DECLARATION OF MARK J. S. HEATH, M.D.

I, Mark J.S. Heath, M.D., hereby declare as follows:

1. I am an Assistant Professor of Clinical Anesthesiology at Columbia University in New York City. I received my Medical Doctorate degree from the University of North Carolina at Chapel Hill in 1986 and completed residency and fellowship training in Anesthesiology in 1992 at Columbia University Medical Center. I am Board Certified in Anesthesiology, and am licensed to practice Medicine in New York State. My work consists of approximately equal parts of performing clinical anesthesiology, teaching residents, fellows, and medical students, and managing a neuroscience laboratory. As a result of my training and research I am familiar and proficient with the use and pharmacology of the chemicals used to perform lethal injection. I am qualified to do animal research at Columbia University and am familiar with the American Veterinary Medical Association's guidelines.

2. Over the past several years, I have performed many hundreds of hours of research into the techniques that are used during lethal injection procedures in the United States. I have testified as an expert medical witness in courts in Maryland, Georgia, Tennessee, Kentucky, Virginia, and Louisiana in the following actions: *Reid v. Johnson*, No. Civil Action 3:03cv1039 (E.D. Va.); *Abdur'Rahman v. Bredesen*, No. 02-2236-III (Davidson County Chancery Ct., Tenn.); *State v. Michael Wayne Nance*, 95-B-2461-4 (Ga. Superior Ct.); *Ralph Baze & Thomas Bowling v. Rees*, 04-CI-01094, (Franklin County Circuit Ct., Ky.); *Walker v. Johnson*, No. 1:05cv934 (E.D. Va.); *Evans v. Saar*, No. 06-149 (D. Md.); *Code v. Cain*, No. 138,860-A (1st Judicial District Court, Caddo Parish, La.); *Baker v. Saar*, No. WDQ-05-03207 (D. Md.). I have also filed affidavits and/or declarations regarding lethal injection that have been reviewed by

courts in the above states and also in California, Pennsylvania, New York, Alabama, North Carolina, South Carolina, Ohio, Oklahoma, Texas, Missouri, Nevada, Delaware, and by the United States Supreme Court.

3. During court proceedings, I have heard testimony from prison officials who are responsible for conducting executions by lethal injection. I testified before the Nebraska Senate Judiciary Committee regarding proposed legislation to adopt lethal injection. I also testified before the Pennsylvania Senate Judiciary Committee regarding proposed legislation to prohibit the use of pancuronium and the other neuromuscular blockers in Pennsylvania's lethal injection protocol. My research regarding lethal injection has involved extensive conversations with recognized experts in the field of lethal injection, toxicology, and forensic pathology and the exchange of personal correspondence with the individuals responsible for introducing lethal injection as a method of execution in Oklahoma (the first state to formulate the procedure) and in the United States.

4. My qualifications are further detailed in my curriculum vitae, a copy of which is attached hereto as Exhibit A and incorporated by reference as if fully rewritten herein.

5. I have been asked by attorney Julie Brain, counsel for Mr. Terrick Nooner, to review the procedures concerning lethal injection currently in place in Arkansas to assess whether those lethal injection procedures create medically unacceptable risks of inflicting pain and suffering on inmates while the lethal injection is administered. I hold all opinions expressed in this Declaration to a reasonable degree of medical certainty, except as specifically noted at the end of paragraph 41, where I make a speculative comment.

6. The material I have reviewed in order to prepare specifically for this report

includes:

- an Arkansas statute entitled "5-4-617. Method of execution;"
- a document entitled "Arkansas Department of Correction Administrative Directive 96-06 Procedure for Execution" approved 5/23/96;
- statutory text related to veterinary practice in Arkansas;
- execution logs, photographs, toxicology reports, autopsy reports, and other material related to 26 executions conducted by lethal injection in Arkansas;
- newspaper reports discussing and describing executions conducted in Arkansas;
- declarations of execution witnesses Charles L. Carpenter and John Jewell.

7. I have also reviewed the 2000 Report of the Panel on Euthanasia of the American Veterinary Medical Association, the American Society of Anesthesiologist's Practice Advisory for Intraoperative Awareness and Brain Function Monitoring, and the American Society of Anesthesiologist's Standards for Basic Anesthetic Monitoring.

8. Based upon my review of this material and my knowledge of and experience in the field of anesthesiology, and based on my research regarding the practice of lethal injection in the United States, I have formed several conclusions with respect to the protocol of the Arkansas Department of Corrections ("ADC") for carrying out lethal injections. These conclusions arise both from the details disclosed in the materials I have reviewed and from medically relevant, logical inferences drawn from the omission of details in those materials (e.g., details regarding the training of the personnel involved; details of all of the medical equipment used; and details of the precise methods by which the personnel involved use the equipment to carry out an execution by lethal injection).

ADC's Lethal Injection Protocol – The Use of Potassium Chloride

9. ADC's lethal injection protocol calls for the administration of 2 grams of sodium thiopental, 50 milligrams of pancuronium bromide (Pavulon), and 50 milliequivalents of potassium chloride. Broadly speaking, the sodium thiopental is intended to serve as an anesthetic, rendering the inmate unconscious for the duration of the execution. Two grams of sodium thiopental is a massive, and potentially lethal, dose. The pancuronium bromide paralyzes the inmate's muscles and thereby disables all voluntary movements, including those of his chest and diaphragm. Pancuronium is not an anesthetic or sedative drug, and it does not affect consciousness. Potassium chloride is a salt solution that, when rapidly administered in high concentrations, induces cardiac arrest. Potassium chloride, too, has no effect on consciousness or ability to feel pain; to the contrary, the drug itself causes excruciating pain.

