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ROOT CAUSE ANALYSIS REPORT
RCA# 2017-02
DECEMBER 21, 2017

Executive Summary

On September 19, 2017, the Office of the Chief Medical Examiner (OCME) Quality Assurance Director was informed of an error which occurred in the autopsy suite. The error involves a contamination event which resulted in an erroneous DNA match notification. After careful review, the QA Director determined that this was a “significant event” within the meaning of Title 17, Chapter 2, Section 17-207 of the Administrative Code of the City of New York. On November 9, 2017, OCME assembled a Root Cause Analysis (RCA) Committee to identify the causal factors and corrective actions to be taken for this event, which was identified as RCA# 2017-02.

The RCA Committee met and reviewed the autopsy workflow for homicide cases and identified areas for improvement. Several causal factors were identified for this event, including the following: lack of awareness of the potential for DNA contamination among staff working in the autopsy suite, lack of training on how to minimize risk of contamination in the autopsy suite, and the lack of a written procedure for autopsies and DNA evidence collection. As discussed below, the RCA Committee recommends that the agency increase awareness of DNA contamination by providing training to mortuary staff, photographers, and medical examiners. The committee also recommends that the agency develop a written procedure for autopsies and DNA evidence collection and explore methods to protect swabs while air drying.

Background

The Office of Chief Medical Examiner (OCME) has the responsibility to investigate certain deaths, including those occurring from criminal violence, by accident, by suicide, suddenly when in apparent health, or in any unusual or suspicious manner. The OCME also investigates any case that may present a threat to public health.

Each morning, operations staff and medical examiners meet to review case files and assign the day’s cases to individual medical examiners. During an autopsy, a medical examiner may choose to collect DNA evidence from the decedent. If collected, the samples are submitted to the Department of Forensic Biology (Forensic Biology) for processing. Laboratory staff examine the evidence, perform DNA testing, generate a report, and upload any eligible profiles to the Combined DNA Index System (CODIS). If a match is found, the laboratory confirms the match and enters the information in the DNA HITS application. DNA HITS is a web-based application that allows for immediate e-mail notification of DNA matches to the NYPD and the District Attorney offices.

See Appendix A for an overview of the workflow and Appendix B for a detailed process map.

Event Description

On August 3, 2017, a medical examiner performed an autopsy on a homicide victim. Swabs of the decedent's hands were collected and submitted to Forensic Biology for testing to determine if the perpetrator's DNA was found on the decedent.

On September 7, 2017 Forensic Biology issued a report for the hand swabs. A DNA profile for a "DNA Donor A", which was not the same as the DNA profile of the arrested suspect, was obtained from the sample designated as "swab from R hand" and submitted to CODIS.

On September 11, 2017, Forensic Biology received a State Match Detail Report for the "swab from R hand" sample.

On September 18, 2017, Forensic Biology entered the match in DNA HITS.

On September 19, 2017, the Manhattan District Attorney's office informed OCME that the DNA HIT did not match the suspect in the case. OCME determined that the match was to another decedent who was autopsied on the same day in the same mortuary location as the homicide victim and that the contamination did not occur during laboratory processing.

On September 21, 2017, Forensic Biology expunged the profile of "DNA Donor A" from the CODIS database, since it proved not to be a profile from a putative perpetrator. Forensic Biology also issued an additional report detailing the expungement.

See Appendix C for a detailed chronology of events.

