Our Mission:

NSF International, an independent, not-for-profit, nongovernmental organization, is dedicated to being the leading global provider of public health and safety-based risk management solutions while serving the interests of all stakeholders.

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Laboratory Services for the Point-of-Use and Point-of-Entry Drinking Water Treatment Industry

NSF International
The Public Health and Safety Company™

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Laboratory Services for the Point-of-Use and Point-of-Entry Drinking Water Treatment Industry

INTRODUCTION

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Manufacturers of drinking water treatment components and systems often need high quality, independent, reliable and affordable laboratory testing services. To satisfy this need, NSF International is pleased to offer the industry laboratory capability and capacity for testing point-of-use (POU) and point-of-entry (POE) water treatment devices — services that are unparalleled by any other independent testing organization.

NSF's laboratory services assist manufacturers in a wide range of product evaluation needs. There are virtually no limits in the type and scope of POU and POE testing that NSF can perform, from very basic product evaluations that measure a single point of interest, to demonstrating compliance with national and international standards. NSF offers you the highest quality and value in testing, along with expert consultation in method selection and test design, including method development where needed.

Capabilities of NSF laboratory services span the following:

- **Organic and Inorganic Chemical Analyses**
- **Microbiological Testing, including Bacteria, Virus, and Parasitic Cysts**
- **Physical Material Testing**
- **Structural Integrity Testing**
- **Particulate Testing**
- **Radiological Testing**

The above services are all performed at NSF's laboratory. We do not contract these services, but rather provide a complete service in one location. This ensures the greatest degree of consistency and quality in the services we provide, and the ability to optimize the overall completion of your project. It also provides you with the convenience of knowing where your product is at all times. You are welcome to participate and witness the testing of your product, from start to finish.

NSF's laboratory services can be tailored to meet any needs you may have. You may be interested in a test that screens multiple new carbon suppliers for contaminants, testing a new plastic housing to failure, determining exhaustion of a media bed, or any number of other product evaluations. In this document you will find a number of sample case studies to provide examples of services designed to meet specific client needs. Keep in mind these represent only some of the many options offered.

NSF can assist you in completing any project you have envisioned. Please contact us to discuss your concept, work with you to develop a test plan and cost estimate, and complete your project with the quality testing, attention to detail, and superb level of customer service that you expect, deserve, and receive from NSF.

GENERAL INFORMATION

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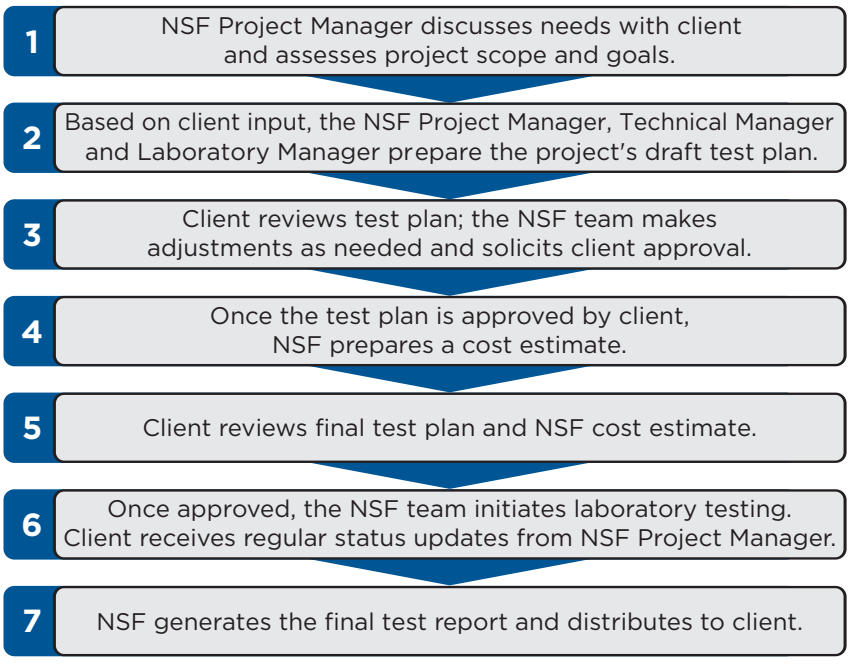
Service Delivery

NSF ensures that all aspects of your laboratory services project are reviewed, documented, verified with you, and communicated effectively to the laboratory technicians. This means that you get what you expect and need from your laboratory services project – a test plan focused on answering specific questions and providing the requested data that meets your ultimate needs and objectives.

