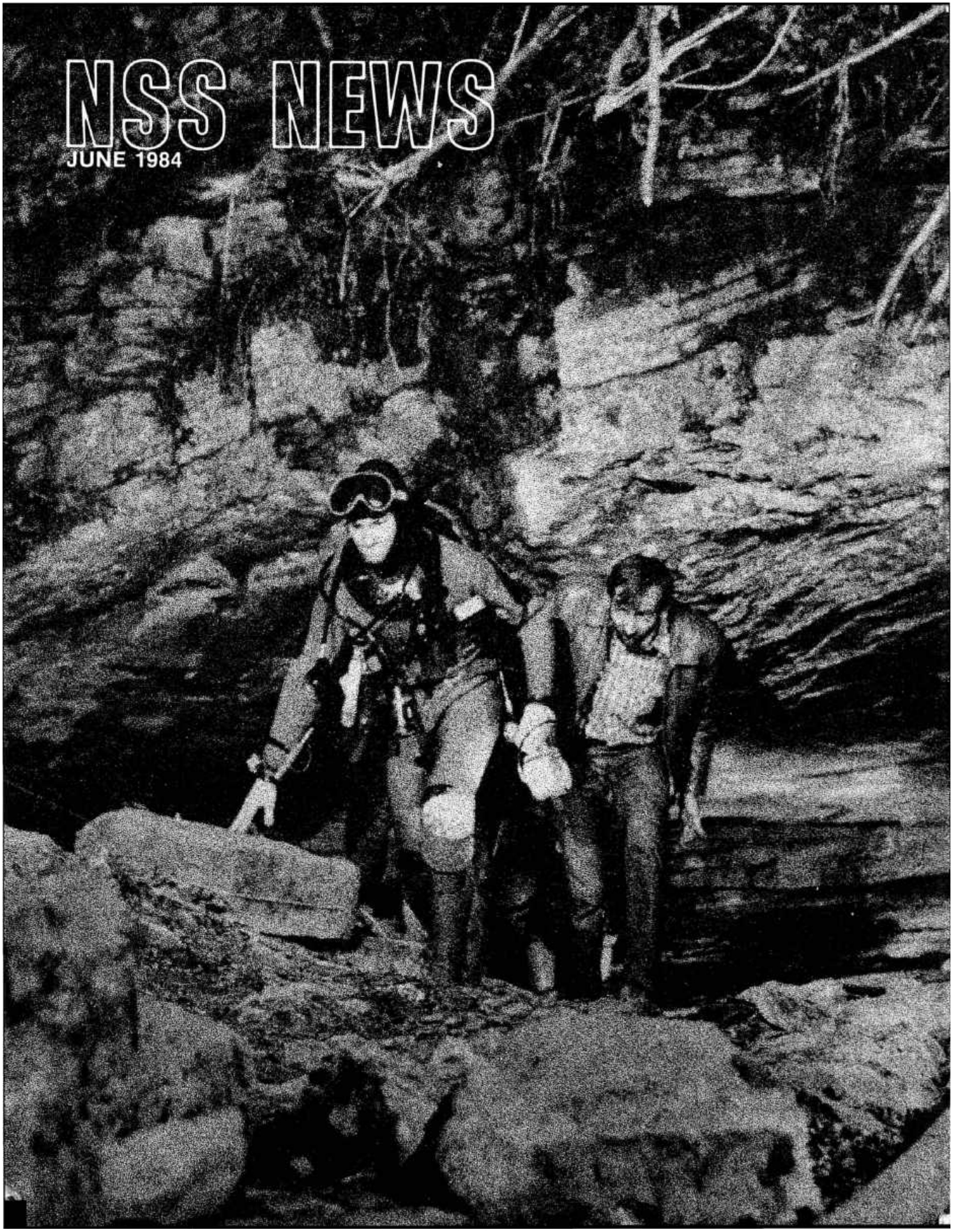
NSS NEWS

JUNE 1984



Precinct #11:
Case History of a Successful Rescue

By Geary Schindel, Terry Leitheuser, George Veni

SUMMARY

The Precinct #11 cave incident received national media coverage and was the longest cave rescue to take place in Kentucky since the death of Floyd Collins in 1925. Eight cavers from the Greater Cincinnati Grotto of the National Speleological Society were trapped in the cave by high water for three days. The rescue of these individuals involved numerous man-hours, large quantities of equipment and a great deal of devotion to insure the success of the rescue operation. This report is an attempt to present a chronology and analysis of events. As with any event of this magnitude, some details may have been omitted.

