K-STATE Kansas State University

WATER QUALITY SERIES

Plugging Cisterns, Cesspools, Septic Tanks, and Other Holes

Many rural homesites, farmsteads, and older homes have used underground holes to store water (cisterns) or dispose of waste (cesspools, septic tanks, and seepage pits). These holes are safety hazards for people and animals and potential routes for possible groundwater contamination. When these features are no longer used and there is no specific plan for future use or they are not suitable for future use, they should be properly plugged to eliminate the hazard.

It is the responsibility of the landowner to provide safety and protection of groundwater through plugging of cisterns, cesspools, septic tanks, and other holes. This bulletin presents the best procedures to eliminate these holes.

Origin of cisterns, cesspools and other holes

Historically, homes located where groundwater was not readily available depended heavily on roof runoff collection and cistern storage for household water. Many cisterns are unused today because homesites are now served by other water supplies. The cistern may pose environmental and safety hazards in much the same manner as an abandoned well.

This open cesspool is a serious potential safety hazard.

Although now illegal, wastewater has often been disposed of in a cesspool or dry well. Construction was similar to a shallow dug well lined with bricks or stone. It was often 6 to 10 feet in diameter and 15 to 20 feet deep. The depth was less than that of groundwater, thus the name "dry" well.

Cesspools are a serious potential source of groundwater contamination and a definite safety hazard.

In the past, Kansas law permitted seepage pits following the septic tank for wastewater disposal. These were holes in the ground filled with stone or other inert material such as broken brick. They were constructed according to state guidelines for size and depth. Construction of seepage pits has been illegal since May 1996, and existing pits must be properly disposed of whenever they are not used or not working.

Plugging highly recommended

It is strongly recommended that unused cisterns, cesspools, septic tanks, pits, or other holes in the ground be given the same consideration as abandoned wells. Although not as deep, these excavations create the same environmental concerns as dug wells. They should be properly eliminated of by plugging or filling following recommended procedures and approved materials. The Uniform Plumbing Code, Sec. 722, states that *every cesspool, septic tank, and seepage pit that has been abandoned or is not used shall have the contents and top removed, and then be filled with earth, sand, gravel, concrete or other approved material. When abandoned in conjunction with connecting to a public sewer, filling shall occur within 30 days.* Proper closure eliminates the following situations:

- safety hazard from possible collapse of the top or opening
- possible future problems with structural integrity for any construction on top of or adjacent to the structure
- a possible pathway of groundwater contamination
- liability exposure for safety or groundwater contamination from unplugged holes

By following the well-plugging procedure these concerns will be satisfied with permanent disposal of the unused or abandoned structure. Though this plugging

