

NEW MEXICO OFFICE OF THE STATE ENGINEER
FOOD SERVICES INDUSTRY WATER AUDITS

INSTRUCTION MODULE

June 2009



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Executive Summary

The New Mexico Office of the State Engineer (NMOSE), Food Service Industry Water Audit Instruction Module is specifically designed for restaurants and cafeterias within the utility's water supply systems. It provides instructions, questionnaires, evaluations, reporting information, and supplemental resources on how to conduct a food service industry water audit program within a utility.

Food Service Industry Water Audit Instruction Module is a product of the Bureau of Reclamation grant funded *Water Conservation Training Audits and Retrofits for Food Services* program. The grant program was based on a proven technologies and research that increases water efficiency within the commercial and industrial food businesses. NMOSE pilot tested during 2008-2009 with three New Mexico public utilities: the City of Gallup, Los Alamos County, and the City of Rio Rancho. The project involved pre-audit data analysis for each participating establishment, on-site water audits for both indoor and outdoor water use, analysis of on-site usage and post audit evaluation.

The Food Service Industry Water Audit Instruction Module incorporates all of the comments received and lessons learned during the grant project.

Why do Food Service Industry Audits?

New Mexico is a semi-arid state with limited water sources. These sources are subjected to increasing pressure of a growing population. Effective water demand management strategies, such as water conservation, can help stretch existing supplies. As a first step, drinking water suppliers should know exactly where their water is going. The NMOSE recommends completing the American Water Works Association's water audit¹ and the NMOSE's Gallons per Capita per day Calculator² to determine water use by sector and season. Once these baselines have been determined, the drinking water supply can implement various programs, targeting high water use areas such as commercial use.

Commercial water use, which includes restaurants, can have a significant effect on local water demands. This impact increases in New Mexico's popular tourism areas. For the drinking water supplier, targeting restaurants can have dual impact: saving water within the commercial sector, and providing educational opportunities to the public they serve. For the restaurants, water conservation programs can reduce business costs through reduction of water, wastewater and energy bills. For maximum effect, combine the water audit program with other programs such as energy audits or commercial toilet rebates.

Water audits can be tailored to meet the needs of both the water provider and the food service provider. They can be a one time, simple overview of the establishment's water use or an intricate long-term program with multiple layers. It can include hardware changes or simple changes in behavior. Either way it is an active, community based program that provides multiple outreach opportunities. By combining this with other active and passive water conservation programs, the utility is helping to ensure sufficient water supplies for present and future generations.

¹ <http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47846&navItemNumber=48155>

² http://www.ose.state.nm.us/wucp_pws.html

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Getting Started

Prior to starting an audit program, the utility will need to decide what type of audit program to implement. Who will the program focus on? Will retrofits (pre-rinse spray nozzles or faucet aerators) be included as part of the site visit? Will any follow up be provided by utility? Does the utility have any programs that compliment the audits, (i.e. commercial toilet retrofit)? Is this an on-going program or a one-time offer? Is the media going to be involved?

Let's start with who to include in the program. There are two main options, focus on high end users or open to anyone. Each option of course has multiple variations. If there is limited time and limited money, the utility may decide to focus on the high end users. This has potential for the largest water savings. If the plan is to provide audits as an on-going program, the utility may decide to open it as a first come-first served basis. This provides willing participants for the utility's learning curve. Either plan can be bundled into a short time frame or partitioned out, providing only a couple audits month, depending on time and money. Also consider whether the establishment has a separate meter. All participants will benefit from the audits, but separate meters allow for analysis a usage data and simpler pre and post audit comparisons. Establishments that share meters, such as strip malls, will be harder to analyze. Finally, decide which establishments will be included. The food service industry includes: fast food, traditional restaurants, cafeterias, schools, and hospitals. If the audits are open to schools and hospitals, will areas besides the kitchens be included in the audit? For more information on other types of commercial audits, see the [WaterSmart Guidebook](#) listed in the resource section, Appendix I.

Next the utility must decide whether to include retrofits or hardware as part of the audits. The most common retrofits are the pre-rinse spray nozzle and the faucet aerator. This decision will be based mainly on budget available and the skill set of the auditor. If the auditor is comfortable replacing these items, simple retrofits are a good idea. They will provide immediate water savings and are relatively inexpensive. If the auditor does not feel comfortable replacing fixtures, the utility can leave them for staff to replace. However, there is no guarantee that they will be installed. If the utility decides not to purchase or install fixtures, a list of suggested replacements can be included in the final report.

