related to the timing of the project, which tend to fall within three types:

- **Remedial;** a major upset or harmful spill that needs to be addressed immediately to get the solutions implemented quickly
- **Short-term;** a one-time system upset or issue that requires addressing and fixing as soon as possible
- **Long-term;** a chronic system upset or issue that requires addressing and fixing as soon as possible in addition to repetitive attention to preventing recurrences



How quickly the treatability study turnover is needed will determine the **manpower and equipment timeline required** for completing a treatability study and implementing the solution. Sometimes a treatability study for a remedial event will be needed urgently, and the facility will want to be implementing the solution full-scale the next day or shortly thereafter.

For example, let's say a refinery or chemical plant that discharges to a municipal wastewater treatment (POTW) has a problem in their process and inadvertently upsets the city's process. A treatability study and proper solution would be needed urgently. The company sought to provide the treatability study should be able to have someone respond right away to address the emergency.

Also, because fresh samples of wastewater are often needed for evaluation, the company performing the treatability study might mobilize a laboratory on-site or ship specialized equipment to the facility's lab to get the process started, so be sure to **ask if they have the manpower to appropriately help with your issue based on the urgency.**

When it comes to the availability of remedial equipment, **keep in mind that wastewater storage tanks, pump skids, temporary chemical storage tanks, and dosing systems, etc., can be rented until a permanent solution is engineered**, thus allowing for an effective treatment process to be mobilized as quickly as possible.



Narrowing down a solution that works specifically for the facility

Sometimes laboratory procedures might be similar to those used in other projects. For example, say a biological treatment plant has a bulking problem; there could be at least eight methods that may work to solve the problem and prevent a future occurrence. If these eight methods are being considered, then the question becomes **“Which solution would be best for this particular customer?”** A company that is cognizant of this will consider all options and give their customer the choice as to which solution they might want to implement, depending on project scale, timing, cost, etc. If the company is trying to sell your facility their in-house chemicals and equipment, then question their motives since there is likely more than one available solution and price to solve your wastewater treatment issue.

Also keep in mind **a facility might also have access to the solution already**. Take a Transport Storage and Disposal Facility (TSDF) for an example; these facilities bring in wastewaters from all kinds of manufacturers. Say one of the facilities brings in wastewater from a chlorine manufacturer—the TSDF might store the chlorine in big storage tanks until they can figure out what to do with it. At the same time, they might have another stream that has a lot of sulfides in it, which are both highly odorous and toxic. In a situation like this, after running treatability tests, the facility may decide to mix the two waste streams and neutralize both problems at the same time. A company that is providing your treatability study might be able to offer such



solutions to you, so again, be aware that there might be more than one fix to your problem than ordering chemicals and/or equipment, and be sure to be as thorough with what you have on hand and the type of solution you are looking for to get the best possible results.

Stringent discharge and disposal regulations

When you're looking for someone to conduct a treatability study, make sure they understand what discharge regulations your plant is required to meet as they will be able to better understand the chemistry of the wastewater stream you should be aiming for. The company performing the study should also interface with your environmental specialists because they're involved with the regulatory aspects. If this is not done properly, chances are you may incur heavy fines for not meeting these regulations . . . a financial and potentially time-consuming setback that can be avoided by completing proper testing up-front.

Costs associated with the treatability study services

Companies used to offer treatability studies for free in an effort to sell their products, but more and more there are costs associated with these services. When treatability fees are imposed, these rates can vary, but they typically comprise costs for manpower, lab resources, and analytical work, so make sure you factor this in when you're calculating your budget for the project. **Costs can range from \$1,500 for a one-day evaluation to over \$40,000 for an extensive study of**



several applicable technologies, depending on the complexity of the contaminants, number of analyses, and requirements of the facility, so it's important to ask about these potential costs up-front.



Chapter Four

HOW TO PERFORM AN EFFECTIVE WASTEWATER TREATABILITY STUDY



WHAT'S THE BEST WAY TO PERFORM A WASTEWATER TREATABILITY STUDY?

