

John H. Kerr Dam and Reservoir: Ingredient in a Recipe for Disaster

by

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Ingredient in a Recipe for Disaster

Abstract

In today's world, dams have become possible bioterrorist tools to cause harm, destruction, and death. One such dam is the John H. Kerr Dam and Reservoir that was created to control flooding and produce hydroelectric power for parts of Virginia and North Carolina. A history of its development as well as its many benefits to the areas surrounding the facility in terms of wildlife habitats and its recreational uses will be discussed in addition to those involved with flood control, hydroelectric power, and drinking water supply. This paper will present scenarios of a possible threat from bioterrorists as well as the possibility of an accidental compromise to the John H. Kerr Reservoir. Responses by local, state, and federal agencies to both the accidental release of the herbicide atrazine and to the purposeful contamination with the radiological material, tritium, will be presented. Because these scenarios will eventually be published online as teaching tools, questions and answers based on the materials presented have been provided for that purpose.

Introduction

The John H. Kerr Reservoir was completed in the early 1960's to control flooding and produce hydroelectric power for southern Virginia and northern North Carolina. The Corp of Engineers maintains the dam, hydroelectric facility, the reservoir, and its shoreline.

Although the dam was originally constructed to bring electricity to the area, it has become one of the area's top economic resources offering numerous recreational opportunities such as campgrounds, boat ramps, and picnic areas. The shorelines are dotted with tobacco, corn, and soybean fields reflecting the agricultural heritage of the area. Virginia and North Carolina have histories rich in tobacco, corn, and soybeans (Corp. 20 "John h. kerr", 2007).

The reservoir also serves as the source of drinking water to numerous municipalities in the area. The towns of South Hill, Clarksville, Chase City, and Boydton are a few Virginia localities that pull water from the reservoir for municipal purposes. The towns of Henderson and Roanoke Rapids in North Carolina pull water for municipal use. Probably the largest city to draw water

from the lake is Virginia Beach. It pumps approximately 6 square acres of water to the city a day.

After the events of September 11, 2001, the general public could no longer visit the hydroelectric facility for fear of a terrorist attack. Bioterrorism is a genuine threat to the facility, but accidental threats are also a concern. Losing the reservoir, causing harm to the general public, or harming the wildlife in the area were problems not seen with the birth of the John H. Kerr Dam. County, state, and federal agencies are tasked with protecting the dam and the people in the surrounding areas. Any incident occurring at the Kerr Lake Reservoir whether it involves the accidental contamination of the water or an intentional act of terrorism could result in a major disaster with adverse effects on the public either physically or psychologically. The objectives in writing this report are to:

- explain how bioterrorists could use the dam as a weapon.

- explain how the demographics and engineering of this dam as with any dam make it a suitable target for terrorist.

- present scenarios of an accidental contamination and a deliberate attack on the John H. Kerr Dam and Reservoir.

- explain planned responses by local, state, and federal agencies to each of the scenarios.

History

In the early 1900's, the United States began a program of dam building throughout the country. The study of the Roanoke River as a possible dam site began in 1927 and was conducted by the U.S. Army Corp of Engineers. The prime reason for the study was a need to control the flooding of lands within the Roanoke River Basin. The study concluded in 1934 with a suggestion by the Corp to build several dams along the basin not only to control floodwaters but to produce hydroelectric power as well. Congress was unwilling at the time to move forward with the plan

largely due to the Great Depression. It took a tropical storm dumping massive amounts of rain causing an estimated \$5 million in damage for Congress to decide the dam at John H. Kerr Reservoir was necessary. In 1944, the project was given a green light to proceed. The site in Mecklenburg County was chosen due to the stable bedrock which would provide the foundation (Weston, 2002).

Before work on the actual dam began, other activities had to be accomplished. The area being flooded included twelve miles of railroad, fourteen miles of primary highway, twelve miles of secondary roads, thirty-seven miles of transmission lines, sixteen miles of telephone lines, eighteen miles of telegraph lines, and 2,100 graves had to be moved. The 115,000 acres of land was valued at \$10,190,000. A total of 380 families were affected by the damming of the waters and were paid a fair price for their land (Weston, 2002).

The specifications of the dam were to have a one half mile long concrete dam flanked by low earthen dikes. The total length was 22, 285 feet. The height of the dam was 144 feet and a twenty-four foot wide roadbed ran across the top of the dam. The money needed for the dam and powerhouse was \$4,157,969. The materials were to be steel, concrete, and granite, which were mined not far from the dam site (Weston, 2002).

