

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA**

In the Matter of the Federal Bureau of Prisons' Execution Protocol Cases, LEAD CASE: <i>Roane et al. v. Barr</i> THIS DOCUMENT RELATES TO: <i>Nelson v. Barr, et al.</i>, 20-cv-557	Case No. 19-mc-0145 (TSC)
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SECOND SUPPLEMENTAL EXPERT DECLARATION OF GAIL VAN NORMAN, M.D.

Pursuant to 28. U.S.C. § 1746, Gail Van Norman M.D. declares as follows

I. INTRODUCTION

1. On November 1, 2019, I provided Plaintiffs' counsel with my opinions regarding the Federal Execution Protocol in a Declaration that included detailed discussion and cited evidence. On June 29, 2020, I provided a Supplemental Declaration addressing specific questions regarding flash pulmonary edema in prisoners executed by intravenous (IV) administration of five grams of pentobarbital.

2. Counsel for Keith Nelson have provided me with the Preliminary Findings Report ("autopsy report") from an autopsy performed by Dr. Joyce Lynn deJong, DO, at Western Michigan University on prisoner Wesley Purkey, who was executed on July 16, 2020 by IV administration of pentobarbital, in accordance with the Federal Execution Protocol. Counsel asked me to comment on the finding of flash pulmonary edema in Mr. Purkey's autopsy report and whether this finding is consistent with my previous opinion that prisoners executed with five grams

of pentobarbital will be sensate, will experience flash pulmonary edema and will experience extreme pain and suffering.

3. In addition to the materials listed in my Expert Declaration dated November 1, 2019, and in my Supplemental Declaration dated June 29, 2020, I have reviewed and relied upon the following materials:

- Preliminary Findings Report by Dr. Joyce Lynn deJong DO, pathologist, of autopsy findings for Wesley Purkey;
- Various authoritative textbooks, peer-reviewed articles, materials from government regulatory agencies such as the FDA, and other publications and materials as included in the references cited throughout this declaration.

4. As I have stated previously, if additional documents or materials are provided to me for specific review and analysis, or if I become aware of other scientific or clinical evidence that impacts my opinions, or if in attendance at any hearings or trials in this case I learn of relevant evidence, I may modify these opinions accordingly. To aid counsel and the Court, I will summarize some of my previous conclusions in this declaration, in addition to addressing counsel's questions.

II. SUMMARY OF OPINIONS

5. The autopsy findings for Wesley Purkey, who was executed with a five gram IV dose of pentobarbital, unequivocally demonstrate pulmonary edema. Mr. Purkey's lungs were filled with fluid to the extent of nearly doubling their normal weight, and frothy pulmonary edema fluid filled his main airways all the way up in the trachea.

6. The findings of Mr. Purkey's autopsy are consistent with, and affirm, my opinion that premortem flash pulmonary edema is a virtual medical certainty in any execution carried out in accordance with the Federal Execution Protocol.

7. Consistent with my previous opinion, prisoners executed by lethal injection in accordance with the Federal Protocol remain sensate and able to experience the extreme pain and suffering related to the occurrence of flash pulmonary edema.

III. DISCUSSION

A. Clinical Background and Evidence

8. Flash pulmonary edema is a physical phenomenon that has been well-known and well-described for many decades. The mechanism of barbiturate-associated flash pulmonary edema is believed to occur via a combination of 3 mechanisms: (1) immediate, direct caustic injury to delicate linings of capillary vessels in the lungs, that, in conjunction with pressure from the beating right ventricle, causes them to leak serum into the air-exchanging chambers (alveoli); (2) the immediate toxic effect of the barbiturate on the left ventricle of the heart, which causes the heart to fail (i.e. beat less effectively), allowing fluid backup into the lungs that further increases pressure in the capillaries and capillary leakage of fluid into the alveoli of the lungs; and (3) partial or total airway obstruction due to pentobarbital-related relaxation of tissues in the upper airway in a spontaneously breathing person, such that when the subject attempts to take a breath, air entry in the lungs is prevented, and increasing negative pressure ("suction") within the chest draws fluid from the capillaries into the alveoli and airways. Please see my November 1, 2019 Declaration (pages 31-32, paragraphs 65-67) and my June 29, 2020 Supplemental Declaration (pages 7-10) for references and fuller discussion. All of the above mechanisms require a beating heart and/or respiratory efforts, which can only occur in a living subject.