Deciding whether to provide follow up assistance depends largely on staff time and if the utility has additional programming to offer. If the utility has a commercial toilet retrofit program, a follow up visit to replace the toilet would be the logical next step. Other options include hand delivering final report, checking on retrofits or replacements made during the audit, following up the final report with a phone call or site visit to see if the establishment has questions, or making a formal presentation of the Certificate of Participation. The final option provides opportunity for media coverage that benefits both the establishment and the utility.

Depending on the publicity desired, the press can be invited to participate at any stage. It is recommended that a press release be distributed at the beginning of the project (see Appendix A for an example). Be sure to include an invitation to the press to attend one or more of the

on-site audits. This will need to be cleared prior to the visit with the participating restaurant. Some will want the publicity, others will not.

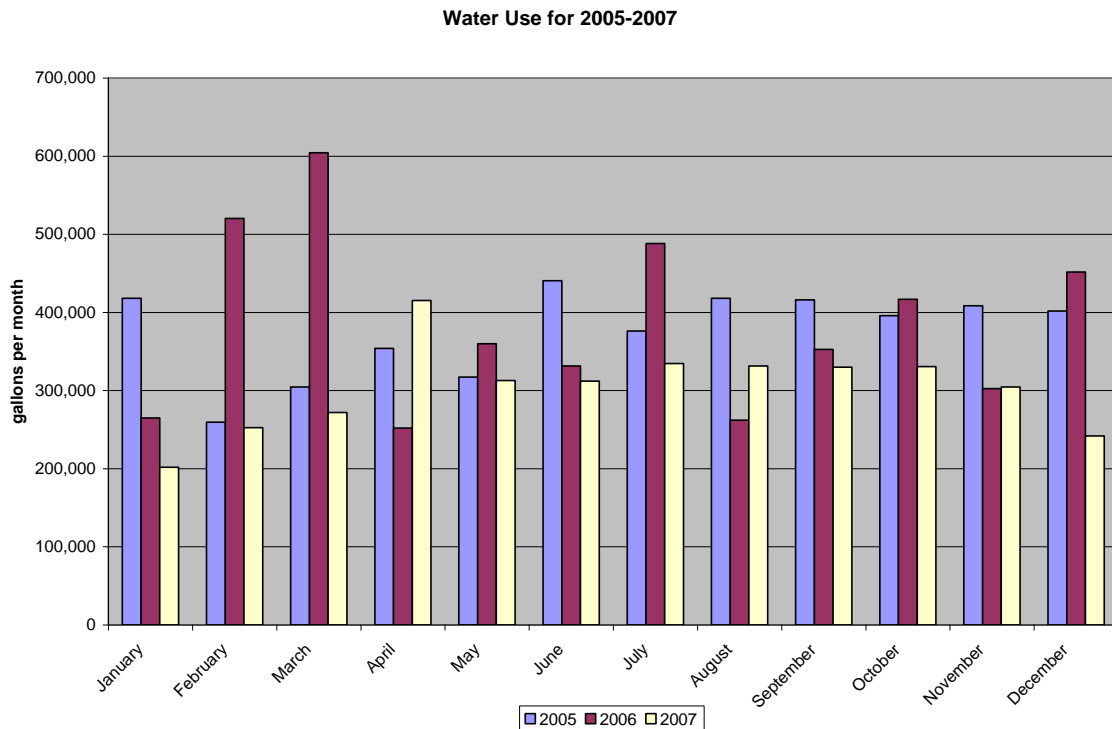
Pre-Audit Analysis

Gathering pre-audit data

Prior to conducting on-site commercial water audits, the utility should analyze the water use for each establishment. Collect monthly water meter readings for a minimum of 1 year for the analysis; three years of data is recommended.

Analyzing data

Calculate annual, seasonal and daily averages to assess the establishment's actual water use. Seasonal averages of summer use (traditionally June, July, and August) and winter use (traditionally December, January, February) water use will provide an understanding of how much water is being used for outdoor irrigation versus indoor uses. Look for substantial changes over the three year period and spikes that might indicate leaks. Below is a simple bar graph showing monthly billed water usage for an establishment for a three year time period.