Your NSF project manager will be your primary point of contact to handle all aspects of your testing project. They will work with you directly to assess the purpose and scope of your project. The project manager then reviews the draft test plan with the NSF technical manager and laboratory manager, ensuring the plan is properly targeted to meet your needs, minimizes the cost to achieve your objective, and is delivered on schedule with your time frame. A proposal, including cost and turnaround times, will be provided to you for review and concurrence before any work is initiated.

Your project manager will communicate with you regularly through all phases of the project, from sample receipt, through set-up in the lab, testing, and final reporting. This communication includes answering any questions you may have. NSF recognizes that, with laboratory services, frequent communication is a key to success. And NSF is firmly committed to the success of your testing project.

Laboratory Testing Services Process Chart



NSF Laboratory Services projects are handled smoothly and efficiently, with clients involved during each of the 7 steps in the process. It is only through effective communication that projects successfully meet client goals and objectives.

Laboratory Services and Product Certification

NSF will assist manufacturers in their test design by advising them on the applicability of the testing toward product certification. The ultimate decision is that of the manufacturer and depends on the long-term plans for the product evaluation.

It is generally the case that testing applicable to certification will be of higher cost due to the requirement to meet the full test method of the applicable standard. If the product is nearing final stages of development and planned for certification, then such testing may well deliver the value that comes from the additional cost. In fact, many tests can be designed in such a way as to accomplish both a research value and long-term certification value. For example, a test can be designed to test in parallel several media formulations. There are cost efficiencies in such volume testing that minimize the total cost while enabling the manufacturer to determine which product provides the preferred performance. At the conclusion of the test, the data can be immediately applied to certification for the selected formulation.

NSF and Confidentiality

NSF understands the highly proprietary, confidential nature of the information you share with us. In fact, protecting confidential information is a cornerstone of our organization and is given the same priority and commitment as the quality and integrity in our independent testing services. NSF takes great measures to ensure confidentiality of all projects, including shrouding and concealing all products during laboratory testing. NSF takes this same degree of caution no matter what the scope of the project.

Protocol Development

One unique category of service offered only by NSF is development of NSF Protocols that lead to NSF Certification. Protocols are formal documents, adopted through a consensus process similar in many ways to NSF/ANSI Standards. Protocols are typically developed for:

- **Unique technologies**
- **Unique applications of technologies**
- **Specific end users of categories of unique products**

Some examples of protocols developed by NSF that you may be familiar with include:

- **P231 – Microbiological Water Purifiers**
- **P248 – Emergency Military Operations Microbiological Water Purifiers**
- **The Homeland Security testing of Point-of-Use systems for performance with chemical contaminants and microbial agents**

Additional information regarding these and other NSF protocols can be found at:

www.nsf.org/info/protocols.

FREQUENTLY ASKED QUESTIONS (FAQs)

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Q: I already have products certified by NSF. If I have new prototypes or other products tested and they fail, will that impact my certification status?

A: Testing of new products has no impact on any current certifications.

Q: I would like to have my prototypes tested by NSF, but am concerned about confidentiality issues. How does NSF handle this?

A: NSF maintains strict confidentiality for all our testing services, whether for certification testing or for general testing services. NSF even goes so far as to cover all test units in the laboratory so that only NSF technicians know what products are on test.

Q: My company is considering buying another product manufacturer. Can NSF test their products for us, making sure they're up to our high quality standards?

A: NSF has successfully conducted testing for exactly this type of evaluation. This is a great way to ensure the quality of products manufactured by a potential acquisition target.

Q: How does NSF compare to other service providers?

A: NSF's laboratory is the most comprehensive, highest quality independent laboratory available, with the largest capacity and most experienced staff. With more than three decades of experience, NSF's laboratory has the most highly automated testing equipment in the industry, and is on the cutting edge of current testing methodologies and laboratory equipment due to its unique leadership position in developing global product standards. In addition, because we deliver a Certification Mark that provides the highest consumer and buyer recognition, testing with NSF provides a much quicker and more efficient process to certify the product at a later date, should you choose to do so.

Q: I'd like to have products tested by NSF but I'm not ready to certify quite yet. If the results are good enough to meet the standard requirements, do I have to get it tested all over again when I am ready to certify?

A: General testing results can be used for certification when the time comes, as long as the product tested is representative of the product that is being certified. NSF will advise you in advance of starting the project whether or not the data can be used for the purpose of certification later.

Q: Can you help with testing to international standards?

A: Yes. NSF is an international organization with offices and relationships worldwide. We understand foreign markets and foreign standards. Not only can we test to foreign standards, but we can custom design a test plan whereby one test can potentially offer approval to multiple standards. Though often different in their methods, NSF has the knowledge and expertise to know which elements of the method are sufficiently similar to deliver the same end result. In addition, the NSF laboratories carry international accreditations to ensure global recognition of the test data.