9. In a study of “normal” lung weights at autopsy, Joachim et al.¹ demonstrated clearly that if a person survived lung trauma for a period of time of even a few minutes, lung weights increased dramatically and immediately, as a result of pulmonary edema or blood accumulating in the lungs while the person was still alive (i.e. within the “survival time”). The authors specifically examined the interval between death and autopsy and found that “the interval between death and autopsy is without demonstrable influence on the total blood content [of the lungs], the extravascular fluid, and the lung weight.” In other words, lung injury leads to rapid pulmonary edema that can occur within minutes while the person remains alive, and after death there is no further fluid accumulation in the lungs.

10. The occurrence of flash pulmonary edema with barbiturate overdose has been well described, and is not speculative. Furthermore, in rare cases, even subanesthetic doses of the IV barbiturate thiopental—a drug that is in all relevant characteristics equivalent to pentobarbital—have led to flash pulmonary edema *within seconds* of administration. Please see my November 1, 2019 Declaration (pages 32-33, paragraphs 66-67) and Supplemental Declaration (pages 7-10) for full references regarding barbiturates and pulmonary edema. As I stated on page 20 of my Supplemental Declaration, I have personally experienced a case in which pulmonary edema developed after *a single breath* in a patient, accompanied by immediate onset of respiratory distress that necessitated placement of a breathing tube and admission to the intensive care unit. These cases represent clinical experiences in which a knowledgeable observer (the anesthesiologist) was able to authoritatively attest to the rapidity of onset of pulmonary edema and symptoms within seconds, or within a single breath, of administration. Peak effects of IV

¹ Joachim H, Riede UN, Mittermayer Ch. The weight of human lungs as a diagnostic criterium. Path Res Prac 1978; 162:24-40

barbiturates are well described and occur within 2 minutes after IV injection. Thus we know beyond a doubt that the onset of flash pulmonary edema precedes the timing of expected peak effects of barbiturates in the brain.

B. Sensations Associated with Pulmonary Edema

11. Flash pulmonary edema increases the work of breathing, decreases blood oxygen levels and causes sensory nerves in the lungs to transmit a sensation of profound shortness of breath and suffocation to the brain, demanding that the brain “breathe harder.” We know from descriptions of surviving patients that this sensation is identical to that reported by victims of near-drowning or suffocation—a sensation exploited during enhanced interrogations described by the European Court of Human Rights as “torture.” These are among the most excruciating feelings known to man. Please refer to my November 1, 2019 Declaration (pages 33-34, paragraphs 68-69) for references and discussion of this issue.

C. Autopsy Indicators of Pulmonary Edema

12. At autopsy, normal adult lung weights are generally expressed as separate weights for the right and left lung. This is because anatomically, the right and left lungs are not identical. In addition, in the case of pulmonary edema fluid does not always extravasate (i.e. leave the blood vessels and enter the alveoli) symmetrically.² Thus total lung weight generally provides us with more information than single lung weights. Many authorities list normal lung weights at autopsy as 445 gm for the right lung and 395 gm for the left lung (840 gm total).³ However, a study by Joachim et al.,⁴ demonstrated that in the absence of lung trauma (e.g. blunt force injury) in the

² There are many reasons for asymmetrical extravasation of pulmonary edema fluid, including differential blood flow to each lung due to patient position, intrinsic abnormalities of the vessels or pathology in the lungs, and differential degree of injury to one lung versus the other.