10. Although the successful delivery into the circulation of 2 grams of sodium thiopental and 50 milligrams of pancuronium would be lethal, it is important to understand that the lethality of sodium thiopental and pancuronium is due to respiratory arrest, which takes several minutes to ensue and does not typically occur prior to the administration of potassium. In the execution sequence, before death is caused by respiratory arrest from sodium thiopental and pancuronium, death is caused by cardiac arrest brought on by potassium. I base this opinion, that the potassium and not the pancuronium or sodium thiopental is responsible for the death of prisoners during lethal injection, on the following:

A) Review of records from EKGs from lethal injection procedures conducted in other states. During lethal injection, cardiac activity consistent with generating perfusion persists through the administration of sodium thiopental and pancuronium and only stops after potassium has been

administered. The relatively sudden cessation of organized EKG activity is not consistent with a cessation of circulation due to administration of sodium thiopental and/or pancuronium and is consistent with cessation of circulation after the administration of a large dose of potassium chloride.

B) Properties of Sodium Thiopental and Pancuronium. Sodium thiopental and pancuronium exert their effects by interacting with molecular targets in the nervous system and on muscle cells in a manner that induces unconsciousness and stops breathing. Sodium thiopental and pancuronium, unlike other chemicals such as cyanide, do not kill cells or tissues, and are useful to clinicians precisely because they do not kill or harm cells or tissues. The reason that sodium thiopental and pancuronium can cause death is that they cause the prisoner to stop breathing. Failure to breathe will result in brain damage, brain death, and cardiac arrest as the level of oxygen in the blood declines over time. These processes take a varying amount of time, depending on many factors. Physicians generally use four minutes of not breathing as the approximate benchmark time after which irreversible brain damage from lack of oxygen occurs, and death typically occurs some number of minutes after the onset of brain damage. It is worth noting, however, that this general figure of four minutes is often used in the context of cardiac arrest, in which there is no circulation of blood through the brain. If some level of blood circulation persists, it is very likely that brain damage and brain death would take longer than four

minutes.

C) Of note, the Arkansas Medical Examiner appears to agree with the conclusion that in lethal injection procedures death is caused by potassium chloride. For example, the Medical Examiner Report on the death by execution of Ronald Gene Simmons states that the cause of death was "hyperkalemia due to Injection of Potassium Chloride 50 milliequivalents", (the term "hyperkalemia" means an abnormally elevated concentration of potassium in the blood).

11. In the context of lethal injection, sodium thiopental and pancuronium, if successfully delivered into the circulation in large doses, would indeed each be lethal, because they would stop the inmate's breathing. However, as described above, in execution by lethal injection as practiced by Arkansas and other states the administration of potassium and death precede any cardiac arrest that would be caused by sodium thiopental and pancuronium.

12. Intravenous injection of concentrated potassium chloride solution causes excruciating pain. The vessel walls of veins are richly supplied with sensory nerve fibers that are highly sensitive to potassium ions. The intravenous administration of concentrated potassium in doses intended to cause death therefore would be extraordinarily painful. ADC's selection of potassium chloride to cause cardiac arrest needlessly increases the risk that a prisoner will experience excruciating pain prior to execution. There exist alternative chemicals that cause cardiac arrest without activating the nerves in the vessel walls of the veins in the way that potassium chloride does. Despite the fact that the statute authorizing lethal injection in Arkansas does not specify or require the use of potassium, ADC has failed to choose a chemical that would

cause death in a painless manner.

13. Thus, ADC has exercised its statutory discretion to select the means of causing death by choosing a medication (potassium chloride) that causes extreme pain upon administration, instead of selecting available, equally effective yet essentially painless medications for stopping the heart. In so doing, ADC has created the necessity for ensuring, through all reasonable and feasible steps, that the prisoner is sufficiently anesthetized and cannot experience the pain of the potassium chloride injection.

ADC's Lethal Injection Protocol – The Use of Pancuronium Bromide

14. As noted, the ADC's lethal injection protocol additionally calls for the administration of 50 milligrams of pancuronium bromide (Pavulon). The use of pancuronium bromide serves no legitimate purpose and compounds the risk that an inmate may suffer excruciating pain during his execution. Pancuronium paralyzes all voluntary muscles, but does not affect sensation, consciousness, cognition, or the ability to feel pain and suffocation. Because the sodium thiopental and potassium chloride would in themselves be sufficient to cause death, and the potassium is administered well before death would result from the pancuronium alone, it is my opinion held to a reasonable degree of medical certainty that there would be no rational place in the protocol for pancuronium as the lethal amount of potassium chloride is administered.

15. Pancuronium bromide is a neuromuscular blocking agent. Its effect is to render the muscles unable to contract; it does not affect the brain or the nerves. It is used in surgery to ensure that the patient is securely paralyzed so that surgery can be performed without movement resulting from contraction of the muscles. If administered alone, a lethal dose of pancuronium

would not immediately cause a condemned inmate to lose consciousness. It would totally immobilize the inmate by paralyzing all voluntary muscles and the diaphragm, causing the inmate to suffocate to death while experiencing an intense, conscious desire to inhale. Ultimately, consciousness would be lost, but it would not be lost as an immediate and direct result of the pancuronium. Rather, the loss of consciousness would be due to suffocation, and would be preceded by the torment and agony caused by suffocation. This period of torturous suffocation would be expected to last at least several minutes and would only be relieved by the onset of suffocation-induced unconsciousness or by the onset of death resulting from potassium chloride.

16. Because the administration of a paralyzing dose of pancuronium bromide to a conscious person would necessarily cause excruciating suffering, it would be unconscionable to administer pancuronium without first anesthetizing the inmate and without first assessing the plane of anesthetic depth. In surgery, pancuronium bromide is not administered until the patient is adequately anesthetized. The anesthetic drugs must first be administered to ensure that the patient is unconscious and does not feel, see, or perceive the procedure. This can be determined by a trained medical professional, either a physician anesthesiologist or a nurse anesthetist, who provides close and vigilant monitoring of the patient, their vital signs, and the various diagnostic indicators of anesthetic depth. ADC's execution protocol, to the extent disclosed, fails to provide any indication that anesthetic depth will be properly assessed prior to the administration of pancuronium bromide.