This graph shows an unusual spike in Feb-March 2006. This could be a leak or an unusual high customer count. Bring this up with management prior to or during the visit to see if there is a logical explanation. Otherwise, the data is relatively consistent by season, suggesting that there is little or no outdoor water use in the summer.

Soliciting Participation

If the utility has decided to focus on the high end users, direct contact with each establishment works best. Identify which establishments use the most water and approach the management through an introductory letter and follow up phone call. Be clear with the management that this is a voluntary program designed to benefit the establishment. The letter should include: a history of the billing data, the analysis of the establishment's data, any retrofit or hardware offers, and the range of potential savings. If the utility also provides energy, any energy savings that results from water savings can also be included. During the follow up phone call, the utility should assess interest level, answer questions and if ready schedule the audit.

If the utility is opening the audits to anyone who would like to participate, a marketing plan will need to be implemented. This can include letters or flyers sent to all food service establishments or advertisements in local newspapers. An example letter and flyer have been included in Appendix B. Keep in mind the limits of the utilities time and money when advertising the audits. Either limit participation on a first-come first-served basis until all the time slots are full or schedule only a couple a week until everyone that requested an audit has been served.

Scheduling Visits

It's best to avoid prime time restaurant hours: breakfast (7 – 9 AM), lunch (11 AM – 1 PM) and dinner (5 – 9 PM). The audit will take approximately 1.5 hours on site, smaller restaurants and fast food establishments take considerably less. Be sure to coordinate with a manager or owner to accompany the auditor for the entire audit. They will be able to answer the necessary questions and provide access to all areas. When scheduling the visit, be clear about the access needed to kitchens, dishwashing areas, mop closets, bathrooms, irrigation control rooms, and outdoor areas. Also, be clear about any installations or retrofits that are offered. Provide retrofits as an option that comes with the audit. It is not a mandate that these fixtures be replaced in order to receive the audit. Get permission from management prior to the visit for any fixture changes.

A sample audit schedule is provided in Appendix C. This example is for a concentrated one-time offer for 16 food service establishments.

On-Site

What to bring

The list of materials, and supplies needed to conduct an audit include:

- Questionnaire, (Attachment C)
- Clip board
- Two copies of the results of the pre-audit data analysis (one to reference and one to leave with management)
- Replacement pre-rinse spray nozzle(s), plumber's tape, and two wrenches (if pre-rinse spray nozzles will be installed/replaced)
- Graduated flow rate measurement bag
- Drip gage cylinder
- Food coloring

- Replacement aerators of various sizes, plumber's tape, and wrench (if aerators will be installed/replaced)
- Timer or watch with second hand

What to look for

The water audit includes eight major sections:

1. General Information,
2. Background Information,
3. Kitchen Water Use,
4. Restroom Water Use,
5. Laundry Water Use,
6. Cooling Water Use,
7. Outdoor Water Use, and
8. Other Uses, Leaks, and Lost Water.

The on-site audit involves first sitting down with knowledgeable party to complete Section 1. General Information and 2. Background Information. This includes a history of the building and the establishment as well as information on the seating capacity, number of meals served per day, number of employees per shift and hours of operation.

The second part of the audit is doing a walk through of each area looking at all water uses and fixtures and inquiring about their use. There are five main areas of the establishment to review: kitchen, restrooms, laundry, cooling, and outdoor. Be on the look out for other potential uses of water. These can include brewing beer, conference centers, mop closets, or shower facilities. Also be aware of employee practices and restaurant policies. The questionnaire will guide the auditor through each section. Feel free to edit the questionnaire, depending on the type of establishment that is audited and on the areas of focus for the audit. In some cases items will be found that are missing from the audit questionnaire; writing, drawing and miscellaneous notes on the back side are encouraged.

Practices and Policies³

There are several practices within a restaurant that can be extremely water consumptive. Look for the following activities and provide recommendations for saving water.