INTRODUCTION

The Greater Cincinnati Grotto (GCG) has been involved in the exploration and mapping of Precinct #11 Cave, Rockcastle Co., Ky. since 1979. These efforts have resulted in over 4 miles of surveyed passage. The entrance to the cave is through an overflow passage for the cave stream. This area contains about 200 feet of low passage before the higher upper levels of the cave are reached. In some areas of the entrance section, air space is restricted to less than 4 inches. The cave was known to sump closed during high water and has, on occasion, been closed for several months at a time. The co-leaders of this trip, Gary Bush and Jack Hissong, were some of the initial explorers, and had led many trips to map and explore the cave system. These individuals had previously entered the cave under light showers and noted little effect on the water level. They had, however, placed a cache of food and supplies in a dry upper level in case anyone should be detained by a sumped entrance. Also, the GCG had placed a staff gauge in the entrance pool to check the pool height. At the time the cave was entered, the water level was standing at 18 inches on the gauge. The cave was known to sump if the water depth at the gauge reached 21 inches.

Crews quickly establish lines from pumps used to lower sump during rescue.—Photo courtesy of the Courier-Journal and Louisville Times.

SATURDAY, APRIL 23, 1983

At approximately 11:00 a.m. EST, on Saturday, April 23, 1983, Gary Bush, age 45; Jeffrey Gardner, 27; Mary Gratsch, 26; Jack Hissong, 45; Jacques Ramsey, 26; Mark Rocklin, 26; Jill Vedder, 24; and John Wisher, 36; entered Precinct #11 Cave.

Weather reports from a Cincinnati, Ohio cable television weather station on Friday predicted light showers for Friday night and Saturday, with clearing Saturday evening for south central Kentucky. A light rain was falling at the time the cavers entered the cave (Bush, 1983a). A National Weather Service bulletin issued at 10:30 p.m. Friday from Louisville, Ky., predicted rain and possible thundershowers in the Rockcastle County area, which would gradually end late Saturday. A weather summary update at 5:20 a.m. on Saturday reported widespread rain in western and southern Kentucky and parts of Tennessee. The rain was caused by a low pressure system moving east across the gulf states. There was a possibility that rainfall would be heavy, and could exceed 1 inch before ending on Saturday night.

By early Saturday morning, rainy and wet weather conditions were predicted for all but northern Kentucky. Bowling Green, Kentucky, 120 miles southwest of the accident site, had received a hard, steady rain since 6:00 a.m. This caused a number of cave trips in the region to be aborted or altered. The storm system was moving out of the south and covered much of the gulf states. The storm moved into Rockcastle County and dumped up to 2 inches of rain in some areas by early Sunday.

Two members of the Cincinnati group, Barry Pitcher and Butch Stockelman, planned to spend Saturday checking out some small local caves as a possible back entrance to the Precinct #11 Cave System. Pitcher and Stockelman became alarmed at finding high water levels at the entrance to Precinct #11 Cave System. The entrance was obviously closed due to the high water. They hoped the water level would drop quickly and allow a quick exit from the cave by the trapped explorers.

SUNDAY, APRIL 24

By Sunday morning the water had not receded. On Sunday afternoon, Pitcher and Stockelman alerted the Kentucky Cave and Rock Rescue Team (KCRRT) through Dennis Robertson in Bowling Green, Kentucky, at about 2:50 p.m. The KCRRT responded with approximately 11 cavers and equipment. Terry Leitheuser (National Association for Cave Diving) from Mammoth Cave National Park was also contacted for assistance. George Veni (NSS Cave Diving Section) from Bowling Green could not be reached at the time. The KCRRT arrived at the scene about 8:30 p.m. on Sunday, immediately assessed the problem, and assumed command of the rescue operation. They decided to request the presence of at least one more cave diver and to place other cave divers on alert. Tom Vines, National Commission (NCRC), was contacted and informed of the problem at 10:30 p.m. Vines contacted Scott Air Force Base in Illinois for possible transportation aid and also contacted Steve Hudson, Southeast Regional Coordinator for NCRC. Mary Tinker, who was on stand-by in Bowling Green, was contacted and asked to inform George Veni of the problem and to request his presence as a second cave diver at the scene. Amateur radio operators were requested by the KCRRT at approximately 10:00 p.m. and were contacted by the state police. Steve Hudson placed several cave divers on alert and would await further information.