17. It is my understanding that ADC's execution protocol requires the presence of official witnesses to the execution and permits media witnesses to the execution. It is my opinion

based on a reasonable degree of medical certainty that pancuronium, when successfully administered, effectively nullifies the ability of witnesses to discern whether or not the condemned prisoner is experiencing a peaceful or agonizing death. Regardless of the experience of the condemned prisoner, whether he or she is deeply unconscious or experiencing the excruciation of suffocation, paralysis, and potassium injection, he or she will appear to witnesses to be serene and peaceful due to the immobilization of the facial and other skeletal muscles.

18. The doses of sodium thiopental and potassium chloride are lethal doses. Therefore, it is unnecessary to administer pancuronium bromide in the course of an execution when it is quickly followed by a lethal dose of potassium chloride. It serves no legitimate purpose and only places a chemical veil on the process that prevents an adequate assessment of whether or not the condemned is suffering in agony, and greatly increases the risks that such agony will ensue. Removal of pancuronium from the protocol would eliminate the risk of conscious paralysis from occurring. It would also eliminate the risk that an inhumane execution would appear humane to witnesses. Finally, removal of pancuronium would vastly reduce the possibility that the citizens, officials, and courts of Arkansas could be inadvertently misled by media reports describing a peaceful-appearing execution when in fact the prisoner could be experiencing excruciating suffering.

Failure to Adhere to a Medical Standard of Care in Administering Anesthesia

19. Based on the information available to me, it is my opinion held to a reasonable degree of medical certainty that the ADC's lethal injection protocol creates an unacceptable risk that the inmate will not be anesthetized to the point of being unconscious and unaware of pain for the duration of the execution procedure. If the inmate is not first successfully anesthetized,

then it is my opinion to a reasonable degree of medical certainty that the pancuronium will paralyze all voluntary muscles and mask external, physical indications of the excruciating pain being experienced by the inmate during the process of suffocating (caused by the pancuronium) and having a cardiac arrest (caused by the potassium chloride).

20. The provision of anesthesia has become a mandatory standard of care whenever a patient is to be subjected to a painful procedure. Throughout the civilized world, the United States, and Arkansas, whenever a patient is required to undergo a painful procedure, it is the standard of care to provide some form of anesthesia. Circumstances arise in which prisoners in Arkansas require surgery, and in many instances the surgery requires the provision of general anesthesia. In these circumstances general anesthesia is provided, and it is provided by an individual with specific training and qualifications in the field of anesthesiology. It is critical to understand that the great majority of physicians and nurses and other health care professionals do not possess the requisite training, skills, experience, and credentials to provide general anesthesia. It would be unconscionable to forcibly subject any person, including a prisoner in Arkansas, to a planned and anticipated highly painful procedure without first providing an appropriate anesthetic, and it would be unconscionable to allow personnel who are not properly trained in the field of anesthesiology to attempt to provide or supervise this anesthetic care.

21. As a living person who is about to be subjected to the excruciating pain of potassium injection, or the unnecessary suffering of suffocation due to a paralyzed diaphragm, it is imperative that all prisoners undergoing lethal injection be provided with adequate anesthesia. This imperative is of the same order as the imperative to provide adequate anesthesia for any Arkansas prisoner requiring general anesthesia (or any type of anesthesia) before undergoing

painful surgery. Given that the injection of potassium is a scheduled and premeditated event that is known without any doubt to be extraordinarily painful, it would be unconscionable and barbaric for potassium injection to take place without the provision of sufficient general anesthesia to ensure that the prisoner is rendered and maintained unconscious throughout the procedure, and it would be unconscionable to allow personnel who are not properly trained in the field of anesthesiology to attempt to provide or supervise this anesthetic care.

22. Presumably because of the excruciating pain evoked by potassium and the torture that would result from death by suffocation following paralysis, lethal injection protocols like that in Arkansas purport to provide general anesthesia using sodium thiopental. When successfully delivered into the circulation in sufficient quantities, sodium thiopental causes sufficient depression of the nervous system to permit excruciatingly painful procedures to be performed without causing discomfort or distress. Failure to successfully deliver into the circulation a sufficient dose of sodium thiopental, however, will result in a failure to achieve adequate anesthetic depth and thus failure to block the excruciating pain of potassium administration and suffocation.

23. The ADC's procedures do not comply with the medical standard of care for inducing and maintaining anesthesia prior to and during a painful procedure. Likewise, the ADC's procedures are not compliant with the guidelines set forth by the American Veterinary Medical Association for the euthanasia of animals. Further, the ADC has made insufficient preparation for the real possibility, which has been encountered in Arkansas as well as in many other jurisdictions, and planned for in those jurisdictions, that peripheral IV access cannot be successfully established.

1. The Dangers of Using Sodium Thiopental as an Anesthetic

24. The use of sodium thiopental as the anesthetic in the ADC's lethal injection protocol is inappropriate and medically unsatisfactory. Sodium thiopental is an ultrashort-acting barbiturate with a relatively short shelf life in liquid form. Sodium thiopental is distributed in powder form to increase its shelf life; it must be mixed into a liquid solution by trained personnel before it can be injected.

25. When anesthesiologists use sodium thiopental, we do so for the purposes of temporarily anesthetizing patients for sufficient time to intubate the trachea and institute mechanical support of ventilation and respiration. Once this has been achieved, additional drugs are administered to maintain a "surgical depth" or "surgical plane" of anesthesia (i.e., a level of anesthesia deep enough to ensure that a surgical patient feels no pain and is unconscious). The medical utility of sodium thiopental derives from its ultrashort-acting properties: if unanticipated obstacles hinder or prevent successful intubation, patients will likely quickly regain consciousness and resume ventilation and respiration on their own.