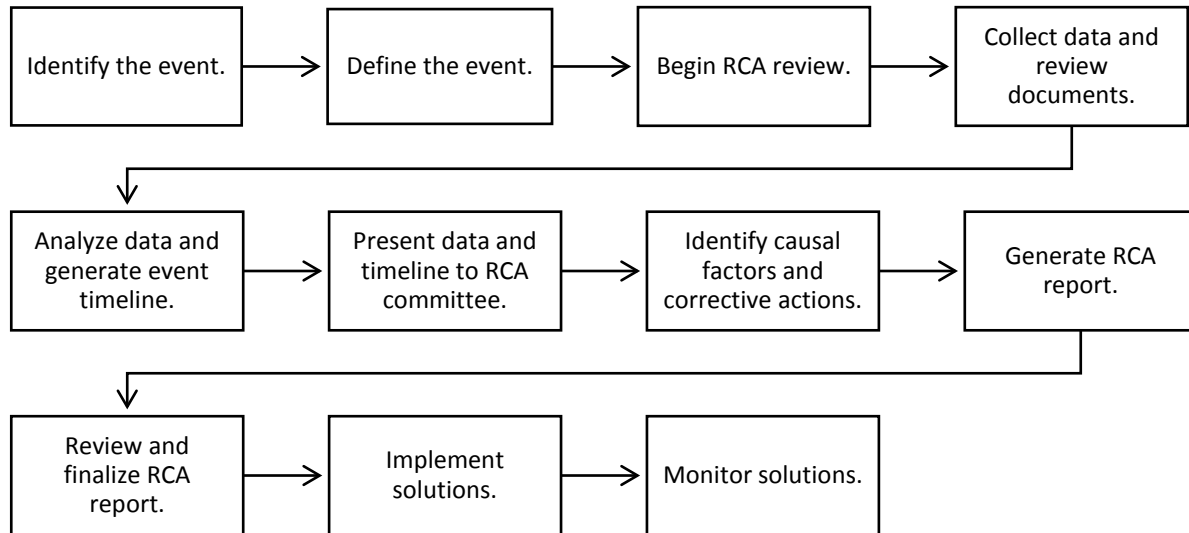
Composition of RCA Committee

The RCA Committee is a multidisciplinary team of professionals assembled in accordance with criteria defined by Title 17, Chapter 2, Section 17-207 of the City's Administrative Code. The RCA committee includes OCME employees and an external expert who serves in a medical or scientific research field. The members of this RCA committee include the following:

- The root cause analysis officer.
- Two employees who are knowledgeable in the area relating to the event.
- A member of the OCME executive management.
- Two employees from OCME departments that are not implicated by the event.
- An outside expert with risk management experience in the medical field.

OCME Root Cause Analysis Process

Root Cause Analysis (RCA) is a structured methodology used to study and learn from events. The goal of the RCA is to understand what happened, identify why it happened and recommend solutions to prevent recurrence. The process used is as follows:



Causes and Contributing Factors

The RCA committee reviewed the evidence and agreed with management's determination that the contamination did not occur during laboratory processing. When the error was discovered, Forensic Biology had only processed the evidence for the homicide case. The sample submitted for the second case (the source of the contamination) was in storage and had not been processed. Because the second sample had not been opened and examined by the laboratory, it is most likely that the contamination actually occurred in the autopsy suite, during sample collection.

RCA committee members examined the workflow in the autopsy suite and the event timeline and employed cause and effect analysis to identify causes and contributing factors for the contamination. Although the committee was unable to identify a root cause for the contamination with absolute certainty, the committee did identify the following causal factors:

1. *Staff working in the autopsy suite may have unintentionally contaminated the sampling site before the DNA swabs were taken.*

Evidence:

The RCA committee reviewed the autopsy workflow for homicide cases and concluded that the autopsy suite is a complex environment involving multiple medical examiners and support staff with diverse training interacting with each other during an autopsy. An autopsy examination for a homicide case involves a medical examiner, a mortuary technician, a forensic photographer, and an x-ray technician. If a medical examiner determines that DNA is critical to the case and that it should be collected, then the DNA must be protected until the swabs are taken. This requires the autopsy examination to begin and proceed in a specific order to preserve the quality of the DNA and minimize the risk of contamination until the swabs are collected. Communication among staff and coordination of the tasks they perform is critical for collecting high quality, uncontaminated DNA during an autopsy.