Countless men and women worked on the project, and at one time the number of employees was 1200 making the project a complete economic success to the area. The primary objectives of the dam project were to control flooding and create electric power. The eventual results of the dam allowed for recreation, wildlife conservation, and water quality which also enhanced this section of Mecklenburg County (Weston, 2002).

During construction, the project was referred to as the Bugg's Island project, which was named for one of the early settlers in the area who lived on a nearby island by the name of

Samuel Bugg. The dam was officially dedicated to Congressman John H. Kerr upon the completion of the dam in 1952. Kerr, a North Carolina Congressman, had been instrumental in getting the plans approved in Congress. Today, locals refer to the area as Bugg's Island but the official name is the John H. Kerr Dam and Reservoir (Weston, 2002).



Photo is Courtesy of The Corp of Engineers, Wilmington District

Wildlife Resources

Mecklenburg County Virginia is the primary home for the reservoir but the counties of Charlotte and Halifax are at the headwaters of the Roanoke River. North Carolina counties of Warren, Granville, and Vance border the reservoir on its south side. The tail waters of the reservoir flow through Brunswick County in Virginia and Halifax County in North Carolina. The reservoir is home to numerous species of fresh-water fish and has anadromous fishes and eels that migrate yearly into the reservoir to spawn. Deer, black bear, rabbits, squirrels, raccoons, beaver, otter, and countless other four-legged animals roam the shores of the reservoir. Twenty-six areas around the 48,900 - acre lake have been designated wildlife refuge areas. The reservoir has been

a testing area for the re-introduction of the Bald Eagle into the area. The Bald Eagle is a common sight within the reservoir area today (“John h. kerr”, 2007).

Reservoir Uses for Municipalities

The reservoir covers an area of 48,900 acres with 800 miles of shoreline. The towns of South Hill, Virginia, Clarksville, Virginia, and Henderson, North Carolina pump water from the reservoir to use in the municipalities. Approximately 8,000 people reside in these towns alone. There are numerous homes built outside the Corp of Engineers’ designated area. Some homes belong to year round residents, but many are summer homes. There are thirty recreational facilities open to the public on Bugg’s Island. The hydroelectric facility generates 426,749,000 kilowatt hours per year which is sold to local power companies for consumer use. The area is largely agricultural and many farmers use the reservoir water for irrigating tobacco, corn and soybean crops (Corp. 20”John h. kerr”, 2007).

First Occupants

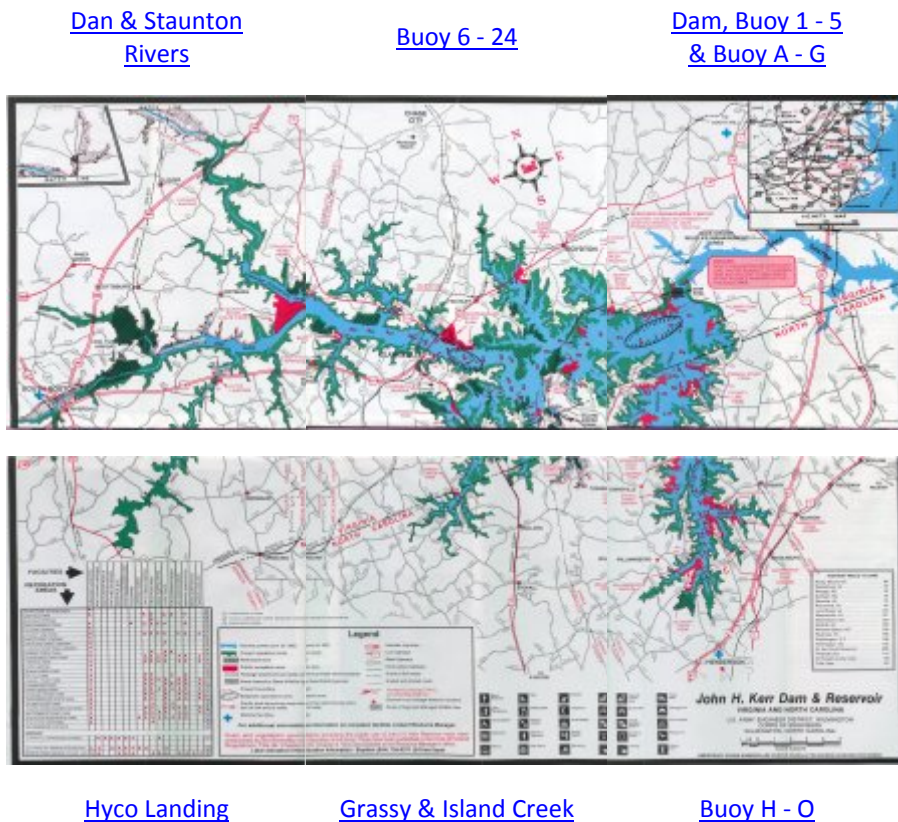
The original inhabitants of the area were the Oconneechee Indians. The Oconneechees lived in the area from 1250 AD until 1676. Many artifacts have been discovered along the shorelines (Corp. 2009). Fish channels can still be found in areas of the lake. The indians created channels along the streams of the Roanoke River in order to catch fish. They would place rocks at the corners of a stream to guide fish into nets waiting on the other side of the channels (Weston, 2002). Indeed today, the reservoir serves as a source of fish for food as well as recreational activities, and the water from the lake is used for irrigation purposes by the current inhabitants.