³ Molina DK, DiMaio VJM. Normal organ weights in men: part II—the brains, lungs, liver, spleen and kidneys. *Am J Forensic Med Path.* 2012; 33:368-372

⁴ Joachim H, Riede UN, Mittermayer Ch. The weight of human lungs as a diagnostic criterium. *Path Res Prac* 1978; 162:24-40

“immediately dead,” lung weights are actually much lower, at around 234 g each (468 gm total). The authors ascribe their findings of these lower “normal weights” to the “agonal period” that most other studies do not account for, i.e. the amount of time it took the person to die after lung injury, during which time fluid was accumulating in the lungs. While other studies do not control for the variable of the length of time it took a person to die, in their study, they examined only patients without lung injury who died immediately.

13. It has long been known that a person who dies after lung injury can demonstrate the development of pulmonary edema during a relatively short survival period of only a few minutes.⁵ Joachim et al., demonstrated that if a person survived lung trauma prior to death, lung weights increased dramatically and almost immediately as a result of pulmonary edema or blood accumulating in the lungs within the survival time. The authors examined the time between death and autopsy, and found that “the interval between death and autopsy is without demonstrable influence on the total blood content [of the lungs], the extravascular fluid, and the lung weight,” *and thus this fluid accumulated before death and not as a result of accumulation of fluid after death.* In other words, lung injury leads to rapid pulmonary edema that can occur within minutes, but after death there is no further fluid accumulation in the lungs.

D. Autopsy Evidence of Flash Pulmonary Edema in Executed Prisoners

14. The Preliminary Findings Report from the autopsy of Mr. Purkey, which demonstrates significant flash pulmonary edema, is consistent with numerous reports that I reviewed from autopsies performed on prisoners executed with pentobarbital or its equivalent, thiopental, either as the single drug or in combination with other drugs. I laid out the details of

⁵ Ibid.

these reports in Appendix III of my November 1, 2019 Declaration and I have attached that chart here.

15. Of the twenty-seven autopsy reports I reviewed, twenty-six included autopsy findings, including information on the lungs. Twenty reports use the specific term “pulmonary edema” to describe lung findings and provide detailed, obvious and dramatic findings, including but not limited to “abundant blood and frothy fluid,” “intense dependent congestion,” “oozing bloody froth,” “frothy fluids in tracheobronchial tree and larynx,” and other descriptors.

16. Of the six reports that do not use the specific term “pulmonary edema,” the total weight of the lungs in all the prisoners was measured and significantly exceeded the normal total weight of autopsied lungs immediately following death in patients without lung trauma, thus indicating pulmonary edema.

17. Using the appropriate weight for normal lungs after immediate death stated in the Joachim study, all six prisoners had increased total lung weights, by a minimum of 2.5 times normal weight to a maximum of almost 4 times normal total weight. Even using a more commonly referenced total weight of approximately 840 g (which comes from studies that includes patients who did not die immediately, some of whom suffered trauma) all six prisoners significantly exceeded normal total lung weight, by a minimum of 1.6 times normal lung weight, and up to 2.4 times normal lung weight. These are extraordinarily abnormal findings, which, in the absence of blunt lung trauma, indicate the presence of pulmonary edema.

18. Taken altogether, the autopsy findings by multiple medical examiners indicate that in all twenty-six prisoners for whom information is available about the lungs postmortem, pulmonary edema was present. This finding, as we know from studies of large numbers of lungs at autopsy, is not a normal or even a usual autopsy finding. Furthermore, we know from the

Joachim study, as well as from the well-documented understanding of flash pulmonary edema, that the fluid in the lungs of these prisoners accumulated before death.

E. Autopsy Report of Wesley Purkey

19. The autopsy report of Wesley Purkey, conducted by Dr. Joyce Lynn deJong, DO, on August 5, 2020, reveals the following relevant findings:

- “Severe, bilateral, acute pulmonary edema”
- Weight of right lung 1140 gm
- Weight of L lung 1160 gm
- “Frothy pulmonary edema in the trachea and mainstem bronchi”
- Atherosclerotic coronary vascular disease, with severe narrowing of the proximal LAD coronary artery

20. When we compare Mr. Purkey’s autopsy findings to those of other prisoners, we find that his lung weights were between *2.73 and 4.3 times* that of normal lungs, depending on which “normal values” are referenced. Whereas Mr. Purkey’s right lung weighed 1140 grams, a normal right lung at autopsy weighs an average of 445 grams; and whereas Mr. Purkey’s left lung weighed 1160 grams, a normal left lung at autopsy weighs an average of 395 grams. Gross, bilateral, severe pulmonary edema was found, with fluid not only in the lung tissue itself, but also in Mr. Purkey’s airways up into the trachea.