Q: If I have a product tested and it fails, does that mean it can never be certified?

A: No. There are several options to deal with failures. One is to refine the product and retest. A second is to test for alternate contaminants that the product may be able to successfully reduce. The product can then be certified for the reduction of these contaminants. A third option is to reduce the capacity of the product, if failure was to due to exceeding the effluent requirements prior to reaching the preferred capacity. A fourth is to modify the test conditions themselves, as allowed for in the Standard, such as the ON/OFF cycle times or flow rates. Your project manager can review these and other options with you.

Q: We've got a deadline coming up soon; can you do expedited testing?

A: Yes. The extensive capacity of NSF enables for such fast-tracking of tests. Your project manager will coordinate this with the laboratory, delivering you a timeline that addresses your specific needs.

Q: Can I use the NSF Mark on my product after it is tested by NSF?

A: The NSF Mark may be used only on products that have met the full requirements of certification, as notified to you in writing by NSF. Certification requires that specific tests be successfully completed, along with product documentation and facility audits. The tests you perform may be applied toward the process, but the tests alone are not sufficient to demonstrate NSF certification, and thus use of the NSF Mark. Your project manager will clarify for you all the requirements applicable to NSF certification.

Q: I know I want my product tested by a third-party laboratory, but I'm not quite sure what the most appropriate tests are. Can you help me pick the right tests to prove my claims and help me get my product to market?

A: With NSF's vast experience in certification testing and general laboratory services, we can customize a test plan for your specific product. All you have to do is share your goals, timeline, and budget with us, and we will develop the best possible program to achieve those goals within your guidelines.

Q: Following NSF testing, what proof of test results will I receive?

A: NSF provides detailed, signed reports for any tests completed.

Q: Do you let your clients watch their products while they're being tested?

A: Yes. With advance notice, NSF allows clients to visit the laboratory and be present when testing is conducted.

Q: What other types of water testing do you do? Can you test commercial water filtration products, municipal water products, other R&D testing?

A: NSF conducts a wide array of testing of water-related products to support various certification programs. This includes testing of municipal water products for certification to NSF/ANSI Standards 60 and 61, as well as field-based testing for evaluating the treatment performance of small systems under the NSF Environmental Technology Verification (ETV) program. NSF has also conducted various evaluations of POU and POE products for R&D and Homeland Security applications, as well as purifier testing according to EPA's Guide Standard, which is incorporated into NSF's P231 Protocol.

CASE STUDIES FOR GENERAL LABORATORY SERVICES

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The following sections of this guide include specific application case studies of NSF's laboratory services. These case studies are categorized for your convenience:

- **Contaminant Reduction Testing**
- **Material Extraction Testing**
- **Structural Integrity Testing**
- **Reverse Osmosis Performance Testing**
- **Ultraviolet Systems Dosage Evaluation**
- **Water Softener Efficiency Testing**

Each case describes the needs expressed by the manufacturer, the custom solution developed by NSF, and the advantages and benefits realized from the service.

These case studies are simply examples of the types of services NSF offers. They may exactly address the type of project you wish to undertake, or may cause you to think about variations and similar approaches outside the scope of these examples that better fit your exact needs. The possibilities for laboratory services are virtually endless, and NSF eagerly awaits your ideas, concepts, and proposals. Whatever your needs may be, please consider NSF to be open to the concept and excited to hear your ideas and fulfill your objectives.

Contaminant Reduction Testing

Case 1: A manufacturer wanted to evaluate the contaminant reduction performance of multiple product formulations. Specifically, the manufacturer wanted to determine which media ingredient mix would perform best. The manufacturer was worried about the validity of making comparisons of test results obtained under different laboratory conditions.

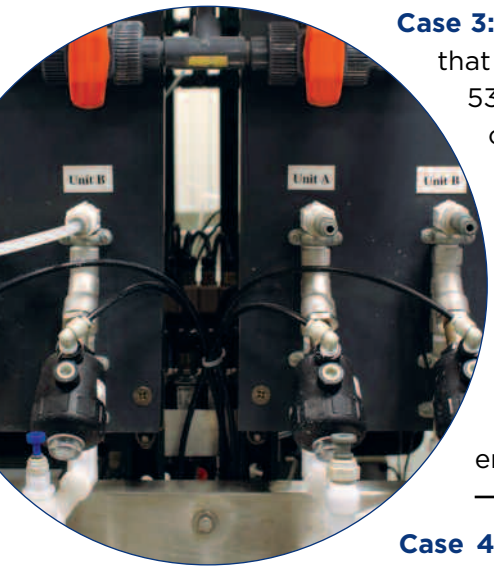
Solution: NSF designed a test using one influent stream, split to 6 test units of varying formulations which were all individually plumbed to the same test stand.