The Present Reservoir

Today, the John H. Kerr Dam includes a concrete gravity dam, a gated spillway, earthen dikes, a powerhouse, and switchyard. At its highest point, Kerr Dam is 322 feet at mean sea level or msl.

The length is 2,785 feet with a road running over the dam. The streambed is 144 feet below with the spillway having a crest elevation of 288 feet msl. The dam is crested by 22 gates that are 32 feet high and 42 feet wide. The average daily outflow for the month of November 2009 was 347,590 cubic feet per second of water with 573,791 cubic feet flowing in (“John h. kerr”, 2007). The major tributaries of the reservoir are the Bannister River which flows into the Dan River just east of the town of South Boston, Virginia; the Roanoke or Staunton River as it is known in the western counties of Virginia, meets the Dan River at the Mecklenburg Charlotte counties line. These three rivers feed the John H. Kerr Reservoir. The lake elevations are determined by rainfall amounts, runoff amounts, drought, and municipality usage (“John h. kerr”, 2007).

John H. Kerr Reservoir Map



Map is the Courtesy of the Corp of Engineers, Wilmington Division

Terrorism and Weapons of Mass Destruction Defined

The attacks on the World Trade Center on September 11, 2001 and the Amerithrax attacks in October of the same year made the word “terrorism” a household word. Terrorism is defined as the intentional use of weapons of mass destruction to cause death or disease of animals, plants, and humans, and destruction of critical infrastructures such as the dam and the environment (“Report on activities,” 2009). The realization of our vulnerability led to many new laws and directives such as the Executive Order 13228, establishing the Office of Homeland Security and the Homeland Security Council (“Executive order 13228-,” 2001). Committees were established to report on activities for countering proliferation and NBC (Nuclear, Biological, and Chemical) terrorism to prevent the use of such weapons against the United States (“Report on activities,” 2009).

Understanding the motives of terrorists can be helpful in anticipating potential targets and their selection of weapons. Major motives influencing terrorists’ attacks might be to get attention for religious sects or political causes, or to create surprise and shock implying the United States remains vulnerable to future attacks. Terrorists want to instill fear in the American people, cause economic loss, or seek revenge for a perceived or actual personal wrong. Terrorists may be domestic or from foreign countries. They may act alone or as a group with similar interests. Weapons of mass destruction, (WMD) can be classified into Chemical, Biological, Radiological, Nuclear, high yield Explosives (CBRNE) types of weapons (Chemical, biological, radiological, “ 2002). Terrorists choose their weapons based on the intended target, motives, and the desired results.

Hierarchy of the Response to an Incident

The John H. Kerr Reservoir and surrounding land is owned, protected, and maintained by the Department of the Interior and the Army’s Corp of Engineers making it a federal facility.

Location and severity play key roles in the determination of who responds to occurrences on the John H. Kerr Reservoir. In many cases, the state level responses involve agencies from both Virginia and North Carolina because the waters are used by both states.

At the onset of a threat, local and state government officials would handle the majority of agricultural related disasters. Local response would include the local county sheriff's department to help with maintaining the threat and keeping it confined to the smallest area as possible. At the state level, Virginia or North Carolina, the county State Departments of Health, State Police departments, the Department of Environmental Quality, and the Department of Game and Inland Fisheries would also become involved. The Corp of Engineers would be involved from the onset if the occurrence happened only on Corp property. If the occurrence happened on local land and affected the reservoir, all other agencies would respond and handle until the reservoir became involved.