After reviewing the workflow, the committee noted that medical examiners work on one case at a time, but mortuary staff and photographers may be asked to work on more than one case at a time. For example, a mortuary technician may be assigned to a particular autopsy but he/she may also be called to assist in moving another body to an autopsy table. If the mortuary technician does not change gloves between cases, he/she may unintentionally transfer DNA from one decedent to the other. Similarly, a forensic photographer may unintentionally transfer DNA when photographing multiple cases. A photographer may contaminate their gloves with DNA after touching a hospital tag and then transfer that DNA to a different decedent while orienting the decedent's hands for a photo. Either of these scenarios, or similar circumstances, can lead to the contamination of the sampling site on the decedent before DNA swabs are collected. The committee explored the mechanisms in place to minimize cross-contamination during the autopsy and learned that the agency does not have a policy which requires staff to replace gloves with a new, clean pair if they are asked to assist on a homicide case or any case where DNA evidence may be collected.

The RCA committee also noted that, after the post-mortem body bag is opened, the medical examiner will prepare the case paperwork and organize collection material. While the medical examiner prepares the paperwork and collection material, mortuary staff will move the body to the autopsy suite and the photographer will begin to take the first set of autopsy photos. These tasks may occur with or without the medical examiner present. Committee members discussed the potential for contamination and agreed that there is an increased risk of contamination if work is performed on a body, which has not yet had DNA evidence collected, without continuous medical examiner oversight. The risk is further increased if additional support staff is called to assist and are not made aware of any instructions from the medical examiner or have not changed gloves.

2. *Mortuary staff and photographers have not received training on how to minimize risk of contamination.*

Evidence:

The committee inquired about DNA and contamination training and learned that training had not been provided to mortuary staff and photographers. Only medical examiners had received DNA training. Training was not provided to support staff because the potential for cross-contamination by support staff was not anticipated.

The RCA committee agreed that the absence of education and training programs for staff contributed to a limited awareness of cross-contamination. A shared understanding of contamination mechanisms and potential is critical since an autopsy requires individuals with different training and experience levels to work together in order to minimize risk of contamination.

3. *The medical examiner that performed the autopsy had not received training to minimize contamination prior to examining his first homicide case.*

The RCA committee learned that the medical examiner who performed the autopsy on the homicide case was a new forensic pathology fellow, and that this was his first

homicide case. Fellows receive training from the Forensic Biology laboratory every year. This training provides fellows with an overview of the laboratory testing process, informs them which samples may be submitted, and reviews sample collection technique. The training also includes a tour of the Forensic Biology laboratory. The committee reviewed the event timeline and found that the medical examiner autopsied the case on August 3 but the DNA training was not scheduled to take place until November 15.

The committee reviewed the Forensic Biology training and found that it did not include guidance on how to conduct an autopsy so that contamination risk is minimized. As stated earlier, the autopsy examination requires coordination of support staff in order to minimize the risk of DNA contamination until swabs are collected. The committee also found that the agency does not have a written procedure for conducting an autopsy or written guidelines on how to minimize contamination during an autopsy. The committee agreed that this information should be available as a reference for fellows and that fellows should be provided this information before performing their first autopsy on a homicide case.

4. *Swabs are not protected from cross-contamination while air drying in the autopsy suite.*

Evidence:

The committee also explored the possibility that a swab would be contaminated after the DNA evidence was collected. Interviews with staff found that, after the swabs are collected, they are set aside to air dry. Medical examiners place the DNA swabs in a rack which is used to hold the swabs upright. The rack is then placed, uncovered, on an empty autopsy table until the medical examiner has completed the autopsy examination (an autopsy examination may take two hours or more). After the medical examiner has completed the autopsy, the swabs are packaged and submitted to the Forensic Biology laboratory.

The committee discussed the drying of the swabs and found that the swabs could potentially be cross-contaminated when left to air dry in the open. Medical examiners leave one autopsy table empty between them while working. This practice helps to minimize the risk of cross-contamination, but swabs can potentially be contaminated by droplets or bone dust from a nearby autopsy. Also, the rack used to hold the swabs is a styrofoam tube rack that is not cleaned or discarded after use. The same rack may be used again later, potentially contaminating a set of swabs.