- Instead of defrosting meat under running water try defrosting the meat in the refrigerator. This requires a little extra forethought but will make a huge difference in water use. If there is no choice but to use the running water, keep the flow at a minimum, just enough to circulate the water and make sure the faucet has an aerator.
- Instead of spray cleaning floors or mats, use a mop bucket or waterbroom instead.
- Instead of automatically serving water to guests, serve it only on request. It takes almost four times the amount of water to clean that extra glass then it does to fill it for the customer.

Faucets

³ Sustainable Food Services (www.sustainablefoodservice.com/cat/water-efficiency.htm)

Measure the flow rates and any leaks for each faucet encountered. Also make a note of the primary use for each faucet. Examples of uses include: hand washing, food preparation, dishwashing, water pitchers, etc. This will help determine whether a faucet aerator is appropriate or not. A hand washing sink would be a great spot for an aerator, however a water pitcher station will use the same amount of water to fill pitchers regardless of an aerator. To measure the flow rate, use a graduated flow rate measurement bags. To measure any leaks use a drip gauge cylinder. Both the flow rate bag and drip gauge cylinder are available by various water conservation supply companies for a total under \$5.

If aerators are part of the retrofits, install the aerators while on-site. Keep a supply of various flow rates and styles, along with plumber's tape, and wrenches. Be sure to install aerators only where it is appropriate and only with management's permission. Make sure that the aerator is installed correctly and is not creating a problem. Often the faucet is without an aerator because the connection is broken or warped. This will result in water going in multiple directions and can only be corrected by replacing the faucet. In this case, leave the aerator off and make the replacement of the faucet part of the recommendations in the final report.

Toilets

When auditing bathrooms, the auditor should record the type of toilet, any leaks, and the volume of the flush. A gravity tank toilet is similar to the toilet found in residential homes. They have a tank on the back and use the weight of the water or pressure assist to flush waste down the trap. These tanks will need to be check for leaky flappers. Place four to five drops of food coloring in the toilet tank. Wait ten minutes without flushing. If food coloring shows up in the toilet bowl, then the flapper is probably leaking. Any flapper leaks should be immediately replaced or reported in the final report. A flushometer or flush valve toilet is a commercial/ institutional type toilet. It will not have a tank, but will have a pipe containing a pressure valve connected to the wall. This will generate a flush by the opening of a valve directly connected to the pressurized water system. There is no simple way to check for leaks in the valve toilet.

There are several ways to check the volume of water used per flush. On tank and valve toilets, the volume should be printed behind the seat. This was the intended volume per flush and should be double checked to determine actual use. For a very general measure, time the flush. A flush that takes approximately 7 seconds is probably a 1.6 gallon flush; a 12 to 15 second flush is closer to 3.5 gallons. Anything longer than 20 seconds is at least 5 gallons. This method can be dependant on the water pressure. Systems with very low pressure may take longer to fill, even with low-flow toilet. Another option for tank toilets is to measure the tank dimensions and water levels. See side bar for details. Any toilet flushing over 1.6 gallons should be added to the final report as a recommended retrofit or replacement. When recommending toilet replacements, check the Environmental Protection Agency's (EPA) WaterSense listing or the Maximum Performance

Determine Volume by Tank Dimensions

- a. Measure the length of the tank.
- b. Measure the width of the tank.
- c. Measure the full water level in the toilet tank (depth 1).
- d. Flush the toilet and measure the drop at the lowest level (depth 2).
- e. Subtract depth 2 from depth 1. This will give you the "drop" measurement.
- f. Multiply the length times the width times the "drop" to determine the volume of cubic inches of water used per flush.
- g. Divide the volume by 231 to get the number of gallons per flush.

testing for toilets (MaPs) report. Appendix E contains additional information on low-flow and high efficiency toilets and Appendix J provides references for WaterSense and MaPs.

Toilets that are stamped as 1.6 gpf but are measuring a high volume flush have probably been incorrectly retrofitted. On tank toilets check the flapper to make sure it is the appropriate fit. This may require checking the manufacture's specifications on-line. On a valve toilet, check the diaphragm which is located in the pressure valve. The diaphragm should be stamped with its flow rate. Again you may need to check the manufacture's specification for the appropriate replacement diaphragm.