If the incident is deemed beyond the capacity of local officials to handle, they will request the state's governor to declare a state disaster area. If there is a declaration of a federal disaster area, then people, equipment, technical, and financial assistance are provided.

As the incidence escalates and the findings are that of an intentional mishap, the Federal Government takes control of the investigations and proceedings. Agencies and sub-agencies of the Federal Bureau of Investigations, United States Environmental Protection Agency, Homeland Security, and other agencies of the Department of Interior become involved. If the threat is determined to be that of terrorists and falls within the CBRNE guidelines for response, the necessary agency would be contacted. For this to happen, the threat would be of a chemical, biological, radiological, nuclear, or extreme explosive event. All of this would be coordinated by the Department of Homeland Security, a sub-agency of the Department of the Interior which

would be the ultimate agency to provide the unifying core for the vast national network of organizations and institutions involved in national security. These guidelines were established by the Center for Counterproliferation Research at the National Defense University (CBRNE, 2002). The type of threat would determine which branch of the military would respond.

Based on the information presented above, one becomes readily aware of the vastness and complexity of the dam, reservoir, and surrounding areas. It is easy to see how hard it would be to monitor the facility, and how a major problem could develop either accidentally or intentionally. Two scenarios are presented below to illustrate how easily a problem could arise. These scenarios and the questions that follow can be used as teaching tools.

Scenario #1 – Accidental Introduction of Herbicide Into the Lake

Introduction

This first scenario depicts the accidental introduction of the herbicide, atrazine, into the water. Atrazine is the triazine organic compound used widely to stop pre-and post-emergent broadleaf and grassy weeds. It acts by binding to the plastoquinone-binding protein in photosystem II and plants die due to starvation and oxidative damage effectively shutting down photosynthesis, (Inchem.org, 3/1/2010). Unfortunately, its use is highly controversial because of its effects on nontarget species like amphibians. It is a suspected teratogen causing endocrine problems in frogs leading to hermaphroditism, a condition in which both male and female sexual characteristics exist in one animal (Trivedi, 2002). Unfortunately, this research is questionable at best, as the work indicating no side effects, was funded by the company that makes the herbicide (Epa: triazine cumulative,” 2006). It also causes widespread contamination of underground water sources. Some studies report atrazine can cause human birth defects, low birth weights, and menstrual problems, (epa.gov, 2010).

The maximum contaminant level (MCL) of atrazine in drinking water is 0.003 milligrams per liter of water. Continuous consumption of atrazine contaminated water can result in moderate toxicity to humans and animals. Direct exposure to humans can result in immediate symptoms of abdominal pain, diarrhea, vomiting, and irritation to eyes and skin. Congestion of heart, lungs, kidneys, muscle spasms, weight loss and damage to adrenal glands are symptomatic of short term exposure to atrazine (Atrazine, 2006). As a result, atrazine is highly regulated. So let's see what can happen when a farmer gets careless while using this product.

Incident

Farmer Smithenhite has farmed 250 acres of corn in southwestern Mecklenburg County for the last 35 years. His farm is directly across Bugg's Island Lake from Clarksville. His family has owned the farm for a century but Farmer Smithenhite has tried to bring new technologies to the farm and has experienced some success. In 2000, he transitioned much of the tobacco allotment to corn and some soybean production. He has rotated fields between corn and soybeans to get the optimum use of natural nitrogen from the beans. He has dug several drainage ditches to help with watering and run-off, and for years he has pumped water for irrigation from the nearby lake to ensure good crop production. His theory is that the water not absorbed by the plants will run back into Bugg's Island by way of the drainage ditch and can be pumped and used again.

One of Farmer Smithenhite's goals is to work smarter not harder so he has done research to use the best fertilizers, herbicides, and insecticides. One of his favorite herbicides is granular atrazine mixed with water pumped from the lake. He chooses atrazine because it stifles photosynthesis in unwanted weeds (inchem.org, 3/1/2010). His application rates are in accordance with the manufacturer's recommended applications for pre-emergence of two quarts per acre or two pounds per acre for post emergence (Syngenta Crop Protection, 2009). Farmer Smithenhite gets

his granular atrazine from the local crop production services store, and depends on the store for proper measurement and delivery to each of his cornfields.

