

**VERTICAL OPENING
RECLAMATION PROJECT**
Cherokee and Crawford County
in Southeast Kansas

Submitted by:
**The Kansas Department of Health and Environment
Surface Mining Section**

Designed by:
**The Kansas Department of Health and Environment
Surface Mining Section**
Frontenac, Kansas

for

**The Kansas Department of Health and Environment
Surface Mining Section**

Construction by:
Robison Construction
Oswego, Kansas

Started : November 1, 1996

Renewed: Yearly

Cost: \$100,000.00/Year

March 2003

Vertical Opening Reclamation Project Crawford & Cherokee Counties

Managed by the Kansas Department of Health & Environment
Surface Mining Section

Background

Most underground mining of coal in Kansas occurred in the southeast part of the state between the 1870's and 1930's (Marcher, 1984). The coal mined at that time was hand dug. The Weir-Pittsburg coal seam was the predominantly mined seam with most mining occurring 70 to 130 years ago. The shallowest mining took place along a line from Pittsburg, Kansas to Weir, Kansas and then south to Turck, Kansas (Vertical Opening Specifications, 1996). It has been observed that the shallowest mining was between ten and fifteen feet below the surface.

Kansas currently has over 350 abandoned coal mine sites identified as Priority Two problems. The majority of these sites are dangerous highwalls, but there are also a considerable number of subsidences, which are the result of continuing and unforeseen collapses of abandoned underground coal mine passages. Other vertical openings left by the mining companies and associated with abandoned underground mining are abandoned mine shafts. These shafts may be air shafts or entry shafts and are either wood or concrete lined (Vertical Opening Specifications, 1996). The shafts were used either for entrance to the mines or for fresh air. Because not all subsidences or shafts fall under the Emergency Program s requirement for a sudden occurrence , a reclamation project named Shaft Closure was bid in 1994. Six openings were filled in conjunction with that project. The average cost of filling each shaft was \$8,377.00. The Kansas Surface Mining Section (SMS) felt there should be a better and more economical way to address the many Vertical Openings (VO s) still plaguing the area. The Vertical Opening Reclamation Project (VOP) was started in 1996 with the intention of being a continuing project to assure the reclamation of those subsidences and openings which did not fall under the Emergency Program, but which posed a real and definite concern for public health and safety.

Robison Construction of Oswego, Kansas was awarded the first contract of the Vertical Opening Reclamation Project. Since the start of the project in November of 1996 and through the end of fiscal year 2002, there have been approximately **422** holes filled with their associated hazards abated. The average cost of filling each hole is about \$1,500.00. When comparing the cost of reclamation of the six holes filled in the Shaft Closure Reclamation Project and the 422 holes filled in the Vertical Opening Reclamation Project the continuing VOP has been very cost effective.

The Problem

In shallow mining areas, subsidences can reach the surface as open voids or holes in the landscape, rather than a depression. Most subsidences in the area have been caused by collapse of the shallow underground mine roofs left from mining the Weir-Pittsburg coal seam, although other coal seams may be involved. The ceiling of the coal bed was poor quality having little or no sandstone or limestone for structural support. When the major coal companies abandoned a mine site the workers often robbed pillars and collapsed the mine rooms as they moved out. If pillars were left, small coal companies or individuals needing coal to burn, would rob the pillars. Besides having poor or no roof support, most often the mines would fill with water which eventually erodes any remaining support and during periods of either high precipitation or drought more subsidences would appear.

Many of the VOP sites are located along highly traveled state and county roads. Some VOP sites are within a few feet of residences, and some are within community boundaries. Such was the case in the small community of Turck, Kansas. There are approximately two dozen houses left in this once thriving mining town, all of which set upon ground that was deep mined. After the mining ceased the mines were often used for dumping sewage. Several landowners were dumping raw sewage into the mine workings just as their forefathers had done, not realizing the affects on the ground water.

The basic criteria for abating a vertical opening is:

1. Mining which caused the hazard must have taken place before 1977.
2. Owners of the property on which the hazard is located, did not participate in the mining.
3. A danger to the health and safety of the public must be present.