Advantages: The test provided a true "apples to apples" comparison of different formulations tested under the same conditions. The result is a significant cost savings due to economies of scale, leading to a simple comparison of results for the best performing product.

Case 2: A manufacturer wanted to determine the maximum capacity of their product so the product could be marketed with the best possible claims, but without risking test failures due to an estimated capacity that was too high.

Solution: NSF tested the product until the performance exceeded the effluent requirements of the Standard, with samples collected at intervals sufficient to give the manufacturer the desired volume capacity prior to reaching failure.

Advantages: Rather than predicting capacity, resulting in a failure or significantly underestimating product performance, testing to failure provided the manufacturer with all the information needed to set the exact product capacity.



Case 3: A manufacturer wanted to conduct a cost effective arsenic reduction test that would provide results predictive of testing according to NSF/ANSI Standard 53. Because the product was still in development, the manufacturer was not concerned about being able to use the test results for Certification. Instead, the manufacturer needed an indication that the project was on track with projected performance.

Solution: To save cost, NSF conducted the test with a reduced number of samples and more infrequent analysis of the test water characteristics.

Advantages: Partial sampling and tank water testing provided for a significant cost savings and faster completion, while still providing the manufacturer with an assessment of the product's performance. This enabled them to proceed with confidence in their final product development.

Case 4: A customer wanted to know if their product was capable of reducing contaminants not included in the NSF/ANSI Standards. The manufacturer thought the product would likely perform well, but needed independent test data as a basis for the claim.

Solution: NSF developed a protocol to appropriately test for reduction of the selected contaminant. Using NSF's knowledge and expertise from the development of the NSF/ANSI Standards, appropriate challenge concentrations, test water characteristics, and other aspects of current test methodologies were employed to give the best demonstration of the product's performance.

Advantages: Such custom testing offers manufacturers the option to demonstrate performance reduction capabilities of their product for claims not covered by the NSF/ANSI Standards, thereby adding additional marketability to their product.

Case 5: A manufacturer wanted to evaluate different media used in a point-of-entry (POE) system. The manufacturer was concerned about the high cost and length of time associated with determining the best media for the application.

Solution: Rather than conduct a full-scale test, NSF tested the media in glass columns to simulate beds in a POE system. Multiple columns were prepared with varying medias, each simulating the actual POE product. The test units were identical, with the exception of the media, and all were tested with a split influent stream on the same test stand.

Advantages: The test provided the manufacturer with a significant cost and time saving for testing and comparing the performance of multiple POE systems.

Material Extraction Testing

Case 1: A product failed extraction testing for a specific contaminant. The manufacturer wanted to evaluate modifications to their product for reducing the concentration of the contaminant to a safe level. They wanted to conduct the evaluations as quickly as possible, without undue costs, so they could proceed with certification and market launch of the product.

Solution: The NSF project manger reviewed the product modifications with our in-house toxicologists and determined that the changes would not affect any of the passing results. NSF repeated the extraction testing of the modified product, but analyzed for the failed contaminants only.

Advantages: The cost and time savings to the manufacturer were significant, and the passing results of the modified product enabled them to stay on track with their product launch target date.

Case 2: A manufacturer was considering changing to a different supplier for certain parts of their certified systems, but was concerned about the potential impact of this change on the material safety of the product.

Solution: The NSF project manager worked with our in-house toxicologists to design a test that addressed only the extraction characteristics of concern relating to the system changes from incorporating the new part. Only potential contaminants associated with this material were evaluated, to save time and costs.

Advantages: O-rings, fittings, heads, and other parts can be evaluated individually for contaminant leaching.

Case 3: A manufacturer failed an extraction test due to specific contaminants. Scientists in the manufacturer's R&D area theorized that the concentration of this leached contaminant would quickly decrease over time. The manufacturer wanted to verify the rate of decay in the leaching rate of contaminants within their product.

Solution: Individual exposure samples, i.e., Day 1, Day 2, Day 3, were analyzed in addition to the composite sample that is required by the Standard.

Advantages: Based on evaluating individual daily extraction levels, the manufacturer was able to determine the rate of decay of contaminant leaching. Such testing can be carried out for longer periods of time to determine long-term leaching characteristics.

Structural Integrity Testing

Case 1: A manufacturer wanted to learn the relative strength of a new material to determine its ability to withstand the cyclic testing required by the Standard.