See Appendix D for the cause and effect analysis.

Corrective Action Plan

The RCA committee recommends the following actions to address the identified causal factors:

1. Managers should identify ways to minimize contamination of sampling sites on the decedent's body before DNA swabs are taken. The RCA committee recommends that the agency consider the following:

- Require staff to change gloves between cases, if asked to assist on a homicide case that has not completed collection of DNA evidence.
 - Assign one mortuary technician to homicide cases only. This will reduce the number of individuals that may handle the body.
 - Require medical examiners to be present and coordinate the activities of support staff from the moment the seal is broken and the post-mortem body bag is opened until the DNA evidence is collected.
2. The agency must provide contamination training to all staff who may assist with an autopsy. Because DNA results have the potential to implicate or exonerate individuals, the agency must make sure that all staff are aware of the potential consequences. The committee believes that education and awareness are critical to minimizing contamination risk in the mortuary.

The training should include an explanation of DNA contamination, the consequences of contamination, and guidelines to prevent contamination during an autopsy. This training should be provided once a year to medical examiners, mortuary technicians, forensic photographers, fingerprint specialists and x-ray technicians.

3. The agency must develop a standard operating procedure for homicide autopsies. The question, of whether to collect DNA evidence or not, is a critical decision point during the autopsy examination. If a medical examiner decides that DNA evidence must be collected, it will impact how the autopsy begins and which tasks should be completed first. How the autopsy should proceed, from the medical examiner's perspective, is information that should be made available to fellows before they perform their first homicide.

The contents of the procedure should then be incorporated into the training program. A committee member suggested that the agency consider developing a brief, focused training on homicide cases only for fellows. This may be a dedicated session that covers the challenges of homicide cases and the medical examiner's role in minimizing contamination during autopsy.

The RCA committee also recommends that the Forensic Biology training be scheduled earlier in the academic year, before fellows perform their first autopsy on a homicide case.

4. The RCA committee recommends that the agency consider using swabs with tip protectors and disposable drying racks to prevent contamination while the swabs are air drying. An alternative is to consider purchasing a commercial swab drying cabinet for the autopsy suite.

See Appendix E for a cause map with identified corrective actions.