21. Scientific studies have confirmed that flash pulmonary edema does not occur after death, consistent with the well-worn understanding of the mechanisms of flash pulmonary edema. It is therefore my expert opinion that the flash pulmonary edema experience by Mr. Purkey occurred premortem and could not have occurred postmortem.

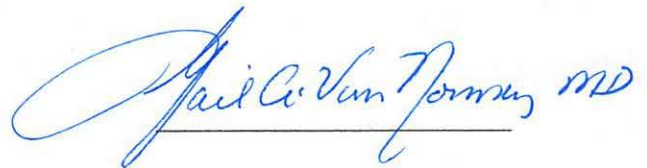
IV. CONCLUSION

22. In my previous Declaration and Supplemental Declaration, I concluded that every autopsy report I reviewed from prisoners executed using pentobarbital where the lung tissues were examined, demonstrated findings of pulmonary edema and that premortem flash pulmonary edema is a virtual medical certainty in any execution in which pentobarbital is used. I also concluded that prisoners executed by lethal injection in accordance with the Federal Protocol remain sensate and able to experience the extreme pain and suffering related to the occurrence of flash pulmonary edema.

23. I reiterate those opinions here to a reasonable degree of medical certainty and add the opinion that Mr. Purkey experienced the pain and suffering of pulmonary edema caused by administration of five grams of pentobarbital prior to his death.

I declare under penalty of perjury that the foregoing is true and correct.

Executed in Seattle, Washington on August 7, 2020.

A handwritten signature in blue ink, reading "Paul A. Van Horn, MD". The signature is written in a cursive style with a horizontal line underneath the name.

APPENDIX III

Relevant Autopsy Findings Regarding Pulmonary Edema and Vascular Access During Executions involving pentobarbital or thiopental as the solo drug or in combination with other drugs.

- 1) Daniel Wayne Cook. Execution: August 8, 2012, Arizona
1-drug pentobarbital protocol, 5 grams
 - a) IV catheters and punctures: 5 peripheral attempts
 - b) Weight of lungs: R 940 gm, L 395 gm
 - c) Pulmonary edema not mentions, although lungs are "heavy". No apparent lung sections taken.
- 2) Thomas Arnold Kemp
Execution: April 25, 2012, Arizona
1-drug pentobarbital protocol, 5 grams
 - a) 1 peripheral IV, 1 central line ("triple lumen) in groin
 - b) Weight of lungs: R 1070 gm, L 980 gm
 - c) Pulmonary edema not mentioned, lungs are very heavy. Apparently no sections taken
- 3) Samuel Villegas Lopez
Execution: June 27, 2012, Arizona
1-drug pentobarbital protocol, 5 grams
 - a) 2 peripheral IVs
 - b) Weight of lungs: R 970 gm, L 720 gm
 - c) Pulmonary edema: yes, severe. Cut surfaces of lungs "exude abundant blood and frothy fluid
- 4) Robert Henry Moorman
Execution: February 29, 2012, Arizona
1-drug pentobarbital protocol, 5 grams
 - a) 2 peripheral IVs
 - b) Weight of lungs: R 560 gm, L 170 gm
 - c) Pulmonary edema: yes. Moderate. Moderate amounts of blood and frothy fluid.
- 5) Robert Charles Towry
Execution: March 8, 2012, Arizona
1-drug pentobarbital protocol, 5 grams
 - a) 1 peripheral line, R groin central line "triple lumen"
 - b) Weight of lungs: R 740 gm, L 690 gm
 - c) Pulmonary edema: apparently no lung sections taken and no mention
- 6) Thomas Paul West
Execution: July 19, 2011, Arizona
3-drug protocol with pentobarbital, 5 grams
 - a) 1 peripheral line, 1 peripheral puncture, 1 central line "triple lumen" R groin
 - b) Weight of lungs: R 920 gm, L 740 gm