Solution: NSF conducted cyclic testing of a prototype unit until the product failed. The number of cycles at failure was reported.

Advantages: Changeover to new materials can be a significant investment for manufacturers. Inexpensive testing, such as cyclic pressure tests, can give early indications of product performance. Passing results can be used later for certification, if the material is selected for use.

Case 2: A manufacturer was concerned that a product with threaded sumps may be prone to unthreading. They wanted to conduct testing to determine if design modifications were required.

Solution: NSF conducted cyclic testing with observation at predetermined intervals. Measures such as tightening to different degrees of tightness were investigated to determine conditions of unthreading.

Advantages: The manufacturer was able to assess the potential for product malfunction, avoiding costly maintenance and repair costs of product sold into the marketplace.

Reverse Osmosis Performance Testing

Case 1: A manufacturer wanted to quickly determine the approximate performance of their RO system. Because the product was not yet in production, changes to the design could be made if daily production rate and TDS rejection were not meeting design requirements.

Solution: NSF conducted a partial test, collecting samples only on Day 1 of the test, instead of the seven-day test required by NSF/ANSI Standard 58.

Advantages: The approximate performance was determined at a greatly reduced cost. The manufacturer also had the option to continue testing for the full seven days if the initial results proved promising.

Ultraviolet Systems Dosage Evaluation

Case 1: A manufacturer wanted to determine the dose-response curve for their UV system at different flow rates. Because the lamp, ballast, and reaction chamber were new for the manufacturer, they wanted to find out early in the product development cycle if the expected UV dosage was being achieved.

Solution: NSF performed Day 1 testing only, instead of the seven-day test required by NSF/ANSI Standard 55. An abbreviated dose-response curve was developed. Bioassay testing with MS-2 or *Bacillus subtilus* was conducted to determine the UV dose of the system.

Advantages: The approximate performance was determined at a greatly reduced cost. The manufacturer also had the option to continue testing for the full seven days if the initial results proved promising.

Water Softener Efficiency Testing

Case 1: A manufacturer wanted to evaluate softener efficiency under variable conditions. Potential customers for the softener required a California efficiency rating, which the manufacturer knew might require some adjustment of the operational parameters.

Solution: NSF conducted capacity testing with variables such as service flow rate, fast rinse flow rate, slow rinse flow rate, cycle times, etc. The NSF laboratory technicians were able to quickly change the variables based on the manufacturer's feedback.

Advantages: The variable testing provided the ability to maximize the softener efficiency. The manufacturer had the option to continue testing with the most efficient configuration in order to use the data for certification.

GLOSSARY

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Bioassay: A test using microorganisms, to determine the ultraviolet (UV) dose of a system.

Capacity: The volume of water a system can process while maintaining a minimum amount of contaminant reduction performance. This is usually stated in gallons or liters.

Component: A part of a system. Types of components include housings, filters, membranes, faucets, fittings, tubing, valves, storage tanks, etc.

Contaminant Reduction Testing: Testing to determine the capability of a system to reduce the concentration of contaminants in water.

Cyclic Testing: A test of structural integrity that simulates stress due to valves opening and closing over the life of a product. One cycle represents pressure being increased to a maximum value, and decreased to a minimum value.

Daily Production Rate (DPR): The amount of product water a system produces per day. This is usually used in reference to reverse osmosis systems.

Dose Response Curve: A graphical representation of the relationship between the UV dose administered and the inactivation response of the test microorganism.

DWTU (Drinking Water Treatment Unit): A POU or POE system designed primarily for residential water treatment applications.

Exposure Sample: Water that has been in contact with a system or component for purposes of extraction testing. This sample is analyzed for contaminants that may have leached from the system or components.

Flow Rate: The rate at which water flows through a system, usually expressed as gallons per minute (gpm) or liters per minute (lpm).

Formulation: The composition of raw ingredients (the "recipe") for an individual material.

Influent: Test water containing specific contaminants put into a DWTU system for contaminant reduction testing.

Material Extraction Testing: Testing to ensure that materials and/or components in contact with drinking water do not leach levels of contaminants that exceed the Maximum Drinking Water Levels (MDWLs) specified in the standards.

Media: Material(s) in a system or component that has adsorptive or absorptive properties and contributes to the reduction of contaminants in water.

Point-of-Entry System (POE): A system that treats most or all of the water entering a house. Point-of-Entry systems are usually installed after the water meter.

Point-of-Use System (POU): A system that treats water at a single tap or multiple taps. POU systems are not used to treat an entire household water supply.

System: A complete water treatment device, comprised of components.

Total Dissolved Solids (TDS): The sum of the mineral salts in water, measured in mg/L.

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