26. The benefits of sodium thiopental in the operating room engender serious risks in the execution chamber. Although the full two grams of sodium thiopental, if properly administered into the prisoner's bloodstream, would be more than sufficient to cause unconsciousness and, eventually, death, if no resuscitation efforts were made, my research into executions by lethal injection strongly indicates that executions have occurred where the full dose of sodium thiopental listed in the protocol was not fully and properly administered. If an inmate does not receive the full dose of sodium thiopental because of errors or problems in administering the drug, the inmate might not be rendered unconscious and unable to feel pain, or

alternatively might, because of the short-acting nature of sodium thiopental, regain consciousness during the execution.

27. Although the concerns raised in this declaration apply regardless of the size of the dose of sodium thiopental that is prescribed under the protocol, the ADC's arbitrary decision to administer only two grams, as opposed to the three or five grams used in some other jurisdictions, unduly decreases the margin of error and the risk that inadequate anesthesia will be achieved. The level of anesthesia, if any, achieved in each individual inmate depends on the amount that is successfully administered, although other factors such as the inmate's weight and sensitivity/resistance to barbiturates are also important. Many foreseeable situations exist in which human or technical errors could result in the failure to successfully administer the intended dose. If error occurs that results in the prisoner receiving only half of a five gram dose, the prisoner will still receive 2.5 grams and adequate anesthesia will likely occur despite the error. If the same error occurs and the prisoner receives only half of a two gram dose, however, the risks of inadequate anesthesia and conscious suffering are significant. ADC's execution protocol both fosters potential problems and fails to provide adequate instruction for preventing or rectifying such situations, and it does these things needlessly and without legitimate reason. Examples of problems that could prevent proper administration of sodium thiopental include, but are not limited to, the following:

a) Errors in Preparation. Sodium thiopental is delivered in powdered form and must be mixed into an aqueous solution prior to administration. This preparation requires the correct application of pharmaceutical knowledge and familiarity with terminology and abbreviations. Calculations are also required, particularly if the protocol requires the use of a

concentration of drug that differs from that which is normally used. The ADC's protocol instructs only that the powder be dissolved in "the least amount of clear diluent possible to attain complete, clear suspension," without providing any indication as to how much fluid that might be or how the person performing the mixing should determine how much to use or how success has been achieved.

b) Error in Labeling of Syringes. ADC's execution protocol calls for the execution drugs to be placed in syringes labeled only by number and not by name. This creates the risk of confusion in creating the syringes, leading to mislabeling, which is highly unlikely to be detected and corrected later in the process.

c) Error in Selecting the Correct Syringe during the sequence of administration. The syringes are to be selected in series by hand during the execution, and thus the wrong sequence of drug administration will occur if the executioner simply picks up an incorrect syringe.

d) Error in Correctly Injecting the Drug into the Intravenous Line. The Arkansas execution description fails to identify the persons responsible for injecting the lethal drugs and further fails to specify their qualifications. The use of insufficiently qualified executioners increases the risk that problems such as the following will occur, and decreases the probability that such problems will be detected and corrected if they do occur.

e) The IV Tubing May Leak. An "IV setup" consists of multiple components that are assembled by hand prior to use. If, as appears to be the practice in Arkansas, the personnel who are injecting the drugs are not at the bedside but are instead in a different room or part of the room, multiple IV extension sets need to be inserted between the inmate and the administration

site. Any of these connections may loosen and leak. In clinical practice, it is important to maintain visual surveillance of the full extent of IV tubing so that such leaks may be immediately detected. The Arkansas practice, in which the executioners are in a separate room with hindered opportunity for visual surveillance, interferes with detection of any leak that may occur and is not acceptable.

f) Incorrect Insertion of the Catheter. If the catheter is not properly placed in a vein, the sodium thiopental will enter the tissue surrounding the vein but will not be delivered to the central nervous system and will not render the inmate unconscious. This condition, known as infiltration, occurs with regularity in the clinical setting. Recognition of infiltration requires continued surveillance of the IV site during the injection, and that surveillance should be performed by the individual who is performing the injection so as to permit correlation between visual observation and tactile feedback from the plunger of the syringe.

g) Migration of the Catheter. Even if properly inserted, the catheter tip may move or migrate, so that at the time of injection it is not within the vein. This would result in infiltration, and therefore a failure to deliver the drug to the inmate's circulation and failure to render the inmate unconscious.

h) Perforation or Rupture or Leakage of the Vein. During the insertion of the catheter, the wall of the vein can be perforated or weakened, so that during the injection some or all of the drug leaves the vein and enters the surrounding tissue. The likelihood of rupture occurring is increased if too much pressure is applied to the plunger of the syringe during injection, because a high pressure injection results in a high velocity jet of drug in the vein that can penetrate or tear the vessel wall.

i) Excessive Pressure on the Syringe Plunger. Even without damage or perforation of the vein during insertion of the catheter, excessive pressure on the syringe plunger during injection can result in tearing, rupture, and leakage of the vein due to the high velocity jet that exits the tip of the catheter. Should this occur, the drug would not enter the circulation and would therefore fail to render the inmate unconscious.

j) Securing the Catheter. After insertion, catheters must be properly secured by the use of tape, adhesive material, or suture. Movement by the inmate, even if restrained by straps, or traction on the IV tubing may result in the dislodging of the catheter.

k) Failure to Properly Loosen or Remove the Tourniquet from the Arm or Leg after placement of the IV catheter will delay or inhibit the delivery of the drugs by the circulation to the central nervous system. This may cause a failure of the sodium thiopental to render and maintain the inmate in a state of unconsciousness.

l) Impaired Delivery Due to Restraining Straps. Restraining straps may act as tourniquets and thereby impede or inhibit the delivery of drugs by the circulation to the central nervous system. This may cause a failure of the sodium thiopental to render and maintain the inmate in a state of unconsciousness. Even if the IV is checked for "free flow" of the intravenous fluid prior to commencing injection, a small movement within the restraints on the part of the inmate could compress the vein and result in impaired delivery of the drug.