Pre-rinse spray nozzles

These nozzles are now regulated as part of Energy Policy Act of 2005. All units manufactured after January 1 2006 must have a flow rate of not more than 1.6 gallons per minute. Models made prior to the deadline had a flow rate of around 3 gallons per minute. By replacing these higher-volume models with the lower-flow, high-pressure model, each facility can save over 0.16 acre feet of water a year.⁴ This action alone will save money on water and energy for the facility and is designed to inspire the on-site decision makers to implement the additional audit recommendations. There are many high-efficiency, low-flow nozzles available for sale from multiple companies for about \$30.00 each, although per unit cost will depend on the quantity and quality of nozzles purchased.

Ice Machines

Ice machines either make flake/nugget or cube ice, and use either air or water to cool their compressors. Air-cooled, flake ice machines are the most energy- and water-efficient type of ice machine available. Flake/nugget ice machines use 20 gallons of water to make 100 pounds of ice, while cube ice machines use 30 or more gallons of water per 100 pounds of ice. Water cooled ice machines use an additional 72 to 240 gallons of water per 100 pounds of ice to cool the machine's compressor.⁵

When performing the audit check for the brand, make and model of the ice machine. Most machines can be identified on the Internet or with a little research. In general, a water cooled machine will take up less space than the air cooled machines. Air cooled machines need ventilation for the hot air. They will usually have a vent out the roof. However, these machines are becoming more efficient and newer models cannot always be identified by size. When recommending replacement machines, check for the EPA's Energy Star label. At this time, WaterSense is not labeling ice machines.

Water Cooled Ice machine ⁶

Air Cooled Ice machine

⁴ California Urban Water Conservation Council, "Rinse and Save: Final Report Summary," (February 2005)

⁵ East Bay Municipal Utility District, *Watersmart Guidebook*, (2008).

⁶ Pictures from <http://www.restaurantsource.com>



Outdoor Irrigation

For establishments with irrigated landscaping, the irrigation water should be assessed. This is usually evident in the pre-audit analysis. If summer months provide a significant spike in water usage, this can be due to outdoor irrigation. In some cases it is due to increased tourism, so discuss both possibilities with the owner prior to the site visit. If increase water use is due to irrigation, schedule a little extra time on-site for the irrigation portion of the audit.

For large turf areas with sprinkler systems, the Irrigation Association⁷ has established an auditing protocol to determine application rates and distribution uniformity. Contact the Irrigation Association to learn about a class in your area or to find a certified landscape audit specialist. For smaller areas, a simple walk through the grounds and a review of the irrigation schedule should suffice. For sprinkler systems, make sure sprinkler heads are appropriately placed and aligned (not watering the sidewalk), that they are providing head-to-head coverage, and that they are not clogged or leaking. For drip irrigation systems, check to make sure the emitters are appropriately placed in the drip line of the plants, that each plant has at least two emitters, and that the emitter rates are appropriate to the plants watering needs. If there is an automated timer, make sure that it is set for early morning or late evening, that it is adjusted by season, and if appropriate, that it is shut down every winter. To determine appropriate run times for irrigation systems, use the NMOSE New Mexico Landscape Irrigation “Smart” Controller that can be found on the NMOSE website at http://www.ose.state.nm.us/newtstweb/conservation_index.html. All findings and recommended adjustments should be included in the final report.

Reporting

What was found?

⁷ <http://www.irrigation.org/default.aspx>

The final report should provide the management with the details of the pre-audit analysis, what was replaced or done on-site, what was found while on-site, and what are the recommendations. Start the report with a review of their current water use, including an overview of any seasonal differences in water use or unusual spikes. Provide a legible copy of the completed audit questionnaire. This provides management with the details regarding all the fixtures and appliances that were tested or discussed. It also provides a baseline for any follow up or additional audits the establishment might undertake. In a letter or report format, provide the details regarding what was found, what if anything was done, and what the findings mean. For example, if a faucet aerator was installed what are the expected water savings in both gallons and dollar amounts per year. Other findings can include:

- leaky or high flow faucets,
- non-low-flow toilets,
- water cooled ice machines,
- irrigation system problems,
- non-native landscapes, and
- actions that waste water.