The stepwise process, broken down

Treatability studies are useful in the wastewater treatment process to **help determine how wastewater might be properly managed**, ensuring effective treatments are considered and/or implemented. These studies pinpoint which contaminants need to be removed in addition to narrowing down the ideal technological solutions.

By using treatability studies as one of the first steps toward finding a solution, **an industrial facility can save valuable time and resources by:**

- eliminating treatment technology guesswork
- ensuring proper solutions are implemented
- complying with local and federal effluent regulations

If you are new to this approach, you might be wondering, **“What is the best way to perform an effective treatability study?”**

Here at SAMCO, we use the EPA tiered treatability study guide as a basis for our treatability study development, but we also include extra steps to guarantee a thorough, effective study.



Our method is a **multitiered platform where the results from each tier are evaluated before moving to the next, adjusting the study as new information is learned.**

The five tiers are illustrated and explained in further detail below:

Tier 1: Site Characterization

During the completion of Tier 1 of the treatability study, **a sample of the raw process wastewater is submitted for analytical characterization and evaluation** of the “substrates of interest.”

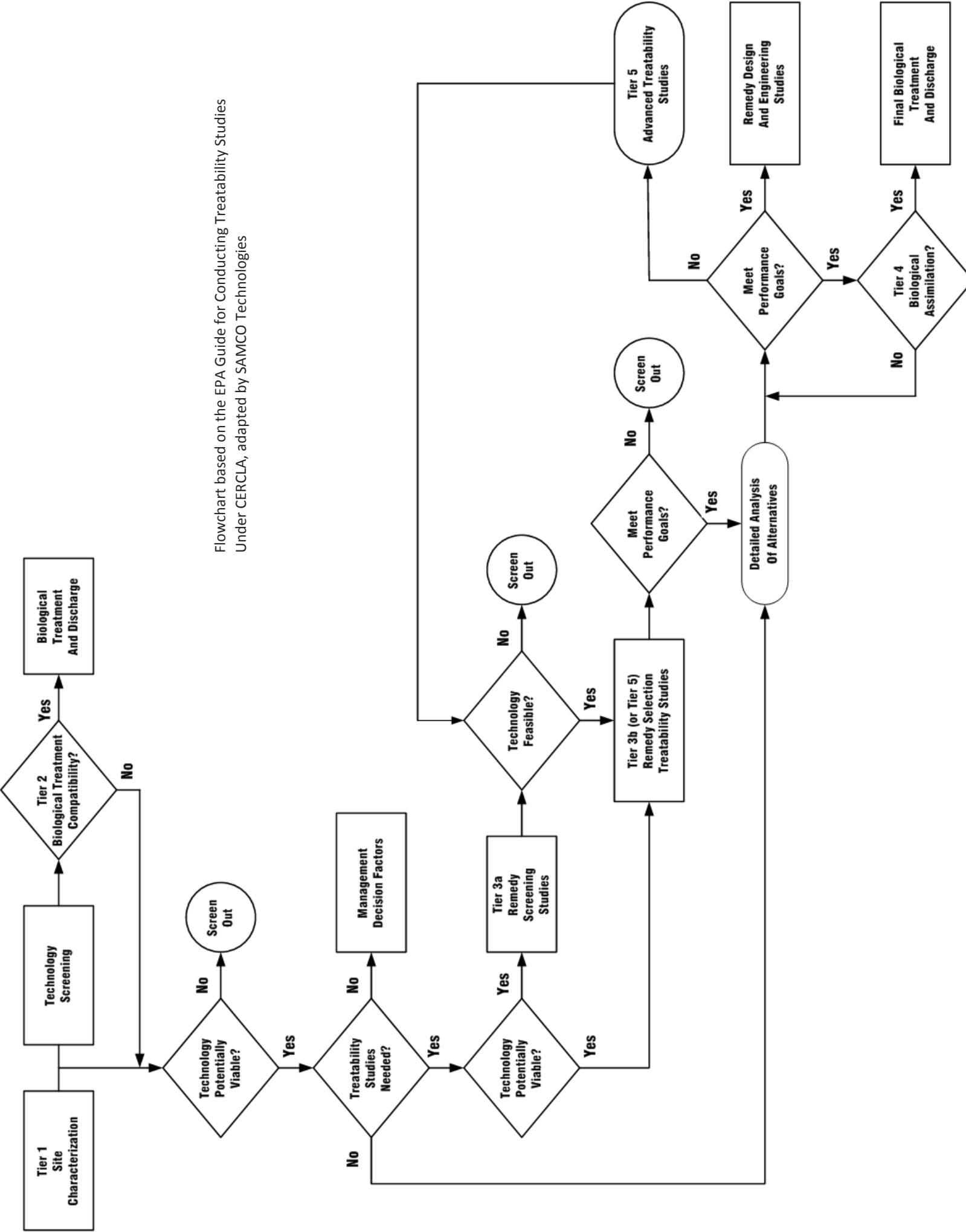
During this step, the company performing the treatability study will also go on-site and spend a day (or longer) understanding the facility’s processes and problems.