- c) Pulmonary edema: yes, moderate. "moderate amounts of pink frothy fluid from cut surfaces"
- 7) Donald Edward Beaty.
Execution: May 25, 2011, Arizona
3-drug thiopental protocol, 5 grams
 - a) Single "triple lumen" in R groin with 2 hubs labeled A and B. No backup line.
 - b) Weight of lungs: R 960 gm, L 830 gm
 - c) Pulmonary edema: yes, severe. "intense dependent congestion, cut surfaces exude abundant frothy fluid"
- 8) Richard Lynn Bible
Execution: June 30, 2011, Arizona
3-drug thiopental protocol, 5 grams
 - a) Single triple lumen line R groin, no back up
 - b) Weight of lungs: R 840 gm, L 1000 gm
 - c) Pulmonary edema: yes, severe. "severe congestion and edema"
- 9) Marshall Gore
Execution: October 1, 2013, Florida
3-drug pentobarbital protocol, 5 grams
 - a) 2 peripheral lines
 - b) Weight of lungs: R 945 gm, L 715 gm
 - c) Pulmonary edema: Yes, at least moderate. "oozing bloody froth"
- 10) Joshua Daniel Bishop
Execution: March 31, 2016, Georgia
1-drug pentobarbital protocol, 5 grams
 - a) 2 peripheral lines, 1 puncture hand.
 - b) Weight of lungs: R 760 gm, L 620 gm
 - c) Pulmonary edema: not mentioned, apparently no lung sections done.
- 11) Robert Earl Butts Jr.
Execution: May 4, 2018, Georgia
1-drug pentobarbital protocol, 5 grams
 - a) 2 peripheral lines
 - b) Weight of lungs: R 780 gm, L 680 gm
 - c) Pulmonary edema: yes, moderate. "moderate amount of bloody foam, moderate amount of white froth in airways."
- 12) Roy W. Blankenship
Execution: June 23, 2011, Georgia
1-drug pentobarbital protocol, 5 grams
 - a) 2 peripheral IVs, one appears infiltrated.
 - b) Weight of Lungs: R 860 gm, L 720 gm
 - c) Pulmonary edema: yes, moderate. "moderately edematous"

- 13) Andrew Howard Brannan
Execution: January 1m 2015, Georgia
1-drug pentobarbital protocol, 5 grams
a) 2 peripheral lines
b) Weight of Lungs: R 820 gm, L 720 gm
c) Pulmonary edema: yes, severe. "parenchyma edematous, frothy fluid in lower airways"
- 14) John Conner
Execution: July 15, 2016, Georgia
1-drug pentobarbital protocol, 5 grams
a) 2 peripheral lines
b) Weight of Lungs: R 860 gm, L 820 gm
c) Pulmonary edema: not mentioned, and no lung slices taken.
- 15) Andrew Cook
Execution: February 21, 2013, Georgia
1-drug pentobarbital protocol, 5 grams
a) 2 peripheral lines
b) Weight of lungs: R 720 gm, L 640 gm
c) Pulmonary edema: yes, severe. "frothy fluids in tracheobronchial tree and larynx"
- 16) Kenneth E. Fults
Execution: April 12, 2016, Georgia
1-drug pentobarbital protocol, 5 grams
a) 2 peripheral lines
b) Weights of Lungs: R 560 gm, L 460 gm
c) Pulmonary edema: yes, severe. "moderate congested and edematous, and moderate amount of fluid in the major airways.
- 17) Kelly Renee Gissendaner.
Execution: September 20, 2015, Georgia
1-drug pentobarbital protocol, 5 grams
a) 2 peripheral lines
b) Weight of Lungs: R 620 gm, L 530 gm
c) Pulmonary edema: yes, severe. "Moderate amount of white foam" in upper airway, "parenchyma exudes moderate amounts of blood tinged foamy fluid".
- 18) Warren Lee Hill Jr.
Execution: January 27, 2015, Georgia
1-drug pentobarbital protocol, 5 grams
a) 4 peripheral IVs, additional areas suggesting 5th puncture.
b) Weight of Lungs: R 760 gm, L 700 gm
c) Pulmonary edema: yes, moderate. "blood and frothy fluid in cross sections"