A number of scuba divers from fire departments, rescue teams, etc., were on hand and wanted to dive the cave. Permission was refused by the KCRRT due to their lack of training and experience in diving restricted overhead environments. They also lacked certification from either The National Association for Cave Diving or the Cave Diving Section of the National Speleological Society.

MONDAY, APRIL 25

Amateur radio operators requested by the KCRRT on Sunday night arrived at the site and set up a communications network at about 4:00 a.m. This consisted of a mobile radio unit stationed at the cave entrance and communication command post located in a field nearby. Subsequent communications were handled from the site by these individuals.

Terry Leitheuser, the first cave diver to arrive at the scene, was running a 103° fever and was unfit for diving. George Veni, a cave diver and paramedic, arrived at 4:30 a.m. Leitheuser briefed Veni on the situation and informed him that additional divers would be made available. It was decided Veni would make a reconnaissance dive to attempt contact with the trapped cavers. Veni entered the cave at about 5:30 a.m. equipped with standard cave diving gear plus one day pack and one ammo box full of food, stoves, and hot packs. Veni was planning to install a guide line, make contact with the cavers, and supply them with food and hot packs to prevent hypothermia.

During this period, the incident was receiving local media recognition. Media coverage soon expanded to the national news as Louisville, Lexington and Cincinnati news teams arrived on the scene.

The use of water pumps for the rescue effort were offered by the KANEB corporation. Their offer was accepted and the KANEB corporation responded with their LeeCo Coal and Mountain Clay Coal Companies from Mt. Vernon, Kentucky. Men and equipment arrived at 5:30 a.m. Initially, four pumps were delivered; and a fifth pump was delivered at 10:30 a.m. LeeCo also supplied Tony Gill (foreman) and two crews to operate the pumps. The first pump was placed in the water at 9:30 a.m. The delay was due to possible interference with the diving effort. The pumps were 3-inch diameter intake pumps and discharged about 500 gallons per minute. The LeeCo Coal pumps lowered the water level

By 9:00 am., Veni had not returned. It was assumed either that he had come up into an air-filled passage and did not have enough air to return, or that he had not yet located the trapped cavers. There was also some concern that Veni may have encountered an unforeseen problem. Cave divers, Stephen Maegerlein and Jeff Forbes (Bloomington, Indiana), Steve Hudson (Chattanooga, Tennessee), and Forrest Wilson (Atlanta, Georgia) were contacted for assistance on Monday morning. Scott Air Force Base arranged transportation for the divers at the request of the NCRC.

Veni exited the cave at 11:30 a.m., having found no sign of the missing cavers. This considerably increased the level of media coverage. The possibility of a major disaster and a lack of major news events that week caused both local and network news teams to respond to the event.

Veni had left his cave diving guideline in place and the supplies in a dry passage of the cave. The line would assist other divers entering the cave. Diving conditions were poor due to high water. Visibility was 1-1½ feet. Veni reported that the sump was initially tight and required the tank to be dragged by hand or worn on the side. The passage soon opened to 3-5 feet high. Prior to his dive, conflicting descriptions of the cave estimated the sump area to be something on the order of a stoopway to a crawlway and from 40 to 1000 feet long. After 80 feet of diving, Veni found the passage tightened to a crawl and came up into an air passage within another 20 feet. Veni tied off his dive line and crawled down a wide, low passage, dragging the pack and ammo box. Within 300 feet the cave opened into a walking-size passage, but sumped again after 400 feet. Veni then checked side passages and domes but found no sign of the cavers. He then returned to the first sump and retrieved his scuba gear to dive a second sump. Veni explored from the second sump to a third sump, 150 feet beyond. Approaching a fourth sump, Veni decided he was in the wrong passage. Returning to sump #1, he located a passage heading towards what he now knew to be the correct route. Unfortunately, it appeared to sump.

Veni was using a borrowed facemask and reel. Most of his cave diving equipment had been placed in Roppel Cave (Hart County, Ky) to set up for a dive. This dive was scheduled for April 23, 1983. The dive and an attempt to retrieve the stashed gear were aborted because of rapidly rising water levels (Veni, 1983). As a result, the borrowed face mask and reel turned out to be a problem for Veni. The reel was damaged and required Veni to leave the cave, and make repairs, before attempting to dive the newly-discovered sump.