This is also the point in the process where resources available for a pilot study (including full-scale staff support) are evaluated. If the study needs to be performed on-site and they have no laboratory, the company performing the study should be able to provide a mobile/temporary version of the facilities needed, such as a lab and/or lab equipment.

Once the scope of the problem is understood, technology screening and Tier 2 follow.

Tier 2: Biological Treatment Compatibility

If a project can be solved with biological treatment, it is usually best to explore this option. Because of this, **the first thing that should be completed during Tier 2 is a biological treatment compatibility study** (if it hasn’t been completed already).



Flowchart based on the EPA Guide for Conducting Treatability Studies Under CERCLA, adapted by SAMCO Technologies



This is a process where a mixed biological culture is provided to the laboratory. Once the biological culture is growing and healthy, a sample of the facility's wastewater is added, and a chemist or microbiologist will determine the compatibility with the microorganisms. If there is immediate compatibility, then the team performing the treatability study should consider the biological route before pursuing chemical and physical treatment systems. (Biological treatment is typically more economical and self-sustaining.)

If it is determined that the biological culture becomes inhibited or dies off, the wastewater may not be subject to biological treatment without additional pretreatment, and the study should move on to Tier 3 where a chemical treatability study is conducted.

If it's possible to determine that a similar wastewater has been successfully treated before, the technologies that haven't shown promising results may be screened out in favor of the ones that have been successful.

Tier 3: Treatability Study Requirement

If these technologies are narrowed down and it is determined that a treatability study on a similar scenario has been completed already (meaning no treatability study is needed), the project can immediately go to “management decision factors,” where the water treatment experts and chemists decide what solution may be viable.

If a treatability study is needed, then Tier 3a and 3b should be completed to determine the viable technologies.



Tier 3a: Remedy Screening

During Tier 3a, a screening of traditional chemical treatments, redox mechanisms, and advanced oxidation processes, respectively, are performed. In other words, this is where the effects of different chemical treatments when mixed with the wastewater are evaluated.

At this point in the process, **chemicals that show a positive reaction can be categorized as a possible solution, and ones that don't can be screened out.**

Tier 3b: Remedy Selection

Now that the possible technologies are selected, it is a good idea to test if they meet the performance goals. If not, the technologies should be screened out, but if they do, a detailed analysis of each should be performed. Once it is determined the performance goals are met, the pilot study can be developed and the components of a full-scale system design considered.

If the selected technologies don't meet the performance goals, jumping to Tier 5 should follow, which is a more advanced treatability study. This is only done when all the testing previously performed isn't yielding the desired results. The company performing the study would then need to loop back to earlier steps (Remedy Selection), perhaps introducing a second or third chemical product working in a synergistic manner, then proceeding through the rest of the flow chart.