2. The Need for Adequate Training in Administering Anesthesia

29. Because of these foreseeable problems in administering anesthesia, in Arkansas and elsewhere in the United States the provision of anesthetic care should be performed only by personnel with advanced training in the medical subspecialty of Anesthesiology. This is because

the administration of anesthetic care is complex and risky, and can only be safely performed by individuals who have completed the extensive requisite training to permit them to provide anesthesia services. Failure to properly administer a general anesthetic not only creates a high risk of medical complications including death and brain damage, but also is recognized to engender the risk of inadequate anesthesia, resulting in the awakening of patients during surgery, a dreaded complication known as "intraoperative awareness." The risks of intraoperative awareness are so grave that, in October 2005, the American Society of Anesthesiologists published a new practice advisory on the subject of intraoperative awareness. If the individual providing anesthesia care is inadequately trained or experienced, the risk of these complications is enormously increased. In Arkansas and elsewhere in the United States, general anesthesia is administered by physicians who have completed residency training in the specialty of Anesthesiology, and by nurses who have undergone the requisite training to become Certified Registered Nurse Anesthetists (CRNAs). Physicians and nurses who have not completed the requisite training to become anesthesiologists or CRNAs are not permitted to provide general anesthesia.

29. In my opinion, individuals providing general anesthesia in the Arkansas prisons should not be held to a different or lower standard than is set forth for individuals providing general anesthesia in any other setting in Arkansas. Specifically, the individuals providing general anesthesia within prisons in Arkansas should possess the experience and proficiency of anesthesiologists and/or CRNAs. Conversely, a physician who is not an anesthesiologist or a nurse who is not a CRNA should not be permitted to provide general anesthesia within an Arkansas prison or anywhere in Arkansas.

30. ADC's execution protocol fails to specify whether the person or persons administering the lethal injection have any training in administering anesthesia, or, if personnel are given training, what that training might be. The absence of any details as to the training, certification, or qualifications of injection personnel raises critical questions about the degree to which condemned inmates risk suffering excruciating pain during the lethal injection procedure. The great majority of nurses are not trained in the use of ultrashort-acting barbiturates; indeed, this class of drugs is essentially only used by a very select group of nurses who have obtained significant experience in intensive care units and as nurse anesthetists. Very few paramedics are trained or experienced in the use of ultrashort-acting barbiturates. Based on my medical training and experience, and based upon my research of lethal injection procedures and practices, inadequacies in these areas elevate the risk that the lethal injection procedure will cause the condemned to suffer excruciating pain during the execution process. Failure to require that the person or persons administering the lethal injection have training equivalent to that of an anesthesiologist or a CRNA compounds the risk that inmates will suffer excruciating pain during their executions.

3. ADC's Failure to Account for Foreseeable Problems in Anesthesia Administration

31. In addition to lacking any policy on the training necessary to perform a lethal injection, ADC's execution protocol imposes conditions that exacerbate the foreseeable risks of improper anesthesia administration described above, and fails to provide any procedures for dealing with these risks. Perhaps most disturbingly, the Arkansas lethal injection practice prevents any type of effective monitoring of the inmate's condition or whether he is anesthetized and unconscious. This falls below the standard of care. Accepted medical practice dictates that

trained personnel monitor the IV lines and the flow of anesthesia into the veins through visual and tactile observation and examination. The lack of any qualified personnel present in the chamber during the execution thwarts the execution personnel from taking the standard and necessary measures to reasonably ensure that the sodium thiopental is properly flowing into the inmate and that he is properly anesthetized prior to the administration of the pancuronium and potassium.

32. In my opinion, having a properly trained and credentialed individual examine the inmate after the administration of the sodium thiopental (but prior to the administration of pancuronium) to verify that the inmate is completely unconscious would substantially mitigate the danger that the inmate will suffer excruciating pain during his execution. As discussed later in this affidavit, this is the standard of care, and in many states the law, that is set forth for dogs and cats and other household pets when they are subjected to euthanasia by potassium injection. Yet ADC's execution protocol does not provide for such verification, and indeed Arkansas practice actively prevents the person or persons administering the lethal injection from determining whether or not the inmate remains conscious by requiring that all of the drugs must be administered remotely, from another room without even visual surveillance.

33. The ADC's execution protocol provides no specifications regarding the timing of the administration of the drugs, thereby compounding the risks described in this Declaration. This concern is greatly amplified by the use of an ultrashort-acting barbiturate and is borne out by a review of the execution records from California. In each of the executions, the time between administrations of the three drugs varied for no apparent reason. The lack of a defined schedule for the administration of the three drugs increases the risk that the sedative effect of the sodium

thiopental will wear off, should the inmate not receive the full dose.

34. The Arkansas lethal injection protocol fails to account for procedures designed to ensure the proper preparation of the drugs used. I have not seen details regarding the credentials, certification, experience, or proficiency of the personnel who will be responsible for the mixing of the sodium thiopental from powder form, or for the drawing up of the drugs into the syringes. Preparation of drugs, particularly for intravenous use, is a technical task requiring significant training in pharmaceutical concepts and calculations. It is my opinion based on my review of lethal execution procedures in states that have disclosed more detailed information than what I have seen about the Arkansas procedures, that there exist many risks associated with drug preparation that, if not properly accounted for, further elevate the risk that the drug will not be properly administered and the inmate will consciously experience excruciating pain during the lethal injection procedures.