As Veni approached the entrance, he heard a sudden loud noise, the source of which were the four water pumps straining to lower the water level. This startled Veni, who thought the noise indicated a free-flowing regulator, and he hastily exited from the cave. As a result Veni dropped and lost the dive reel and aborted the possibility of an immediate return

search for the trapped cavers.

The trapped cavers and the Precinct #11 Cave situation had received national news media coverage by this time. The rescue scene was becoming crowded with members of the news media, casual observers, and rescue personnel. Numerous additional management problems were soon encountered by the organizers of the rescue operation.

At 3:30 p.m. the cave divers from Indiana arrived on the scene and were briefed by Veni and Leitheuser. Steve Maegerlein and Jeff Forbes planned to follow the guideline and attempt to make contact with the trapped cavers. At 4:00 p.m., Steve Hudson and Forrest Wilson arrived on the scene and were also briefed. At 4:45 p.m. cave divers, Maegerlein and Forbes, entered the cave. They experienced some problems in the cave's entrance area due to its restricted size. After following Veni's line about 100 feet, they came up into the air passage where they located a note attached to the line at 5:45 p.m. indicating that all the trapped cavers were safe. The note read as follows:

HELP
8 CAVERS WAITING
ON DRY LEDGE 1800 FEET
UPSTREAM FROM HERE.
LEAVE DIVING TANKS HERE.
ONLY NEEDED FOR ENTRANCE
BEEN HERE SINCE 11:00 AM SAT. (4/23)
NOW NOON 4/25.
GARY BUSH

This was the first communication with the trapped cavers and was significant since the cavers were now known to be fairly safe, as had been assumed from the beginning. Also, the presence of Veni's guideline assured the cavers that a rescue operation was in progress.

The side passage located by Veni just inside sump #1 near the end of his dive, turned out to be a low air space passage. Since Veni had been using a borrowed face mask, which did not fit properly and required prescription lenses, it appeared to him the passage sumped when air space actually existed. When Bush returned to check the sump's water level, he found Veni's line and left the note.

The cave divers returned to the surface to deliver the note, report to the surface crew, and rest. At 7:30 p.m. cave divers, Steve Hudson and Forrest Wilson entered the cave to make contact with, and carry supplies to, the trapped cavers. Meanwhile, Maegerlien and Forbes went downstream to retrieve the supplies stashed by Veni, which were soon taken to the cavers. Hudson and Wilson made contact with the cavers, assessed their condition, and gave them the supplies. The cavers were found to be cold and uncomfortable, but in good condition and in high spirits. The divers then exited the cave to report on the caver's condition and bring in more supplies.

At 9:00 p.m. a 6-inch diameter intake pump was installed by LeeCo. This larger pump created whirlpools on the intake hoses that required wetsuited cavers to break up with paddles and lumber. Cavers were only allowed near the hoses for ten minutes due to high carbon monoxide levels from the pumps. The problem of cavitation was solved by placing the hoses in deeper water. Although this appears to be an obvious solution, it proved difficult due to the restricted size of the passage and the necessity of maintaining access to the cave.

At around 10:00 p.m. Hudson and Wilson made another dive to bring the cavers warm clothes and sleeping bags. Hudson told the trapped cavers they should get some sleep and cave divers would be back the next day at 1:00 p.m. to bring everyone out. This would allow everyone to get some rest and allow more time for the water level to decrease. The trapped cavers were in good shape with the supplies brought by the cave divers and had a fairly comfortable night's sleep.

Hudson and Wilson reported exhaust fumes in the cave, apparently from the pumps. This was the first indication that the water level had decreased enough to allow air exchange. The cavers were not in danger since they were in a high dome and the exhaust fumes were being carried away from them. However, the cave divers did have problems returning to their equipment and were concerned that they might not reach the safety of their air tanks before being overcome by fumes.

A large high pressure system was the cause of air moving into the cave once the sump opened up. It pushed the low pressure system that caused the rain out of Kentucky. It also carried exhaust fumes from the pumps into the cave. Exhaust fans from the local fire department were brought in to attempt blowing the fumes out of the cave. This did not work because of the nature of the entrance and the volume of air exchange. The problem was solved by the LeeCo crew, who built a canvas curtain around the pumps, moved most of the pumps to one side of the entrance, and placed exhaust fans behind the pumps. The canvas acted as a wind break and allowed the fans to flow the fumes from the pumps away from the cave.