This should be followed up by any actions that the utility recommends for the establishment. Again, include what taking these actions would mean for the establishment. For example, if a water cooled ice machine was found, the recommendation would be to replace it with an air cooled unit that might have a pay back period of 2 years. Another example might be an irrigation timer that was not properly programmed, where a recommended schedule change would show immediate savings for the owners without any additional costs. This list should be very specific and should include any references or follow up information that might be needed to get the job done. Here is one final example:

It is recommended that the two high volume flush toilets (3.5 gpf) in the women's restroom be replaced with low-flow (1.6 gpf) or ultra-low-flow (1.3 gpf) toilets. At the current rate of \$3.24 per 1,000 gallons, a \$350 low-flow toilet will pay for itself in 19 months; an ultra-low-flow would pay for itself in 17 months. For a complete list of high performance toilets refer to the Maximum Performance testing of toilets published by California Urban Water Conservation Council at <http://www.cuwcc.org/>. For more information on commercial toilet rebates, contact your utility representative at 505-***-****.

Programs offered by utility

Be sure to include a listing of all water conservation or pertinent programs offered by the utility. This includes programs that were identified as relevant in the audit, such as a toilet rebate program but should also include complimentary programs, such as printed material available, and upcoming training programs or events. This would be a great place to mention the benefits any federal water programs or utility sponsored energy programs. An example of one utility's table tent program is provided in Appendix H. If the utility is planning any follow-up visits or post audit data analysis, include the details within the final report.

Cost Benefit Analysis

An example cost benefit analysis spreadsheet has been included in Appendix F. This worksheet illustrates how to estimate the conservation savings that would come from fixing leaks, reducing faucet flow rates, and pay back period for retrofitting fixtures such as toilets and ice machines.

As shown in the example cost-benefit analysis spreadsheet, a 3.5 gpf fixture is replaced with a 1.6 gpf fixture. It is assumed that the toilet is flushed 100 times per day. The example also uses a current volume based water rate of \$3.24 per 1,000 gallons. Therefore, it will take 1.6 years for the water bill savings to equal the cost of a \$350.00 replacement toilet. The pay back time will vary depending on the cost of water and the toilet purchased as well as the number of flushed per day.

Another example is replacing a water-cooled, cube-style ice machine (the least efficient type) that makes 250 pounds of ice per 24-hour period with an air-cooled, flake ice machine will lead to a savings of approximately 600 gallons of water each day. An air-cooled ice machine costs about \$1,000 more than a water-cooled ice machine, and a nugget/flake-ice machine costs between \$500 and \$1,200 more than a cube style ice machine. In this case and assuming that the current volume based water rate is \$3.24 per 1,000 gallons, it will take approximately two years for the water bill savings to repay the cost of a \$1,500 replacement ice machine.

Certificate of Participation

A Certificate of Participation is a simple way to show the utility's gratitude for the establishment's cooperation. It also allows the establishment to show their collaboration with the utility. Make sure the certificate is only highlighting the involvement in the audit, and does not promise that the establishment is low-water-use. The certificate should include your logo, the logo of any partners and the signature of someone in authority. If there is a little extra money, a nicely framed certificate would encourage the restaurant to put it on display. An example Certificate of Participation can be found in Appendix I.

Follow-up

The utility will need to decide at the beginning of the program, what kind of follow up assistance will be provided, if any. This will largely depend on staff time, financing and whether the utility provides any complimentary programming. Most programs end with the delivery of the final report. Potential follow up activities could include: an on-site visit to determine if all retrofitted or replaced items are properly working, an on-site check of installation items that qualify for rebates with the utility (toilets, ice machines, etc.), or sending an analysis of the post audit data one year after the audit.

Wrap Up

Throughout the process it is very important to keep good records of the work that is done. Record the participating establishments by name, date of audit, and account number. This

will allow for tracking the results of the program. It may also be beneficial to record any work that was done on-site (retrofits, leak repair, etc.). This is also a good opportunity for another press release. It can include participating restaurant and the estimates of water saved. One year or so after the final audit, the utility should repeat the AWWA water audit⁸ and the NMOSE's Gallons per Capita per day Calculator⁹ to determine how or if the audits impacted the utility's water use. This will be harder to pinpoint if several programs were running at the same time. However, with the account numbers and date of audit recorded, the utility can also pull specific records to determine the impacts of the audits.

⁸ <http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47846&navItemNumber=48155>

⁹ http://www.ose.state.nm.us/wucp_pws.html