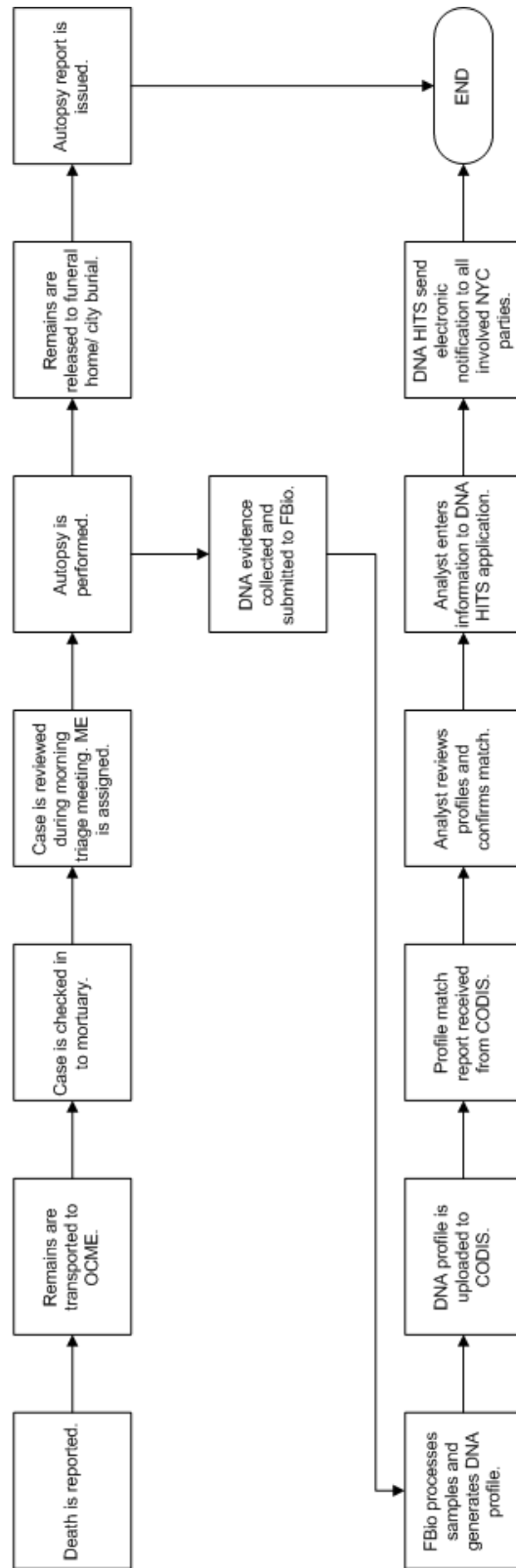
Summary of Corrective Actions

Causal Factor	Recommended Corrective Actions	Recommended Completion Date
Staff may have unintentionally contaminated the sampling site before the DNA swabs were taken.	<ol style="list-style-type: none"> 1. Require staff to change gloves between cases if asked to assist on a homicide case that has not completed collection of DNA evidence. 2. Assign one mortuary technician to homicide cases only. This will reduce the number of individuals that may handle the body. 3. Require medical examiners to be present and coordinate the activities of support staff from the moment the post-mortem body bag is opened until the DNA evidence is collected. 	3/30/18
Mortuary staff and photographers have not received training on how to minimize risk of contamination.	<ol style="list-style-type: none"> 1. Provide training to all staff that may be directly involved or assisting on an autopsy. 	3/30/18
The medical examiner who performed the autopsy had not received training to minimize contamination prior to examining his first homicide case.	<ol style="list-style-type: none"> 1. Develop a standard operating procedure for homicide autopsies. 2. Schedule the Forensic Biology training earlier, before fellows perform first autopsy on a homicide case. 	3/30/18
Swabs are not protected from cross-contamination while air drying in the autopsy suite.	<ol style="list-style-type: none"> 1. Consider using swabs with tip protectors and disposable drying racks to prevent contamination while the swabs are air drying. 	3/30/18

The Quality Manager and Laboratory Director will monitor the implementation and effectiveness of improvements.