TUESDAY, APRIL 26

At 5:00 a.m. another 6-inch pump was installed. These pumps greatly assisted in lowering the water level sufficiently to allow wetsuited cavers to enter the cave and escort the trapped cavers out.

At 9:00 a.m. the cave divers reported that the water level had lowered sufficiently and that enough air space was present to bring the trapped cavers out safely. One of the large pumps was having a problem with its bearings. Therefore, it was decided to make an attempt to bring out the trapped cavers as soon as possible rather than wait for the pumps to further lower the water level. Four wetsuited cavers entered the cave and started to escort the trapped cavers out. The eight trapped cavers were brought out in two groups, with one rescue caver assigned to each. While waiting for the first group of cavers to exit the cave, one of the 6-inch pumps began to falter. The LeeCo Coal crew immediately oiled the bearings to try to get them to last. The water began to rise at about a ¼ inch every 5 minutes (Heist, 1983). The sump only had about 1½ to 2 inches of air space on the way in. As the second group of victims were being brought out, the pumps started to work more efficiently and the air space increased to 2½ to 3 inches. Everyone was out of the cave by 11:00 a.m. The cavers were cold, wet, and tired after their 3-day ordeal, but in good shape otherwise. After the pumps were turned off, the water level rose, causing the cave to sump shut again within 15 minutes.

HYDROLOGICAL ASPECTS

Use of water pumps at the entrance to the cave was debated by the KCRRT. Many of the rescue personnel thought that it would be futile to attempt to pump water out of the cave. It was compared to attempting to lower the upstream level of a high gradient stream by pumping water out downstream. The method was approved simply because it was worth a try. The reason the water pumps worked was that the entrance pool of water causing the cave to sump was separated from the flowing stream by breakdown and sediment. Water from the cave stream flows over and through this blockage to flood the entrance area during periods of high water. The pool height depended upon the stream height. Water from the cave stream discharges at a spring located about 100 yards from the cave entrance. As the water pumps lowered the water level of the pool, a steeper gradient was created, which allowed water to move from the stream to the pool, through the sediment blockage, at a faster rate. The steeper the gradient, the faster the water would flow through the blockage. This is why the pumps would lower the water a few inches and then stabilize at a new level. The pumps would lower the water level until the amount of water flowing through the blockage caused by the steeper gradient was equal to the amount of water being pumped out. The decrease in water level required to remove the trapped cavers was only 6 to 12 inches. The larger pumps were able to create enough drawdown to allow an airspace to remain open.

The important variables were the stage height of the cave stream, the permeability of the material between the stream and the pool, the stage height of the stream in relation to the distance needed to create an airspace, and the capacity of the pumps. Once the pumps were installed and the drawdown stabilized, the stage height of the pool should have been noted. If the stage height of the pool was insufficient to allow an airspace to open, the pumps could have been shut down until more pumps and/or larger pumps were brought in. The problem was not the volume of water but the rate at which it could be pumped. Stabilization of water level usually occurred in less than 30 minutes. After all pumps were shut off, the water rose and again closed off the sump. Had this been an unobstructed stream, without sediment banks restricting flow into the entrance pool, the pumping would have been much less effective and probably would

not have worked. This is one of the few cases known to the authors where water pumps have worked in a cave rescue.

ANALYSIS OF PROBLEMS ENCOUNTERED

A great deal can be learned from the problems encountered and the events which led up to the rescue. The problems are of two kinds—the weather and how the cavers dealt with it, and management of the rescue. This analysis is presented as a learning experience in hopes of assisting with future incidents.

On the weekend of April 23rd and 24th, rainfall was predicted throughout Kentucky. The importance of rainfall cannot be overlooked. The storm front which caused the rain stretched across the midwest and dropped over an inch of rain in most areas. A rainstorm of this magnitude is not an uncommon event and occurs in this region of the country several times each year. Several rain events occurred in the state earlier in the month. It was already likely the ground was saturated and additional rainfall would result primarily in runoff. The cavers reported a fair amount of rain had fallen the night before and the local streams were flowing full (Bush, 1983b). The cave was looked at and it appeared to be handling the rain. Since the gauge was reading 18 inches, only light rain was falling, and the rain was supposed to clear later in the day, the Cincinnati group assumed there would be no problem.