Project Design

The Vertical Opening Project includes backfilling both dangerous subsidences of unknown depth and abandoned mine shafts. The SMS has allocated \$100,000.00 per year for the reclamation of these problems. Funding is renewed each year and sites not filled will remain on the inventory to be used for the next year s list. Initially the SMS designated 32 holes out of the identified 115 holes to be filled the first contract year. Additional holes would be filled if funding allowed. The contract is renewed and extended as new sites are discovered. The SMS reserves the right to renew this contract for four additional twelve (12) month periods at the same prices, terms, and conditions, if agreeable to the contract parties. A written yearly approval is requested, but if the parties cannot agree on renewal terms, the project may be rebid. Contract adjustment for inflation may be included in the contract renewals (Vertical Opening Specifications, 1996). The VOP was rebid in 2001 and was again awarded to Robison Construction, who has since renewed the contract on a yearly basis. The project will be up for rebid again in 2006.

Generally most sites will be backfilled as follows:

1. Large well graded shot rock in the bottom of the excavated hole to reduce further settling and prevent the subsequent earth fill from being washed away by mine water.
2. Six inches to one foot layer of fine crushed stone on top of the shot rock to seal the large voids in the shot rock preventing the loss of material above.
3. About two feet of compacted clay on top of the crushed stone.
4. Sufficient clay, spoil, or other suitable material as required to reach the surface depending on the hole depth.
5. Approximately one foot of root growth medium covering, mounded and graded to drain.

General Procedures:

1. Call Dig-Safe and other utilities to locate buried cables and pipes.
2. Clear away brush and trees, remove trash and debris.
3. Excavate to remove any unsuitable material, stabilize sides of the openings and enlarge the subsidence area for backfill placement.
4. Backfill to within 12 inches of the surface with materials to be designated by the SMS.
5. Place and compact at least one foot of root growth medium to fill area. Mound root growth medium over hole so that all water will flow off the backfilled area.
6. Grade, seed and mulch disturbed areas with grasses that are compatible with surrounding vegetation.
7. Clean up site and repair all damages caused by reclamation activities.

As with the Emergency Program, NEPA compliance is addressed with a blanket approval. That is, a letter was sent to all agencies concerned explaining the project, then a blanket approval was made by each agency. For example, as stated in a letter dated August 15, 1995 to the U.S. Fish and Wildlife Service, As with the emergency program, due to the small size and number of sites which must be backfilled, it is not practical for either the SMS, the Kansas Department of Wildlife and Parks (KDWP) or your agency to have each site cleared by KDWP individually . The U.S. Fish and Wildlife Service responded, Based on our review of this project, and through coordination with the KDWP, I concur with your determination that there should be no adverse effect on federally-listed threatened and endangered species as a result of project implementation. Therefore, the Fish and Wildlife Service has no objection to your proposal . And as stated in a letter from The Kansas Historical Society addressing the issue, It would be our preference that we exempt all subsidences from review, as they are already disturbed areas, in lieu of the memorandum .

Project Construction and Reclamation

While some of the larger VO s may take a week to excavate, fill, grade, and revegetate, some of the smaller holes may take only a few hours to reclaim, making it possible to fill five or six holes in one day. One of the larger sites has been chosen to show the extent to which these subsidences can be a major health and safety hazard to the general public. Also discussed are some general excavating, backfilling, and revegetating activities.

Most VO s are excavated to a solid base, filled first with shot rock, then fine crushed stone, clay, and topped with root growth medium. The root growth medium is mounded to permit settling, it is then raked and seeded with grasses compatible to the surrounding area. Root growth medium is usually found around the subsidence and is salvaged by the contractor. When necessary, root growth medium is obtained by the contractor from an approved site.

When the VO is in a stream channel or drainage ditch, the rock fill may be grouted to seal the hole. The grout seals the edges so water cannot flow along the perimeter of the fill, much the same way that wax does on the top of jelly, during the canning process. If water has a chance of eroding the shaley edges of the subsidence, the overburden might eventually decay and result in another opening. In other words, the top of the fill is armored with grout to protect the shaley subsoil from erosion.