35. The altering of established medical procedures without adequate medical review and research, by untrained personnel, causes great concern about the structure of the lethal injection protocol and its medical legitimacy. Appropriate mechanisms for medical review, and standardization of the implementation and amendment process, are critical features in any medical protocol so that the medical professionals and the public can be assured that proper and humane procedures are in place and being followed. Indeed, in other states, physicians and other medical personnel play a role in ensuring that any protocol is consistent with basic medical standards of care and humaneness. Otherwise, the process is subject and prone to ad hoc administration and error, if not gross negligence. With lethal injection, such concerns are highly elevated.

36. Based on my medical training and experience, and based on my research into lethal injection procedures and practices, it is my opinion to a reasonable degree of medical certainty that any reliable, humane lethal injection procedure must account for the foreseeable circumstance of a condemned inmate having physical characteristics that prevent intravenous access from being obtained by a needle piercing the skin and entering a superficial vein suitable for the reliable delivery of drugs. There have been multiple lethal injections in which this problem has arisen from a variety of circumstances, including at least two procedures performed in Arkansas. Problems may occur due to conditions including obesity, corticosteroid treatment, history of intravenous drug use and history of undergoing chemotherapy. Additionally, some people just happen to have veins that are too small or deep to permit peripheral access. It is often not possible to anticipate difficult intravenous access situations in advance of the execution, and there are multiple examples of executions in which the personnel placing the intravenous lines struggled to obtain peripheral IV access and eventually abandoned the effort. ADC's execution protocol is deficient in its failure to plan for the foreseeable possibility that peripheral IV access cannot be obtained.

37. In this setting, state lethal injection protocols typically specify the use of a "cut-down" procedure to access a vein adequate for the reliable infusion of the lethal drugs. Despite the fact that serious difficulties with gaining intravenous access have been experienced by the ADC in the past, the Arkansas lethal injection execution protocol contains no reference to plans for dealing with the foreseeable circumstance wherein peripheral intravenous access cannot be obtained in the arm or leg. No information regarding the training, experience, expertise, credentials, certification, or proficiency of the personnel who would perform such a "cut down"

procedure is listed in the Arkansas lethal injection protocol. In this regard, the ADC's lethal injection protocol is deficient in comparison to those of other states that I have reviewed. This complicated medical procedure requires equipment and skill that are not accounted for in the execution protocol. It has a very high probability of not proceeding properly in the absence of adequately trained and experienced personnel, and without the necessary equipment. If done improperly, the "cut-down" process can result in very serious complications including severe hemorrhage (bleeding), pneumothorax (collapse of a lung which may cause suffocation), and severe pain.

38. It is well documented that lethal injection procedures in other states have at times required the use of a central intravenous line. Further, the ADC has at times obtained intravenous access using cut down and central line techniques. For example, based on photographs and the Medical Examiner's report it appears that Mr. Rickey Rector underwent 10 failed attempts to place a peripheral IV, followed by a cutdown procedure. Reports by witnesses to the execution, describing "loud moans," indicate that Mr. Rector experienced significant pain while enduring this. Additionally, Mr. Clay Smith was executed by means of lethal injection through a subclavian central line, a form of intravenous access that is significantly more difficult, risky, painful and invasive to obtain than peripheral iv access. In the absence of further information about the personnel who performed these procedures, their proficiency and credentialing and currency, the equipment available to them, and their ability to recognize and treat complications, is not possible to make any assessment about whether the necessary safeguards have been set in place to ensure that the procedure is reasonably humane.

39. Problems with intravenous access during lethal injection are not unique to

Arkansas, and have been encountered in other jurisdictions. During the recent execution of Joseph Clark in Ohio, difficulties in finding a vein delayed the execution by almost 90 minutes. The execution team struggled for several minutes to find usable vein. The team placed a "shunt" in Clark's left arm, but the vein "collapsed". Subsequently, the team placed a "shunt" in Clark's right arm, but mistakenly attempted to administer the lethal drugs through the IV in the left arm where the vein had already "collapsed". The difficulties prompted Clark to sit up and tell his executioners "It don't work" and to ask "Can you just give me something by mouth to end this?"

40. Similar problems occurred during the execution of Stanley "Tookie" Williams, the injection team took 12 minutes to insert the IV lines. The first line was placed quickly but spurted blood, and the staff struggled for 11 minutes to insert the second line, having so much difficulty that Williams asked whether they were "doing that right." The difficulty of the challenge presented to the IV team is evidenced by the comment that "by 12:10 a.m., the medical tech's lips were tight and white and sweat was pooling on her forehead as she probed Williams' arm."

41. In the execution of Stephen Anderson on January 29, 2002, one of the persons who attempted to secure an IV was unable to do so without causing significant bleeding and the need to remove his gloves. Again, this indicates that the process is a difficult one and that it is necessary that the persons doing it are properly trained and experienced. As is widely recognized in the medical community, administration of intravenous medications and the management of intravenous systems are complex endeavors. While speculative and not evidence-based, it is my opinion that it is likely that IV placement is rendered more difficult in the context of executions because the inmates are often in a very anxious status, which causes the release of epinephrine

(adrenalin) and norepinephrine, thereby causing constriction (narrowing) of blood vessels (including veins). When veins are constricted/narrowed it can be difficult or impossible to insert an IV catheter. This phenomenon, in conjunction with the use of inadequately qualified execution personnel, is the best explanation I can provide for the otherwise unexplained extremely high incidence of difficult or failed peripheral IV placement, in individuals lacking known risk factors for difficult IV access.

4. ADC's Protocol Has Resulted in Botched Executions

42. There is evidence that the ADC's lethal injection protocol has caused some inmates in Arkansas to be executed without adequate anesthesia. Both execution records and witnesses' accounts of these executions provide evidence that is indicative of continued consciousness following the purported administration of the sodium pentothal. A dose of Sodium Pentothal of 2mg or more, properly administered, will cause unconsciousness within one minute or less. However, in several executions that have been performed in Arkansas, the inmate displayed signs of consciousness for considerably longer that the one minute maximum that is consistent with successful administration of the anesthetic.