Caves that are known to flood or sump shut deserve a great deal of respect during periods of wet weather. Flooding is a major cause of multiple deaths in caving and has caused many entrapments. It is a good idea to monitor the weather very closely when caving in base level areas (i.e. low level stream sections of a cave). The most accurate, official weather reports come from the National Weather Service over the National Oceanographic and Atmospheric Administration (NOAA) weather radio channel and these are only accurate for the forecast zone where the report is broadcast. Listening to a weather report at home and driving 200 miles to go base level caving is potentially dangerous. A good, safe rule of thumb is to completely avoid caving in base level passages during periods of questionable weather conditions. Few cavers have an accurate idea of what "karst in action" is like. Cavestream rises of over 50 feet are not uncommon events in Kentucky. They can be quite impressive, especially if viewed from inside a cave. However, this is generally not recommended.

The Cincinnati cavers had reported they had entered the cave under similar conditions of light rain without any effect on the cave stream. Flooding of the cave was caused by runoff. In simple terms, runoff is caused by rainfall exceeding the infiltration capacity of the soil. Many factors go into determining how much runoff will occur from a given storm event. These include the amount of moisture in the soil, type of soil, slope, amount of active vegetation, surface covering, and intensity and duration of the rainfall event. Vegetation helps take up a large amount of rainfall in the summer months. A rainfall event may easily have more effect on cave streams during the winter for this reason, all things being equal. Once the infiltration capacity of the soil is exceeded, water starts to pool up. When storage capacity is exceeded, water starts to flow. Water then enters joints in the rock, sinkholes, and sinking streams, increasing flow of water in cave stream conduits. It is very difficult to quantify the amount of runoff that is likely to occur from a rainfall event. This is why it is much safer to stay out of base-level areas during wet weather conditions.

In the Precinct #11 situation, the cave was very prone to flooding. The region and the season provided minimal soil and vegetation to retain and absorb any substantial amounts of precipitation. The ground was thoroughly soaked and further rainfall would only result in increased runoff. Factors such as these cannot be ignored if cavers are to explore base level cave streams.

The Precinct #11 incident was the first cave rescue involving the Kentucky Cave and Rock Rescue Team (KCRRT) and they were caught unprepared on the topics of crowd control, organization, and resource management.

The last of the trapped cavers to leave the cave, Gary Bush is greeted by rescue operations director, Tom Staublitz. Photo courtesy of the Courier-Journal and Louisville Times.

Since the KCRRT was in charge of this incident, the responsibility of its outcome falls upon them. The major problem in this regard was poor management of the KCRRT caused by the lack of preorganization, assertive leadership, and delegation of authority and responsibility at the rescue scene. This resulted in a breakdown of communication, loss of efficiency, and a duplication of effort among several groups involved in the rescue.

Crowd control and organization of the rescue scene were poor or nonexistent. Several nonessential groups were commonly in the way of rescue personnel. All personnel not involved in the actual rescue operation should have been removed from the immediate rescue site. For example, all media representatives should have been encouraged to remain in a defined area well away from the cave location. It is important in this case to assign a competent, responsible person to act as a liaison between the media and rescue personnel. Although Tom Staubitz partially served in this capacity, the scope of his position and purpose was poorly defined reducing his effectiveness. Individuals performing this task should be responsible for providing regular updates to the media and arranging interviews, as necessary, away from the rescue site. The media has a right to be in attendance, but should be handled in an efficient manner.

These lessons of crowd control can be applied to all rescue situations. A "restricted zone" should be maintained around the immediate cave entrance/active rescue area. Only those actively involved in the rescue should be in that zone. The media, curious unlookers, resting and inactive cavers/rescue volunteers, should be kept away from the restricted zone if at all possible. With such a strictly monitored zone, many of the problems encountered during surface-site coordinations would be eliminated.

In addition, no one was assigned to act as a recording secretary for the Precinct #11 cave rescue. As a result, numerous difficulties were encountered due to communication problems. A competent and responsible recording secretary would have alleviated many of these problems or prevented them from occurring. Good records help the site coordinator to keep track of, and control resources and people during a rescue operation. The information is also important in attempting to understand the events of the rescue in a proper time frame and to place decision-making processes in the proper context. This is important if any of the decisions are later questioned. Our own attempts to reconstruct the events of the rescue for this article were plagued by the necessity for interviews and filtering through sketchy notes from several of the rescue personnel.

