

For the Love of Chemistry

Penned by Connie Hayes, CEO

This month we will discuss Simulated Natural Certified Reference Materials – Part I: Simulated Rainwater

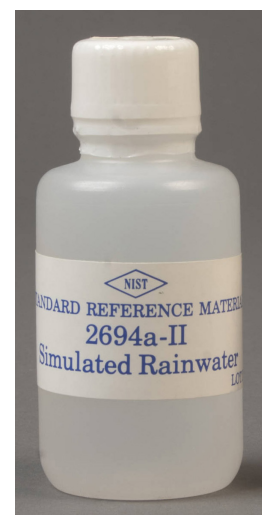


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Part I: Simulated Rainwater

These are standards that simulate the results of a real sample of a natural matrix. High-Purity Standards initiated these products, beginning with Simulated Rainwater, in 1992. Simulated Rainwater (part numbers SR-1 and SR-2) were designed from research conducted by the National Bureau of Standards (NBS), now NIST, sponsored by the EPA and USGS on acid rain. Our founder, Theodore Rains, participated in this research. This report is based upon his collection of notes and documents from that research that spanned over 10 years.

The goal was to create well-characterized and stable Standard Reference Materials (SRM) to aid in the monitoring of acid rain. It is the pH of the rain that categorizes it as acid rain. Normal rain is defined as having a pH of approximately 5.6. At a pH of 4.6 the rain will have a 10-times increase in acidity, and at 3.6 will have a 100-times acidity. The development of a simulated standard versus the collection of natural rainfall was based upon the need for a stable reference material containing minimal contaminants and unneeded components. The result of the project was the production of SRM 2694 “Simulated Rainwater”. The SRM consisted of four 50 mL solutions at two levels for a total of two bottles at a pH of 4.3 and two bottles at a pH of 3.6.



The first of the reports of the results came out in 1975, *Simulated Precipitation Reference Materials*, NBSIR 75-958. As this report describes, production of the initial standards was based upon recommendations from the EPA. The first adjustment was to balance the cation and anion concentrations. This adjustment moved the team away from the EPA recommendations. A decision was made to give preference to the cation guidelines. Further complicating the requirements was the goal of preparing a concentrate solution, 50-times the concentration of the final working solution. Lead and copper proved to be unstable at the concentration and pH of the standard. The samples were packaged in glass ampules and stability studies were run. The sodium values were found to increase over time, indicating a leaching from the ampule walls.

The experimentation was repeated in 1977, 1979 and 1982 and reported in *Simulated Precipitation Reference Materials II* NBSIR 77-1315, *III* NBSIR 79-1953 and *IV* NBSIR 82-2581. These studies included a separate reference material for pH, conductivity and acidity to address problems from the first set of materials with those measurements. They repeated the preparation and analysis with new sets of material as well as conducting stability analysis on the previous sets of reference materials.

By 1984, NBS had developed a Reference Material, RM 8409, for the Simulated Rainwater. By this time the packaging had switched from glass ampules to polyethylene bottles and transition and heavy metals were eliminated. This was as a result of a decision to increase the stability of the material for those components most critical to acid rain studies: pH, acidity, conductance, nitrate, and sulfate. Of these components, the measurement of pH was the primary driving factor. Stability studies of RM 8409 at the eighth month point indicated degradation by a factor of greater than three in the concentration of ammonium.

Standard Reference Material (SRM) 2694 was introduced the following year. As an SRM, it would undergo more extensive testing than an RM, as RM standard only require a single analytical technique for each analyte. The SRM benefited from the studies of the previous standards and reference material. A new analytical method in the Inorganic Analytical Research Division of NBS was utilized for the metals analysis: laser-enhance ionization flame spectrometry. This method complimented by the ICP/FAA/FES methods used in the metals analysis. The ammonium and chloride values were listed on the Certificate of Analysis as reference data, not certified values, due to the stability issues previously observed.

High-Purity Standards has maintained this product as a catalog item since 1992. Unlike SRM 2694, we sell these items as two separate products. SR-1 mimics the Level 1 standard of SRM 2694 and SR-2 that of the Level 2 standard. You can find those items in our [Water Standards](#) category on our website and part numbers [SR-1](#) or [SR-2](#). The analytes in these products are traceable to various NIST SRMs. SRM 2694 is currently unavailable from NIST. Other related products to this include standards for [pH buffers](#), [conductivity](#) and [alkalinity](#).

Can't find what you need? [Custom standards](#) can still be a very popular method of providing a specific matrix match for your use. To make this option cost effective, consider purchasing a larger quantity or placing a blanket order to lock in your current price and ensure its availability.