Farmer Smithenhite has decided to spread his herbicide the first week of May because it appears his corn would have all broken ground by then. There is not much crop residue on the field and the erosion rate of his fields is high very high because of the slope toward the lake and the cultivation of the crop field. He contacts the farm store to have his atrazine delivered. He will make the first application on his 50-acre field which is next to the river. The farm supply store brings the granular atrazine and dumps it at the top of the field. Because the farm supply store is so busy during this time of year, Farmer Smithenhite agrees that all 1000 pounds of the granular atrazine will be dumped at the first application sight. Farmer Smithenhite will be responsible for mixing and moving his atrazine to his different fields. The farm supply driver reminds Farmer Smithenhite of the regulations associated with the applications and Farmer Smithenhite assures him that he is aware of the distance from water supplies (50 feet) that he should apply the atrazine. Farmer Smithenhite does not consider his drainage ditch a water supply (“Using atrazine and,” 2005).

On Monday, the atrazine is dumped, and Farmer Smithenhite goes to his shed to get his 1966 International Harvester tractor with the water tank trailer and water pump attached. Upon trying to start his tractor, the engine will turn over but will not start. He checks the battery and the charge is good. He then checks the starter and finds the starter has gone bad. He removes the starter and goes to Clarksville Auto to purchase a new starter. Joe at the auto store tells Farmer Smithenhite that he must order the starter but it should be in by Wednesday. Now Farmer Smithenhite ponders how he should get his atrazine applied. He decides that waiting two more

days should not make that much difference to the corn. He decides to cover his granular atrazine so any wind that blows won't move the pile.

On Tuesday afternoon, Farmer Smithenhite calls the auto parts store and Joe assures him the starter is on its way from the warehouse. So again, Farmer Smithenhite assures himself it is safe to wait and does not use another tractor for the application. After all, it would take a day to change the application from one tractor to another. Unfortunately, looking back toward the western sky, a spring thunderstorm is brewing.

By 4 p.m., the storm had reached Clarksville, and it brought with it high winds in excess of 60 miles an hour and rain falling at a rate of two inches an hour. Farmer Smithenhite's pile of atrazine is in jeopardy of floating down his drainage ditch to the lake. The storm lasted four hours and produced eight inches of rain causing flash flooding along the banks of the lake and in small streams. By morning, much of Farmer Smithenhite's atrazine had reached the lake.

Farmer Smithenhite was well aware that Clarksville used the lake water as the municipal drinking water source. He knew he needed to contact the local town government to report the atrazine runoff.

Farmer Smithenhite, on his way to the auto parts store, goes to the water treatment plant across the river to inform his friend Henry who manages the treatment plant of the contamination. The water treatment plant immediately test samples of water for atrazine contamination. The rates of atrazine are negligible so the waste water treatment workers think nothing of it, to the point no one documents Farmer Smithenhite's visit. The Virginia Department of Environmental Quality is not contacted, the Virginia Department of Game and Inland Fisheries is not contacted, and the Virginia Department of Agriculture is not contacted. The runoff of the huge amount of atrazine is not reported because no one thinks it to be necessary.

Farmer Smithenhite repairs his tractor and moves on to mixing and spreading the remaining atrazine. He has enough to cover the immediate field but calls the farm supply store to place another order.

Scenario #1 – Questions and Sample Responses

1. Is this incident considered an act of terrorism or just an accident?

Answer: This is not an act of terrorism. Farmer Smithenhite had no intention of contaminating the lake with the atrazine. This is truly a sad accident.

2. Is Farmer Smithenhite ultimately responsible for the accident or is the responsibility shared with the farm supply company?

Answer: Farmer Smithenhite is ultimately responsible but the farm supply company is in violation of several packaging, containerization, and storage regulations.

3. What penalties should be levied on the violators?

Answer: Farmer Smithenhite should be fined to help pay for the clean-up cost. He should attend seminars on proper use, storage, and disposal of toxic chemicals. The farm supply company should be investigated for possible other infractions associated with farm chemicals. If they are in other violations, they too should be fined, attend educational seminars, and put on probation until corrective action has taken place.

4. Is the water treatment plant at fault for anything?

Answer: Yes, friendships should not have clouded the judgment of the manager. He should have reported the incident to the proper authorities, instructed his personnel to continue monitoring the water samples for increased levels of atrazine, and instructed Farmer Smithenhite on the proper steps to take for him to report the incident.