19) Travis Hitson

Execution: February 17, 2016, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 2 peripheral IVs
- b) Weight of Lungs: R 580 gm, L 580 gm
- c) Pulmonary edema: yes, mild-mod. "pulmonary parenchyma edematous"

20) Robert Wayne Holsey

Execution: December 9, 2014, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 3 peripheral lines.
- b) Weight of lungs: R 740 gm, L 580 gm
- c) Pulmonary edema: yes, moderate. "moderate congestion"

21) Marcus Ray Johnson

Execution: November 19, 2015, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 2 peripheral lines, 1 with extravasation
- b) Weight of lungs: R 760 gm, L 640 gm
- c) Pulmonary edema: Yes, moderate. "parenchyma congested and edematous"

22) Brandon A Jones

Execution: February 3, 2016, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 3 peripheral IVs, 2 of which appear to have extravagated. 1 central line, triple lumen in R groin, with hemorrhage
- b) Weight of Lungs: R 720 gm, L 600 gm
- c) Pulmonary edema: not mentioned, and apparently no lung slices taken.

23) Daniel Anthony Lucas.

Execution: April 27, 2016, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 2 peripheral lines
- b) Weight of lungs: R 520 gm, L 540 gm
- c) Pulmonary edema: Yes, severe. "prominent amount of white frothy fluid in tracheobronchial tree"

24) Bryan Terrell

Execution: December 19, 2015, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 2 peripheral IVs, 2 additional punctures.
- b) Weight of lungs: R 800 gm, L 640 gm
- c) Pulmonary edema: Yes, severe. "frothy material in mainstem bronchi and into the smaller airways.

25) Marcus Wellons

Execution: June 17, 2014, Georgia

1-drug pentobarbital protocol, 5 grams

- a) 3 peripheral IVs.
- b) Weight of lungs: R 860 gm, L 720 gm
- c) Pulmonary edema: yes, moderate. "moderately congested"

26) Michael Wilson

Execution: January 9, 2014, Oklahoma

3-drug pentobarbital protocol, 5 grams

- a) No exam included in file and no mention about lungs.

27) Lloyd Lafavers

Execution: January 30, 2001, Oklahoma

3-drug thiopental protocol, 5 grams

- a) No info on IVs.
- b) Weight of lungs: R 800 gm, L 700 gm
- c) Pulmonary edema: yes, "edema and congestion" not further characterized.

Summary of my review:

- I. Note that normal lung weights are approximately R 445 gm, L 395 gm. Moorman L lung was noted at 170 gm, which may be an error. With that exception all lungs were significantly heavier than normal.
- II. Pulmonary edema was present in at least 20 of the 27 autopsies (77%). In the remaining 7 there was no comment, and/or lung slices were not taken.
- III. In the 20 cases of pulmonary edema, autopsy findings suggest severe pulmonary edema in 8 (40%) and moderate pulmonary edema in 10 (50%). Edema was not characterized in 2 cases.
- IV. For autopsies in which lung examination was documented, 100% demonstrated pulmonary edema, which was moderate to severe in 90% of the cases. In the remaining cases, severity was not characterized.
- V. Of 27 autopsies, 2 did not comment on IV access. Of those in which there is a description, 8 cases (32%) had multiple attempts, 6 (24%) had femoral central lines placed, 3 (12%) had signs of extravasation or infiltration, only 11 (44%) appear uncomplicated.