Tier 4: Biological Assimilation

Once all the performance goals are met, biological assimilation tests should be performed to assure the wastewater transformation is compatible with existing downstream systems. (When one wastewater problem is solved, there is a possibility another has been created, and this step will account for it.) The resulting pretreated wastewater may be subjected to further biological polishing in a downstream on-site wastewater treatment plant, or perhaps discharged to a local sewer and municipal publicly owned treatment works (POTW). This procedure is similar to Tier 2, which helps determine if the wastewater is now compatible with biological polishing.

Once the performance goals are met and final biological treatment is successful, the system can be designed and implemented.

Tier 5: Advanced Treatability Study

If the previously selected technologies are not yielding desirable results, additional conditioning of the wastewater may be needed to improve performance and achieve the final objectives.



Chapter Five

HOW MUCH DOES A WASTEWATER TREATABILITY STUDY COST FOR YOUR PLANT?



WHAT WASTEWATER TREATABILITY STUDIES COST

Pricing, factors, etc.

When our customers ask, “**How Much Does a Water/Wastewater Treatability Study Cost?**” it’s difficult to answer this definitively, as several factors go into estimating the cost. Also, the costs will vary depending on the customer’s individual needs. Therefore, this chapter will explore the different factors that make up the cost of a treatability study and how they might affect what you’ll be spending if your plant requires testing prior to treatment.

The base rates of a treatability study

Usually there are two types of base rates in a treatability study:

1. There’s typically some kind of **manpower** rate to conduct the studies, meaning the chemists in the laboratory doing the physical work.
2. Then there is also the cost of the **analytical work** of the samples. Some of the analysis is done by the chemist in the lab, or he or she will collect those samples and then submit them to an outside analytical laboratory.



Base manpower cost for a treatability study

A typical rate for the manpower of a treatability study (having a chemist conduct the sampling) will usually run you **about \$1,000 per day**, depending on the complexity and severity of the issue.

For example, if your plant is experiencing a remedial event, such as a chemical spill or contamination issue in your wastewater, and you need someone on-site immediately to figure out what these contaminants are, you might pay extra for having a chemist come out to your plant and set up a laboratory on-site. Usually the manpower rates are the same per day in a situation like this, but you might see extra costs factored into your estimate for traveling and room and board, in addition to the cost for mobilizing and setting up the on-site laboratory.

Base rates for treatability study analytical work

Base rates for the analytical work **will vary depending on what you're testing for and to what degree**. For example, let's say a plant needs to analyze chromium in its wastewater stream, then doing that one chromium test is about \$15 . . . and as you list all the individual components you want to test for, there is a fixed rate for each analysis, which are chosen then added to the cost.

This is where your estimate can start to add up. Keep in mind that the company performing the treatability test should be testing for contaminants thoroughly. There are hundreds of substrates that can be identified in wastewater, for example, and there are certain



varieties that should be tested for depending on what the customer thinks the problem is. An effective treatability study will have this accounted for and will test for these species in addition to what else might be problematic based on certain EPA profiles. The EPA has identified groups of chemicals and contaminants that can be toxic, and with today's analytical procedures, a lot of it is automated, identifying roughly hundreds of compounds in a single scan.

Also, there are lots of empirical measurements (something like water that contains organic carbon). What is the organic carbon made of? and what does that mean? This is where a treatability study can help your plant identify the family of carbons present in addition to what each individual carbon-containing component is.

Different contaminants cause a wide range of environmental issues, and typically the problem a plant is trying to avoid is that if these contaminants were released into the environment, they would be toxic and could kill fish, microorganisms, and aquatic life. And that is highly prohibited with most environmental and municipal regulations, so careful analysis will help you avoid these costly violations.

Treatability study cost and regulations

When you're using a treatability study, you must know the local and federal regulations. Usually the company providing the testing is working with an engineer that is operating the problematic process, but the company performing the study should also interface with your environmental specialist because they're involved with the regulatory aspects. The treatability test should be geared toward



meeting or superseding the environmental requirements in order to be cost-effective. If this is not done properly, chances are you will incur heavy fines for not meeting these regulations . . . a financial and potentially time-consuming setback that can be avoided by completing proper testing up-front.