5. If the incident had been handled properly, who or what agency would be responsible for alerting the general public to the atrazine contamination?

Answer: The Mecklenburg County Public Health Department would be responsible. Using public service announcements over the local radio, internet postings, and local television coverage would alert the general public and those planning to use the lake for recreation purposes. The Corp of Engineers and park rangers would be tasked with enforcement and education at the site for individuals residing or using the lake in the immediate incident location.

Scenario #2 -Intentional Introduction of Tritium in the Lake

Introduction

Lake Anna is home to a large nuclear power facility called the North Anna Nuclear Power Plant. The facility has operated for years with little to no interruptions due to accidents or intentional mishaps but North Anna, like all nuclear power facilities, must dispose of its nuclear waste. Uranium is the primary fuel used to produce electricity in the pressurized-water reactors. The core inside the reactor provides the heat for the pressurized water in the primary coolant loop which is carried to the generator. Here, the steam is directed to the turbine where the turbine turns producing electricity. The remaining steam is condensed back into water where the cycle begins again. The core assemblies are cooled by water which eventually must be released as waste water (U.S. NRC. 2008).

Tritium is a radioactive isotope of hydrogen that is used in the processing of nuclear fuels into energy. It is also produced naturally in the upper atmosphere and within Earth's crust. Detecting trace amounts of tritium in water or in the ground is relatively normal. Tritium is produced by thermal or fast neutron reactions as in the producing of electricity in nuclear power plants. It is circulated in the coolant and eventually released into the environment ("Executive summary," 2007).

The release of tritium into the environment is negligible due to the fact that tritium dilutes quickly and easily with river water and soils. The amount of tritium released by nuclear power facilities is monitored and measured at a minimum of twice a year at areas that could be affected. Research has shown that tritiated water release from nuclear power facilities if used for irrigation shows no increase in accepted levels of tritium in normally consumed foods. However, increased levels of tritium are linked with human cancers, death in aquatic species, and genetic defects that carry into generations ("Guidelines for the," 2006).

When tritium enters the body, it takes the place of the normal water and acts the same as normal water to cells within tissues of organs. Tritium is slightly radioactive, and could cause cancers and genetic defects that other radioactive materials cause. The normal life expectancy of tritium inside a human body is 7 to 14 days. Therefore, normal release amounts of tritium due to natural releases or nuclear power releases do not pose any problems to humans. However, if tritium levels in certain areas are increased, the effects to the environment could become detrimental (“Executive summary,”2007).

Incident

William Pilgrim has worked at the North Anna Nuclear Power Plant (NANPP) for 22 years, and has been newly promoted to manager of the nuclear waste department at the facility. It is his responsibility to maintain proper records on the discharge and disposal of nuclear waste and spent nuclear fuels. At NANPP, spent nuclear fuel is stored in spent fuel pools that are later discharged or removed by Nuclear Regulatory Commission standards. One such method of removing treated waste water, or water used to circulate and cool reactors is to store the liquid effluents in tanks for dispersal after treatment or release into the environment once the levels of contamination have dropped to the required specifications for release. William is knowledgeable in his job and trusts his subordinates in meeting all NRC guidelines and standards.

William likes to boast about his job and the benefits of his success to his subordinates. He boasts of his new Lexus, his 30 foot cabin cruiser, and his newly constructed five bedroom house on the John H. Kerr Reservoir. He prefers the Kerr Reservoir to Lake Anna because it gets him away from his highly stressful job and the area around Kerr Reservoir is much nicer, quieter, and he can really catch nice fish at Bugg’s Island.

Serge Trombleson is one of Pilgrim's trusted subordinates. Serge came to the United States 25 years ago from Slovenia seeking the "American Dream". He was passed over by the hiring committee for the same job that Pilgrim was given. Trombleson has been at NANPP for 25 years and truly felt he should have had the job. His job at the plant has been to treat and release the nuclear effluent and it looks as though he will remain in this job until he retires.

Trombleson has two sons, one attending the University of Richmond and the other attending Georgetown University. He had hoped to get the promotion, as it would have lessened some of his financial college burden. In the summer, his sons work the midnight shift at the power plant and drive the tanker trucks to remove effluent or take the effluent to disposal sites.