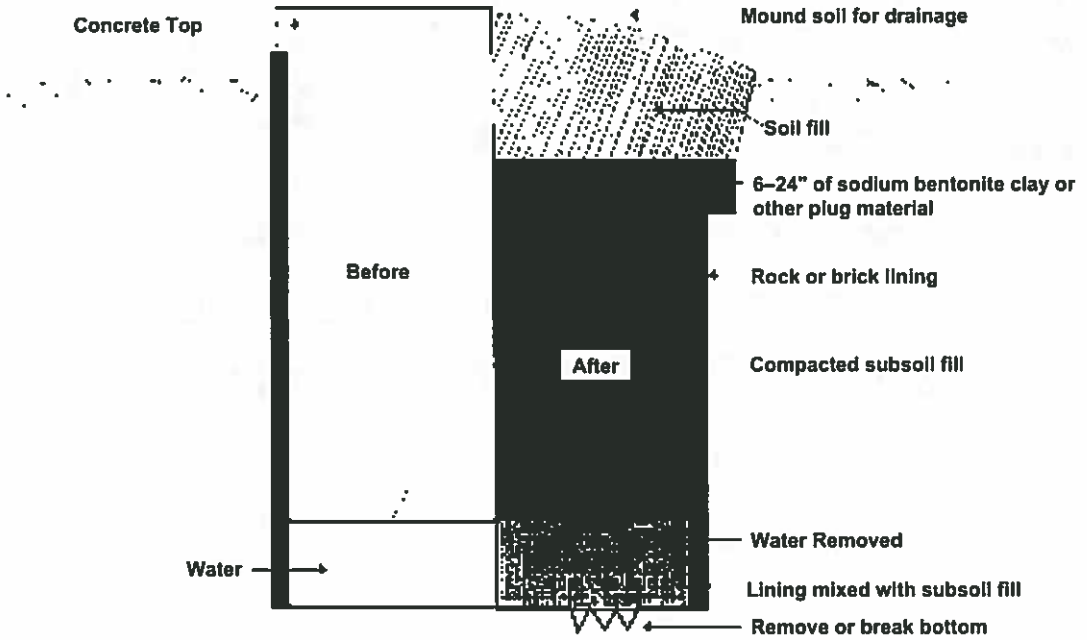

Figure 1. *Plugging diagram for cistern, cesspool or septic tank.*

procedure is a permanent solution, there may be special cases where a less permanent solution may be appropriate for a cistern as discussed later in the section on filling inactive cisterns.

The procedures discussed in this bulletin apply only to holes located at single-family residences and used only for storage or disposal of water or wastewater. Any tank or cavity used for storage of petroleum products or other chemicals requires Kansas Department of Health and Environment (KDHE) contact and procedures. Other KDHE programs such as the underground injection control (UIC) program could require other procedures. Closure of a cesspool, seepage pit, septic tank, or other hole that has received sewage, may be subject to city or county code through local health, environmental, or other agencies. Check with local agencies to determine if they have rules or assistance programs.

Procedure for plugging holes

The plugging procedure described here follows the well-plugging rules established by KDHE for dug wells and is illustrated in Figure 1. This procedure is recommended for plugging non-well holes deeper than 10 feet. Plugging a cistern, cesspool, septic tank, or other non-well hole is not addressed in Kansas law or regulations, thus no plugging report is required. The plugging procedure described in this bulletin would be most suited for deep (greater than 10 feet) and small-diameter (less than 8 feet) holes.

However, if the structure intercepts groundwater, regardless of how it was used, it is a well, and all requirements used for well plugging must be met including filing the WWC-5 or WWC-5P report with KDHE. These forms can be obtained by contacting the KDHE at (785) 296-5545.

Step 1: Remove water and organic debris. Pump any water, semisolid, or solid organic material from the cistern, cesspool, septic tank, or other hole. Organic solids, semisolids, or liquid material should be disposed of in a permitted wastewater-treatment facility or properly land applied according to current regulations. Pumping should be done by a licensed septage hauler unless the property owner has the proper equipment and does the work.

Note: Is the hole acting as a well? Sometimes cisterns, cesspools, septic tanks, or other holes might contain water either seasonally or continually. If water returns after being pumped, it is a well and should be plugged as a well following procedures outlined in Extension bulletin MF-935, *Plugging Abandoned Wells,* available at County Extension offices.

Step 2: Clear debris. Remove all hardware and foreign material or debris from the hole and remove debris from around the site. Remove any buried non-masonry or stone device, such as a car or truck body, used as the walls of the seepage pit.

Seepage pits or other filled holes constructed following old Kansas rules have their interior filled with chunks of masonry, stone, or other inert nondegrading material. It is not practical to remove this fill material, so it should remain in place. As stated earlier, car bodies or other cavity devices or structures used for seepage pits must be removed. They should have all piping entering or exiting the hole removed or plugged.

Step 3: Puncture the floor. It is important that water not accumulate inside a cistern or other structure to form a perched water table. Removing the floor is preferred, but drilling or breaking the floor is usually adequate to allow drainage and prevent any accumulation of water after plug-

ging or filling. Floors should not be present in cesspools, seepage pits, or most other holes.