Treatability testing on-site

Sometimes the testing can be performed in a separate laboratory, and sometimes it is done on-site, which can cost a bit extra. This requires the company performing the test to pack up their laboratory, mobilize it, and set it up at a customer's location. But depending on whether or not the study is short- or long-term will determine whether or not testing on- or off-site will add to the cost of the study.

When you are considering having the treatability testing company perform these tests on location, consider there will be costs for shipping materials in, ordering materials, and bringing anything else in the testing will require, including people. This might also include normal laboratory equipment and chemicals, glassware, etc.

Is there a way to save money on a treatability study?

At the end of the day, even though the testing costs might add up, it's important to be thorough with the contaminant list to ensure that:

1. Plant personnel aren't exposed to harmful chemicals
2. Harmful chemicals from the plant's process aren't released into the environment



It can become extremely costly to incur employee lawsuits or environmental fines from local or federal authorities. You might also be exposed to public awareness that can have a lot of financial repercussions in terms of boycotts, etc., for polluting the environment, so making sure that your plant is taking the proper steps to comply with your local regulations is key.

Choosing the right company to perform your treatability study

Once a proposal is worked through (typically in a tiered format as outlined and recommended by the EPA), it's important to consider alternative treatment methods. Keep in mind there are usually several treatment methods that will solve a plant's particular problem, but you'll want to work with a company that will be able to help you home in on the methods that are the least expensive to implement.

Here at SAMCO, we see, in many cases, that certain engineering companies go out looking for company to perform treatability studies for their customer, but the companies who perform these studies only offer a single process for treating the customer's particular contamination issue. This often results in a company trying to sell the customer a system, a salesman trying to sell a piece of equipment that he thinks will work.

For example, let's say the treatment process will involve the use of hydrogen peroxide, which is a very powerful oxidizer that can detoxify



a lot of wastes. And say the company looks at another manufacturer that makes potassium permanganate, also an incredibly powerful oxidizer, but one that can't treat many of the same problems that hydrogen peroxide can. If the engineering company goes to a company that sells hydrogen peroxide asking for a treatability study, they will sell you hydrogen peroxide. If they go to a company that sells potassium permanganate, they will have the same result.

The type of company you want to have perform your treatability study is one that will evaluate the hydrogen peroxide and potassium permanganate in a treatability study and provide you the most cost-effective process recommendation, whereas the other companies will not do that because it's not in their product line to sell a competitive product, and there could be 10 different chemicals out there that are just as effective.

Also make sure to ask about saving on the cost of a system. Sometimes the company you work with will apply part of your treatability study costs toward the purchase or rental of the system equipment. If the equipment costs you are seeing are competitive, this can save you in the long run—sometimes significantly.

The bottom line

Although it's hard to say for certain what a treatability test will cost you, as there are many factors involved that will fluctuate this, on the very light side, such as a simple metals analysis treatability with a known technology, that kind of a treatability study at the very bottom side might be around **\$2,500 to \$5,000**, and a more complex test will



run you around **\$9,000 to \$10,000** depending on the scale of the process. But when the treatability test is something very complex that requires a great deal of expertise and analytical support, the **\$30,000** range and higher is also possible, depending on the environmental issues and size of the facility. The important thing to remember is that a treatability study provides preliminary development and proof of a best method for treating a wastewater stream to meet the treatment objectives and regulatory requirements. Done properly, it can save tens of thousands of dollars for a small system and millions for a large system. Implementing the wrong solution based on a poorly executed treatability study can lead to rework, plant shutdowns, and regulatory fines.

As always, make sure you find a company to do the study that will be thorough and has your best interests in mind. That will go a long way in saving you money in the long run by ensuring all steps taken are accurate and the treatment options are chosen according to your individual needs while considering local environmental and municipal regulations.

HOW CAN SAMCO HELP?

SAMCO has over 40 years' experience helping design and engineer some of the most effective water treatment systems in the industry. For more information about our wastewater treatability study services and how we can help your facility, please visit our website or contact us to schedule a consultation with one of our engineers.

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