43. Ronald Gene Simmons was executed by the State of Arkansas on June 25, 1990. The administration of the lethal chemicals began at 9:02pm. Between 9:02 and 9:04pm, according to an eyewitness, Mr. Simmons appeared to nod off into unconsciousness. However, at 9:05pm he called out "Oh! Oh!" and began to cough as though he might be having difficulty breathing. During the next two minutes, he coughed approximately 20 times. With each cough his stomach heaved slightly and the gurney to which he was strapped shook. Mr. Simmons became still at 9:07pm, after which his face and arm turned first blue and then purple. An ADC

employee twice appeared to adjust the IV tube in Mr. Simmons' arm, and not until 9:19pm was Mr. Simmons pronounced dead by the coroner.

44. The typical reaction to the administration of sodium pentothal is yawning, drawing one or two deep breaths, or visibly exhaling so that the cheeks puff out. Obviously, repeated audible vocalization is not consistent with the induction of a surgical plane of anesthesia by sodium thiopentol. Also, repeated, prolonged, irregular heaving of the chest is not consistent with the deep depression of the central nervous system caused by the successful administration of a large dose of sodium pentothal.

45. On January 24, 1992, Rickey Ray Rector was put to death in Arkansas. The execution took one hour and 9 minutes to complete, during which time Mr. Rector's hands and arms were punctured 10 separate times by ADC personnel searching for a suitable vein in which to place the IV line, as noted above. The catheter was finally inserted into a vein in Mr. Rector's hand, although not before a cut-down was made in his arm. Once the IV line was secured, the flow of lethal chemicals began at 9:50pm. For two minutes Mr. Rector looked to witnesses as though he was nodding off to sleep. However, one observer noted that Mr. Rector said "I'm getting dizzy" two minutes after the execution began. Then at 9:55pm, Mr. Rector's lips were seen to move rapidly, as if he was drawing shallow breaths. His lips did not stop moving until one minute later. Mr. Rector still was not pronounced dead; at 10:06pm a witness noted that a heart monitor at the head of the gurney appeared to be flat-lining, only to then see another jump followed by another flutter. Death was finally pronounced at 10:09pm.

46. On May 7, 1992, Steven Douglas Hill was executed. His execution began at 9:02pm. His eyes closed one minute later, but shortly after that he had what witnesses described

as a seizure. His back was arched and his cheeks were popping out. He was visibly gasping for air, and even though he was strapped down to the gurney his chest was noticeably heaving against the belt across his chest. The seizure ended at 9:04pm and Mr. Hill was pronounced dead at 9:10pm.

47. Christina Riggs was executed on May 2, 2000. The procedure was delayed for 18 minutes while ADC personnel struggled to insert the IV line into her elbows. When they could not do so, they asked Ms. Riggs if they could insert the catheters into her wrists, and she consented. The execution then proceeded. However, a minute after the drugs had purportedly begun to flow into her body, Ms. Riggs was still vocalizing. Witnesses heard her say "I love you, my babies."

48. It is my opinion that these accounts of Arkansas executions are indicative of problems with the administration of the lethal drugs and raise concerns that adequate anesthesia may not be being reliably provided. They are part of a growing body of evidence that suggests that such problems are recurring over and over again in jurisdictions throughout the country that utilize similar lethal injection protocols.

49. It is my further opinion that to ensure a lethal injection without substantial risks of inflicting severe pain and suffering, proper procedures must be put in place that are clear and consistent: there must be qualified personnel to ensure that anesthesia has been achieved prior to the administration of pancuronium bromide and potassium chloride, if those drugs are used; there must be qualified personnel to select chemicals and dosages, set up and load the syringes, administer "pre-injections," insert the IV catheter, and perform the other tasks required by such procedures; and there must be adequate inspection, testing and monitoring of the equipment and

apparatus by qualified personnel throughout the execution process. The Arkansas Department of Corrections' written procedures for implementing lethal injection, to the extent that they have been made available, provide for none of the above.

The Arkansas Execution Protocol Falls Below the Minimum Standards Mandated for Veterinary Euthanasia

50. The injection protocol employed by the ADC for putting human beings to death is strongly discouraged by the American Veterinary Medical Association (AVMA) and prohibited by law from being used on animals in 19 states. Specifically, the 2000 Report of the Panel on Euthanasia of the American Veterinary Medical Association states that when potassium chloride is to be used as a euthanasia agent, the animals must be under a surgical plane of anesthesia and the personnel performing the euthanasia must be properly trained to assess the depth of anesthesia. The AVMA panel specifically states that the animal must be in a surgical plane of anesthesia characterized not simply by loss of consciousness, but also by "loss of reflex muscle response and loss of response to noxious stimuli." Additionally, the AVMA recommends that sodium pentobarbital be used as an anesthetic, which is much longer lasting and more stable than sodium thiopental. It is difficult to understand why the ADC would chose, at its discretion, to use potassium to execute prisoners and would then fail to adhere to the basic requirements set forth by the AVMA to ensure that animals do not experience the excruciating pain of potassium injection during euthanasia.

Conclusion

51. Based on my research into methods of lethal injection used by various states and the federal government, and based on my training and experience as a medical doctor

specializing in anesthesiology, it is my opinion based on a reasonable degree of medical certainty that, given the apparent absence of a central role for a properly trained medical or veterinary professional in the ADC's execution procedure, the chemicals used, the lack of adequately defined roles and procedures, and the failure to properly account for foreseeable risks, the lethal injection procedure Arkansas employs creates medically unacceptable risks of inflicting excruciating pain and suffering on inmates during the lethal injection procedure. All of these problems could easily be remedied, and yet ADC has failed to address them and has failed to meet the minimum standards set forth for veterinary euthanasia.

52. In addition, in order to more fully and fairly assess the impact of the failings of the Arkansas execution protocol, it will be necessary to obtain all official witness statements from prior executions, all available EKG and toxicology data from prior executions, as well as the full rules and regulations devised by the ADC for administering lethal injections. This would include identifying the qualifications, experience and training of those persons who apply the IVs and who administer and monitor the injection.