Step 4: Plug/fill the structure. Plug the cistern, cesspool, or septic tank with local low-organic-matter subsoil (usually natural clay) material. Be sure this material contains no other potential contaminants and is moist enough to compact easily. The clay should be placed in layers of 6 inches to a foot (no more than 2 feet) and compacted to prevent settling. Some form of mechanical compacting should be used. Stop when the fill is within 5 feet of the surface.

The lining of the cesspool or cistern can be used as part of the fill. In some cases, however, there may not be enough volume to dispose of the lining in the hole. In this case, the excess lining should be removed. Generally, a rock or brick wall and mortar lining can be pried loose with large pry bars. However, a backhoe or front-end loader may be desirable for large structures. When using heavy equipment, the surface soil around the hole should be scraped away to expose the subsoil layer. As the rock walls are added to the fill, be certain to add sufficient fill material to eliminate any voids around the rocks.

Step 5: Place grout plug. Level the lining at the desired depth, which usually is 5 feet below the surface, and complete the subsoil fill up to this same level. The structure is now ready for the plug of approved grout material which should be 6 to 24 inches thick. Sodium bentonite clay is recommended.

Because of bentonite's expansive and pliable nature, it will conform to the uneven edges and expand to fill voids. If any settlement should occur, the bentonite plug will not crack or lose integrity as a seal. Cement also is an approved plug material. A cement plug must be much thicker and should be reinforced to have enough strength to prevent cracking and collapse.
A low water to cement ratio (max 0.5) with an ultimate design strength of at least 3,500 pounds of strength should be used. The following is an example of a cistern or cesspool grout plug procedure.

> Example: A 6-foot inside diameter lined hole is filled and ready for the plug material. How many bags of bentonite are needed?
>
> Since bentonite will expand, the minimum 6-inch thick plug will be used. Remember, the plug should extend beyond the lining of the original hole diameter. For this example, assume the brick lining is 4 inches thick and has an equal width of loose fill outside the brick lining. The plug needs to extend beyond into undisturbed soil, therefore, an 8-foot diameter plug will be placed. From Table 1, an 8-foot diameter hole requires 50 cubic feet of fill per foot of depth. Since only a 6-inch plug is required, only 25 cubic feet of material is needed. Dividing 25 cubic feet by 0.7 cubic feet/50-pound bag determines that 36 bags of bentonite are needed.

The grout seal can become very expensive for large diameters. Since this is recommended rather than required, a substitute for an approved grout would be any natural high-clay-content, low-organic-matter, and low permeability subsoil. A natural clay plug should be at least 2 feet thick. It should be thoroughly wet and compacted as placed.

Table 1
Volume per Foot of Depth for Round Holes

Diameter of Opening	ft^3/foot of fill
3 ft.	7.1
4 ft.	13
5 ft.	20
6 ft.	28
7 ft.	38
8 ft.	50
9 ft.	64
10 ft.	79
11 ft.	95
12 ft.	113
13 ft.	133
14 ft.	154
27 ft^3 = 1 yard	1 50-lb. bag of bentonite = 0.7 ft^3

Step 6: Restore surface grade. After placement of the grout seal, fill the remainder of the hole with soil. The top foot or so should be topsoil. Mound the fill at least 10 inches above the surrounding surface to allow for settling and to prevent surface water ponding.

Temporary fill for inactive cisterns

Using a filling procedure described as follows is not suitable for a cesspool, septic tank, or for other holes that received sewage. Use the plugging procedure presented previously for permanent disposal of these holes.

In cases where specific conditions occur, a cistern can be safely filled and still comply with safety and potential groundwater contamination concerns. The owner must understand that filling is a temporary fix, and construction should never occur over a filled cistern. Furthermore, construction also is discouraged adjacent to a filled cistern. The only situation where filling may be suitable is when all of the following conditions are satisfied. The filling procedure assumes the top of the cistern will remain intact rather than being completely removed.