Trombleson has listened to Pilgrim brag about his new found wealth, home, and hobbies long enough and Trombleson believes his pursuit of the "American Dream" has vanished. He knows the radioactive materials in the holding tanks are dangerous to the environment if released too soon. He also knows that tritium acts like water, has a short 12 year half-life, and reports have shown negligible traces of tritium at test sites down river from North Anna ("Guidelines for the," 2006). He decides that just maybe he can shut-up his boss's boasting by taking away what he boasts most about.

The July work scheduling has come out and Trombleson decides he wishes to work the midnight shift along with his sons. His boss is also taking his vacation at Kerr Reservoir the first two weeks in July. He advises the gate watchman that two tanker trucks will be leaving the facility each night for the next two weeks, and will return prior to the morning shift. The night gate keeper acknowledges and knows this is standard procedure to keep tanker trucks from being on the highways during high traffic periods.

Trombleson instructs his sons to meet him at the effluent tanks to load their trucks. Trombleson has his sons hook to the tanks that have the effluent just removed from the reactors. This effluent has not been treated at all. He instructs his sons that a new release point has been established, and he gives his sons directions to two boat ramps located at the John H. Kerr Reservoir. The boat ramps are North Bend Park and Palmer's Point, both ramps are within eyesight of Pilgrim's new home. The boat ramps are not controlled after dark and have no gates to pass through.

The trip from North Anna to the reservoir is about two hours. Release of the effluent will take the two men about two hours and the return to North Anna approximately two hours. No one would ever suspect anything. This would occur for the next two weeks making the total loads of effluent release to be 20 tanks at the same sites.

By doing this, Trombleson knew the tritium levels in the water would adversely affect the fish, and he also knew it would affect the drinking water for millions of people due to the municipalities served by the reservoir. He knew that his boss would not notice the tritium in the water, and would continue to catch and eat the fish he caught from the reservoir. Trombleson's boss would be oblivious to the dangers associated with high concentrations of tritium in water that would adversely affect the nervous and digestive systems of the aquatic life at the reservoir. The genetic changes among the aquatic life would be long term and could possibly wipe out the ecosystem at the lake. Plankton levels would become radioactive affecting fish; vultures and eagles would be affected by eating the contaminated fish; and people who depend on fish for food from the lake would be affected. The entire food web of the Kerr Reservoir ecosystem would be shut down, and not for just a short period of time. The genetic defects would hamper reproduction and the ability to sustain species. Land animals drinking directly from the infected site could suffer cancers and genetic defects that would cause long term problems within those

species. The reservoir as an ecosystem, recreational facility, water supplier, and financial stimulant to an area, would have to be shut down until the levels of tritium are within normal ranges again. However, the detection of the radioactivity would go unnoticed until local residents notice unusual fish kills which could take weeks to occur. The long term affects to humans of this contamination will not be known until years later with the increased occurrences of cancer and failed reproductive systems in females. This long term, Trombleson conceded, would match the length he would have to live not attaining his “American Dream”.

Local people around the reservoir would not become alarmed at seeing tanker trucks at the boat ramps. Many construction companies and state departments of transportation use the reservoir water for construction purposes and wetting down dusty roads and asphalt when paving.

Because the event took place in the reservoir, the Corp of Engineers would have primary oversight. After detection, the local water treatment plants would be tasked with monitoring the amounts of tritium showing in drinking water. The Department of Game and Inland Fisheries would work in conjunction with the Corp in establishing treatment and removal of infected wildlife and reestablishing the ecosystem. Because tritium was detected at a high level, Homeland Security would be involved because there is no reason for the tritium levels to become so high since there is nothing other than natural tritium release from the atmosphere. Obviously, the tritium has been placed in the waters, and is being used as a biological weapon. This incident would fall under the CBRNE response guidelines because tritium is radioactive and is a byproduct of nuclear power generation. The proper branch of the military would respond and in this incidence it would be the Army’s special task force for CBRNE events. The FBI would conduct investigations on how the tritium got to John H. Kerr Reservoir. Local sheriff departments would be tasked with keeping people from swimming in high concentrated areas

and from not removing fish from the waters. The health departments would be put on alert for increased numbers of fetal deaths and trouble with reproductive organs. Local hospitals would be informed of the contamination to watch for any increased cancers or stomach disorders. Both state and federal Environmental Protection Agencies would aid in the cleanup and monitoring. The Centers for Disease Control would help with testing of long term effects on aquatic as well as human life.

What Serge Trombleson designed as a tool for punishing his boss for ruining his “American Dream”, has now become a disaster for the John H. Kerr Reservoir.