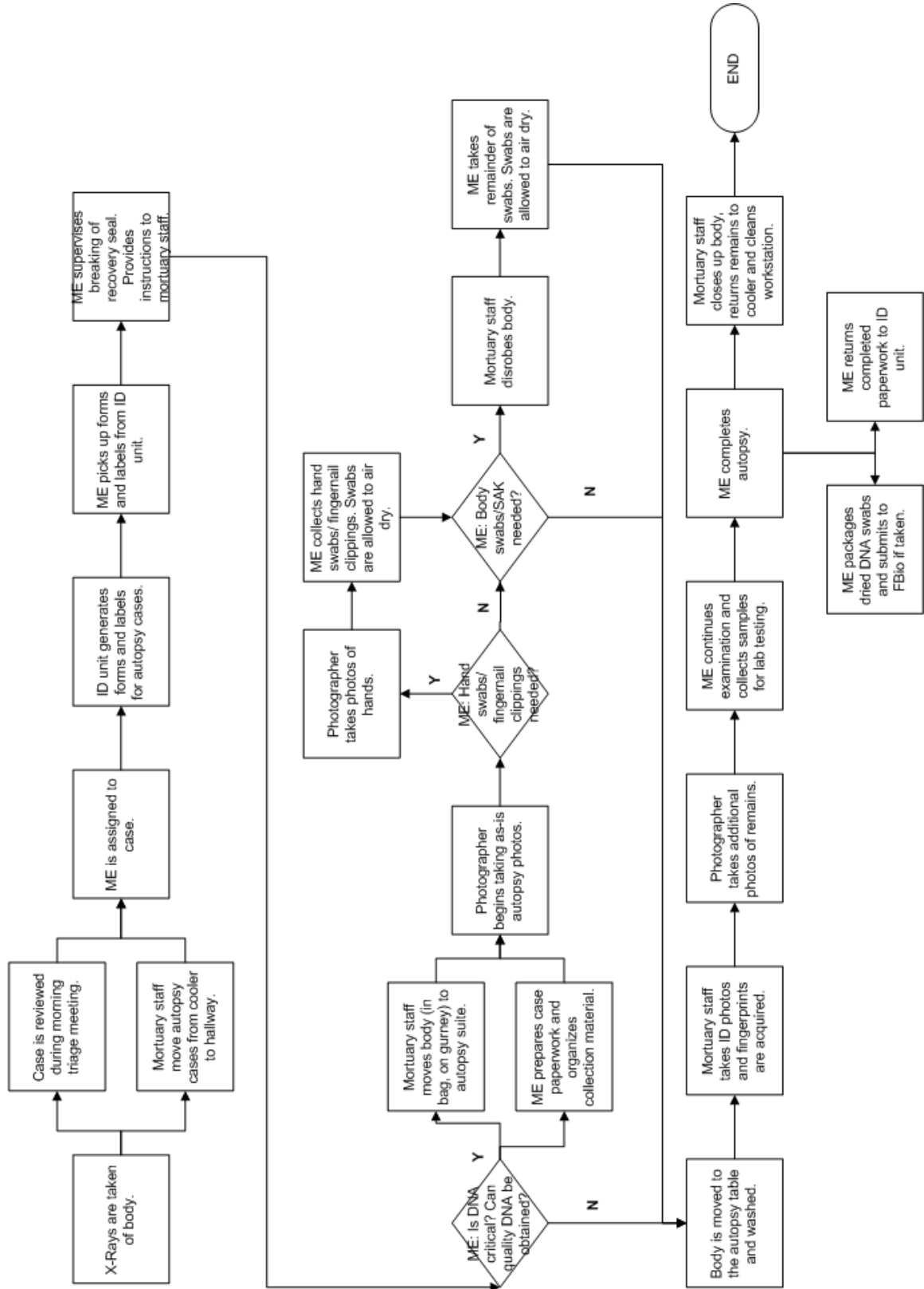
Appendix A

**NYC OFFICE OF CHIEF MEDICAL EXAMINER
HOMICIDE CASE OVERVIEW**



Appendix B

NYC OFFICE OF CHIEF MEDICAL EXAMINER
HOMICIDE AUTOPSY WORKFLOW

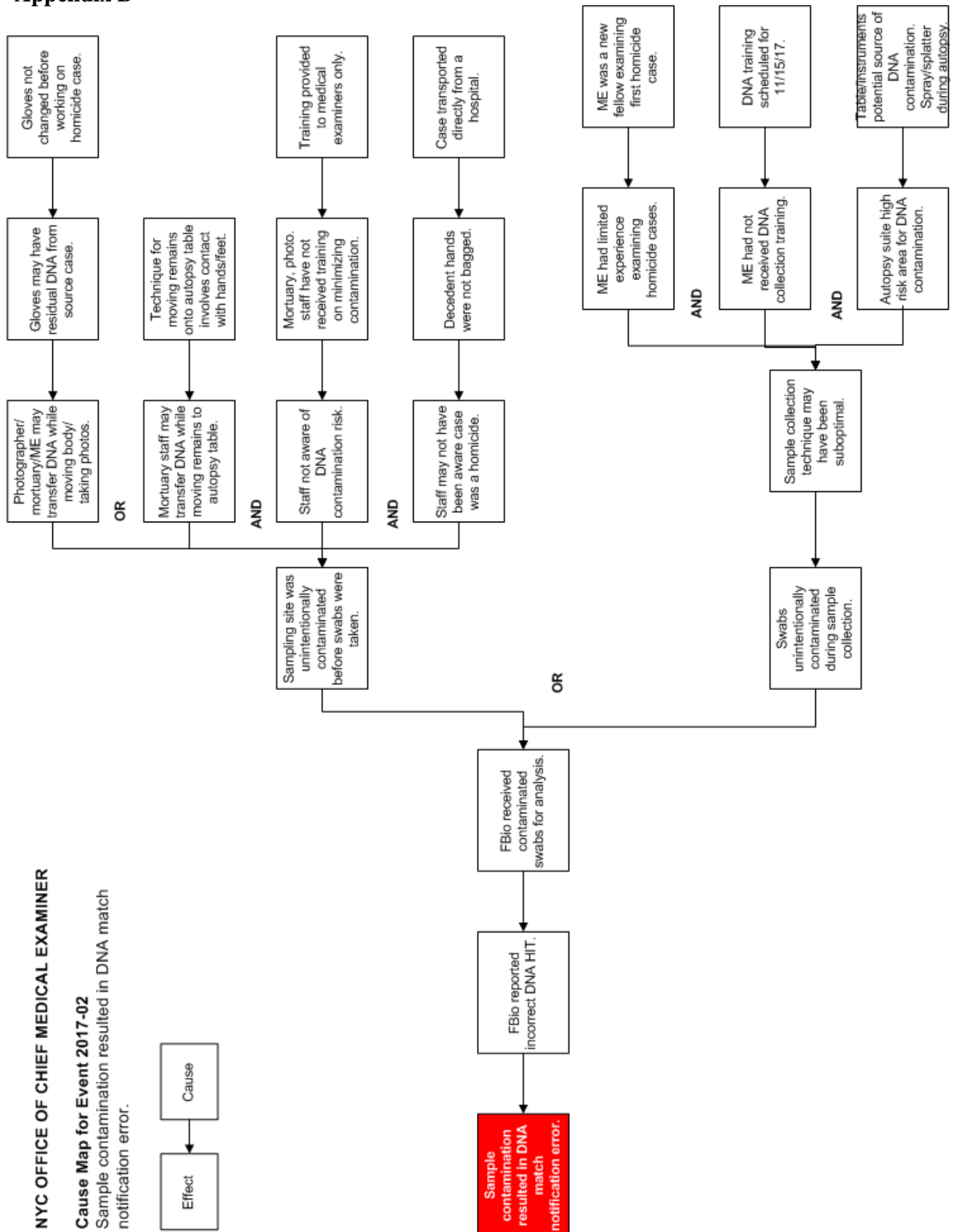


Appendix C

CHRONOLOGY OF EVENTS

DATE	SOURCE OF INFORMATION	EVENT
8/2/17	CMS Event Log	Case 1 is checked in to Manhattan morgue.
8/3/17	CMS Event Log	Case 2 is checked in to Manhattan morgue. Case 1 and case 2 autopsies are performed in the morning. DNA swabs of case 1 decedent's hands were collected and submitted to Forensic Biology.
8/4/17	CMS Event Log	Case 2 is released to funeral home. Forensic Biology received case 1 hand swabs.
8/12/17	CMS Event Log	Case 1 is released to funeral home.
9/7/17	Laboratory Report	Forensic Biology issued a report for the case 1 hand swabs. A profile for DNA Donor A was obtained from the sample designated as "swab from R hand" and submitted to the Combined DNA Index System (CODIS).
9/11/17	CODIS Record	State Match Detail Report was received for "swab from R hand".
9/13/17	FBio Record	Forensic Biology reviewed and confirmed the match.
9/18/17	DNA HIT Record	Forensic Biology entered the match in the DNA HITS application.
9/19/17	Email	The Manhattan District Attorney office contacted the OCME Special Counsel and informed her that the DNA HIT did not match the suspect in the case. The OCME Special Counsel determined that the DNA HIT was for the case 2 decedent.
9/21/17	DNA HIT Record	Forensic Biology expunged the profile of DNA Donor A from the CODIS database.
9/22/17	Laboratory Report	Forensic Biology issued an additional report detailing the CODIS expungement.

Appendix D



Appendix E