- At least 4 feet of medium-or fine-texture soil (silts and clays) separate the bottom of the cistern from groundwater or permeable material such as sand, gravel, or fractured rock.
- The cistern sides and top are leakproof (no cracks or joints) and structurally sound. Generally, the cistern must be of high-quality reinforced concrete to meet this requirement. A good test for structural quality is to remove the cover and hit the riser hard with a heavy hammer (6 pounds or more). If no cracks or breakage occur, it passes the test.
- The cistern has not received any waste material in either solid or liquid form.
- No future construction will ever be done near or over the cistern.

If all of these conditions are satisfied, the cistern may be filled following this procedure. However, the owner must understand that this is not a permanent solution, and the proper plugging procedure may be required in the future if a structure is to be built or the cistern structure becomes leaky.

Step 1. Remove water and sediment. All water, sediment, and other debris must be removed from the cistern before beginning. Because roof runoff contains some sediment, it is not unusual for considerable sediment to have accumulated in the cistern bottom. Pump out water and semi solids and dig out solid material from the cistern.

Note. Is the cistern a well? If water seeps in after emptying the cistern, it is acting as a well and well-plugging procedures must be followed as specified previously. Follow procedures outlined in Extension Bulletin MF-935, *Plugging Abandoned Wells*.

Step 2. Clear debris. Remove all piping, hardware and nonmasonry or stone materials from inside and around the site.

Step 3. Puncturing the bottom. The cistern must not hold water, so the bottom must be removed, broken, drilled, or otherwise made to leak so any water that may seep from the surface into the cistern can get away and not accumulate inside.

Step 4. Plugging openings. Any pipes into the cistern must be removed or cut off at the inside surface. These holes and all other openings must be carefully cleaned and plugged with high quality cement to make a permanent plug. Disconnect and plug all underground inlet pipes at the source if it is not practical to remove the pipe. When finished the top and any top or side penetrations should not allow any water to enter the cistern. This may require a new cover or caulking the cover in place.

Step 5. Filling the cistern. Sand, gravel, or other clean, inert, granular material may be used. This material must be carefully placed in far corners before finally filling near the opening. The whole interior must be filled and compacted so it will not settle and leave voids. Considerable efforts will be required to fill all spaces in corners, and sand will require compacting to prevent settling.

Step 6. Replace the top cover. The inert fill material will prevent any safety hazard from possible collapse of the top. If the top should crack, deteriorate, or otherwise become leaky, repairs must be made to keep water out, or the permanent plugging previously described must be done.

Shallow Cistern Removal

Many cisterns are shallow (no more than a few feet deep), and may be partially above ground. The best course of action for disposal of these cisterns is complete removal. This is especially true if the side walls are brick or concrete block laid with mortar. Removal is a permanent solution that may not involve much more effort than the less-permanent solution of filling the structure in place. Once removed, the hole should be filled in shallow layers with local subsoil and thoroughly compacted. If the hole is less than 5 feet deep and the bottom does not contact fractured rock or coarse material, it is not necessary to place a grout plug.

Summary

Abandoned cisterns, cesspools, seepage pits, septic tanks or other holes are a potential safety hazard to people, animals and structures. They also are possible sources of direct contamination of valuable groundwater. To eliminate safety and environmental hazards and minimize liability exposure, they should always be properly plugged as a preventive action.

Other information sources include KDHE (785-296-5545) or local offices such as the Nonpoint Source program through the county conservation district office, local health or environmental office and county extension office.

List of References

Selected K-State Research and Extension Publications

Plugging Abandoned Wells MF-935
Safe Domestic Wells MF-970
KDHE Bulletin 4-2, *Minimum Standards for Design and Construction of Onsite Wastewater Systems*, K-State Research and Extension MF-2214
Get to Know Your Septic System MF-2179

Other Publications

Uniform Plumbing Code

Authors

Danny H. Rogers
Extension Irrigation Engineer

G. Morgan Powell
Natural Resource Engineer

Kansas State University Agricultural Experiment Station and Cooperative Extension Service, Manhattan

MF-2246 July 1998