Scenario #2 – Questions and Sample Responses

1. Is this an act of terrorism or just a disgruntled employee acting out?

Answer: By definition, terrorism is the intentional use of WMD to cause death or harm to humans or the environment. Trombleson’s intention was to do harm to Pilgrim. Trombleson used an agent of WMD as tritium is radioactive. This was an act of terrorism.

2. What mistakes has Trombleson made that should lead to discovering his act of violence?

Answer: When downstream samples of water are taken at Lake Anna and the “normal” rates of tritium are down, environmentalist at North Anna should become suspicious. When the tritium increase is detected at John H. Kerr Reservoir, the two reports should shed light on where the tritium came from. Then, the release records should indicate when and who was responsible for releasing the tritium. Trombleson’s biggest mistake was revenge, but satisfaction outweighs jail time.

3. Can tritium, in this scenario, be considered a weapon of mass destruction?

Answer: CBRNE classifications make tritium a WMD. In this scenario, humans and the aquatic ecosystem are the massive numbers that make it a weapon of mass destruction.

4. Should any local authorities share in any of the responsibility associated with this incident?

Answer: Yes, after 9/11, the hydroelectric facility was closed for tours by the general public. This was done to prevent terrorists from gaining access or operating procedure knowledge to the hydroelectric facility. Much emphasis has been placed on infrastructure protection, but the environment needs as much emphasis. Gates can be monitored around the clock which would eliminate entry by “unwanted” into the boat ramps or other recreational facilities at the lake.

Park Rangers and local law enforcement agencies should be tasked with protecting the entry points.

5. What would be the greatest loss should this incident actually take place?

Answer: The ecosystem loss would propel losses up the food chain to humans. Humans consume fish and water from the lake. As genetic mutations take place among the aquatic species, old species will be lost. As water becomes undrinkable, (if only temporary) local economies suffer. The money gained in Mecklenburg County from Virginia Beach would have to be recouped from local residents in order to maintain current lifestyles. The greatest loss would be the species that have occupied the lake or original river for centuries.

Final Conclusions

Any accidental or intentional threat to John H. Kerr Dam and Reservoir would change one of America's jewels. The reservoir is home to vast species of animals and offers tranquility and relaxation for the humans who can enjoy it. Prior to the building of the dam, local farmers and land owners were against the construction, but time has mellowed those descendants and the economical value on the Dam is priceless. Many localities in Virginia have had to monitor and correct unintentional human errors with releases of fertilizers and other harmful chemicals into waterways eventually used for drinking. In Blacksburg, Virginia Tech was prompted with a study of effluent and runoff from a local golf course, which resulted in invaluable information on containment and runoff reduction. This is just one example how human error that has long been ignored can be corrected for future generations.

The water in the John H. Kerr Reservoir was determined to be the cleanest water in Virginia in the early 1990's. It was so clean that the municipality of Virginia Beach negotiated with Mecklenburg County state representative to install a pipeline and pump no less than six cubic acres of water from the reservoir each day. By 2000, the pipeline was up and running much to the dismay again of the local residents around Kerr Reservoir. Could this prompt an angry

resident to retaliate and pollute the waters of Kerr Reservoir? Possibly, since the pumping began, local residents have seen lake levels drop drastically especially during drought periods. No matter what the local situation around the lake, Virginia Beach was going to get its water. Local boat ramps have been closed to activity because lake levels are so low, boats cannot be launched. The only salvation to not polluting the lake is knowing that if you do, you will suffer too. The lake is home to most of southern Mecklenburg County's drinking water, and it is hard to find local businesses that do not benefit from the tourist traffic during the months of April to November. Kerr Reservoir has become home to a few premier bass tournaments and local fishermen can boast of the great catches they have pulled from the lake over the years.

Local residents have been forced to accept the changes to the lake, some willingly and some disgruntled. Since the events of September 11, local residents have become increasingly aware of the possibility the lake could be used for bioterrorism. Local residents look out for one another and if anything looks peculiar, conversations among locals get to a conclusion or reports to the Corp are made.

Hopefully, the lake will not change drastically over the course of lifetimes, and it can remain one of the most pristine and loved localities in Virginia. It is up to the people of the area to educate the next generation on the values of the lake. As populations grow, more demands will be placed on available drinking water and on land space. Making changes to the lake to meet these needs is unacceptable.

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