Site number 9620-01 is located in a drainage ditch in an open field close to a railroad grade. The vertical opening was a result of a subsidence of the shallow mining in the area. The opening was 60 feet in diameter and 40 feet deep. The contractor cleared 200 square feet and excavated 15 cubic yards. One ton of trash was hauled to a landfill in the process of excavation. The hole was filled with 750 tons of shot rock, 150 tons of fine crushed stone, and because the opening was in a drainage ditch, 90 cubic yards of grout. Eighteen hundred tons of clay were backfilled to within 12 inches of the surface and one foot of root growth medium was compacted on top of the clay. An additional 7000 square feet of root growth medium was mounded over the entire area not to exceed four feet in height. To complete the reclamation, the area was fine graded, seeded, mulched and planted with grasses compatible to the surrounding area.

The first VO s filled were considered to be the most hazardous to the general public, and were generally within 75 feet of either county roads or state roads. The next VO s filled were those close to residences or within communities. The VOP program encouraged landowners to stop the practice of dumping raw sewage down into the mine works and install septic systems so that the dangerous openings could be filled. One vacant lot in the town of Turck had 20 plus openings. Children playing in the area were in grave danger. The VOP filled all of these openings making the area safe for people and animals. VO s remaining on the inventory list will be filled according to the degree of danger such as those close to residences, roads, and railroads, as well as subsidences in stream channels. Locality is also a factor taken into consideration. It is often more economical to fill several VO s in the same locality than to move the equipment ten miles or more to fill a larger hole and then move back to the smaller holes again. Of course, health and safety are the top priorities and those VO s most dangerous to the public will be filled first.

While the surface of the earth is constantly changing it is seldom noticed or observed. However, where mankind has intervened and mined in areas where the shallow Weir-Pittsburg coal seam was found, there are often sudden changes that adversely affect the earth's surface and are a threat to the health and safety of the public. As some of these sites are reclaimed, other dangerous sites are newly discovered. The public is the usual means by which subsidences and shaft openings are reported. Once reported, the SMS immediately investigates and adds them to the inventory if they meet the basic criteria.

The VOP was started in 1996 as a pilot project, but with hopes of being an ongoing way to reclaim the many openings left from past coal mining that were and are a detriment to the public. Now in its sixth year the SMS feels that the VOP has been a success. Well over 400 holes have been filled that were a safety and health concern. Since the beginning of the VOP many holes in road shoulders have been filled. This not only keeps roads stable, but aids in safety of motorists if they happen to leave the road. A number of holes have been filled in farm fields, keeping farm equipment and people safer and adding back acres to productivity. In addition, well over 14 VO's have been filled in major streams and waterways, keeping the ground water from entering the mine works and potentially creating acid mine drainage and additional erosion of the underground works. Over the past decades most holes of any size have been used as trash dumps, and as discussed previously, VO's have been used for dumping household raw sewage. Reclamation of these subsidences eliminates breeding grounds for mosquitos and other vermin, and decreases the pollution of ground water.

The SMS has received a great deal of positive feedback from the public since starting the VOP. The file is filled with thank you letters and acknowledgments from those landowners that have benefitted from the project. Other letters and memos are from people who like what the VOP has done for health, safety, and the environment, and the economic benefits in the form of more farmable land and road stability. As more subsidences and shaft openings are reported the SMS envisions that the VOP will be a part of the Kansas Surface Mining Section program for many years to come.

Photo Captions:

Photo 1. The drainage ditch is in upper left corner. Flowing water finally eroded underlying shales and collapsed the roof of the mine.

Photo 2. Pouring grout on top of the shot rock to make a seal so that water cannot erode shales around the edge of the newly filled VO.

Photo 3. March 7th, 2003. The drainage ditch was put back in pre-subsidence condition to establish the original flow pattern of the stream. The site was completed in the spring of 1997 and is fully revegetated. There is no evidence of erosion problems or further subsidence.

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LITERATURE CITED

Marcher, M.V. and J.F. Kenny. 1984. Hydrology of Area 40, Western Region, Interior Coal Province. U.S. Geological Survey, Water-Resources Investigations Report 83-266.

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