Open water SCUBA divers were not used at the rescue, although they were seriously considered by some. Their insufficient training, experience, and judgement for cave diving could have resulted in fatalities. Cave diving is a highly specialized sport. Preparation of the prospective cave diving student is a blend of equipment, training, technique, common sense, good judgement, and experience. The only adequate training is available through the National Association For Cave Diving and the Cave Diving Section of the National Speleological Society. Several open-water SCUBA divers were present at the rescue scene and would have attempted to dive in Precinct #11 Cave if allowed to do so. Several of these individuals were impulsive and determined to enter the cave to save their friends. The rescue personnel had no reason to believe the trapped cavers were in any immediate danger and, therefore, had the luxury of time to plan a safe rescue attempt. The irrational actions of people caught in the heat of the moment can occur at any incident. Strong leadership, delegation of authority, crowd control, experience and common sense are necessary to prevent these problems at the scene. The fact that many people present seriously considered the use of open-water divers at the Precinct #11 Cave rescue indicates a serious lack of knowledge concerning cave diving, even among NSS cavers.

Lastly, the KCRRT did not initially notify the NCRC that they were involved in a cave rescue attempt. Communication of this fact to the NCRC could have significantly reduced response time. Also, this could have relieved any problems of confusion in the event another caving problem occurred somewhere else in their response area. A similar situation could have occurred during the cave diving attempt scheduled in Roppel Cave for the same weekend. This trip, however, was altered because of the rain. The entrapment of two different teams of cavers in separate caves by high water, did occur in the southeastern U.S. in 1980 (NSS, 1980).

WHAT WENT RIGHT

The trapped cavers were all brought out alive, unharmed and in good spirits. This was fortunate since the possibility of fatalties must always be considered in situations involving cavers trapped by flooding.

The pumps brought in by the LeeCo Coal Company were instrumental in bringing about a safe solution to this incident. Tony Gill and his two crews of men worked day and night to keep the pumps running. They also solved the difficult problems of equipment (pump) failures and exhaust fumes entering the cave. Their professional and dedicated assistance proved to be invaluable. Had it not been for the pumps and the LeeCo crew, the cavers may have been trapped for a much longer period of time.

The Amateur Radio Operators performed an invaluable service in establishing and maintaining a much-needed communications network at the rescue scene. This operation not only required the use of operators at the scene, but tied up the ham network across the eastern United States.

The trapped cavers tried to remain comfortable, stayed out of additional danger, and remained in good spirits. They made good use of the supplies left in the cave for just such an emergency. All the trapped cavers remained under control during the accident. As Gary Bush stated, they "became survivors" (Bush, 1983b). This was necessary to maximize their chances for survival.

The Kentucky Cave and Rock Rescue Team performed well for their first rescue call out. This was the first time that most of the KCRRT personnel had been to a cave rescue. It was a valuable learning experience for the group. A number of significant factors helped with the successful outcome of the rescue. These include the early arrival and assumption of command by the KCRRT early in the incident. This was greatly assisted by their recognition as the official cave rescue organization for Kentucky, authorized as such by the Kentucky Department of Disaster and Emergency Services. As a result, cooperation from the State Police and other agencies was excellent. Requests through these agencies were promptly acted upon and followed through to completion.

ACKNOWLEDGEMENTS

On behalf of the victims of this incident, the authors would like to thank the following groups for their generous support of the Precinct #11 cave rescue:

Amateur Radio Operators, American Red Cross, Brodhead Fire Department, Cave Diving Section of the National Speleological Society, Civil Air Patrol, Danville Fire Department, Druthers Inc., Famous Recipe Inc., Greater Cincinnati Grotto of the National Speleological Society, Green River Grotto of the National Speleological Society, Kentucky Cave and Rock Rescue Team, Kentucky Department of Mines & Minerals, Kentucky Department of Disaster and Emergency Services, Kentucky State Police, KANEB Corporation, Laurel County Rescue Squad, LeeCo Coal Company, Livingston Fire Department, Mountain Clay Coal Company, Mt. Vernon Fire Department, National Association for Cave Diving Inc., National Park Service, and Rockcastle County Rescue Squad. We apologize for anyone or any group not listed.

Special thanks are extended to Chris Kerr, Susan Schindel, Tim Schafstall and Dr. Pauline Jones for review and comments on this manuscript. We are also grateful to Mr. D. Glen Conner, Kentucky State Climatologist, for assistance in obtaining and interpreting weather records during the incident period.

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