I declare under penalty of perjury under the laws of the United States and the State of Arkansas that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on June 11, 2006 in Kansas City, Missouri.

Mark J. S. Heath, M.D.

Curriculum Vitae

1) Date of preparation: December 19, 2004

2) Name: Mark J. S. Heath

Birth date: March 28, 1960
Birthplace: New York, NY
Citizenship: United States, United Kingdom

3) Academic Training:

Harvard University	B.A., Biology, 1983
University of North Carolina, Chapel Hill	M.D., 1987
Medical License	New York: 177101-1

4) Traineeship:

1987 – 1988 Internship, Internal Medicine, George Washington University Hospital, Washington, DC.

1988 – 1991 Residency, Anesthesiology, Columbia College of Physicians and Surgeons, New York, NY

1991 – 1993 Fellowship, Anesthesiology, Columbia College of Physicians and Surgeons, New York, NY

5) Board Qualification:

Diplomate, American Board of Anesthesiology, October 1991.
Testamur, Examination of Special Competence in Perioperative Transesophageal Echocardiography (PTEeXAM), 2001.

6) Military Service: None

7) Professional Organizations:

American Society of Anesthesiologists
International Anesthesia Research Society
Society of Cardiovascular Anesthesiology

8) Academic Appointments:

1993 – 2002	Assistant Professor of Anesthesiology, Columbia University, New York, NY
2002 - present	Assistant Professor of Clinical Anesthesiology, Columbia University, New York, NY

9) Hospital/Clinical Appointments:

1993 – present Assistant Attending Anesthesiologist, Presbyterian Hospital, New York, NY.

10) Honors:

Magna cum laude, Harvard University
Alpha Omega Alpha, University of North Carolina at Chapel Hill
First Prize, New York State Society of Anesthesiologists Resident Presentations, 1991

11) Fellowship and Grant Support:

Foundation for Anesthesia Education and Research, Research Starter Grant Award, Principal Investigator, funding 7/92 - 7/93, $15,000.

Foundation for Anesthesia Education and Research Young Investigator Award, Principal Investigator, funding 7/93 - 7/96, $70,000.

NIH KO8 "Inducible knockout of the NK1 receptor"
Principal Investigator, KO8 funding 12/98 - 11/02,
$431,947 over three years
(no-cost extension to continue through 11/30/2002)

NIH RO1 "Tachykinin regulation of anxiety and stress responses"
Principal Investigator, funding 9/1/2002 – 8/30/2007
$1,287,000 over 5 years

12) Departmental and University Committees:

Research Allocation Panel (1996 – 2001)
Institutional Review Board (Alternate Boards 1-2, full member Board 3) (2003 - present)

13) Teaching:

Lecturer and clinical teacher: Anesthesiology Residency Program, Columbia University and Presbyterian Hospital, New York, NY

Advanced Cardiac Life Support Training

Anesthetic considerations of LVAD implantation. Recurrent lecture at Columbia University LVAD implantation course.

Invited Lecturer:

NK1 receptor functions in pain and neural development, Cornell University December 1994

Anxiety, stress, and the NK1 receptor, University of Chicago, Department of Anesthesia and Critical Care, July 2000

Anesthetic Considerations of LVAD Implantation, University of Chicago, Department of Anesthesia and Critical Care, July 2000

NK1 receptor function in stress and anxiety, St. John's University Department of Medicinal Chemistry, March 2002

Making a brave mouse (and making a mouse brave), Mt.Sinai School of Medicine, May 2002

Problems with anesthesia during lethal injection procedures, Geneva, Switzerland. Duke University School of Law Conference, "International Law, Human Rights, and the Death Penalty: Towards an International Understanding of the Fundamental Principles of Just Punishment", July 2002.

NK1 receptor function in stress and anxiety, Visiting Professor, NYU School of Medicine, New York, New York. October 2002.

Anesthetic Depth, Paralysis, and other medical problems with lethal injecton protocols: evidence and concerns, Federal Capital Habeas Unit Annual Conference, Jacksonville, Florida. May 2004.

Medical Scrutinyof Lethal Injection Procedures. National Association for the Advancement of Colored People Capital Defender Conference, Airlie Conference Center, Warrenton, Virginia. July 2004.

Anesthetic considerations of LVAD implantation. Recurrent lecture at Columbia University LVAD implantation course.

14) Grant Review Committees: None

15) Publications:

Original peer reviewed articles

* Santarelli, L., Gobbi, G., Debs, P.C., Sibille, E. L., Blier, P., Hen, R., **Heath, M.J.S.** (2001). Genetic and pharmacological disruption of neurokinin 1 receptor function decreases anxiety-related behaviors and increases serotonergic function. **Proc. Nat. Acad. Sci**., 98(4), 1912 – 1917.

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* **Heath, M. J. S.**, Lints, T., Lee, C. J., Dodd, J. (1995). Functional expression of the tachykinin NK_1 receptor by floor plate cells in the embryonic rat spinal cord and brainstem. **Journal of Physiology** 486.1, 139 -148.

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* **Heath, M. J. S.**, Dickstein, M. L. (2000). Perioperative management of the left ventricular assist device recipient. Prog Cardiovasc Dis.;43(1):47-54.

* Dickstein, M.L., Mets B, **Heath M.J.S.** (2000). Anesthetic considerations during left ventricular assist device implantation. Cardiac Assist Devices pp 63 – 74.

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* **Heath, M.J.S.**, Mathews D. (1990). Care of the Organ Donor. **Anesthesiology Report** 3, 344-348.

* **Heath, M. J. S.**, Basic physiology and pharmacology of the central synapse. (1998) **Anesthesiology Clinics of North America** 15(3), 473 - 485.

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